



Doc 9760

# AIRWORTHINESS MANUAL

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**Advance second edition (unedited)**

## Foreword

1. The *Airworthiness Manual* was first published in 2001 and contains a consolidation of airworthiness-related information previously found in other ICAO documents. As a result, the first edition of the *Airworthiness Manual* replaced the following ICAO documents: the *Continuing Airworthiness Manual* (Doc 9642), *Airworthiness Technical Manual* (Doc 9051), and the *Manual of Procedures for an Airworthiness Organization* (Doc 9389).
2. This edition of the *Airworthiness Manual* was developed from material previously found in the 2001 edition. The content was reviewed, edited, and expanded on by the Airworthiness Panel during several working group meetings from 2003 to 2007. It incorporates changes to Annex 8 — *Airworthiness of Aircraft*, and to Annex 6 — *Operation of Aircraft*. The content also responds to the request from the ICAO Universal Safety Oversight Audit Programme for additional guidance to States in how to meet their airworthiness responsibilities under the Convention. A new chapter on Production was also added.
3. The breadth and depth of the guidance material provided in this manual has been intentionally limited to keep its size manageable. In order to avoid specific references to material that may become dated, it was decided instead to provide a listing of potential sources of additional, and more detailed, information on the subjects covered in this manual.
4. Although this manual provides guidance on the suggested content of various State airworthiness regulations, no attempt has been made to formulate specific regulations. It is recognized, however, that a number of States, particularly those which are still in the early stages of establishing an effective civil aviation organization, do require assistance in developing a body of appropriate airworthiness regulations. In recognition of this need, the *Manual of Model Regulations for National Control of Flight Operations and Continuing Airworthiness of Aircraft* (Doc 9388) has been developed to assist States in the development of regulations suitable for their needs and which, if implemented, would fulfil their obligations under the Convention.
5. It is recognized that in some cases it may not be feasible for a State, due to the limited scale of aviation operations or lack of technical and economic resources, to establish and maintain the full airworthiness organization it needs to meet its international obligations. This problem may be particularly acute for some States in respect of their obligation to assess and approve or disapprove the maintenance programme of an operator utilizing large and complex aircraft. A State finding itself in this position should not in any way diminish the stringency of its regulations; however, it is essential that the State either enter into an agreement with another Contracting State to assist it with the detailed tasks, or obtain the services, on a temporary basis, of qualified inspectors from a State fully experienced in the matter in question. The ICAO Regional Office accredited to the State may be of assistance to the State in working out cooperative inspection arrangements.
6. It is also recognized that a group of States may elect to discharge their responsibilities through a multinational organization or agency. It is essential that the related agreements clearly define the respective functions of each national authority and the multinational organization or agency, so as to ensure that all obligations of the States are fully discharged.
7. Procedural information in this manual is generally applicable to all types of products unless specifically indicated otherwise. Limited applicability may be ascertained directly from the manual text or indirectly through the associated applicability of a referenced Annex provision.
8. Comments on this manual, particularly with regard to its application and usefulness, would be appreciated from all States, safety oversight audit missions and ICAO technical cooperation field

missions. These will be taken into consideration in the preparation of subsequent editions. Comments should be addressed to:

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## ICAO Websites Related to Airworthiness

### **Flight Safety Information:** [www.icao.int/fsix](http://www.icao.int/fsix)

This site is intended as a portal to existing safety related websites as well as a place to exchange information through various newsgroups. This site contains the following areas:

- *Resolving Safety Deficiencies* – Material to help States resolve safety deficiencies grouped into topic areas based on the results of ICAO Audit reports. It also contains information on how to set up a Regional Safety Oversight Organization, which is one path for a set of countries to pool resources to solve safety deficiencies.
- *Safety Oversight Information* – Contains links to audit reports as well as to the ICAO Universal Safety Oversight Audit Programme page which is restricted to Contracting States. It also contains links to information on accidents and incidents as well as aircraft registration.
- *Regulations* – Contains links to the civil aviation regulations of ICAO Contracting States.
- *Safety Management* – Links to the ICAO Safety Management initiative website.
- *Safety-Related Links* – contains links to other ICAO and industry safety initiatives.

### **Website links for Civil Aviation Authorities and International Organizations:**

[http://www.icao.int/icao/en/m\\_links.html](http://www.icao.int/icao/en/m_links.html)

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## PART I.— DEFINITIONS

When the following terms are used in this manual, they have the meanings shown. These definitions are appropriate to the use of the terms in this document only. Additional definitions can be found in Annexes 6 and 8.

***Aeroplane system.*** An aeroplane system includes all elements of equipment necessary for the control and performance of a particular major function. It includes both the equipment specifically provided for the function in question and other basic related aeroplane equipment such as that required to supply power for the equipment operation. The engine is not considered to be an aeroplane system.

***Airworthiness directive (AD).*** A regulatory document which identifies aeronautical products in which an unsafe condition exists and where the “unsafe” condition is likely to exist or develop in other products of the same type design. It prescribes corrective actions to be taken or the conditions or limitations under which the products may continue to be operated. The AD is the common form of mandatory continuing airworthiness information mentioned in Annex 8.

***Airworthiness Standards.*** For purposes of type certification, these are the detailed and comprehensive design and safety criteria applicable to the category of the aeronautical product (aircraft, engine, propeller) that satisfies, as a minimum, the applicable Standards of ICAO Annex 8. These design standards are detailed in nature and cover aspects such as, but not limited to: flight performance and characteristics, structural strengths and durability, general design and construction, powerplant and systems, aircraft and systems architecture, equipment specifications, overall function and reliability criteria, tests and inspections methods, and operating limitations and information.

***Certification basis.*** The applicable airworthiness and environmental standards established by a State as the basis by which the type design of an aeronautical product, or change to that type design, was approved or accepted. The certification basis may also include special conditions of airworthiness, findings of equivalent level of safety, and/or exemptions when determined by the State to apply to the type design.

***Certification maintenance requirement.*** Maintenance that is required by design to help show compliance with the appropriate type certification requirements by detecting the presence of, and thereby limiting the exposure time to, a significant latent failure.

***Comprehensive and detailed airworthiness code.*** The collective requirement that consists of, but not limited to, the approval or acceptance of the type design to an airworthiness standard, conformity to production or manufacturing standards, performance of inspection, maintenance, repair and modification in accordance with standards that ensure the continuing airworthiness of the aircraft, and a system of surveillance or monitoring of safety by the Contracting State.

***Confidence level.*** Where the probability of occurrence of an event is inferred from a sample of measurements, the confidence can be determined that the true probability of occurrence of the event is greater than or less than the inferred probability, as appropriate. The confidence level is itself a statistical measure which is also expressed as a probability.

***Environmental Standards.*** The specifications and maximum levels defined in Annex 16 — *Environmental Protection* for the certification of aircraft noise and engine smoke and gaseous emissions, including the Standards for the prevention of intentional fuel venting into the atmosphere.

***Exemption.*** A relief from compliance with the requirement(s) of airworthiness or environmental standards, or operating rules, based on the determination by a civil aviation authority that granting such relief will not adversely affect safety.

**Extended diversion time operations.** Any flight by an aeroplane where the flight time at the one engine inoperative cruise speed (in international standard atmosphere and still air conditions), from a point on the route to an adequate alternate aerodrome, is greater than the threshold time approved by the State of the Operator or any flight operated in an area designated by the State as an area of extended diversion time applicability.

**Extended diversion time operations, configuration, maintenance and procedures (CMP) standard.** The particular aeroplane configuration minimum requirements including any special inspection, hardware life limits, master minimum equipment list (MMEL) constraints, and maintenance practices found necessary to establish the suitability of an airframe-engine combination for extended diversion time operation.

**Equivalent level of safety.** As used in type certification, a finding where literal compliance with a specific airworthiness requirement cannot be demonstrated but compensating factors exist in the type design that can be shown to provide a level of safety equivalent to that intended by the certification basis.

**Failure condition.** The effect on the aircraft and its occupants, both direct and consequential, caused or contributed to by one or more failures, considering relevant adverse operational or environmental conditions.

**Instructions for continued airworthiness.** A set of descriptive data, maintenance planning and accomplishment instructions, developed by a design approval holder in accordance with the certification basis for the product, providing operators with the necessary information for development of their own maintenance programme and accomplishment instructions.

**Latent failure.** A failure that is not detected and/or enunciated when it occurs.

**Life-limited part.** Any part for which a retirement time, service life limitation, part retirement, retirement life limitation or life limitation exists, and is permanently removed from service when its operating limit (hours, cycles or calendar time) is exceeded.

**Major modification.** In respect of an aeronautical product for which a Type Certificate has been issued, a change in the Type Design that has an appreciable effect, or other than a negligible effect, on the mass and balance limits, structural strength, powerplant operation, flight characteristics, reliability, operational characteristics, or other characteristics or qualities affecting the airworthiness or environmental characteristics of an aeronautical product.

**Minor modification.** A modification other than a major modification.

**Propulsion system.** A system consisting of an engine, all ancillary parts installed on the engine, and all other equipment utilized to provide those functions necessary to sustain, monitor and control the power/thrust output of any one engine following installation on the airframe.

**Special conditions of airworthiness.** The technical requirements added to the certification basis as a consequence of novel or unusual design feature(s) that exists in a type design and the absence or inadequacy of the applicable airworthiness standards to provide a basis for the certification of such features.

**Type design.** The set of data and information necessary to define a product type for the purpose of airworthiness determination to any later product of the same type.

## **PART II.— AIRWORTHINESS ORGANIZATION: STRUCTURE AND RESPONSIBILITIES OF STATES**

### **CHAPTER 1. AIRWORTHINESS RESPONSIBILITIES OF THE STATE**

#### **1.1 The Convention on International Civil Aviation**

1.1.1 The Convention on International Civil Aviation was signed in Chicago in 1944, and it created the International Civil Aviation Organization (ICAO), which in 1947 became a specialized Organization of the United Nations. The Convention focuses on international civil aviation. It does not necessarily apply to domestic operations, but provides an accepted model for the regulation of civil aviation, and it is sensible for States to have one set of rules that cover both domestic and international aviation. Thus the ICAO Standards apply to international aviation and have a de facto application to domestic aviation.

1.1.2 Article 5 of the Convention provides for all Contracting States, subject to specific conditions, to allow aircraft from other Contracting States to make flights into or across the territory of all Contracting States, unless engaged in scheduled international air services, and to make stops for non-traffic purposes, without prior approval of the Contracting State.

1.1.3 Article 33 of the Convention provides that Certificates of Airworthiness and licences issued by a Contracting State are recognized as valid by other Contracting States, provided the certificates and licences satisfy ICAO Standards.

1.1.4 Article 37 of the Convention requires each Contracting State to collaborate in securing the highest degree of uniformity in all matters where uniformity will facilitate and improve air navigation.

1.1.5 Article 54 of the Convention allows ICAO to issue Standards and Recommended Practices (SARPs), and to designate them as Annexes to the Convention.

1.1.6 The two Annexes covering the airworthiness of aircraft are:

- a) Annex 6 — *Operations of Aircraft*, and
- b) Annex 8 — *Airworthiness of Aircraft*.

The basic aircraft is certificated, manufactured and issued a Certificate of Airworthiness in accordance with Annex 8, then operated in accordance with Annex 6.

1.1.7 The first article of the Convention stresses that every State has sovereignty over its airspace. Each Contracting State may therefore, under Article 38, notify a difference to ICAO, and not adhere to a SARP. ICAO publishes these differences, and Contracting States can decide if aircraft from a State that lodges a difference can be allowed to operate over their territory.

1.1.8 There is no provision in the Convention which allows a Contracting State to not comply with a requirement of the Convention.

1.1.9 ICAO has initiated an audit programme to assess the compliance of States with ICAO obligations in an effort to increase overall understanding and compliance by the Contracting States.

1.1.10 This Airworthiness Manual was amended and restructured by the ICAO Airworthiness Panel. It is approved by the Secretary General of ICAO and published under his authority. The objective of this manual is to provide guidance on the implementation of the airworthiness and maintenance provisions of Annex 6 and Annex 8. The material in the manual will assist Contracting States in enhancing consistency in their application of these Annexes and assist them in carrying out their safety oversight obligations.

1.1.11 This manual is based on the latest information available to the international aviation community on the airworthiness and operation of aircraft and will be amended to take into account developments in the airworthiness field.

## **1.2 Obligations under the Convention**

1.2.1 The Convention on International Civil Aviation provides that every aircraft of a Contracting State, engaged in international navigation, shall carry a Certificate of Registration and a Certificate of Airworthiness (Article 29). It also provides that the Certificate of Airworthiness shall be issued or rendered valid by the State in which the aircraft is registered (Article 31).

1.2.2 The minimum airworthiness Standards for these certificates are contained in Annex 8. The technical specifications in Annex 8 include only broad Standards which define, for application by competent State authorities, the complete international basis for the recognition by States of Certificates of Airworthiness for the purpose of flight of aircraft of other States into or over their territories.

1.2.3 It was recognized that the broad standards in Annex 6 and Annex 8 would provide the basis for the development of national airworthiness regulations and rules which would specify the scope and detail considered necessary by individual States for the certification and the continuing airworthiness of individual aircraft. Thus, it is necessary that each State develop its own comprehensive airworthiness regulations and rules consistent with the provisions of Annex 6 and Annex 8, or adopt appropriate airworthiness regulations developed by another Contracting State. When adopting airworthiness Standards from another Contracting State, the adopting State should be aware of any differences filed by the other State that are reflected in their Standards, as the adopting State may have to file the same differences.

1.2.4 National airworthiness regulations and rules must specify that the State of Registry is the sole authority responsible for ensuring that every aircraft on its registry conforms in all essential respects with the type design certificated in accordance with the airworthiness code it has adopted for that class of aircraft. Furthermore, the State of Registry has the responsibility for ensuring that every aircraft on its registry is maintained in an airworthy condition throughout its service life. Although the methods of discharging the foregoing State airworthiness responsibilities may vary, such arrangements do not relieve the State of Registry from its overall responsibility. The only exception is where the State of Registry has executed an Article 83*bis* agreement with another State for a particular aircraft, in which case all or part of its functions and duties as State of Registry in respect to that aircraft under Articles 12, 30, 31, and 32(a) of the Convention are transferred to the other State. The State of Registry shall be relieved of responsibility in respect to the functions and duties transferred.

1.2.5 A Certificate of Airworthiness as required by the Convention should normally not be issued unless there exists a valid Type Certificate for the aircraft type and model that has been issued by a Contracting State. It is also necessary to determine that the aircraft was produced under a valid production approval to ensure the aircraft conforms to its type design. The requirements for the issuance of a Type Certificate, Production Certificate, and Airworthiness Certificate are addressed in later sections of this manual.

### **1.3 Discharge of State responsibilities**

1.3.1 In order to discharge its overall responsibilities under the Convention, the State needs to enact basic legislation which will provide for the development and promulgation of civil air regulations and practices, including airworthiness regulations, consistent with its acceptance of the Annexes. In the development of these regulations, the State has the option of adopting provisions which will govern its role in the implementation of the regulations. This role may range from highly active to passive.

1.3.2 In the active role, a close day-to-day interest would be taken in the direction and control of all airworthiness matters through an inspection organization. In the passive role, the State would intervene only to institute action when a violation of the regulations has occurred. In practice, neither of these extremes would be compatible with an equitable and effective division of responsibility between the State and the aircraft operators, manufacturers and maintenance facilities.

1.3.3 A system of active supervision by the regulatory authority could be so rigorous as to amount to complete domination and dictation of the conduct of all airworthiness activities, leading to an undermining of the morale of airworthiness personnel, lowering of safety and greatly increasing the cost and time for manufacturing and repairs, and confusing the obligations of operators to be responsible for their actions. Such a system would, in any case, require the establishment of a large inspection and enforcement organization which could hardly be justified.

1.3.4 In the passive role, the State could leave both the interpretation and implementation of the airworthiness regulations to the aircraft operator, manufacturer and maintenance facility, relying upon their technical competence to interpret them correctly, and encouraging compliance through threat of enforcement action. This might place an unreasonable burden of responsibility on those persons involved in interpreting and applying the airworthiness regulations in practice. Further, the State would not be in a position to assess adherence to the regulations other than by knowledge acquired fortuitously or in the course of accident or incident investigation. Such a system would not enable the State to exercise properly the necessary preventive and corrective function; consequently, it could not adequately discharge its responsibility.

1.3.5 The foregoing leads to the conclusion that considerable merit exists for an overall State regulatory system which has elements of both extremes and which will:

- a) represent a well balanced allocation of responsibility between the State and those persons or organizations conducting airworthiness-related activities;
- b) be capable of economic justification within the resources of the State;
- c) enable the State to maintain continuing regulation and supervision of the airworthiness activities of the operator, manufacturer and maintenance facility without unduly inhibiting their effective direction and control of their organizations; and
- d) result in the cultivation and maintenance of harmonious relationships between the State and those persons/organizations applying airworthiness regulations in practice.

1.3.6 The essential elements to be covered by an airworthiness regulatory system include:

- a) aircraft type certification;
- b) approval of modifications and repairs;

- c) manufacture of aircraft and aviation products under a production approval;
- d) registration of aircraft;
- e) airworthiness certifications;
- f) continuing airworthiness;
- g) approval of aircraft maintenance organizations;
- h) certification of operators; and
- i) licensing of personnel.

*Note.— This manual does not cover all aspects of items h) and i) above.*

1.3.7 Through the process of registering aircraft and the issuance of the certificates and approvals listed in 1.3.6, the State has the capability of ensuring the protection of the public interest and will be able to exercise appropriate influence and control of airworthiness activities without encroaching upon the operator's, manufacturer's and maintenance facility's responsibility for safety.

1.3.8 Where the State is not only the airworthiness regulatory authority but also the operator, manufacturer or maintenance facility, the requirements of the Convention on International Civil Aviation will be met and the public safety interest best served by the separation of authority and responsibility between the State airworthiness operating agency and the State regulatory authority. The approval and certification procedures as detailed herein should be followed as if the airworthiness operating agency were a separate non-government entity.

#### **1.4 Airworthiness responsibilities in Annex 6**

1.4.1 Annex 6 includes additional functional requirements that must be incorporated into aircraft for particular types of operation. The aircraft may therefore satisfy the airworthiness requirements of Annex 8, but not be usable for a specific operational task without meeting the additional requirements of Annex 6. This has special significance where the requirements of Annex 8 are generally applied only to new certification projects, and new requirements in Annex 8 will only appear in aircraft after some time. Any additional requirements of Annex 6 must also meet the airworthiness approval requirements of Annex 8. Also, under Article 41 of the Chicago Convention, changes to Annex 8 do not become binding on Contracting States until three years after the Annex is amended. However, a requirement in Annex 6 must be satisfied prior to any current operations, unless otherwise specified.

1.4.2 Annex 6 also includes requirements for continuing airworthiness of aircraft, including such issues as application of a maintenance programme, and the approval of data used for incorporating modifications and repairs. These requirements are intended to ensure that aircraft remain in a safe condition for operation and conform with approved design data throughout the operational life of the aircraft. There may also be an overlap of considerations between the two Annexes; for example, Annex 8, Part II, 4.2.3 f) requires the State of Registry to implement a system whereby information on defects is transmitted to the organization responsible for type design of the aircraft. The systems implemented for aircraft maintenance procedures required to satisfy Annex 6, Part I, Chapter 8 provides the details necessary to satisfy the requirement for submission of defect reports.

## **CHAPTER 2: STATE REGULATORY SYSTEM**

### **2.1 Introduction**

#### 2.1.1 General

There are two prerequisites for the proper introduction of an airworthiness regulatory system:

- a) a provision in the basic aviation law of the State for the establishment of a code of airworthiness regulations; and
- b) the establishment and empowerment of an appropriate State entity with the necessary authority to verify compliance with the regulations, hereinafter referred to as the Civil Aviation Authority (CAA).

#### 2.1.2 Basic aviation law

The basic aviation law of the State should:

- a) authorize the establishment of a CAA to be headed by a Director of Civil Aviation (DCA). (States may choose other titles for the head of the organization, but this title will be used throughout this manual);
- b) make provisions for the adoption of airworthiness regulations based on the provisions of the Annexes to the Convention on International Civil Aviation;
- c) authorize the DCA to:
  - 1) register aircraft and maintain a national registry;
  - 2) issue or validate Type Certificates;
  - 3) issue Production Approvals, as the State of Manufacture;
  - 4) issue, renew or validate Certificates of Airworthiness;
  - 5) issue, amend, cancel and suspend airworthiness approvals, licences and certificates;
  - 6) develop, issue and amend Airworthiness Directives (AD), bulletins, orders, etc., consistent with its airworthiness regulations; and
  - 7) establish an airworthiness organization to assist in carrying out the functions and responsibilities of the office. This organization will often comprise an aircraft certification (or engineering) division, a production division and an airworthiness inspection division.
- d) make provisions for the enforcement of the airworthiness regulations; and



- e) make provisions for authorized personnel to have the right of access to places as necessary to carry out airworthiness functions as provided for in the State's regulations.

### 2.1.3 Airworthiness regulations

The airworthiness regulations adopted by the State should include provisions for:

- a) mandatory registration of all aircraft;
- b) implementation of the airworthiness provisions meeting the requirements of the Convention and the Annexes;
- c) all aircraft on the State's registry to meet relevant airworthiness criteria adopted by the State;
- d) the issuance or validation of the Type Certificate for aircraft intended to be entered on the State's registry;
- e) the issuance of production certificates or approvals of production organizations;
- f) the issuance, renewal and validation of certificates of airworthiness;
- g) the issuance of ADs, bulletins, orders, etc., consistent with the airworthiness regulations;
- h) the issuance, amendment, cancellation and suspension of airworthiness approvals, licences and certificates;
- i) persons or organizations performing specified functions in relation to the design, construction and maintenance of aircraft, components and parts in order to be holders of State approvals, licences and certificates as required;
- j) authorized personnel to inspect and test aircraft, aircraft components, standard parts, materials or processes and systems for the purpose of ascertaining whether the processes and activities covered by an approval, licence or certificate have been carried out in a satisfactory manner; and
- k) the imposition of penalties for a contravention of, or failure to comply with, a provision of the State's civil aviation laws, regulations or directives, or conditions issued, given, made or imposed under, or in force by virtue of, the State laws or regulations or directives.

*Note.— See ICAO's Manual of Model Regulations for National Control of Flight Operations and Continuing Airworthiness of Aircraft (Doc 9388) for guidance on the development of airworthiness regulations.*

## 2.2 Structure of the CAA

2.2.1 Pursuant to delegated authority, the DCA should establish an effective organization and employ the necessary qualified personnel to carry out the responsible functions. Although the scope of the Director's responsibilities should not vary substantially from State to State, the structure and size of the

CAA's airworthiness organization will vary considerably depending on the number, size and complexity of civil air operations in the State and on the size and scope of the State's aviation manufacturing industry.

2.2.2 In deciding upon the required airworthiness organizational structure, the DCA should review the requirements for certification and surveillance of operators as outlined in Part IV of this manual and also in the *Manual of Procedures for Operations Inspection, Certification and Continued Surveillance* (Doc 8335) in light of the number and size of potential air operators in the State. The DCA should consider the level of civil aviation activity and the size of the State's aviation manufacturing industry when establishing the organizational structure. In those States where there are both extensive aviation operations and manufacturing, it will generally be necessary to establish within the CAA airworthiness organization an aircraft certification division (ACD) and an aircraft inspection division (AID). Some States may find it necessary to establish a separate Production Division (PD). The establishment and functioning of these three divisions are discussed in Chapter 3 of this Part. To be effective, the CAA should provide an adequate level of administrative support, including comprehensive information technologies, for members of the organization.

2.2.3 It is also recognized that a State or group of States may elect to discharge their responsibilities through agreements with a multinational organization or agency. It is essential that the agreements clearly define the respective functions each party is to perform, so as to ensure that all obligations of the States are fully discharged. Responsibility for proper execution of ICAO responsibilities remains with the Contracting State.

2.2.4 In those States which do not have an aviation manufacturing industry, the airworthiness organization within the CAA will be mainly concerned with inspection and authorization functions and may not require a separate ACD. Furthermore, in some States which do not have an aviation manufacturing industry and the size and number of commercial and general aviation operations is relatively small, the responsibilities of the DCA may be fulfilled in a more cost-effective manner through cooperative inspection arrangements with neighbouring States or regional inspection organizations. Where the frequency of certain airworthiness inspection or examination activities is low, such as the activity associated with the validation of Type Certificates and issue of Certificates of Airworthiness, it may be advantageous to enter into an arrangement for another State or a competent person to perform work on behalf of the State of Registry. The State of Registry remains responsible under the Convention for the work performed. (The ICAO Regional Office accredited to the State may be of assistance to the DCA in working out cooperative inspection arrangements.)

2.2.5 In any event, the DCA will need to consider carefully the public interest when establishing the airworthiness inspection organization. The DCA must ensure that the CAA retains effective control of important inspection functions. Functions should not be delegated in such a manner that commercial operators, aircraft manufacturers, maintenance facilities and general aviation aircraft owners, in effect, regulate themselves in airworthiness matters. Regardless of the organizational arrangements established, the DCA must bear in mind that the obligations of each State to comply with the requirements of Annexes 6 and 8 remain unchanged.

2.2.6 The Convention requires that a number of approvals be issued by the State, but the CAA may wish to authorize an organization or a person to make approvals on behalf of the CAA. A system of delegations implemented by the CAA will generally satisfy this requirement, providing it incorporates the following features:

- a) the standards to be achieved are clearly documented by the CAA. A delegate can only apply a documented standard approved by the CAA.

- b) the delegates are required to meet technical and regulatory competency requirements and are authorized to make approvals only in areas of their demonstrated competence.
- c) the CAA has an interest in the continuing proficiency of the delegates, and monitors their continued training so that they remain competent in the fields of their authorization.
- d) the delegate's procedures have been approved by the CAA, and the CAA audits the delegates to ensure they follow those procedures. The procedures should clearly identify where an approval is made, and will normally include a clear differentiation between the development of data, and the approval of that data.
- e) the basis of making the approval is clearly documented.
- f) the delegates make approvals for and on behalf of the CAA.

2.2.7 An approval made by a correctly authorized delegate will be accepted as if it was made by the CAA.

## **CHAPTER 3: AIRWORTHINESS ORGANIZATION**

### **3.1 General functional responsibilities**

The major function of the airworthiness organization is to provide technical advice to the DCA on all matters affecting:

- a) design approvals and continued airworthiness of the design;
- b) issuance of various approvals based on the assessment of aircraft, engines, propellers, and equipment produced in the State or of foreign-manufactured aircraft intended to be placed on the registry of the State;
- c) the manufacture of aeronautical products and parts in the State;
- d) aircraft registration;
- e) issuance and renewal of airworthiness certificates;
- f) continuing airworthiness oversight; and
- g) training and licensing.

The specific responsibilities assigned within the airworthiness organization will vary somewhat depending upon the scope of the aviation industry in the State, but should normally include those tasks defined in 3.1.1 through 3.1.3.

#### 3.1.1 Regulations, policy and guidance

The airworthiness organization should:

- a) develop national airworthiness regulations, standards, policy, and guidance;

- b) amend, as appropriate, national airworthiness regulations, policy, and guidance, based on a continual review of the viability and effectiveness of those regulations, policy and guidance;
- c) examine changes in ICAO requirements for incorporation into national requirements, or the filing of appropriate differences;
- d) examine current and new foreign regulations and determine the need for adoption of critical features of the foreign regulations in the national requirements;
- e) establish working relationships with other CAAs and industry that facilitate the certification of foreign aviation products and parts to enable their import and export;
- f) conduct research and development, as necessary, to support issuance of regulations, standards, policy, and guidance; and
- g) identify and resolve regulatory problems associated with continuing airworthiness and establish appropriate general and technical regulations, policies and procedures.

### 3.1.2 Surveillance, investigations, and enforcement

The airworthiness organization should:

- a) perform regular surveillance and audits of industry activities to ensure compliance with airworthiness requirements and associated specifications. This includes:
  - 1) ensuring the proper functioning of any delegates or delegation systems;
  - 2) evaluating changes to a certificate/approval to ensure continued compliance with the applicable airworthiness requirements;
  - 3) coordinating requests for deviations from requirements and specifications, and ensuring adequate treatment for those deviations;
  - 4) discovering and assessing industry problems which threaten timely and satisfactory achievement of safety objectives related to national requirements, including issuing recommendations for corrective action; and
  - 5) witnessing critical tests performed and approval of testing methods and test reports.
- b) investigate major problems or defects discovered in aeronautical products or parts in service, and determine appropriate corrective action to be taken, when the airworthiness objectives of national requirements are not being met.
- c) monitor manufacturer's service bulletins to consider their implications on design, production and maintenance.
- d) evaluate accidents, incidents and service difficulties to determine possible unsatisfactory designs or processes; and

- e) take enforcement actions, when necessary, to ensure compliance with airworthiness requirements.

### 3.1.3 Staffing and training

3.1.3.1 In order to meet its responsibilities, the airworthiness organization must be staffed with qualified and experienced personnel capable of successfully undertaking the wide variety of required tasks. CAAs should ensure they attract and retain technically competent staff with the credibility and competence to interact with industry in an efficient and effective manner. It is essential that the staff be selected with considerable care. Some specialized skills may be obtained from external sources as needed.

3.1.3.2 Staff should possess a high degree of integrity, be impartial and tactful, and have good interpersonal communication and behaviour skills.

3.1.3.3 The CAA should have a programme for induction of new personnel that includes training in organizational responsibilities, appropriate airworthiness standards and policy, organizational working procedures, and the role of a regulator.

3.1.3.4 The CAA should have a structured programme to educate the staff on appropriate new CAA standards, policies, and procedures as they are being implemented.

3.1.3.5 The staff needs to keep abreast of new industry developments in the design, construction and maintenance of aircraft and associated equipment. A programme should be developed that provides for the staff, at regular intervals, to visit appropriate facilities and attend technical training and symposia to gain first-hand knowledge of new developments, including management principles. As a general policy, it is not desirable for individual staff members to obtain technical training or licenses from those entities under their direct regulatory jurisdiction.

3.1.3.6 In order for the CAA to benefit from the retention of experienced staff on the job and to maintain the necessary continuity of the organization, it is important that staff members are provided with conditions of service and remuneration reasonably consistent with that of industry, given the same education, technical knowledge, experience, and the responsibilities of their position.

3.1.3.7 It is preferable that staff should also possess aeronautical licenses, certificates or academic degrees commensurate with their job responsibilities (e.g. engineering degrees, technician/engineer/mechanic certificate with airframe and powerplant ratings, electronics technician ratings).

### 3.1.4 Environmental Standards

In addition to the Annex 8 airworthiness requirements, Annex 16 — *Environmental Protection*, requires States to perform certification of certain environmental aspects of civil aircraft and engines intended for use or operation in international air navigation. States may assign the responsibilities for establishing, and finding compliance with, the environmental standards to their airworthiness organization or to another organization.

### **3.2 Aircraft certification division responsibilities**

3.2.1 In those States with a significant aviation manufacturing industry, it will be necessary to establish an aircraft certification division (ACD) within the CAA airworthiness organization. The size and structure of the ACD should be appropriate to the aviation manufacturing industry and the various types of aircraft on the State's registry. The ACD's activity will normally be directed toward type certification, evaluation of repairs and modifications proposed by manufacturers or operators to correct deficiencies in aircraft already in service or to enhance their usefulness, and continuing airworthiness of type certificated products.

3.2.2 Within the ACD, it may be useful to organize along functional areas of expertise. Specifically, these could include structures, propulsion, electrical/mechanical systems (including software), cabin safety, performance, flight test, etc. When the physical size of the State is large and the level of aviation activity is relatively high, it may be necessary to establish regional offices in the proximity of the aviation industry. In such cases, it is essential that proper lines of communication and responsibility exist between headquarters and field offices.

#### **3.2.3 Approvals and certificates**

The ACD should:

- a) approve design organizations and ensure they have the technical competency and organization to enable them to show compliance with the appropriate design requirements;
- b) issue Type Certificates or design approvals for aircraft, engines, propellers, equipment, and materials;
- c) ensure that the type data necessary to support the Type Certificate of aircraft on the registry of the State is maintained;
- d) validate Type Certificates or approvals issued by another State; and
- e) approve the design of modifications and repairs.

#### **3.2.4 Continuing airworthiness functions**

The ACD should:

- a) ensure that a system is in place through which the operator will report malfunctions, failures, and defects to the type design organization and that the type design organization will review those reports and takes corrective action. The CAA should then monitor that activity in order to ensure that unsafe conditions are corrected;
- b) monitor service bulletins from the manufacturer (both foreign and domestic) to determine likely effects on the continuing airworthiness of aviation products and to establish procedures to avoid or correct service difficulties;

- c) mandate actions to correct any unsafe conditions and disseminate the information to all operators and to CAAs located in States that have the affected product on their national registry;
- d) ensure that a system is in place for the receipt, review, and appropriate action on mandatory continued airworthiness information from the State of Design; and
- e) ensure that a structural integrity programme is in place for each aeroplane above 5 700 kg and monitor its effectiveness.

### 3.2.5 Liaison functions

The ACD should:

- a) provide technical advice on matters relating to production, inspection, and flight operations as required;
- b) work with the organization responsible for accident/incident investigations to ensure that recommendations are adequately addressed; and
- c) work with the aviation industry, other governmental organizations, and the public in safety matters.

## 3.3 Production division responsibilities

### 3.3.1 General

3.3.1.1 In those States with a significant aviation manufacturing industry, it will be necessary to establish a production division (PD) within the aviation organization. The size and structure of the PD will be based on the size and complexity of the aviation manufacturing industry. The PD's primary functions will be the development of regulations, policy and guidance with regard to production certification, the issue of certificates/approvals, the surveillance of aviation manufacturing activities, the oversight of corrective actions, the support of type certification activities for new aircraft, airworthiness determination of products and parts, and liaison activities with the appropriate organizations.

3.3.1.2 Within the PD, it may be useful to organize the division along functional areas of expertise. Specifically, these could include the development of regulations, policy and guidance, certification of production organizations, surveillance and oversight functions, and perhaps more specialized areas such as non-destructive inspection, software quality assurance, and special manufacturing processes. When the physical size of the State is large and the level of aviation manufacturing activity is relatively high, it may be necessary to establish regional offices positioned near manufacturing facilities. In such cases, it is essential that proper lines of communication exist between headquarters and any regional offices.

### 3.3.2 Approvals and certificates

The PD should:

- a) issue a Production Certificate/approval for a manufacturer that produces in aeronautical products or parts;

- b) amend a Production Certificate/approval as necessary;
- c) approve manufacturing organizations to ensure the proper communication with the design organization, the adequacy of manufacturing and test facilities, the competence of skilled personnel, and the existence of satisfactory quality control systems, including coverage of suppliers;
- d) survey and evaluate aircraft for issuance of an Airworthiness Certificate and maintenance of that certificate for aircraft on the registry of the State, or in preparation for export to another State;
- e) issue Authorized Release Certificates for airworthy aeronautical products and parts; and
- f) issue Special Flight Permits for aircraft that do not meet applicable airworthiness requirements, but are capable of safe flight (e.g. prototype aircraft or production flight tests).

### 3.3.3 Surveillance, investigations, and enforcement

The PD should:

- a) perform regular surveillance of manufacturing activities and series production to ensure the manufacturer's compliance with airworthiness requirements and associated manufacturing specifications. This includes:
  - 1) ensuring the manufacturer's compliance with approved production drawings and manufacturing procedures;
  - 2) evaluation of any changes to a Production Certificate/approval to ensure continued compliance with the applicable airworthiness requirements;
  - 3) coordination of manufacturer's requests for deviations from specifications, and ensuring adequate manufacturer's treatment, in coordination with the ACD, for those deviations from specifications;
  - 4) follow through to ensure that the manufacturer submits complete modification drawings, design data and maintenance information for use by the operator, maintenance and overhaul organizations;
  - 5) manufacturer's reporting of problems, which threaten timely and satisfactory achievement of the objectives with recommendations for corrective action; and
  - 6) witnessing of critical tests performed by the manufacturer and approval of testing methods and test reports in coordination with the ACD.
- b) investigate unsatisfactory manufacturing occurrences, which may result in a determination, with the manufacturer, of necessary corrective actions.



### 3.3.4 Support of type certification activities

The PD should:

- a) participate in and manage the activities of the type certification board (TCB) as they apply to manufacturing processes and techniques to be used (guidelines for the establishment of a TCB are given in Part III, Chapter 1, 1.2.5.1);
- b) inspect prototype aircraft, test specimens and test installation as necessary. This includes:
  - 1) determining the conformity of each part, article and test installation with its applicable design data, as well as with the approved test proposal;
  - 2) advising the ACD engineer of the detected discrepancies for conformity purposes; and
  - 3) issuing conformity inspection reports.
- c) evaluate proposals pertinent to manufacturing aspects of the design, repair, and modification of an aircraft or its parts to ensure conformity with CAA specifications; and
- d) support flight manual preparation.

### 3.3.5 Liaison functions

The PD should:

- a) coordinate with the ACD or AID on major problems or defects discovered in aeronautical products or parts in service, and determine the manufacturing corrective action to be taken where airworthiness may be affected;
- b) maintain continuous and effective cooperation with the ACD and AID regarding all aspects of manufacturing that affect the approved design and continued airworthiness of the product or part;
- c) maintain continuous and effective communication with the manufacturing organization to evaluate and advise on any changes to the production system that may affect the inspection, conformity, or airworthiness of the product or part; and
- d) establish relationships with foreign authorities for cooperation on production surveillance of suppliers.

## **3.4 Airworthiness inspection division responsibilities**

3.4.1 In all States it will be necessary to establish some form of airworthiness inspection organization to meet the requirements set forth in the Convention and in Annexes 6 and 8. The organizational structure of an inspection organization within the CAA, hereinafter referred to as the airworthiness inspection division (AID), will vary depending upon the level and scope of aviation activity within the State and whether an ACD has also been established.

3.4.2 The primary responsibilities of the AID should cover all matters concerning the registration of aircraft, continuing airworthiness, approval of maintenance organizations, maintenance certification of operators and, where no separate personnel licensing division exists, the licensing of aircraft maintenance personnel. In those States where an ACD is not established, it will normally be necessary for the AID to be responsible for those engineering tasks associated with continuing airworthiness, in which case suitably qualified staff will need to be employed.

### 3.4.3 Approvals and certificates

The AID should:

- a) record, review and process applications for registration of aircraft, registering and de-registering aircraft as appropriate, and issuing Certificates of Registration;
- b) survey aircraft for issuance, renewal and validation of Certificates of Airworthiness and the subsequent execution of such documents as appropriate; and
- c) issue and review of Maintenance Organization Approvals and Air Operator Certificates (AOC).

### 3.4.4 Surveillance, investigations and enforcement

The AID should:

- a) periodically review the airworthiness condition and records of aircraft on the registry in order to assess the adequacy of their maintenance and the competence and diligence of the persons and organizations who perform the maintenance;
- b) investigate, in coordination with the ACD, significant defects discovered in aircraft and determine corrective action to be taken where airworthiness may be affected. Analyze defect experience to detect and correct any trends and to reveal areas most in need of airworthiness improvement, and establish a service difficulty reporting (SDR) system (for guidance on SDR systems, see Part III, Chapter 4, Section 4.4.4);
- c) in conjunction with the ACD, review aircraft and component manufacturers' service bulletins and airworthiness directives issued by foreign airworthiness authorities to determine their applicability to the national aircraft, and direct corrective action where airworthiness may be affected (guidance on the implementation of Airworthiness Directives is provided in Part III, Chapter 4, Section 4.4.5);
- d) in conjunction with the ACD, approve minor modifications to aircraft, aircraft components and equipment;
- e) conduct periodic surveillance of the maintenance-related facilities, procedures and work of holders of AOCs, making appropriate directions and recommendations and approving amendments to the operator's AOC and to its maintenance organization's procedures and quality control manuals as appropriate;
- f) survey the facilities, procedures and staffing of applicants seeking approval to conduct maintenance on aircraft, and the issuance and renewal of such approval;

- g) assess the qualifications of approved persons within an organization, and of other persons as alternates, to perform certain maintenance-related airworthiness functions, and monitor of the activities of these persons;
- h) recommend and, where necessary, issue directives concerning the maintenance, overhaul and repair standards to be met by aircraft and aircraft components and equipment, and issue procedures to be followed by the aviation industry to comply with the national air law and regulations related to airworthiness;
- i) approve aircraft and component reliability programmes;
- j) participate in maintenance review board activities toward the development and approval of initial maintenance inspection requirements for newly type certificated aircraft and engines; and
- k) survey the facilities, procedures and staffing of applicants for approval to conduct the training of maintenance personnel, and issue and renew such approvals (see Note below).

*Note.— Where a separate personnel licensing division exists, the functions related to the issuance, renewal, and maintenance of such licenses will be discharged by that division, in cooperation, with the AID.*

### 3.4.5 Liaison functions

The AID should:

- a) prepare and distribute advisory material to the aviation industry concerning airworthiness practices and procedures, where such advice does not warrant mandatory action but may still make a significant contribution to flight safety;
- b) provide advice and recommendations in other areas of CAA responsibility, such as shipment of airworthiness-related dangerous goods, certification of operators and on other technical matters relating to aviation techniques, flight operations and aeronautical engineering as may be required;
- c) assist, when requested, in the investigation of aircraft accidents;
- d) participate in type certification board activities;
- e) prepare and distribute to the public, documents containing all issued airworthiness directives;
- f) confer with other national authorities on matters relating to maintenance and operations; and
- g) investigate possible violations of the national air law or regulations in regard to airworthiness support of legal or other corrective action.

### 3.4.6 Aid technical library and records

3.4.6.1 To enable airworthiness personnel to keep up to date with technical and regulatory issues relating to design, maintenance and operation of aircraft, it is essential to establish a properly organized and administered technical library. Arrangements should be made with each State of Design for an automatic supply of the documents related to the airworthiness of aircraft on the State's registry. The library should also be provided with (or have access to) all documents issued by ICAO relating to operations and airworthiness of aircraft. It is important that all documents in the library be promptly amended and kept up to date. This assists airworthiness staff in determining whether or not mandatory modifications, inspections and repairs approved by the State of Design are carried out before the work is certified by the authorised personnel of the operator, or of an approved organization, or by licensed personnel.

3.4.6.2 The CAA will need to keep files for each aircraft registered in the State. The files should contain records detailing applications for the Certificates of Registration and Airworthiness, copies of supporting documents, copies of certificates issued, the maintenance programme approved for the aircraft, together with any other information relevant to the airworthiness of the aircraft.

3.4.6.3 The data can be held in paper or electronic form. Data can be considered to be available if provided by the internet. Manufacturers generally ensure that data made available on the internet is fully amended and up-to-date. However, means will need to be provided to ensure that the data continues to be available if the manufacturer ceases to support the internet documents, or the internet data is temporarily unavailable (such as retaining some data on paper or CDs). There will also need to be a procedure in place to provide changes in the information to users. The information will need to be made available in a format suitable for use, for example, electronic format may be necessary to update some user products, and paper based books may be essential for some uses.

## **PART III.— ANNEX 8 – AIRWORTHINESS OF AIRCRAFT, SUPPORTING GUIDANCE MATERIAL**

### **CHAPTER 1: TYPE CERTIFICATION**

#### **1.1 General**

1.1.1 Article 31 of the Convention on International Civil Aviation prescribes that every aircraft engaged in international civil aviation shall be provided with a Certificate of Airworthiness issued or rendered valid by the State of Registry. Annex 8, Part II, *Procedures for Certification and Continuing Airworthiness*, states in part that the issuance, or rendering valid, of a Certificate of Airworthiness must be based on satisfactory evidence that the aircraft complies with the design aspects of the appropriate airworthiness requirements (i.e. the airworthiness standards) of the State of Registry. An example of evidence that is used by a majority of Contracting States, for the purpose of the Certificate of Airworthiness, is the aircraft Type Certificate.

*Note.— Amendment 98 to Annex 8 introduced the formal requirement for a State of Design to issue a Type Certificate as evidence of approval for any new application for aircraft certification on or after 2 March 2004.*

1.1.2 The original issuance of an aircraft Type Certificate by the State of Design is regarded as satisfactory evidence that; the design and details of such aircraft type have been reviewed and found to comply with the airworthiness Standards, the aircraft type has been subjected to the required ground and

flight tests and, that no known or suspected unsafe aircraft characteristics exist against those Standards of which it had shown compliance. Subsequently, a State of Registry may accept the original Type Certificate in lieu of issuing its own or use it as a basis for issuing its own Type Certificate when processing an aircraft type intended to be entered on the State's civil registry for the first time.

1.1.3 A Type Certificate is a formal document issued by the State of Design or the State of Registry for the approval of a type design of an aeronautical product. Type Certificates are generally issued for aeronautical product categories regarded as whole entities, such as aircraft, engines and propellers. Other forms of design approval may be issued to cover the remaining aeronautical product categories such as major components, auxiliary power units, appliances, equipment, instruments, and other parts intended for installation in the aircraft, engine or propeller. Thus, prior to issuing a Type Certificate for the aircraft, States would also have to ensure compliance with those airworthiness requirements that specify separate Type Certificates for engines and/or propellers or separate design approvals for major components prior to its installation on the aircraft.

1.1.4 The airworthiness organization of the State of Registry, as discussed under Part II, is responsible for ensuring the airworthiness of aircraft to which it issues a Certificate of Airworthiness. It is incumbent upon the State of Registry to facilitate this through a validation of the State of Design's Type Certificate. In doing so, it will rely on the State of Design's certification programme to the maximum extent practicable, in order to ensure the State of Registry's airworthiness standards are satisfied. If adopting the State of Design's airworthiness requirements, the State of Registry may validate the State of Design's Type Certificate without a technical investigation, provided that it is satisfied with the State of Design's airworthiness certification process and findings. When determining the level of technical investigation, the State of Registry may consider the outcome of the ICAO Safety Oversight Audit Programme or rely on a bilateral agreement between the State of Design and State of Registry. The State of Registry may also issue its own Type Certificate to indicate a satisfactory validation of the State of Design's Type Certificate.

1.1.4.1 For those CAAs that have an ACD, the ACD will normally establish and carry out procedures for the type certification or other design approval of aircraft, engine, propellers, equipment, instruments, etc., that are designed or produced in that State, as well as including procedures for the validation of Type Certificates and other design approvals issued by another State. It is essential that the basic criteria and procedures be developed in detail by the ACD, approved by the DCA, and made available to all parties involved within the CAA and the aviation industry. The criteria and procedures should be set forth in straightforward terms and in a form suitable for use by the ACD engineers, as well as the design and test engineers employed by the manufacturers. The procedures should be of a general nature and normally not tailored to a specific aircraft type or specialized equipment and components. Furthermore, the procedures should provide for active participation of the AID at an early stage of the type certification/design approval process and for effective communication between all parties concerned.

1.1.4.2 Some States may not have an aviation manufacturing industry and, consequently, do not necessarily have in their airworthiness organization the engineering capability to perform type design review or technical validation of a foreign Type Certificate. States in this category should establish through, regulations or policy, the recognition and direct acceptance of the type certification already done by the State of Design. Alternatively, States may obtain the services of qualified persons or organizations on a temporary basis to allow the fulfilment of its responsibilities for type certification under Annex 8.

1.1.5 All Contracting States are encouraged to give maximum credit and recognition to the type certification already done by the State of Design, and avoid duplicate or redundant testing where practical and without prejudice to its own unique national requirements. The majority of airworthiness standards currently used by States with aviation manufacturing industries are already harmonized, and the remaining differences are either with the unique technical requirements, due to operational or

environmental constraints, and/or interpretation of the same requirements. Although full harmonization of all airworthiness requirements is yet to come, the overall objective that all States should work towards is reducing the amount of work needed to accomplish the approval of an aircraft type design and, subsequently, the issuance of a Certificate of Airworthiness under Annex 8 by the State of Registry.

## **1.2 Application for a Type Certificate**

### **1.2.1 General**

A Type Certificate is normally issued for an aircraft, engine or propeller. The type certification process is initiated when an applicant submits a formal application to the ACD for the issuance of a Type Certificate for the applicant's aeronautical product. The official acceptance of the application by the ACD may be subject to certain prerequisites or conditions of application. As an example, some States have a financial policy on recovering their costs for services rendered and, may require the applicant's commitment to such policy before the ACD begins type certification. The application phase of any type certification activity normally involves exploratory discussions between the ACD and the applicant on various issues, the intent of which is to acquire as much understanding as possible on the type certification project. In many cases, an application is also made for concurrent certification by another State. Some of these aspects are discussed in the following paragraphs. Once the application is officially accepted by the ACD, the type certification process begins, usually involving the five (5) common key aspects of Section 1.3 of this Part

### **1.2.2 Applicant**

1.2.2.1 An applicant for a Type Certificate can be an organization, an individual or, where allowed by a State, a representative for that organization or individual. Regardless, the applicant is, for purposes of type certification, the organization or individual that has responsibility for the type design of the aircraft, engine, or propeller and in whose name the Type Certificate will be issued. The applicant should have the technical capability, or have access to a technical capability, to establish and demonstrate compliance of the type design to the applicable airworthiness and environmental Standards. In cases of complex design and production of aeronautical products involving multi-national agreements, joint ventures, partnerships or similar collaboration, the applicant for a Type Certificate remains responsible overall for the type design of the aircraft, engine, or propeller that is under consideration for a Type Certificate.

1.2.2.2 Some States require an individual or organization to first demonstrate competency by formally obtaining accreditation or designation from their CAA as an approved design specialist (known in some States as an approved design organization or individual, or of an equivalent status). This technical capability can be a function of the extent and complexity of the aeronautical product being certified and, the nature of the substantiating data needed to establish and demonstrate compliance with the applicable airworthiness and environmental Standards. Type certification of an aircraft, engine or propeller should not be attempted unless the applicant has a sound knowledge of the design principles embodied in the aeronautical product being considered.

### **1.2.3 Application form**

A formal application for a Type Certificate should be submitted in a form and manner prescribed by the CAA and submitted to the ACD. Information should be provided as follows:

- a) for an application for an aircraft Type Certificate, a three-view drawing of that aircraft and preliminary basic data, including the proposed operating characteristics and limitations;
- b) for an application for an engine or propeller Type Certificate, a general arrangement drawing, a description of the design features, the operating characteristics, and the proposed operating limitations of the engine or propeller;
- c) a statement identifying the airworthiness Standards to which the aircraft, engine or propeller is designed and intended to show compliance with; and
- d) an indication from the applicant on the need for concurrent or subsequent type certification in another State or States.

#### 1.2.4 Validity period of an application

An application for a Type Certificate is normally subjected to a validity period prescribed by the CAA, within which the type certification process should be completed. The validity period starts from the date of application up to a pre-determined number of years, the exact number being commensurate to the complexity of the review and approval of the type design of the aeronautical product. For example, many States have a validity period of five years when certifying large transport aircraft, and three years when certifying an engine or propeller. In cases where an applicant can show that his product requires a longer period of time for design, development, and testing, the CAA can approve a longer validity period. Or if during the type certification process, the CAA believes that the Type Certificate will not be issued by the end of the validity period, the applicant should be requested to submit a new application or apply for an extension of the validity period. As a consequence of any extension granted to an applicant, the certification basis should be reviewed again for currency or validity. The CAA and applicant should jointly review the potential impact or consequence of their extended validity period when requesting foreign validation of their Type Certificate.

#### 1.2.5 Management of the application

An application is considered outstanding or open until a Type Certificate is finally issued, or denied by the CAA. Given that an application has to be completed within the validity period established in 1.2.4, the CAA needs to convene a certification team that will administer the type certification process and manage the actual certification activities involved in each application. For a State of Design, this team is commonly referred to as the Type Certification Board (TCB). For a State of Registry, this team is commonly referred to as the Validation Team. The functions of both teams are the same, i.e., to process an application for a Type Certificate and provide a recommendation to the CAA. However, the activities of the Validation Team are expected to be limited in scope and depth, giving due recognition to the work being performed, or already done, by the authority of the State of Design.

##### 1.2.5.1 Type certification board

Type certification boards are normally established for all aircraft and engine projects in which a complete type certification is involved. These may also be established for propellers, when considered necessary, and for projects involving complex changes to the type design. The purposes of a TCB are to acquaint the applicant and the ACD with the specific certification project, resolve significant problems, establish milestones and schedules for the overall accomplishment of the type certification programme,

review the applicant's certification plan, review the proposed certification basis, and assure all outstanding certification issues are resolved. Clear expectations from, and assignments for, the applicant and ACD are established by the TCB. It is also the TCB that submits the final recommendation to the DCA for the issuance or denial of a Type Certificate.

#### 1.2.5.2 Board membership and participation

1.2.5.2.1 The TCB should have permanent members from both the CAA and from the organization responsible for the type design, consisting of at least the following:

- a) a representative of the ACD;
- b) a representative of the AID;
- c) a representative of the Operations Division; and
- d) the applicant and their representatives.

1.2.5.2.2 Additional representatives should be invited as participants on an advisory basis when their presence is warranted because of new features, specialized considerations, or due to inter-regional and regulatory implications. These participants may include the following:

- a) engineering and manufacturing specialists from the CAA;
- b) maintenance and inspection specialists from the AID;
- c) associated aircraft, engine or propeller manufacturers whose representative may assist in providing technical information; and
- d) representatives of other divisions of the CAA, as necessary.

1.2.5.2.3 The representative of the ACD should act as the TCB Chairman and should be responsible for: arranging TCB meetings; securing the desired representation, and notifying the representatives as to the time and location of the meetings. The TCB Chairman should be assisted in his work, as necessary, by aircraft, engine, propeller, and equipment specialists in the ACD.

1.2.5.2.4 Active participation of AID personnel in the early stages of TCB activities is of utmost importance. During the early stages of design and product development, aspects of accessibility and maintainability should be considered. Incorporation of these important design characteristics will enhance the reliability of the product and effectiveness of an operator's maintenance programme.

1.2.5.2.5 The review of manufacturer's maintenance information is another important function of airworthiness inspection. More emphasis is currently being given to the supply by manufacturers of instructions for continued airworthiness. These instructions are normally broad in scope and more detailed than the maintenance manuals currently required. It is important that these instructions be reviewed by, and have the concurrence of, the airworthiness inspectors assigned to the TCB.



### 1.2.5.3 Major activities of the board

1.2.5.3.1 The major activities of the TCB are accomplished in progressive sequence and are commonly divided into three phases, as follows:

- a) *Preliminary Phase* – is initiated by conducting an initial TCB meeting. The initial TCB meeting is commonly scheduled following formal acceptance by the CAA of an application for a Type Certificate. The initial TCB meeting should:
  - 1) enable the participants to become acquainted with the project;
  - 2) permit the discussion with specialists of design details and possible problem areas;
  - 3) commence the evaluation process;
  - 4) establish the certification basis; and
  - 5) identify areas needing the formation of special compliance teams to attain the earliest possible resolution of potential problem areas.
- b) *Pre-flight Phase* (or Pre-Type Inspection Authorization in the case of engines and propellers) – is usually initiated by conducting an intermediate TCB meeting. The timing of the intermediate TCB meeting is commonly scheduled either near the completion, or following completion, of all ground tests, but before commencing any official flight testing by the ACD. At the requests of the ACD or the applicant, the TCB should convene additional meetings as necessary in order to resolve promptly technical and administrative issues or problems as they arise. The intermediate TCB meeting(s) should provide for the discussion and clarification of any questions the applicant may have related to the required test programme of the aircraft, engine or propeller. Any or all outstanding items of significance to the official test programme must be resolved prior to the issuance by the ACD of an authorization to commence official aircraft flight testing or the issuance of the Type Inspection Authorization to commence the official engine or propeller type testing programme.
- c) *Final Phase* – is usually initiated by conducting a final TCB meeting. The timing of the final TCB meeting is commonly scheduled either near the completion, or following completion, of the demonstration of compliance with the certification basis and successful performance of all ground and flight testing. The final TCB meeting should provide for the:
  - 1) review of all outstanding items on which there may be some question of compliance with the agreed certification basis;
  - 2) establishment of the type certification data sheet items and aeroplane flight manual or equivalent document items;
  - 3) determination of the status of any outstanding technical data; and
  - 4) establishment of a TCB position on their readiness, which may be contingent on the disposition or full completion of all outstanding items, to recommend to the DCA the

issuance of a Type Certificate for the aeronautical product for which an application was submitted,

1.2.5.3.2. As stated in 1.2.5.3.1 a) 5), the TCB may require the formation of special compliance teams for the purpose of conducting special certification reviews of potential problem areas. The special certification review normally involves an in-depth, comprehensive study of complex, controversial or troublesome aircraft design features, or aircraft component problems associated with airworthiness determination of an aircraft, engine, propeller or aircraft component. Examples of potential safety problem areas for which such a special review may be appropriate include the following:

- a) complex or unique design features;
- b) advanced state-of-the-art concepts in design, quality or manufacturing processes;
- c) features that may require special conditions;
- d) troublesome features used in similar previous designs requiring further analysis or evaluation;
- e) compliance areas critical to safety and requiring judgment evaluations;
- f) undesirable maintainability characteristics;
- g) equivalent safety proposals with potential for major effects on safety; or
- h) complicated interrelationships of unusual features.

1.2.5.3.3 Special certification reviews are normally conducted with the assistance of specialists groups composed of members of the concerned divisions of the CAA. The groups may seek assistance from other governmental agencies, outside consulting firms and industry, as necessary, to obtain technical expertise for conducting a thorough evaluation. The group's findings and recommendations are submitted to the Chairman of the TCB.

#### 1.2.5.4 Record-keeping of TCB activities

Records should be made and kept for each TCB meeting that clearly identify, among other things, all decisions taken, the certification basis, agreements reached, status of action items, tasking and deliverables of persons, and commitments on schedules. Copies of such records should be distributed promptly to the meeting attendees and to all affected and concerned persons. Each item or subject discussed should be summarized under a separate heading and the problem stated clearly, followed by any conclusions and recommendations. Persons required to take action on specific matters by a critical due date should be identified clearly. Based on the knowledge of the design features or potential safety problems obtained from the TCB meetings, those certification areas for which a special certification review is required should also be identified in the records.

### **1.3 Type Certification activities: State of Design**

#### 1.3.1 General

1.3.1.1 The main objective of the type certification process is for a State to determine for itself the overall compliance of the type design of an aeronautical product with their applicable airworthiness requirements. This objective applies to both the State of Design and State of Registry. The State of Design has prime responsibility for the original or initial approval of the aeronautical product. A State of Registry has a responsibility to establish that there is satisfactory evidence of design approval of an aircraft being issued a Certificate of Airworthiness under Annex 8. While Annex 8 sets the minimum international airworthiness Standards in the form of general design objectives, it is not sufficient by itself to be the sole basis for the approval of a type design and issuance of a Type Certificate. The ability to issue the Type Certificate referred to in Annex 8 is conditioned upon States having comprehensive and detailed airworthiness (design) standards for the aircraft, engine and/or propeller that include or implement the design objectives of Annex 8.

1.3.1.2 There are five key activities associated with a type certification process, namely:

- a) establishing the certification basis;
- b) establishing the means or methods of compliance;
- c) demonstration and findings of compliance;
- d) certifying the type design; and
- e) post-type certification activities.

#### 1.3.2 Establishing the certification basis

- a) The major components of a certification basis are the Airworthiness and Environmental Standards, including if any, special conditions (SC) of airworthiness, findings of equivalent level of safety, and exemptions.
- b) In the application form for a Type Certificate, the applicant would have already proposed the airworthiness and applicable environmental Standards to which he intends to show compliance. Depending on the type design, additional airworthiness or operational requirements may be imposed by the State of Design, or an applicant may be required to show that the product meets additional standards in order to receive type certification in another State due to differences in requirements. All these requirements are established collectively to become the certification basis. The applicant should participate in any ACD discussion concerning the certification basis, but it remains the ultimate responsibility of the State of Design to review, decide, and establish that the certification basis is appropriate for the type design.
- c) Once the certification basis has been established, it should be confirmed in writing by the ACD to the applicant and preserved throughout the validity period of the application for a Type Certificate (*see Section 1.2.4 of this Part, Validity Period of an Application*)

- d) It should be noted that while the certification basis is established very early in the type certification programme, the final certification basis of an aeronautical product may, in some cases, end up being different from that initially established during the initial TCB meeting (*see guidance in Section 1.2.5.3 of this Part, Major Activities of the Board*). The differences may come when the ACD issues SC of airworthiness, findings of equivalent level of safety (FES), or an exemption. The need for the issuance of an SC, FES, or an exemption as part of the certification basis is usually identified by the applicant to the ACD at the beginning of the type certification project. However, the need may not be obvious at the beginning and becomes evident only during the course of the actual type certification. At the conclusion of the type certification activity, the ACD should identify all FES, exemptions and other voluntary compliance that transpired during the certification period in order that these activities may be recorded in the Type Certificate as part of the final certification basis.

#### 1.3.2.1 Airworthiness Standards

The applicable airworthiness standards for a Type Certificate are those that are in effect on the date of application for a Type Certificate, meaning the latest amendment level. Airworthiness Standards are amended from time to time to improve the overall level of safety inherent in these Standards. At the time of application, it is generally regarded that the latest amendment level of a Standard offers the highest level of safety for the product, and the intent is to certify the type design to this level. If after the application date, subsequent amendments to the standards become available, the ACD should promote further enhancement of the level of safety by encouraging the applicant to voluntarily comply with those newer Standards.

#### 1.3.2.2 Environmental Standards

In addition to the Annex 8 airworthiness requirements, Annex 16 — *Environmental Protection*, requires States to perform certification on certain environmental aspects of civil aircraft and engines intended for use or operation in international air navigation. The applicable environmental Standards for aircraft and engines are those defined in Annex 16 that are in effect on the date of application for a Type Certificate. States that have not adopted or accepted Annex 16 as their environmental Standards may use other standards provided it is at least equal to the stringency of Annex 16.

*Note.— Some States assign the responsibilities for establishing, and finding compliance with, the environmental Standards to another governmental organization, and not necessarily to their ACD. States should ensure that both the environmental and airworthiness certifications are addressed at the conclusion of the type certification activity for the affected aeronautical product.*

#### 1.3.2.3 Special conditions (SC) of airworthiness

Annex 8, Part II, 1.2.3 and 1.2.4 require that additional technical requirements be considered in cases where novel or unusual design features of a product render the appropriate airworthiness requirements inadequate. The common instrument used by many States for this purpose is the SC of airworthiness. An SC should be issued as part of the certification basis when the ACD finds that a proposed type design for an aircraft, engine or propeller incorporates novel or unusual design features and the existing applicable airworthiness standards do not contain adequate or appropriate safety standards for certifying such features. The phrase “novel or unusual” applies to the design features of the product to be certificated when compared to the applicable airworthiness Standards. For example, the airworthiness Standards may

only contain provisions for use of metal for structural parts, and therefore a proposal to use composite materials will be novel or unusual to the standards. An SC should contain only such additional airworthiness Standards for the novel or unusual features as are necessary to establish a level of safety equivalent to that intended by the certification basis.

#### 1.3.2.4 Finding of equivalent level of safety (FES)

A FES is not an additional airworthiness requirement by itself, but rather a finding of compliance with the intent of an airworthiness Standards. Usually, the applicant will identify to the ACD very early in the type certification programme a need for an FES against certain airworthiness Standards, attributed to a peculiarity in the proposed type design. Once a need for an FES is established, whether early in the programme or later, the ACD should identify and record all FES as part of the certification basis.

#### 1.3.2.5 Exemption

1.3.2.5.1 A request for exemption is a proposal that a non-compliance with a specific certification requirement could be allowed. All requests for exemption should be based on convincing evidence that granting the exemption relief will not adversely affect safety. A request for exemption may be denied, partly granted, or granted by the CAA. For any case involving a request for exemption, the possibility of an FES should be considered prior to accepting a request from the applicant for exemption from a specific airworthiness or environmental Standards.

1.3.2.5.2 An exemption, when granted, is not an approval, but a relief from demonstrating compliance with a specific requirement of the airworthiness or environmental Standards. An exemption is usually issued with specific conditions to ensure that granting of such relief will maintain an acceptable level of safety. Any grant of exemption by a CAA on a type certification project should be identified and recorded as part of the certification basis.

#### 1.3.2.6 Elect to comply

Airworthiness Standards are mandatory requirements. However, there may be aspects of the Standards that are not enforceable because it is offered as an optional certification provision (for example, ditching provisions). The decision to avail of optional certification provisions rests with the applicant, and not the ACD. In addition, an applicant may choose to voluntarily comply with recent amendments to the airworthiness Standards that only became available after submission of the application for a Type Certificate. In both cases where the applicant elected to comply with later amendments or with optional certification provisions, the ACD should identify and record this voluntary compliance as part of the certification basis.

#### 1.3.2.7 Other compliance considerations

An applicant for an original Type Certificate (issued by the State of Design) may wish to obtain Type Certificate validation by another State(s) at the same time it is obtaining the original Type Certificate. This is an option solely up to the discretion of the applicant as long as it can be supported at the time by the State of Design. If such validation takes place, the validating State may establish additional requirements, beyond those of the State of Design, that are a part of its type certification requirements. These might include:

- a) Design-related operating requirements, where the operating rules may affect either the design features of the product or data on the design relating to the operations of the product that make it eligible for a particular kind of operation in a State; or
- b) Additional technical requirements arising from differences in airworthiness and environmental Standards, differences in interpretation of the same Standards, mandatory airworthiness action taken by a State to correct known or identified unsafe conditions, and other conditions concerning airworthiness that are necessary for the products (aircraft, engine, propeller) to comply with the laws, regulations, Standards, and requirements of the importing State.

The additional requirements from the validating States are not included in the type certification basis for the State of Design's approval, but become a part of the type certification basis for the validating State's Type Certificate. The State of Design need not agree with the additional requirements, but it should determine compliance with them if asked by the validating State. The State of Design should notify the validating State of any situations where it finds that the additional requirements are not compatible with the certification basis of the State of Design.

### 1.3.3 Establishing the means of compliance

#### 1.3.3.1 General

It is the sole responsibility of the applicant to demonstrate compliance of the type design with the certification basis in accordance with the means or methods accepted or agreed to by the ACD. In order to manage this aspect during the type certification process, and before an applicant commits to any compliance action, it is necessary to agree on a certification compliance plan that clearly identifies the types of action to be applied against each item. The majority of States (Design or Registry) find it necessary to have a compliance plan. The certification compliance plan can be an effective tool in managing the certification programme by providing an early understanding of what is required to achieve certification and, assist in the identification of certification problems early in the programme.

#### 1.3.3.2 Means of compliance

The means of compliance is usually dictated by the specific item of the certification basis, and generally falls into one or any combination of the following:

- a) *Test* – is performed when the requirement explicitly calls for a demonstration by test (physical, actual or simulation). Examples of test are flight test, ground test, fatigue test, simulation, fire or flammability test, environmental test (e.g. salt spray), functional test, bird-strike test, and engine ingestion test.
- b) *Analysis* – is performed when the requirement explicitly calls for a demonstration by analysis (qualitative, quantitative, or comparative), or when the applicant can demonstrate, based on previously accepted test results, the validity of using analysis in lieu of testing. Examples of analysis are failure modes and effects analysis, flight performance data reduction and expansion, structural loads analysis, and software evaluation.

- c) *Inspection or evaluation* – is performed against an item that does not require test or analysis, but relies on observation, judgment, verification, evaluation, or a statement of attestation from the applicant or its vendors/contractors.

### 1.3.3.3 Certification compliance plan

1.3.3.3.1 The certification compliance plan is the primary document in the type certification process that serves both as a checklist and official record of compliance. The applicant should prepare a certification compliance plan and establish its contents with the agreement of the ACD. The certification compliance plan should, as a minimum, contain the following information:

- a) itemized breakdown of the certification basis;
- b) identification of items of voluntary compliance;
- c) proposed means of compliance for each item (test, analyses, inspection, or combination of these, or finding of equivalent level of safety);
- d) lists of tests to be conducted;
- e) identification of substantiation reports to be submitted (as proof of compliance);
- f) identification of persons responsible for making findings of compliance;
- g) the level of involvement of the ACD, the applicant, or a delegate of the ACD in the findings of compliance or witnessing of tests; and
- h) the certification project schedule, including the applicant's milestones and when final certification is expected.

1.3.3.3.2 Tests, analyses, and inspections are expensive in terms of cost and time. Applicants, therefore, seek concurrence from the ACD that their proposed means of compliance with the certification basis are acceptable. The acceptance of the means, however, is not an acceptance of the data in advance, it is merely a recognition of the means as satisfactory for the demonstration of compliance. The certification compliance plan, although initially agreed to by the ACD, is a living document whose contents may change (the structure and format will remain the same) throughout the course of type certification. Some of the possible sources of change to this document are as follows:

- a) design changes due to refinements or development;
- b) revised means of compliance;
- c) changes in level of involvement of the ACD and applicant;
- d) changes to the certification basis caused by the issuance of special conditions of airworthiness, alternate means of compliance, or exemptions; or
- e) other issues affecting the design or certification that modify any of the aspects of the certification plan.

1.3.3.3.3 The activities involving demonstration of compliance usually begins after a certification compliance plan has been agreed to between the applicant and ACD. The original (or master) copy of the certification compliance plan is retained by the ACD until completion of the type certification activity. Upon completion of the programme, the plan can be the official certification compliance record for the product.

#### 1.3.3.4 Level of involvement

Some CAAs have regulations that allow delegation of some or all of their functions, duties or powers to qualified individuals or organizations. The responsibilities assigned by the regulations to a CAA, however, cannot be delegated and always remain with the CAA. Under a delegation system, appropriately qualified individuals or organizations may be granted permission or authority to make a finding of compliance on behalf of their CAA. A finding of compliance by a delegate is a finding of compliance by the CAA. As such, an administrative procedure should exist for the recording of the finding of compliance by the delegated individual or organization. Some findings of compliance, however, may be the exclusive responsibility of the ACD and cannot be delegated, or the ACD may limit a delegate to making recommendations only instead of making a finding of compliance. If the applicant proposes to utilize delegated persons or organizations in the certification programme, the exact role of these delegates should be clearly identified in the certification compliance plan and agreed to by the ACD. The levels of involvement of the ACD, applicant and delegates will be defined by the CAA's delegation system, taking into account such factors as limitations of the delegates, complexity of the type design, availability of technical resources, and time constraints of the certification project.

### 1.3.4 Demonstration and finding of compliance

#### 1.3.4.1 General

Annex 8, Part II, 1.3.1 and 1.3.2 specify that proof of compliance with the design aspects of the airworthiness requirements be established through the approval of the type design and the performance of necessary inspections and ground and flight tests. In the certification compliance plan, the means of demonstrating compliance (test, analysis, or inspection/evaluation) and the levels of involvement (applicant and ACD) are already specified for each item of the certification basis. The applicant is responsible for demonstrating compliance through the agreed means, while the ACD is responsible for making a finding of compliance on the means demonstrated. Both demonstration and finding of compliance should be recorded against each item in the plan, as evidence of a successful completion. The implementation of the plan is the joint responsibility of the applicant and the ACD, however, the applicant is responsible for meeting their milestones in the certification schedule contained in the certification plan.

#### 1.3.4.2 Demonstration of compliance

1.3.4.2.1 The demonstration of compliance requires that the applicant submit substantiating data (design data, reports, analyses, drawings, processes, material specifications, operations limitations, flight manuals, instructions for continued airworthiness, etc). The data should be complete and in a logical format for review by the ACD. Where the demonstration of compliance involves a test, a test plan should be developed and approved prior to any actual test being performed. The test plan should show which certification tests are witnessed by ACD personnel or by an ACD delegate, when authorized.

1.3.4.2.2 The applicant should give the ACD access to the product in order to make any inspections, test, and engineering assessment or conduct any flight or ground test that is necessary to



determine compliance with the certification item. However, the applicant should perform his own inspection and test necessary to demonstrate compliance prior to presenting the product to the ACD for testing or evaluation.

1.3.4.2.3 If the applicant elects to comply with optional certification items or later amendments of the airworthiness Standards for the purpose of obtaining credit in the certification basis, the demonstration of compliance for both cases is mandatory, and is not subject to any exemption.

1.3.4.2.4 Where a demonstration of compliance is to be made using an FES, the applicant should provide sufficient justification to the ACD that describes the design feature, action taken (i.e. compensating factor), and how such an action provides an equivalent level of safety to that intended by the regulation.

#### 1.3.4.3 Finding of compliance

Findings of compliance are made against airworthiness and environmental Standards, including special conditions, and requests for equivalent level of safety. The finding of compliance can be made by the ACD, or by its authorized delegate, depending on the pre-defined levels of involvement in the certification plan. Following a successful demonstration of compliance by the applicant on a certification item, the ACD should make a finding of compliance and subsequently sign-off the item in the certification plan. The findings are usually accomplished by the ACD through one or any combination of the following actions:

- a) Acceptance of substantiating data – reports, analysis, drawings, or similar documents are usually produced against each certification item and should be reviewed and accepted. Specific attention should be paid to the methodology and assumptions, rather than the detailed calculations or analysis.
- b) Witnessing of test – tests are performed, and witnessed by the ACD when required and agreed to, in accordance with an approved test plan. The test should be conducted only after conformity with the test plan has been established for the test articles, test environment and test facilities. The ACD does not take part in the actual performance of the test, and should remain impartial and concentrated on the test objective.
- c) Engineering inspection – any aspect of the type design, for which compliance with the certification item cannot be determined through review of drawings or reports, should receive an engineering compliance inspection. An engineering compliance inspection is to assure that an installation, and its relationship to other installations on a product, complies with the design requirements.
- d) Flight Test – for aircraft, an actual demonstration of flight capabilities and characteristics in accordance with an approved flight test plan.

#### 1.3.4.4 Non-compliance

The ACD should notify the applicant in writing of any non-compliance found during the process of data review, inspections, ground and flight tests and, if it becomes necessary, the discontinuance of official type certification tests. The applicant should advise the ACD when the non-compliance finding has been resolved or when the cause of the discontinuance of the tests has been corrected and a

resumption of the type certification tests is requested. The identification and resolution of non-compliance items should be properly documented and kept part of the record for the type certification project.

### 1.3.5 Certifying the type design

#### 1.3.5.1 General

All findings of compliance made by the ACD, or its delegate, should be recorded or annotated in the certification compliance plan. When the applicant has demonstrated compliance and the ACD has found full compliance on all certification items, including the resolution of outstanding items, the plan is signed off and becomes the official certification compliance record for the type certification project. The certification compliance record serves as the satisfactory evidence specified under Annex 8, Part II, Section 1.4, *Type Certificate*, for the issuance of a Type Certificate. The approval of the type design, and subsequent issuance of a Type Certificate, means that:

- a) the type design meets all the relevant requirements specified in the certification basis, including special conditions issued by the CAA,
- b) all engineering and conformity inspections have been completed and the prototype product has been found to meet all pertinent requirements; and
- c) in the case of aircraft, the prototype has been test flown and found to comply with all the performance requirements of the pertinent airworthiness Standards.

#### 1.3.5.2 Withholding approval of type design

There may exist a situation, although rare, where an applicant successfully demonstrated, and the ACD found, compliance with the certification basis but a known or suspected feature makes the aeronautical product unsafe, taking into account the category in which certification was requested. Notwithstanding the entitlement of the applicant for a Type Certificate, the ACD has a responsibility under Annex 8, Part II, 1.3.3 to withhold the approval or issuance of a Type Certificate for an aircraft if it is known or suspected to have unsafe features that are not specifically guarded against by the certification basis. The Type Certificate shall be denied if the applicant fails to correct the unsafe feature.

#### 1.3.5.3 Issuance of a Type Certificate

1.3.5.3.1 A Type Certificate is issued by the CAA under Annex 8, Part II, Section 1.4, as evidence of approval of a type design. An example of a Type Certificate is shown in Appendix A to this Chapter. A Type Certificate usually contains the following information:

- a) the approval or Type Certificate number;
- b) the Type Certificate holder's name and address;
- c) the aeronautical product identification (aircraft, engine, propeller model designation);
- d) the applicable airworthiness requirements,
- e) a statement attesting compliance of the product with the applicable airworthiness requirements;

- f) a statement incorporating or referencing the Type Certificate Data Sheet, which defines the type design, as part of the approval; and
- g) the date of issuance, the original signature and seal (as applicable) of the issuing CAA.

1.3.5.3.2 The holder of the Type Certificate is the organization that has responsibility for the design of the aircraft. In the case of jointly designed aircraft, or in the case where design work is subcontracted to other organizations, the certificating authority will require one organization to be responsible for the type design.

1.3.5.3.3 A Type Certificate is effective until surrendered, suspended or revoked, or until a termination date is otherwise established by the issuing CAA.

#### 1.3.5.4 Type Certificate data sheet

The Type Certificate data sheet is an integral part of, and issued at the same time as, the Type Certificate. The data sheet is prepared by the ACD and identifies in detail the certification basis, the operating conditions, limitations, and maintenance requirements that have been specified as mandatory in the approval of the type design. When several models are included in the same Type Certificate, information should be repeated for each model, except for such common data as reference datum, mean aerodynamic chord, levelling means, control surface movements, etc. An example of a Type Certificate Data Sheet is shown in Appendix B to this Chapter.

#### 1.3.5.5 Documents necessary for approved type design

The conditions and limitations of the approved type design are specified in the CAA-approved Type Certificate data sheet. This information is part of the Type Certificate and is mandatory for the safe operation and continued airworthiness of the aircraft. The Type Certificate data sheet also references other information that is necessary for the proper operation and maintenance of the aircraft in service. This other information may be developed concurrently during the type certification process and approved after the issuance of the Type Certificate. The following information should be documented in a form and manner prescribed by the CAA, and subsequently made available to operators of the aircraft:

- a) limitations and procedures necessary for a safe flight operation because of design, operating, or handling characteristics, including those necessary to maintain compliance with the approved noise limits, if applicable. This information is usually provided in the aircraft flight manual, mass and balance manual, and master minimum equipment list;
- b) limitations and procedures necessary for a safe ground operation and maintenance such as:
  - 1) mandatory replacement times for structural parts, structural inspection intervals, and related structural inspection procedures (usually identified in an airworthiness limitations document);
  - 2) mandatory maintenance tasks to be performed at pre-determined intervals, as established during the type certification process (usually identified as certification maintenance requirements); and

- 3) instructions for continued airworthiness of the aircraft, engine and propeller (usually contained in maintenance review board report), descriptive data and accomplishment instructions for the maintenance, servicing, inspection and repair (usually contained in the aircraft/engine/propeller maintenance manuals, engine installation manual, and structural repair manual).
- c) a continuing structural integrity programme, including specific information concerning corrosion prevention and control, necessary for the continued airworthiness of aeroplanes over 5 700 kg maximum certificated take-off mass (as required in Annex 8, Part II).

*Note.— The publication of CAA-approved data in any document furnished to aircraft operators should provide for the clear identification or distinction of such approval when such document also contains other data or information accepted or not approved by the CAA.*

#### 1.3.5.6 Other information necessary for operation of aircraft

Other information necessary for the operation of the aircraft under Annex 6 are typically developed concurrently with the type certification process, although this information or data are not requirements for the issuance of a Type Certificate. As with airworthiness-related data, this operation-related information should also be provided to operators of the aircraft. This information includes the:

- a) master minimum equipment list – comprising information relating to the permissibility of dispatching aircraft with a known component or system inoperative, *[For additional information, see 1.8.3 of this Part]*;
- b) continuing airworthiness maintenance information (sometimes issued as a maintenance planning document) – is the basis for the initial recommended maintenance programme for newly certified aircraft; and
- c) configuration deviation list – comprising information relating to the operation of an aeroplane without certain secondary airframe or engine parts.

### 1.3.6 Post-type certification activities

#### 1.3.6.1 General

A State of Design that issues a Type Certificate for an aircraft has responsibilities under Annex 8 to provide continuing airworthiness services to States of Registry. The CAA and the Type Certificate holder fulfill this responsibility through a system of receiving and exchanging of information, surveillance, assessment of service difficulty experiences, and development of the necessary airworthiness actions. The organization responsible for the approved type design (holder) is an integral part of this process.

#### 1.3.6.2 Retention of type design data

The type design data are contained in records, reports, drawings, and other documents that describe collectively the exact configuration of the type design when it was approved. The type design data must be maintained by the CAA or the Type Certificate holder, or both. The CAA should determine the eligibility and type of data to be maintained by the Type Certificate holder. In either case, it should be recognized that the type design records are permanent and may not be destroyed as long as an aircraft

remains in service. Data maintained by the Type Certificate holder must be made available to the CAA for such routine activities as production inspection, surveillance, design change reviews, development of corrective actions, or for any other reasons deemed necessary by the CAA. The record-keeping should consist of at least the following:

- a) the drawings and specifications, and a listing of those drawings and specifications necessary to define the configuration and design features of the product as it was shown to comply with the requirements applicable to the product;
- b) reports on analysis and tests undertaken to substantiate compliance with the applicable requirements;
- c) information, materials and processes used in the construction of the aircraft, engine or propeller;
- d) an approved flight manual or its equivalent (type-related document), including the master minimum equipment list and configuration deviation list (if applicable);
- e) an approved maintenance review board (MRB) report, maintenance programme or equivalent document, and aircraft maintenance manual with details of manufacturer's-recommended and CAA-accepted scheduled maintenance plan and procedures guidelines;
- f) any other data necessary to allow, by comparison, the determination of airworthiness and noise characteristics (where applicable) of later products of the same type; and
- g) in the case of revalidation of Type Certificates issued by other States only:
  - 1) a statement from the airworthiness authority of the State of Design detailing the deviations or differences permitted between the national airworthiness Standards and those of the aircraft, engine(s) and propeller(s) as approved;
  - 2) the Type Certificate/design approval or equivalent for the aircraft, engine(s) and propellers, issued by the airworthiness authority of the State of Design; and
  - 3) a listing and complete set of all mandatory airworthiness directives or their equivalent.

#### 1.3.6.3 Responsibility of Type Certificate holder

The Type Certificate holder remains responsible for the continued integrity of the approved type design and it or its representative must continue to be the CAA's contact point for resolving issues that may require corrective action. To fulfill this responsibility, the holder of a Type Certificate should have the continued capability, or access to a capability, of providing appropriate technical solutions for service difficulties when service experience warrants it, or when the CAA requires mandatory corrective action. If the holder is no longer capable or if the Type Certificate is transferred to another holder, the CAA should take action in accordance with the guidance material provided under Part III, Sub-Chapter 4.2, *Interpretation of the Organization Responsible for the Type Design*. In the case of the Type Certificate being transferred to another holder, the CAA should ensure that the new holder is capable of fulfilling the minimum responsibilities described herein.

#### 1.3.6.4 Changes in approved type design

The Type Certificate holder can propose changes to the approved type design, under a system of review and approval established by the ACD. See guidance in Chapter 5 of this Part, *Changes to Approved Type Design*.

#### 1.3.6.5 Continuing airworthiness

Annex 8, Part II, Chapter 4, prescribes the activities and corresponding responsibilities of a State of Design, the States of Registry, and the Type Certificate holder in ensuring the continued airworthiness of an aircraft during its entire operational or service life. Service experiences involving faults, malfunctions, defects and other occurrences that may affect the continuing airworthiness of the aircraft are required to be recorded, reported, and assessed under Annex 8, Part II, Chapter 4, *Continuing Airworthiness of Aircraft*. This information is used to determine if an unsafe or potentially unsafe condition exists in an aircraft. The State of Design, States of Registry, and the Type Certificate holder all play important roles in deciding if and when airworthiness action is needed to either correct an unsafe, or avoid a potentially unsafe, condition. See guidance in Chapter 4, *Continuing Airworthiness of Aircraft*, of this Part.

### 1.4 Type Certification activities: State of Registry

#### 1.4.1 General

1.4.1.1 Annex 8, Part II, Chapter 3, *Certificates of Airworthiness*, states in part that the issuance, or rendering valid, of a Certificate of Airworthiness must be based on satisfactory evidence that the aircraft complies with the design aspects of the appropriate airworthiness requirements of the State of Registry. The satisfactory evidence used by a majority of Contracting States is the aircraft Type Certificate. It is not expected nor encouraged that States of Registry perform the same in-depth determinations of compliance that the State of Design has already done. Instead, States are encouraged, through regulations, bilateral agreements or policy, to give maximum credit to the type certification work already done by the State of Design and, minimize duplicate or redundant testing that add little or no value to the overall airworthiness of the aeronautical product.

1.4.1.2 The majority of airworthiness standards currently used by States with aviation manufacturing industries are harmonized, and the remaining differences are either with the unique technical requirements, due to operational or environmental constraints, and/or interpretation of the same requirements. States that have similar or same airworthiness requirements can take advantage of the potential reduction in type certification activities and associated costs, while still fulfilling their national requirements. For States that do not presently have a well-defined or well-established airworthiness requirements for the type certification of aeronautical products, consideration should be given to accept, adopt, or incorporate by reference in their national regulations those airworthiness standards that are internationally recognized and widely accepted.

1.4.1.3 The type certification activity to be conducted by a State of Registry will depend on their national requirements. Some Contracting States require the issuance of their own Type Certificate. Some Contracting States, however, do not need to issue their own and can accept or adopt the Type Certificate by the State of Design. The overall objective that all Contracting States should work towards is reducing the amount of work needed to accomplish the approval of an aircraft type design and, subsequently, the issuance of a Certificate of Airworthiness under Annex 8 by the State of Registry.

1.4.1.4 A common practice by a majority of States of Registry in establishing compliance of an imported aeronautical product to their own applicable airworthiness standards is the validation exercise. The activities associated with the validation of a Type Certificate are similar to those performed for an initial Type Certificate (see Section 1.3 of this Part, *Type Certification Activities: State of Design*), except for the actual amount of certification work involved. Typically, a State of Registry would confine its certification review to the differences that exist between its airworthiness requirements and those of the State of Design, or on those requirements where the State of Registry retains exclusive approval authority under their certification system. A validation exercise between two Contracting States is conducted on the basis of confidence and a strong commitment to cooperate in reducing the unnecessary duplication of work already accomplished. Under a validation exercise, a complete re-investigation of compliance is not necessary.

## 1.4.2 Validation of Type Certificate

For States that want to perform a review of the approved type design, a validation exercise is highly recommended. The validation of the original Type Certificate issued by the State of Design should generally reduce to one of examination or validation of the type design records and the certification documents held by the State of Design. The validation activity normally includes:

- a) receipt of an application from the Type Certificate holder and State of Design for type certification (or validation);
- b) technical briefing by the applicant and State of Design ACD on the approved type design and certification performed;
- c) an assessment of the adequacy of the airworthiness and environmental Standards applied by the State of Design relative to the requirements of the State of Registry;
- d) an assessment of acceptability of any findings of equivalent level of safety or exemptions granted by the State of Design;
- e) an assessment of suitability of any special conditions of airworthiness specified and certified by the State of Design; and
- f) an assessment of adequacy of the approved type design and compliance demonstration in regard to specified requirements, operating conditions, airworthiness directives, and airworthiness philosophies of the State of Registry.

### 1.4.2.1 Establishing the certification basis

The intent of the validation process is for the State of Registry to fulfill its national requirements for the issuance of its own Type Certificate, or for the recognition and acceptance of the foreign Type Certificate. An important part of the validation exercise is the identification of differences between the airworthiness requirements that the State of Design required as of the date of original application for a Type Certificate, and those that the State of Registry would have required as of the same date of original application to the State of Design. If differences exist, the State of Registry should establish additional technical requirements to the certification basis of the State of Design to equal its own certification basis. The applicant and State of Design should be notified of the additional technical requirements, including any special conditions of airworthiness to be met (and the assessment of their compliance) and the

airworthiness documents (design data, flight manual, etc.) to be submitted for acceptance of the aircraft type by the State of Registry.

#### 1.4.2.2 Establishing the means of compliance

The means of compliance (test, analysis, or description) for the additional technical requirements should be agreed to between the applicant and the State of Registry. The State of Registry may rely on the means of compliance already established by the State of Design for its type certification programme, or request the participation or assistance of the State of Design in establishing a different means of compliance. A certification compliance plan should be developed by the applicant to serve both purposes of project management and record. See guidance in 1.3.3 of this Part, *Establishing the Means of Compliance*.

#### 1.4.2.3 Demonstration and finding of compliance

1.4.2.3.1 The applicant has responsibility for the demonstration of compliance with the additional technical requirements, while the State of Registry has responsibility for making a finding of compliance. See discussions in 1.3.4 of this Part, *Demonstration and Finding of Compliance*. The State of Registry may, however, choose to delegate the finding of compliance to the State of Design ACD, through an agreement or authorization. This delegation is a common practice between States of Registry and the State of Design.

1.4.2.3.2 In addition, the State of Design may, upon request from the State of Registry, certify that the product has been examined, tested and found to meet the applicable aircraft noise and engine emissions requirements, including any other requirements the State of Registry has prescribed for that type of aircraft.

1.4.2.3.3 A review should be conducted on the required documents for type certification and operations of the aircraft and, if applicable, limitations or conditions arising from compliance with the additional technical requirements should be incorporated. See 1.3.5.5 and 1.3.5.6 for a listing of commonly required documents. The State of Registry should indicate its approval or acceptance of these documents.

#### 1.4.2.4 Certifying the Type Design

1.4.2.4.1 At the completion of the type certification or validation activity, the State of Registry should confirm its approval or acceptance of the type design by issuing its own Type Certificate, or by issuing a letter of approval/acceptance to the Type Certificate holder and the State of Design. The certification basis by which the State of Registry granted its type design approval or acceptance should be clearly documented in the Type Certificate Data Sheet or in the approval letter.

1.4.2.4.2 A Type Certificate, or an approval of a type design, should be effective until surrendered, suspended or revoked, or until a termination date is otherwise established by the issuing CAA.



### 1.4.3 Post-Type Certification/Validation activities

#### 1.4.3.1 Continuing airworthiness

Both the State of Design and State of Registry are assigned specific responsibilities under Annex 8 (Part II, Chapter 4) on the continued airworthiness of aircraft. The responsible CAA and/or the Type Certificate holder fulfill these responsibilities through a system of receiving and exchanging of information, surveillance, assessment of service difficulty experiences, and development of the necessary airworthiness actions. It is also assumed that there will always be an organization (holder) responsible for the approved type design that can develop the necessary corrective action(s) when required by the CAA. Many Contracting States place reliance on the State of Design and the Type Certificate holder to decide and develop the necessary airworthiness actions that are needed to correct type design deficiencies or in-service difficulties. However, the State of Registry is ultimately responsible for ensuring the continued airworthiness of all its civil aircraft and should decide if and when airworthiness action is needed. Any mandatory continuing airworthiness action originated by the State of Registry should be communicated with the State of Design and the Type Certificate holder. See guidance in Chapter 4 of this Part, *Continuing Airworthiness of Aircraft*.

#### 1.4.3.2 Changes in approved type design

The Type Certificate holder or any qualified person or organization can propose changes to the approved type design under a system of review and approval established by the State of Registry. See guidance in Chapter 5 of this Part, *Changes to Approved Type Design*.

## 1.5 Instructions for continued airworthiness

### 1.5.1 General

Instructions for continued airworthiness (ICA) are developed by the design approval holder and some of these instructions are approved by the State of Design (see 1.6 below). They provide guidance to the operator about what is necessary to maintain the airworthiness of the aircraft, engine, or propeller, including incorporated modifications or repairs, over time. They provide documentation of necessary methods, inspections, processes, and procedures. These instructions are distributed in two categories depending on the compliance requirements: maintenance requirements that have been specified as mandatory in the approval of the type design and those for which compliance is recommended.

### 1.5.2 ICA format and topics

1.5.2.1 The format and topics will vary depending upon the subject of the instructions and the complexity of requirements to maintain airworthiness. Specific airworthiness codes specify what needs to be addressed by the ICA.

1.5.2.2 The ICA may include sections on airworthiness limitations, certification maintenance requirements (CMR), maintenance instructions, engine and, if applicable, propeller maintenance, component maintenance, system wiring diagrams, and non-destructive test and inspection. A cross-check should be conducted to ensure that ICA elements required by the relevant airworthiness code are addressed in the aircraft documentation. An example of an ICA checklist is provided in Appendix C to this Chapter.

### 1.5.3 Implementation

The State of the Operator, should ensure that the ICA is being followed by the operator and its maintenance organization.

## **1.6 Certification maintenance requirements and airworthiness limitations**

### 1.6.1 Introduction

1.6.1.1 Annex 8 places an obligation on States of Design to ensure that information is provided for use in developing procedures for maintaining the aircraft in an airworthy condition. It requires that mandatory maintenance requirements that have been specified by the State of Design as part of the approval of the type design shall be identified as such.

1.6.1.2 Where the maintenance tasks result from a system safety analysis, they are usually known as certification maintenance requirements (CMRs). A CMR is a required periodic task, established during the design certification of the aircraft as an operating limitation of the Type Certificate. Notwithstanding the importance of the other airworthiness limitations, this chapter is primarily intended to provide an introduction to the concept of CMRs, their relevance to an aircraft maintenance programme and their importance as an integral part of the in-service validation of the type design. It is not intended for this chapter to provide comprehensive guidance on the responsibilities associated with the organizations responsible for the type design.

1.6.1.3 It should be noted that some CMRs require the performance of certain flight crew procedures. When included in a CMR, these procedures are mandatory and should be shown as such in the flight manual or equivalent document. It is likely that future design developments will limit the use of CMR to maintenance tasks.

### 1.6.2 Background information for helicopters

1.6.2.1 Helicopter type designs are unique in comparison to aeroplane designs in that transmissions, rotors, and some elements of the flight control systems have critical components that may be adversely affected by operating conditions and time in service, cycle, and retirement index number (RIN) exposure.

1.6.2.2 The instructions for continued airworthiness (ICA) mandate airworthiness limitations and maintenance instructions for helicopters. ICAs contain airworthiness limitations (structural life limits associated with fatigue requirements for helicopter structures), maintenance provisions, and allow for CMRs. In addition, helicopters systems are increasingly complex and are capable of performing more safety-critical functions. CMRs for helicopters, while not traditionally included in ICAs, may be needed in order to detect and rectify possible hidden (latent) failures.

1.6.2.3 For a number of years, helicopter systems were evaluated to specific requirements, to the single fault criterion, or to the fail-safe design concept.

1.6.2.4 As more demanding helicopter operating environments evolved, more safety-critical functions were required to be performed which generally resulted in an increase in the complexity of the system designed to perform these functions. The potential hazards to the helicopter and its occupants that

could arise in the event of loss of one or more functions provided by a system, or the effect of that system's malfunction, had to be considered, as did the interaction between systems performing different functions.

*Note.— The guidance provided in the following paragraphs for aeroplanes should be adapted, as appropriate, for helicopters. The airline/manufacturer maintenance programme plan document described below was targeted for aeroplanes. However, elements from the programme plan document can also be used for helicopters, adjusting the procedures as appropriate to account for the differences between the two products.*

### 1.6.3 Background

1.6.3.1 For a number of years, aeroplane systems were evaluated to specific requirements, to the single fault criterion, or to the fail-safe design concept.

1.6.3.2 As later generation aeroplanes evolved, more safety-critical functions were required to be performed which generally resulted in an increase in the complexity of the system designed to perform these functions. The potential hazards to the aeroplane and its occupants that could arise in the event of loss of one or more functions provided by a system, or the effect of that system's malfunction, had to be considered, as did the interaction between systems performing different functions.

1.6.3.3 These developments led to the general principle that an inverse relationship should exist between the probability of loss of function(s) or malfunction(s) leading to a serious failure condition and the degree of hazard to the aeroplane and its occupants arising therefrom. Airworthiness codes were amended to recognize this principle, two examples being the introduction of paragraphs 25.1309 in the United States Federal Aviation Regulations, Part 25 and the European Aviation Safety Agency, Certification Specifications (CS)-25. To satisfy these requirements, it is necessary to complete a safety analysis of all system and powerplant installations to determine the effect on the aeroplane of a failure condition or malfunction.

1.6.3.4 In assessing the acceptability of a design, it was recognized that rational probability values would have to be established and these were set on the following basis:

- a) historical evidence indicates that the risk of a serious accident due to operational and airframe-related causes is approximately one per million hours of flight. Of this, 10 per cent can be attributed to failure conditions caused by aeroplane system problems. On this basis, it was considered that serious accidents caused by systems should not be allowed a higher probability than this in new designs. Therefore the probability of a serious accident from all such failure conditions should not be greater than one in ten million flight hours, i.e., a probability of less than  $1 \times 10^{-7}$ .
- b) to be satisfied that this target can be achieved, it is necessary to analyze numerically all the systems on the aeroplane. For this reason, it is arbitrarily assumed that there are about 100 potential failure conditions which would prevent continued safe flight and landing. The target risk of  $1 \times 10^{-7}$  was apportioned equally amongst these conditions, resulting in a risk allocation of not greater than  $1 \times 10^{-9}$  to each one. Thus, the upper risk for an individual failure condition which would prevent continued safe flight and landing is set at  $1 \times 10^{-9}$  for each hour of flight.

1.6.3.5 Various analytical techniques were developed to assist designers in completing the necessary safety analysis to satisfy the requirements:

- a) *Quantitative, by the application of mathematical methods.* Such analysis is often used for hazardous or catastrophic failure conditions of systems that are complex, that have insufficient service experience to help substantiate their safety, or that have attributes that differ significantly from conventional systems.
- b) *Qualitative, by assessment in a subjective, non-numerical manner.* Examples of typical types of qualitative analysis are:
  - 1) a review of the integrity of the installation and the design, based on experienced judgement; and
  - 2) a systematic review of each component failure and an evaluation of its effect on the systems of the aircraft. An advantage to this approach is the identification of potential hidden effects of these failures.

1.6.3.6 All hidden (or latent) failures need to be discovered and rectified in a timely manner. The methods for discovering hidden failures may include:

- a) failure monitoring and warning systems;
- b) scheduled maintenance tasks (operational or functional checks of the sub-systems or components); and
- c) special kind of checks (CMRs).

1.6.3.7 Historically, the MRB was the only body responsible for the determination of necessary maintenance tasks to prevent functional system failures, to find out and to eliminate hidden (or latent) failures of redundant systems or components. These tasks being proposed by an industry steering committee (ISC) then form the initial maintenance programme (or the MRB report) for the aircraft type. This document is subject for the approval of the MRB. The MRB report previously was the sole base for continuing airworthiness of the aircraft type. Later, a requirement in U.S and European standards concerning the “latent failures” led to the procedures for certification maintenance coordination committee (CMCC) activities in the area of defining the scheduled tasks for timely elimination of the latent failures. In fact, these are the same activities as those of the MRB, but there is an option for special kinds of flight crew or maintenance personnel tasks. These tasks cover the type design features that cannot be treated effectively by other means (design change, etc.).

*Note.— Guidance on MRB procedures is provided in 1.7 of this Part.*

#### 1.6.4 Failure monitoring and warning systems

Completion of a safety analysis, using the techniques described in 1.6.2.5 of this Part, may identify potential latent failures. Such failures should be identified to the flight crew by failure monitoring and warning systems. However, it is axiomatic that these systems should be practical and reliable, i.e. within the state of the art. A reliable system is one which will not result in either excessive failures of a genuine warning or excessive or untimely false warnings, which can sometimes be more hazardous than lack of provision for, or failures of, genuine but infrequent warnings. If a practicable and reliable monitoring and warning system cannot be provided, other means should be provided to detect significant latent failures, as described in the following paragraph.

### 1.6.5 Implementation of certification maintenance requirements (CMRs)

1.6.5.1 To reduce or eliminate the hazardous consequences of undiscovered pre-existing failures, checks for such failures should be accomplished. These checks can be developed through the MRB process, system safety assessment or CCMC procedures and published as CMRs where it is necessary to identify significant latent failures. Some checks of this nature may be performed by flight crews. If this is the case, they will be incorporated as mandatory procedures in the flight manual. (As previously mentioned, current design philosophy is to eliminate CMRs from flight crew procedures in future designs and to limit CMRs to maintenance tasks.)

1.6.5.2 CMRs are developed using rational methods, such as quantitative analysis or service experience. The tasks are intended to be implemented concurrently with routine maintenance inspection tasks, i.e. tasks not associated with the design compliance process described in 1.6.1.2 above.

1.6.5.3 CMRs are produced by the organizations responsible for the type design and approved by the State of Design during the type certification process. CMRs are listed in the Type Certificate data sheet or equivalent document. In many cases, it is appropriate for the Type Certificate data sheet to make reference to another document where CMRs may be placed for convenience to the operator. For aircraft with aeroplane maintenance manuals formatted in accordance with Air Transport Association of America Specification 2200 (ATA 2200), formerly Specification 100 (ATA-100), CMRs can be included in Chapter 5 but are sometimes contained in the appropriate section of the ATA 100 maintenance planning data document (MPD) or in a separate airworthiness limitations manual.

### 1.6.6 Incorporation of airworthiness limitations and CMRs in maintenance programmes

1.6.6.1 From the previous text, it is apparent that CMRs are an integral part of the validation of the type design and are essential to continuing airworthiness, even though the same conclusion may be made in respect of other types of airworthiness limitations. During the approval of maintenance programmes (paragraph 1.6.1.1 of this Part refers), the State of Registry should ensure that CMRs and airworthiness limitations (including their associated intervals and tolerances as established by the State of Design) are included.

1.6.6.2 The State of Registry should not approve changes to airworthiness limitations without consulting with the State of Design. Some type designs may include approved procedures which allow the aircraft operator to vary airworthiness limitations task intervals (or limits). It is essential that any variation is completed in accordance with these procedures.

1.6.6.3 Based on service experience, it is normal practice for operators to develop maintenance programmes in terms of variation of task content and escalation of inspection and check intervals. Airworthiness limitations are to be excluded from this escalation process. It is strongly recommended that States of Registry ensure that:

- a) airworthiness limitations are clearly identified as such in the maintenance programme;  
and
- b) procedures exist to prevent airworthiness limitations being varied in any way without the approval of, or in accordance with, a procedure developed by the State of Design.

## **1.7 Maintenance review board (MRB)**

### 1.7.1 Introduction

1.7.1.1 This section is intended to provide an introduction to the maintenance review board (MRB) process used during the development of an initial scheduled maintenance programme, usually done for derivative or newly certificated large aeroplanes as appropriate. It is not intended to provide comprehensive guidance to States and operators.

1.7.1.2 Annex 8 requires that a maintenance programme, which includes the maintenance tasks and recommended intervals at which these tasks are to be performed, be issued. The development of an initial maintenance programme at the time of aircraft type certification is sometimes referred to as the MRB process.

1.7.1.3 Annex 6, Part I, 8.3/Part III, Section II, 6.3 requires an operator to provide an aeroplane/helicopter maintenance programme, approved by the State of Registry, that contains maintenance tasks, intervals, and how the tasks are to be performed. When an MRB document has been issued, the operator should take into account its content when developing its own maintenance programme.

### 1.7.2 General

The primary purpose of the MRB process is to assist the design organization and the operator in establishing an initial approved maintenance programme for aeroplanes and the regulatory authority in approving that programme. The MRB report becomes the basis for the first issue of an operator's initial maintenance programme. Adjustments may be necessary to address operational or environmental conditions unique to that operator. Through operator experience, and with regulatory approval, additional changes to the maintenance programme may be made by the operator in order to maintain a safe and efficient maintenance programme.

### 1.7.3 Background

1.7.3.1 The process of developing maintenance programmes for new aeroplanes has evolved from operator-proposed programmes to one in which the regulatory authority and aviation industry work together to develop initial minimum maintenance requirements for new aeroplanes. Subsequent development of initial scheduled maintenance requirements revealed that a programme of effective maintenance tasks could be developed through the use of logical analysis of possible aircraft system failures and their consequences.

1.7.3.2 The decision logic and analysis procedures were contained in a document entitled "Airline/Manufacturer Maintenance Program Plan Document" (MSG-1). These procedures were used by the aviation industry and the State of Design's regulatory authority to develop initial minimum maintenance recommendations for the B-747 aeroplanes. Through experience gained from this logic, procedures were updated to produce a universal document which could be applied to future newly certificated aeroplanes. This effort resulted in the MSG-2 document.

1.7.3.3 The MSG-2 logic was used to develop initial minimum maintenance procedures during the 1970s. In 1980, with the combined efforts of aeroplane and engine manufacturers, airlines, aviation interest groups and regulatory authorities worldwide, new decision logic and analysis procedures were

generated in a document called MSG-3. Then, in light of the experience gained in using MSG-3 analysis on a number of aeroplanes, industry issued several revisions to MSG-3. Since the 1980s, MSG-3 and its successive revisions have been commonly used in developing aeroplanes' initial maintenance programmes.

#### 1.7.4 Organization

The MRB process involves the following organizational bodies:

- a) *Industry steering committee (ISC)*. Management of maintenance programme development activities is normally accomplished by an ISC composed of operators and design organizations. The ISC establishes policies, sets goals for maintenance check intervals, directs activities of working groups, prepares final maintenance programme recommendations and represents operators in contacts with regulatory authorities.
- b) *Working groups (WGs)*. One or more WGs, consisting of specialists from participating operators, design organizations and regulatory authorities, may also be formed to develop initial minimum maintenance requirements for new or derivative aeroplanes. The ISC ensures that applicable supporting technical data and analysis are provided to the WG.
- c) *Maintenance review board (MRB)*. The State of Design should approve certain minimum maintenance requirements that an operator needs to accomplish when the aeroplane is initially placed in service. The authority normally approves initial minimum maintenance requirements that are proposed by selected specialists in airworthiness requirements, continuing airworthiness and aeroplane design. The State of Design may also invite participation from authorities of the States of the intended operators. A group of these specialists is referred to as the MRB. The MRB also ensures that the design organization and manufacturer provide the necessary technical training to MRB, ISC and WG members. The MRB reviews reports, provides notification of potential problem areas and offers guidance and assistance to the ISC and WG. Upon successful review, the regulatory authority approves the MRB report or revision.

#### 1.7.5 Maintenance review board process

1.7.5.1 The MRB supports, by active participation, the development of a proposal or a report containing the initial minimum maintenance requirements to be used in the development of an approved maintenance programme for a derivative or newly certificated transport aeroplane.

1.7.5.2 The design organization normally provides a recommended maintenance programme for the aeroplane model. In order to assure that this recommended maintenance programme is compatible with the intended operation of the aeroplane, the design organization will assemble an ISC, the goal of which is to review the recommended maintenance programme and revise it as needed so that it meets the requirements of the intended operators. The authorities of the State of Design and the States of the intended operators normally participate in the ISC and its individual WGs in an advisory capacity regarding continuing airworthiness requirements.

1.7.5.3 The ISC directs the WGs and coordinates activities with the MRB. The MRB acts on MRB report proposals or revisions, and briefs other concerned regulatory authorities regarding MRB policies and procedures.

## 1.7.6 Maintenance review board report

1.7.6.1 The MRB report outlines the initial minimum maintenance requirements to be used in the development of an approved maintenance programme for the aeroplane and its major components (airframe, engine, systems and other components). Although the MRB report is approved by the State of Design, there may be a need to identify national regulation differences that are not compatible, acceptable or applicable to all regulatory authorities. When this condition exists, an appendix to the MRB report is normally used to list these differences, each being accepted by the respective regulatory authority. The requirements of the MRB are the basis from which operators develop their initial maintenance programme.

1.7.6.2 When the MRB has resolved all issues, including those raised by other authorities, the report is forwarded to the MRB Chairman for final approval. Once the report is approved by the State of Design, the design organization will normally publish and distribute the report, together with any supporting documents, to all holders of the maintenance programme, including the authorities in the States of Registry and the States of the Operators.

1.7.6.3 The regulatory authorities in the State of Registry and the State of the Operator review the MRB report and, once it is found acceptable, authorize the operator to incorporate all applicable maintenance requirements in the report into his initial maintenance programme.

1.7.6.4 The MRB and ISC normally conduct a joint annual review of each MRB report to determine the need for revision. Where the need exists, the ISC and MRB convene and evaluate the proposed changes. Proposed revisions are processed and approved in the same manner as the MRB report.

## 1.7.7 Implementation of maintenance review board reports and revisions

1.7.7.1 Operators of the aeroplane type are strongly urged to implement the MRB report, or revisions, in accordance with established procedures. For operators of similar aeroplanes and depending upon the operator's qualifications and overall maintenance experience, adjustments to initial maintenance programme intervals may be approved by the State of Registry.

1.7.7.2 With the agreement of the regulatory authority, operators may elect to deviate from the MRB report or revision. In this case, operators may have additional requirements placed in their maintenance programme by the State of Registry to ensure that equivalent safety is maintained.

## **1.8 Aircraft flight manual (AFM), master minimum equipment list (MMEL) and configuration deviation list (CDL)**

### 1.8.1 General

1.8.1.1 The aircraft flight manual (AFM), the configuration deviation list (CDL) and the master minimum equipment list (MMEL) are approved by the State of Design and often established by the organization responsible for the type design. The State of the Registry may either validate these documents or approve its own which could be different due to differences in its airworthiness rules. These documents should not be less restrictive than the one approved by the State of Design.

1.8.1.2 The use by the operator of those documents is described in Chapter 1.12 of Part IV of this manual.



## 1.8.2 Aircraft flight manual (AFM)

1.8.2.1 Annex 8 requires that the AFM shall be made available as a main document associated with an aircraft Certificate of Airworthiness. The AFM is a primary document for flight operations of an aircraft. It contains the limitations, procedures, performance and other information and instructions required to operate the aircraft safely, plus all required AFM supplements. An AFM supplement is a booklet or group of pages containing changes to the information and instructions in the basic AFM (i.e. the approved AFM that the Type Certificate holder provides with the aircraft). The AFM supplement contains AFM changes that are necessary for continued safe operation of an aircraft that is modified, is in a non-standard configuration, has special role equipment fitted, or is to engage in some special purpose activity. An aircraft may not conform exactly to the standard aircraft to which the available basic AFM is applicable. The aircraft may have a different configuration or modifications. If these physical differences cause changes to the approved AFM information, those changes must be accounted for by relevant CAA-approved AFM supplements that provide the necessary extra AFM information.

1.8.2.2 The Type Certificate holder or its licensee should make available a current AFM at the time of delivery of the aircraft to the owner (operator). On the other hand, the certificated operator has an ongoing obligation to keep his flight crew operating manual up-to-date by incorporating amendments approved by the relevant CAA for the AFM.

1.8.2.3 An aircraft operator should use the appropriate parts of the AFM approved for this aircraft together with operating instructions issued by the Type Certificate holders to develop its own operations manual (as required in Annex 6, Part I, 4.2.2 and Part III, Section II, 2.2.2).

## 1.8.3 Master minimum equipment list (MMEL)

1.8.3.1 The MMEL is a master list appropriate to an aircraft type which determines those instruments, items of equipment or functions that, while maintaining an acceptable level of safety as intended by the applicable requirement, may temporarily be inoperative either due to the inherent redundancy of the design, and/or due to specified operational and maintenance procedures, conditions and limitations, and in accordance with the applicable procedures for continued airworthiness.

1.8.3.2 In conjunction with the certification of each new type of aircraft, a board should be established to develop and maintain the MMEL for the aircraft and additional models of that aircraft developed in the future. The board is an advisory body to the CAA and should have representation from the flight operations and airworthiness (AID and ACD) organizations within the CAA, as well as from the organization responsible for the type design and operators of the aircraft. The MMEL board could be an independent organizational body headed by the CAA.

1.8.3.3 The interaction between systems should be fully analyzed to ensure that multiple failures will not result in an unsatisfactory level of safety. When an aircraft is designed, it is designed to achieve a certain level of safety. When any one system, instrument or equipment becomes inoperative, the design level of safety may be reduced. With modern aircraft it is usual to provide extra redundancy in some systems to enable the aircraft to take off and complete a flight with acceptable margins of safety even if, for example, one channel of a system has failed during a previous flight. Minor deficiencies which do not too seriously affect safety may be acceptable to flight, even without the provision of extra redundancy. In any case, the MMEL board will need to carry out a thorough assessment on safety together with engineering judgment as a guide to developing an acceptable list.

1.8.3.4 The MMEL should not include obviously required items such as wings, empennage, power-units, etc., nor should it include items which are not required for safe operation of the aircraft, such as entertainment systems, etc. It must be stressed and understood by all persons developing and using the MMEL that all items which are related to the airworthiness of the aircraft and are not included on the list are automatically required to be operative.

1.8.3.5 The actual format of the MMEL may vary, but all major systems should be listed to indicate they have been considered (communications systems, navigation systems, automatic flight control systems, etc.). In addition, components of those systems required for flight should be listed on the MMEL (e.g. attitude gyros, VSI, DME, etc.).

1.8.3.6 The MMEL board should be responsible for maintaining an up-to-date MMEL. Amendment normally results from operator experience or analyses carried out by the organization responsible for the type design or from rule changes.

#### 1.8.4 Configuration deviation list (CDL)

1.8.4.1 The CDL identifies any external parts of an aircraft type which may be missing at the commencement of a flight, and which contains, where necessary, any information on associated operating limitations and performance correction. Operation of the aircraft without certain secondary airframe and engine parts could be allowed through the use of an approved CDL. The CDL should be included in the AFM as a separately approved appendix. The following guidance should be followed when preparing the CDL.

- a) The parts or combinations of parts permitted to be missing, together with the associated performance penalties and other limitations should be determined and presented in the same format as the Master Minimum Equipment List (MMEL).
- b) Unless it can be established that a zero or negligible performance degradation occurs as a result of a part missing from the aircraft, a performance penalty should be presented for each part or for each combination of parts.
- c) Performance penalties are normally presented as mass or percent mass decrements. Equivalent penalties expressed as other parameters are also acceptable. A single performance penalty applicable to all AFM performance limitations may be presented for a missing part or, subject to certain restrictions, performance penalties may be presented for each phase of flight. Typical examples are:
  - 1) Only a single performance penalty for take-off and a single performance penalty for landing will be permitted. For take-off, the penalty shall be the most restrictive of the take-off field length, first, second and final segment climbs, and take-off flight path considerations. For landing, the penalty shall be the most restrictive of approach climb, landing climb, and landing distance considerations.
  - 2) Only a single mass penalty for en-route climb performance, applying to both the one-engine-inoperative and two-engine-inoperative cases, as applicable, will be permitted.
  - 3) The CDL should contain the explanations of take-off performance penalty, landing performance penalty and en route performance penalty, as appropriate for the aircraft, when individual penalties are used.

1.8.4.2 The following information may be presented in the CDL appendix:

- a) When the aeroplane is operated using the CDL, it must be operated in accordance with the limitations specified in the AFM, as amended in the CDL.
- b) The associated limitations should be listed on a placard affixed in the cockpit in clear view of the pilot in command and other appropriate crew member(s).
- c) No more than one part for any one system may be missing, unless specific combinations are indicated in the CDL. Unless otherwise specified, parts from different systems may be missing. The performance penalties are cumulative, unless specifically designated penalties are indicated for the combination of missing parts.
- d) No more than three parts that have each been determined to cause a negligible performance degradation may be missing for take-off without applying a performance penalty. When more than three such parts are missing, a performance penalty of either 0.05 per cent of the maximum take-off mass or 50 kg, whichever is less, should be applied for take-off, en route, and landing for each missing part.
- e) Take-off performance penalties should be applied to the take-off mass that is limited by performance considerations (i.e. take-off field length, first, second, or, final segment climb, or take-off flight path). If the performance limited take-off mass is greater than the maximum certified take-off mass, the take-off performance penalties should be applied to the maximum certified take-off mass to ensure compliance with the noise requirements.
- f) Landing performance penalties should be applied to the landing mass that is limited by performance considerations (i.e. landing field length, landing climb or approach climb). If the performance limited landing mass is greater than the maximum certified landing mass, the landing performance penalties should be applied to the maximum certified landing mass to ensure compliance with the noise requirements.
- g) En route performance penalties apply only to operations that are limited by the one- or two-engine (s) inoperative en route climb performance.
- h) The numbering and designation of systems in the CDL appendix should be based on Air Transport Association (ATA) Specification 2200 (formerly Specification 100). The parts within each system are identified by functional description and, when necessary, by part numbers.

1.8.4.3 Accountability of performance degradation relative to both minor design changes and CDL items.

1.8.4.3.1 *General.* Whenever a minor change to the type design aerodynamic configuration or a CDL proposal (e.g. installation of wing tip mounted emblem lights, missing flap hinge covers, etc.), has been submitted for CAA approval, the applicable performance degradation needs to be determined. In lieu of a complete flight test analysis to determine the performance degradation, simple criteria are prescribed below for establishing an acceptable level of airworthiness for the affected items.

1.8.4.3.2 *Criteria*

- a) Estimated Drag. The aerodynamic drag of the type design change or CDL item should be evaluated. Design changes or CDL items that have no impact on, or actually improve, the

aerodynamic drag of the aircraft are considered to have no performance penalty. In cases where there are quantifiable effects on aerodynamic drag (no matter how small), the drag value should be estimated and then increased by a factor of 2, unless the estimated drag was determined with equivalent conservatism.

- b) Performance Penalty. Performance penalties (usually expressed in kg or percent mass) should be determined for all appropriate performance limitations (take-off, en route and landing) based on the effects of the estimated drag. If the resulting mass penalty is less than the smaller of 0.05% of the maximum certified take-off mass or 50kg, the performance degradation may be considered negligible. The AFM supplement or CDL appendix should identify those type design changes or CDL items that result in a negligible performance degradation. If the performance degradation is not considered negligible, the appropriate performance penalty should be provided as a limitation in the AFM supplement or in the CDL appendix.

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*Contracting State*  
*Civil Aviation Authority*

**Type Certificate No.** \_\_\_\_\_

Pursuant to Civil Aviation Regulations Number \_\_\_\_\_ of Contracting State, this Type Certificate is issued to:

- *Name of Holder of Type Certificate* -

- *Complete Address of Holder of Type Certificate* -

**For the following Aeronautical product(s):**

- *Aircraft Model* \_\_\_\_\_ -

**Details of this type design, basis of certification, operating limitations and other associated airworthiness requirements are specified in:**

*Civil Aviation Authority Type Certificate Data Sheet* \_\_\_\_\_ *or latest revision*



\_\_\_\_\_  
**Authorized Person – Civil Aviation Authority**

\_\_\_\_\_  
**Date of Issue**

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APPENDIX B.— EXAMPLE OF A TYPE CERTIFICATE DATA SHEET

**CIVIL AVIATION AUTHORITY**

**CAA**

**TYPE CERTIFICATE DATA SHEET  
CAA TCDS Code and Number**

**Aircraft name**

**Manufacturer:**  
Manufacturer name and address

For models:	Aircraft name
Issue 1, <b>Draft 1:</b>	DD.MM.YY

List of effective pages:

All pages are at the latest issue

**SECTION 1. GENERAL**

- **Data Sheet No.:** TCDS authority code and number
- **Airworthiness Category:** Large airplane
- **Performance Category:** A
- **Certifying Authority:** Acronym
- **Type Certificate Holder:** Name and address
- **ETOPS** Not applicable

# SECTION 2. AIRCRAFT NAME

## 2.I General

Aeroplane: ..... Aircraft Name

## 2.II FALCON 7X Certification Basis

- Reference Application Date for EASA Certification: ..... DD.MM.YY
- NAA Certification Date: ..... DD.MM.YY
- NAAA Certification Basis: .....

The following NAA airworthiness standards effective on the reference date are:

- JAR 1 at change 5 plus orange papers 1/97/1 and 1/99/1
- JAR 25 at change 15
- JAR AWO at change 2

Refer to CRI A01 for exhaustive list of applicable requirements.

### 2. Requirements of JAR 25 change 15

Plus JAR 1 change 5 plus Orange papers 1/97/1 and 1/99/1.

Special Conditions:

- CRI B-01 Stalling and scheduled operating speeds
- CRI B-02 Motion and effects of cockpit controls
- CRI B-03 Static directional, lateral and longitudinal stability and low energy awareness
- CRI B-04 Flight envelope protection
- CRI B-05 Normal load factor limiting system
- CRI C-01 Design maneuver requirements
- CRI C-02 Limit forces and torque
- CRI C-03 Design dive speed Vd
- CRI C-05 Interaction of systems and structure
- CRI C-06 Fuel tank crashworthiness
- CRI D-02 Electronic flight control unusual features
- CRI D-05 Flight controls - Harmonized 25.671
- CRI D-07 Nose wheel steering - Towbarless towing
- CRI D-09 Airworthiness standards for subsonic aeroplanes to be operated above 41 000 ft
- CRI D-11 Fire protection of thermal and acoustic insulation material
- CRI D-22 Fuselage doors
- CRI E-01 Fuel tank safety
- CRI E-04 Reversing system requirements
- CRI E-05 Sustained engine imbalance
- CRI F-06 Protection from effects from HIRF
- CRI F-24 Human factors aspects of flight deck design
- CRI F-36 Head up display system

Exemptions: none

Deviation: CRI D-18 Personal injury criteria of dynamic testing of side facing sofa



### Equivalent Safety Findings:

- CRI C-09 JAR 25.251, 25.305 and 25.629 – Vibration, buffet and aeroelastic stability requirements
- CRI C-12 JAR 25.361 – Engine failure loads
- CRI C-15 JAR 25.341, 25.343(b), 25.345(c), 25.371, 25.373(a), 25.391, 25.1517 - Gust and continuous turbulence
- CRI C-16 JAR 25.963(g) – Fuel tank access cover
- CRI D-12 JAR 25.811(d)(1) and (d)(2) – Emergency exit locator sign used also as marking sign – cabin without divider
- CRI D-13 JAR 25.811(d)(1) and (d)(3) – Emergency exit locator sign used also as marking sign – cabin with divider
- CRI D-15 JAR 25.831(a) – Packs-off take off
- CRI D-19 JAR 25.699(b) – Lift and drag device indicator
- CRI D-20 JAR 25.857(b) – Fire protection of class B baggage compartment
- CRI E-02 JAR 25.865, 25.1181, 25.1195, 25.1203 – Engine fire protection in designated fire zones
- CRI E-08 JAR 25.1093(b) – Falling and blowing snow
- CRI E-10 JAR 25.1549 – Powerplant instruments – colour markings
- CRI E-12 JAR 25.971 – Fuel tank sump
- CRI F-22 JAR 25.1357(e), 25.1309 – Integrated Modular Avionics system (compliance with requirements for individual circuit protection)
- CRI F-35 JAR 1459 (a)(2) – Use of IRS for DFDR vertical acceleration
- CRI F37 JAR 25.1329, JAR 25.1335 – Revisions to JAR 25.1329 and 25.1335 resulting from Flight Guidance Systems Harmonization
- CRI F-41 JAR 25.1322 – CAS window red message line space
- CRI G-01 JAR 25X-1591 – Operation on contaminated runways

### 3. Elect to comply by Manufacturer:

- |                          |   |
|--------------------------|---|
| JAR 25.331(c)(2) amdt 16 | Symmetric manoeuvring conditions                |
| JAR 25.335(b)(2) amdt 16 | Design airspeeds                                |
| JAR 25.337(d) amdt 16    | Limit manoeuvring load factors                  |
| JAR 25.391 amdt 16       | Control surface loads: general                  |
| JAR 25.395(b) amdt 16    | Control system                                  |
| JAR 25.415 amdt 16       | Ground gust conditions                          |
| JAR 25.491 amdt 16       | Taxi, takeoff and landing roll                  |
| JAR 25.493(c) amdt 16    | Braked roll conditions                          |
| JAR 25.605(a) amdt 16    | Fabrication methods                             |
| JAR 25.731(d)(e) amdt 16 | Wheels  |
| JAR 25.735 amdt 16       | Brakes  |
| JAR 25.904 amdt 16       | Automatic takeoff thrust control system (ATTCS) |
| JAR 25.907 amdt 16       | Propeller vibration                             |
| JAR 25.933 amdt 16       | Reversing systems                               |
| JAR 25.939(d) amdt 16    | Turbine engine operating characteristics        |
| JAR 25.951(d) amdt 16    | Fuel system - General                           |
| JAR 25.952(c) amdt 16    | Fuel system analysis and test                   |
| JAR 25.954 amdt 16       | Fuel system lightning protection                |
| JAR 25.961(a) amdt 16    | Fuel system hot weather operation               |
| JAR 25.967 amdt 16       | Fuel tank installations                         |
| JAR 25.975(a)(5) amdt 16 | Fuel tank vents                                 |

JAR 25.981 amdt 16	Fuel tank temperature
JAR 25.993 (c) amdt 16	Fuel system lines and fittings
JAR 25.994 amdt 16	Fuel system components
JAR 25.997 amdt 16	Fuel strainer or filter
JAR 25.1013 amdt 16	Oil tanks
JAR 25.1015 amdt 16	Oil tank tests
JAR 25.1019 amdt 16	Oil strainer or filter
JAR 25.1145(c) amdt 16	Ignition switches
JAR 25.1301(d) amdt 16	Function and installation
JAR 25.1305(a)(3),(a)(9), (c)(5), (c)(6),(c)(7),(c)(8), (d)(2) amdt 16	Powerplant instruments
JAR 25.1309 amdt 16	Equipment, systems and installations
JAR 25.1310 amdt 16	Power source capacity and distribution
JAR 25.1323 amdt 16	Airspeed indicating system
JAR 25.1351 (b)(6) amdt 16	Electrical systems and equipment - General
JAR 25.1435 amdt 16	Hydraulic systems
Appendix H §H25.3 amdt 16	Instruction for Continued Airworthiness

- Environmental Standards:

Noise level: ICAO Annex 16, Volume 1, Chapter 4, Amendment 8.

Fuel venting and emissions: ICAO Annex 16, Volume 2, Part II and Part III, Chapter 2, Amendment 4 applicable on 4 November 1999.

- Additional National Requirements:

To be defined at a later stage.

## 2.III Aircraft name technical characteristics and operational limitations type design definition

### 2.III.1 Type design definition

Aircraft name is a maximum 22 occupants, tri-jet, long range, large aeroplane category. It has a low, high swept airfoil, mid-height horizontal stabilizer and tricycle landing gear. Flight controls are fly-by-wire.

Three Engine manufacturer and model engines are rear mounted, two on side of fuselage and one in center position.

### 2.III.2 Dimensions

Length	23.38 m
Span	26.21 m
Height	7.93 m
Gross wing area	70.7 m <sup>2</sup>

### 2.III.3 Engines

Model: Engine manufacturer and model

Engine TCDS: NAA TCDS CODE and Number

Note: Engine is approved for operation with thrust reverser p/n ZZZZZ

Number: 3

#### **Ratings:**

- Maximum takeoff static thrust : 2 849 daN (6405 lbs) limited to 5 minutes
- Max continuous : 2 849 daN (6405 lbs)

Engine limits: Refer to the Airplane Flight Manual and to the relevant Engine Type Certificate Data Sheet

### 2.III.4 Auxiliary power unit (APU)

Model: APU manufacturer and model

**APU limits:** Refer to the Airplane Flight Manual. APU is usable for ground operation only.

### 2.III.5 Fluids (Fuel/Oil/Additives):

Approved Fuel, oils and additives: Refer to the Airplane Flight Manual.

### 2.III.6 Fluid capacities:

Fuel capacity

<b>USABLE FUEL</b>	<b>Liters</b>	<b>kg (*)</b>	<b>US Gallons</b>	<b>lbs (*)</b>
Left circuit	5944	4773	1570	10522
Right circuit	5944	4773	1570	10522
Center circuit	6154	4942	1626	10896
<b>Total usable</b>	<b>18042</b>	<b>14488</b>	<b>4766</b>	<b>31940</b>
<b>UNUSABLE FUEL</b>				
Drainable	65	52	17	115
Undrainable	41	33	11	72
<b>Total unusable</b>	<b>106</b>	<b>85</b>	<b>28</b>	<b>187</b>

\* assuming a fuel density of 0,803 kg/liter

Engine Oil Tank Capacity\*:

	Liters	kg (**)	US gallons	lbs (**)
<b>Max oil level</b>				
Left engine	7.87	7.67	2.08	16.90
Right engine	7.87	7.67	2.08	16.90
Center engine	7.87	7.67	2.08	16.90
<b>Total</b>	<b>23.61</b>	<b>23.01</b>	<b>6.24</b>	<b>50.70</b>
<b>Min oil level</b>				
Left engine	6.23	6.07	1.64	13.38
Right engine	6.23	6.07	1.64	13.38
Center engine	6.23	6.07	1.64	13.38
<b>Total</b>	<b>18.69</b>	<b>18.21</b>	<b>4.92</b>	<b>40.14</b>

(\*) Tank quantities do not include undrainable oil or residual oil in the Accessory Gearbox, oil filter bowl or air-cooled oil cooler (ACOC)

(\*\*) Based on specific gravity of 0.975

2.III.7 **Airplane speed limits**

(Unless otherwise specified, speeds are indicated airspeeds )

V <sub>MO</sub>	at sea level .....	350 kts
V <sub>MO</sub>	straight line variation up to 10,000 ft.....	370 kts
V <sub>MO</sub>	from 10,000 ft to 28,000 ft .....	370 kts
M <sub>MO</sub>	from 28,000 to 51,000 ft .....	0,9
V <sub>A</sub>	maneuvering speed .....	218 kts
V <sub>FE</sub>	SF1 .....	200 kts
	SF2 .....	190 kts
	SF3.....	180 kts

**Note.**– Above 20 000 ft., do not establish, nor maintain a configuration with the slats and the flaps extended.

V <sub>LO</sub>	Landing gear operation .....	200 kts
M <sub>LO</sub>	.....	0,70
V <sub>LE</sub>	Landing gear extended .....	245 kts
M <sub>LE</sub>	.....	0,75
V <sub>MCA</sub>	minimum control speed in flight .....	80 kts (CAS)
V <sub>MCG</sub>	minimum control speed on ground .....	81,3 kts (CAS)

2.III.8 **Maximum operating altitude**

15 544 m (51,000 ft)

2.III.9 **All-weather capability**

Category I Auto Pilot

2.III.10 **Maximum Mass**

Mean aerodynamic chord (MAC): 3 347.54 mm

Datum is 25 per cent of mean aerodynamic chord (MAC): 12 183 mm from the forward end of the aircraft nose cone

	Mass		Forward limit % MAC	Aft limit % MAC
	kg	lbs		
Minimum flight - Aft	14 696	32 400	N/A	38.5
Minimum flight - Forward	15 694	34 600	26.0	N/A
Maximum zero fuel	18 597	41 000	19.5	38.5
Maximum landing	28 304	62 400	19.5	38.5
Maximum for aft CG at 38,5 %	25 890	57 078	19.5	38.5
Maximum takeoff	31 298	69 000	19.5	33.65
Maximum ramp	31 389	69 200	19.5	31.5

For mass and balance calculation refer to the Loading Manual (manufacturer document reference) - See Note 1.

2.III.11 **Leveling means**

Aircraft is leveled in the longitudinal and lateral axis by means of a plumb bob and target in the left main landing gear bay

2.III.12 **Minimum flight crew:**

2 — pilot and copilot

2.III.13 **Maximum Seating Capacity:**

2 + 1 crew — third crew member seat authorized for take-off and landing in the cockpit.

19 passengers in cabin.

See note 2.

2.III.14 **Exits**

	Type	Size
1 Passenger door	I	0.800 x 1.72 m (31.50 x 67.72 in)
1 Emergency exit	III	0.534 x 0.916 m (21.02 x 36.06 in)

**2.III.15 Baggage/cargo compartments**

Baggage compartment: 909 Kg, not to exceed 400 kg per square meter.  
See note 2.

**2.III.16 Wheels and tyres**

This aircraft is equipped with wheels, brakes and H type radial tubeless tires.

Main wheel tyres are H32×10.5R16.5

Nose wheel tyres are 16×6.0R6

No mixability (tyre manufacturer + others) is not approved.

**2.IV Aircraft name Operating and Service Instructions**

The aircraft must be operated according to the EASA approved Airplane Flight Manual manufacturer document reference

The Instructions for Continued Airworthiness consist of:

Maintenance Review Board Report	Manufacturer document reference
Airplane Maintenance Manual	Manufacturer document reference
Structural Repair Manual	Manufacturer document reference
CMR and ALI	

**2.V Notes**

**Note 1:**

- a) A current mass and balance report must be carried in the aircraft at all times from the moment the aircraft is originally certified.
- b) Loading of the aircraft must be accomplished in a manner that always maintains the center of gravity within the specified limits considering crew and passenger movements as well as fuel consumption and transfer.

**Note 2:**

Cabin interior and seating configuration must be approved.

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**APPENDIX C.— EXAMPLE OF SMALL AEROPLANE ICA CHECKLIST**

<b>INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) REQUIREMENTS</b>	<b>Regulation Appendix (sample reference)</b>	<b>Location In ICA</b>
<input type="checkbox"/> ICA for each engine.	G23.1(b)	
<input type="checkbox"/> ICA for each propeller.	G23.1(b)	
<input type="checkbox"/> ICA for each appliance required by this chapter.	G23.1(b)	
<input type="checkbox"/> Required information on the interface of <input type="checkbox"/> appliances, <input type="checkbox"/> engines, and <input type="checkbox"/> propellers with the aircraft.	G23.1(b)	
<input type="checkbox"/> If ICA are not supplied by the manufacturer of an <input type="checkbox"/> appliance, <input type="checkbox"/> engine, or <input type="checkbox"/> propeller installed on the aircraft, the ICA for the aircraft must include <input type="checkbox"/> the information essential to the continued airworthiness of the aircraft.	G23.1(b)	
<input type="checkbox"/> Applicant's programme showing how they or the manufacturers of products and appliances installed on the aeroplane will distribute changes to the ICA.	G23.1(c)	
<input type="checkbox"/> ICA in a manual or manuals.	G23.2(a)	
<input type="checkbox"/> Manuals arranged for easy and practical use.		
<input type="checkbox"/> Manuals prepared in English.	G23.3	
<input type="checkbox"/> Manual's must include introductory information that includes an explanation of the aeroplane's features and data to the extent necessary for maintenance or preventive maintenance.	G23.3(a)(1)	
<input type="checkbox"/> Description of the <input type="checkbox"/> aircraft and its systems and installations, <input type="checkbox"/> engines and its systems and installations, <input type="checkbox"/> propellers and its systems and installations, and <input type="checkbox"/> appliances and its systems and installations.	G23.3(a)(2)	
<input type="checkbox"/> Basic control and operating information describing <input type="checkbox"/> how the aircraft components and systems are controlled and <input type="checkbox"/> how the aircraft components and systems are operated, including <input type="checkbox"/> any special procedure and limitations.	G23.3(a)(3)	
<input type="checkbox"/> Servicing information covering <input type="checkbox"/> servicing points, <input type="checkbox"/> capacities of tanks, <input type="checkbox"/> capacities of reservoirs, <input type="checkbox"/> types of fluids used, and <input type="checkbox"/> pressures applicable to the various systems.	G23.3(a)(4)	
<input type="checkbox"/> Location of access panels for <input type="checkbox"/> inspection and <input type="checkbox"/> servicing.	G23.3(a)(4)	
<input type="checkbox"/> Servicing information covering <input type="checkbox"/> locations of lube points and <input type="checkbox"/> lube used.	G23.3(a)(4)	
<input type="checkbox"/> Equipment required for servicing.	G23.3(a)(4)	
<input type="checkbox"/> Tow instructions and limitations.	G23.3(a)(4)	
<input type="checkbox"/> Mooring information	G23.3(a)(4)	
<input type="checkbox"/> Jacking information	G233(a)(4)	
<input type="checkbox"/> Leveling information	G33(a)(4)	
<input type="checkbox"/> Scheduling information for each part of the <input type="checkbox"/> aircraft, including recommended periods for <input type="checkbox"/> cleaning, <input type="checkbox"/> inspecting, <input type="checkbox"/> adjusting, <input type="checkbox"/> testing, and <input type="checkbox"/> lubricating; and <input type="checkbox"/> the work recommended at these periods.	G25.3(b)(1)	
<input type="checkbox"/> Scheduling information for <input type="checkbox"/> aircraft engines, including recommended periods for <input type="checkbox"/> cleaning, <input type="checkbox"/> inspecting,	G23.3(b)(1)	

<b>INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) REQUIREMENTS</b>	<b>Regulation Appendix (sample reference)</b>	<b>Location In ICA</b>
( ) adjusting, ( ) testing, and ( ) lubricating; and ( ) the work recommended at these periods. <b>NOTE:</b> This information may be in the FAA accepted engine ICA.		
( ) Scheduling information for ( ) the aircraft's auxiliary power unit, including recommended periods for ( ) cleaning, ( ) inspecting, ( ) adjusting, ( ) testing, and ( ) lubricating; and ( ) the work recommended at these periods.	G23.3(b)(1)	
( ) Scheduling information for ( ) aircraft propellers, including recommended periods for ( ) cleaning, ( ) inspecting, ( ) adjusting, ( ) testing, and ( ) lubricating; and ( ) the work recommended at these periods.	G23.3(b)(1)	
( ) Scheduling information for ( ) aircraft accessories, including recommended periods for ( ) cleaning, ( ) inspecting, ( ) adjusting, ( ) testing, and ( ) lubricating; and ( ) the work recommended at these periods.	G23.3(b)(1)	
( ) Scheduling information for ( ) aircraft instruments, including recommended periods for ( ) cleaning, ( ) inspecting, ( ) adjusting, ( ) testing, and ( ) lubricating; and ( ) the work recommended at these periods.	G23.3(b)(1)	
( ) Scheduling information for ( ) aircraft equipment, including recommended periods for ( ) cleaning, ( ) inspecting, ( ) adjusting, ( ) testing, and ( ) lubricating; and ( ) the work recommended at these periods.	G23.3(b)(1)	
( ) Degree of inspection for each part of the ( ) aircraft and its ( ) engines, ( ) the auxiliary power unit, ( ) propellers, ( ) accessories, ( ) instruments, and ( ) equipment.	G23.3(b)(1)	
( ) Applicable wear tolerances.	G23.3(b)(1)	
Applicant may refer to an ( ) accessory, ( ) instrument, or ( ) equipment manufacturer as the source of this information if applicant shows ( ) that the item is exceptionally complex and requires specialized maintenance techniques, test equipment, or expertise.	G23.3(b)(1)	
( ) Recommended overhaul periods and necessary cross-references to the ALS.	G23.3(b)(1)	
( ) An inspection programme that includes ( ) the frequency and ( ) extent of the inspection necessary to provide for continued airworthiness .	G23.3(b)(1)	
( ) Troubleshooting information describing ( ) probable malfunctions, ( ) how to recognize those malfunctions, and ( ) remedies for them.	G23.3(b)(2)	
( ) Description of the order and method of ( ) removing and ( ) replacing products (engines and propellers) with any precautions.	G23.3(b)(3)	
( ) Description of the order and method of ( ) removing and ( ) replacing parts, with any precautions.	G23.3(b)(3)	
( ) Other instructions, including ( ) storage limitations and procedures for ( ) testing system during ground running, ( ) making symmetry checks, ( ) weighing and determining the center of gravity, ( ) lifting, and ( ) shoring.	G23.3(b)(4)	



INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) REQUIREMENTS	Regulation Appendix (sample reference)	Location In ICA
( ) Diagrams of structural access plates and information needed to gain access for inspections when access plates are not provided.	G23.3(c)	
( ) Details for applying special inspection techniques, including radiographic and ultrasonic testing, where such processes are specified.	G23.3(d)	
( ) Information needed to apply protective treatment to structure after inspection.	G23.3(e)	
( ) All data on structural fasteners, such as ( ) identification, ( ) discard recommendations, and ( ) torque values.	G23.3(f)	
( ) List of special tools needed.	G23.3(g)	
( ) For Commuter Category aircraft: electrical loads applicable to the various systems.	G23.3(h)(1)	
( ) For Commuter Category aircraft: methods of balancing control surfaces.	G23.3(h)(2)	
( ) For Commuter Category aircraft: identification of primary and secondary structures.	G23.3(h)(3)	
( ) For Commuter Category aircraft: any special repair methods applicable.	G23.3(h)(4)	
( ) ICA must contain a section, titled Airworthiness Limitations, that is ( ) segregated and ( ) clearly distinguishable from the rest of the document. <b>NOTE:</b> The appropriate CAA office will evaluate and approve the Airworthiness Limitations Section (ALS) in the applicant's ICA.	G23.4	
( ) ALS must describe each ( ) mandatory replacement time, ( ) structural inspection interval, and ( ) related structural inspection procedure, including ( ) envelope structural integrity, required for type certification.	G23.4	
( ) If ICA consist of multiple manuals, the ALS required by this paragraph must be in the principal manual.	G23.4	
( ) ALS must contain a legible statement in a prominent location, that reads : "The Airworthiness Limitations Section is CAA approved and specifies maintenance required, unless an alternative programme has been CAA approved."	G23.4	

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## CHAPTER 2.— PRODUCTION APPROVALS/CERTIFICATION

### 2.1 Production certificate/approvals

#### 2.1.1 General

2.1.1.1 An applicant (manufacturer) may be eligible for a production certificate or production organization approval from the CAA, subject to determination by the CAA based on its examination of supporting data and inspection of the production facilities, processes and organization, that the applicant has complied with the relevant requirements.

2.1.1.2 An applicant for a production certificate/approval should hold, for the product or part concerned:

- a) a current Type Certificate or other approved design (or, in the case of a production organization approval, should have applied for a Type Certificate/Design Approval); or
- b) a Supplemental Type Certificate (or, in the case of a production organization approval, should have applied for a Supplemental Type Certificate/Design Approval); or
- c) the right of access to the applicable design data of a Type Certificate/Supplemental Type Certificate for production purposes under an agreement.

#### 2.1.2 Quality system

2.1.2.1 The applicant should show that it has established and can maintain a quality system for any product or part for which he requests a production certificate/approval, so that each article will meet the design provisions of the pertinent design approval. The quality system should include the following:

- a) an organization chart indicating the chain of authority, including any delegations of that authority, and documentation of the assigned responsibility and authority of the management representative who ensures implementation and compliance with the quality system, and the interrelation of key personnel affecting the quality system;
- b) procedures for the control of design data. The procedures shall ensure that documents and data are reviewed for adequacy, by authorized personnel, prior to design data changes;
- c) procedures to control documents and data that form the quality system and any subsequent changes. The procedures shall ensure that documents and data are reviewed for adequacy, by authorized personnel, prior to inclusion in the quality system;
- d) procedures to ensure conformance of supplier furnished products, parts, materials, and services to the approved design prior to release for installation in the product or part, including, but not limited to:
  - 1) methods for initial supplier evaluation and selection;
  - 2) methods for controlling suppliers at all tiers, including procedures for corrective actions;

- 3) methods for the monitoring/surveillance of suppliers, based on techniques such as risk assessment; qualification and auditing of supplier's quality system; monitoring continued capability throughout the supply chain; first article inspection; incoming inspections and tests of supplied parts; identification of incoming documentation and data relevant to the showing of conformity; and a supplier rating system, which gives visibility of the performance, capability and reliability of the suppliers;
- 4) an arrangement which defines all necessary elements and procedures between the manufacturer and the supplier, including items such as design data and configuration control, incoming inspections, identification and traceability, non-conformities, sub-tier suppliers, access for the CAA, and significant changes to the quality system; and

*Note.— A model supplier arrangement can be found in Appendix A to this Chapter.*

- 5) methods for notification to the CAA of significant changes to the scope of any supplier arrangements.
- e) procedures to control the manufacture and quality of products and parts to the approved design;
  - f) procedures for all types of inspection and test, including flight test, to determine products and parts conform to the approved design at points in the manufacturing process where an accurate conformity determination can be made;
  - g) procedures to ensure that all tooling, inspection, measuring, and test equipment, used in determining conformity of products and parts to the approved design, is calibrated and controlled;
  - h) procedures for the identification of inspection and test status of materials, products, and parts supplied or manufactured to the approved design;
  - i) procedures to ensure that products, parts, and materials that do not conform to the approved design are segregated and submitted to a material review board. Material review board procedures should ensure that a material review board is established and composed of authorized individuals. The procedures should provide for the disposition of nonconforming products, parts, and materials. The procedures should also address the identification, segregation, and documentation of those products and parts that are approved for use by the board. Nonconforming products and parts that are rejected by the board should be marked and disposed of in a manner that renders them unsuitable for installation on type certificated products;
  - j) procedures for implementing corrective and preventive action to eliminate or minimize the causes of actual or potential nonconformities to the approved design;
  - k) procedures to prevent damage and deterioration of materials, products, and parts in process and in storage;
  - l) procedures for identification and retrieval of inspection and test records that demonstrate the product or part conforms to the approved design, and records that demonstrate compliance with the requirements of the approved quality system;

- m) procedures to include a software quality assurance process, when software is included in the approved design data; and
- n) procedures, in case of production under an agreement, to ensure reporting to the design holder all cases where products, parts and appliances have been released by the production organization and subsequently identified as having possible deviations from the design, and to investigate with the design holder in order to identify those deviations which could lead to an unsafe condition.

2.1.2.2 The manufacturer should also establish procedures for an independent quality assurance function (e.g. internal quality audits), including any corrective action system, for the purpose of assuring compliance with the approved quality system.

2.1.2.3 The manufacturer should submit, for approval, a quality system manual that documents in detail the quality system and the internal quality assurance function described in 2.1.2.1 and 2.1.2.2 above, in order to ensure that each product or part produced conforms to the approved type design and is in a condition for safe operation.

2.1.2.4 After the issue of a production certificate/approval, changes to the quality system should be subject to review by the CAA. The holder of a production certificate/approval should immediately notify the CAA in writing, of any change that may affect the inspection, conformity or airworthiness of the product.

2.1.2.5 A production limitation record should be issued as part of a production certificate/approval. The record lists the Type Certificate of every product that the applicant is authorized to manufacture under the terms of the production certificate/approval.

2.1.2.6 Each holder of a production certificate/approval should cooperate with the CAA and allow the CAA to make any inspections and tests necessary to determine compliance with the applicable regulations.

2.1.2.7 A production certificate/approval should be effective until surrendered, suspended or revoked, or until a termination date is otherwise established by the CAA, or the location of the manufacturing facility is changed. A production certificate/approval should not be transferable.

2.1.2.8 The holder of a production certificate/approval should retain the production certificate/approval on the premises in which the product concerned is manufactured, and make it available to the CAA.

### 2.1.3 Privileges and responsibilities

2.1.3.1 The holder of a production certificate/approval may:

- a) obtain a Certificate of Airworthiness for an aircraft it produces without further showing when the aircraft conforms to an approved type design and is in a condition for safe operation, except that the CAA may inspect the aircraft for conformity with the type design;
- b) obtain an airworthiness approval for a part, or product other than an aircraft, that conforms to the approved design data and is in a condition for safe operation, prior to that

part or product leaving the production certificate holder's approved quality system. In the case of a production organization approval, the holder of a production organization approval may directly issue airworthiness approval documents for parts or products other than aircraft in accordance with the privileges of the production organization approval.

2.1.3.2 The holder of a production certificate/approval should:

- a) maintain the quality system in conformity with the data and procedures approved for the production certificate/approval;
- b) determine that each part and completed product conforms to the type design and is in a condition for safe operation;
- c) mark or tag all products and parts in accordance with the applicable regulations;
- d) maintain a complete and current design data file for each product produced under the production approval; and
- e) maintain complete and current inspection records showing that all inspections and tests required to ensure compliance with the applicable regulations have been properly completed and documented. These records typically should be retained for five years.

## **2.2 Production without a production certificate or production organization approval**

### 2.2.1 General

Prior to commencing serial production of aircraft or components for which a Type Certificate has been applied for or issued, a manufacturer normally obtains approval from the CAA in the form of a production certificate or production organization approval. A production certificate/approval is the preferred method of approving serial production of aircraft or components. In the absence of a production certificate/approval, a manufacturer may fabricate, with limitations, aircraft or parts under a Type Certificate only, with the establishment of an CAA-accepted or approved production inspection system.

### 2.2.2 Basic requirements for production without a production certificate/approval

Each manufacturer of a product or part fabricated under a Type Certificate only should:

- a) make each product and part available for inspection by the CAA;
- b) maintain, at the place of manufacture, all technical data and drawings necessary for the CAA to determine whether each product and its parts conform to the type design;
- c) establish and maintain an accepted or approved production inspection system that ensures that each product conforms to the type design and is in condition for safe operation;
- d) upon establishment of the accepted or approved production inspection system, submit to the CAA a manual that describes the system and the means for making the determinations required by the materials review board; and

- e) mark or tag each product and part in accordance with the applicable regulations.

### 2.2.3 Production inspection system - Materials review board

2.2.3.1 Each manufacturer should develop a production inspection system which:

- a) establishes a materials review board, to include representatives from the inspection and engineering departments, and materials review procedures; and
- b) maintains complete records of materials review board action for typically five years for the purpose of continued airworthiness.

2.2.3.2 The production inspection system should provide a means whereby the materials review board may determine at least that:

- a) incoming materials, and bought or subcontracted parts, used in the finished product meet the specifications indicated in the type design data;

*Note.— Guidance on the interaction between manufacturer and supplier can be found in Part III, Chapter 2, 2.1.2 d).*

- b) incoming materials, and bought or sub-contracted parts, are properly identified, especially when their physical or chemical properties cannot be readily and accurately determined;
- c) all materials are suitably stored and adequately protected from damage and deterioration;
- d) processes affecting the quality and safety of the finished product are accomplished in accordance with the specifications established by the design data;
- e) parts and components in process are inspected for conformity with the type design data at points in production where accurate determinations can be made;
- f) current design drawings are readily available to manufacturing and inspection personnel, and used when necessary;
- g) design changes, including material substitutions, are controlled and approved before being incorporated in the finished product;
- h) rejected materials and parts are segregated and identified in a manner that precludes their inadvertent installation in the finished product;
- i) materials and parts that are withheld because of departures from design data or specifications, and that are to be considered for installation in the finished product, are processed through the materials review board. Those materials and parts determined by the board to be serviceable should be properly identified and re-inspected if rework or repair is necessary. Materials and parts rejected by the board should be marked and disposed of to ensure that they are not incorporated in the final product; and

- j) inspection records are maintained, identified with the completed product where practicable, and retained by the manufacturer for typically five years for the purpose of continued airworthiness.

#### 2.2.4 Production test – Aircraft

2.2.4.1 The manufacturer of an aircraft under a Type Certificate only should establish a CAA-approved production flight test procedure and should flight test each aircraft in accordance with that procedure.

2.2.4.2 The production flight test procedure should include at least the following:

- a) an operational check of the trim, controllability, or other flight characteristics to establish that the production aircraft has the same range and degree of control as the prototype aircraft;
- b) an operational check of each part of the system operated by the crew while in flight to establish that, during flight, instrument readings are within normal range;
- c) a determination that all instruments are properly marked, all placards are installed in appropriate places, and flight manuals are available in the aircraft;
- d) a check of the operational characteristics of the aircraft on the ground; and
- e) a check on any other items peculiar to the aircraft being tested that can best be done during the ground or flight operation of the aircraft.

#### 2.2.5 Production test – Engines

The manufacturer of aircraft engines under a Type Certificate only should subject each engine (except rocket engines for which the manufacturer should establish a sampling technique) to an acceptable test run that includes at least the following:

- a) break-in runs that include a determination of fuel and oil consumption and a determination of power characteristics at rated maximum continuous power or thrust and, if applicable, at rated take-off power or thrust; and
- b) five hours of operation at rated maximum continuous power or thrust. For engines having a rated take-off power or thrust higher than rated maximum continuous power or thrust, the five-hour run should include thirty minutes at rated take-off power or thrust.

*Note.— The test runs may be made with the engine installed on the aircraft or appropriately mounted and using suitable power- and thrust-measuring equipment.*

#### 2.2.6 Production test – Propellers

The manufacturer of propellers under a Type Certificate only should give each variable pitch propeller an acceptable functional test to determine that it operates properly throughout the normal range of operation.

## 2.2.7 Statement of product conformity

2.2.7.1 Each holder of a Type Certificate or holder of an authorization (e.g. licensing agreement) to a Type Certificate who produces a product in the absence of a production certificate/approval should provide a statement of conformity, as required by the CAA. The statement of conformity should be provided:

- a) at the time of initial transfer of the ownership of such product, provided that product has not been issued an airworthiness approval; or
- b) at the time of application for the original issue of an aircraft airworthiness certificate or an aircraft engine or propeller airworthiness approval tag.

2.2.7.2 The conformity statement should be signed by an authorized person who holds a responsible position in the manufacturing organization, and should include:

- a) for each product, a statement that the product conforms to its Type Certificate and is in condition for safe operation;
- b) for each aircraft, a statement that the aircraft has been flight checked; and
- c) for each aircraft engine or variable pitch propeller, a statement that the engine or propeller has been subjected by the manufacturer to a final operational check.

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## APPENDIX A.— MODEL FOR A SUPPLIER ARRANGEMENT

*Note 1.— The term “manufacturer” in this appendix includes manufacturers:*

- a) with a Production Approval/Certificate (see Part III, Section 2.1) and*
- b) without a Production Approval/Certificate (see Part III, Section 2.2).*

*Note 2.— The term “quality system” in this appendix includes a quality system according to Part III, Section 2.1.2 and a production inspection system according to Part III, Section 2.2.3.*

*Note 3.— The term “item” in this appendix comprises products, parts or appliances as well as consumables, materials, standard parts or services.*

The supplier arrangement shall be documented through a contract which defines all necessary elements and procedures for the contracting parties. The following list comprises the minimum elements to be defined in the arrangement between the manufacturer and the supplier. Whenever one or more of these elements is found to be not applicable by the manufacturer, it shall be stated in the supplier arrangement.

Guidance on the content of each element is provided, but this is not intended to be comprehensive.

### **List of elements for a manufacturer — Supplier arrangement**

#### **1. Scope**

- a) Identify items (see Note 3) provided by the supplier and the associated supplier facilities.
- b) Identify any limitation(s) defined by the manufacturer.

#### **2. Manufacturer evaluation**

Stipulate that the supplier is acting under the manufacturer’s quality system, and all the corrective actions requested by the manufacturer are to be implemented.

#### **3. Implementation procedures**

Attach a quality plan or equivalent documentation to the contract.

#### **4. Internal quality system**

- a) Identify methods for the manufacturer to evaluate the internal quality system of the supplier.
- b) Describe the interface between the quality systems of the manufacturer and the supplier in the quality plan.

#### **5. Design data and configuration control**

- a) Identify the design data package provided by the manufacturer, which includes all pertinent data required for the supplied item(s) to be identified, manufactured, inspected, used and maintained.
- b) Establish procedures for the management of design changes.

**6. Manufacturing data**

Identify the manufacturing data developed by the supplier, if any, based on the design data (see item # 5 above) submitted by the manufacturer.

**7. Test and inspections (including incoming)**

Identify procedures to define the necessary test and inspection processes:

- a) to ensure and determine conformity of the supplied item(s) during the supplier's manufacturing activities and at receipt by the manufacturer
- b) to be performed for (re-)qualification of the supplier (including First Article Inspection) and the related documentation requirements

*Note.— The manufacturer may rely on inspection/tests performed by supplier, provided that:*

- a) personnel responsible for these tasks satisfy the quality standards of the manufacturer, and*
- b) quality measurements are clearly identified, and*
- c) the records or reports showing evidence of conformity are available for review and audit.*

**8. Identification and traceability**

Stipulate that the manufacturer ensures flow down, to the supplier and any sub-tier suppliers, of the item(s) identification and traceability requirements in order to identify the configuration of the item(s) throughout the item(s) life.

**9. Supplier personnel competence**

Identify the manufacturer's requirements for supplier personnel (i.e. production, inspection, and quality staff) competence, based on qualifications, education, training, skills, and experience.

**10. Calibration**

- a) Ensure that calibration is traceable to a national standard that is acceptable to the CAA of the manufacturer.
- b) Ensure that certificates are submitted where suppliers perform calibration services for the manufacturer.

**11. Handling, storage (segregation) and packing**

- a) Identify requirements from the manufacturer concerning handling, storage, packing, and shelf-life to be followed by the supplier.
- b) Address segregation of approved and non-approved items as well as non-conforming items.

**12. Record completion and retention**

Identify procedures for document management and retention by the supplier

**13. Non-conformities**

Identify procedures for the handling and documenting of non-conformities between the manufacturer and the supplier, addressing the:

- a) identification, documentation, and classification (major, minor, etc.) of non-conformities, and
- b) the disposition of non-conformities and the subsequent segregation and control of the non-conforming parts and materials including the secure disposition of scrap items to avoid reuse (see Item 11).

*Note.— The disposition of non-conformities is generally the responsibility of the Design Approval Holder. Nevertheless it may be acceptable to the CAA that the Design Approval Holder may delegate under its responsibility the disposition of non-conformities to persons located in the organization of the manufacturer and its suppliers, thus acting as part of the Design Approval Holder in this respect.*

**14. Conformity document**

Specify the document by which the supplier certifies conformity to the applicable design data to the manufacturer.

**15. Provisions for direct delivery/direct shipment**

Identify the authorization and the requirements for direct delivery/direct shipment to end users from the supplier's facilities based on relevant regulatory requirements.

**16. Assistance for continued airworthiness**

Identify procedures for supplier assistance to the manufacturer for continued airworthiness, including methods to notify and act upon notification of already delivered non-conforming items, ensuring proper investigation and implementation of corrective action.

**17. Sub-tier suppliers**

Specify the conditions under which the supplier may sub-contract to or supply from a third party (in some cases specific authorization may be needed, in some others only notification may be sufficient).

Specify procedures:

- a) for a supplier to flow down the applicable CAA and manufacturer requirements to sub-tier suppliers;
- b) for notification to the manufacturer in case of further sub-tier supplier activity and/or significant problems encountered during manufacturing.

**18. Significant change to the quality/inspection system**

Require that the manufacturer is notified as soon as practical of any changes to the supplier system evaluated by the manufacturer which may affect the quality of the supply.

**19. Occurrence reporting system**

Specify to the supplier the necessary requirements for occurrence reporting to ensure that the manufacturer can comply with CAA requirements for occurrence reporting.

**20. Access for manufacturer and manufacturer's CAA**

Ensure the right of access to all involved facilities in the supply chain for the manufacturer and manufacturer's CAA to enable:

- a) the manufacturer to verify compliance with the manufacturer-supplier arrangement and to assess the quality of the contracted items; and
- b) the CAA or its designated agent to investigate the manufacturer's compliance with the applicable requirements at supplier level.

**21. Language**

Identify the language to be used for the exchange of information (to include all working documents such as technical and quality data), which is acceptable to the manufacturer's CAA.

**22. Identification of responsibilities**

Identify responsible office/function/positions in charge for all elements of the manufacturer-supplier arrangement.

**23. Duration of the supplier arrangement**

Identify the duration of the supplier arrangement in terms of time and/or quantity of supply to be delivered to the manufacturer.

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## **CHAPTER 3.— AIRCRAFT REGISTRATION, CERTIFICATES OF AIRWORTHINESS AND APPROVALS FOR EXPORT AND SPECIAL FLIGHTS**

### **3.1 Registration of aircraft**

3.1.1 The proper registration of aircraft is fundamental to the regulation of international air operations and is therefore accorded considerable attention in Chapter III of the Convention on International Civil Aviation. Details on the registration and marking of aircraft are contained in Annex 7 to the Convention.

3.1.2 In accordance with international provisions, each aircraft must be registered in a State and each State must maintain a registry of aircraft. An aircraft cannot be validly registered in more than one State, but its registration may be changed from one State to another. The Convention does not provide for an aircraft to be registered by an international organization such as an agency of the United Nations. However, Article 77 of the Convention does provide for two or more Contracting States to establish joint air transport operating agencies subject to ICAO Council determination as to how the provisions of the Convention will apply concerning the registration and nationality of the aircraft operated by such agencies. To date no such agencies have been formed. Subject to any future action the Council might take in respect of joint operating agencies, each aircraft must have only one State of Registry and that State has, among a number of responsibilities in respect of each aircraft on its registry, a fundamental responsibility to ensure that the aircraft is operated in an airworthy condition. A transfer of responsibilities may be agreed but only under the specific formal arrangements required by Article 83 *bis* of the Convention. (For further information on Article 83 *bis*, refer to Part V of this manual.)

3.1.3 Under Article 19 of the Convention, the registration or transfer of registration of aircraft in any Contracting State shall be made in accordance with its laws and regulations. Accordingly, the State will need to adopt detailed regulations covering all aspects of registration including such matters as the basic requirement for aircraft to be registered with the State's application procedures, data required, display of the Registration Certificate and fees (if any). The CAA will need to issue internal administrative instructions on the maintenance of the registry.

### **3.2 Certificate of Airworthiness**

#### **3.2.1 General**

3.2.1.1 As required by Article 31 of the Convention, all aircraft engaged in international flight operations must have a valid Certificate of Airworthiness issued or rendered valid by the State in which the aircraft is registered. The basic requirements for a Certificate of Airworthiness, including its format, are stated in Annex 8, Part II, Chapter 1 for certification of the aircraft type and Chapter 3 for the issuance of the Certificates of Airworthiness. The recommended procedures to be followed in issuing or rendering valid Certificates of Airworthiness follow in this chapter.

3.2.1.2 Normally, the responsibility for developing the procedures for, and the issuing of, Certificates of Airworthiness should be assigned to the AID.

3.2.1.3 In the development of procedures concerning Certificates of Airworthiness, the AID will need to consider three basic situations:

- a) the issuance of a new Certificate of Airworthiness when an aircraft is first registered in the State (this can be a newly manufactured aircraft or an aircraft coming from a foreign State). (Refer to 3.2.2 below);

- b) the renewal of a Certificate of Airworthiness issued by the State. (Refer to 3.2.3 and 3.2.4 below); and
- c) the validation by the State of a Certificate of Airworthiness issued by a foreign State. (Refer to 3.2.6 below).

3.2.1.4 The AID should accept, to the maximum extent possible, the findings of airworthiness made by other Contracting States, when validating or otherwise reviewing modifications made to an aircraft prior to issuance of a Certificate of Airworthiness.

### 3.2.2 Issuance of a Certificate of Airworthiness

*Note.— Guidance on the content of an application form for the issuance of a Certificate of Airworthiness is given in Appendix A to this chapter.*

3.2.2.1 The issuance of a Certificate of Airworthiness for an aircraft is dependent upon the aircraft being registered in the State.

3.2.2.2 The procedures developed by the AID for the issuance of a Certificate of Airworthiness should cover the following requirements, the completion of some of which may be delegated to suitably approved organizations. In the case of imported aircraft, depending on the State's assessment of the adequacy of the exporting State's airworthiness code, these procedures may be adjusted.

- a) an application should be completed and submitted to the AID;
- b) the applicant should specify the design standards and airworthiness requirements according to which the aircraft type was certificated. Where a Type Certificate has been issued, the details should also be specified.

*Note.— The AID may, from time to time, stipulate special requirements to be met before a Certificate of Airworthiness is issued. These should be listed as special conditions and communicated to the applicant.*

- c) the applicant should make the aircraft available, at a time and place acceptable to the AID, for such checks and inspections considered necessary by the AID;
- d) it should be the responsibility of the applicant to provide personnel and equipment so that these checks and inspections may be satisfactorily carried out;
- e) all relevant records of previously completed maintenance, Airworthiness Directive compliance and flight tests should be made available for inspection by the AID;
- f) all work required to be done on the aircraft for the issuance of a Certificate of Airworthiness should be carried out under the supervision of a suitably authorized individual or of an organization approved by, or acceptable to, the AID and should be carried out in a proper manner and in conformity with the requirements, specifications, drawings and instructions relating to the approved design of the subject aircraft;
- g) full particulars of the work done should be entered in the appropriate log book and a maintenance release should be issued;

- h) a report of any ground or flight testing if such tests are required by the AID; and
- i) the organization referred to in f) or a suitably authorized person should provide a certification that the aircraft is fit to fly as far as can be reasonably determined from inspections of the aircraft and its records and manuals, and that all applicable airworthiness directives and other applicable requirements of the State of Design and the AID have been carried out and certified as having been carried out.

3.2.2.3 *Documentation.* The applicant should be required, in respect of every aircraft to be issued a Certificate of Airworthiness, to provide the following documents for examination by the AID. The AID should retain copies of those documents needed for airworthiness approval and oversight purposes. In addition, depending upon the State's assessment of the adequacy of the previous State of Registry's airworthiness code, the applicant may be required to submit a statement certifying any departure from the national certification requirements, from an individual or organization acceptable to the State of Registry certifying such departures, e.g. repairs and modifications, as may have been authorized, and the aircraft flight manual or acceptable equivalent document relating to the aircraft.

- a) the Type Certificate and the Type Certificate data sheets or acceptable equivalent documents where the aircraft is first of type on the registry;
- b) a declaration, for example an Export Certificate of Airworthiness, issued by the State of manufacture or previous State of Registry, and the previous Certificate of Airworthiness;
- c) a list of any incorporated STCs and other modifications;
- d) the flight manual or acceptable equivalent document (some States consider the flight manual to be an integral part of the Certificate of Airworthiness and may require the flight manual document reference to be entered on the Certificate of Airworthiness);
- e) the manufacturer's maintenance, overhaul and repair manuals;
- f) all manufacturer's service bulletins or equivalent documents issued in respect of the aircraft;
- g) log books and maintenance records;
- h) the current mass and balance report;
- i) where applicable, the maintenance review board report for the aircraft type, or the manufacturer's current maintenance planning data; and
- j) where applicable, the master minimum equipment list (MMEL).

*Note.— The applicant may also be required to provide additional documents when needed for specific airworthiness approval and oversight purposes.*

3.2.2.4 The applicant may be required to make the necessary arrangements with aircraft and engine manufacturers for the provision to the AID of amendments to any manuals the AID holds together with any service bulletins that may be issued from time to time.

### 3.2.3 Continuing validity of the Certificate of Airworthiness

3.2.3.1 The guidance material in this chapter is intended to assist national regulatory authorities in fulfilling their obligations under Annex 8, in relation to the continuing validity or renewal of Certificates of Airworthiness. Annex 8, Part II, Chapter 3, 3.2.3 specifies that a Certificate of Airworthiness shall be renewed or shall remain valid, subject to the laws of the State of Registry, provided that the continuing airworthiness of the aircraft shall be determined by a periodical inspection at appropriate intervals having regard to lapse of time and service or, alternatively, by means of a system of inspection approved by the State which will produce at least an equivalent result.

3.2.3.2 The practice of most Contracting States is to control the validity of Certificates of Airworthiness in one of two ways:

- a) the issue of a Certificate of Airworthiness with a predetermined period of validity which can be renewed. The periods of time concerned are commonly between one and three years. Renewal is subject to a determination of continuing airworthiness by the regulatory authority of the State concerned, either by direct inspection or on receipt of a recommendation from an organization it has approved. (Refer to 3.2.4 below for further information on the periodic renewal of a Certificate of Airworthiness.); or
- b) the issue of a Certificate of Airworthiness with a non-expiring period of validity, continuing airworthiness being determined through a system of inspection approved by the State. (Refer to 3.2.5 below for further information on the system of inspection.)

3.2.3.3 Regardless of the period of validity shown on it, failure to comply with any of the following will invalidate the Certificate of Airworthiness:

- a) the aircraft remains in conformity with the type design approved by the State of Registry:
  - 1) modifications or repairs completed in accordance with procedures and methods approved by the State of Registry (Part III, Chapter 5 and Part IV, Chapter 3 refers);
  - 2) replacement components, parts, equipment or material are in accordance with the design requirements and installed in accordance with any prescribed procedures;
  - 3) all markings and placards included in the approval of the type design by the State of Registry are present;
  - 4) in addition to the information specified in Annex 8, the flight manual includes any changes made mandatory by the State of Registry as required by Annex 6, Part I, 11.1 or Part III, Section II, 9.1, as applicable;
  - 5) if the aircraft has been released to service with any airworthiness significant systems, components or equipment unserviceable, this is in compliance with a minimum equipment list or similar document approved by the State of Registry;
  - 6) if the aircraft has been released to service with any structural parts missing, this is in compliance with procedures approved by the State of Registry; and

*Note.— Information of this nature is sometimes included as a configuration deviation list in the flight manual.*



- 7) unrepaired damage is within limits acceptable to the State of Registry (reference should be made to the structural repair manual for the aircraft type concerned to determine acceptable limits);

b) The aircraft has been correctly maintained in an airworthy condition, including:

*Note.— Annex 6, Part I, 8.3 requires operators of commercially operated aeroplanes to provide an aeroplane maintenance programme, approved by the State of Registry, containing maintenance tasks and intervals at which these tasks are to be performed.*

- 1) it is in compliance with a maintenance programme acceptable to the State of Registry;
- 2) if the aircraft is the subject of a reliability programme, including in particular engine trend monitoring, corrective action has been instituted to rectify any adverse trends;
- 3) it complies with any certification maintenance requirements at the prescribed intervals;
- 4) it complies with all modifications or inspections declared mandatory by the State of Registry (commonly referred to as Airworthiness Directives).

*Note.— The responsibilities of States of Registry in relation to continuing airworthiness requirements of this nature are contained in Annex 8, Part II, Chapter 4 (For more information, refer to Part III, Chapter 4, Section 4.4 of this manual).*

- 5) that those parts of the aircraft that have an ultimate service life limit declared by the organization responsible for the type design or the State of Registry have not exceeded their approved lives;

*Note.— Aircraft maintenance manuals prepared in the format required by the Air Transport Association of America Specification Number 2200 (ATA 2200), formerly Specification 100 (ATA 100) contain this information in Chapter 5. For some older aircraft types, this information may sometimes be published in the flight manual or Type Certificate Data Sheet.*

- 6) conformity of the aircraft mass and balance data with the requirements of the State of Registry, including re-weighing if appropriate and/or compliance with a system for recording progressive mass and balance change; and
- 7) conformity of the aircraft records with the requirements of the State of Registry, which must at a minimum meet the requirements of Annex 6, Part I, 8.4, Part II, 8.2.1 or Part III, Section II, 6.4 as applicable.

### 3.2.4 Certificate of Airworthiness with an expiring period of validity

3.2.4.1 The following paragraphs set out one acceptable process for the periodic renewal of the Certificate of Airworthiness by the AID. The periodic renewal is intended to ensure that the State is able to discharge its Annex 8 continuing airworthiness responsibilities by imposing a finite calendar life on the Certificate's validity, typically one, two or three years, thereby requiring direct involvement by the AID in the form of sample inspections of the aircraft and its supporting documentation, in order to assure itself

that the aircraft continues to remain in compliance with the applicable airworthiness requirements. Once satisfied, the AID will renew the validity of the Certificate for a further period.

3.2.4.2 Some States facilitate the renewal of a Certificate of Airworthiness by the approval of individuals or organizations to make renewal recommendations to the AID, the AID then renewing the period of validity of the Certificate on receipt of a satisfactory recommendation. In this case the approved organizations themselves are subject to periodic audits by the AID to ensure that they are correctly discharging their responsibilities.

*Note.— Guidance on the content of an application form for the renewal of a Certificate of Airworthiness by the State is given in Appendix B to this chapter.*

3.2.4.3 The procedures developed by the AID for the renewal of a Certificate of Airworthiness should cover the following requirements:

- a) the applicant should be required to make an application for renewal in a timely manner and to make the aircraft available, at a time and place acceptable to the AID, for such checks and inspections required by the AID;
- b) the applicant should be required to provide the necessary personnel and equipment so that required checks and inspections may be satisfactorily carried out;
- c) all relevant records of previously completed maintenance and flight tests should be made available for inspection by the AID as listed under 3.2.4.4 below
- d) all work for the maintenance of airworthiness of the aircraft should have been carried out under the supervision of appropriately licensed aircraft maintenance personnel or of an organization approved by, or acceptable to, the AID and should be carried out in a proper manner and in conformity with the requirements, specifications, drawings and instructions relating to the approved design of the subject aircraft;
- e) full particulars of the work accomplished should have been entered in the appropriate log book and a maintenance release should be issued;
- f) the mass of the aircraft should have been determined as required by the AID; and
- g) any ground or flight tests, if such tests are required by the AID, should have been completed.

3.2.4.4 The applicant for renewal of a Certificate of Airworthiness should be required to provide the following documents for AID examination:

- a) a copy of an inspection report giving brief details of the work done since the last renewal of the Certificate of Airworthiness. This report should be in the form of a schedule and should include the following documents:
  - 1) a record of the work accomplished since the last renewal of the certificate;
  - 2) a record showing details of major maintenance checks carried out since the last renewal of the certificate;

- 3) a record of the total flying hours and cycles for the airframe, engine(s) and propeller(s) since new and since the last renewal;
  - 4) a record showing compliance with service bulletins, modifications and Airworthiness Directives or their equivalent; and
  - 5) a record of major component changes;
- b) a current mass and balance report; and
  - c) a ground or flight test report for the aircraft, if such tests are required by the AID.

### 3.2.5 Certificate of Airworthiness with non-expiring period of validity

3.2.5.1 The following paragraphs set out an acceptable system of inspection of the continuing airworthiness of an aircraft, when the Certificate of Airworthiness has a non-expiring period of validity. (Annex 8, Part II, 3.2.3 refers)

3.2.5.2 If the State has introduced a system with continued validity of a Certificate of Airworthiness, continuing airworthiness must be monitored with an inspection system approved by the State. This system must ensure appropriate airworthiness monitoring that will produce results at least equivalent to the system of periodic renewal of a Certificate of Airworthiness specified in 3.2.4 above. The approved system of inspection should be included in the operator's maintenance control manual, if applicable.

3.2.5.3 In some States the authority requires that aircraft airworthiness be reviewed annually by a specifically approved continuing airworthiness management organization. This organization should have skilled personnel appropriate for its duties, as well as the necessary tools, facilities, procedures, quality system and instructions. Continued validity of a Certificate of Airworthiness requires that such a review has been conducted and an Airworthiness Review Certificate is granted for a fixed period on the basis of it. The authority oversees the operations of continuing airworthiness management organizations and carries out sample aircraft inspections.

3.2.5.4 The alternative is that aircraft airworthiness is continuously monitored by the approved maintenance organization and the operator responsible for continuing airworthiness of that aircraft. In this case, it should be required that the operator and the maintenance organization have skilled personnel appropriate for continuing airworthiness monitoring duties, as well as the necessary tools, facilities, procedures, quality system and instructions. The authority oversees the operations of these organizations and carries out sample aircraft inspections.

### 3.2.6 Validation of a Certificate of Airworthiness

3.2.6.1 When a State of Registry, in accordance with Annex 8, Part II, 3.2.5 renders valid a Certificate of Airworthiness issued by the previous State of Registry, it shall provide a suitable statement of authorization to be carried with the original certificate. The validity of the authorization should be for a short period only and shall not extend beyond the period of validity of the original certificate.

3.2.6.2 When entering an aircraft onto the aircraft registry, the State of Registry concerned assumes full responsibility for airworthiness and continuing airworthiness monitoring of that aircraft. The State may consider the previous valid Certificate of Airworthiness as satisfactory evidence, in whole or in part,

that the aircraft is airworthy and in compliance with the appropriate airworthiness requirements. Even if a State renders a Certificate of Airworthiness issued by the previous State of Registry valid, it must be notified that the aircraft has been removed from the other State's aircraft registry, and that State no longer attends to its continuing airworthiness monitoring. For that reason, the new State of Registry must ensure compliance with all continuing airworthiness requirements in Annex 8.

### 3.2.7 Certificate of Airworthiness restoration following significant structural repair or replacement

3.2.7.1 Depending on the method of construction, many of the items which formed part of the complete aircraft at the time it was issued with its first Certificate of Airworthiness are capable of replacement, both from a practical and a legal requirement viewpoint. Though the aircraft will retain the unique serial number recorded on its data plate throughout, many of its component parts and assemblies, including some significant structural items, may be replaced during its operational life. It is essential therefore that any replacement parts:

- a) are approved parts (see paragraph 4.5 – Authenticity and Serviceability of Aircraft Parts) and documentary evidence exists to this effect; and
- b) are installed in accordance with the Type Certificate holder's requirements or other applicable data acceptable to the State of Registry by a competent and appropriately approved individual or maintenance organization.

3.2.7.2 In the case of a repair following an accident or at any time when significant structural replacement becomes necessary, the AID of the State of Registry may wish to have a more direct role in the aircraft's return to service, perhaps completing an inspection of the aircraft or requiring the submission of a report by an individual or organization prior to the restoration of the Certificate of Airworthiness.

3.2.7.3 The crucial role played in such circumstances by the related airworthiness records, i.e. log books, worksheets, etc. is self-evident and these will require considerable attention in order to ensure the aircraft is properly configured and conforms to its type design.

### 3.2.8 Airworthiness flight test

*Note.— This paragraph is not intended to specify any particular necessity to carry out airworthiness flight tests additional to test flights for normal production/initial Certificate of Airworthiness issue, or maintenance/modification approval flight tests. Such flight tests are expected to be part of regular production procedures or be specified in the aircraft manufacturers maintenance data or in the requirements pertaining specifically to the approval of a particular modification and be under the control of an organization, or person, approved to do such test flying.*

*This paragraph is intended to ensure that, when a CAA does require airworthiness flight tests in support of continuing airworthiness assurance, the flight tests are carried out with due care and attention to safety, and under appropriate management by the CAA and the organization conducting the flight tests. The principles for safe flight test control and operation are expected to be applied to all test flights for whatever purpose.*

3.2.8.1 A State may require airworthiness flight tests to be performed in support of continuing airworthiness assurance. Such flight tests should be carried out by pilots and crew approved for the

purpose by the CAA/AID. The crew should be appropriately licensed for the specific aircraft type and competent to conduct the tests defined in the flight test schedule. Except when additional crew are required to be carried for a specific flight test purpose, the number of persons conducting the flight test should be restricted to the minimum crew specified in the Certificate of Airworthiness (Flight Manual).

3.2.8.2 A flight test schedule, specific to the aircraft involved, will be prepared and agreed with the CAA, before the test flight. The flight test schedule should define the purpose of the test(s), the requirements and/or the conditions to be met and any particular limitations for the test(s), which may apply, in addition to the normal limitations of the Certificate of Airworthiness and the Flight Manual.

3.2.8.3 A flight test report, in a format acceptable to the CAA, should be prepared and presented, as soon as possible after the test flight, for acceptance/approval by the CAA.

### **3.3 Approvals for special flights**

3.3.1 When an aircraft is not fully in compliance with its airworthiness requirements, the CAA airworthiness regulations may, nevertheless, make provisions for the AID to issue a special flight permit, providing the aircraft is capable of safe flight. Such occasions might include:

- a) relocating the aircraft to a base where maintenance is to be performed, or to a point of storage;
- b) delivering the aircraft; or
- c) evacuating the aircraft from an area of impending danger, or in cases of *force majeure*.

3.3.2 Application for a special flight permit should be submitted in a manner prescribed by the AID, indicating at least the following:

- a) the make, model, serial number and registration marks of the aircraft;
- b) the purpose of the flight;
- c) the proposed itinerary;
- d) the crew required to operate the aircraft;
- e) details of non-compliance with applicable airworthiness requirements;
- f) any restriction the applicant considers necessary for safe operation of the aircraft; and
- g) any other information considered necessary by the AID for the purpose of prescribing operating limitations.

3.3.3 When issuing a special flight permit, appropriate limitations should be prescribed to minimize hazard to persons or property. The following limitations are considered to be essential in all special flight permits:

- a) a copy of the permit should be on board the aircraft at all times when operating under the terms of the permit;

- b) the registration marks assigned to the aircraft by the State of Registry should be displayed on the aircraft in conformity with the requirements of that State;
- c) persons or property should not be carried for compensation or hire;
- d) no person should be carried in the aircraft unless that person is essential to the purpose of the flight and has been advised of the contents of the authorization and the airworthiness status of the aircraft;
- e) the aircraft should be operated only by crew who are aware of the purpose of the flight and any limitations imposed, and who hold appropriate certificates or licenses issued or validated by the State of Registry;
- f) all flights should be conducted so as to avoid areas having heavy traffic or any other areas where flights might create hazardous exposure to persons or property;
- g) all flights should be conducted within the performance operating limitations prescribed in the aircraft flight manual and those additional limitations specified by the State of Registry for the particular flight; and
- h) the limit of validity of the permit should be specified.

3.3.4 If the aircraft is not in compliance with Annex 8 and the flight involves operations over States other than the State of Registry, the operator of the aircraft must obtain special flight authorizations from the appropriate authorities of each of those States prior to undertaking the flight.

### **3.4 Airworthiness approvals for exports**

#### 3.4.1 General

The following note follows Annex 8, Part II, 3.2.4.

*“Note.— Some Contracting States facilitate the transfer of aircraft onto the register of another State by the issue of an “Export Certificate of Airworthiness” or similarly titled document. While not valid for the purpose of flight such a document provides confirmation by the exporting State of a recent satisfactory review of the airworthiness status of the aircraft. Guidance on the issue of an “Export Certificate of Airworthiness” is contained in the Airworthiness Manual (Doc 9760).”*

In producing procedures for facilitating the export of aircraft, States have adopted various titles for the export document, e.g. “Export Certificate of Airworthiness” or “Certificate of Airworthiness for Export”. While differing in title, all such certifications are intended to achieve the same goal which is a statement by the exporting State confirming to the importing State the acceptable airworthiness status of the aircraft or other product. In the case of a complete aircraft the Export Certificate of Airworthiness either confirms the aircraft’s conformity with the approved design data and its acceptable airworthiness status, stating in effect that if the aircraft were to remain on the registry of the exporting State it would continue to qualify for the continuance of its Certificate of Airworthiness or that the aircraft standard complies with the requirements of the importing State and is in a condition for safe operation. It should be noted that some States have no provision for export certification or have any requirement for such certificates from States from which they receive exported products.

### 3.4.2 Procedures for issue

The AID of a State intending to issue an Export Certificate of Airworthiness should follow closely the procedures required to be followed for the renewal of a Certificate of Airworthiness described in 3.2.4 or 3.2.5 above and any applicable requirements specified by the importing State. The depth to which the AID wishes to apply these procedures will however depend to a large extent on how recent its involvement with the aircraft in question has been. The records to be produced may also be restricted to those covering maintenance, etc. performed since the AID last carried out an inspection.

*Note.— Guidance on the content of an application form for the issue of an Export Certificate of Airworthiness is given in Appendix C to this Chapter.*

### 3.4.3 Exceptions

If it has any specific certification or operational requirements in place in addition to those adopted or required by the exporting State, the importing State will make these known to the exporting State and either agree that these may be listed as exceptions on the Export Certificate of Airworthiness or require compliance with the additional requirements before agreeing to accept the Export Certificate of Airworthiness. Exceptions therefore are a matter of agreement between the States concerned. When an aircraft is removed from storage immediately prior to its export, required maintenance inspections or Airworthiness Directives may not have been accomplished. For the purpose of the delivery flight, these non-compliances may be accepted by the importing State but again will be listed as agreed exceptions on the Export Certificate of Airworthiness.

### 3.4.4 Export certificate of airworthiness status

It is very important to understand that an export certificate of airworthiness is not a Certificate of Airworthiness as defined by Article 31 of the Convention and therefore does not confer the right of international flight and cannot be validated in accordance with Annex 8, Part II, Chapter 3, 3.2.4. To fly internationally, an aircraft having an Export Certificate of Airworthiness will require a valid Certificate of Airworthiness issued by the State of Registry, or some equivalent document mutually acceptable to the exporting and importing States and accepted by any State over which the aircraft will fly on its delivery flight.

### 3.4.5 Export certification of products other than a complete aircraft

Some States may have adopted more detailed export airworthiness approval procedures, covering not only the issue of an Export Certificate of Airworthiness for a complete aircraft but also encompassing the issue of export certifications for engines, propellers and other component parts. For the purpose of such procedures, the item being exported may be placed within a particular “Class”, for example:

- a) *Class I product* – a complete aircraft, engine or propeller which has been type certificated in accordance with the appropriate airworthiness requirements and for which the necessary type certificate data sheets or equivalent have been issued.
- b) *Class II product* – a major component of a Class I product such as a wing, fuselage, empennage surface, etc. the failure of which would jeopardize the safety of a Class I product or any part, material or system thereof.

- c) *Class III product* – any part or component which is not a Class I or Class II product or a standard part.

For products other than a Class I product, the export airworthiness certification may be issued in the form of certificates or identification tags, which will confirm that the product in question meets the approved design data, is in a condition for safe operation and complies with any special requirements as notified by the importing State.

*Note.— A sample export certificate of airworthiness for Class I products is shown in Appendix D to this Chapter.*

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## **APPENDIX A.— APPLICATION FOR ISSUE OF A CERTIFICATE OF AIRWORTHINESS – CONTENT**

An applicant for the issue of a Certificate of Airworthiness (See Section 3.2.2 of Part III) will be required to provide sufficient detail concerning the aircraft, its engines and, if applicable, its propellers in order to enable the CAA to make an initial judgment concerning the aircraft's immediate history, current status, equipment fit, modifications embodied and potential certification status.

The form to be completed in support of the application is therefore intended to provide basic details. Subsequent surveys of the aircraft, its logbooks and other supporting documentation by staff of the CAA's AID or by its delegated representatives will allow detailed consideration concerning whether the aircraft conforms with the requirements of the State for the issue of a Certificate of Airworthiness. An application form therefore needs to require sufficient information to be provided for the initial assessment to be made but not to seek the essential but very detailed information which is readily obtainable later in the process.

The form should therefore typically require the following information:

- I. Contact information for the owner/applicant
- II. Basic information regarding the aircraft, such as:
  1. The category of Certificate of Airworthiness, if applicable, the applicant requires.
  2. Aircraft designation, including type and series, manufacturer's name, aircraft serial number and year of manufacture.
  3. Current airframe hours and cycles.
  4. Engine and propeller type and serial numbers.
  5. Aircraft certified maximum take off mass.
  6. Current location of the aircraft and details of the individual or organization acting on behalf of the registered owner who will be responsible for presenting the aircraft for inspection.
- III. Other detailed information required with the application, such as:
  1. Flight Manual, or equivalent, reference.
  2. Details of the current Certificate of Airworthiness and/or Export Certificate of Airworthiness. (It is probably sufficient to require only copies of these documents at this stage, the originals can be viewed at a later stage in the issue process)
  3. Basic details of any major modifications or major changes incorporated since initial certification.
  4. Details of equipment installations intended for particular operational roles, e.g. towing, agricultural spraying and provision for the carriage of any external loads.

*Note 1.— The application form may typically contain a section requiring the certification and signature of the applicant. Some States also use a separate section on the form to enable the CAA or delegated representative to certify that the information provided is complete, and that the product is airworthy and conforms to the pertinent requirements, except as noted in the additional remarks section. It should be noted that such a "CAA only" section on the form may be useful but is not considered obligatory.*

*Note 2.— Because of radio licensing requirements some States will require details to be provided of equipment capable of transmitting and receiving radio signals. The application form can also request such information if required.*

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## **APPENDIX B.— APPLICATION FOR THE RENEWAL OF A CERTIFICATE OF AIRWORTHINESS**

The extent of information required to be provided by an applicant for the renewal of a Certificate of Airworthiness (see paragraph 3.2.4 of Part III) will depend on whether the State has a direct “hands-on” requirement for involvement in the renewal process or relies on certified statements of compliance provided by an organization or individual approved by the CAA.

Where there is extensive involvement by the CAA in the renewal process the application may consist only of a simple statement of, for example, the applicant’s name and address, the aircraft type and registration, the date of expiry of the current Certificate of Airworthiness, and where the aircraft and supporting documentation will be made available for inspection by the CAA’s airworthiness inspection division (AID): in effect a simple administrative application intended to set in motion a formal inspection by the AID.

In the case of a Certificate of Airworthiness renewal recommendation from an authorized organization or individual, the application may take the form of a certified statement of the aircraft’s current compliance with a number of CAA requirements. An application of this type may therefore typically require the following information.

- I. Contact information for the applicant
- II. Basic information regarding the aircraft, such as:
  1. Aircraft designation including type and series, manufacturer’s name, aircraft serial number and year of manufacture.
  2. Current airframe hours and cycles.
  3. Engine and propeller types, serial numbers, hours and cycles.
- III. A certified statement of compliance with the following:
  1. Airworthiness directives and any other requirements made mandatory by the CAA.
  2. Continued compliance with the type certificate data sheet (TCDS).
  3. Current maintenance programme reference and compliance status.
  4. Current mass and balance report.
  5. Flight Manual or equivalent amendment status.
- IV. Depending upon the particular requirements of the CAA the form may also typically require details of:
  1. Any flight test required to be completed in support of the renewal.
  2. Any major modifications or major changes incorporated since the Certificate of Airworthiness was issued or last renewed.
  3. Date on which the aircraft was last weighed.

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## APPENDIX C.— APPLICATION FOR THE ISSUE OF AN EXPORT CERTIFICATE OF AIRWORTHINESS

An applicant for the issue of an Export Certificate of Airworthiness (see Section 3.4.2 of Part III) will be required to provide sufficient detail concerning the product (e.g. aircraft, engines, or propellers) in order to enable the CAA to make a determination that the product conforms with the approved design data, is in a condition for safe operation, and complies with the requirements of the importing State.

The form to be completed in support of the application is intended to provide enough information to allow the CAA's AID or its delegated representative to make the determination of conformity to the applicable airworthiness requirements.

The form should therefore typically require the following information:

- I. Contact information for the exporter and foreign purchaser, as well as country of destination.
- II. Basic information regarding the product, such as:
  1. Type of product (e.g., aircraft, engine, or propeller).
  2. Make and model.
  3. Identification number.
  4. Serial number(s).
  5. Operating time in hours since overhaul and total operating time.
  6. Is the product new, used (for aircraft), or newly overhauled.
  7. If applicable, the status of the current Certificate of Airworthiness.
- III. Information Regarding the Airworthiness Requirements, such as:
  1. Does the product comply with all applicable CAA regulations and Airworthiness Directives?
  2. Have the applicable special requirements of the importing country been complied with?
  3. Additional remarks with regard to either the applicable CAA regulations or special requirements of the importing country (e.g. exceptions to the approved data or special requirements).

*Note.— The application form may typically contain a section requiring the certification and signature of the applicant (exporter). Some States also use a separate section on the form to enable the CAA or a delegated representative to certify that the information provided is complete, and that the product is airworthy and conforms to the pertinent requirements, except as noted in the additional remarks section. It should be noted that such a “CAA-only” section on the form may be useful, but is not considered obligatory.”*

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**APPENDIX D.— SAMPLE EXPORT CERTIFICATE OF AIRWORTHINESS  
(FOR CLASS I PRODUCTS)**

[INSERT CIVIL AVIATION AUTHORITY NAME]

No.

***EXPORT CERTIFICATE OF AIRWORTHINESS***  
(for Class I products)

THIS CERTIFIES that the product identified below and detailed in [INSERT TYPE CERTIFICATE NO.] has been examined and as of the date of this certificate, is considered airworthy in accordance with the regulations of [INSERT EXPORTING STATE], and is in compliance with those special requirements of the importing State, except as stated below.

**Note:** This certificate in no way attests to compliance with any agreements or contracts between the vendor and purchaser, nor does it constitute authority to operate an aircraft.

Product:

Manufacturer:

Model:

Serial No.:

New       Newly overhauled       Used aircraft

State to which exported:

Exceptions:

**Signature of AID Inspector      Date**

For complete aircraft, list applicable specification or Type Certificate Data Sheet numbers for the aircraft, engine and propeller. Applicable specifications or Type Certificate data sheet, if not attached to this Export Certificate, will have been forwarded to the appropriate governmental office of the importing country.

AID Form No. A/W . . . . .

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## CHAPTER 4.— CONTINUING AIRWORTHINESS OF AIRCRAFT

*Note.— General information on the continuing airworthiness procedures followed in individual ICAO Contracting States is published in ICAO Circular 95 — The Continuing Airworthiness of Aircraft in Service.*

### 4.1 Introduction to the concept of continuing airworthiness

4.1.1 Continuing airworthiness covers the processes that require all aircraft to comply with the airworthiness requirements in their type certification basis or imposed as part of the State of Registry's requirements and are in a condition for safe operation, at any time during their operating life.

4.1.2 Under the control of the respective CAAs of the State of Design, the State of Registry and, when appropriate, the State of the Operator, continuing airworthiness includes the following:

- a) design criteria which provide the necessary accessibility for inspection and permit the use of established processes and practices for the accomplishment of maintenance;
- b) information that identifies the specifications, methods, and procedures necessary to perform the continuing airworthiness tasks identified for the aircraft and the tasks necessary to maintain the aircraft, as developed, by the type design organization; and publication of this information in a format that can be readily adapted for use by an operator;
- c) adoption by the operator into its maintenance programme, the specifications, methods, and procedures necessary to perform the continuing airworthiness tasks identified for the aircraft and the tasks necessary to maintain the aircraft, using the information provided by the type design organization;
- d) the reporting of faults, malfunctions, and defects and other significant maintenance and operational information by the operator to the type design organization in accordance with the requirements of the State of Registry and the State of the Operator;
- e) the reporting of faults, malfunctions, and defects and other significant maintenance information by the maintenance organization to the type design organization in accordance with the requirements of the State having jurisdiction on the maintenance organization;
- f) the analysis of faults, malfunctions, defects, accidents and other significant maintenance and operational information by the type design organization, the State of Design and the State of Registry and the initiation and transmission of information and recommended or mandatory action to be taken in response to that analysis;
- g) consideration of the information provided by the type design organization and action on the information as deemed appropriate by the operator or the State of Registry, with particular emphasis on action designated as “mandatory”;
- h) adoption and accomplishment by the operator of all mandatory requirements with particular emphasis on fatigue life limits and any special tests or inspections required by

the airworthiness requirements of the type design of the aircraft or subsequently found necessary to ensure structural integrity;

- i) adoption by the operator into its maintenance programme, supplemental structural inspection programmes and subsequent structural integrity programme requirements, taking into consideration the structural integrity programme for aeroplanes recommended by the type design organization; and
- j) compliance with structural integrity programmes for aeroplanes.

4.1.3 The structural integrity programme for aeroplanes (sometimes referred to as the ageing aeroplane programme) may include the following, dependent on the structural design criteria:

- a) supplementary structural inspection programme,
- b) corrosion prevention and control programme;
- c) service bulletin review and mandatory modification programme;
- d) repairs review for damage tolerance; and/or
- e) widespread fatigue damage (WFD) review.

## **4.2. Organization responsible for the type design**

### 4.2.1 Type certificate holder

4.2.1.1 Annex 8, Part II, Chapter 4 refers to the transmittal of information relating to the continuing airworthiness of the aircraft to the type design organization of that aircraft. Normally, this organization will be the holder of the Type Certificate for the aircraft type; in some cases (prior to Amendment 98 of Annex 8), it will be the holder of an equivalent document certifying approval of the type design by the certifying authority.

4.2.1.2 The reference to transmittal of this information to such an organization necessitates that:

- a) for aeroplane over 5 700 kg maximum certificated take-off mass and helicopters over 3 175 kg certificated take-off mass engaged in international civil aviation, an organization holding the Type Certificate (or equivalent document) will exist throughout the operational life of the aircraft type; and
- b) the holder of the Type Certificate (or equivalent document) will be in possession of the type design and type certification data and have the competence to use that data as necessary for the continuing airworthiness of the aircraft.

*Note 1.— Throughout the remainder of this Chapter 4, the “organization responsible for the type design” will be referred to as the “Type Design Organization” for ease of reading.*

*Note 2.— When appropriate, States should also update their information concerning design organizations responsible for type design under their jurisdiction that is listed in ICAO Circular 95 — The Continuing Airworthiness of Aircraft in Service.*

#### 4.2.2 Transfer of the Type Certificate to a new holder

4.2.2.1 Cases can be envisaged where the holder of a Type Certificate (or equivalent document) may transfer legal ownership of a type design to a new owner, for business purposes. If the new owner remains located within the same geographical jurisdiction as the previous owner, then the State of Design remains unchanged. However, if the new owner is located under the geographical jurisdiction of another Contracting State, then there is also a change in the designation of the State of Design. The activities involving the transfer of a Type Certificate should be regulated by the appropriate CAA to ensure that the continuing airworthiness responsibilities under Annex 8, for the affected type design, are maintained or retained by the new holder and/or State of Design.

4.2.2.2 The CAA responsible for the new holder will need to be satisfied that all necessary background data, including the type design data and type certification data, have been transferred to the new holder and that the new holder is able to support the continuing airworthiness of the aircraft type. Where the transfer involves another Contracting State, the CAAs of the previous and new State of Design will need to resolve any problems arising from any different requirements and procedures for type certification in the new State of Design. In addition, if the aircraft is manufactured under the jurisdiction of another Contracting State, Annex 8, Part II, Chapter 4 requires that both the State of Design and the State of Manufacture establish an agreement that ensures the manufacturing organization cooperates with the type design organization in assessing information received on service experiences.

4.2.2.3 Following the successful transfer of a Type Certificate, the CAA that has jurisdiction over the new holder must:

- a) issue a Type Certificate to the new holder; and
- b) notify, in a timely manner, Contracting States that have the aircraft type on its registry of the new type design organization responsible for receiving information on faults, malfunctions, defects and other occurrences that are required to be reported for purposes of continuing airworthiness.

#### 4.2.3 Absence of, or deficiency by a holder

4.2.3.1 Cases can be envisaged where the holder of a Type Certificate may cease to legally exist (e.g. due to financial constraints or corporate mergers) or decides to abandon its responsibilities over the type design by surrendering the Type Certificate (e.g. due to economic constraints to support small number of aircraft in service). Another possible case is when the holder of a Type Certificate fails to carry out its continuing airworthiness responsibilities over the affected approved type design. As a consequence of all these cases, in-service reports submitted by industry concerning faults, malfunctions, defects, and other occurrences may not receive the proper assessment for adverse effects on the continuing airworthiness of the aircraft. When this happens, the State of Design may face difficulties in fulfilling its responsibility concerning dissemination of mandatory continuing airworthiness information, and any required corrective action, to the affected States of Registry. If a State of Design is confronted with any of these cases, the CAA would need to take appropriate action, which could be a combination of any of the following:

- a) to assume the responsibilities of the holder itself;
- b) to seek a new holder (see paragraph 4.2.2 – Transfer of the Type Certificate to a new Holder) or an organization that is willing to fulfill the responsibilities of a holder, under a type responsibility agreement with the responsible CAA; or



- c) to suspend or revoke the Type Certificate (or equivalent document) if no other mitigating factor is possible.

*Note 1.— Under actions a) and b), the responsible organization may need to place limitations on the validity of the Type Certificate when service experience reveals a potentially unsafe condition, pending availability of a corrective action by an owner or operator to address the condition; or*

*Note 2.— The agreement referenced in b) above should provide for the assignment of the responsibilities and the privileges of the new holder and the CAA for continued airworthiness support, provisions for possible future transfers, surrenders, or cancellation, and timely notification of any information relevant to the Type Certificate to Contracting States. Such a responsible organization needs to have the basic resources and facilities necessary to review and analyse SDRs, accident and incident reports, trend data, and issue continuing airworthiness and corrective information as appropriate.*

4.2.3.2 Where a legitimate holder cannot be established as responsible for the affected type design, or where the State of Design decides to suspend or revoke its Type Certificate (or equivalent document) because of the absence of a holder, the responsible CAA should, in accordance with Annex 8 Part II, Chapter 4, notify in a timely manner all affected Contracting States of such information, including a clear declaration if they are retaining or abandoning their designation as State of Design.

4.2.3.3 Regardless of the availability or not of a holder for a Type Certificate or State of Design, Annex 8 ultimately assigns to each State of Registry the responsibility for determining the continuing airworthiness of the aircraft in its registry. Annex 8, Part II, Chapter 4 requires that a State of Registry develop or adopt requirements necessary for ensuring the continuing airworthiness of the aircraft in its registry during its service life.

### **4.3 Structural integrity programme**

#### **4.3.1 Introduction**

The material for this section applies to aeroplanes of over 5 700 kg maximum certificated take-off mass. It is intended to provide guidance to type design organizations responsible for the type design and to operators on a continuing structural integrity programme which would include information to ensure that the structural integrity will be maintained over the operational life of the aeroplane.

The objective of this section is to assist CAAs in the application of Annex 8, Part II, 4.2.1.1c) which states:

“The State of Design shall ensure that, in respect of aeroplanes over 5 700 kg maximum certificated take-off mass, there exists a continuing structural integrity programme to ensure the airworthiness of the aeroplane. The programme shall include specific information concerning corrosion prevention and control.”

#### **4.3.2 Implementation**

4.3.2.1 The type design organization should be responsible for submitting to the certifying authority a programme for making and updating a structural integrity assessment for the type and publishing this programme whenever the analysis of service and test experience of the aeroplane indicates that modified maintenance procedures are needed or that supplemental inspections would yield necessary information on fleet conditions.

4.3.2.2 The continuing structural integrity programme should be initiated by the type design organization and developed jointly with representatives of operators and airworthiness authorities. The authority in each State of Registry having aeroplanes affected should determine how, and to what extent, the substance of the programme is made mandatory, consistent with the State of Registry's own experience with the aeroplane and its procedures for enforcement of continuing airworthiness requirements.

4.3.2.3 As a minimum the continuing structural integrity programme should include, dependent upon the structural design criteria:

- a) supplemental inspections;
- b) corrosion prevention and control;
- c) structural modifications and associated inspections;
- d) repair assessment methodology; and
- e) widespread fatigue damage (WFD) review.

4.3.2.4 The corrosion prevention and control programme should be initiated as early as possible in the service life of the aeroplane and should preferably be available when the aeroplane is introduced into service. The other elements of the continuing structural integrity programme should be developed once sufficient service experience has been accumulated; normally they should be initiated by the time that the lead aeroplane has reached the half-design-life goal for the type and be reviewed periodically.

### 4.3.3 Procedures and methods

4.3.3.1 It is recognized that each operator should have a maintenance programme when the aeroplanes enter service. In addition, the type design organization is responsible for conducting a continuing assessment of the structural integrity of its type designs over their operational life, taking into account the original design objectives and assumptions, advancements in technology and the behaviour of the structure in service. From this assessment, the type design organization and the operators are jointly responsible for developing and issuing information to supplement the ongoing operator maintenance programmes for the purpose of detecting structural damage before it becomes a serious problem in the fleet. This inspection information should be based on analysis supported by test evidence and operator experience, and should be included in a continuing structural integrity programme. This should be published and revised as indicated in 4.3.2.1 above.

4.3.3.2 The methods, principles and data underlying the continuing assessment of structural integrity and the development of the continuing structural integrity programme should be available for review by the certifying authority. It should be emphasized that the inspections, modifications and replacements described in the programme are additional to the original maintenance programme.

4.3.3.3 Service experience is a vital ingredient requiring the cooperation of all operators. Each operator should revise the maintenance programme to include, as appropriate, the data contained in the continuing structural integrity programme and should also provide an adequate system for recording and reporting in a timely way to the type design organization the operational usage, the structural discrepancies experienced in service and, where available, the results of initial analysis. These data should include a description and the location of the damage, identification of the aeroplane, relevant data on its

modification status and operating history, time since beginning operations, time since the last maintenance check, the means by which the discrepancy was detected and its probable cause. It should be recognized that each operator has to make an individual determination as to how the data that are in the continuing structural integrity programme should be incorporated in the maintenance programme owing to the differences in the various operators' maintenance programmes, operating environment and fleet modification status.

4.3.3.4 Where an operator wishes to introduce into service an aeroplane of a type for which a structural integrity assessment has been made, the operator should determine that the continuing structural integrity programme acceptable for the particular aeroplane type is available and that a statement of special additions necessary to cover any particular features of significant structural repairs or modifications is also available. The operator should also have access to sufficient past maintenance records of the aeroplane to determine the time at which the structural inspection/modification would be required.

#### 4.3.4 Continuing assessment of structural integrity

##### 4.3.4.1 General

4.3.4.1.1 The first essential is to identify the structural parts and components which contribute significantly to carrying flight, ground, pressure or control loads and whose failure could affect the structural integrity necessary for the safety of the aeroplane and whose damage tolerance or safe-life characteristics it is therefore necessary to establish or confirm.

4.3.4.1.2 Analyses made in respect of the continuing assessment of structural integrity should be based on supporting evidence which includes test and service data. This supporting evidence should include a representative operating loading spectra, structural loading distributions and material behaviour. In establishing inspection threshold, inspection frequency and, where appropriate, retirement life, an appropriate allowance should be made for crack initiation through the life of the structure and the rate of crack propagation. Alternatively, an inspection threshold may be based solely on a statistical assessment of fleet experience, provided that it can be shown that equal confidence can be placed in such an approach.

*Note 1.— Operating loading spectra may be confirmed by an in-flight loads monitoring programme.*

*Note 2.— In the case of corrosion, no analytical techniques are available and the establishment of thresholds and repeat intervals will need to be based on the analysis of world-wide service experience.*

4.3.4.1.3 Some organizations responsible for the type design find that an effective method of evaluating the structural condition of older aeroplanes is a selective inspection with intensive use of non-destructive techniques and an inspection of individual aeroplanes involving partial or complete dismantling (tear-down) of available structures.

4.3.4.1.4 The effect of repairs and modifications approved by the type design organization should also be taken into account. In addition, it may be necessary to consider the effect of repairs and operator-approved modifications on individual aeroplanes. The operator is responsible for ensuring notification and consideration of any such aspects.

*Note.— The assessment of continuing airworthiness of repairs and modifications is a complex task involving both operators and organizations responsible for the type design.*

4.3.4.1.5 The continuing structural integrity programme should be checked from time to time against current service experience. Any unexpected defect that occurs should be assessed as part of the continuing assessment of structural integrity to determine the need for revision of the programme. Future structural service bulletins should state their effect on the programme.

#### 4.3.4.2 Damage-tolerance assessment

4.3.4.2.1 Damage tolerance characteristics should be based on the best information available, including analysis, test and operational experience and special inspections which can be related to the type. From this information, the site or sites of likely cracking within each structural part or component and the time or number of flights (cycles or hours) at which this might occur may be judged.

4.3.4.2.2 The growth characteristics of damage and the interactive effects on adjacent parts in promoting more rapid or extensive damage should be determined. This study should include those sites which may be subject to the possibility of crack initiation owing to fatigue, corrosion, stress corrosion, wear, disbonding, accidental damage, manufacturing defects or other discrepancies in those areas which service experience or design judgement has shown to be vulnerable.

4.3.4.2.3 The minimum size of damage that it is practical to detect and the proposed method of inspection should be determined together with the number of flights required for the crack to grow from detectable to the allowable final size of damage in such a way that the structure has a residual strength corresponding to the conditions stated for fail-safe qualification. It is recognized that the residual strength requirements include the provision that they apply only where the critical damage would not be readily detectable, whereas in the case of damage which is readily detectable within a relatively short period, a lower residual strength may be agreed with the certificating authority. A probability approach may be acceptable for these latter assessments.

*Note.— In determining the proposed method of inspection, consideration should be given to:*

- a) visual inspection;*
- b) non-destructive testing; and*
- c) analysis of data from built-in load and defect monitoring devices.*

4.3.4.2.4 The continuing assessment of structural integrity may involve more extensive damage than might have been considered in the original evaluation of the aeroplane, such as:

- a) a number of small adjacent cracks, each of which may be less than the minimum detectable length, developing suddenly into a long crack;
- b) failures or partial failures in other locations, due to a redistribution of loading and a more rapid spread of fatigue, following an initial failure in a particular location;
- c) concurrent failure or partial failure of multiple load path elements (e.g. lugs, planks or crack arrest features) working at similar stress levels;
- d) the influence of corrosion; and
- e) the influence of wear.

#### 4.3.4.3 Safe-life structures

The basis for the determination of the safe-life of parts and components should be re-analysed using knowledge gained from service experience, including operational usage, loading assumptions and loading spectra and from any further tests that may have been conducted.

#### 4.3.4.4 Information to be included in the assessment

4.3.4.4.1 The continuing assessment of structural integrity for the particular aeroplane type should be based on the principles outlined in 4.3.4.1 to 4.3.4.3 above. The following information should be included in the assessment and kept by the type design organization in a form available for reference:

- a) the current operational statistics of the fleet in terms of hours or flights;
- b) the typical operational mission or missions assumed in the assessment;
- c) the structural loading conditions from the chosen missions; and
- d) supporting test evidence and relevant service experience.

4.3.4.4.2 In addition to the information specified in 4.3.4.4.1 above, the following should be included for each critical part or component:

- a) the basis employed for evaluating the damage tolerance or safe-life characteristics of the part or component;
- b) the site or sites within the part or component where damage could affect the structural integrity of the aeroplane;
- c) the recommended inspection methods for the area and the detectable size of damage;
- d) for structure designed and assessed using damage tolerance principles, the maximum damage size at which the required residual strength capability can be demonstrated and the critical design loading case for the latter;
- e) for structure designed and assessed using damage tolerance structures, at each damage site the inspection threshold and the damage growth interval between detectable and critical, including any likely interaction effects from other damage sites; and
- f) information related to any variations found necessary to safe-lives already declared for parts and components.

*Note.— Where re-evaluation of fail-safety or damage tolerance of certain parts or components indicates that these qualities cannot be achieved or can only be demonstrated using an inspection procedure whose practicability may be in doubt, then replacement or modification action may need to be defined (refer to Section 4.3.6.3 of this Part).*

### 4.3.5 Inspection programme

4.3.5.1 The purpose of a continuing airworthiness assessment is to supplement the current inspection programme to ensure continued safety of the aeroplane type.

4.3.5.2 In accordance with 4.3.4.1 and 4.3.4.2 of this Part, an allowable final size of damage should be determined for each site so that the structure has a residual strength for the load conditions, except where probabilistic methods can be used with acceptable confidence. The size of damage that it is practical to detect by the proposed method of inspection should be determined together with the number of flights required for the crack to grow from detectable to the allowable final size of damage defined above.

4.3.5.3 The recommended inspection programme should be determined from the data described in 4.3.5.2 above, giving due consideration to the following:

- a) fleet experience, including all of the scheduled maintenance checks;
- b) confidence in the proposed inspection technique; and
- c) the joint probability of reaching a particular load level and size of damage in those instances where the probabilistic methods can be used with acceptable confidence.

4.3.5.4 Inspection thresholds for supplemental inspections should be established. These inspections would be supplemental to the normal inspections, including the detailed internal inspections.

4.3.5.5 For structures with reported cracking, corrosion or wear, the threshold and recurrent inspection interval (i.e., initial inspection and periodicity for repeat inspections) should be determined by analysis of the service data and available test data for each individual case as appropriate.

4.3.5.6 For structures with no reported cracking or wear it may be acceptable, if sufficient fleet experience is available, to determine the inspection threshold on the basis of analysis of existing fleet data alone. The inspection threshold and intervals for modern structures are determined as part of a complex and extensive analysis and test verification programme. These should not be varied without the agreement of the type design organization and the CAA of the State of Design.

*Note.— Some States do not accept the determination of the inspection threshold on the basis of analysis of existing fleet data alone, but also require reference to fatigue analyses supported by test evidence.*

4.3.5.7 For corrosion inspection and control, the threshold will need to be established on the basis of world-wide fleet experience and expressed in calendar time.

### 4.3.6 The continuing structural integrity programme

#### 4.3.6.1 Supplemental inspections

4.3.6.1.1 A supplemental inspection programme should contain the recommendations for the inspection procedures and replacement or modification of parts or components necessary for the continued safe operation of the aeroplane. The programme should include the following information:

- a) identification of the variants of the basic aeroplane type to which the programme relates;

- b) a summary of the operational statistics of the fleet in terms of hours and flights and a description of the typical mission or missions;
- c) reference to documents giving any existing inspections, or modifications of parts or components and to existing structural service bulletins which may still need to be applied, in addition to those given in the programme; and
- d) the types of operations for which the inspection programme is considered valid.

4.3.6.1.2 The following points should be addressed in the inspection programme:

- a) description of the part or component and any relevant adjacent structure (means of access to the part should also be given);
- b) type of damage which is being considered (e.g. fatigue, wear, corrosion, accidental damage);
- c) any service experience and service bulletins which may be relevant;
- d) the likely site(s) of damage;
- e) recommended inspection method and procedure and alternatives;
- f) minimum size of damage considered detectable by the method(s) of inspection;
- g) guidance to the operator on which inspection findings should be reported to the type design organization;
- h) recommended initial inspection threshold;
- i) recommended repeat inspection interval;
- j) reference to any optional modification or replacement of part or component as terminating action to inspection;
- k) reference to the mandatory modification or replacement of the part or component at given life if fail-safety by inspection is impractical; and
- l) information related to any variations found necessary to safe-lives already declared.

#### 4.3.6.2 Corrosion prevention and control programme

4.3.6.2.1 This programme should contain recommendations for the definition of corrosion levels, inspection techniques, re-application of protective treatments and recording and reporting of findings.

4.3.6.2.2 A simple, unambiguous way of defining corrosion severity should be stated, for example:

- a) *Level 1*. Corrosion damage occurring between successive inspections that:
  - 1) is local and can be re-worked within structural repair manual limits;

- 2) can be attributed to an event not typical of operator usage of other aircraft in the same fleet (e.g. mercury spill); or
  - 3) had been blended out several times and the result of the latest inspection now exceeds the allowable limits requiring a repair or partial replacement of a primary structural member.
- b) *Level 2.* Corrosion damage occurring between successive inspections that requires re-work exceeding the structural repair manual limits or that requires a repair or partial replacement of a primary structural member, but is not of immediate airworthiness concern.
  - c) *Level 3.* Corrosion damage of immediate airworthiness concern requiring expeditious action.

*Note.— When Level 3 corrosion is found, consideration should be given to actions required on other aeroplanes in the operator's fleet. The State of Registry should ensure that details of corrosion findings and proposed actions are expeditiously reported to the State of Design.*

4.3.6.2.3 The action to be taken upon finding corrosion of the different levels should be clearly specified.

4.3.6.2.4 The inspections should be specified in areas of the aircraft rather than specific components.

4.3.6.2.5 The required access and cleaning required prior to inspection should be stated.

4.3.6.2.6 The circumstances in which inspection methods other than visual are required should be clearly defined.

4.3.6.2.7 Details of re-protection, both primary and secondary, should be adequately specified for each area.

4.3.6.2.8 Recording and reporting procedures should be defined.

*Note 1.— Recording is particularly important in the case of corrosion control so that at subsequent inspection the control of corrosion can be demonstrated.*

*Note 2.— In some cases it may be appropriate to include the corrosion control programme directly in the aircraft inspection programme.*

*Note 3.— A means of corrosion control is by use of water-displacing corrosion-inhibiting fluids (see 4.3.9 of this Chapter).*

#### 4.3.6.3 Structural modifications and associated inspections

4.3.6.3.1 This programme should contain, for all locations on the aircraft where there is a known history or hazard of cracking, details of modifications or replacement action that will reduce or eliminate the need for repetitive inspection to maintain structural integrity.

4.3.6.3.2 Appropriate times for accomplishment of these modifications should be established.



4.3.6.3.3 For aeroplanes certificated to damage tolerance requirements, the type design organization, in conjunction with operators, is expected to implement the review at appropriate time and frequency, of structurally related inspection and modification service bulletins to determine the validity of the design assumptions and hypothesis made for the type certification to damage tolerance requirements. This review should encompass damage tolerance criteria used and assumptions made for the type certification of aeroplane structures in order to assess whether or not they were conducive to an effective inspection programme and if weak fatigue prone/deficient design areas were left unidentified or underestimated at the time of type certification as, by contrast evidenced by the service experience or by the ongoing fatigue/damage tolerance testing after the type certification. The review should also serve as basis for complementing – when appropriate commensurate to the resulting potential airworthiness concern – the structural integrity programme with elements for widespread fatigue damage (WFD) assessment as well as for coping with human errors and human performances limitations associated with the inspections.

4.3.6.3.4 For aeroplanes not certificated to damage tolerance requirements, the type design organization, in conjunction with operators, is expected to initiate a review of all structurally related inspection and modification service bulletins to determine which require further actions to ensure continued airworthiness, including mandatory modification action or enforcement of special repetitive inspections. Any aeroplane primary structural components that would require frequent repeat inspection, or where the inspection is difficult to perform, taking into account the potential airworthiness concern, should properly consider the human factors associated with the inspection, so as to minimize human error.

*Note.— In areas where the inspections are difficult, cover extensive areas or are frequently repetitive, it is likely that modification or replacement action will be made mandatory.*

#### 4.3.6.4 Repair assessment methodology

4.3.6.4.1 The repair assessment need only be conducted on aeroplanes that were not designed and certificated to damage tolerance principles.

4.3.6.4.2 Historically, aircraft (non-damage tolerant aircraft only – may be redundant for modern aircraft) have commonly been repaired on the basis of the design requirements applicable when the aircraft was first certificated. Many structural repair manuals still retain this concept and, as a result, repairs have been designed on an equivalent static strength basis with little regard for fatigue, crack growth or residual strength. As an example, repairs to pressure cabin skins can still be observed being carried out by stop-drilling a crack and riveting on a patch of the same or greater thickness, extending beyond the critical crack length and with no specific non-destructive inspections being introduced.

4.3.6.4.3 Uncracked structures of non-damage tolerant designs have long had to be re-evaluated in accordance with the damage tolerance philosophy and the results promulgated by way of supplemental inspection documents. A similar retrospective review of existing structural repairs of aircraft in service is needed.

*Note.— This is considered to have been completed by a one-time review by TC holders.*

4.3.6.4.4 Even the major organizations responsible for the type designs do not have the capability to handle the volume of work that individual appraisals would require. Accordingly, the organizations responsible for the type designs, with assistance from operators and airworthiness authorities, are working to provide a practical methodology that will allow operators to evaluate existing repairs without complex analysis.

4.3.6.4.5 The repair assessment programme should provide guidelines for the identification and documentation of all repairs in a three-stage programme which, generally, is as follows:

*Stage 1.* To identify areas where assessment is not required, e.g. secondary structure or low stress areas.

*Stage 2.* To provide operators with guidelines for dividing repairs into the following three categories:

*Category A.* Meets the design certification requirements of the aircraft, and requires no special inspections other than normal maintenance.

*Category B.* Meets design certification requirements of the aircraft; however, must be periodically inspected beyond normal maintenance requirements to ensure structural integrity.

*Category C.* Meets design certification requirements of the aircraft; however, repair is obviously of a temporary nature and to ensure structural integrity requires periodic inspection other than normal maintenance and must be replaced or upgraded to a Category B or better at a certain time limit.

*Stage 3.* To provide guidelines for operators to apply in establishing inspection intervals and removal time limits.

4.3.6.4.6 Typical repair parameters to be established by inspection of records or aircraft by the operator are:

- a) location;
- b) proximity to other repairs;
- c) condition;
- d) corrosion protection;
- e) size of damage or cut out;
- f) patch material and thickness;
- g) embodiment date;
- h) ratio of original to repaired thickness;
- i) fastener details for original and repair type, diameter, pitch, number of rows, edge margin; and
- j) extent of wear.

### 4.3.7 Widespread fatigue damage

4.3.7.1 The likelihood of the occurrence of fatigue damage in an aeroplane's structure increases with aeroplane usage. The design process generally establishes a design service goal (DSG) in terms of flight cycles/hours for the airframe. It is expected that any cracking that occurs on an aeroplane operated up to the DSG will occur in isolation (i.e. local cracking), originating from a single source, such as a random manufacturing flaw (e.g. a mis-drilled fastener hole) or a localised design detail. The supplementary structural inspection programme (SSIP) described above or the maintenance review board (MRB) derived inspections for damage, are intended to find this form of damage before it becomes critical. Therefore, if aircraft are not operated beyond the initial limit of validity of the maintenance programme, it may not be required to perform a widespread fatigue damage (WFD) assessment.

4.3.7.2 With extended usage, uniformly loaded structure may develop cracks in adjacent fastener holes, or in adjacent similar structural details. These cracks, while they may or may not interact, can have an adverse effect on the structural capability before the cracks become detectable. The development of cracks at multiple locations may also result in strong interactions that can affect subsequent crack growth, in which case the predictions for local cracking would no longer apply. An example of this situation may occur at any skin joint where load transfer occurs. Simultaneous cracking at many fasteners along a common rivet line may reduce the residual strength of the joint below required levels before the cracks are detectable under the routine maintenance programme established at time of certification.

4.3.7.3 The type design organization, in conjunction with operators, and in some cases the operators themselves, is expected to initiate development of a maintenance programme with the intent of predicting the onset of WFD and establishing an appropriate limit of validity (LoV) of the maintenance programme for the operation without multiple site damage or multiple element damage. Such programmes should be implemented before analysis, tests, and/or service experience indicates that widespread fatigue damage may develop in the fleet and substantially before LoV is reached on any aeroplane in service.

*Note.— This may be based on typical construction, and may require a different methodology for composite structure.*

### 4.3.8 Limit of validity of maintenance programmes

Associated with these programmes is the need to identify a limit of validity (LoV) of the maintenance programme that contains them. Operators may not operate aeroplanes beyond this LoV unless the structural integrity programmes have been reviewed and been found valid for an extension of the maintenance programme. A new LoV will then be defined.

### 4.3.9 Water-displacing corrosion-inhibiting fluids

4.3.9.1. Water-displacing corrosion preventatives (WDCPs) are a class of products widely used as a temporary and repetitive application to prevent corrosion and inhibit the progression of existing corrosion of metallic structures. There are many products available meeting a number of specifications with various classes of film hardness, tackiness and colour.

4.3.9.2. WDCPs may consist of a mixture of a water-displacing compound, a water-repelling agent and a corrosion-inhibiting agent contained in a low surface tension carrier solvent. Generally, the mixture is sprayed or brushed onto the structure and penetrates into cracks, crevices and contact surfaces of joints by capillary action. Evaporation of the carrier solvent leaves a waterproof corrosion-resistant film on surfaces, and seals cracks and crevices.

4.3.9.3. Apart from discouraging metal dissolution by displacing water, greases and oil films also help to exclude oxygen and simultaneously introduce a high electrical resistance between possible anodes and cathodes.

4.3.9.4. The inclusion of an inhibiting agent encourages the formation of a passive film on the metal surface, a primary corrosion control measure.

4.3.9.5. The efficacy of WDCP compounds depends purely on their ability to prevent corrosion in structural assemblies. They can protect metal surfaces when the original protective systems are no longer fully operative. By their very nature, however, these products raise some concerns.

- a) There has been considerable investigation into the effect of these fluids on the fatigue life of structural joints. Many joints transfer load through a clamping friction mechanism as well as by bearing on the fasteners. If the successful operation of a joint requires complete dependence upon friction between the members, WDCP or other lubricants should not be used during assembly. In general, however, the prevention of corrosion is even more important to the fatigue life and, except in very special cases, the advantages of using WDCP on joints outweigh any concerns of a possible fatigue life reduction.
- b) WDCPs can effectively seal pre-existing cracks, making it difficult to detect cracks by some common non-destructive testing (NDT) methods such as dye penetrant and ultrasonic. These products may be extremely difficult to remove from deep crevices to perform NDT procedures and hence an operator should consider the implications of using WDCPs in areas which require crack-checking procedures.
- c) The efficacy is maximized if applied during original manufacture and as early in the construction sequence as possible. Full coverage is more readily assured and corrosion has not already started. If applied to older aircraft, there is less likelihood of the product penetrating completely into deep lap joints or that moisture and other corrosive agents are truly displaced from the full depth of the joint. But again, the benefits of repetitive use, especially in aggressive environments, are usually worthwhile.
- d) Consideration should be given to the effect of WDCPs on other parts of the aircraft such as electrical components, hoses, filters, etc., to their environmental effects and to the safety of personnel applying them.
- e) Some solvent-based WDCP fluids may flush out lubricants, so caution should be exercised, particularly to avoid removing the lubrication from control cables which could lead to high wear rate or even failure.

4.3.9.6 In summary, if the product is recommended by the type design organization or if the operator and airworthiness authority agree that the product is satisfactory for the intended use and it is applied using an appropriate standard, then the service life of the aircraft should be enhanced.

## 4.4 Exchange and use of continuing airworthiness information

### 4.4.1 Introduction

4.4.1.1 Aircraft are designed and certificated to airworthiness standards. In service, however, faults, malfunctions, defects and other occurrences (service difficulties) may be experienced. To satisfy their responsibilities under the Convention on International Civil Aviation, it is essential that States of Registry are kept informed of service difficulties by their operators and maintenance organizations.

4.4.1.2 Furthermore, it is also essential that the type design organization and the State of Design are kept informed of service difficulties. The type design organization, receiving this kind of information from all operators of the type of aircraft, is in the best position to develop recommendations to solve the problems of the aircraft in service. The State of Design, being the certificating authority of the type of aircraft will, if necessary, make these recommendations mandatory and initiate changes to the airworthiness requirements, if appropriate.

4.4.1.3 The recommendations (service bulletins, etc.) issued by the type design organization and the information made mandatory by the State of Design (airworthiness directives, etc.) should be obtained by all operators and their authorities and appropriate actions taken.

4.4.1.4 Because it is clear that a proper exchange and use of continuing airworthiness information is essential for the continuing airworthiness of aircraft, relevant requirements are incorporated in Annexes 6 and 8 to the Convention on International Civil Aviation.

4.4.1.5 This part of the manual provides guidance material on these requirements. Section 4.4.2 below provides guidance on mandatory airworthiness information, while Section 4.4.3 provides material on other airworthiness information.

### 4.4.2 Mandatory airworthiness information

#### 4.4.2.1 Mandatory airworthiness information to be transmitted by the State of Design

##### 4.4.2.1.1 Annex 8, Part II, 4.2.1.1 states:

“The State of Design of an aircraft shall ...transmit to every Contracting State which has in accordance with 4.2.3a) advised the State of Design that it has entered the aircraft on its register, and to any other Contracting State upon request, any generally applicable information which it has found necessary for the continuing airworthiness of the aircraft, including its engines and propellers when applicable, and for the safe operation of the aircraft (herein called mandatory airworthiness information) ...”

*Note 1.— In Annex 8, Part II, Note 1 to 4.2.1.1 states that the term ‘mandatory continuing airworthiness information’ is intended to include mandatory requirements for modification, replacement of parts or inspection of aircraft and amendment of operating limitations and procedures. Among such information is that issued by Contracting States in the form of Airworthiness Directives.*

*Note 2.— ICAO Circular 95 — The Continuing Airworthiness of Aircraft in Service — provides the necessary information to assist Contracting States in establishing contact with competent authorities of other Contracting States, for the purpose of maintaining continuing airworthiness of aircraft in service.”*

(Refer to Part III, Chapter 4, Section 4.4.5 for more detail regarding Airworthiness Directives.)

4.4.2.1.2 The type, model and serial number of the aircraft, engine, propeller, equipment or instrument affected shall be included in the contents of the mandatory continuing airworthiness information. The mandatory information may require additional or more frequent inspections or maintenance or modifications, and usually with a time limit for compliance in terms of a date, flying hours or number of landings.

4.4.2.1.3 The State of Design, in determining the time limit for compliance should, without prejudice to safety considerations, take into account the availability of modification kits, tools, material, etc. It should also take into account the service experience in other States and should not limit its evaluation to the service experience in its own State. Time limits for conducting initial inspections, as well as conducting recurrent inspections, are frequently tailored to the inspection methods being used.

4.4.2.1.4 States with maintenance organizations approved for aircraft types not registered or not operated in that State, or approved for parts or equipment not used in that State, should request the State of Design to provide all mandatory airworthiness information on those types and parts.

4.4.2.1.5 When the State of Design of the engine or propeller is different to the State of Design of the aircraft, the State of Design for the aircraft should review mandatory airworthiness information from the State of Design for the engine or propeller and either promulgate that information as being applicable to the aircraft type in question, or supplement it to take account of the specific installation in the aircraft. The aircraft type design organization should assist in this review. (Reference Annex 8 Part II 4.2.1.2)

4.4.2.1.6 In accordance with Annex 8, Part II, Chapter 4, 4.3.1.2, when the State of Design of a modification is different from the State of Design of the product being modified, the State of Design of the modification must transmit the mandatory continuing airworthiness information to the State of Design of the product and to States that have the modified product on their Registries. A State may fulfil this obligation by transmitting mandatory continuing airworthiness information to:

- a) Contracting States that are known (by the State of Design of the modification) to have the modification embodied on aircraft on their register; or
- b) Contracting States that have notified under 4.2.3(a) with respect to aircraft types for which the modification is eligible; or
- c) All Contracting States.

4.4.2.1.7 The intent of Annex 8 requirement is to ensure that States of Registry receive any relevant continuing information that impact aircraft on their registries. However, State of Design for a modification may not have information available as to the location of the modified aircraft. Therefore, several options for transmission of information are available to the State of Design for a modification. The smallest group of States that covers the known population of aircraft should be targeted in order to reduce the administrative burden as far as practicable.

#### 4.4.2.2 Action by State of Registry upon receipt of mandatory airworthiness information

##### 4.4.2.2.1 Annex 8, Part II, 42.3 d) states:

“The State of Registry shall, upon receipt of mandatory continuing airworthiness information from the State of Design, adopt the mandatory information directly or assess the information received and take appropriate action.”

Legally, the mandatory status of mandatory airworthiness information is limited to the State that has issued that information. It is essential, however, that appropriate action be taken on all affected aircraft and parts in all States concerned. States should therefore carefully consider mandatory airworthiness information issued by the State of Design, as the State of Design and the type design organization are primarily responsible for issuing this airworthiness information and they normally are the best informed about accidents, incidents and service experience concerning the type design.

4.4.2.2.2 When the State of Registry legally adopts by reference the mandatory airworthiness information issued by the State of Design and does not provide its operators with that information, the State of Registry should assure that its operators have access to the mandatory airworthiness information and implement the required actions.

4.4.2.2.3 Some States assess all mandatory airworthiness information issued by States of Design and subsequently issue their own mandatory information. Such States should have the necessary expertise and human resources to do so. States of Registry should verify whether or not the mandatory airworthiness information is applicable to the aircraft on their registry and can be accomplished as intended. The aircraft may have been modified or had equipment installed without the type design organization or the State of Design being directly involved in that modification or installation approval.

4.4.2.2.4 When in receipt of mandatory airworthiness information for an engine or propeller which has a different State of Design to that of the aircraft, the State of Registry should ensure that it has received any associated mandatory airworthiness information from the State of Design for the aircraft. It must make a determination as to which one of the two is more appropriate to the specific operator. In general, the aircraft mandatory airworthiness information will only vary from that of the engine or propeller to account for specific features of the aircraft installation or operation in question.

4.4.2.2.5 Operators and States of Registry should be aware that some States of Design do not issue their mandatory airworthiness information in the form of Airworthiness Directives, and may instead give mandatory status to service bulletins, etc. by requiring the type design organization to include a statement in the service bulletins, etc. that the information has mandatory status for aircraft registered in the State of Design. Some of these States of Design publish summary lists of service bulletins, etc. which they have classified as mandatory.

4.4.2.2.6 This service information made mandatory by the State of Design should be clearly distinguished from service information that might be declared mandatory by the organization responsible for the type design. The type design organization may have classified the information as mandatory for reasons related to improving maintainability, inspectability, lifetime or for liability reasons.

4.4.2.2.7 The operator should accomplish actions made mandatory by its CAA, otherwise the aircraft is not considered airworthy. The operator should also carefully record the actions accomplished. If this is not done conscientiously, the operator may be in a difficult position when surveyed by the CAA and in terms of liability, especially in case of an accident. Proper documentation of mandatory actions will also enable a smoother transfer of aircraft.

4.4.2.2.8 If an operator wishes to comply in an alternative way or desires an extension of the compliance limit associated with mandatory airworthiness information, the approval of the airworthiness authority of the State of Registry must be obtained. For mandatory information issued by the State of Design and accepted by the State of Registry, the latter may not have sufficient knowledge or expertise to make an informed decision. In such cases, the State of Registry may wish to consult the airworthiness authority of the State of Design or accept advice from the type design organization.

4.4.2.2.9 On occasion, compliance with mandatory airworthiness information has to be effected at very short notice. Therefore, operators should be able to receive this information at any time (by telex, fax, email, etc.) and to develop the necessary actions.

#### 4.4.2.3 Transmission to the State of Design of mandatory airworthiness information by other States

Annex 8, Part II, 4.2.3e) states:

“The State of Registry shall ensure the transmission to the State of Design of all mandatory continuing airworthiness information which it, as the State of Registry, originated in respect of that aircraft.”

States should only make mandatory requirements additional to those of the State of Design when there are urgent safety-related reasons. When possible, such action should entail prior consultation with the State of Design, but in all cases the State of Design should be notified as soon as practicable or when the State of Registry has uniquely designed or modified aircraft because of unique airworthiness requirements.

#### 4.4.2.4 Airworthiness actions by State of Design and design organization

4.4.2.4.1 Annex 8, Part II, 4.2.1.1 b) states:

“The State of Design of an aircraft shall ensure that, in respect of aeroplanes over 5 700 kg and helicopters over 3 175 kg maximum certificated take-off mass, there exists a system for:

- i) receiving information submitted in accordance with 4.2.3 f);
- ii) deciding if and when airworthiness action is needed;
- iii) developing the necessary airworthiness actions; and
- iv) promulgating the information on those actions including that required in 4.2.1.1 a).”

The State of Design and the type design organization should assess all airworthiness information received, including the information mentioned under Annex 8, Part II, 4.2.3 e) and 4.2.3 f) and information on accident investigations (see paragraph 4.4.3.1 below concerning guidance on 4.2.3 f) of Annex 8, Part II).

4.4.2.4.2 The type design organization should respond to the reporting operator and should include in the response advice on the actions needed for the reported service difficulty to ensure continuing airworthiness. The type design organization should also inform other affected operators.



4.4.2.4.3 Whenever there is evidence that its product is unsafe because of a manufacturing or design defect, the type design organization should investigate the reason for the defect and report to the State of Design the results of its investigation and any action being taken or proposed to correct the defect. If action is required to correct the defect, the type design organization should submit the data necessary for the issuance of appropriate mandatory airworthiness information.

4.4.2.4.4 When the State of Design considers that the issuance of mandatory airworthiness information is necessary to correct the unsafe condition, the type design organization should propose the appropriate design changes and/or required inspections and submit details of these proposals for approval. Following the approval of the proposed design changes or inspections, it should make available to all operators appropriate descriptive data and accomplishment instructions. The organization responsible for type design should also make updates to user documents not subject to approval by the CAA, such as the aircraft service manual, illustrated parts catalogue, etc.

#### 4.4.3. Other airworthiness information

##### 4.4.3.1 Transmission of information on faults, malfunctions and defects and other occurrences

###### 4.4.3.1.1 Annex 8, Part II, 4.2.3 f) states:

“The State of Registry shall ensure that in respect of aeroplanes of over 5 700 kg and helicopters above 3 175 kg maximum certificated take-off mass, there exists a system whereby information on faults, malfunctions, defects and other occurrences which cause or might cause adverse effects on the continuing airworthiness of the aircraft is transmitted to the organization responsible for the type design of that aircraft.”

When the State of Design for the engine or propeller is different to the State of Design for the aircraft, the State of Design of the aircraft should have a system to transmit information on service difficulties to the State of Design for the engine or propeller. The State of Registry may also elect to transmit the information to the State of Design for the engine or propeller.

4.4.3.1.2 It is essential that information on airworthiness deficiencies is transmitted without any delay to the type design organization of the aircraft affected, so that corrective action may be developed by that organization and communicated to all operators of the aircraft type.

4.4.3.1.3 Some States may elect to enact regulations requiring operators of aircraft registered in the State to report airworthiness deficiencies to the type design organization of the aircraft affected. Alternatively, a State may choose to require reporting to its own airworthiness authority, which should then pass the information on to the type design organization of the aircraft affected.

4.4.3.1.4 If the performance of maintenance is either partially or wholly assigned to a maintenance organization, service experience on faults, malfunctions, defects, findings in inaccuracy of maintenance data, etc. of both the operator and the maintenance organization should be transmitted to the type design organization. The information from the operator should pertain to the operational and maintenance experience of its fleet. The information from the maintenance organization should pertain to its maintenance experience of all aircraft designed by the type design organization.

4.4.3.1.5 Details of a number of Contracting States' systems for reporting of information on faults, defects and malfunctions may be found in ICAO Circular 95 — *The Continuing Airworthiness of Aircraft in Service*.

#### 4.4.3.2 Information to be reported to the authority

##### 4.4.3.2.1 Annex 8, Part II, 4.2.4 states:

“Each Contracting State shall establish, in respect of aeroplanes over 5 700 kg and helicopters above 3 175 kg maximum certificated take-off mass, the type of service information that is to be reported to its airworthiness authority by operators, organizations responsible for type design and maintenance organizations. Procedures for reporting this information shall also be established.”

Operators, organizations responsible for type design and maintenance organizations should report to their airworthiness authority all faults, malfunctions, defects and other occurrences which cause or might cause adverse effects on the continuing airworthiness of the aircraft.

4.4.3.2.2 Some States have established a service difficulty reporting system. Operators in these States should report information on faults, malfunctions, defects, etc. through this system. (Paragraph 4.4.4 of this Chapter provides information on such systems.)

4.4.3.2.3 It is necessary for the type design organization to systematically and periodically review and analyze service data obtained from all operators. Summarized data should be reported to the State of Design. Use should be made of appropriate statistical methods and comparison of service data with predictions made for type certification. This aspect may be controlled by State of Design specifically for each case.

#### 4.4.3.3 Monitoring and assessment of maintenance and operational experience by the operator

4.4.3.3.1 Responsibilities for monitoring and assessment of maintenance and operational experience by the operator is specified in Annex 6, Part I, 8.5.1 and should be referred to in this respect:

“The operator of an aeroplane over 5 700 kg maximum certificated take-off mass shall monitor and assess maintenance and operational experience with respect to continuing airworthiness and provide the information as prescribed by the State of Registry and report through the system specified in Annex 8, Part II, 4.2.3 f) and 4.2.4.”

If the performance of maintenance is either partially or wholly assigned to a maintenance organization, this organization should report all maintenance action taken and all discrepancies found to the operator of the aircraft, thus enabling the operator to monitor and assess both maintenance and operational experience and any mutual relationship. The operator should have the expertise to fulfil this task or make contractual arrangements to obtain this expertise.

4.4.3.3.2 The operator should report all known discrepancies and adverse operational experience relevant to the work contracted to the maintenance organization, thus enabling the maintenance organization to correct any possible technical cause of an operational problem.

4.4.3.3.3 Information on operators' reliability programmes may be found in Part IV, Section 1.7 of this Manual.

#### 4.4.3.4 Assessment of airworthiness information and subsequent action by the operator

4.4.3.4.1 Operators responsibilities with regard to the assessment of airworthiness information are to be found in Annex 6, Part I, 8.5.2. (Reference should be made to Part IV for explanatory material in this respect.)

“The operator of an aeroplane over 5 700 kg maximum certificated take-off mass shall obtain and assess continuing airworthiness information and recommendations available from the type design organization and shall implement resulting actions considered necessary in accordance with a procedure acceptable to the State of Registry.”

Recommendations by the type design organization are normally made by service bulletins, service letters, etc.

4.4.3.4.2 Usually the airworthiness portions of the recommendations are approved by the State of Design. If so, the document will clearly identify that approval. Operators should be aware that not all recommendations made by the type design organization have airworthiness consequences, and these may not be approved by the State of Design. In addition, some recommendations made by the type design organizations, usually things for which no operational credit is being given, may not have the full approval of the State of Design. In these cases, the State of Design merely ensures that the recommended action does not interfere with the safe operation of the aeroplane, and that its installation complies with the appropriate requirements. If there is any doubt as to what is approved and to what degree, the type design organization or the State of Design should be consulted.

4.4.3.4.3 Although these recommendations are normally not made mandatory by the State of Registry, the operator should obtain and carefully assess this information. It is clear that the operator needs qualified staff to do so. In general, it is worthwhile to accomplish the recommendations of the organization responsible for type design, as they enhance the reliability and hence availability for service of the aircraft.

4.4.3.4.4 Even if a modification is optional, it still requires approval by the State of Registry.

4.4.3.4.5 Even if the performance of maintenance is either partially or wholly assigned to a maintenance organization, the operator remains responsible for the continuing airworthiness of the aircraft. This means that the operator should have the expertise and personnel to perform the assessment of all relevant information and inform the maintenance organization, especially if this organization is in a different State, of all information made mandatory by the State of Registry.

4.4.3.4.6 The maintenance organization should have at its disposal all information issued by the type design organization relevant to the contracted work.

#### 4.4.3.5 Type of information on continuing airworthiness to be transmitted by the type design organization

4.4.3.5.1 Response to the reporting operator should include advice on the actions needed to overcome the reported service difficulty and ensure continuing airworthiness. Service difficulties that affect continuing airworthiness should be reported to the authority in the State of Design. Communication to the operator and the authority should include the following:

- a) a clear discussion of the seriousness and possible causes of the difficulty;

- b) permissible limits for continued operation;
- c) special inspection procedures where applicable;
- d) the repeat inspection interval needed if continued operation is permissible;
- e) repairs or replacement required, and when required; and
- f) limitations for non-revenue ferry flight.

4.4.3.5.2 The type design organization should also inform other affected operators of reported service difficulties that affect the continued airworthiness of the aircraft type. Communications should include the following:

- a) a clear description of the difficulty reported using visual aids (photograph or sketch);
- b) a clear discussion of the seriousness of the difficulty;
- c) applicable part and serial numbers;
- d) aircraft and/or component time in landings and flight hours when the difficulty was found;
- e) how the difficulty was discovered;
- f) analysis of the cause, if known;
- g) recommended actions;
- h) permissible limits for continued operation; and
- i) feedback information desired.

#### 4.4.4 Service difficulty reporting system

##### 4.4.4.1 General

4.4.4.1.1 The Service Difficulty Reporting System (SDR) is established to support the CAA in its mandate to foster an acceptable level of safety by:

- a) promoting product safety improvement;
- b) detecting trends (as opposed to isolated cases); and
- c) giving the CAA the necessary tools to discharge the State of Registry's obligations with regard to continuing airworthiness information, as set forth in Annex 8, Part II, 4.2.3 f).

4.4.4.1.2 The current aircraft population is too large to achieve full knowledge of all potential safety problems solely through inspection. Furthermore, in most States the aircraft population is increasing more rapidly than the AID staff. The SDR assists in effective decision making, manpower utilization and enhancement of safety. A properly implemented SDR provides the intelligence needed to assess defects, institute early corrective action and thus assist in accident prevention.

4.4.4.1.3 The SDR is a feedback system which provides a most effective resource for decision-making on matters of reliability and airworthiness. The level of sophistication of the SDR can range from the use of advanced computers with immediate readout capabilities, to manual programmes which utilize a reporting form that is completed by the operator and manually processed by the regulatory agencies. Future development of the SDR could result in a world-wide sharing of service difficulty information such as is being done now with the ICAO coordinated accident/incident reporting programme.

#### 4.4.4.2 Sources of information for the service difficulty report

Service difficulty reports should be received from sources such as commercial aviation operators, and from any source having access to aviation safety information, such as air traffic control. Significant malfunctions, failures, or conditions brought to the attention of or noted by the AID inspector during surveillance of aviation industry activities should also be reported.

#### 4.4.4.3 Guidelines for reporting

4.4.4.3.1 CAA regulations should require commercial operators to submit specified information to the AID. The reports should be submitted on a common form. The regulations should require a report for each malfunction, failure, or defect that occurs under the reportable categories. Similar failures that continue to occur should be reported so the manufacturer and the State of Manufacture are aware of trends that are developing. One-time reporting of similar defects is unacceptable. In addition, each operator should report any other failure, malfunction, or defect in an aircraft that occurs or is detected at any time, if in the holder's opinion that failure, malfunction or defect has endangered or may endanger the safe operation of an aircraft.

*Note.— A number of examples of forms and methods used for handling service difficulty reports by Contracting States may be found in ICAO Circular 95 — The Continuing Airworthiness of Aircraft in Service.*

4.4.4.3.2 Each operator should report the occurrence or detection of each failure, malfunction or defect concerning at least the following:

- a) fires during flight and whether or not a fire warning system was installed and functioned properly;
- b) false fire warning during flight;
- c) an engine exhaust system that causes damage during flight to the engine, adjacent structure, equipment, or components;
- d) an aircraft component that causes accumulation or circulation of smoke, vapour, or toxic or noxious fumes in the crew compartment or passenger cabin during flight;

- e) engine shutdown during flight because of flameout;
- f) engine shutdown during flight when external damage to the engine or aircraft structure occurs;
- g) engine shutdown during flight due to foreign object ingestion or icing;
- h) shutdown during flight of more than one engine;
- i) a propeller feathering system or ability of the system to control overspeed during flight;
- j) a fuel or fuel-dumping system that affects fuel flow or causes hazardous leakage during flight;
- k) a landing gear extension or retraction, or opening or closing of landing gear doors during flight;
- l) brake system components that result in loss of brake actuating force when the aircraft is in motion on the ground;
- m) aircraft structure that requires significant repair;
- n) cracks, permanent deformation, or corrosion of aircraft structure, if more than the maximum acceptable to the manufacturer or the CAA;
- o) aircraft components or systems that result in taking emergency actions during flight (except action to shut down an engine).
- p) each interruption to a flight, unscheduled change of aircraft en route, or unscheduled stop or diversion from a route, caused by known or suspected mechanical difficulties or malfunctions;
- q) the number of engines removed prematurely because of malfunction, failure or defect, listed by make and model and the aircraft type in which it was installed; and
- r) the number of propeller featherings in flight, listed by type of propeller and engine and aircraft on which it was installed.

4.4.4.3.3 In addition to the reports required above, each operator should report any other failure, malfunction or defect in an aircraft that occurs or is detected at any time, if in his opinion, the failure, malfunction or defect has endangered or may endanger the safe operation of the aircraft.

4.4.4.3.4 The reports required of the operator should be submitted in writing to the State's organization, and in the timeframe, identified in the approved air carrier operations specifications.

#### 4.4.4.4 Significant Reports

4.4.4.4.1 The following significant reports warrant immediate notification of the appropriate State organization by telephone or telex:

- a) primary structure failure;

- b) control system failure;
- c) fire in the aircraft;
- d) engine structural failure; or
- e) any other condition considered an imminent hazard to safety,

4.4.4.4.2 The telephone or telex report should follow the format of the Service Difficulty Report and being of an alert nature, should contain the following information when available and relevant:

- a) aircraft owner's name and address;
- b) whether accident or incident;
- c) related service bulletins, service letters, airworthiness directives; and
- d) disposition of the defective parts.

4.4.4.4.3 The information contained in the telephone or telex report should be entered on the SDR form and submitted in the normal manner to the AID as soon as possible after the telephone/telex submission.

#### 4.4.5 Airworthiness Directives

##### 4.4.5.1 General

4.4.5.1.1 A primary safety function of the airworthiness organization within the CAA is to require correction of unsafe conditions found in an aircraft, aircraft engine, propeller, equipment or instrument or when such conditions develop in other products of the same design. The unsafe conditions may be due to design deficiencies, manufacturing defects, maintenance programme deficiencies, or other causes. Airworthiness Directives (ADs) usually are the means used to notify aircraft owners and other interested persons of unsafe conditions and to prescribe the conditions under which the product may continue to be operated.

4.4.5.1.2 ADs are divided into two categories:

- a) those of an urgent nature requiring immediate compliance upon receipt; and
- b) those of a less urgent nature requiring compliance within a relatively longer period.

4.4.5.1.3 The contents of ADs include the aircraft, engine, propeller, equipment or instrument type, model and serial numbers affected. Also included are the compliance time or period, a description of the difficulty experienced, and the necessary corrective action.

4.4.5.1.4 A large number of States operate aircraft that have been manufactured or certificated in another State. In order to continue to maintain such aircraft at a level of airworthiness equivalent to that achieved at type certification, the State in which such aircraft are currently registered needs to regularly obtain all information, particularly ADs, service bulletins, etc. issued by the type certification authority, by the type design organization or, on rare occasions, by the airworthiness authority of any other State in which the same type of aircraft are registered, particularly where such information pertains to the

continuing airworthiness and the prevention of recurring defects in aircraft and its components and equipment. It is therefore necessary that each State receive all continuing airworthiness information relating to aircraft on its registry, no matter what State originates the information. It is equally necessary, to facilitate coordinated corrective measures, for the State of Design to receive continuing airworthiness information originated in any other State relating to aircraft it has certificated. With the introduction of the Internet, some States, together with commercial organizations, provide information regarding ADs via this medium.

#### 4.4.5.2 Responsibility for airworthiness directives

##### 4.4.5.2.1 Responsibilities of the operator

4.4.5.2.1.1 The manner in which the operator complies with ADs issued by the State of Registry depends upon the arrangements under which the operator has leased, chartered or otherwise acquired control of an aircraft. The operator may arrange with the owner for the latter to carry out all actions arising out of ADs, or the operator may arrange to carry them out himself.

4.4.5.2.1.2 The operator will determine by which means it will be kept informed on ADs. However, the operator must ensure that the ADs have been implemented in the manner prescribed and refrain from engaging in flight operations contrary to the provisions of the applicable ADs.

##### 4.4.5.2.2 The owner's role

4.4.5.2.2.1 The owner should not use his aircraft, or knowingly allow it to be used by others, except in compliance with ADs issued up to date. If the owner leases the aircraft or allows another person to maintain it, the owner should take effective steps to assure compliance with ADs. The owner cannot assume that others will take over the burden of maintenance automatically. The situation may call for a written agreement, or a verbal one, depending on circumstances. But there should be no doubt as to who will take the necessary responsive action to ADs.

4.4.5.2.2.2 In some cases, the owner may elect to also comply with ADs issued by other than the State of Registry in order to facilitate transfer of registration at the end of a lease.

##### 4.4.5.2.3 The role of aircraft maintenance engineers or maintenance organizations

4.4.5.2.3.1 The responsibility of the aircraft maintenance engineer (AME) or maintenance organization with regard to AD compliance should also be clearly understood. Some operators may be under the impression that when they submit their aircraft for maintenance, or a progressive inspection, the AME will routinely ensure that all ADs in effect on that date are complied with before signing off on the inspection. This is not necessarily true. Some ADs in effect may deal with components which are not normally part of the inspection, such as radios. Also, some ADs already in effect at the time of the inspection may have delayed compliance dates; in such cases the AME is not obliged to act upon them, and may not do so unless requested by the operator.

4.4.5.2.3.2 Whenever an AD has been complied with by an AME, the AME should not only record the date of compliance and time in service in the aircraft maintenance records, but also furnish a description of the work done — several alternative methods of compliance may be possible, and at some later date it may be important to know which route was followed. Before the aircraft goes back into



service, whoever accepts it from the shop should first determine that the maintenance record, including ADs, is fully up to date.

4.4.5.2.3.3 The responsibility for compliance with ADs cannot be disclaimed by any of the parties involved in its operation or maintenance, namely the AME, maintenance organization, owner or operator. All have some degree of responsibility, depending always upon the circumstances under which the aircraft is used; all are expected to know about the procedures for issuing ADs, and to understand their role in compliance.

## **4.5 Authenticity and serviceability of aircraft parts**

### 4.5.1 Introduction

4.5.1.1 The need to ensure that parts installed on an aircraft meet the design specification and are serviceable is self-evident. The installation of any part failing to meet the intended design requirements degrades those requirements, leading to a degradation of airworthiness.

4.5.1.2 It is essential that for the purposes of continuing airworthiness a system of control exists which ensures that only parts meeting the approved design data applicable to a particular aircraft are installed on that aircraft. This chapter provides guidance on the establishment of such a system.

### 4.5.2 Approved parts

4.5.2.1 An approved part is one whose design has been found to be acceptable to the State of Design, whose proper manufacture has been approved by the State of Registry, and that has been found to be in a condition for safe operation by the State of Registry.

*Note.— Parts approved pursuant to 4.5.2.1 above are eligible for installation on a specific aircraft if, and only if, they also meet the approved design data applicable to the particular aircraft they are to be installed on. For example, a seat designed and approved for 9 g forward loads is not eligible for installation on an aircraft which is required to have a seat that is dynamically tested for 16 g.*

4.5.2.2 Standard parts such as fasteners are considered as approved parts when they are in compliance with a national or industry accepted standard and when referenced in the type design of the particular aircraft.

### 4.5.3 Unapproved parts

Parts not meeting the criteria described in 4.5.2.1 and 4.5.2.2 above are considered to be unapproved. Any part not supported by the required documentation (see 4.5.4 below) would also be considered to be unapproved. Unapproved parts also include those parts improperly returned to service, for example:

- a) parts supplied directly to the end user by a subcontractor without direct ship authority from the design approval holder and the State of Manufacture to do so;
- b) parts maintained or approved for return to service by a person or organization not approved to do so;

- c) parts not maintained in accordance with the requirements of the applicable approved data; and
- d) parts having reaching their life limit, including, if applicable, any shelf-life limit.

#### 4.5.4 Supporting documentation

4.5.4.1 A documentation process providing written evidence of the acceptability of a part is an essential element of any system designed to ensure that only approved parts are installed on an aircraft. Such a process is intended to provide all relevant information concerning the part to which it refers sufficient to enable a potential installer to readily ascertain its status.

4.5.4.2 Such documents will contain information relating to:

- a) the authority under which it is issued;
- b) reference identification for the purposes of traceability;
- c) name, address and approval reference of the issuing organization;
- d) work order, contract or invoice number;
- e) quantity, description, part number and, if applicable, serial number of the part;
- f) relevant information concerning any life limitations, including in-service history records;
- g) the signature and approval reference of the person issuing the document; and
- h) whether the part is new or used.

#### 4.5.5 Precautions to prevent the inadvertent acceptance of unapproved parts

4.5.5.1 Documentary evidence of compliance with an approved process will not in itself provide a guarantee against the installation of unapproved parts if the original supplier of such parts knowingly provides false information or otherwise sets out to deceive.

4.5.5.2 It is always necessary to have secondary defences in place designed to give early warning of unapproved parts prior to their release for installation. The primary defence in such cases is a strong, well-informed and alert parts ordering and receiving system which, through auditing and reports, establishes a satisfactory level of confidence in its parts suppliers and which:

- a) ensures a continual correlation between parts ordered and parts received;
- b) is alert to any unauthorized alterations to supporting documentation and to any inability of the supplier to supply the required documentation;
- c) is aware if a quoted price for the part is significantly lower than that quoted by other suppliers;

- d) is aware that delivery times are significantly shorter than those quoted by other suppliers; and
- e) is aware of parts packaging methods used by approved parts manufacturers, maintenance organizations and distributors, and can detect deviations from these methods.

4.5.5.3 Organizations, particularly approved maintenance organizations and operators, should ensure that all those staff who have routine contact with parts, including especially buyers, stores staff, mechanics and certifying staff, are fully aware of the dangers posed by unapproved parts and also the likely sources. Ample warnings should be given to such staff about accessing any unapproved parts database. Approved maintenance organizations and operators will also need to ensure that their parts suppliers are fully integrated into the reporting network, and audits will be necessary among staff at intervals to ensure that all remain vigilant to the problem.

#### 4.5.6 Unapproved parts reporting

4.5.6.1 Systems used by end users to report to Type Certificate holders and regulatory agencies are intended to provide widespread warning of the detection of unapproved parts so that operators of similar equipment can be made aware as soon as possible. In view of the likely random appearance of unapproved parts, access to a reporting system should be easy and available at all reasonable times. It follows that publicity for the reporting system (and the programmes generally) should be widespread.

4.5.6.2 In order to obtain as much information as possible from a report of a suspected unapproved part, it is necessary to have a standardized reporting format. Information required will include part description and from where received; part and (if applicable) serial numbers; particular colours, markings, dimensions and features common to the unapproved part which distinguish it from the genuine item; and the nature of any accompanying documentation.

4.5.6.3 At any time a part is deemed to be suspect, it and any accompanying documentation should be quarantined immediately and held until the body responsible for processing the reports is satisfied that the evidence is no longer required or until the authenticity of the part has been established.

4.5.6.4 Some reports of suspected unapproved parts will eventually turn out to be false as further information becomes available in the form of supporting documentation, etc. A successful reporting system should accept such false alarms and the wasted effort they generate in the knowledge that to discourage them might eventually lead to the suppression of a genuine report.

4.5.6.5 A relatively simple database, preferably computer driven, will be required to maintain a record and allow easy processing of reports of suspected unapproved parts. The database should be capable of interrogation such that any common thread within the reports received is readily identified by keyword access. The database itself can be a dedicated system or part of a much larger general occurrence reporting system.

4.5.6.6 In view of the international nature of the aviation industry and in particular the known international nature of the generation and distribution of unapproved parts, the ability to link national databases is obviously advantageous, the unimpeded cross-flow of information being essential in successfully combating the problem.

#### 4.5.7 Parts stockists and distributors

4.5.7.1 It is recognized that parts stockists and distributors have a significant influence over preventing the use of unapproved parts. Such organizations have an established commercial role of stocking or obtaining parts, often at short notice. Some States approve stockists and distributors but others do not.

4.5.7.2 In airworthiness terms, the parts supplier's role is simply that of a holder of a part and its supporting data for a limited period, the part and data being passed in their entirety to the purchaser. The most effective control is exercised by the purchaser of the parts by ensuring that the part is correct and that the documentation truly reflects the status of the part. Further assurance is provided by the installer purchasing only from those suppliers having a known satisfactory record.

4.5.7.3 Parts distributors may also break down large orders of identical parts into smaller lots for shipment to end users. In this case they should provide documentation that the parts came from the original large order and either issue a second set of airworthiness documentation, if authorised by their State regulatory authority to do so, or attach a copy of the original airworthiness documentation.

#### 4.5.8 Parts removed from an aircraft no longer in service

4.5.8.1 Aircraft withdrawn from service are often used as a source of spare parts, a process sometimes described as "parting out". These parts, although serviceable at the time the aircraft was placed in storage, may have been affected adversely by storage conditions, including especially environmental factors, or by the length of storage.

4.5.8.2 The records for the aircraft and its parts prior to the aircraft being placed into storage will need to be researched in order to ascertain the previous maintenance history, and airworthiness directive, modification and repair status of the parts being removed. Any unusual events immediately prior to storage, e.g. heavy landings or lightning strikes, will also have to be considered when deciding on the serviceability of the parts being removed.

4.5.8.3 It is important that the part removal process be planned and controlled in a manner as close as possible to that adopted for routine maintenance tasks on in-service aircraft. The following points in particular should be considered:

- a) the means by which the part is removed should be in accordance with the normal maintenance data (e.g. maintenance manuals), using the tooling specified;
- b) adequate access equipment should be provided;
- c) if conducted in the open, disassembly should cease during inclement weather;
- d) all work should be carried out by appropriately qualified maintenance personnel;
- e) all open connections should be blanked; and
- f) a protected and enclosed quarantine storage area for the parts being removed should be provided in the immediate vicinity of the work area and

- g) normal maintenance documentary controls should be used, e.g. the use of work sheets or cards to record component removals, and label identification to show serviceability status.

4.5.8.4 An assessment for condition and eventual return to service of each removed part will need to be conducted by a suitably approved organization. The extent of the work necessary before the part is returned to service may, depending on the factors noted in 8.1, range from a simple external visual inspection to a complete overhaul.

#### 4.5.9 Parts recovered from aircraft involved in accidents

4.5.9.1 When an aircraft has been involved in an accident, the title to the salvage may pass from the insured owner to other persons (e.g. aircraft insurers); this salvage may be offered for sale either complete or as separate aircraft items in an “as is, where is” condition. While some items may be totally unaffected by the accident or incident which caused the aircraft to be declared as salvage, it is essential to obtain clear evidence that this is the case. If such evidence cannot be obtained, the item may not be returned to service.

4.5.9.2 Before overhaul and reinstallation can be considered, all such items must therefore be subject to airworthiness assessment and inspection in the light of adequate knowledge of the circumstances of the accident, subsequent storage and transport conditions, and with evidence of previous operational history obtained from valid airworthiness records. Confirmation of this assessment in the form of an airworthiness release is essential.

4.5.9.3 In particular, if a crash load is sufficient to take any part above its proof strength, residual strains may remain which could reduce the effective strength of the item or otherwise impair its functions. Loads higher than this may of course crack the item, with an even more dangerous potential. Further, a reduction in strength may be caused by virtue of the change of a material’s characteristics following overheating from a fire. It is therefore of the utmost importance to establish that the item is neither cracked, distorted or overheated. The degree of distortion may be difficult to assess if the precise original dimensions are not known, in which case there is no option but to reject the item. Any suggestion of overheating would be cause for a laboratory investigation into significant change of material properties.

#### 4.5.10 Disposal of scrapped parts

4.5.10.1 Those responsible for the disposal of scrapped aircraft parts and materials should consider the possibility of such parts and materials being misrepresented and sold as serviceable at a later date. Caution should be exercised to ensure that the following types of parts and materials are disposed of in a controlled manner that does not allow them to be returned to service:

- a) parts with non-repairable defects, whether visible or not to the naked eye;
- b) parts that are not within the specifications set forth by the approved design, and cannot be brought into conformity with applicable specifications;
- c) parts and materials for which further processing or rework cannot make them eligible for certification under an approved system;
- d) parts subjected to unacceptable modifications or rework that is irreversible;

- e) life-limited parts that have reached or exceeded their life limits, or have permanently missing or incomplete records;
- f) parts that cannot be returned to an airworthy condition due to exposure to extreme forces or heat (see paragraph 4.5.8 above); and
- g) principal structural elements removed from a high-cycle aircraft for which conformity cannot be accomplished by complying with the mandatory requirements applicable to ageing aircraft.

4.5.10.2 Scrapping of parts and materials may not be appropriate in certain cases when there is an ongoing evaluation process to determine whether a part or material may be restored to an airworthy condition. Examples of these cases include the extension of life limits, the re-establishment of in-service history records, or the approval of new repair methods and technologies. In these cases, such parts should be segregated from serviceable parts until the decision has been made as to whether these parts can be restored to an airworthy condition, or be scrapped.

4.5.10.3 Scrapped parts should always be segregated from serviceable parts and when eventually disposed of should be mutilated or clearly and permanently marked. This should be accomplished in such a manner that the parts become unusable for their original intended use and unable to be reworked or camouflaged to provide the appearance of being serviceable.

4.5.10.4 When scrapped parts are disposed of for legitimate non-flight uses, such as training and education aids, research and development, or for non-aviation applications, mutilation is often not appropriate. In such cases the parts should be permanently marked indicating that they are not serviceable; alternatively, the original part number or data plate information can be removed or a record kept of the disposition of the parts.

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## CHAPTER 5.— CHANGES TO APPROVED TYPE DESIGN

### 5.1 General

5.1.1 A Type Certificate issued in accordance with Annex 8, Part II, Section 1.4 is evidence of approval of a type design of an aeronautical product in its configuration as of the date of Type Certificate issuance or approval. After issuance of an initial or original Type Certificate, there are many activities that can be performed or required by the Type Certificate holder, the State of Design, a State of Registry, aircraft operators, and other design organizations that will result in the modification of an aeronautical product. For example, the Type Certificate holder may want to develop a model derivative of the same aeronautical product, or an operator may want to replace an aircraft's existing navigation systems with state-of-the-art technology. Incorporating a modification to an aircraft will invalidate its conformity to a Type Certificate, until such time that the modification is approved and recorded as part of an approved type design for that specific aircraft. The intent under Annex 8, among other things, is to ensure that the aircraft Type Certificate remains valid, and that an approved type design exists, throughout the service life of the aircraft.

5.1.2 A Certificate of Airworthiness, at the time of its issuance by a State of Registry in accordance with Annex 8, is conditional on the aircraft having an approved type design or Type Certificate. The Certificate of Airworthiness remains valid as long as the aircraft is airworthy, i.e. the aircraft continues to conform to its approved type design and is in a condition for safe operation. Considering that a modification is a change in the approved type design, it follows that any modification to the aircraft must be approved in order for a Certificate of Airworthiness to remain valid. Both Annex 8 (Part II, Section 4.2) and Annex 6 specify various requirements for keeping an aircraft in an airworthy condition and, among other things, ensuring the continued validity of the Certificate of Airworthiness.

5.1.3 A major modification to an aircraft should be accomplished in accordance with design data approved by, or on behalf of, or accepted by the airworthiness authority of the State of Registry, such that the modification conforms to applicable standards of airworthiness. This relationship between modifications to aircraft and the Certificate of Airworthiness is clearly explained by the following three requirements that form part of several general provisions on maintenance in Annex 6:

- a) an operator must ensure that the Certificates of Airworthiness on aircraft they operate remain valid;
- b) an operator must keep records of appropriate details of modifications incorporated on aircraft;
- c) modifications shall comply with airworthiness requirements of, or acceptable to, the State of Registry, and procedures shall be established to ensure that the substantiating data supporting compliance with the airworthiness requirements are retained.

5.1.4 Approving a modification can be processed in many ways, depending on the scope and complexity of the proposed design change and the regulatory system in place for each Contracting State. But the general process of approving the design change remains fundamentally the same with that of a type certification process (see *Chapter 1, Type Certification* of this Part). Annex 8, Part II, 1.3.4, puts an obligation on all Contracting States to ensure their approval of a design of a modification is based on satisfactory evidence that the aircraft continues to comply with the design aspects of the appropriate airworthiness requirements used for the type certification of that aircraft. Satisfactory evidence of approval of a modification is most commonly recorded as either an amendment or supplement to the Type Certificate.

5.1.5 The airworthiness organization of a Contracting State is responsible for the approval of modifications incorporated on civil aircraft that have been issued a Certificate of Airworthiness in accordance with Annex 8. Regardless of whether a State has an aviation manufacturing industry or not, it is incumbent upon States to implement the requirement to approve aircraft modifications by either conducting their own approval process, or through reliance and acceptance of modification approvals already granted by the State of Design, a State of Registry, or a State of Operator. The functions, structure, and technical capability of airworthiness organizations vary from State to State. (See Part II of this Manual, *Airworthiness Organization Structure and Responsibilities of States*)

5.1.6 All Contracting States, regardless of their technical capability to approve modifications, are encouraged to give maximum credit and recognition to the modification approvals granted by the State of Design or another Contracting State with a demonstrated technical capability, and avoid duplicate or redundant testing where practical, and without prejudice to their own unique national requirements. Many airworthiness standards currently used by States with aviation manufacturing industries are already harmonized, and the remaining differences are either with the unique technical requirements, due to operational or environmental constraints, and/or interpretation of the same requirements. Although full harmonization of all airworthiness requirements is yet to come, the overall objective that all States should work towards is reducing the amount of work needed to accomplish the approval of an aircraft modification.

## **5.2 Application for approval of a modification**

### 5.2.1 General

5.2.1.1 An applicant requesting approval of a proposed modification to an aircraft, engine or propeller can be an organization, an individual or, where allowed by a State, a representative for that organization or individual. Examples of an applicant could be the Type Certificate holder, an aeronautical product manufacturer, a specialized design engineering organization, Air Operator with engineering capability, individual engineers as consultants, or an aircraft maintenance organization or repair station. Regardless, the applicant is the organization or individual that has responsibility for the proposed modification and in whose name the approval will be granted. In cases of complex design changes involving multi-national agreements, joint ventures, partnerships or similar collaboration, the applicant remains overall responsible for integrating all design data from its various sources, and submitting it to the airworthiness organization of the Contracting State as a complete and detailed proposal for the modification of an aircraft, engine or propeller.

5.2.1.2 The Contracting State that has first taken responsibility for approval of a modification is designated as the State of Design for the modification, and by definition must have jurisdiction over the individual or organization responsible for the modification. A clearly identified State of Design is necessary to allow for the implementation of the responsibilities on continuing airworthiness of aircraft under Annex 8, Part II, Chapter 4.

### 5.2.2 Applicant

5.2.2.1 A person or organization (holder) to whom a Type Certificate was issued for an aircraft, engine or propeller can apply for an amendment of their Type Certificate. The holder is responsible for the type design of the complete aeronautical product, and is entitled under the privileges of their Type Certificate to introduce modifications to their type design, while still maintaining full responsibility for the complete product. It is also the privilege of a holder to request approval of their modification through



a supplemental approval (described in 5.2.2.2 below) instead of an amendment of their Type Certificate. The decision to pursue an amendment or supplemental approval is usually made by the holder.

5.2.2.2 A person or organization (non-holder) who does not hold the Type Certificate for the product can only apply for approval of their modification as a supplement to a Type Certificate, commonly referred to as an approval under a Supplemental Type Certificate (STC). An STC is an approval of only those aspects or areas of the aircraft, engine, or propeller that were modified. This is the primary reason why a non-holder of a Type Certificate is not eligible to apply for an amendment of a Type Certificate.

5.2.2.3 An applicant may be located within the geographical jurisdiction of a State of Registry (considered a local applicant) or located in another State (considered a foreign applicant). Annex 8 makes no distinction between local and foreign applicants, as both are required to demonstrate compliance of a modification to the appropriate airworthiness requirements of a State. A major consideration by a State of Registry in accepting a foreign applicant should be the existence of the State of Design for the proposed modification. Annex 8 recognizes that the State of Design has formal jurisdiction over the individual or organization responsible for the design change. Further, Annex 8, Part II, Chapter 4 specifically defines the relationship that should exist between the State of Design and a State of Registry to ensure the continuing airworthiness of aircraft. Therefore, a State of Registry should not commit to becoming the State of Design if a foreign individual or organization responsible for the design change falls outside their jurisdiction. The enforceability of national regulations or requirements for continuing airworthiness on foreign individuals or organizations should be assessed carefully. For this reason, some Contracting States require that the foreign applicant first secure their State's approval of their modification and apply for foreign approval through their CAA. Some States, in addition to the prior approval, also require bilateral arrangements to formalize roles and responsibilities between the State of Design and a State of Registry concerning the approval process and continuing airworthiness.

5.2.2.4 Some States require an individual or organization to first demonstrate competency by formally obtaining accreditation or designation from their CAA as an approved design specialist (known in some States as an approved design organization or individual, or of an equivalent status). This technical capability can be a function of the extent and complexity of the proposed design change and the nature of the substantiating data needed to establish and demonstrate compliance of the proposed modification with the applicable airworthiness and environmental standards. The design of major modifications to aircraft, engines or propellers should not be attempted unless the applicant has a sound knowledge of the design principles embodied in the aeronautical product being considered for modification. There may be cases where access to the analyses and test reports from the original type certification activity of the aeronautical product is needed in order to assess compatibility or suitability of the proposed design change. If this is the case, it is recommended that the applicant seek ways for the participation in, or review and comment on, the modification design by qualified representatives from the holder of the Type Certificate. Where such cooperation is not available, the responsible airworthiness authority should not approve the modification design unless it is confident that the applicant has:

- a) comprehensive knowledge, experience and capabilities in the applicable technologies, such that in-depth analyses can be performed where required; and
- b) sufficient information on the type design of the aircraft involved (if there is any doubt, consultation is suggested with the airworthiness authority of the State of Design).

### 5.2.3 Application for approval

An application for the approval of a proposed modification should be submitted in a form and manner prescribed by the CAA, and submitted to the ACD. Information on the proposed modification should include, as a minimum, the following:

- a) the name and address of the applicant to which the approval will be issued;
- b) the make and model of the affected aeronautical product (registration and/or serial number) and its Type Certificate number (or approval reference);
- c) the title, detailed description, and purpose of the proposed modification, including any changes affecting the noise and emissions level of the aircraft or engine;
- d) the type of approval requested (see guidance in Section 5.4.5.3 of this Part, *Issuance of Approval*);
- e) the proposed airworthiness standards, including environmental standards if applicable, to which the proposed modification is designed and with which it is intended to comply;
- f) documentation and/or substantiating data of the design change;
- g) for a local applicant, an indication on the need for a concurrent or subsequent approval by another State, and;
- h) for a foreign applicant, evidence of prior approval by the State that has jurisdiction over the individual or organization responsible for the modification.

*Note.— Some States of Registry require a foreign applicant to submit their application through their CAA, who then makes an application on their behalf. This procedure ensures that the State of Design is aware of the application and their corresponding responsibilities on continuing airworthiness under Annex 8 if the modification is eventually approved by a State of Registry.*

### 5.2.4 Validity period of an application

An application for an amendment of a Type Certificate or issuance of a Supplemental Type Certificate is normally subjected to a validity period prescribed by the CAA, within which the approval of the modification should be completed. For other forms of approval, a validity period may also apply, or not be applicable, depending on CAA policy. The validity period starts from the date of application up to a pre-determined number of years, the exact number being commensurate to the complexity of the review and approval of the proposed modification. For example, many States have a validity period of five years for applications involving modifications to large transport aircraft, and three years for modifications to engine or propellers. In cases where an applicant can show that his proposed modification requires a longer period for design, development, and testing, the CAA can approve a longer validity period. Or, if during the approval process the CAA believes that the approval will not be issued by the end of the validity period, the applicant should be requested to submit a new application or apply for an extension of the validity period. As a consequence of any extension granted to an applicant, the certification basis of the proposed modification should be reviewed again for currency or validity. The CAA and applicant should jointly review the potential impact or consequence of their extended validity period when requesting foreign validation of their modification.

### 5.2.5 Management of an application

An application is considered outstanding or open until an approval is finally issued, or denied by the CAA. Given that an application has to be completed within the validity period established in 5.2.5, the CAA may need to convene a review team that will administer the approval process and manage the actual approval activities involved in the application. The size of the review team will vary according to the complexity and magnitude of the proposed design change, and the extent by which the CAA wants to be involved. For a State which will first take responsibility for approval of a modification, thus becoming the State of Design, this team is expected to consist of expertise from both the ACD and AID necessary to do a complete and comprehensive review of compliance with the applicable airworthiness standards, and eventually submit a final recommendation to the CAA for either an approval or denial of an application. For a State of Registry which is considering a foreign-approved modification for its own purpose, this team is commonly referred to as the Validation Team. The functions of both teams are the same, i.e., to process an application for approval of a modification and provide a recommendation to their CAA. However, the activities of the Validation Team is expected to be limited in scope and depth, giving due recognition to the work being performed, or already done, by the State of Design of the modification.

### 5.2.6 Record-keeping of approval process

Records should be made and kept for each application that clearly identify, among other things, all decisions taken by the review team, the agreed certification basis of the modification, agreements reached, status of action items, tasking and deliverables of persons, and commitments on schedules. Copies of such records should be distributed promptly, as required, to all affected and concerned members of the team. Each item or subject discussed by the review team with the applicant should be summarized on record under a separate heading and the problem stated clearly, followed by any conclusions and recommendations. Persons required to take actions on specific matters by a critical due date should be identified clearly. Based on the knowledge of the proposed design change or potential safety problems obtained during the review process, those areas of the modification for which special attention is required should also be identified in the record.

## 5.3 Modification categories

### 5.3.1 General

5.3.1.1 Modifications are intended to change a function, operation, limitation, performance, and/or characteristic of the physical or functional element(s) of an existing aircraft, engine, and/or propeller for the purpose of achieving a desired feature, role or capability for the affected aeronautical product. Modifications will vary in design philosophy, application technology, complexity, and magnitude. The maintenance provisions of Annex 6, including the Type Certificate and continuing airworthiness requirements of Annex 8, specify that modifications must be approved by States, and could be interpreted as encompassing all modifications regardless of their varying nature. Depending on the civil aviation activity within a State, approving all modifications could overwhelm a CAA and require extensive technical resources to execute the approval process in a timely manner. For this reason, a majority of Contracting States have introduced a system for categorizing design changes as either a major modification or minor modification.

5.3.1.2 The general intent behind the categories is to optimise the CAA's resources by identifying those modifications that require their direct participation in the approval process, determining the kind of data needed to substantiate the modification, and establishing the type and form of approval (*see 5.4.5 of this Part, Approving the Modification*). Some States require their direct involvement and approval of both

major and minor modifications, while other States only require approval of major modifications. Also, the threshold or level that distinguishes a major from a minor modification may vary from State to State. It is up to each State to establish their national policy on approval of modifications.

5.3.1.3 An applicant seeking foreign approval of their modification should request their local CAA to consult foreign CAAs to clarify potential differences in the modification category, and consequently their approval requirements. In addition to airworthiness considerations, an assessment on the environmental standards of the aircraft or engine should be conducted to ensure that the approved noise and exhaust emissions levels remain within the approved limitations.

### 5.3.2 Major modification category

By definition, a major modification has an appreciable, or other than negligible, effect on the airworthiness of an aeronautical product. The CAA should evaluate the technical merit of each modification proposal and establish a clear understanding of the intended and/or consequential effect on the affected product. The intensity of such effect will vary with the complexity and extent of the proposed design change, but is generally recognized as falling under one of the following three levels, presented in order of decreasing effect:

- a) *Substantial Change*. A proposed change in design, configuration, power, thrust, speed limitations, or mass is so extensive that a substantially complete investigation of compliance with the applicable airworthiness standards is required. A design change at this level is generally viewed as having a technical scope and nature that the affected product, when modified, can be regarded as essentially a new product, i.e. there are differences in major design and/or production elements. Further, due to the extensiveness of the proposed modification, most of the existing substantiation of the product will no longer be applicable. Therefore, there is a need for a substantially complete, or complete, re-investigation of compliance of the new substantiating data with the applicable airworthiness requirements. For this reason, some States may consider this level of design change as enough to warrant an application as a new Type Certificate, rather than as a modification. The need for a new Type Certificate may not be obvious when the proposed modification is first submitted to the CAA. A substantial change to an aeronautical product may evolve from single extensive design change proposal, or from previous relevant design changes that incrementally evolved an aircraft, engine or propeller over a period of time. If at some point, during the application and/or approval process, a proposed modification is evolving into a substantial change, the CAA should cease the modification approval process, and require the application to become an application for a new Type Certificate (see Part III, Chapter 1 of this manual: *Type Certification*). Some examples of modifications that are generally regarded as substantial change are:
  - 1) in the case of aircraft, the modification involves change in the number or location of engines, change in the number of rotors, increase from subsonic to supersonic flight regime, change from high wing to low wing configuration, or change from an all metal aircraft to an all composite primary structure (fuselage, wing, empennage);
  - 2) in the case of an aircraft engine, the modification involves change in the principle of operation or use of different principles for propulsion; or
  - 3) in the case of propellers, the modification involves change in the number of blades or the principle of pitch change operation.

- b) *Significant Change*. A proposed change in the general configuration, principles of construction, assumptions used for the certification, or a combination of these, of a type certificated product but not to the extent to be considered a substantial change. A significant change in the general configuration are design changes that are likely to require a new product model designation to distinguish it from other product models. A significant change to the principles of construction are changes to the materials and/or construction methods that affect the overall product's operating characteristics or inherent strength. A significant change to the assumptions used for certification are changes to the product level assumptions associated with the compliance demonstration, performance, or operating envelope so different that they invalidate the original assumptions. The assessment of the effect of a significant change is made on the overall aircraft, engine, or propeller, rather than at the level of a part, component or system. A significant change usually results in a modified product that is distinct from other models of the same product, while still retaining common major design or production elements. Some examples of modifications that are generally regarded as significant changes are:
- 1) in the case of aircraft, the modification involves increase in the seating capacity, installation of floats or skids, conversion from passenger to freighter version, fuselage stretch, increase in design mass of more than 10 per cent, primary structure change from metallic to composite material, certification for flights into known icing conditions, or comprehensive flight deck upgrades;
  - 2) in the case of an aircraft engine, the modification involves use of new design fan blade and fan hub in a turbine engine, change in the containment case material, conversion from mechanical to electrical control systems, addition of a turbocharger, or conversion from spark-ignition to compression-ignition for piston engines; or
  - 3) in the case of propellers, the modification involves introduction of a different principle of blade retention.
- c) *Not Significant Change*. A design change whose effect on the product does not rise to the level of neither a substantial nor significant change. A Not Significant change remains a major modification, and should not be confused as equivalent to, or treated like, a minor change (see 5.3.3, *Minor Modification Category*). The effect of a Not Significant change is usually confined to a single area, system, or component of an aircraft, engine or propeller. Some examples of modifications that are generally regarded as Not Significant changes are:
- 1) in the case of aircraft, the modification involves general avionics upgrade, relocation of galley, installation of non-essential auxiliary power unit, substitution of one structural bonding method for another, installation of wheel skis, installation of quieter exhaust system, increase in fuel tank capacity, installation of new type passenger seats, or mass increase of less than 5 per cent;
  - 2) in the case of an aircraft engine, the modification involves change in oil tank design, fan blade re-design, software changes, bearing change, change in limits on exhaust gas temperature, change from one hydro-mechanical control to another hydro-mechanical control, change in crankshaft, or redesigned cylinder head, valves or pistons; or

- 3) in the case of propellers, the modification involves change in the material of the bearing or change to a component in the control system.

### 5.3.3 Minor modification category

By definition, a minor modification is a design change that has a negligible, or no appreciable, effect on the mass, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of the product. The accomplishment of minor modifications normally involves use of standard or generally accepted practices.

### 5.3.4 Emissions change category

The type certification of an aircraft and engine include compliance with, and certification to, the environmental standards of Annex 16, *Environmental Protection*. The demonstrated levels of noise and exhaust smoke and gaseous emissions for which an aircraft and/or engine were approved for purposes of issuance of a Type Certificate are those recorded in the Type Certificate Data Sheet. The intent of Annex 16 is to ensure that these recorded levels are maintained, or improved, throughout the operational life of the aircraft or engine. Where a modification is not intended to change the approved emissions limit of an aircraft or engine, an environmental assessment may be conducted, at the discretion of the CAA, to verify the unintended consequential changes to the approved emissions limit of the aircraft or engine. However, if the proposed modification is specifically directed at changing or improving the current emissions level of an aircraft or engine (such as retrofit of hush kits or re-engine programme), a re-certification is necessary to establish compliance with the applicable requirements. As part of an assessment of a modification as either major or minor, the proposed modification to emission levels should also be categorized as one or more of the following:

- a) *Noise Emissions Change*. Any change in the type design of an aircraft which may increase the noise levels of that aircraft;
- b) *Engine Emissions Change*. Any change in the type design of the engine which may increase the exhaust smoke and gaseous levels of that engine; and/or
- c) *Fuel Venting Change*. Any change in the type design of the aircraft or engine which may affect the certification related to prevention of intentional fuel venting into the atmosphere.

## 5.4 Approval activities

*Note.— Reference is made throughout this Section to the requirements of the State of Registry. When the State of the Operator is not the same as the State of Registry, it may be necessary to consider any additional requirements of the State of the Operator.*

### 5.4.1 General

5.4.1.1 The main objective of the approval process is for a State to determine for itself the overall compliance of a proposed modification with their applicable airworthiness and environmental standards, such that the affected aeronautical product, when modified, will continue to have a valid and approved type design. This objective applies to the State of Design and State of Registry, both having the

responsibility to establish satisfactory evidence of approval of modification of an aircraft that has been issued a Type Certificate and/or a Certificate of Airworthiness under Annex 8.

5.4.1.2 There are five (5) key activities associated with a modification, namely:

- a) Establishing a certification basis;
- b) Establishing the means or methods of compliance;
- c) Demonstration and findings of compliance;
- d) Approving the modification; and
- e) Post-approval activities.

## 5.4.2 Establishing a certification basis

### 5.4.2.1 General

5.4.2.1.1 The type certificate data sheet of an aircraft, engine or propeller identifies the detailed certification basis by which the type design of that product was approved. The major components of a certification basis are the airworthiness and environmental standards, including if any, special conditions of airworthiness, findings of equivalent level of safety, and exemptions. For most States, the approval procedure remains at ensuring that a modified aircraft, engine, or propeller continues to comply with the certification basis recorded in the type certificate data sheet. However, ICAO encourages States to undertake activities for enhancing safety in civil aviation and, among other things, promoting an airworthiness policy of approving modifications to a level of safety higher than that intended by its original certification basis. This policy requires that modifications demonstrate compliance with design standards that are in effect on the date of application, or with later amendments to the design standards recorded on the type certificate data sheet, whenever the State deems that such policy will result in a material contribution to the safety of the modified product and is practical (cost-effective and feasible). The effect of such policy is a progressive upgrading of the inherent levels of safety of products to the greatest extent practicable, as it undergoes several modifications throughout its service or operational life. For the purpose of this Section, only the procedures for implementing ICAO's Standards on modifications are discussed herein.

*Note.— It should be noted that beginning in 2003, several States of Design have codified into their national regulations a similar or equivalent airworthiness policy that makes it mandatory for significant changes (see Section 5.3.2 of this Part, Major Modification Category) to demonstrate compliance with the latest airworthiness standards, unless an exception could be justified to the CAA. The policy implementation may exclude certain types of aircraft or other modifications where the resulting increase in safety on the modified area(s) does not significantly enhance the overall safety of the complete aircraft, engine, or propeller. As an example, these States excluded applications to minor modifications, repairs, major modifications to appliances or components, or to Not Significant Design Changes. The exclusion may allow for continued compliance with the existing certification basis. Contracting States that implemented these procedures in their regulations refer to this requirement as the “Changed Product Rule”, or CPR.*

5.4.2.1.2 States which have not implemented the airworthiness policy discussed in 5.4.2.1.1 above may find that their modification approvals are not acceptable nor sufficient to those States who have elected to implement such policy, because of the potential difference in the approved level of safety. An

applicant intending to seek foreign approval of their modifications should be made aware of the differences in the approval requirements.

5.4.2.1.3 In the application for a modification approval, the applicant proposes the airworthiness and applicable environmental standards to which they intend to demonstrate compliance. Depending on the modification, additional airworthiness or operational requirements may be imposed by a State, or an applicant may be required to show that the product meets additional standards in order to receive approval in another State, due to differences in requirements. All these requirements are established collectively to become the certification basis for the modification. The applicant should participate in any ACD discussion concerning the proposed certification basis, but it remains the ultimate responsibility of the CAA to review, decide, and establish that the certification basis is appropriate for the proposed modification.

5.4.2.1.4 Once the certification basis has been established, it should be confirmed in writing by the ACD to the applicant and preserved throughout the validity period of the application (*see Section 5.2.5 of this Part — Validity Period of an Application*).

5.4.2.1.5 It should be noted that while the certification basis is established very early in the approval process, the final certification basis of a modified product may, in some cases, end up being different from that established initially. The difference(s) may come when the ACD issues special conditions of airworthiness (SC), findings of equivalent level of safety (FES), or an exemption. The need for the issuance of an SC, FES, or an exemption as part of the certification basis is usually identified by the applicant to the ACD at the beginning of the application process. However, this need may not be obvious at the beginning, and becomes evident only during the course of the actual approval activities. At the conclusion of the approval activities, the ACD should identify all SC, FES, exemptions and other voluntary compliance that transpired during the approval period in order that these activities may be recorded as part of the final certification basis.

#### 5.4.2.2 Airworthiness design standards

5.4.2.2.1 States should promote compliance with the applicable airworthiness design standards that are in effect on the date of application for a modification approval, meaning the latest amendment level. Airworthiness standards are amended from time to time to improve the overall level of safety inherent in these standards. At the time of application, it is generally regarded that the latest amendment level of a standard offers the highest level of safety for the product, and the intent is to certify the type design to this level. If after the application date subsequent amendments to the standards become available, the ACD should promote further enhancement of the level of safety by encouraging the applicant to voluntarily comply with those newer standards (*see 5.4.2.8 below, Elect to Comply*).

5.4.2.2.2 The CAA should assess the contribution to safety that can be realized by requiring a modification to comply with the latest airworthiness standards, and whether it will be practical at all. Consideration should also be given to allowing compliance with later amendments to the design standards recorded in the Type Certificate Data Sheet. The intent is to promote upgrading the level of safety of modified products to the greatest extent practicable. The merit(s) of each modification should be evaluated on a case-by-case basis and where an applicant can establish convincing substantiation, an exception to the requirement should be granted. It is the responsibility of the applicant to provide the ACD with a complete and detailed substantiation.

5.4.2.2.3 Paragraph 5.4.2.3 below offers some guidance on how States may conduct an assessment on the practicality and contribution to safety of requiring compliance with the either the latest



airworthiness requirements or with later amendments of the design standards recorded in the Type Certificate Data Sheet.

#### 5.4.2.3 Determining the appropriate amendment level of airworthiness standards

*Note.— The following material is provided to explain how the general ICAO airworthiness policy on enhancing the level of safety of modified products can be pursued in practice. However, some States may not apply this policy to certain types of aircraft or certain levels of modifications. The appropriate upgrading of the certification basis for a modified product could range, depending on the product, from a very simple assessment to a very complex balance between the safety benefit intended to be achieved and the limits imposed by practical considerations (e.g., economic impact assessments). Determination of the appropriate certification basis requires extensive knowledge and experience. This manual only provides a brief explanation of the approach so that the CAA and the applicant can recognize of the type of assessment and decision making process involved in determining the appropriate amendment level of airworthiness standards. Therefore, the intent of this paragraph is to provide general, introductory guidance only. Comprehensive guidance material on this subject exists and should be consulted in order to obtain a more complete understanding. This process commonly referred to as “Changed Product Rule” resulted from cooperative efforts of many CAA’s and aviation industry. (See also Note under 5.4.2.1.1)*

5.4.2.3.1 This section provides general guidance to States on the application of the ICAO airworthiness policy on enhancing the level of safety of modified products, as cited in this Part III, Chapter 5 – *Changes to Approved Type Design*, 5.4.2.1. The policy aims at progressively upgrading the inherent levels of safety of an aircraft, engine, or propeller, to the greatest extent practicable, as it undergoes several modifications throughout its service or operational life. In general, the policy requires that a modified product demonstrate compliance with the design standards that are in effect on the date of application (rather than with the original certification basis), or with later amendments to the design standards recorded in the product’s Type Certificate. The policy has two components – determining the type of modifications that can benefit the most from compliance with the latest design standards, and assessing if such compliance is cost-effective, meaning practical. The policy encourages incorporating the safety enhancements by giving due consideration to the resources or costs involved to achieve it.

5.4.2.3.2 Where compliance with the latest design standards is deemed to materially contribute to the overall level of safety of an aircraft, engine, or propeller, the next step is to further assess the cost-effectiveness of applying such policy. Demonstration of compliance entails costs, and both the applicant and CAA should assess if the incremental costs associated with demonstrating compliance with the latest design standards is commensurate with the incremental safety benefit to be gained. If the incremental safety benefit can be shown to economically justify the incremental costs, then the policy should be applied. Otherwise, the applicant should be allowed to continue complying with the design standards recorded in the existing certification basis of the product, or if the applicant chooses, with later amendments to those design standards. It is not the intent of this policy to improve safety regardless of costs.

5.4.2.3.3 Each proposed modification should be judged on its own merit when making the final determination of the certification basis. Also, the certification basis should not be dependent on whether the Type Certificate holder or an applicant for a STC is undertaking the proposed modification. The process applies equally to applications made for Type Certificate amendments, STCs, or STC amendments. The brief introduction to the steps in the process for determining the appropriate amendment level of airworthiness standards follows:

- a) *Identification of the proposed modification.* The applicant should identify/describe the proposed modification to the aeronautical product. The application for approval could involve a single modification or a collection of modifications. Changes to a product can include physical design changes, changes to an operating envelope, and/or performance changes. An applicant for a change to a type design should consider all previously installed modifications to the affected aeronautical product that are relevant to the proposed modification. It is important that the effects of the proposed modification on other systems, components, equipment, or appliances of the affected product are properly identified. The intent is to encompass all aspects where there is a need for re-evaluation, that is, where the substantiation presented for the product being modified should be reviewed, updated, or rewritten.
- b) *Determination if the proposed modification is considered a substantial change.* The question of whether a proposed modification is considered a Substantial change should be addressed at the beginning of the process. By definition, if the proposed change in design, power, thrust, or mass is so extensive that a substantially complete investigation of compliance with the applicable airworthiness standards is required, the ACD should require the applicant to apply for a new Type Certificate instead. A “substantially complete investigation” of compliance is warranted when it is determined that most of the existing substantiation is no longer applicable to the modified product. A new Type Certificate could be required for either an extensive modification, or for a new design that evolved or was derived through a series of previous relevant modifications, to a previously type certificated product. The need for a new Type Certificate may or may not be obvious when the proposed modification is first considered, and may need a more extensive evaluation by the ACD. If at any point, while developing the certification basis, it becomes clear that the proposed modification is a substantial change, then the application ceases to be a modification approval process and becomes a new type certification process under Part III, Chapter 1 – *Type Certification* of this manual.
- c) *Determination if the proposed modification is a Significant change.*
  - 1) Following a determination in b) above that the proposed modification is not a substantial change, the next step is to segregate Significant changes from other types of modifications considered excluded from the application of the airworthiness policy. Most States have determined that a significant change is an automatic candidate for requiring compliance with the latest design standards. Significant changes are typically product level changes and, by their very nature, distinct from the vast majority of major modifications. In general, a significant change is either the result of an accumulation of previous modifications or occurs through an isolated but extensive major modification that rises to a product level. A modification to a single area, system, or component of an aircraft, engine, or propeller will not likely result in a product level change.
  - 2) When assessing the proposed modification, the cumulative effect of previous relevant modifications in the areas related to the current proposal should be considered. For example, previous relevant aircraft design changes may address incremental increases in mass or thrust that, while individually not significant (for example, 2 per cent, 4 per cent, 5 per cent discrete increases) can, through a series of modifications, achieve a significant product level change. The collective and cumulative effects of previous modifications, along with the proposed modification, may result in the modified product being considerably different from the latest product or model. If this is the case, the proposed modification should be categorized

as a significant change. Typically, significant product level changes result in a model change necessitating an amendment to the Type Certificate or an STC that rises to a level similar to that of an amended Type Certificate. Applications for a new model designation that are not associated with hardware changes (that is commercial considerations) are not an indication of a Significant change. In cases of doubt, and to ensure a consistent outcome, the ACD should work closely with the applicant during this important step of categorizing the proposed modification.

- 3) The assessment performed under this step will result in the proposed modification being categorized under one of the following (refer to Part III, Section 5.3.2, Major Modification Category):
    - i) *Significant change.* The ACD assumes at this point that the proposed modification would have to demonstrate compliance with the latest design standards for all affected areas of the product. The next step is to assess whether such requirement is cost-effective (practical).
    - ii) *Not significant change.* The ACD should allow the proposed modification to demonstrate compliance with the existing certification basis of the affected product. The applicant may, however, volunteer to demonstrate compliance with later amendments to the design standards of the existing certification basis.
  - 4) The conclusion of this Step is the determination of the proposed modification as either “significant change” or “not significant change”. For a “not significant change”, the applicant and ACD can finalize the certification basis under g) below.
- d) *Determining whether the latest standards be used for all areas affected by the modification.*
- 1) The proposed modification, in its entirety, is considered a significant change (under step c) above), and by policy requires demonstration of compliance with the latest design standards for all areas affected by the modification. Where an applicant accepts to use the latest design standards for all affected areas, the full intent of the airworthiness policy is deemed to have been met. The applicant is also considered to have completed some form of self-assessment that supports or address the cost-effectiveness (or practicality) of their decision to comply with the latest design standards. No further justification is needed from the applicant, and the ACD records this decision and the process of establishing the certification basis is considered concluded.
  - 2) There may be cases where a significant change that requires compliance with the latest design standards may be too expensive (costly) to pursue, in contrast to the extra safety benefit to be gained. In this case, the costs of compliance may discourage the installation of modifications of potential safety benefits. The ACD and applicant should engage in a detailed review of each affected area of the modification to consider prior amendment levels to the latest design standards where the increased safety can be economically justified. This aspect is consistent with the airworthiness policy of encouraging upgrade of the level of safety of aeronautical products to the greatest extent practicable. The next steps explain the process of determining the appropriate certification basis.

e) *Determining if this is an affected area.* All areas affected by the proposed design change should comply with the latest requirements, unless the applicant shows otherwise under Step 6 that demonstrating compliance with such requirement would not contribute materially to the level of safety or would be impractical. The applicant should be provided an opportunity to discuss with the ACD the merits of complying with prior amendment levels to such design standards. The applicant has the burden of preparing and documenting data to support their argument for complying with other than the latest design standards. The ACD is obligated to review the data and ultimately establish the appropriate amendment level after considering the applicant's submission. The following process involves the identification of each physical and/or functional area of the aeronautical product that is affected by the proposed modification, and determining the appropriate amendment level (other than the latest) of the design standards that should be applied to each affected area. It is important that the effects of such change on other systems, components, equipment, or appliances of the product are properly assessed because areas that have not been changed may also be affected.

1) Affected areas of the modification generally cover the following:

i) *Physical aspects.* The physical aspects include, but are not limited to, structures, systems, equipment, components, and appliances (physical aspects can cover both "hardware" and "software"). When assessing the affected areas, it may be necessary to identify secondary changes resulting from the proposed product level change. Secondary changes may be changes in both physical aspects and/or performance characteristics that are part of, and consequential to, the overall product level change. An example of a secondary change may be the lengthening and re-routing of the various aeroplane cable or electrical circuits as a result of extending the fuselage length. The intent is to ensure that affected areas are not overlooked for purposes of determining a need for re-evaluation. Secondary changes, although considered an affected area, may be evaluated to the existing certification basis for the product being modified.

ii) *Performance/functional characteristics.* The less obvious aspect of the word "areas" covers general characteristics of the aeronautical product, such as performance features, handling qualities, emergency provisions, fire protection, structural integrity, aero elastic characteristics, or crashworthiness. These characteristics may be affected by a product level change. For example, extending the fuselage length significantly affects aircraft performance and handling qualities.

2) Not Affected areas of the modification can be generally described as any area, system, component, equipment, or appliance that is not affected by the proposed product level change. For a product level change, it is important that the effects of such change on other systems, components, equipment, or appliances of the product are properly assessed because areas that have not been changed may be affected.

f) *Determining if the latest standard contributes materially to the level of safety AND is practical.*

1) This step is an assessment process repeated as many times as there are affected areas. Typically, there are modifications that can achieve a positive safety benefit that are resource effective. Conversely, there are modifications that may achieve a small safety benefit at the expense of a large amount of resources to implement. The focus

of this step is to provide two assessment criteria that the ACD should use to arrive at the most appropriate amendment level of a design standard relative to the cost involved. This process is intended to be used along with good engineering judgment and a strong commitment to practicality. The applicant and ACD should strive to establish a certification basis that consists of either the latest design standards, or an amendment level higher than the existing certification basis. Although the ACD ultimately decides the certification basis, an appropriate amendment level (of a design standard) is where the applicant and ACD are both convinced that the safety benefits justify the resources involved.

- 2) Usually, it is determined that the latest standard contributes materially to the level of safety and is practical, considering the premise that the latest design standards offer the highest levels of safety. The process is generic but very subjective, and differs only in the technical details and design standards being assessed for the affected area (for example, modifications to the passenger cabin will require an assessment of the various cabin safety requirements that apply, and the different amendment levels of those standards). In order for an applicant to demonstrate compliance with design standards other than the latest (existing certification basis or later amendment levels), the ACD should be convinced that the latest standard does not contribute materially to the level of safety and is practical. The qualifiers for the two criteria are provided below.
  - i) *Not contributing materially to the level of safety.* Compliance with the latest design standards could be considered to not contribute materially to the level of safety if the proposed design and relevant service experience can demonstrate that a level of safety comparable to that provided by the latest design standards can be achieved, or if compliance may compromise the existing level of safety for that particular modified product. The applicant should provide sufficient justification to allow the ACD to make this determination. Some of the factors that can be assessed for this purpose are:
    - (a) *Design.* This aspect considers the consistency of the proposed design. For example, when a fuselage structure is extended by adding a small section, additional seats and overhead bins are likely to be installed, and the lower cargo hold extended (affected areas). The new components to be added may be identical to the existing components. The level of safety may not be materially increased at the product level by applying the latest design standards only to the added fuselage length, since the entire modified product may not be any safer than the original design. Similarly, there may be no safety benefit in applying earlier amendments to the latest design standards to both the new and changed components. In this case, it may be acceptable for the affected areas to demonstrate compliance with the existing certification basis.
    - (b) *Service experience.* This aspect recognizes the use of relevant service or operating experience, such as fleet hours performance or reliability statistics, to demonstrate that compliance with the latest design standards may not contribute materially to the level of safety, and as such the use of other than the latest design standards may be appropriate. The service experience levels necessary to demonstrate the appropriate level of safety as they relate to the proposed design change would have to be reviewed and agreed to by the DCA.

- (c) *Effectiveness of latest design standards or prior amendment levels.* A design standard is intended to address specific hazards. The effectiveness of a specific design standard to address the hazard(s), from minimizing its effects to eliminating the source, will vary with its amendment history. The proposed modification should be evaluated for its ability to comply fully with the requirement, giving consideration also to the effectiveness of the design standard to address the hazard(s). The effectiveness of the design standards at various amendment levels (beginning with that of the existing certification basis) should be estimated, and the safety benefits of complying with various levels should be compared to that achieved by complying with the existing certification basis.
  - ii) *Not Practical.* Compliance with the latest design standards may be considered not practical if the applicant can substantiate that it would result in additional resource requirements (incremental costs) that are not commensurate with the safety benefits to be gained. The incremental costs are those that would be incurred beyond the basic costs of demonstrating compliance with the existing certification basis, and could include additional design changes to the proposed modification required for compliance and the effort required to demonstrate such compliance. Substantiating data and analyses should support an applicant's position that compliance is not practical, and the ACD should agree with this position.
- 3) The conclusion of the process in this step should be documented by the ACD, including all the substantiating data submitted by the applicant. Examples of possible conclusion for each affected area would include, but not be limited to:
  - i) Compliance with the latest requirement is necessary. The applicant would pursue the affected area at the latest amendment level.
  - ii) Compliance with an amendment level between the existing certification basis and the latest design standard would adequately address the hazard at an acceptable cost. Complying with the latest amendment level would not be practical. The applicant would then propose the intermediate amendment level of the requirement.
  - iii) The increased level of safety is not commensurate with the increased costs associated with meeting the latest amendment instead of the existing certification basis. Therefore, the applicant would propose the existing certification basis.
  - iv) The results of the assessment were inconclusive. Further discussions with the applicant are warranted.
- g) *The Certification Basis of the proposed modification is finalized.* The certification basis of the proposed modification can now be finalized, and may consist of a combination of the latest design standards, the design standard of the existing certification basis, or an intermediate level between the existing and the latest design standards. Areas of the aircraft, engine or propeller that are considered unchanged or not affected by the proposed modification can continue to comply with the existing certification basis (i.e. there is no need to re-visit the certification basis).

*Note. Appendix A provides a high-level illustration of the common assessment process followed by most States in determining the appropriate amendment level of the airworthiness standards for a modified product.*

#### 5.4.2.4 Environmental Standards

The applicable environmental Standards for a modification of an aircraft or engine are described in Annex 16 — *Environmental Protection*. States that have not adopted or accepted Annex 16 as their environmental standards may use other standards provided it is at least equal to the stringency of Annex 16.

*Note.— Some States assign the responsibilities for establishing, and finding compliance with, the environmental standards to another government organization, and not necessarily to their ACD. States should ensure that both the environmental and airworthiness certifications are addressed at the conclusion of the modification approval process.*

#### 5.4.2.5 Special conditions of airworthiness

Annex 8, Part II, 1.2.3 and 1.2.4 refer to the use of additional technical requirements where design features of a product render a certification basis inadequate. This requirement applies beginning with the original type certification of an aircraft, engine, or propeller and for any subsequent design changes to these aeronautical products. The common instrument used by many States for this purpose is the special conditions of airworthiness (SC). A SC should be issued when the ACD finds that a proposed modification incorporates novel or unusual design features and the applicable airworthiness standards do not contain adequate or appropriate safety standards for certifying such feature. For example, the airworthiness standards may only contain provisions for use of metal for structural parts, and therefore a proposal to use composite materials will be novel or unusual to the standards. The phrase “novel or unusual” applies to the design features of the proposed modification when compared to the applicable airworthiness standards. The existing certification basis of an aircraft, engine, or propeller being considered for modification may already contain special conditions of airworthiness (SC), either from the original type certification activity or from previously incorporated modifications. The applicant and ACD should assess the impact of a proposed modification on an existing SC and, as appropriate, amend it or issue a new one. A SC should contain only such additional airworthiness standards for the novel or unusual features as are necessary to establish a level of safety equivalent to that intended by the certification basis established for the modification.

#### 5.4.2.6 Finding of equivalent level of safety

A finding of equivalent level of safety (FES) is not an additional airworthiness requirement by itself, but rather a finding of compliance with the intent of an airworthiness standard(s). Usually, the applicant will identify to the ACD very early during the application process of a need for an FES against certain airworthiness standards, attributed to a peculiarity in the proposed modification. Once a need for an FES is established, whether early in the programme or later, the ACD should identify and record all FES as part of the certification basis for the modification. The existing certification basis of an aircraft, engine, or propeller being considered for modification may already contain FES, either from the original type certification activity or from previously incorporated modifications. The applicant and ACD should assess if a proposed modification will invalidate or alter the basis of an existing FES and, as appropriate, amend it or issue a new one. The level of safety to be established under an FES should be equivalent to that intended by the certification basis established for the modification.

#### 5.4.2.7 Exemption

5.4.2.7.1 A request for exemption is a proposal that a non-compliance with a specific certification requirement can be allowed. A request for exemption must be based on convincing evidence that granting the exemption relief will not adversely affect safety and that the requirements for environmental protection are still met. A request for exemption may be denied, partly granted, or granted by the CAA. An exemption is usually issued with specific condition(s) to ensure that granting such relief will maintain an acceptable level of safety and that the requirements for environmental protection are still met. For any proposed modification involving a request for exemption, the possibility of a FES should be considered prior to accepting a request from the applicant for exemption from a specific airworthiness standard.

5.4.2.7.2 The existing certification basis of an aircraft, engine, or propeller being considered for modification may already contain an exemption, either from the original type certification activity or from previously incorporated modifications. The applicant and ACD should assess the impact of granting an exemption against an affected airworthiness standard for which compliance was demonstrated prior to the proposed modification. The assessment should consider the overall degradation that an exemption could potentially cause on the overall aircraft, engine, or propeller level of safety, rather than just on the affected areas of the proposed modification. Any grant of exemption by a CAA on a modification should be identified and recorded as part of the certification basis.

#### 5.4.2.8 Elect to comply

Airworthiness standards are mandatory requirements. However, there may be aspects of the standards that are not enforceable because they are offered as an optional provision (for example, ditching provisions). The decision to avail of an optional airworthiness provision rests with the applicant, and not the ACD. In addition, an applicant may elect to comply with recent amendments to the airworthiness standards that only became available after submission of the application for modification approval. “Elect to comply” in this context means a voluntary act by the applicant to include these optional standards as part of the proposed certification basis. Once the “elect to comply” items have been accepted and established by the ACD as part of the certification basis, demonstration of compliance is mandatory and not an applicant’s option. In both cases where the applicant elected to comply with later amendments or with optional airworthiness provisions, the ACD should identify and record this “elect to comply” items as part of the certification basis.

#### 5.4.2.9 Other compliance considerations

An applicant may wish to obtain validation of its proposed modification by another States(s) at the same time it is obtaining the original approval. This is an option solely up to the discretion of the applicant as long as it can be supported at the time by the State of Design. If such validation takes place, the validating State may establish additional requirements, beyond those of the State of Design, that are a part of its type certification requirements. These might include:

- a) Design-related operating requirements, where the operating rules may influence either the design features of the product or data on the design relating to the operations of the product that make it eligible for a particular kind of operation in a State; or
- b) Additional technical requirements arising from, differences in airworthiness and environmental standards, differences in interpretation of the same standards, mandatory



airworthiness action taken by a State to correct known or identified unsafe conditions and, other conditions concerning airworthiness that are necessary for the products (aircraft, engine, propeller) to comply with the laws, regulations, standards, and requirements of the Importing State.

The additional requirements from the validating States are not included in the type certification basis for the State of Design's approval, but become a part of the type certification basis for the validating State's Type Certificate. The State of Design need not agree with the additional requirements, but it should determine compliance with them if asked by the validating State. The State of Design should notify the validating State of any situations where it finds that the additional requirements are not compatible with the certification basis of the State of Design.

### 5.4.3 Establishing the means of compliance

#### 5.4.3.1 General

It is the sole responsibility of the applicant to demonstrate compliance of the proposed modification with the certification basis established by the ACD (*see Section 5.4.2 above Establishing A Certification Basis*), in accordance with the means or methods accepted or agreed to by the ACD. In order to manage this aspect during the modification approval process, and before an applicant commits to any compliance action, it is necessary to agree on a certification compliance plan that clearly identifies the types of action to be applied against each item of the certification basis. The majority of States (Design or Registry) find it necessary to have a compliance plan. The certification compliance plan can be an effective tool in managing the certification programme by providing an early understanding of what is required to achieve approval and, assist in the identification of approval problems early in the programme.

#### 5.4.3.2 Means of compliance

The means of compliance is usually dictated by the specific item of the certification basis, and generally fall into one or any combination of the following:

- a) *Test* – is performed when the requirement explicitly calls for a demonstration by test (physical, actual or simulation). Examples of test are flight test, ground test, fatigue test, simulation, fire or flammability test, environmental test (e.g. salt spray), functional test, bird strike test, and engine ingestion test.
- b) *Analysis* – is performed when the requirement explicitly calls for a demonstration by analysis (qualitative, quantitative, or comparative), or when the applicant can demonstrate, based on previously accepted test results, the validity of using analysis in lieu of testing. Examples of analysis are failure modes and effects analysis, flight performance data reduction and expansion, structural loads analysis, and software evaluation.
- c) *Inspection or Evaluation* – is performed against an item that does not require test or analysis, but relies on observation, judgment, verification, evaluation, or a statement of attestation from the applicant or its vendors/contractors.

### 5.4.3.3 Certification compliance plan

5.4.3.3.1 The certification compliance plan is the primary document in the modification approval process that serves both as a checklist and official record of compliance. The applicant should prepare a certification compliance plan and establish its contents with the agreement of the ACD. The certification compliance plan should, as a minimum, contain the following information:

- a) itemized breakdown of the certification basis;
- b) identification of items of voluntary compliance (elect to comply);
- c) proposed means of compliance for each item (test, analyses, inspection, or combination of these, or finding of equivalent level of safety);
- d) lists of tests to be conducted;
- e) identification of substantiation reports to be submitted (as proof of compliance);
- f) identification of persons responsible for making findings of compliance;
- g) the level of involvement of the ACD, the applicant, or a delegate of the ACD in the findings of compliance or witnessing of tests; and
- h) modification project schedule, including the applicant's milestones and when final approval is expected.

5.4.3.3.2 Tests, analyses, and inspections are expensive in terms of cost and time. Applicants should, therefore, seek concurrence from the ACD that their proposed means of compliance with the certification basis are acceptable. The acceptance of the means, however, is not an acceptance of the data in advance, it is merely a recognition of the means as satisfactory for the demonstration of compliance. The Certification Compliance Plan, although initially agreed to by the ACD, is a living document whose contents may change (the structure and format will remain the same) throughout the course of modification approval process. Some of the possible sources of change to this document are as follows:

- a) design changes due to refinements or development;
- b) revised or alternate means of compliance;
- c) changes in level of involvement of the ACD and applicant;
- d) changes to the certification basis caused by the issuance of special conditions of airworthiness, or exemptions, and
- e) other issues affecting the design or approval that modify any of the aspects of the certification plan.

5.4.3.3.3 The activities involving demonstration of compliance should not begin until after a certification compliance plan has been agreed to between the applicant and ACD. The original (or master) copy of the certification compliance plan is retained by the ACD until completion of the modification approval activity. Upon completion of the programme, the plan can be the official certification compliance record for the modified product.

#### 5.4.3.4 Level of involvement

Some CAAs have regulations that allow delegation of some or all of their functions, duties or powers to qualified individuals or organizations. The responsibilities assigned by the regulations to a CAA, however, cannot be delegated and always remain with the CAA. Under a delegation system, appropriately qualified individuals or organizations may be granted permission or authority to make a finding of compliance on behalf of their CAA. A finding of compliance by a delegate is a finding of compliance by the CAA. As such, an administrative procedure should exist for the recording of the finding of compliance by the delegated individual or organization. Some findings of compliance, however, may be the exclusive responsibility of the ACD and can not be delegated, or that the ACD may limit a delegate to making recommendations only instead of making a finding of compliance. If the applicant proposes to utilize delegated persons or organizations in the modification approval programme, the exact role of these delegates should be clearly identified in the certification compliance plan and agreed to by the ACD. The levels of involvement of the ACD, applicant and delegates will be defined by the CAA's delegation system, taking into account such factors as limitations of the delegates, complexity of the modification, availability of technical resources, and time constraints of the modification approval project.

#### 5.4.4 Demonstration and finding of compliance

##### 5.4.4.1 General

Annex 8, Part II, 1.3.1 and 1.3.2 specify that proof of compliance with the design aspects of the airworthiness requirements be established through the approval of the type design and the performance of necessary inspections and ground and flight tests. In the certification compliance plan, the means of demonstrating compliance (test, analysis, or inspection/evaluation) and the levels of involvement (applicant and ACD) are already specified for each item of the certification basis. The applicant is responsible for demonstrating compliance through the agreed means, while the ACD is responsible for making a finding of compliance on the means demonstrated. Both demonstration and finding of compliance should be recorded against each item in the plan, as evidence of a successful completion. The implementation of the plan is the joint responsibility of the applicant and the ACD, however, the applicant is responsible to meet their milestone in the modification approval schedule contained in the certification plan.

##### 5.4.4.2 Demonstration of compliance

5.4.4.2.1 The demonstration of compliance requires that the applicant submit substantiating data (design data, reports, analysis, drawings, processes, material specifications, operations limitations, flight manuals, instructions for continued airworthiness, etc). The data should be complete and in a logical format for review by the ACD. Where the demonstration of compliance involves a test, a test plan should be developed and approved prior to any actual test being performed. Official certification tests are witnessed by ACD personnel or by an ACD delegate, when authorized.

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

5.4.4.2.3 If the applicant elects to comply with optional certification items or later amendments of the airworthiness standards for the purpose of obtaining credit in the certification basis, the demonstration of compliance for both cases is mandatory, and is not subject to any exemption.

5.4.4.2.4 Where a demonstration of compliance is to be made using a finding of equivalent level of safety, the applicant should provide sufficient justification to the ACD that describe the design feature, action taken (i.e. compensating factor), and how such action provides an equivalent level of safety to that intended by the applicable airworthiness standard.

#### 5.4.4.3 Finding of compliance

Findings of compliance are made against airworthiness and environmental standards, including special conditions of airworthiness and request for equivalent level of safety. The finding of compliance can be made by the ACD, or by its authorized delegate, depending on the pre-defined levels of involvement in the certification plan. Following a successful demonstration of compliance by the applicant on a certification item, the ACD should make a finding of compliance and subsequently sign-off the item in the certification plan. The findings are usually accomplished by the ACD through one or any combination of the following actions:

- a) *Acceptance of substantiating data.* Reports, analysis, drawings, or similar documents are usually produced against each certification item and should be reviewed and accepted. Specific attention should be paid to the methodology and assumptions, rather than the detailed calculations or analysis.
- b) *Witnessing of Test.* Tests are performed, and witnessed by the ACD where required or agreed to, in accordance with an approved test plan. The test should be conducted only after conformity with the test plan has been established for the test articles, test environment and test facilities. The ACD does not take part in the actual performance of the non-flight test, and should remain impartial and concentrated on the test objective. For flight testing, the ACD or its delegate may perform the flight testing.
- c) *Engineering inspection.* Any aspect of the type design, for which compliance with the certification item cannot be determined through review of drawings or reports, should receive an engineering compliance inspection. An engineering compliance inspection is to assure that an installation, and its relationship to other installations on a product, complies with the design requirements.
- d) *Conformity inspection.* Where required, should be performed by the AID to verify conformity of the modified product with drawings, specifications, and special processes. An engineering inspection should not be confused with a conformity inspection. A conformity inspection is done to determine conformity to the engineering data, while an engineering compliance is done to determine compliance with the certification requirement.
- e) *Flight Test.* For aircraft, an actual demonstration of flight capabilities and characteristics in accordance with an approved flight test plan.

#### 5.4.4.4 Non-compliance

The ACD should notify the applicant in writing of any non-compliance found during the process of data review, inspections, ground and flight tests and, if it becomes necessary, the discontinuance of official type certification tests. The applicant should advise the ACD when the non-compliance finding has been resolved or when the cause of the discontinuance of the tests has been corrected and a resumption of the type certification tests is requested. The identification and resolution of non-compliance items should be properly documented and kept part of the record for the modification approval project.

#### 5.4.5 Approving the modification

##### 5.4.5.1 General

All findings of compliance made by the ACD, or its delegate, should be recorded or annotated in the certification compliance plan. When the applicant has demonstrated compliance, and the ACD has found full compliance on all items of the certification basis, including the resolution of outstanding items, the plan is signed off and becomes the official compliance record for the modification project. The certification compliance record serves as the satisfactory evidence specified under Annex 8, Part II, 1.3.4 for the approval of the modification. The approval of the modification means that:

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

##### 5.4.5.2 Withholding approval of the modification

There may exist a situation, although rare, where an applicant successfully demonstrated, and the ACD found, compliance with the certification basis but a known or suspected feature makes the modified aeronautical product unsafe, taking into account the category in which certification was requested. Notwithstanding the entitlement of the applicant for an approval, the ACD has a responsibility under Annex 8, Part II, 1.3.3 to withhold the approval or issuance of an approval for an aircraft if it is known or suspected to have developed unsafe features after the modification, that are not specifically guarded against by the certification basis. The modification approval shall be denied if the applicant fails to correct the unsafe feature.

##### 5.4.5.3 Issuance of approval

5.4.5.3.1 Most Contracting States will grant approval of a major modification using one of the three forms of approval below, provided the proposed modification is not so extensive as to require a new Type Certificate (*see Section 5.3 above, Modification Categories*). Depending on the applicant's eligibility, the form of approval for the proposed modification is usually indicated by the applicant at the time of application (*see Section 5.2.2 above, Applicant Eligibility*). Also, a majority of Contracting States grant approval of minor modifications using a less formal process, as a way of expediting the approval process

for modifications that do not necessarily rise to the complexity and demand for resources like those of major modifications. Annex 8 does not specify the exact form for recording an approval of a modification, but the formal practice by most States is to record the approval through an amendment of a Type Certificate or to issue a document called Supplemental Type Certificate (STC). Regardless, all three forms of approval fulfill the requirements of Annexes 6 and 8, that the State of Design or a State of Registry approve the modification. The only difference between these approvals is the form by which the approval is recorded. Note, however, that some States of Registry may only accept or recognize, for their purpose, a foreign modification that was approved using an amended Type Certificate or STC.

- a) *Amendment of a Type Certificate.* Approval of design changes made by the holder of a Type Certificate. An amendment of a Type Certificate retains the holder's overall responsibility for the type design of an aircraft, engine or propeller, both as approved under the initial Type Certificate and as modified. Common examples of design changes leading to an amendment of a Type Certificate may be the addition of a new model designation or derivative of an aircraft, engine or propeller, the revision of operating conditions or limitations listed in the Type Certificate data sheet, or changes to aircraft passenger or cabin configuration.
- b) *Supplemental Type Certificate.* A Supplemental Type Certificate is an approval of a major modification covering those areas or aspects of an aeronautical product that were modified. Together, the Supplemental Type Certificate and the relevant Type Certificate constitute the approved type design for a modified aircraft, engine, or propeller. It should be noted that an aeronautical product that does not have a Type Certificate can not be issued a modification approval under a Supplemental Type Certificate (examples are appliances, parts, components, instruments). Further, a Supplemental Type Certificate should not be issued for approval of minor modifications, or approval of replacement parts or repair, unless its installation represents a modification. Appendix B provides a sample Supplemental Type Certificate form.
- c) *Other approvals.* For modifications that do not warrant the detailed approval process of an Amended or Supplemental Type Certificates, States may consider other means of granting approval. Such means of approval may be administered by delegated individuals or organizations with demonstrated technical competence, and reported to the CAA under an administrative reporting system for purposes of regulatory oversight. Modifications that are candidates for this approval category typically involve on-demand design changes by aircraft operators, maintenance and/or design organizations, and manufacturers to support varying maintenance and operational needs under time constraints. Examples of modifications that can be approved under this category are: Product improvements by manufacturers (introduced through service bulletins), airline-type modifications relating to operational reliability or passenger configuration changes, repair design, field-type modifications that do not involve extensive or multi-discipline engineering analysis. The types of design changes that can be approved using this other means should be decided by each State according to their resources, delegation policy, and the level of modification activity within their civil aviation industry.

5.4.5.3.2 The person or organization (holder) to whom the modification approval was granted has responsibility for the approved design change. If multiple participants (e.g. joint design ventures, partnerships, sub-contracting or similar arrangements) are involved in the modification, the CAA will require one person or organization to be responsible for the overall design change, and to whom the approval will be issued.

5.4.5.3.3 An approval granted for a modification (amended Type Certificate, Supplemental Type Certificate or other approvals) shall remain valid until otherwise specified or notified by the issuing CAA.

#### 5.4.5.4 Providing evidence of approval

5.4.5.4.1 States should require all holders of modification approvals to provide clients or customers of a copy of the CAA approval, or provide a declaration that a modification is CAA-approved. The person or organization performing the installation of a modification on an aircraft, engine, or propeller has a responsibility to ensure that modifications are in accordance with approved data. Providing a copy, or making a declaration, of the CAA approval facilitates the fulfillment of an aircraft Operator's responsibility under the Maintenance provisions of Annex 6 to retain details of modifications and evidence of its approval.

5.4.5.4.2 States should also require the certification basis of an approved modification be identified and listed as part of the approval document. The detailed certification basis should list the specific airworthiness standards for which compliance with a higher level of amendment were shown (amendment levels higher than those recorded in the Type Certificate data sheet). Providing such detailed recording of the certification basis will facilitate the identification of the current level of safety of a modified product, allowing future proposed modifications to retain or further upgrade it.

#### 5.4.5.5 Documents necessary for a modified product

The conditions and limitations of the approved type design, as initially type certified by the State of Design, are specified in the original Type Certificate data sheet. This information is part of the Type Certificate and is mandatory for the safe operation and continued airworthiness of the aircraft. If the approved modification changes any of the information identified in this manual under Part III, Chapter 1, Section 1.3.5.5, *Documents Necessary for Approved Type Design*, the applicant should prepare the appropriate revisions to this information and submit to the CAA for approval or acceptance. Following approval by the CAA, the revised information should be published in a form and manner prescribed by the CAA and subsequently provided as part of the modification approval documentation.

*Note.— The publication of CAA-approved data in any document furnished to aircraft Operators should provide for the clear identification or distinction of such approval when such document also contains other data or information accepted or not approved by the CAA.*

#### 5.4.5.6 Documents necessary for operation of a modified aircraft

Other information necessary for the safe operation of the aircraft under Annex 6 were developed concurrently with type certification of the aeronautical product. If the approved modification changes any of the information identified under Part III, Chapter 1, Section 1.3.5.6 of this manual, *Documents Necessary for Operation of Aircraft*, the applicant should prepare the appropriate revisions to this information and submit to the CAA for approval or acceptance. Following approval by the CAA, the revised information should be published in a form and manner prescribed by the CAA and subsequently provided as part of the modification approval documentation.

## 5.5 Post-approval activities

### 5.5.1 General

The State of Design of a modification (i.e. State that first gave the initial approval) has responsibilities under Annex 8 to provide continuing airworthiness support to the State of Registry (i.e. a State that incorporated the modification on its products). The CAA of both States and the holder of the modification approval fulfill this responsibility through a system of receiving, and exchanging information, surveillance, assessment of service difficulty experiences, and development of the necessary airworthiness actions. Annex 6 states requirement for detailed record-keeping of modifications and evidence of compliance with the appropriate airworthiness requirements. (Also see 4.4.2.1.6 and 4.4.2.1.7 of this Part)

### 5.5.2 Retention of design change data

The data constituting the design change are contained in records, reports, drawings, and other documents that describe collectively the exact configuration of the design change when it was approved. The design change data must be maintained by the CAA or the holder of the modification approval, or both. The CAA should determine the eligibility and type of data to be maintained by the modification approval holder. In either case, it should be recognized that the design change records are permanent and may not be destroyed. Data maintained by the modification approval holder must be made available to the CAA for such routine activities as production inspection, surveillance, design change reviews, development of corrective actions, or for any other reasons deemed necessary by the CAA. The record-keeping should consist of at least the following:

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



### 5.5.3 Responsibility of holder of modification approval

The holder of the modification approval remains responsible for the continued integrity of the design change to approved type design and it or its representative must continue to be the CAA's contact point for resolving issues that may require corrective action. To fulfill this responsibility, the holder should have the continued capability, or access to a capability, of providing appropriate technical solutions for service difficulties when service experience warrants it, or when the CAA requires mandatory corrective action. If the holder is no longer capable, the CAA must take action in accordance with Section 4.2 of Part III of this manual, *Interpretation of the Organization Responsible for the Type Design*. If the approval is transferred to another holder, the CAA should ensure that the new holder is capable of fulfilling the minimum responsibilities described herein.

### 5.5.4 Continuing airworthiness

Annex 8, Part II, Chapter 4, prescribes the activities and corresponding responsibilities of a State of Design, the States of Registry, and the modification approval holder in ensuring the continued airworthiness of an aircraft during its entire operational or service life. Service experiences involving faults, malfunctions, defects and other occurrences that may affect the continuing airworthiness of the aircraft are required to be recorded, reported, and assessed under Annex 8, Part II, Section 4.2. This information is used to determine if an unsafe or potentially unsafe condition exists in an aircraft. The State of Design, States of Registry, and the modification approval holder all play important roles in deciding if and when airworthiness action is needed to either correct an unsafe, or avoid a potentially unsafe, condition. See guidance in Chapter 4, *Continuing Airworthiness of Aircraft*, of this manual.

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**APPENDIX A.— FLOW CHART OF PROCESS FOR DETERMINING  
AIRWORTHINESS STANDARDS FOR A MODIFIED PRODUCT**

APPENDIX B.— EXAMPLE OF A SUPPLEMENTAL TYPE CERTIFICATE

*Contracting State  
Civil Aviation Authority*

**Supplemental Type Certificate No. \_\_\_\_**

Pursuant to Civil Aviation Regulations Number \_\_\_\_\_ of Contracting State,  
this Supplemental Type Certificate is issued to:

*Name of Holder*

*Complete Address of Holder*

**For the following**

**Description of design change:**

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**Affected Type Certificate Number** \_\_\_\_\_

**Product make and model** \_\_\_\_\_

**Limitations and conditions of approval** (*See Continuation Sheet*):

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**Date of application:**



**Conditions:** This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated will not adversely affect the airworthiness of the modified product.

\_\_\_\_\_  
**Authorized Person – Civil Aviation Authority**

\_\_\_\_\_  
**Date of Issue**

*Contracting State  
Civil Aviation Authority*

**Supplemental Type Certificate No. \_\_\_\_\_**  
(Continuation Sheet)

**Certification Basis:**

Based on Part XX, and the Contracting State policy for major design changes, the certification basis for the Aircraft Model \_\_\_\_\_, as modified is as follows:

- a. The type certification basis for Aircraft Model \_\_\_\_\_ series airplane is shown on Type Certificate Data sheet \_\_\_\_\_ for parts or areas not affected or changed by the modification.
- b. The certification basis for parts affected or changed by the modification since the date of application (mm/dd/yy) is based upon Part XX, as amended by Amendment XX-98. The certification basis for this modification was determined to be:

Regulations at the latest amendment XX-0 through XX-98  
XX.1 – XX.31, XX.301-XX.307, XX.561-XX.563, XX.601-XX.625

Regulations at an intermediate amendment  
XX.574 Amendment XX-54  
XX.629 Amendment XX-26  
Appendix X Amendment XX-58

Regulations at the amendment level in TCDS \_\_\_\_\_  
XX.25, XX.321-XX.373, XX.471-XX.519

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## CHAPTER 6.— REPAIRS TO APPROVED TYPE DESIGN

### 6.1 General

6.1.1 A Certificate of Airworthiness issued under Annex 8 is based on satisfactory evidence that an aircraft complies with a type design approved or accepted by a State of Registry. For aircraft engaged in international civil aviation, the recognition and acceptance of a Certificate of Airworthiness is facilitated through Article 33 of the Convention on International Civil Aviation. A State of Registry claiming such recognition, however, must ensure that there exists a national requirement for ensuring the continued airworthiness of an aircraft during its service life. This national requirement involves the aircraft owner or operator and the CAA in ensuring that the aircraft continues to conform to its approved type design after a modification, repair, and installation of a replacement part. For further details on continuing validity of the Certificate of Airworthiness, refer to Annex 8 Part II, Chapter 4, *Continuing Airworthiness of Aircraft* and in this guidance material Part III, Chapter 3.

6.1.2 An aircraft will experience accidental damage, wear and tear, environmental deterioration, fatigue, malfunction, and failure during its operational life. Repair is a corrective action intended to restore an aircraft back to its approved type design and, is regarded primarily as a maintenance function. If a repair design is needed, the State of Registry has an obligation under Annex 8 to approve the repair design, as a way of ensuring that the aircraft will continue to comply with the design aspects of the airworthiness standards used for the type certification of that aircraft. An unapproved repair design could render a Certificate of Airworthiness invalid for international flights. The relationship between repair to an approved type design and the Certificate of Airworthiness is explained further by the following three (3) requirements that form part of several general provisions on Maintenance in Annex 6:

- a) An operator must ensure that the Certificates of Airworthiness on aircraft they operate remain valid.
- b) An operator must keep records of appropriate details of repairs incorporated on aircraft.
- c) Repairs shall comply with the airworthiness requirements of the State of Registry, and procedures shall be established to ensure the substantiating data supporting compliance with the airworthiness requirements are retained.

6.1.3 Accomplishing a repair on an aircraft may involve such actions as performing maintenance or servicing procedures, replacing a defective part with a like serviceable unit or with an approved substitute part, or designing and incorporating a repair scheme. Generally, the documents encompassing the instructions for continued airworthiness (ICA) such as, but not limited to, maintenance manuals, servicing instructions, overhaul manuals, and repair manuals contain adequate maintenance procedures that are recognized by Contracting States as either approved or acceptable for purposes of accomplishing repairs to aircraft. For example, a structural repair manual contains several State of Design-approved repair schemes for typical damages or structural failures that can be readily applied by an operator, without the need for obtaining prior approval of the CAA. However, where the repair action specifically requires designing a repair scheme, the repair design (data) must be approved or accepted by the CAA prior to the release of an aircraft for return to service.

6.1.4 Approving a repair design prior to the release of an aircraft for return to service can be processed in many ways, depending on the scope and complexity of the proposed repair and the regulatory system in place for each Contracting State. The approval of repairs may be a function delegated by a Contracting States to authorized persons or organizations, while other Contracting States exercise it as their exclusive function. Some repair approvals are limited to the approval of the design data

only, whereas other approvals may also constitute installation approval. Regardless, the approval process is intended to verify that the repair design complies with the airworthiness requirements of the State of Registry for the purpose of maintaining validity of a Certificate of Airworthiness issued under Annex 8.

6.1.5 All Contracting States, regardless of their approval procedures, are encouraged to give maximum credit and recognition to the repair design approvals granted by the State of Design, or another Contracting State with a demonstrated technical capability, and avoid duplicate or redundant evaluation where practical, and without prejudice to their own unique national requirements.

## **6.2 Application for approval of repair design**

### 6.2.1 General

6.2.1.1 An applicant requesting approval of a repair design can be the owner or operator of an aircraft, a Type Certificate holder, a maintenance, repair and overhaul facility, an original equipment manufacturer for components and parts, a specialized engineering organization, or an individual engineer acting as a consultant, or, where allowed by a State, their representatives. An applicant is the organization or individual that has responsibility for the repair design, and whose name the approval will be granted. Neither Annex 6 nor 8 requires the aircraft operator to be the holder of the repair design approval, but only to ensure that the repair design is approved and specifically applicable to the affected aircraft.

6.2.1.2 Some Contracting States may treat repair design as a change in type design, rather than a restoration, and invoke elements of their formal certification process to issue an approval. The difference between these two approaches is in the way Contracting States establish their policy on repair design. As a restoration function, a Contracting State may view a repair design as providing a level of safety at least equal to that established for the product being repaired, even if the design offers an improvement over the original design. Other Contracting States may view that same improvement in a repair design as an upgrading of the level of safety, and therefore treat it as a change in type design. Regardless, the end result of either policy is the approval of a repair design that complies with the applicable airworthiness standards of the State of Registry that issued the Certificate of Airworthiness.

### 6.2.2 Applicant

6.2.2.1 Any person or organization may apply for approval of a repair design to an aircraft. An applicant may be located within the geographical jurisdiction of a State of Registry (considered a local applicant) or located in another State (considered a foreign applicant). Annexes 6 and 8 make no distinction between local and foreign applicants because the emphasis is on the aircraft operator to ensure that a repair design is approved prior to the release of an aircraft for return to service. Unlike modification, approval of a repair design usually entails a less intensive airworthiness review, and does not require a strict relationship protocol under Annex 8 to designate a State of Design. Some States of Registry may require a foreign applicant to first obtain their corresponding CAA's approval of the repair design prior to granting recognition or acceptance for use in their jurisdiction. Contracting States that treat repair design as a design change may have a more restrictive eligibility requirement because of the continuing airworthiness responsibilities assigned to design approval holders.

6.2.2.2 Some States require an individual or organization to first demonstrate competency by formally obtaining accreditation or designation from their CAA as an approved design specialist (known in some States as an approved design organization or individual, or of an equivalent status). This technical capability can be a function of the extent and complexity of the repair design and the nature of the substantiating data needed to establish and demonstrate compliance with the applicable airworthiness standards of the State of Registry. A repair design should not be attempted unless the applicant has a

sound knowledge of the design principles embodied in the affected aircraft. There may be cases where access to the analyses and test reports from the original type certification activity of the aeronautical product is needed in order to assess compatibility or suitability of the proposed repair design. If this is the case, it is recommended that the applicant seek ways for the participation in, or review of, the repair design by qualified representatives from the holder of the Type Certificate. Where such cooperation is not available, a State of Registry should establish that the applicant has:

- a) comprehensive knowledge, experience and capabilities in the applicable technologies, such that in-depth analyses can be performed where required; and
- b) sufficient information on the type design of the aircraft involved (if there is any doubt, consultation is suggested with the airworthiness authority of the State of Design).

### 6.2.3 Application procedure

6.2.3.1 An application for the approval of a repair design should be submitted in a form and manner prescribed, or agreed to, by the CAA, and submitted to the ACD. Information to be submitted on the proposed repair should include, as a minimum, the following:

- a) the name and address of the applicant or operator to which the approval will be issued;
- b) the make and model of the affected aeronautical product (registration and/or serial number) and its Type Certificate number (or approval reference);
- c) the title, detailed description, and purpose of the repair design;
- d) the proposed airworthiness standards to which the proposed repair is designed and intended to show compliance with, including the identification of any impact on approved airworthiness limitations contained in the Instructions for Continued Airworthiness for the affected product;
- e) documentation and/or substantiating data of the repair design; and
- f) when required by a State of Registry for a foreign applicant, evidence of prior approval by the State that has jurisdiction over the individual or organization responsible for the repair design.

6.2.3.2 The administrative procedure or policy of a CAA for receiving a request for repair approvals should be flexible and supportive of the needs of aircraft operators. For example, the policy should be sensitive to approval turn-around times. The need for a repair design cannot always be predicted and largely a consequence of the aircraft's operating situation. Therefore, a too strict procedure could impede aircraft operations.

6.2.3.3 When the repair design approval holder is, or will be a different person or organization than the aircraft operator, it may be necessary for the operator to obtain administrative or technical approval from the State of Registry to use or reference the repair design for their specific application. If the approval holder and aircraft operator are both under the jurisdiction of the same CAA, then no additional technical review is needed since the repair design would have already been approved. However, if the approval holder is under the jurisdiction of a foreign CAA, then the aircraft operator must obtain technical approval or acceptance of the repair design by the State of Registry. If commercial or proprietary considerations are involved between the approval holder and the aircraft operator, the CAA involvement

is limited to ensuring that the repair design is approved and specifically applicable to the Operator's aircraft.

6.2.3.4 An application is considered outstanding or open until an approval is finally issued. There is no validity period for an application within which the CAA must grant the approval. The operating schedule of the aircraft Operator normally indicates the time limitation by which an approval is needed, in order to release an aircraft back to service.

## **6.3 Repair categories**

### **6.3.1 General**

6.3.1.1 The maintenance provisions of Annex 6 and the continuing airworthiness requirements of Annex 8 specify that repairs, including the installation of a replacement part, must be in accordance with the airworthiness requirements of the State of Registry. This could be interpreted as requiring all repairs to be approved by the State of Registry. Depending on the civil aviation activity within a State, approving all repair designs could overwhelm a CAA and, require extensive technical resources to execute the approval process in a timely manner. For this reason, a majority of Contracting States have introduced a system for categorizing repairs as either a major repair or minor repair.

6.3.1.2 The general intent behind the categories is to optimize the CAA's resources by identifying those repair designs that require their direct participation in the approval process. The repair categories also help an aircraft operator in deciding the kind of data needed to accomplish a repair. Some States may only participate in the approval of major repairs, while other States may require their involvement in the approval of both major and minor repairs. It is up to each State to establish their national policy on approval of repairs.

6.3.1.3 An applicant seeking foreign approval or recognition of their repair design should request their local CAA to consult foreign CAAs to clarify potential differences in the repair category, and consequently their approval requirements.

### **6.3.2 Major repair category**

A major repair is usually considered a repair that might appreciably affect mass, balance, structural strength, performance, powerplant operation, flight characteristics, or other qualities affecting airworthiness. A repair in this category normally requires some form of engineering analysis or assessment. The CAA should evaluate the technical merit of a repair design proposal, and establish a clear understanding of the intended or consequential effect on the affected product. For example, it may not be appropriate to approve a repair that is purposely designed to be much stronger than the structure being repaired because the effect may be an undesirable change in the original structural load distribution. The threshold or level that distinguishes a major from a minor repair may vary from State to State. For the purpose of illustration, the following are examples that can be used to categorize a major repair:

- a) repairs involving a principal component of the aircraft structure, such as a frame, stringer, rib, spar of stressed skin;
- b) repairs to structural elements that were approved using damage tolerance or fail-safe evaluation;
- c) repairs to pressurized areas;



- d) repairs involving the installation of an item of mass necessitating structural re-evaluation;
- e) repairs to structural attach points intended for the stowage or retention of significant mass;
- f) repairs to load bearing structure of aircraft seats, harnesses, or to occupant restraint equipment;
- g) repairs involving substitution of materials, or use of a different repair process or technique; or
- h) repairs to components, parts, appliances where form, fit, and function may be affected.

### 6.3.3 Minor repair category

A minor repair involves any repair that does not fall under the major repair category, meaning the repair has a negligible effect on the airworthiness of the affected product.

## 6.4 Approval activities

### 6.4.1 General

6.4.1.1 There are four key activities in the approval of a repair design, namely:

- a) establishing an approval basis;
- b) establishing the means or methods of compliance;
- c) demonstration and findings of compliance; and
- d) approving the repair design.

6.4.1.2 The main objective of the approval process is for a State of Registry to determine compliance of a proposed repair design with its applicable airworthiness requirements, such that the affected aeronautical product is restored to its approved type design.

### 6.4.2 Establishing an approval basis

6.4.2.1 Annex 8, Part II, Chapter 1, *Type Certification*, states in part that the basis of approval for a repair design should be the same airworthiness standards used in the certification of the type design by the State of Registry. The following should be the basic policy for repairs, unless otherwise established differently by a State of Registry:

- a) for an aircraft, the approval basis is the aircraft design standards recorded in the Type Certificate data sheet issued by the State of Registry or, where allowed, by the State of Design.
- b) for an engine or propeller, the approval basis is the engine or propeller design standards recorded in the Type Certificate data sheet issued by a State of Registry or, where

allowed, by the State of Design of the engine or propeller. It is not the State of Design of the aircraft on which the engine or propeller is installed that applies.

- c) for a component, part, appliance or article that is not type certificated or have a separate design approval other than a Type Certificate, the approval basis is the airworthiness standard of the type certificated product (aircraft, engine, or propeller) on which the component, part, appliance or article is installed.

6.4.2.2 The approval basis for a repair design shall not include any proposal for an exemption or a finding of equivalent level of safety because a repair is a restoration to an approved type design. The intent of the repair is to maintain the same level of safety that the product was certified to.

6.4.2.3 The approval basis could be also be affected by additional requirements that are not related to the original approval or type certification of the product. For example, a supplemental structural integrity programme or a repair assessment programme for ageing aircraft may influence repair designs to be held to higher design standards or evaluation techniques. In establishing the approval basis, a State of Registry should also account for other factors, such as maintenance or operating rules, which may affect the actual installation of the repair.

#### 6.4.3 Establishing the means of compliance

The means of compliance is usually dictated by the design standard(s) in the approval basis for which compliance will be demonstrated, and generally falls into one or any combination of the following:

- a) *Test* – is performed when the requirement explicitly calls for a demonstration by test (physical, actual or simulation). Examples of test are fatigue test, simulation, functional or operational test, fire or flammability test, and environmental test (e.g. salt spray).
- b) *Analysis* – is performed when the requirement explicitly calls for a demonstration by analysis (qualitative, quantitative, or comparative). Examples of analysis are failure modes and effects analysis, static strength or damage tolerance analysis, and structural loads analysis.
- c) *Inspection or Evaluation* – is performed against an item that does not require test or analysis, but relies on observation, judgment, verification, evaluation, or a statement of attestation from the applicant or its vendors/contractors.
- d) *By Derivation or Similarity* – is performed when a new repair design can be developed or derived from a previously approved repair and the two repair designs can be considered similar.

#### 6.4.4 Demonstration of compliance

6.4.4.1 The demonstration of compliance requires that the applicant submit substantiating data (design data, reports, analysis, drawings, processes, material specifications, instructions for continued airworthiness, etc). The data should be complete and in a logical format for review by the CAA. Where the demonstration of compliance involves a test, a test plan should be developed and approved prior to any actual test being performed. Official certification tests are conducted or witnessed by ACD personnel or by an ACD delegate, when authorized.

6.4.4.2 The applicant should give the ACD access to the product being repaired in order to make any inspections, test, and engineering assessment that may be necessary to determine compliance with the approval basis of the repair. However, the applicant should perform his own inspection and test necessary to demonstrate compliance, prior to presenting the repaired product to the ACD for testing or evaluation.

#### 6.4.5 Finding of compliance

The CAA makes a finding of compliance on the approval basis. The finding of compliance can be made by the ACD, AID, or by its authorized delegate, depending on the pre-defined levels of involvement in the repair approval process. Following a successful demonstration of compliance by the applicant, the ACD should make a finding of compliance and conclude the approval process. The findings are usually accomplished through one or any combination of the following actions:

- a) *Acceptance of substantiating data.* Reports, analysis, drawings, or similar documents are usually produced against each item in the approval basis and should be reviewed and accepted. Specific attention should be paid to the methodology and assumptions, rather than the detailed calculations or analysis.
- b) *Witnessing of test.* Tests are performed in accordance with an approved test plan and witnessed by the ACD. The test should be conducted only after conformity with the test plan has been established for the test articles, test environment and test facilities. The ACD does not take part in the actual performance of the test, and should remain impartial and concentrated on the test objective.
- c) *Engineering inspection.* Any aspect of the repair design for which compliance with the approval basis cannot be determined through review of drawings or reports, should receive an engineering compliance inspection. An engineering compliance inspection is to assure that an installation, and its relationship to other installations on a product, complies with the design requirements.
- d) *Conformity inspection.* Where required, should be performed by the AID to verify conformity of the repaired product with drawings, specifications, and special processes. An engineering inspection should not be confused with a conformity inspection. A conformity inspection is done to determine conformity to the engineering data, while an engineering inspection is done to determine compliance with the approval requirement.

#### 6.4.6 Approving the repair design

6.4.6.1 The CAA approval of the repair design should be documented such that a physical record can be retained by the aircraft Operator, as required by the maintenance recordkeeping requirement of Annex 6. A statement of “no technical objection” should be avoided, such an expression does not mean an approval, acceptance, or rejection. The CAA should consider documenting their clear approval through one of the following means:

- a) issuance of an approval letter signed by the CAA;
- b) issuance of an approval using a standard form established by the CAA;
- c) by signature or marking (stamp or seal) the repair approval document as submitted by the applicant; or

- d) in the case of recognizing foreign approvals, a statement of endorsement that such foreign approval is considered approved by the State of Registry.

6.4.6.2 The repair design should not be approved if there is a known or suspected design feature that could make the repaired product unsafe after installation. For example, the use of an inappropriate type of blind fasteners (multi-piece) to install a structural repair patch in an area subject to repeated vibration could eventually loosen the fasteners and weaken the repair. Applying this type of repair in the intake area of a turbine engine could result in loose or dislodged fasteners being ingested during engine operation.

6.4.6.3 The CAA should stipulate limitations, if any, associated with their approval of the repair design including, but not limited to, time limits (in the case of temporary repairs, or life-limited repairs), follow-up or repeat inspection requirement, installation considerations, specific applicability (or repeatability of application) to aeronautical product(s), permitted deviations or substitutions from the repair design. The stipulation should also identify approved changes or revisions to the approved airworthiness limitations contained in the Instructions for Continued Airworthiness for the affected product.

6.4.6.4 Repair designs provided by the original equipment manufacturer (OEM), which includes aircraft, engine and propeller manufacturers, should clearly indicate the approval status of their repairs. Where a CAA that has jurisdiction over the OEM approves a repair design, the State of Registry should give maximum credit and recognition to the approved repair. If clearly the OEM repair design has not been approved, the State of Registry should proceed with their own approval. Often, this type of repair is developed or provided in accordance with a specific request or need of an Operator because it is not available in the OEM-supplied repair manuals.

## **6.5 Post-approval activities**

### **6.5.1 General**

6.5.1.1 The activities following approval of a repair design involve; the actual accomplishment of the repair on the aeronautical product, documenting the repair accomplished, and the maintenance release of the affected aeronautical product as being airworthy.

6.5.1.2 Refer to Part IV, Chapter 3, *Aeroplane Maintenance – Modifications and Repairs*, of this manual for considerations involving repair installation and the responsibilities of the installer and aircraft operator.

### **6.5.2 Retention of repair design data**

6.5.2.1 The requirement for an operator to retain repair data accomplished on their aircraft is stated under the maintenance record-keeping provision of Annex 6. If the holder of the repair design approval is different from the aircraft operator, the aircraft operator should be required to retain the repair data as a permanent record for the affected aircraft, engine, or propeller for as long as the affected product remains in service.

6.5.2.2 The CAA should keep a record of approvals granted for repair designs. The approval record need not necessarily include the substantiating documents normally retained by the aircraft operator or approval holder.

### 6.5.3 Responsibility of holder of repair design approval

The approval holder remains responsible for the continued integrity of the repair design and it or its representative must continue to be the aircraft operator's contact point for resolving continuing airworthiness issues related to the design. To fulfill this responsibility, the holder should have the continued capability, or access to a capability, of providing technical solutions when service difficulties warrant it, or when a State of Registry requires mandatory corrective action. If the approval holder is outside the jurisdiction of the State of Registry and corrective action is needed, assistance should be requested from the CAA of the approval holder.

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**PART IV.— ANNEX 6 OPERATIONS OF AIRCRAFT,  
SUPPORTING GUIDANCE MATERIAL**

**CHAPTER 1.— AIR OPERATOR CERTIFICATE –  
AIRWORTHINESS ASPECTS**

**1.1 General**

1.1.1 A well established method by which the State of the Operator may exercise the necessary control of its operators is through the issuance of an Air Operator Certificate (AOC). The award of an AOC constitutes certification by the State of the Operator that specified operations are authorized in compliance with applicable regulations and rules. Through the issuance of an AOC, the State of the Operator can ensure the protection of the public interest and exercise indirect influence and control upon the major aspects of the operation without encroaching upon the operator's direct responsibility for its safety. Detailed guidance on the establishment of a State system for the initial certification of operators and the subsequent surveillance of operations is contained in ICAO's *Manual of Procedures for Operations Inspection, Certification and Continued Surveillance* (Doc 8335). The material contained in the present Chapter and in Part IV, Chapter 4 (Approval of Maintenance Organizations) is to be used in conjunction with Doc 8335 to amplify the airworthiness aspects of operator certification and surveillance procedures. In some instances, certain material contained in Doc 8335 has been repeated herein for the sake of clarity.

1.1.2 Annex 6, Part I, 4.2.1.3 and Part III, Section II, 2.2.1.4 state:

“The issue of an air operator certificate or equivalent document by the State of the Operator shall be dependent upon the operator demonstrating an adequate organization, method of control and supervision of flight operations, training programme as well as ground handling and maintenance arrangements consistent with the nature and extent of the operations specified.”

In making the “maintenance arrangements” referred to above, operators are required to ensure that the aircraft they operate are maintained in an airworthy condition. Annex 6, Part I, 8.1.2 and Part III, Section II, 6.1.2 require that an aircraft shall not be operated unless it is maintained and released to service by an approved maintenance organization or under an equivalent system.

1.1.3 Operators may have an approved maintenance organization as part of their organization or the maintenance may be contracted to one or more maintenance organizations approved for the purpose. The approval of the maintenance organization shall be acceptable to the State of Registry of the operator's aircraft. In issuing the AOC, the State of the Operator will have to be satisfied as to the actions of the State of Registry in granting the approval of the maintenance organization, maintenance programme and setting the standards for the continuing airworthiness of the operator's aircraft. For States which have ratified Article 83*bis*, the State of Registry may transfer some or all of its responsibilities for the airworthiness aspects for the issuance of an AOC to the State of the Operator. (Refer to Doc 8335, Chapter 10 and to Part V of this manual, for information on lease, charter and interchange.)

1.1.4 Procedures for operator certification and surveillance should normally take the sequence of:

- a) application to the CAA by the prospective operator;
- b) preliminary assessment of the application;

- c) operational inspection (administrative, flight, maintenance, etc.);
- d) decision on application and award of AOC; and
- e) continuing surveillance and inspection.

1.1.5 A major factor in the certification process is the determination of the capability of applicants to adequately maintain their aircraft in an airworthy condition. This will require a detailed inspection and evaluation of the applicant's maintenance organization, staffing, facilities, maintenance programme, operator's maintenance control manual, maintenance organization's procedures manual, training and ability to carry out day-to-day operations. The maintenance inspections and evaluations should be carried out by qualified inspectors of the AID under the overall coordination of the inspector-in-charge of the certification team. The inspector-in-charge may be the Director himself or a flight operations inspector designated by the Director.

1.1.6 When first assigned to a CAA certification team, the AID inspector should make certain that he fully understands the interrelationship of the various duties and responsibilities of the individual inspectors. This understanding is essential in order to prevent duplication of effort, contradictory instructions to the applicant and conflicting inspection schedules. It is also incumbent upon the AID inspector to develop, at a very preliminary stage of the certification, an overall appreciation of the exact nature of the proposed operation.

## **1.2 Airworthiness assessment**

1.2.1 The application for an AOC should contain the essential information which will permit an assessment of the capability of the applicant to conduct the proposed operation. In respect of flight operations and maintenance, the application should contain at least the following information:

- a) management organization and a listing of key staff members, including their titles, names, education and practical experience (in particular, the name, background and responsibility of the designated manager should be provided);
- b) types of aircraft, communications and navigation equipment, instruments and major items of equipment to be used;
- c) manuals and documents as described in the following paragraphs:
  - 1) arrangements for flight operations and maintenance and inspection of aircraft and associated equipment;
  - 2) State of Registry of the aircraft (if foreign-registered, a copy of the lease agreement should be provided);
  - 3) area of operations and bases from which operations will be conducted; and
  - 4) detailed description of how the applicant intends to show compliance with each flight operations and maintenance-related provision of the applicable civil aviation regulations.

1.2.2 The importance of a thorough and careful preliminary assessment of the application cannot be overemphasized. The more thoroughly the applicant's competence is established at the initial stage, the less will be the likelihood of having serious problems in the operational inspection phase preceding certification or during the course of subsequent operations. In assessing the application prior to a detailed operational inspection, it will be necessary for the AID inspector member of the certification team to make a preliminary investigation to satisfy himself (and the inspector-in-charge) that the applicant has:

- a) a comprehensive operations manual and maintenance programme;
- b) suitable personnel, equipment, facilities, manuals, buildings, shops, service agreements, etc. or will be able to obtain them;
- c) aircraft with AFM and other documentation suitable for the proposed operation. The following questions should be considered:
  - 1) Can the aircraft be properly maintained and supplied with the available maintenance and spare parts resources?
  - 2) Is the requirement for aircraft utilization reasonable?
  - 3) Does the plan of operations permit compliance with aircraft maintenance schedules?
- d) outlined the duties and responsibilities of key flight operations and maintenance staff with sufficient precision to provide a reasonable assurance that the safety of operations will not be adversely affected by the lack of organization and management control; and
- e) a full appreciation of responsibilities under the regulatory requirements, including the obligations of a potential holder of an AOC.

1.2.3 It is generally beneficial for the AID inspector to arrange for meetings with key personnel of the applicant's organization to review the information submitted in the application to clarify any questions the inspector or the applicant's personnel may have concerning the certification procedure. The inspector should arrange to have minutes or notes kept of these meetings, to be included in the report of the certification assessment.

### **1.3 Flight operations and maintenance management**

1.3.1 Annex 6, Parts I and III require that an operator shall establish a flight safety documents system for the use and guidance of operational personnel. Flight safety documents system is a set of inter-related documentation established by the operator, compiling and organising information necessary for flight and ground operations, and comprising, as a minimum, the operations manual and the operator's maintenance control manual. *[For additional information, see in Annex 6, Part I, 3.2.9 and Attachment H; and Part III, Section II, 1.2.6 and Attachment G containing the guidance material on the development and organization of a flight safety documents system].* An aircraft should be operated in accordance with the operations manual which has to include all pertinent information from the approved AFM for the aircraft and be maintained by an approved maintenance organization or under an equivalent system. An approved maintenance organization may be a part of the operator's organization or it may be another organization to which the operator has subcontracted aircraft maintenance tasks. In either case, the operator shall employ a person or persons to ensure that the flight operations and maintenance work is carried out in accordance with the operator's operations manual (referred to in Annex 6, Part 1, 4.2.2, Annex 6, Part III,



Section II, 2.2.2, and the operator's maintenance control manual (referred to in Annex 6, Part I, 8.2 and Part III, Section II, 6.2). The responsibilities of Section 1.2 above should be fully satisfied and the quality assurance programme of 1.4 below should be in place.

1.3.2 Where the maintenance organization is part of the operator's own organization, it should be subjected to the same approval procedure as for independent organizations (see Part IV, Chapter 4 of this manual).

1.3.3 Where maintenance is contracted out, a written contract should be agreed between the operator and the maintenance organization detailing the responsibilities of both parties. The technical aspects of the contract should be accepted by the Authority.

## **1.4 Safety management**

Annex 6, Part I, 3.2.1 and Part III, Section II, 1.2.1 require the States to establish a safety programme in order to achieve an acceptable level of safety in the operation of the aircraft. Additionally, Annex 6, Part I, 3.2.4 and Part III, Section II, 1.2.4 require States, as part of their safety programme, to ensure from 1 January 2009 that the operators implement a safety management system acceptable to the State of Operator.

*Note.— Guidance on both the safety programme applicable to States and the safety management system applicable to the operator, is contained in the Safety Management Manual (SMM) (ICAO Doc 9859).*

## **1.5 Quality system**

### **1.5.1 Quality assurance system**

1.5.1.1 An operator should establish a quality assurance system as part of the management system and designate a quality manager to monitor compliance with, and adequacy of, procedures required to ensure safe maintenance practices and airworthy aircraft. Compliance monitoring should include a feedback system to the designated manager to ensure corrective action as necessary. The operator may establish a single quality assurance system for both the operations department and the maintenance department.

1.5.1.2 The quality system should include a quality assurance programme which contains procedures designed to verify that all tasks are being conducted in accordance with all applicable requirements, standards and procedures. The quality assurance system, and the quality manager, should be acceptable to the CAA, and should be described in relevant documentation.

### **1.5.2 Alternative to a quality assurance system**

When the CAA issuing the approval agrees that setting up a comprehensive quality assurance system is not appropriate, the CAA may accept a simpler method of quality verification.

### 1.5.3 Items specific to maintenance

For maintenance purposes, the operator's system described in 1.5.1 and 1.5.2 above, should include at least monitoring:

- a) that the maintenance activities related to the responsibilities of the operator are being performed in accordance with accepted procedures;
- b) that all contracted maintenance is carried out in accordance with the contract;
- c) that implementation actions related to mandatory continuing airworthiness information are performed in time; and
- d) the continued compliance with the appropriate provisions of this chapter.

### 1.5.4 Subcontracting of monitoring

If, in case of a small operator, the monitoring as described in 1.5.1 above is subcontracted, the technical details of the contract should be submitted to the CAA for review and acceptance.

## **1.6 Operator's operations manual and maintenance control manual**

1.6.1 Annex 6, Part I, Section 4.2.2 and Part III, Section II, Section 2.2.2 require operators to ensure that an operations manual is provided for the use and guidance of their operational personnel. The operator is required to ensure that the manual is amended and revised as necessary and that copies of changes are distributed to holders of the manual. *[For additional information, see ICAO Doc. 9376 containing the guidance material on preparation of the operations manual].*

1.6.2 Annex 6, Part I, 8.2 and Part III, Section II, 6.2 require operators to ensure that a maintenance control manual is provided for the use and guidance of their maintenance and operational personnel as applicable. The operator is required to ensure that the manual is amended and revised as necessary and that copies of changes are distributed to holders of the manual. Annex 6, Part III, Section II, 6.2 and Part I, 8.2.1 specify that the design of this manual shall observe the human factors principles.

*Note.— Guidance material on the application of human factors principles can be found in the Human Factors Training Manual (ICAO Doc 9683).*

1.6.3 Annex 6, Part I, 11.2 and Part III, Section II, 9.2 specify the subjects that shall be included in the maintenance control manual. The manual may be issued in separate parts, but must be acceptable to both the State of the Operator and the State of Registry. The required contents of the maintenance control manual, per Annex 6, are as follows:

- a) a description of the procedures required to ensure that:
  - 1) each aircraft is maintained in an airworthy condition;
  - 2) the operational and emergency equipment necessary for the intended flight is serviceable; and

- 3) the Certificate of Airworthiness of each aircraft remains valid;
- b) a description of the administrative arrangements between the operator and the approved maintenance organization;
- c) a description of the maintenance procedures and the procedures for completing and signing a maintenance release when maintenance is based on a system other than that of an approved maintenance organization;
- d) the names and duties of the person or persons employed to ensure that all maintenance is carried out in accordance with the maintenance control manual;
- e) a reference to the maintenance programme (refer to 1.5.3 of this Chapter);
- f) a description of the methods used for the completion and retention of the operator's maintenance records which show:
  - 1) the total time in service (flight hours, flight cycles, landings, calendar time etc. as appropriate) of the aircraft and all life-limited components (including the in-service history records);
  - 2) the current status of compliance with all mandatory continuing airworthiness information;
  - 3) appropriate details of modifications and repairs to the aircraft or its components;
  - 4) the time in service (flight hours, flight cycles, landings, calendar time, etc. as appropriate) since the last overhaul of the aircraft or its components subject to a mandatory overhaul life;
  - 5) the current status of aircraft's compliance with the maintenance programme; and
  - 6) the detailed maintenance records to show that all requirements for the signing of a maintenance release have been met;
- g) procedures for monitoring and assessing maintenance and operational experience in order to improve the maintenance programme;
- h) a description of the procedures for monitoring, assessing and reporting maintenance and operational experience to the State of Registry (only applicable to aeroplanes over 5 700 kg and helicopters over 3 175 kg maximum certificated take-off mass);
- i) a description of the procedures for complying with the service information reporting requirements of Annex 8, Part II, 4.2.3f) and 4.2.4;
- j) a description of the procedures for assessing continuing airworthiness information and recommendations available from the organization responsible for the type design. Resulting actions considered necessary as a result of the assessment shall be in accordance with a procedure acceptable to the State of Registry (only applicable to aeroplanes over 5 700 kg and helicopters over 3 175 kg maximum certificated take-off mass);

- k) a description of the procedures for implementing action resulting from mandatory continuing airworthiness information;
- l) a description of establishing and maintaining a system of analysis and continued monitoring and performance and efficiency of the maintenance programmes, in order to correct any deficiency in that programme (refer to Section 1.7 of this chapter);
- m) a description of aircraft types and models to which the manual applies;
- n) a description of procedures for ensuring that unserviceabilities affecting airworthiness are recorded and rectified;
- o) a description of the procedures for advising the State of Registry of significant in-service occurrences; and
- p) a description of the quality system required in 1.5 of Part IV of this manual

## 1.7 Maintenance programme

### 1.7.1 General

1.7.1.1 Annex 6, (Part I, 8.3 for aeroplanes and Part III, Section II, 6.3 for helicopters) places an obligation on operators to provide a maintenance programme approved by the State of Registry for the use and guidance of maintenance and operational personnel and to ensure that the maintenance of their aircraft is performed in accordance with this maintenance programme. Annex 6, Part III, Section II, 6.3 and Part I, 8.3 specify that the design and application of the operator's maintenance programme shall observe the human factors principles.

*Note.— Guidance material on the application of human factors principles can be found in the Human Factors Training Manual (Doc 9683).*

1.7.1.2 Annex 6, (Part I, Section 11.3 for aeroplanes and Part III, Section II, Section 9.3.3 for helicopters) also requires that maintenance tasks and intervals that have been specified as mandatory in approval of the type design shall be identified as such (refer to Part III, Chapter 1, Section 1.6 of this manual— *Certification Maintenance Requirements and Airworthiness limitations*).

1.7.1.3 Annex 6, (Part I, 11.3.3 for aeroplanes and Part III, Section II, 9.3.3 for helicopters) also contains a recommendation that the maintenance programme be based on maintenance programme information made available by the State of Design or by the organization responsible for the type design. For large aeroplanes, this information is normally issued in the form of a maintenance review board report for the particular aircraft type (refer to Part III, Section 1.7 of this manual, *Maintenance Review Board*).

1.7.1.4 The maintenance programme is a document which describes the specific maintenance tasks and their frequency of completion, necessary for the continued safe operation of those aircraft to which it applies.

1.7.1.5 A maintenance programme for each aircraft as required by Annex 6, Part I, Section 8.3 and Part III, Section II, 6.3 shall contain the following information:

- a) maintenance tasks and the intervals at which these are to be performed, taking into account the anticipated utilisation of the aeroplane;

- b) when applicable, a continuing structural integrity programme;
- c) procedures for changing or deviating from a) and b) above; and
- d) when applicable, condition monitoring and reliability programme descriptions for aircraft systems, components and power plants.

*Note. — In the context of this paragraph, “when applicable” means that the condition monitoring and reliability programmes are only applicable to aircraft types where the maintenance programme was derived using the maintenance review board process (see Section 1.7 of Part III of this manual)*

### 1.7.2 Maintenance programme approval

In accordance with the basic aviation law of the State, the DCA should be given the authority and responsibility for the approval of each operator’s maintenance programme — that is, the approval of the programme in which an operator establishes the time limitations (or standards for determining time limitations) for scheduled maintenance tasks for the aircraft (overhauls, inspections and checks of aircraft, engines and appliances and their monitoring).

### 1.7.3 Maintenance programme development basis

1.7.3.1 Operator's maintenance programmes should normally be based upon the manufacturer recommended instructions for continued airworthiness such as, but not limited to, the maintenance review board report (see Section 1.7 of Part III of this manual), where available, and the Type Certificate holder's maintenance planning document or Chapter 5 of the maintenance manual (i.e. the manufacturer's recommended maintenance programme). The structure and format of these maintenance instructions may be rewritten by the operator to better suit his operation and control of the particular maintenance programme.

1.7.3.2 For a newly type-certificated aircraft, where no previously approved maintenance programme exists, it will be necessary for the operator to comprehensively appraise the manufacturer's recommendations (and the MRB Report where applicable), together with other airworthiness information, in order to produce a realistic programme for approval.

1.7.3.3 For existing aircraft types, it is permissible for the operator to make comparisons with maintenance programmes previously approved. It should not be assumed that a programme approved for one operator will automatically be approved for another operator. Evaluation is to be made of aircraft/fleet utilisation, landing rate, equipment fit and, in particular, the experience of the maintenance organization should be assessed. Where the CAA is not satisfied that the proposed maintenance programme can be used as is by the operator, the CAA should request the operator to introduce appropriate changes to it, such as additional maintenance tasks or de-escalation of check frequencies, or to develop the aircraft initial maintenance programme based upon the manufacturer’s recommendations.

### 1.7.4. Updating the maintenance programme

1.7.4.1 Revisions to the approved programme should be raised by the operator, to reflect changes in the Type Certificate holder’s recommendations, modifications, service experience, or as required by the CAA. Reliability programmes form one important method of updating approved programmes.

1.7.4.2 The operator may only vary the periods prescribed by the programme with the approval of its CAA. The CAA should not approve intervals escalations or tasks modifications related to airworthiness directives (AD), airworthiness limitation (ALI) and certification maintenance requirements (CMR) without an appropriate consultation with the State of Design (see Section 1.6 of Part III of this manual).

1.7.4.3 Operator's approved aircraft maintenance programmes should be subject to periodic review to ensure that they take into account the current Type Certificate holder's recommendations, revisions to the maintenance review board report, mandatory requirements and maintenance needs of the aircraft.

1.7.4.4 The operator should review the content of the maintenance programme at least annually for continued validity in the light of operating experience.

## **1.8 Reliability programmes**

1.8.1 A reliability programme could be required in the following cases :

- a) the aircraft maintenance programme is based upon MSG-3 logic; or
- b) the aircraft maintenance programme includes condition monitored components; or
- c) the aircraft maintenance programme does not include overhaul time periods for all significant system; or
- d) when specified by the Manufacturer's maintenance planning document or MRB.

*Note.— for the purpose of this paragraph 1.8, a “significant system” is a system the failure of which could hazard the aircraft safety.*

### 1.8.2 Intent of a reliability programme

The purpose of a reliability programme is to ensure that the aircraft maintenance programme tasks are effective and their periodicity is adequate. It therefore follows that the actions resulting from the reliability programme may be not only to escalate or delete maintenance tasks, but also to de-escalate or add maintenance tasks, as necessary. A reliability programme provides an appropriate means of monitoring the effectiveness of the maintenance programme.

### 1.8.3 Details of reliability programmes

1.8.3.1 Reliability programmes are designed to supplement the operator's overall programme for maintaining aircraft in a continuous state of airworthiness. There are a number of maintenance reliability programmes now in operation that use new and improved maintenance management techniques. Although the design and methods of application vary to some degree, the basic goals are the same — to recognize, access and act upon meaningful symptoms of deterioration before malfunction or failure in order to establish and monitor the maintenance control requirements.

1.8.3.2 Performance standards (alert values, etc.) are established by actuarial study of service experience using statistical methods coupled with application of technical judgement. These standards are used to identify trends or patterns of malfunction or failures experienced during programme operation.

Even though reliability programmes vary, they should provide means for measurement, evaluation, and improvement predictions. They should contain the following elements:

- a) an organizational structure;
- b) a data collection system;
- c) a method of data analysis and display;
- d) procedures for establishing performance standards or levels;
- e) procedures for programme revision;
- f) procedures for time control; and
- g) a section containing definitions of significant terms used in the programme.

1.8.3.3 It is intended that the specific needs of operators, in terms of operating philosophy, record-keeping practices, etc. be reflected in their reliability programmes. The extent of statistical and data processing required for programme operation is entirely dependent on the character of the particular programme. Programmes may be simple or complex, depending on the size of the operator and other factors. The smaller as well as the larger operators may develop maintenance reliability programmes to meet their own specific needs.

#### 1.8.4 Reliability programme criteria

1.8.4.1 The word “reliable” is a broad term meaning dependable or stable. The term, as used by the aviation industry, applies to the dependability or stability of an aircraft system or part thereof under evaluation. A system or component is considered “reliable” if it follows an expected law of behaviour and is regarded “unreliable” if it departs from this expectation. These expectations differ greatly, depending upon how the equipment is designed and operated.

1.8.4.2 Reliability programmes should describe the techniques used for measuring the performance and calculating the remaining service life of the component sufficiently in advance in order to take corrective maintenance action prior to failure. Essentially, reliability programmes are used for the control of maintenance by establishing performance levels for each type of unit and/or system individually or as a class. Generally, reliability programmes depend on the collection of data which can be analysed and compared to previously established programme goals.

1.8.4.3 A good reliability programme should contain means for ensuring that the reliability which is forecast is actually achieved; a programme which is very general may lack the details necessary to satisfy this requirement. It is not intended to imply that all of the following information should be contained in one programme, since the operating philosophy and programme management practices, etc. for each operator are different. However, the following information could be applied to the specific needs of either a simple or a complex programme.

### 1.8.5 Organizational structure

The programme should contain an organizational chart which includes:

- a) a diagram of the relationship of key organizational blocks;
- b) a listing of the organizational elements by title responsible for the administration of the programme;
- c) a statement describing lines of authority and responsibility. The programme should identify the organization responsible to management for the overall reliability functions. It should define the authority delegated to these organizations to enforce policy and assure necessary follow-up and corrective actions; and
- d) a procedure for the preparation, approval and implementation of revisions to the programme.

### 1.8.6 Data collection system

It is important that the data be as factual as possible in order that a high degree of confidence may be placed in any derived conclusion. Data accuracy is particularly important when it is used for predicting reliability because the prediction technique gives at best a broad estimate of the expected reliability. Therefore, the more dependable the data, the higher the degree of confidence that can be placed in the reliability estimate. Data should be obtained from units functioning under different operational conditions. Typical sources of information are: unscheduled removals, confirmed failures, pilot reports, sampling inspections, functional checks, shop findings, bench checks and service difficulty reports, flights cancellation and delays. The data should be collected at specific intervals and should be sufficient to appropriately support the analysis.

### 1.8.7 Data analysis and display

1.8.7.1 Data display and reporting provide a timely and systematic source of information, and even though after the fact, this material is a necessary prerequisite for correcting existing deficiencies. Reporting is not an end objective, but rather a necessary link in the chain of events leading to system improvement. The principal reason for gathering reliability data is to use it for making various determinations and predictions. Among these are such items as failure rate of parts and components, serviceability, and maintainability.

1.8.7.2 In general, almost any desired information can be extracted from these data if they are obtained in a planned and organized manner and carefully recorded and collated. However, the methods of analysis should be clearly understood in order to interpret properly the results obtained. Reliability data collected and analysed with no particular end in view usually result in conclusions that are defective for one reason or another. The programme should provide the information necessary to properly evaluate the graphic presentations submitted in support of the programme. These are used to reveal briefly and simply via graphics those aspects which would normally require a cumbersome analysis of a text or tabular material.



## 1.8.8 Performance standard

1.8.8.1 Each reliability programme should include a performance standard expressed in mathematical terms. This standard becomes the point of measure of maximum tolerable unreliability. Thus, satisfactory reliability trend measurements are those which fall at or preferably below the performance standard. Conversely, a reliability trend measurement exceeding the performance standard is unsatisfactory and calls for some type of follow-up and corrective action.

1.8.8.2 A performance standard may be expressed in terms of system or component failures per thousand hours of aircraft operation, number of landings, operating cycles, departure delays, or of other findings obtained under operational conditions. In some instances, an upper and lower figure may be used. This is known as a reliability band or range and provides the standard by which equipment behaviour may be interpreted or explained.

1.8.8.3 When the performance standard is exceeded, the programme should provide for an active investigation which leads to suitable corrective action.

1.8.8.4 A description of the types of action appropriate to the circumstances revealed by the trend and the level of reliability experience should be included in the programme. This is the central core of maintenance control by reliability measurement. It is the element that relates operating experience to maintenance control requirements. Statistical techniques used in arriving at reliability measurements presented in support of maintenance control actions should be described. Appropriate corrective actions might be:

- a) verify that engineering analysis is appropriate on the basis of collective data in order to determine the need to change the maintenance programme;
- b) actual maintenance programme changes involving inspection frequency and content, functional checks, or overhaul limits and times;
- c) aircraft system or component modification, or repair; or
- d) other actions peculiar to the condition that prevails.

1.8.8.5 The results of corrective action programmes should become evident within a reasonable time from the date of implementation of corrective action. An assessment of the time permitted should be commensurate with the severity or safety impact of the problem. Each corrective action programme should have an identified completion date.

1.8.8.6 Due to the constantly changing state-of-the-art, no performance standard should be considered fixed — it is subject to change as reliability changes. The standard should be responsive and sensitive to the level of reliability experienced. It should be “stable” without being “fixed”. If, over a period of time, the performance of a system or component improves to a point where even abnormal variations would not produce an alert, then the performance standard has lost its value and should be adjusted downward. Conversely, should it become evident that the standard is consistently exceeded in spite of taking the best known corrective measures to produce the desired reliability, then the performance standard should be re-evaluated and a more realistic standard established. Each programme should contain procedures to effect, when required, such changes to the prescribed performance standards.

## 1.8.9 Establishing initial standards

1.8.9.1 In order to establish the initial standards for structural components, powerplants and systems, the past operating experience with the same (or, in the case of new aircraft, similar) equipment should be reviewed in sufficient depth to obtain a cross-section of the subject system's performance. Normally, a period of six months to one year should be sufficient. For a system common to a large fleet of aircraft, a representative sample may be used, while small fleet systems may require 100 per cent review. Operators introducing a new aircraft into service may establish their alert by using this available data. After the operator completes about one year's operating experience, however, the alert value should be adjusted based upon his experience.

1.8.9.2 Due to different operating conditions and system design, it is necessary to use different measuring devices (either singly or combined) to obtain satisfactory performance criteria. As stated before, there are various methods used to evaluate and control performance — aircraft diversions, mechanical interruptions in flight, delays and flight cancellations, component unscheduled removal rates, etc.

1.8.9.3 The following are typical examples of methods that can be used to establish and maintain alert values. It should be understood that the methods of evaluation given below are only illustrative and that other suitable methods of evaluation could be used:

a) Pilot reports per 1,000 aircraft departures:

- 1) Several operators have selected pilot reports as related to the number of departures as the primary measure of aircraft systems performance reliability. The reference base for the computation of alert values is a cumulative rate of the previous calendar year's experience. This provides a large statistical base and takes into consideration the extremes in seasonal effects. The baseline for each system is initially calculated by compiling the number of pilot reports logged for the previous twelve-month period times 1 000 divided by the number of aircraft departures for the same twelve-month period. The purpose of multiplying the pilot reports by 1 000 is to arrive at a figure that expresses the rate per 1 000 departures.
- 2) In order for this to be a cumulative or rolling rate for the immediately previous twelve month period, it should be recalculated each month. The data for the first month of the existing twelve month data set is dropped, and the data compiled for the last month is added; i.e. if the initial calculation was from March 1998 to February 1999, the next month's calculation would cover the period from April 1998 to March 1999.
- 3) When the base line is computed for a particular system, an alert value is established at a point above the base line equal to, say, five pilot reports per 1 000 aircraft departures. The alert values assigned to each system represent the maximum rate of pilot-reported malfunctions considered to deviate sufficiently from the base line to require investigation.

b) Pilot reports per 1 000 aircraft hours:

- 1) For the purpose of measuring reliability, pilot reports per 1 000 aircraft flight hours may be selected as the indicator of aircraft systems performance. Performance standards in terms of pilot reports per 1 000 hours are established for each of the aircraft systems. Several programmes in current use utilize two performance numbers,

an “alert” number and a “target” number. A review and evaluation of a minimum of six to twelve months’ history of pilot reports are done to establish the initial alert and target numbers. Established alert and target numbers are valid for a six-month period, at the end of which all alert and target numbers are reviewed and adjusted as necessary.

- 2) The alert number is defined as the three-month moving (running) average which is considered to indicate unsatisfactory performance.
- 3) Historically, alert numbers show seasonal variations. To provide a more realistic alert number, the year is divided into six-month periods. One period encompasses the winter months, the other, the summer months. When reviewing a particular six-month period to ascertain if the alert number is still practical, it is important that the comparison is made between similar periods.
- 4) The target number is defined as the operator’s goal and predicted level of performance at the end of a six-month period. Target numbers are set to specify the operator’s desires and expectations for future system performance. The target number is established in the same manner as the alert number, the difference being that the alert number is the upper limit of the range and, when exceeded, indicates unsatisfactory performance. The target or the lower limit is set as a goal which represents a level that the operator believes is attainable.
- 5) Each month a three-month running average for each system is calculated. First, a three-month average is obtained by compiling and analysing data for three consecutive months — the total pilot reports for three months are divided by the number of aircraft hours flown during the same three-month period. To maintain a running average, each month the first month's data is deleted and the data for the current month added. Any system which either exceeds the alert or which has a trend indicating the target will not be met is considered to be in need of special attention.

#### 1.8.10 Establishing alert values statistically

1.8.10.1 Many programmes establish alert values by reviewing past performance and then, by using “good judgement”, establish the numerical value for the alert. Although this generally works well, the value can become controversial since the “good judgement” of one person may well be different from that of another person. In an effort to avoid controversy, some operators prefer the statistical or mathematical approach. This is a broad term that covers a number of methods of gathering numbers of instances and evaluating the result; all methods, however, require a sufficient quantity of accurate data to be available for analysis.

1.8.10.2 In order to establish system alert values, an evaluation is made of the operational performance of each system to be controlled by the programme. The yardsticks covering failure performance are clearly defined in the programme. Using these definitions, the failure data for each system are extracted from pilot-reported malfunctions for at least a 12-month period. The “mean” and the “standard deviation” are then computed from those data and each system's alert value is established equal to the mean plus three standard deviations.

1.8.10.3 The current performance level of each system is computed on a monthly basis as a three-month cumulative performance rate. This rate is computed by multiplying the number of in-flight malfunctions for a three-month period by 1 000 and dividing by the total aircraft flight hours for the same

period. Maintaining a cumulative rate requires that the first month's data be deleted and the data for the current month be added to the sum of the previous two months. When a trend of deteriorating system performance is detected, or if a system is over the alert value, an active investigation is conducted to assess the causes of the change in system performance and to develop an active corrective programme, if required, to bring the system performance under control.

#### 1.8.11 Condition-monitored maintenance programmes

1.8.11.1 Other techniques are used which monitor the functional condition of systems or components without disturbing them in their installed environment. These programmes are based on the establishment of acceptable performance as base line data. Internal and external leakage, functional testing, and unit teardown analysis are the factors used to determine the base line. The results of this test become a part of the aircraft's permanent record. The point to be established is that the tests accurately and conservatively identify discrepancies before operational reliability is degraded.

1.8.11.2 This type of programme lends itself readily to components. It has also proven very successful in monitoring the functional condition of aircraft systems such as hydraulics, air conditioning and pneumatics (the system primarily utilizing this type of programme is hydraulics). The various tests perform the function of system or subsystem interrogation to determine the presence or absence of component degradation. Internal leakage rates serve as the criteria to evaluate wear and rigging effect on component performance while pressures are used to determine certain component functional responses.

1.8.11.3 During the test, individual parts, components and subsystems are evaluated by selective positioning of the various system controls and isolation points. From the comparison of the response produced by sequential steps to the established tolerance, the general location or the specific location of the faulty unit can be determined.

1.8.11.4 Additional advantages are:

- a) analysis of the data is not required before departure unless functional tests indicate a need for immediate corrective action;
- b) results of the test do not require immediate replacements of units showing deterioration provided the functional tests of the subsystem or component are satisfactory; and
- c) evaluation of these test data can be used to schedule component replacement at a subsequent inspection or check.

#### 1.8.12 Monitoring by age/reliability relationship

1.8.12.1 Several operators use an actuarial analysis technique as a basic requirement for making technical decisions concerning component reliability in their "on-condition" overhaul and monitored maintenance reliability programmes. Components selected for these programmes are those on which a determination of continued airworthiness may be made by visual inspection, measurements, tests or other means without a teardown inspection or periodic overhaul. Under these programmes, components are allowed to operate in service subject to meeting the established performance standard or the established "on-condition" base line data.

1.8.12.2 Initially, an actuarial analysis of each component is prepared to determine its reliability versus age characteristics. A component is considered acceptable for inclusion in the programme when

the analysis shows that reliability does not deteriorate with increased time in service up to a predetermined point established by the operator. Normally, this cut-off point is considered to be the practical limit based on the amount of data collection and analysis required to qualify the component.

1.8.12.3 When the reliability of a component deteriorates to a value above the established performance standard, another actuarial analysis is made to determine the component's reliability versus age characteristics. Normally, this analysis will also include a determination of the reasons for the deterioration and the corrective action required to bring the condition under control. This reliability analysis is a continuing process and reveals whether a component requires a different maintenance programme or is in need of a design change to improve reliability.

1.8.12.4 An actuarial analysis is also made when the observed performance of a component improves to the point where more components are reaching higher operating times without experiencing premature removal failures. With such an improvement in survival characteristics possible, it is desirable to make a reliability analysis to determine its age-to-reliability characteristics.

1.8.12.5 Premature removal rate and the subsequent analysis of the teardown findings in the shop. The introduction of the "on-condition" overhaul concept has made it increasingly important to gain more information about the operating performance of the components and to examine the relationship of this performance to the time in service. This need has fostered the development of actuarial analysis techniques.

1.8.12.6 This method of analysis requires, for a specified calendar period, that the following information be available for each component under study:

- a) the time on each operating component at the beginning of the study;
- b) the time on each component removed and installed during this period;
- c) the reason for removal and disposition of each component; and
- d) the time on each operating component at the end of the study period.

1.8.12.7 An analysis is made of the performance of each component as its life progresses from one overhaul to another as follows:

- a) A time and failure distribution chart is prepared showing the amount of operating time for each component and the failures experienced in each 100-hour time bracket for the specified study period. In conjunction with this chart, a digest of the causes of failure for each 100-hour time bracket is also prepared.
- b) The next step is to develop failure rate and survival curves versus time since overhaul (TSO). A failure rate curve shows the failure rate per 1 000 hours for each component in each 100-hour time bracket. A survival curve shows the number of units remaining at any given TSO. The shape of the survival and failure rate curves are valuable when determining the deterioration of reliability. The operating time which can be realized between consecutive overhauls is determined by the area which is under the survival curve and is bounded by the horizontal and vertical axes.
- c) Additional information is available from these data by developing a probability curve. This curve will show the probability of a component reaching a given TSO and the number of components expected to fail in a given time bracket. The number of

components that would probably fail in a given time bracket is obtained by taking the difference of the ordinates at the beginning and end of a given time bracket. This would also be a reflection of the slope of the survival curve at that point. The percentage of components which survive to a given TSO is also the probability of a single component operating to that time without failing.

- d) A still better evaluation is possible by developing a conditional probability curve. This curve will show the probability of failure of a component within a given time interval. Data for a conditional probability is obtained by dividing the number (or percentage) of components entering an interval by the number (or percentage) of components removed during an interval. It is considered that this curve best depicts the relationship between reliability and overhaul time.

1.8.12.8 Some advantages of this type of analysis are as follows:

- a) a determination can be made as to whether failures are being prevented by the TSO specification;
- b) an indication is given statistically concerning the current TSO limit and whether or not it has reached an optimum point;
- c) an indication is provided as to what might occur to the overall premature removal rate if the TSO limit were changed;
- d) an indication will be provided of any unusual high rate of premature removals/failures that have occurred immediately after a check and repair or overhaul;
- e) in some cases, an indication may be given that scheduled interim maintenance would result in an improvement of the overall premature rate;
- f) other useful conclusions can be made concerning the relationship of the failure to the time in service, time intervals, engineering change accomplishment, etc; and
- g) this technique of in-service component reliability analysis readily lends itself to computer programming.

These advantages emphasize the value of such an analysis in determining a maintenance programme that is best for the component involved.

### 1.8.13 Control for adjusting time limitations

1.8.13.1 When considering the merits of a time extension, there are many different methods which may be used. The programme should identify these methods and the group responsible for the preparation of a substantiation report to justify the requested time extension. The programme should show that such action is approved by at least two separate organizational segments of the operator, one of which exercises inspection or quality control responsibility for the operator. The programme should also identify the other organizational segment responsible for the performance of the function. When evaluating a particular programme, consideration should be given to the following:

- a) Are the specific parameters used to determine time extensions spelled out (i.e. sampling, functional checks, unscheduled removal, etc.)?

- b) If sampling is used, does it explain the method, number of samples required, when they will be taken, and at what time interval? Time on units or exhibits used as samples should be specified.
- c) Does the programme provide for time increase in overhaul times, periodic services, routine and service checks, phase checks and block overhauls?
- d) Are provisions made for changing items having specified fixed time between overhaul to “on-condition”?
- e) What substantiating data are provided to justify a time increase for emergency equipment which is not normally operated during routine flight?
- f) Who establishes the increments of time increases, the sampling requirements, and other substantiation for each proposed action?
- g) Are instructions available relative to manual revision concerning time increases and what will have to be accomplished prior to pursuing a subsequent time increase?
- h) Does the programme provide for revision of the Operations Specifications, Part D — Maintenance whenever a change is made to the current document?

1.8.13.2 It should be ensured that the proposed time between overhauls (TBO) adjustment does not conflict with a corrective action programme established by a previous reliability analysis. A provision should be made for the AID to be advised when increases to time limitations of system/components controlled by the programme occur. Furthermore, operators should be encouraged where possible to include a graphic display of major system/component (engine/airframe) TBO escalation.

#### 1.8.14 Approval of programmes

1.8.14.1 Maintenance reliability programme approvals are a means of complying with the CAA Regulations and, therefore, become part of the AOC holder’s operations specifications. The programmes are to be administered and controlled by the AOC holders and monitored by the AID Inspector. An operator's application for approval should be accompanied by a document describing programme operation. This document should contain the essentials of systems operation and any other instructions required because of the particular programme or character of maintenance organization involved.

1.8.14.2 The AOC holder should submit the maintenance reliability programme and standard for determining time limitations to be included in the operations specifications, Part D — Maintenance (it is not necessary to enter the entire document). Due to the differences encountered in the programmes submitted for approval, the operations specifications will vary somewhat from operator to operator.

1.8.14.3 An attempt should be made to list all the important elements that should be considered regardless of the programme being evaluated. It is recognized that all of the elements may not apply to a particular programme; however, the AID Inspector should use those that are appropriate to the programme being evaluated. Emphasis should be given to the elements entered in the operations specifications.

1.8.14.4 The procedures for implementing revisions to the programme should be described in sufficient detail to identify the isolated areas which require AID approval. The AOC holder should also

identify the segment of the organization having overall responsibility for the approval of amendments to the programme. The areas involving programme revision which require AID approvals include:

- a) reliability measurement;
- b) changes involving performance standards, including instructions relating to the development of these standards;
- c) data collection analysis;
- d) data analysis methods and application to the maintenance programme;
- e) procedures for adding or deleting systems or components; and
- f) procedures for transferring systems or components to other programmes.

1.8.14.5 When evaluating programme revision procedures, consideration should also be given to the following:

- a) Does the programme provide for periodic review to determine if the established performance standard is still realistic or in need of recalculation?
- b) What distribution is given to approved revisions?
- c) Are the overhaul and inspection periods, work content and rescheduled maintenance activities controlled by reliability methods reflected in the appropriate maintenance manuals?

1.8.14.6 The AID Inspector member of the operator certification team faces a complex and demanding task in reaching a decision as to the adequacy of the applicant's proposed maintenance reliability programme. In the case of applicants proposing to operate large aircraft, the inspector may require assistance from other AID technical experts. In many States where adequate AID resources are not available for this important function, the DCA will need to obtain technical assistance from the CAA of the State of Manufacture or another State possessing substantial experience in such matters.

## **1.9 Mass and balance programme**

### 1.9.1 General

1.9.1.1 The applicant for the issuance or the renewal of a Certificate of Airworthiness should be required to provide the current mass and balance report for the aircraft.

1.9.1.2 The mass and balance report is normally obtained by weighing. Nevertheless, if the changes in mass and balance have been duly computed and recorded and if the resulting change is minor, the accurate mass may be obtained by calculation from the previous weighing. (A sample of a mass and balance report can be found in Appendix A.)

1.9.1.3 A complete, current, and continuous record of changes in empty mass and empty centre of gravity position should be maintained for each aircraft. This record should contain details of all alterations affecting either the mass or balance of the aircraft.



## 1.9.2 Periodic determination of mass

1.9.2.1 The aircraft should be re-weighed at periods determined by the CAA.

1.9.2.2 Notwithstanding 1.9.2.1 above, it should be the responsibility of the operator of an aircraft to renew the load data sheet if a modification results in a significant change in the empty mass or empty centre of gravity position.

1.9.2.3 Further to the provisions of 1.9.2.2, above if the CAA or the operator is of the opinion that adequate mass control has not been exercised over an aircraft during the modification, the CAA or the operator may require that a new empty mass and empty centre of gravity position should be determined.

1.9.2.4 For a fleet or group of aeroplanes of the same model and configuration, an average gross mass and CG position may be used as the fleet mass and CG position, provided that the gross masses and CG positions of the individual aeroplanes are within a tolerance specified by the CAA. The average gross mass and CG position may be determined on a sampling basis. This method allows longer intervals between the weighing of aircrafts dependent on the fleet size of the operator.

## 1.9.3 Procedures for determining mass

1.9.3.1 Aircraft mass determination should be supervised by either an airworthiness officer of the CAA or a person duly trained and nominated by an operator or an owner to sign on its behalf. Aircraft should be presented for mass determination in a condition acceptable to the person authorized to supervise the measurements.

1.9.3.2 Two independent determinations should be made and the aircraft longitudinal datum line should be horizontal. The load should be completely removed from the weighing equipment between determinations. The aircraft gross masses as determined by the two measurements should be consistent. If not, the measurements should be repeated until the gross masses, as determined by two consecutive and independent measurements are consistent.

1.9.3.3 Prior to the initial issue of a Certificate of Airworthiness for each aeroplane and helicopters, a list of equipment included in the empty mass should be established. If an operating mass is used, a similar list of removable equipment and disposable load included in the operating mass should also be established. Where a change occurs in the items included in either the empty mass or, if applicable, the operating mass of an aircraft, the appropriate list should be amended by the operator.

1.9.3.4 Normal precautions, consistent with good practices in the mass determination procedures, should be taken, such as:

- a) aircraft and equipment should be checked for completeness in accordance with 1.9.3.3 above;
- b) fluids should be properly accounted for;
- c) mass determination should be carried out in an enclosed building, to avoid the effect of wind; and
- d) the scales used should be properly calibrated and used in accordance with the manufacturer's instructions.

1.9.3.5 An aircraft mass summary should be completed and certified by the person supervising the measurement. Data recorded should be sufficient to enable the empty mass and empty mass centre of gravity position to be accurately determined.

1.9.3.6 The empty mass and empty centre of gravity position should be determined by the owner or operator of the aircraft in accordance with the recorded results of the measurements.

#### 1.9.4 Loading data

1.9.4.1 The loading schedule should be kept with the aircraft, forming a part of the aircraft flight manual. It should include instructions on the proper load distribution such as filling of fuel tanks and oil tanks, passenger movement, distribution of cargo, etc. A check should be made to determine if the schedule will allow computation of separate loading conditions when the aircraft is to be loaded in other than the specified conditions shown in the loading schedule.

1.9.4.2 Information on which to base records of mass and balance changes to the aircraft may be obtained from the pertinent aircraft specifications, aircraft flight manual and the aircraft mass and balance report. Operators should maintain records of all known mass and centre of gravity changes which occur after the aircraft mass has been determined.

1.9.4.3 A mass and centre of gravity schedule should be provided for each aircraft. Each schedule should be identified by the aircraft designation, nationality and registration marks. The date of issue of the schedule should be given and the schedule should be signed by an approved representative of the organization or a person suitably qualified or acceptable to the CAA. A statement should be included indicating that the schedule supersedes all earlier issues.

#### 1.9.5 Aircraft mass control organization

1.9.5.1 The CAA should consider applications from an operator to determine the mass of certain types of aircraft on a sampling basis, provided the operator has an approved mass control organization.

*Note.— Three or more aircraft of the same type under the control of one operator may, with the approval of the CAA, be treated as a fleet for the purposes of preparation and approval of loading data.*

1.9.5.2 Such an organization should consist of a minimum of two engineers, or one engineer and one mass control officer, or two mass control officers. The staff of an approved mass control organization should have adequate facilities to enable the maintenance of records of mass changes of each aircraft of the operator's fleet.

1.9.5.3 *Application for approval.* Application for approval should be made to the CAA and should include the following:

- a) the qualifications, and experience required by the operator for members of the aircraft mass control organization;
- b) details of the method of liaison with other sections of the organization to ensure that all records of mass changes are transmitted to the aircraft mass control organization; and
- c) details of the procedure within the organization for ensuring adequate control of the loading of all aircraft.

1.9.5.4 The mass and balance control system should include methods by which the operator will complete a current and continuous record of the mass and centre of gravity of each aircraft. Such records should reflect all alterations and changes affecting either the mass or balance of the aircraft and should include a complete and current equipment list. When fleet mass is used, pertinent computations should be available in individual aircraft files.

1.9.5.5 The operator should take into account all probable loading conditions which may be experienced and show that the loading schedules may be applied to individual aircraft or to a complete fleet. When an operator uses several types or models of aircraft, the loading schedule (which may be index type, tabular type, or computer based) should indicate the type or model of aircraft for which it is designed.

#### 1.9.6 Preparation and approval of loading data

1.9.6.1 Loading data prepared in accordance with the provisions of this sub-section should be acceptable to the CAA. Where the applicable flight manual pages are used as the load data sheet and to specify any required loading system, the completed pages should be submitted to the CAA for incorporation in the aircraft flight manual.

1.9.6.2 The operator should be responsible for the preparation of a load data sheet for each aircraft based on the empty mass and empty centre of gravity position.

1.9.6.3 The operator should be responsible for the preparation of a loading system for each aircraft based on the empty mass and empty centre of gravity position, unless it can be shown that the aircraft cannot be loaded so that its centre of gravity falls outside the approved range.

### **1.10 Maintenance records**

#### 1.10.1 Introduction

1.10.1.1 Annex 6, Part I, Chapter 8, 8.4.1 and Part III, Section II, 6.4.1 state that:

“An operator shall ensure that the following records are kept for the periods mentioned in 8.4.2 for the aeroplane and in 6.4.2 for the helicopter:

- a) the total time in service (hours, calendar time and cycles, as appropriate) of the aeroplane and all life-limited components;
- b) the current status of compliance with all mandatory continuing airworthiness information;
- c) appropriate details of modifications and;
- d) the time in service (hours, calendar time and cycles, as appropriate) since last overhaul of the aircraft or its components subject to a mandatory overhaul life;
- e) the current status of the aeroplane’s compliance with the maintenance programme; and
- f) the detailed maintenance records to show that all requirements for signing of a maintenance release have been met.”

1.10.1.2 Annex 6, Part I, Chapter 8, 8.4.2 and Part III, Section II, 6.4.2 state:

“The records in 8.4.1 for aeroplanes or in 6.4.2 for helicopters a) to e) shall be kept for a minimum period of 90 days after the unit to which they refer has been permanently withdrawn from service, and the records in 8.4.1f) for aeroplanes or 6.4.1f) for helicopters for a minimum period of one year after the signing of the maintenance release.”

1.10.1.3 Annex 6, Part I, Chapter 8, 8.4.3 and Part III, Section II, 6.4.3 state:

“In the event of a temporary change of operator, the records shall be made available to the new operator. In the event of any permanent change of operator, the records shall be transferred to the new operator.”

1.10.1.4 Annex 6, Part I, Chapter 8, 8.7.6.1 states:

“The maintenance organization shall retain detailed maintenance records to show that all requirements for the signing of a maintenance release have been met.

1.10.1.5 Annex 6, Part I, Chapter 8, 8.7.6.2 states:

“The records required by 8.7.6.1 shall be kept for a minimum period of one year after the signing of the maintenance release.”

## 1.10.2 General

1.10.2.1 Maintenance records should give an overall picture of the maintenance status of the aeroplane.

1.10.2.2 Operators should ensure that they always receive complete records associated with maintenance release from approved maintenance organizations so that the required records can be retained.

1.10.2.3 The term “an operator shall ensure that the following records are kept” does not mean that operators have to retain the maintenance records by themselves. This can also be done by an approved maintenance organization. When operators arrange for the relevant maintenance organization to retain maintenance records on their behalf, they will nevertheless continue to be responsible for the preservation and transfer of records. Operators should ensure that the approved maintenance organization retains the maintenance records in compliance with the retention periods as prescribed in Annex 6 and that they receive all maintenance records concerning their aircraft retained by the approved maintenance organization when this maintenance organization terminates its operation.

1.10.2.4 In all cases, an approved maintenance organization must record details of all work carried out.

1.10.2.5 The appropriate authority must have access to any maintenance records, whether kept by an operator or an approved maintenance organization.

1.10.2.6 The keeping of maintenance records should be described in the operator’s maintenance control manual and the approved maintenance organization’s procedures manual.

### 1.10.3 Contents of records

1.10.3.1 When recording data on the compliance of airworthiness requirements, the aircraft or component identification should contain information about the model, serial number, part number and registration mark. Information about the work carried out should identify the certifying staff who performed or supervised the work and the inspector of that work, if applicable, and should contain the date the work was completed.

1.10.3.2 The current status of compliance with all mandatory continuing airworthiness information should identify the applicable information, including revision or amendment numbers. Where the information is generally applicable to the aircraft or component type but is not applicable to the particular aircraft or component, this should be identified. The status of the information should include the date when it was accomplished. The status of the information should further specify which part of a multi-part directive has been accomplished and the method, where a choice is available in the information.

1.10.3.3 Appropriate details of modifications and repairs include records identifying any modification or repair and information about their accomplishment as well as the return-to-service approval; the details should include component installation and removal data.

*Note.— Part IV, Chapter 3, 3.3 of this Manual contains further information about the retention of records of modifications and repairs concerning the substantiating data supporting compliance with the airworthiness requirements.*

1.10.3.4 Records about aircraft or component inspection status found during inspections should include information about defects or unairworthy conditions, details of faults and any subsequent rectification, the total time in service as appropriate and the state of maintenance when it enters the approved maintenance organization's facilities.

1.10.3.5 The current record status of all life-limited parts should contain the information specified in the Part I - *Definitions* of this manual. It is important to retain authentication data for the components that have been installed.

1.10.3.6 When operators wish to take advantage of modular design (e.g. modular assembled gas turbines where a specification of a true total time in service is not relevant), the total time in service and maintenance records for each module are to be maintained. The maintenance records as specified are to be kept with the module and should show compliance with any mandatory requirements pertaining to that module.

### 1.10.4 Record-keeping

1.10.4.1 The maintenance records required in Annex 6 should be kept in a form and manner acceptable to the authority.

1.10.4.2 If a paper system is applied, a robust material which can withstand normal handling and filing should be used. The record should remain legible throughout the required retention period, irrespective of the medium.

1.10.4.3 If a computer system is used, it should have at least one back-up system which should be updated within 24 hours of any maintenance. Each terminal should contain programme safeguards against unauthorized alteration of the database and should also have traceability features (for example, requiring

the use of a magnetic or optical card in conjunction with a personal identity number (PIN) known only to the individual concerned).

1.10.4.4 If microfilming or optical or other high-density storage of maintenance records is used, the records should be as legible as the original record and remain so over the required retention period.

1.10.4.5 Maintenance records should be kept in a such a way that they are protected from hazards such as fire, flood, theft or alteration. Computer backup disks, tapes, etc. should be safely stored in a different location.

1.10.4.6 Records should be structured or stored in such a way as to facilitate auditing.

1.10.4.7 Further information about keeping and transferring records in case of aircraft leasing is contained in Chapter 1.2 of Part V of this manual.

## **1.11 Assessment of the operator's arrangements for maintenance**

### 1.11.1 General

The preceding sections of this Chapter, together with Section 1.10 and in Chapter 4 of this Part set out the airworthiness requirements to be met for the issuance of an AOC. The AID inspector will be required to make an assessment as to the adequacy of the operator's actions in meeting these requirements prior to the issuance of an AOC. The following paragraphs may assist in the assessment.

#### 1.11.2 Operator's maintenance control manual, maintenance programme and maintenance organization's procedures manual

The content of these documents should be checked against the guidance set out in this chapter and in Chapter 4 of this part. In connection with their detailed review, AID inspectors should ascertain that effective procedures have been established by the applicant for the distribution, amendment and use of the document. Each manual should be numbered and issued according to a specific distribution list, and each holder made responsible for its prompt and accurate amendment. The distribution list should include all key maintenance and servicing personnel as well as flight engineers and others requiring the information therein for proper performance of their duties. Those parts of the manuals required to be carried on board each aircraft should be designed for convenient use and all parts should permit ready and accurate reference. Acceptance or approval of these documents is by the State of Registry.

#### 1.11.3 Continuing airworthiness information

Although continuing airworthiness information issued by manufacturers and States, such as service bulletins, etc. is not considered part of the document set described above, the inspector should determine that such information relevant to the equipment operated by the applicant is promptly circulated to all those who need such information.

#### 1.11.4 Maintenance records

As part of the assessment, maintenance records should be examined to ensure that the guidance set out in 1.10 is being met.

#### 1.11.5 Maintenance inspection and quality management

State regulations should require the applicant to ensure that there is a system of inspection and quality management within the maintenance organization to ensure that all maintenance, overhaul, modifications and repairs which affect airworthiness are carried out in accordance with the operator's procedures and pertinent State regulations. The adequacy and functioning of this system should be checked during the inspection of the applicant's maintenance organization. In this regard, the ready availability of properly qualified and designated maintenance inspectors should be determined by spot checks of ongoing work requiring inspections.

#### 1.11.6 Maintenance training programme

The AID inspector should check the adequacy of the applicant's maintenance training programme and ascertain that personnel receive instruction in new or revised maintenance methods or equipment. In this connection, the qualifications of maintenance staff should be examined on a random basis to determine recent training received and, as a measure of effectiveness, ability to perform the various associated work processes of overhaul, repair, alteration and periodic checks of the aircraft and installed systems and components.

#### 1.11.7 Certifications for maintenance

During the inspection of the applicant's maintenance organization, several checks should be made at each facility and base to ensure that persons certifying the airworthiness of an aircraft following maintenance or signing the maintenance release for flight are duly licensed or possess equivalent qualifications as properly authorized personnel in an approved maintenance organization.

#### 1.11.8 Maintenance facilities

The applicant's maintenance facilities, including workshops, shop equipment, engine test cells, instrument overhaul and test shops, spare parts storage, etc., should be inspected for adequacy with respect to the proposed operations, and for compliance with safety regulations. This inspection should cover the facilities at each base utilized for maintenance of the applicant's aircraft. An operator should provide suitable office accommodation at appropriate locations for the personnel involved in maintenance management.

#### 1.11.9 Operational considerations

In addition to the above items, the AID inspector should ensure that the operator's aircraft are equipped for their particular operational roles with the necessary avionics, safety equipment and cargo restraints, etc.

## 1.12 Maintenance-related operations specifications

### 1.12.1 General

1.12.1.1 State regulations should require that the operations specifications and limitations applicable to an AOC be issued in conjunction with the issuance of the certificate. These operating specifications and limitations, hereinafter referred to as operations specifications, are utilized to supplement the general provisions of the basic certificate, list authorizations and limitations not specifically covered by State regulations and facilitate administrative procedures. The combined issuance of the AOC and the operations specifications constitutes State approval of the operation.

1.12.1.2 For purposes of standardization and administrative convenience, operations specifications may be divided into separate parts. The exact content of the various parts of the operations specifications will vary depending upon the nature and scope of the operation and the provisions of the individual State regulations. In general terms, however, the parts should cover the following:

- a) *Part A — General provisions.* Specify the make and model of aircraft authorized for use, the maximum passenger seating capacity authorized by the State, the regulation under which the AOC was issued, and any other general authorizations or limitations not covered by the other parts.
- b) *Part B — En-route authorizations and limitations.* Specify the routes or route segments which may be used by the operator, the conditions under which deviations from such routes are authorized, minimum en-route altitudes, conditions under which operations are authorized under VFR and operations within minimum navigation performance specifications (MNPS) airspace.
- c) *Part C — Aerodrome (or heliport) authorizations and limitations.* Specify destination and alternate aerodromes authorized for use, instrument approach procedures, aerodrome (or heliport) operating minima authorized including take-off minima and any special operating limitations in respect of minima.
- d) *Part D — Maintenance.* Specify all special maintenance authorizations on inspections, overhauls and reworking of components.
- e) *Part E — Mass and balance.* Specify all authorizations of standard mass quantities and mass and balance control.
- f) *Part F — Interchange of equipment operations.* Specify the authorized interchange of aircraft between the operator and other operators, the type of equipment to be used, the crews to be utilized, the routes and aerodromes to be used, the operations manual and aircraft operating manual to be utilized (i.e. which operator's manual) and applicable aerodrome (or heliport) operating minima.
- g) *Part G — Aircraft leasing operations.* Specify the parties to the agreement and the duration thereof; the type of lease (i.e. wet or dry); in the case where two operators are involved, the operator responsible for operational control; the routes, area of operation and aerodromes (or heliports) involved; the type and registration numbers of the aircraft involved; the party responsible for maintenance; and reference to States' approval letter or order of the lease.



*Note 1.— Sample forms for operations specifications Parts A, B, C, F and G are given in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335); sample forms for Parts D and E are given in Appendix B and C of this Chapter.*

*Note 2.— See the Manual of All-Weather Operations (Doc 9365) concerning Part C, aerodrome operating minima.*

1.12.1.3 In most cases, considerable time and effort will be saved if the CAA inspector and assistants work closely with the applicant and staff in preparing the various parts of the operations specifications prior to the time the recommendation is made to the DCA. It should be recognized that the details of the operations specifications should initially be drafted by the applicant and that the final version should be acceptable to the operator, the CAA inspector and the DCA. Accordingly, every reasonable effort should be made by the CAA inspector to detect and informally resolve any difficulties which might result in a delay or possible disapproval at the time when the DCA is asked to take a formal decision on the application.

#### 1.12.2 Operations specifications — Part D, Maintenance

1.12.2.1 Part D (an example is in Appendix B of this section) is necessary to provide any detailed maintenance-related authorizations and limitations for a particular operator that are not specifically prescribed by CAA regulations. For example, time limitations for overhaul, inspections and checks may vary with aircraft type and the type of maintenance programme followed; some aircraft have parts that are life-limited by the manufacturer. Consequently, such authorization and limitations need to be specified and, when so specified, should be as binding on the operator as the CAA regulations themselves.

1.12.2.2 It is generally convenient to divide Part D into two categories of material. One category specifies the inspection, check and overhaul time limits for airframes, powerplants, propellers, rotors and other equipment. The pages of Part D listing the foregoing are frequently referred to as “maintenance pages”. The other category of material consists of a number of maintenance-related authorizations which are required by the particular characteristics of the proposed operations. These specified authorizations are generally divided into sub-categories, depending on the individual operation. A sample of the individual authorization pages (sometimes referred to as the “preface pages”) and maintenance pages of Part D are contained in Appendix B to this Chapter. Authorization pages should be numbered consecutively, but separately from maintenance pages and vice versa

1.12.2.3 Operations specifications are prepared by the applicant (operator) in the form prescribed by the DCA. The assistance of the AID Inspector member of the certification team may be requested. In many instances, considerable time and effort will be saved if the assigned Inspector works closely with the applicant in the formulation of the specifications.

#### 1.12.2.4 Authorization pages

Authorization pages are divided into the categories described below and are completed as required by the individual applicant's proposed operation.

- a) *General.* These pages contain the conditions which should be met in order for the operator to operate his aircraft under the terms of the Operations Specifications (for an example, see Appendix B, Figure I-11B-1).

- b) *Check, inspection and overhaul time limits.* These pages specify the time limits and conditions for the aircraft services, checks and inspections approved for the applicant. Limits expressed in terms other than time (in-service, clock, or calendar time) need to be defined. The symbols used on the maintenance pages are defined on this page. These pages may also be used to authorize the use of an identifiable programme, such as a manufacturer's maintenance programme (for an example, see Appendix B, Figure I-11 B-2).
- c) *Reliability programme authorization.* These pages are used to authorize and control reliability programmes which generally fall into one of two categories:
  - 1) those which control the inspection, check and overhaul times for the entire airframe or powerplant; or
  - 2) those which control the inspection, check and overhaul time for complete systems or for individually specified items within the system.

In the case listed in 1) above, the authorization listed on the page may serve as the sole control as far as the operations specifications are concerned. When the entire airframe or powerplant is governed by a reliability programme, there is no need to list individual items on the aircraft maintenance pages; however, the airframe or powerplant controlled by an approved programme should be adequately identified on the authorization page (see Appendix B, Figure I-11B-3 for an example page). In the case listed in 2) above, where complete systems or selected individual items are controlled by a reliability programme, reference to the control programme should be made on the authorization page, specifically identifying the controlling document. Individual items should be further identified on the aircraft maintenance page on which they appear by an asterisk, control programme name or acronym, or other symbol. The identification marks and symbols used should be identified on an authorization page.

- d) *Short-term escalation authorization.* Applicants who wish to establish authorization for short-term increases in maintenance intervals (escalation) other than those which are part of their approved reliability programmes need to have those procedures authorized by an operations specification page. This page should reference the applicant's maintenance programme or other approved publication defining those procedures, in a manner that requires the operations specification page to be amended whenever the procedure is revised (for an example page, see Appendix B, Figure I-11B-4.)
- e) *Maintenance contractual authorization.* CAA regulations should permit an operator to make arrangements with other persons for the performance of any maintenance, preventive maintenance or alterations. However, the DCA should require that this arrangement be approved by the CAA, and that an operations specification authorization page be issued containing such pertinent information as the names of contracting operators, contract identification and date, place where maintenance will be performed, reference documents approved for the control of maintenance and a clause referring to termination or alteration of the contract (for an example page, see Appendix B, Figure I-11B-5).
- f) *Leased aircraft maintenance authorization.* This page is prepared to authorize an operator to use two different maintenance programmes for the same type aircraft. This authorization is intended to apply only in cases involving short term leases of aircraft that are intended to be returned to the lessor. This authorization permits the lessor to retain

maintenance programme compatibility with other aircraft in his fleet (for an example page, see Appendix B, Figure I-11B-6).

- g) *Parts pool authorization.* CAA regulations should contain provisions which permit, subject to approval by the CAA, an operator to enter into parts pool agreements with other persons or operators. In those cases where an operator wishes to enter into such an agreement, an authorization page should be prepared containing at least the elements listed on the example page shown in Appendix B, Figure I-11B-7.
- h) *Prorated time authorization.* Whenever prorating is used to establish initial maintenance starting times, an authorization page needs to be included in Part D. This authorization is essential, not only for proper time accountability, but also for the transfer of the correct times should the aircraft be sold to another operator. This page should indicate to all concerned that the aircraft is being operated under adjusted times since overhaul, calculated by prorating (for an example page, see Appendix B, Figure I-11B-8).
- i) *Parts borrowing authorization.* CAA regulations should provide for operators of large aircraft to obtain reasonable relief from approved overhaul time limits when borrowing parts from another operator. The preparation of an authorization page is necessary because an operator may need to borrow a part and the only available part may have a higher time since overhaul (TSO) than the operator's approved overhaul time limit. In some States, the operator is authorized to use the borrowed part for up to 100 hours (or 50 landings if part life is controlled by number of landings). In the case where the borrowed part has a lower TSO than the operator's approved overhaul time limit, the part in question is generally permitted to be used up to the operator's approved overhaul time limit providing:
  - 1) the part has at least 200 hours (or 100 landings if the overhaul time limit is controlled by the number of landings) remaining to overhaul in respect of the lender's approved overhaul time limit; and
  - 2) the part is not operated beyond its approved life if it is specifically "life limited" (for an example page, see Appendix B, Figure I-11B-9).
- j) *Ferry flight authorization.* CAA regulations should contain provisions which permit continuing authorization for an operator to conduct ferry flights providing certain criteria are met. An example page which grants this type of authorization is shown in Appendix B, Figure I-11B-10.

#### 1.12.2.5 Maintenance pages

Maintenance pages provide an orderly itemized listing of the inspection, check and overhaul time limits for airframes, powerplants, propellers, rotors and appliances. The symbology used on the maintenance pages is defined in the authorization page entitled "Check, Inspection and Overhaul Time Limits" (Appendix B, Figure I-11B-2). Sample maintenance pages are shown in Appendix B, Figures I-11B-11 and I-11B-12.

### 1.12.3 Operations specifications — Part E, Mass and Balance Page

1.12.3.1 Part E (an example is in Appendix C of this section) is necessary to specify the procedures the operator is to follow for control of the mass and balance of the aircraft to be used. The method of compliance given in Part E should not make reference to any general guidance material. All references should be limited to the operator's mass and balance control manual or operations manual.

1.12.3.2 The material contained in Part E needs to provide a clear and accurate description of the methods and procedures the operator is to follow for:

- a) determination of mass of passengers and crew;
- b) determination of mass of cargo and baggage;
- c) periodic determination of aircraft mass (weighing);
- d) loading schedules for each type and series of aircraft; and
- e) loading instructions.

*Note.— An example of a Mass and Balance Control page is given in Appendix C to this Chapter.*

## **1.13 Operations manual, minimum equipment list (MEL) and configuration deviation list (CDL)**

### 1.13.1 General

1.13.1.1 The operator is responsible for exercising the necessary operational control to ensure that his aircraft is not dispatched outside of the limitations of approved AFM or if its configuration is contrary to the provisions of the configuration deviation list (CDL) or its instruments and equipment are not in an operable condition except as provided in the MEL. According to Annex 6, the CAA should specify that the operator is responsible for exercising the necessary operational control to ensure that his aircraft are not dispatched with multiple MEL items inoperative without first determining that any interface or interrelationship between the inoperative systems or components will not result in degradation in the level of safety or an undue increase in crew workload.

1.13.1.2 Annex 6, Part I, 4.2.2 and 4.2.5 and Part III, Section II, 2.2.2 and 2.2.5 require that the operator include aircraft operating instructions and checklists in the operations manual. This part of the operations manual has to be acceptable to the State of the Operator, and contain all AFM information and additional data including normal, abnormal and emergency procedures, checklists, limitations, performance information, details of the aircraft systems and other material relevant to the operation of the aircraft. Sometimes the aircraft manufacturer provides the aircraft operator with operating instructions in order to help it to develop its own operations manual.

1.13.1.3 Annex 6, Part I, 6.1.3 and Part III, Section II, 4.1.3 requires that the operator include in the operations manual a MEL, which specifies for a given model of aircraft the minimum operable equipment required, taking into account operating rules for the existing operational conditions, for the commencement and continuance of flight.

1.13.1.4 Annex 6, Part I, Attachment G and Part III, Section, II, Attachment E contain guidance on the MEL which should be developed from the master minimum equipment list (MMEL) which should

have been developed by the organization responsible for the type design in cooperation with the operators of the aircraft and the CAA at the time the aircraft first enters service.

1.13.1.5 The AFM, the MMEL and the CDL are described in Chapter 1.8 of the Part III of this manual.

### 1.13.2 Operator minimum equipment list

1.13.2.1 Operators engaged in commercial air transportation must be required to produce their own MELs which are then approved by the CAA for incorporation in their operating manuals for the use and guidance of flight and ground operations personnel. The MEL should be tailored to the individual operator's routes and procedures, within the constraints imposed by the MMEL, meaning that the operator's approved MEL should be based upon, but not less restrictive than the relevant MMEL. The current MMEL for a given aircraft may normally be obtained from the organization responsible for the type design of the aircraft or from the CAA of the State of Design. The MMEL is not normally part of the required aircraft documentation and it is frequently necessary for an operator utilizing aircraft manufactured in another State to request a copy of the current MMEL and amendments as they occur, in order to develop and maintain an MEL for approval by his State CAA.

1.13.2.2 In developing an MEL, the philosophy should be to authorize flights with inoperative equipment only when the inoperative equipment does not render the aircraft unairworthy for the particular flight. Limitations, procedures and substitutions may be used to provide conditions under which the inoperative equipment will not make the operation unsafe or the aircraft unairworthy. It should be emphasized that the operator will need to exercise close operational control over the use of the MEL by all concerned. The MEL is intended to establish limits for the continued operation of the aircraft with MEL items inoperative. In the case of inoperative MEL items, the operator must make repairs and/or replacement within the timeframe prescribed in the MEL.

1.13.2.3 CAA regulations must require that the MEL be carried on board as part of the operations manual (it may be a separate volume). The manual must contain en-route flight, navigation and communications procedures for the continuance of flight if any item of equipment required for the operation becomes unserviceable en route. If dispatch with unserviceable equipment is allowed, the manual must also cover these requirements and procedures.

1.13.2.4 For an inoperative item in the MEL, which would require an operational and/or maintenance procedure to ensure the required level of safety, the operator should develop the necessary operational/maintenance procedures based upon, but not less restrictive than those contained in the MEL. Those procedures should provide clear direction to the crewmembers and maintenance personnel of the action to be taken, including procedures necessary for securing those inoperative items. Alternatively, if the necessary procedure is contained in another document, e.g., other part of the operations manual (for operational procedures) or the maintenance control manual (for maintenance procedures), the MEL may refer to a section of this appropriate document.

### 1.13.3 Configuration deviation list (CDL)

1.13.3.1 Operators generally use the CDL which is associated to the AFM. In any case, they should use an approved CDL not less restrictive than the one in the AFM.

1.13.3.2 Operators should produce procedures for the use of the CDL, such as:

- a) The pilot in command should be notified and aware of each missing part(s) before the flight. These missing part(s) should be listed in the aircraft logbook in an appropriate notation
- b) If an additional part is lost in flight, the aircraft may not depart the airport at which it landed following this event, until it again complies with the limitations of the CDL.

### **1.14 Recommendations following assessment**

Following the satisfactory completion of the inspections described in this Chapter and the required correction of any deficiencies by the applicant, AID inspectors should submit to the inspector-in-charge their recommendations as to the applicant's ability, in respect of maintenance, to carry out safely the proposed operation. These recommendations should of course be accompanied by inspection reports and other documentation to substantiate the recommendation.

### **1.15 Surveillance**

This aspect is addressed in Chapter 8 of the *Manual of Procedures for Operations Inspection, Certification and Continued Surveillance* (Doc 8335). The areas to be covered are essentially the same as those assessed for the issuance of the AOC.

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**APPENDIX A.— SAMPLE MASS AND BALANCE REPORT**

**MASS CONTROL CERTIFICATE**

Date issued . . . . . \*Date/time of first flight . . . . . UTC

\* Note: This date/time must be later than the date of issue

**Aircraft mass and centre of gravity determination**

No.

Date

Aircraft registration

Aircraft type

Aircraft serial number

Name of operator

Place of determination of mass

Reason for determination of mass

Performed by
Checked by
Empty mass
Empty CG from datum line
Index

Approved by:

(Authorized personnel)

## MASS CONTROL CALCULATION

### Empty mass lever arms

Aircraft type

Registration

Reaction (wheel, jack, point, etc.)	Average scale reading (kg)	ARM (cm)	Moment (cm-kg)
Left main gear			
Right main gear			
Sub-total			
Nose/tail gear			
Total (as measured)			

Items included in empty mass:

- 1.
- 2.
- 3.
- 4.
- 5.

Remarks:



## MASS CONTROL CALCULATION

### Aircraft mass and centre of gravity determination

<b>COLUMN I</b>				<b>COLUMN II</b>			
Items included but not part of empty mass	Mass (kg)	AR M (cm)	Momen t (cm-kg)	Basic items not included when determining mass	Mass (kg)	AR M (cm)	Momen t (cm-kg)
<b>TOTAL</b>				<b>TOTAL</b>			

### Aircraft mass record

Description	Net mass (kg)	ARM (cm)	Moment (cm-kg)
Total (as measured)			
Less total mass from Column I			
Plus total mass from Column II			
Net empty mass			

CG  
limitation:

forward           ..... cm

aft                 ..... cm   } from reference line

Index formula:

INDEX:

**APPENDIX B.— OPERATIONS SPECIFICATIONS,  
PART D — MAINTENANCE**

Government of \_\_\_\_\_ Page 1 of \_\_\_\_\_

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**General**

Irrespective of the type of operation to be conducted by (name of operator), the continuing airworthiness and inspection programme limitations which are described and specified in these operations specifications shall be applicable to all (name of operator) aircraft listed and authorized for use under CAA Regulations.

The operator shall provide a comprehensive maintenance programme necessary to fulfil his responsibility to maintain the aircraft in an airworthy condition in accordance with applicable CAA Regulations and standards prescribed and approved by the Director.

The aircraft and its component parts, accessories, and appliances shall be maintained in an airworthy condition in accordance with the maximum time limits hereinafter set forth for the accomplishment of the overhaul, periodic inspections, and routine checks of the aircraft and its component parts, accessories, and appliances.

“On-condition” items will be maintained in a continuous airworthy condition by periodic and progressive inspections, checks, services, repair, and/or preventive maintenance and shall be appropriately described in the operator’s maintenance programme.

Parts or subcomponents, not listed below, will be checked, inspected and/or overhauled at the same time limitations specified for the component or accessory to which such parts or subcomponents are related or at the time period indicated in the maintenance programme.

Effective date: \_\_\_\_\_

**Figure I-11B-1. Sample authorization page (general)**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**Check, inspection and overhaul time limits  
Douglas DC-XXX****Preflight (PF)**

The "pre-flight inspection" shall be accomplished in accordance with the applicable procedures in XYZ Airlines maintenance programme, Volumes A and C, each calendar day when the aircraft is in operation.

**Service Check (SC)**

The "service check" shall be performed at intervals not exceeding 50 hours of aircraft time in service in accordance with the applicable procedures in XYZ Airlines maintenance programme, Volumes A and C.

**"Line" Inspection and Check (LC)**

The "line" inspection and check shall be performed at intervals not exceeding 100 hours of aircraft time in service in accordance with the applicable procedures in XYZ Airlines maintenance programme, Volume C.

**"A" Inspection and Check (A)**

The "A" inspection and check shall be performed at intervals not exceeding 175 hours of aircraft time in service and includes, in addition to the "line inspection and check", all applicable procedures in current chapters 01 and 02 of XYZ Airlines maintenance programme, Volume C.

**"B" Inspection and Check (B)**

The "B" inspection and check shall be performed at intervals not exceeding 350 hours of aircraft time in service and includes, in addition to the "A" inspection and check, all applicable procedures in current chapters 01 and 02 of XYZ Airlines maintenance programme, Volume C.

**"Overhaul" (Major Inspection Programme)**

A block overhaul will be performed at intervals not to exceed three thousand (3000) hours of aircraft time in service. A series of six (6) block overhauls comprise the complete major inspection programme. The blocks will be performed in accordance with applicable procedures in XYZ Airlines maintenance programme, Volume E.

**"Fixed Radio Installation"**

The term "fixed radio installation" shall be understood to include the following: fixed antennae, indicators and warning light assemblies, jack boxes, cables, plugs, wiring, junction boxes, shockmounts, and remote tuning shafts.

Effective date: \_\_\_\_\_

**Figure I-11B-2. Sample authorization page —  
Check, inspection and overhaul time limits**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**Reliability programme authorization  
Douglas DC-XXX**

XYZ Airlines is authorized to utilize the provisions of a maintenance reliability programme which contains the standards for determining maintenance intervals and processes.

The programme for these systems is described in and the standards are established in XYZ document (enter name, number, and date).

The time limitations for the overhaul, inspection and checks of the aircraft and/or systems/components controlled by the programme are contained in XYZ Airlines DC-XXX maintenance programme.

1. The service time limits will be listed in the 5-2-0 section of the maintenance programme.
2. The component overhaul time limits and life limits will be listed in the 5-2-1 section of the maintenance programme.
3. The service item checks and scheduled maintenance tasks to be performed at routine service periods will be listed in the 5-2-2 section of the maintenance programme.
4. The inspection and maintenance of aircraft structures will be listed in the 5-2-3 section of the maintenance programme.
5. The parts and sub-components not listed in the 5-2-1 section of the maintenance programme will be checked, inspected and/or overhauled at the same time limit specified for the components or assembly to which such components are related.

In the event the programme document referenced above is cancelled, the maintenance programme covered by said document will be completely re-evaluated and maintenance and overhaul time limits established by the CAA.

Effective date: \_\_\_\_\_

**Figure I-11B-3. Sample authorization page —  
Reliability programme authorization**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**Short-term escalation authorization**

A. The procedure for short-term escalation of maintenance intervals is contained in XYZ Airlines General maintenance programme, Chapter 7, Section 3. This procedure is applicable to the following equipment:

DOUGLAS DC-XXX Fleet

## B. Limitations

1. Aircraft A & B checks — 15 hours — time in service.
2. Aircraft C checks — 50 hours — time in service.
3. Aircraft D checks — 400 hours — time in service.
4. Powerplants and powerplant components — 5% not to exceed 500 hours — time in service.
5. Airframe components and appliances — 10% not to exceed 500 hours — time in service.

*Note.— An individual item may be escalated to a higher figure predicated on justification presented to the assigned CAA principal AID Inspector (maintenance or avionics as applicable) and subject to his approval prior to exceeding the current limit.*

## C. Prohibitions

Short-term escalation procedures do not apply to the following:

1. Intervals specified by CAA airworthiness directives.
2. Life limits specified by Type Certificate data sheets, flight manuals, or manufacturer's publications.
3. Limitations specified by minimum equipment lists.
4. Structural sampling periods imposed by maintenance review boards.

Effective date: \_\_\_\_\_

**Figure I-11B-4. Sample authorization page —  
Short-term escalation authorization**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**Maintenance contractual authorization**

XYZ Airlines is authorized to utilize the provisions of a contractual agreement with RST Airlines identified as \_\_\_\_\_ dated \_\_\_\_\_ for the maintenance of the following XYZ Airlines' DC-XXX aircraft in accordance with RST Airlines' approved continuous maintenance programme:

C-345A

C-459A

The agreement provides for RST Airlines to perform all scheduled maintenance above the "A" check level, including structural inspection, powerplant shop maintenance and aircraft component shop maintenance, in accordance with RST Airlines' methods, standards, and procedures.

Under the terms of this agreement RST will provide XYZ with a current copy of the publications and documents relating to their maintenance programme as listed in that agreement and revisions thereto. All maintenance performed by XYZ will be in accordance with those publications and documents.

XYZ Airlines is authorized to participate in RST Airlines' reliability programme identified as \_\_\_\_\_ as revised, with XYZ aircraft included in RST fleet for the purpose of that programme. Maintenance intervals and assignment of maintenance processes are controlled by that programme.

Under the terms of this agreement all maintenance records applicable to the subject aircraft shall be maintained by RST Airlines at their maintenance base in \_\_\_\_\_. XYZ Airlines shall expeditiously forward the original of all maintenance records generated during the period of this agreement to RST Airlines for inclusion in the records for that aircraft, and XYZ Airlines will retain a copy for their files for that aircraft.

XYZ Airlines will determine that all replacement components, other than those provided by RST Airlines, that are common to the above listed aircraft and the RST fleet are evaluated by RST Airlines to ensure they meet RST standards.

RST Airlines will maintain all components and systems not common to RST Airlines' fleet in accordance with the requirements of XYZ Airlines' specifications. Administration of this agreement and related policies and procedures, including those pertaining to the control of maintenance interval limits, will be included in XYZ Airlines' maintenance programme.

In the event this arrangement is cancelled, altered, or if RST Airlines should cease for any reason to provide the services contracted for, the entire programme is subject to reevaluation by CAA.

Effective date: \_\_\_\_\_

**Figure I-11B-5. Sample authorization page —  
Maintenance contractual authorization**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**Leased aircraft maintenance authorization**

XYZ Airlines, Inc., is authorized to maintain DC-XXX aircraft C9351 S/N 1237, in accordance with RST Airlines, Inc., approved DC-XXX maintenance programme in accordance with the aircraft lease agreement between XYZ and RST dated \_\_\_\_\_. All maintenance accomplished under this authorization will be according to RST maintenance programme and will be recorded on RST forms except for the following, which will be maintained under XYZ's approved programme:

1. Life rafts, life vests, and emergency transmitters.
2. Pre-flight inspections.

This authorization has no bearing on XYZ Airlines, Inc., approved maintenance programme for this type aircraft.

Effective date: \_\_\_\_\_

**Figure I-11B-6. Sample authorization page —  
Leased aircraft maintenance authorization**



**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**Parts pool authorization**

The holder of these Operations Specifications is authorized, subject to the conditions and limitations specified herein, to participate in a parts pool agreement.

1. Only those parts pool participants specified herein shall be eligible to provide parts to \_\_\_\_\_.
2. \_\_\_\_\_ shall not utilize any part provided by any participant identified herein unless such part meets with the applicable provisions of the Civil Air Regulations and the certificate holder's manual.

Effective date: \_\_\_\_\_

**Figure I-11B-7. Sample authorization page —  
Parts pool authorization**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**Prorated time authorization**

The aircraft listed herein and including its installed powerplants, propellers, and appliances shall be maintained in accordance with the adjusted hours of time since overhaul as set forth in the document identified as:

Adjusted time since overhaul for C \_\_\_\_\_

Document No. \_\_\_\_\_

Dated \_\_\_\_\_

A copy of which is on file at the operator's main maintenance base and with the CAA.

These time limits and this specification page shall remain in effect until such time as the aircraft, its powerplants, propellers and appliances are first overhauled. Thereafter, this authorization page shall be cancelled and the aircraft will be inspected and overhauled in accordance with \_\_\_\_\_ airlines' maintenance programme and approved time limits.

Effective date: \_\_\_\_\_

**Figure I-11B-8. Sample authorization page —  
Prorated time authorization**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**Parts borrowing authorization**

XYZ Airlines, when in need, may borrow a part from another \_\_\_\_\_ (State) operator (or from a parts pool if the operator is a participant of a parts pool agreement) and may use such part for a maximum of 100 hours (or 50 landings if the service or overhaul time limit is controlled by the number of landings) even though the time in service of such part exceeds XYZ Airlines' approved service and overhaul time limit providing:

- a) the part in question has a minimum time of 200 hours (or 100 landings if the service or overhaul time limit is controlled by the number of landings) remaining to service or overhaul in relation to the lender's approved service and overhaul time limit.
- b) the part is not specifically life limited. In such a case, the part may not be operated beyond its approved service life.

Effective date: \_\_\_\_\_

**Figure I-11B-9. Sample authorization page —  
Parts borrowing authorization**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES

AUTHORIZATION PAGE

**Ferry flight authorization**

This special flight permit with continuous authorization is (AOC) authorization to fly any aircraft listed in the Operations Specifications, that may not meet applicable airworthiness requirements but is capable of safe flight, to a base where the necessary maintenance or alterations can be performed.

1. A copy of this operations specification, or appropriate sections of the AOC holder's manual containing a restatement of this permit, shall be carried on board the aircraft when operating under a special flight permit.
2. Before operating an aircraft that does not meet applicable airworthiness requirements, the AOC holder shall make a determination that the aircraft can safely be flown to a station where maintenance or alterations can be performed. In addition, the AOC holder will have the aircraft inspected in accordance with procedures contained in the operator's manual and have a certificated engineer certify in the aircraft logbook that the aircraft is in safe condition for the flight as specified in the operator's manual.
3. Only flight crew members and persons essential to operations of the aircraft shall be carried aboard during ferry flights where the aircraft flight characteristics may have been altered appreciably or the flight operations affected substantially.
4. Operating mass of the aircraft must be the minimum necessary for the flight with necessary reserve fuel load.
5. Flight shall be conducted in accordance with appropriate special conditions or limitations contained in (appropriate sections or pages) of the AOC holder's manual.
6. This authorization does not permit operation of a product to which an airworthiness directive applies except in accordance with the requirements of that directive.
7. Aircraft involved in an accident or incident may not be ferried prior to notifying the CAA accident co-ordinator.
8. The AOC holder shall impose any further conditions or limitations necessary for safe flight.

Effective date: \_\_\_\_\_

**Figure I-11B-10. Sample authorization page —  
Ferry flight authorization**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES  
 MAINTENANCE PAGE  
 Douglas DC-XXX

System/component	Model or P/N	Manufacturer	Overhaul period	Inspection and check period	Other
Air conditioning			OC	A, C, D	FC @ 1D
Turbine, air cycle			3 000	1C	
Valve, pneumatic			3 000	4C	
Filter, air			OC	1C	Clean @ 1C
Altimeter, cabin			9 000	1C	
Control, cabin pressure			OC	1C	Replace Filter Element @ 1D
Control, differential pressure			12 000	1C	
Regular, servo pressure			7 000	6C	
Valve, outflow			11 000	2C	1D-Replace Filter Element
Communications			OC	A, B, C	
Fixed radio installation			OC	C	
Amplifier, isolation	AI-27	Telephonics	2 000	C	
Transceiver HF	618T-2	Collins	OC	C	
Control, communications	VHF G-4817	Cables	OC	C	
Cockpit voice recorder	A-100	Fairchild	OC	C	
Equipment and furnishings			OC	B, C, D	

Evacuation slides			1 yr.	A, C	
Life vests			1 yr.	A, C	
Evacuation slide inflation bottles			3 yr.	A, C	See Note 25.1
Escape ropes or straps (cockpit/cabin)			OC	A, C	
Megaphone			OC	A	
Flotation equipment			OC	A, C	
First aid kit			OC	A	
Crash axe			OC	A	
Smoke goggles			OC	A	
<p>Note 25.1: Inspections, hydrostatic test, and life limits will be accomplished as set forth in _____ of CAA Regulations.</p> <p>Effective date: _____</p>					

**Figure I-11B-11. Sample maintenance page**

**OPERATIONS SPECIFICATIONS PART D**

XYZ AIRLINES  
 MAINTENANCE PAGE  
 Douglas DC-XXX

System/component	Overhaul period	Inspection and check period			Other
		P.F.	S.C.	P.I.	
Hydraulic	AO	X	X	X	
Pump, emergency	2 000	X	X	X	
Pump, engine-driven		X	X	X	
Regulator, air pressure	4 000			X	
Valve-reservoir, relief	4 000			X	
Accumulator, emergency	4 000		X	X	
Accumulator, regulator – primary	4 000		X	X	
Filters, pressure	OC		X	X	R & R 4-PI
Valve, thermal relief – emergency	4 000	X	X	X	
Reservoir air filters	OC				
Ice and rain	AO	X	X	X	
Windshield	OC		X	X	
Valve, modulating	OC		X	X	
Instruments	AO	X	X	X	
Flight data recorder (Fairchild P/n 15630-601)	2 500	X	X	X	
Clock (Elgin A-3)	OC	X	X	X	

Landing gear	10 000	X	X	X	
Wheels	OC	X	X	X	Zygo wheels each tire change
Brakes	OC	X	X	X	
Anti-skid control units	OC			X	Spin check at wheel or brake change
Tires	OC	X	X	X	
Cable – emergency system	OC			X	FC 4-PI
Bottle, nitrogen	OC	X	X	X	0
Doors and linkage	OC	X	X	X	
Valve assembly – power brake	4 000	X	X	X	
Lights	OC	X	X	X	
* Inspections, hydrostatic test, and life limits will be accomplished as set forth in _____ of CAA Regulations					
Effective date: _____					

**Figure I-11B-12. Sample maintenance page**



**APPENDIX C.— OPERATIONS SPECIFICATIONS,  
PART E — MASS AND BALANCE CONTROL**

(sample)

Government of \_\_\_\_\_ Page 1 of \_\_\_\_\_

**OPERATIONS SPECIFICATIONS PART E**

XYZ AIRLINES

**Aircraft mass and balance control**

The following procedures have been established to maintain control of mass and balance of the XYZ Airlines' aircraft operated under the terms of these Operations Specifications (identified below) and to ensure that these aircraft are loaded within the gross mass and centre of gravity limitations.

*Determination of mass of passengers and crew.* Procedures by which either actual or approved average passenger mass may be used are provided for in the operator's mass and balance control manual.

*Determination of mass of baggage*

- a) When computing the mass and balance of the aircraft, the average passenger baggage mass used is in accordance with the operator's mass and balance control manual.
- b) The average passenger baggage mass authorized in paragraph a) shall not be used in computing the mass and balance of charter flights and other special services involving the carriage of special groups.

*Periodic Aircraft Weighing.* All aircraft will be weighed in accordance with the procedures for establishing individual or fleet aircraft mass as outlined in the operator's aircraft mass and balance control manual.

*Loading schedules and identification of aircraft.* The following loading schedules are used for routine operations:

*Aircraft type      Type of loading schedule*

- 1. Douglas Model DC-XXX (passenger and cargo)      Tabular
- 2. Lockheed Model L-XXX (passenger)      Index
- 3. Boeing Model B-XXX (passenger)      Computer
- 4. Boeing Model B-XXX (passenger)      Computer

*Loading instructions.* Loading instructions relative to the above-listed loading schedules are set forth in XYZ Airlines' Stations Manual, Volume E and Flight Operations Manual, Volume C.

Effective date \_\_\_\_\_

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## **CHAPTER 2.— AIRWORTHINESS REQUIREMENTS FOR EXTENDED DIVERSION TIME OPERATIONS**

### **2.1 Introduction**

The material in this chapter provides guidance on the continuing airworthiness approval for extended diversion time operations as defined in Annex 6, Part I, 4.7.

### **2.2 General**

ICAO Standards containing the basic requirements for the approval of extended diversion time operations are contained in Annex 6, Part I, 4.7. Attachment E of the Annex contains guidance on the setting of a threshold time and on the means of achieving the required level of safety. Paragraph 2.6 of this Chapter contains guidance on the assessment of the level of performance and reliability of systems. Part V, Chapter 2 of this Manual contains information on the approval of extended diversion time operations in the case of international leasing arrangements.

### **2.3 Continuing airworthiness considerations**

#### **2.3.1 General**

2.3.1.1 In considering an application from an operator to conduct extended diversion time operations, an assessment should be made of the operator's over-all safety record, past performance, training and maintenance programmes. The data provided with the request should substantiate the operator's ability and competence to safely conduct and support these operations and should include the means used to satisfy the considerations outlined in this paragraph. Any reliability assessment obtained, either through analysis or service experience, should be used as guidance in support of operational judgements regarding the suitability of the intended operation.

2.3.1.2 Operators without such experience should establish a programme that results in a high degree of confidence that the operator is able to safely conduct and support these operations and should include the means used to satisfy the considerations outlined in this paragraph.

#### **2.3.2 Assessment of the operator's propulsion system reliability**

2.3.2.1 A determination should be made of the operator's capability to achieve and maintain an acceptable level of propulsion system reliability based on operator's past experience or a process review.

2.3.2.2 For operators with past experience, this determination should include trend comparisons of the operator's data with other operators as well as the world fleet average values and the application of a qualitative judgement that considers all of the relevant factors. The operator's past record of propulsion system reliability with related types of engines should be reviewed, as well as its record of achieved systems reliability with the airframe-engine combination for which authorization is sought to conduct extended diversion time operations.

2.3.2.3 Operators without such experience should establish a programme that results in a high degree of confidence that the propulsion system reliability appropriate to the extended diversion time operations would be maintained.

### 2.3.3 Engineering modifications and maintenance programme considerations

Although these considerations are normally part of the operator's continuing airworthiness programme, the maintenance and reliability programme may need to be supplemented in consideration of the special requirements of extended diversion time operations (see Sections 2.4 and 2.5 of this Chapter). The following items, as part of the operator's programme, should be reviewed to ensure that they are adequate for extended diversion time operations.

- a) *Engineering modifications.* The operator should provide to the State of Registry and, where applicable, to the State of the Operator the titles and numbers of all modifications, additions and changes which were made in order to substantiate the incorporation of the configuration maintenance and procedures (CMP) standard in the aeroplanes used in extended diversion time operations. As provided by Section 4.7.2 of Annex 6, Part 1, since the aeroplanes with more than two engines, for which an application for type certification was submitted prior to [applicability date of the pending Annex 6 standard], need not comply with the requirements of Annex 8, Part IIIB, G.2.8, there will be no requirement for engineering modification for configuration changes except for installation of cargo fire suppression system as required by Section 4.7.6 of Annex 6, Part 1.
- b) *Maintenance procedures.* If changes to established maintenance and training procedures, practices or limitations are required in order to qualify for extended diversion time operations, then these changes should be submitted to the State of the Operator and, where applicable, to the State of Registry, before such changes may be adopted.
- c) *Reliability reporting.* The reliability reporting programme, supplemented as appropriate and approved should be implemented prior to and continued after approval of extended diversion time operations. Data from this process should result in a suitable summary of problem events, reliability trends and corrective actions and should be provided regularly to the State of the Operator and to the concerned airframe and engine manufacturers.
- d) *Modifications and inspections implementation.* Approved modifications and inspections that would maintain the reliability objective for the propulsion system and airframe systems as a consequence of AD actions and revised CMP standards should be promptly implemented. Other recommendations made by the engine and airframe manufacturers should also be considered for prompt implementation. This would apply to both installed and spare parts.
- e) *Aeroplane dispatch and verification procedures.* Procedures and centralized control processes should be established which would preclude an aeroplane's being dispatched for extended diversion time operations after propulsion system shutdown or primary airframe system failure on a previous flight, or significant adverse trends in system performance, without appropriate corrective action having been taken. Confirmation of such action as being appropriate may, in some cases, require successful completion of verification in a flight. Such verification may be accomplished in a non-revenue flight or a revenue flight with non-extended diversion time operations. If such verification is to be conducted on a regular scheduled revenue flight with extended diversion time operations,

then the verification of the affected system should be satisfactorily completed prior to reaching the extended diversion time entry point. The operator should establish verification flight procedures.

- f) *Maintenance programme.* The operator's maintenance programme should ensure that the airframe and propulsion systems will continue to be maintained at the level of performance and reliability necessary for extended diversion time operations. This includes such programmes as an engine condition monitoring programme and an engine oil consumption monitoring programme and, if appropriate, an APU in flight start monitoring programme.
- g) *Considerations affecting sub-contracted maintenance.* Maintenance personnel involved in extended diversion time operations should be aware of any potential additional requirements of the maintenance programme associated with extended diversion time operations. When maintenance is sub-contracted, the operator should ensure that the maintenance and all airworthiness flight dispatch procedures are performed to the standard as defined in the operator's approved maintenance programme.

#### 2.3.4 Airworthiness flight dispatch considerations

Although many of the airworthiness flight dispatch considerations may already be incorporated into approved programmes for other aeroplanes or non-extended diversion time operations, the nature of extended diversion time operations necessitates a re-examination of these programmes to ensure that they are adequate for this purpose. Systems redundancy levels appropriate to extended diversion time operations should be reflected in the master minimum equipment List (MMEL). An operator's minimum equipment list (MEL) may be more restrictive than the MMEL considering the kind of extended diversion time operations proposed and equipment and service problems unique to the operator. Systems considered to have a fundamental influence on flight safety may include, but are not limited to:

- a) electrical, including battery;
- b) hydraulic;
- c) pneumatic;
- d) flight instrumentation;
- e) fuel;
- f) flight control;
- g) ice protection;
- h) engine start and ignition;
- i) propulsion system instruments;
- j) navigation and communications;
- k) auxiliary power-units (APU);

- l) air conditioning and pressurization;
- m) cargo fire suppression;
- n) engine fire protection;
- o) emergency equipment; and
- p) any other equipment required for extended diversion time operations.

## **2.4 Continuing surveillance**

2.4.1 The State of the Operator should monitor all aspects of the operation it has authorized to ensure that the level of reliability achieved in extended diversion time operations remains at the necessary level and that the operation continues to be conducted safely. In the event that an acceptable level of reliability is not maintained that significant adverse trends exist, or that significant deficiencies are detected in the design or the conduct of the operation, the State of the Operator should initiate a special evaluation, impose operational restrictions, if necessary, and stipulate corrective action for the operator to adopt to resolve the problems in a timely manner.

2.4.2 Causes of engine inflight shutdown, or other engine/propulsion system problems may be associated with design problems, and/or maintenance and operation procedures applied to the aeroplane. It is important to identify the root cause of events so that the appropriate corrective action is implemented. An operator should not be considered responsible for the occurrence of a design related event in its fleet. However, maintenance or operational problems may be wholly, or partially, the responsibility of the Operator. If an Operator has an unacceptable engine inflight shutdown rate attributed to maintenance or operational practices, then action tailored to that operator may be required by the State of the Operator.

2.4.3 A high rate of engine inflight shutdowns for a small fleet, may be due to the limited number of engine operating hours and may not be indicative of an unacceptable rate. The underlying causes for such a jump in the rate will have to be considered by the State.

2.4.4 The State of the Operator should alert the State of Design when a special evaluation is initiated and provide for its participation independent of the determined cause.

## **2.5 Maintenance requirements**

### **2.5.1 Introduction**

The operator's maintenance programme should include the standards, guidance and direction necessary to support the intended extended diversion time operations. Maintenance personnel involved should be made aware of the special nature of extended diversion time operations and have the knowledge, skills and ability to accomplish the requirements of the programme.

### **2.5.2 Maintenance programme**

2.5.2.1 The basic maintenance programme for the aircraft being considered for extended diversion time operations should be the continuing airworthiness maintenance programme currently approved for that operator, for the make and model airframe-engine combination. This programme should be reviewed

to ensure that it provides an adequate basis for development of extended diversion time operations maintenance requirements. These should include maintenance procedures to preclude common cause human failures without proper verification processes or operational testing prior to extended diversion time operations. For two engine aeroplanes, the same person should not perform maintenance action on the same element of identical but separate maintenance significant systems during the same routine or non-routine visit. For aeroplanes with more than two engines, the same person should not perform maintenance action on the same element of identical but separate maintenance significant systems on two engines of a three engine aeroplane, or more than one engine per side of a four engine aeroplane during the same routine or non-routine visit. If such dual maintenance actions cannot be avoided, the State of the Operator may allow use of adequate ground tests, inspection procedures, a verification flight or other approved maintenance procedures to preclude common cause human failure modes.

2.5.2.2 If extended diversion time operations-related tasks are identified, then these tasks should be included on the operator's routine work forms and related instructions.

2.5.2.3 Extended diversion time operations-related procedures, such as involvement of centralized maintenance control, should be clearly defined in the operator's programme.

2.5.2.4 A service check should include verification that the status of the aircraft and certain critical items are acceptable for extended diversion time operations. This check should be accomplished and signed off by an adequately trained maintenance person prior to an extended diversion time operations flight.

2.5.2.5 Log books should be reviewed and documented as appropriate to ensure proper MEL procedures, deferred items and maintenance checks and that system verification procedures have been performed.

### 2.5.3 Extended diversion time operations manual

The operator should develop a manual for use by personnel involved in extended diversion time operations. This manual need not include, but should at least refer to, the maintenance programme and other requirements described by this Chapter and clearly indicate where they are located in the operator's manual system. All extended diversion time operations requirements, including supportive programme procedures, duties and responsibilities, should be identified and be subject to revision control. Alternatively the operator may include this information in existing manuals used by personnel involved in extended diversion time operations.

### 2.5.4 Oil consumption programme

The operator's oil consumption programme should reflect the manufacturer's recommendations and be sensitive to oil consumption trends. It should consider the amount of oil added at all stations with reference to the running average consumption, i.e., the monitoring should be continuous up to, and including, oil added at the departure station. If oil analysis is relevant to this make and model, it should be included in the programme. If the auxiliary power-unit (APU) is required for extended diversion time operations, it should be included in the oil consumption programme.

## 2.5.5 Engine condition monitoring

2.5.5.1 This programme should describe the parameters to be monitored, method of data collection and corrective action process. The programme should reflect manufacturer's instructions and industry practice. This trend monitoring should be used to detect deterioration at an early stage to allow for corrective action before safe operation is affected.

2.5.5.2 The programme should ensure that engine limit margins are maintained so that a prolonged one-engine inoperative diversion may be conducted without exceeding approved engine limits (e.g., rotor speeds, exhaust gas temperatures) at all approved power levels and expected environmental conditions. Engine margins preserved through this programme should account for the effects of additional engine loading demands (e.g., anti-ice, electrical, etc.) which may be required during the one-engine inoperative flight phase associated with a diversion.

## 2.5.6 Verification programme

The operator should develop a verification programme, or procedures should be established, to ensure corrective action following an engine shut-down, primary system failure, adverse trends or any prescribed events which require verification flight or other action and should establish means to assure their accomplishment. A clear description of who should initiate verification actions and the section or group responsible for the determination of what action is necessary should be identified in the programme. Primary systems or conditions requiring verification actions should be described in the operator's extended diversion time operations manual.

## 2.5.7 Reliability programme

2.5.7.1 An extended diversion time operations reliability programme should be developed or the existing reliability programme supplemented, if appropriate. This programme should be designed with early identification and prevention of extended diversion time operations-related problems as the primary goal. The programme should be event-orientated and incorporate reporting procedures for significant events detrimental to extended diversion time operations flights. This information should be readily available for use by the operator and the State of the Operator to help establish that the reliability level is adequate and to assess the operator's competence and capability to safely continue extended diversion time operations. Regardless of the reliability level, it is possible that a particular event may also warrant corrective action implementation even though the required engine inflight shutdown rate is not being exceeded. It is recommended that the State of the Operator should be notified within a short time (usually 96 hours) of events reportable through this programme.

2.5.7.2 In addition to the items required to be reported by the State of the Operator, the following items should be included:

- a) in-flight shut-downs;
- b) diversion or turn-back;
- c) uncommanded power changes or surges;
- d) inability to control the engine or obtain desired power;
- e) problems with systems critical to extended diversion time operations; and

- f) any other event detrimental to extended diversion time operations.

2.5.7.3 The report should also identify the following:

- a) aircraft identification (make and serial number);
- b) engine identification (make and serial number);
- c) total time, cycles and time since last shop visit;
- d) for systems and engines, time since overhaul or last inspection of the defective unit;
- e) phase of flight; and
- f) corrective action.

#### 2.5.8 Propulsion system monitoring

The operator's assessment of propulsion systems reliability for the extended diversion time operations fleet should be made available to the State of the Operator (with the supporting data) on at least a monthly basis to ensure that the approved maintenance programme continues to maintain the level of reliability necessary for the operator's extended diversion time operational authority. The assessment should include, as a minimum, engine hours flown in the period, in-flight shut-down rate for all causes and engine removal rate computed on a 12-month rolling average basis. Any adverse sustained trend would require an immediate evaluation to be accomplished by the operator in consultation with the State of the Operator. The evaluation may result in corrective action or operational restriction being applied.

#### 2.5.9 Maintenance training

Maintenance training should take into account the requirements of extended diversion time operations. These requirements should be included in normal maintenance training. The goal of this programme is to ensure that all personnel involved in extended diversion time operations are provided with the necessary training so that the extended diversion time operations maintenance tasks are properly accomplished and to emphasize the special nature of extended diversion time operations maintenance requirements. Qualified maintenance personnel are those that have completed the operator's or manufacturer's training programme which includes the requirements identified above.

#### 2.5.10 Parts control

The operator should develop a parts control programme that ensures the proper parts and configuration are maintained for extended diversion time operations. The programme includes verification that parts placed on extended diversion time operations aircraft during parts borrowing or pooling arrangements, as well as those parts used after repair or overhaul, maintain the necessary extended diversion time operations configuration for that aircraft. As provided by Chapter 4.7.2 of Annex 6 Part I, since the aeroplanes with more than two engines, and for which an application for type certification was submitted prior to [applicability date of this Standard], need not comply with the requirements of Annex 8, Part IIIB, G.2.8, there will be no requirement for engineering modification for



configuration changes except for installation of cargo fire suppression as required by 4.7.6 of Annex 6, Part I; and therefore may not have a need to develop a specific parts control programme.

## **2.6 Requirements for systems performance and reliability assessment**

### 2.6.1 Introduction

2.6.1.1 The following material provides guidance to the State of Design for the assessment of the level of performance and reliability of aeroplane systems and associated equipment required by the Standard of Annex 6, Part I, 4.7.2 and Attachment E of for extended diversion time operations.

2.6.1.2 The probability of a failure condition to happen and the maximum consequences of that failure condition accepted for aircraft certification are as follows:

- a) *Probable Failure Conditions* are those failure conditions that are anticipated to occur one or more times during the entire operational life of an aircraft. The maximum consequences acceptable are classified as *Minor*. These failure conditions would not significantly reduce aircraft safety and involve flight crew actions that are well within their capabilities but
  - 1) a slight reduction in safety margins or functional capabilities,
  - 2) a slight increase in flight crew workload, or
  - 3) some physical discomfort to passengers or cabin crew may occur.
- b) *Remote Failure Conditions* are those failure conditions that are unlikely to occur to each aircraft during its total life, but which may occur several times when considering the total operational life of a number of aircraft of the same type. The maximum consequences acceptable are classified as *Major*: These failure conditions would reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions to the extent that:
  - 1) a significant reduction in safety margins or functional capabilities,
  - 2) a significant increase in flight crew workload or in conditions impairing flight crew efficiency, or
  - 3) a discomfort to the flight crew or physical distress to passengers or cabin crew, possibly including injuries would occur.
- c) *Extremely Remote Failure Conditions* are those failure conditions that are not anticipated to occur to each aircraft during its total life but which may occur a few times when considering the total operational life of all aircraft of the same type. The maximum consequences acceptable are classified as *Hazardous*. These failure conditions would reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions to the extent that:
  - 1) a large reduction in safety margins or functional capabilities,

- 2) physical distress or an excessive workload such that the flight crew cannot be relied upon to perform their tasks accurately or completely, or
  - 3) serious or fatal injury to some occupant other than the flight crew would occur.
- d) *Extremely Improbable Failure Conditions* are those failure conditions that are so unlikely that they are not anticipated to occur during the entire operational life of all aircraft of the same type. The maximum consequences acceptable are classified as *Catastrophic*: The Failure Conditions would result in:
- 1) multiple fatalities of the occupants, or
  - 2) incapacitation or fatal injury to a flight crewmember normally with the loss of the aircraft

## 2.6.2 Reliability requirements

2.6.2.1 Aeroplane system failure or failure combinations which could result in the loss of safe flight and landing capability should be extremely improbable.

2.6.2.2 The risk of failure of any aeroplane system essential to continued safe flight and landing at an aerodrome after the failure of one engine should be improbable.

2.6.2.3 Aeroplane system failure or failure combinations which have an appreciable impact on the capability of the aeroplane or crew to cope with anticipated operating conditions should be improbable.

## 2.6.3 Reliability assessment

2.6.3.1 Compliance with Annex 6, Part I, 4.7.2, Attachment E of Annex 6, Part I, and with Section 2.6.2 above should be shown by assessment of the systems operating separately and in relation to other systems. This assessment should, where necessary, be supported by appropriate ground, flight or flight simulator tests.

2.6.3.2 The assessment should include the possible modes of normal operation and of failure, the resulting effects on the aeroplane and occupants considering the stage of flight and operating conditions, the awareness of the crew of the failure conditions and the corrective action required, the capability of detecting failures and the aeroplane inspection and maintenance procedures. Consideration should be given to failure conditions being accompanied or caused by events or errors. In such combinations, allowance may be made for the probabilities of the failure conditions, events and errors.

2.6.3.3 In assessing individual systems, due account should be taken of previous experience with similar systems.

2.6.3.4 The assessment should take account of the variation of performance of the system(s). Statistical distribution of performance parameters may be used.

2.6.3.5 Compliance with reliability levels, which are related in the requirements to catastrophic effects, should not be established on the basis of assessed numerical values alone, unless these values can be substantiated beyond reasonable doubt.

2.6.3.6 The probability of a single failure of a system or component may be accepted as being remote only when the system or component is assessed to have the necessary order of reliability based on either:

- a) service experience which analysis shows to be applicable, supported by analysis and/or testing of the particular design; or
- b) a detailed engineering evaluation of the design supported by testing.

2.6.3.7 The probability of a single failure of a system or component may be assessed as being extremely improbable only when it applies to a particular mode of failure (e.g. jamming) and it can be shown to the satisfaction of the certificating authority from the aspects of construction and installation that such a failure need not be considered as a practical possibility.

2.6.3.8 The probability of crew error combined with system failures may be difficult to substantiate in meaningful statistical terms. In considering the probability of crew errors combined with system failures, an evaluation of the likelihood of such errors and their consequences should be made.

2.6.3.9 In the analysis and demonstration of systems reliability, special consideration should be given to the expected duration of aeroplane flights associated with extended diversion time operations.

2.6.3.10 The following areas of concern are significant in regard to the extension of range of aeroplanes with turbine engines. As a minimum these areas should be emphasized in the reliability assessment:

- a) no system or equipment failure or combination of failures, not shown to be improbable, should result in a propulsion system failure, either as a direct result of the failure condition or due to crew action resulting from false or misleading information;
- b) in the event of engine failure, cascading failures or consequential damage or failure of remaining systems or equipment should not preclude continued safe flight and landing of the aeroplane;
- c) in the presence of extended-duration one engine inoperative operation, and considering the resulting limitations on the performance of the aeroplane type, malfunction of remaining systems and equipment should not jeopardize the continued safe flight and landing of the aeroplane or place additional sustained workload on the crew;
- d) during extended duration with one engine inoperative, secondary power (electrical, hydraulic, pneumatic), should continue to be available at the levels necessary to permit continued safe flight and landing. Unless it can be shown that cabin pressure can be maintained with one engine inoperative at the altitude required for continued flight to a suitable aerodrome, oxygen capacity should be available to sustain the passengers and crew for the maximum diversion time; and
- e) the aeroplane is capable of continued safe flight and landing for any single failure or combination of failure conditions of electrical power not shown to be extremely improbable, considering the maximum diversion time the aeroplane is approved for.

2.6.3.11 One of the elements considered for the authorization of extended diversion time operations is the maturity and reliability of the propulsion system appropriate to the flight duration and the maximum extended diversion time.

- a) For extended diversion time operations of 180 minutes or less, the reliability target of the propulsion system should be such that the risk of catastrophic loss of thrust from independent causes is extremely remote.
- b) For extended diversion time operations of greater than 180 minutes, the reliability target of the propulsion system should be such that the risk of catastrophic loss of thrust from independent causes is extremely improbable.

#### 2.6.4 Analysis of failure effects

2.6.4.1 The evaluation of failure and failure combinations should be based on engineering judgement. The analysis should include consideration of the effects of continued flight with one-engine inoperative, including allowance for damage that could have resulted from engine failure. Reliability analysis should be used as guidance in verifying that the proper level of redundancy has been provided, unless it can be shown that equivalent safety levels are provided (i.e. the probability of failure is not related to exposure time) or the effects of failure are minor.

2.6.4.2 Consideration should be given to the effects on the flight crew's performance and physiological needs of continued flight with an engine and/or system(s) inoperative.

2.6.4.3 In assessing the effects of failure conditions, account should be taken of:

- a) the variations in the performance of the system, the probability of the failure(s), the complexity of the crew action and the likely frequency of the relevant crew training; and
- b) factors which might alleviate or aggravate the direct effects of the initial failure condition including consequential or related conditions existing within the aeroplane which may affect the ability of the crew to deal with direct effects such as the presence of smoke, aeroplane accelerations, interruption of air-to-ground communication, cabin pressurization problems, etc.

2.6.4.4 *Propulsion system.* Effects of failures, external conditions or crew errors that could jeopardize the operation of the remaining engine(s) under one-engine inoperative conditions need to be examined closely. Examples are:

- a) failures of engine controls;
- b) failures of engine instruments;
- c) failures of auto-throttle systems (e.g. engine over-speed);
- d) failures of ice detection and ice protection systems;
- e) failures of the fire warning system (e.g. false fire warning);
- f) effects of environmental conditions such as lightning, ice, hail and precipitation on engine operation (the vulnerability of an electronic fuel control to lightning damage is an example);
- g) effects of crew errors;

- h) response to system failures (e.g. fire warning); and
- i) improper engine operation that could result in propulsion system failure (e.g. during altitude changes).

2.6.4.5 *Hydraulic power and flight controls.* Consideration of these systems may be combined since many modern commercial aeroplanes have fully hydraulically powered controls. System redundancy should be provided to ensure that the loss of aeroplane control is extremely improbable. A review of the redundancy features complemented by a statistical analysis considering exposure times associated with extended diversion time operation, should be provided.

2.6.4.6 *Electrical power.* Electrical power is provided to a small group of instruments and devices required for safe flight and landing and to a much larger group of instruments and devices needed to allow the flight crew to cope effectively with adverse operating conditions. Multiple sources (engine driven generators, auxiliary power- units (APUs), batteries, etc.) are provided to meet both the safe flight and landing requirements and the adverse condition requirements. A review of redundancy features supported by a statistical analysis considering exposure times and one-engine inoperative consideration associated with extended diversion time operation should be provided.

2.6.4.7 *Equipment conditioning (environmental).* A number of elements of equipment in the primary systems are normally provided with equipment conditioning services. Verification of the ability of the system to provide adequate conditioning for the equipment, considering the exposure time associated with extended- range operation and one-engine inoperative condition, should be based on analysis or test data. The data should establish the conditioning equipment's ability to operate acceptably with the conditioning system operating in normal, standby or backup modes.

2.6.4.8 *Cargo compartment fire suppression.* An analysis or tests should be made to verify that the ability of the fire suppression system to suppress or extinguish fires is adequate to ensure that flight safety is not compromised, considering the maximum diversion time required to reach a suitable aerodrome for landing.

2.6.4.9 *Communication and navigation.* It should be shown that under all combinations of propulsion and/or aeroplane system failures which are not extremely improbable, there will be available a reliable means of communication, a sufficiently accurate means of navigation and any required route and destination guidance needed to comply with contingency procedures and achieve continued safe flight and landing at a suitable aerodrome.

2.6.4.10 *Cabin pressurization.* Loss of cabin pressure can affect the flight crew's ability to cope with adverse operating conditions. A review of redundancy features should be undertaken to ensure that the likelihood of such loss is minimized under one-engine inoperative conditions. Aeroplane performance data should be provided or referenced in the flight manual to enable the flight crew to verify whether an extended diversion time operation can be completed after loss of pressure and subsequent operation at a lower altitude.

2.6.4.11 *Auxiliary power-unit.* If the auxiliary power-unit is considered an essential item of equipment, it should be capable of restart and operation at any altitude suitable for flight with one propulsion system inoperative.

2.6.4.12 *Fuel systems.* The aeroplane fuel system should maintain the engine inlet fuel pressure and flow to all operable engines throughout any diversion. Fuel necessary to complete the extended diversion time operation should be available to the operating engine(s) after an engine failure and other system failures unless the combination is shown to be extremely improbable. For aeroplanes with application for

Type Certificate after the effective date of this revision, alerts should be displayed to the flight crew when the quantity of fuel available to the engines falls below that level required to complete the operation. These alerts should include provisions for abnormal fuel management or transfer between tanks, and possible loss of fuel.

#### 2.6.5 Assessment of manufacturer's maintenance instructions

2.6.5.1 An assessment should be made of the manufacturer's maintenance instructions with the object of eliminating the possibility of such errors as could produce hazardous and catastrophic effects during extended diversion time operations.

2.6.5.2 Maintenance errors can, in general, be divided into two types:

- a) those errors which increase system failure rates and which can, to some extent, be allowed for in the assessment of failure rates; and
- b) those errors which may result in a condition where a system cannot fulfil its design function. It is not usually possible to quantify such errors. An assessment should be made of the design and of the maintenance instructions with the object of eliminating the possibility of errors which could produce hazardous and catastrophic effects.

#### 2.6.6 Flight manual information

For extended diversion time operations, at least the following information should be included or referenced in the flight manual:

- a) the maximum flight time, one engine inoperative, for which the systems and engines reliability and capacity of time-limited systems has been approved in accordance with the airworthiness requirements established for extended diversion time operations;
- b) a list of additional equipment installed to meet the airworthiness requirements for extended diversion time operations;
- c) additional performance data, including limitations, and flight procedures appropriate to extended diversion time operations; and
- d) a statement to the effect that the aeroplane systems associated with extended diversion time operations meet the required airworthiness and performance criteria but that the meeting of such criteria does not by itself constitute approval to conduct extended diversion time operations.

#### 2.6.7 Continuing surveillance

The fleet average engine in-flight shut-down (IFSD) rate for the specified airframe-engine combination should be monitored by the State of Design. In the event that an acceptable level of reliability is not maintained, significant adverse trends exist, or if significant deficiencies are detected in the design of the aeroplane or propulsion system, the State of the Design should inform the State of Registry and the State of the Operator of appropriate action to be taken.

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## **CHAPTER 3.— AIRCRAFT MAINTENANCE – MODIFICATIONS AND REPAIRS**

### **3.1 Introduction**

3.1.1 This paragraph should be read in close conjunction with Part III, Chapter 1 “*Type Certification*”. In particular, all of the certification aspects (design requirements and CAA approval) for modifications and repairs are dealt with in Part III.

3.1.2 All modifications and repairs must comply with airworthiness requirements acceptable to the State of Registry which must approve these modifications and repairs. Procedures must be established to ensure that the substantiating data supporting compliance with the airworthiness requirements are retained. In this regard the structural repair manual (SRM) of the manufacturer of the aeronautical product is approved by the State of Design directly or by delegation. Repairs incorporated in accordance with such a manual may be deemed to be in accordance with approved data.

3.1.3 The objective of this part is to provide guidance to aircraft operators by setting out acceptable means for showing that modifications and repairs to aircraft comply with appropriate airworthiness requirements. Guidance is also provided concerning acceptable procedures for retention of substantiating data supporting compliance with the airworthiness requirements.

3.1.4 The information in this part applies to all types and classes of aircraft for which a Type Certificate or equivalent document has been issued and includes all components of the aircraft.

### **3.2 Compatibility of modifications and repairs**

#### **3.2.1. Introduction**

3.2.1.1 When any modification or repair is installed on an aircraft, care should be taken to ensure that it is compatible with all other design changes installed on that aircraft. Modifications or repairs designed separately may conflict or interfere with each other, despite having been individually shown to comply with all applicable standards of airworthiness. Interaction between different modifications or repairs may be of a physical, aerodynamic, structural or fatigue strength, electromagnetic or any other nature. Such interaction may jeopardize the airworthiness of the aircraft.

3.2.1.2 An example of potential incompatibility would be a repair installed in close proximity to an existing repair. While the two repairs individually may be completely satisfactory if separately installed on an aircraft, the combination in close proximity may introduce additional stress concentrations which cause fatigue cracks to occur after a period of time in service. The designer of a repair scheme should survey the aircraft to be repaired to establish whether there are any other design changes in the vicinity which may interfere. In the case of an existing repair in close proximity to the new damage, it may be necessary to remove the old repair and install a new repair encompassing both damaged areas, designed in a manner to reduce any stress concentrations to a level that will not produce fatigue cracking.

3.2.1.3 In a more general situation, modifications may be separately designed for the same basic aircraft type by different organizations with no knowledge of the other’s work. The modifications may be shown separately to comply with all applicable airworthiness standards; however, they may physically interfere with each other. Alternatively, no problems may be encountered with the installations, but it may be found in service that the combination causes aerodynamic buffeting, stability or control problems, fatigue cracking, structural failure, electromagnetic interference, or other problems. If the concurrent

installations of different modifications are not rigorously assessed for compatibility, there exists the possibility that in combination they may cause serious airworthiness hazards.

3.2.1.4 Modifications and repairs may be designed by the same organization that operates the aircraft into which they are incorporated. In the more general case, however, the organization that designs and obtains design approval for the modification or repair, the operator of the aircraft, and the organization that installs the design change on the aircraft may all be different. The operator's and installer's separate responsibilities are discussed below.

### 3.2.2 Responsibilities of installers

Because the holder of a design approval for a particular modification or repair cannot be expected to be aware and to have conducted analyses and tests for all the possible design changes installed on all aircraft of a given type, the installer has some responsibility to verify compatibility with other modifications and repairs before installing any design change. As stated in the following paragraph, the ultimate responsibility remains on the operator. The installer should survey the aircraft records and the aircraft itself to determine what other design changes exist on the aircraft. Any questions of incompatibility with other modifications or repairs arising from the survey should be referred for resolution to the operator.

### 3.2.3 Responsibilities of operators

3.2.3.1 Operators have the overall responsibility to ensure the compatibility of all design changes incorporated in their aircraft. The operator contracting with an installer for incorporation of any aircraft modification or repair should provide the installer with information on all existing design changes to the aircraft so that compatibility may be verified. Any questions of design change incompatibility which may arise during installation or in service should be thoroughly investigated by consultation with the approval authority or approval holder, or by an independent engineering organization. In every case of incompatibility between modifications or repairs, the problem must be corrected and it must be established to the satisfaction of the authority of the State of Registry that the modified aircraft continues to comply with the applicable standards of airworthiness.

3.2.3.2 In addition to correction of the problem on the aircraft on which it is discovered, it is necessary that any incompatibilities between modifications or repairs be addressed on all other affected aircraft. The operator should promptly report any design change incompatibilities detected during installation or in service to the approval holder, to the installer and to its own airworthiness authority.

## **3.3 Retention of modification and repair data and records**

### 3.3.1. Introduction

3.3.1.1 Annex 6, Part I, 8.6 and Part III, Section II, 6.6 state:

“All modifications and repairs shall comply with airworthiness requirements acceptable to the State of Registry. Procedures shall be established to ensure that the substantiating data supporting compliance with the airworthiness requirements are retained.”

Annex 6, Part I, 8.4.1 and Part III, Section II, 6.4 state:



“An operator shall ensure that the following records are kept for the periods mentioned in [8.4.2 for the aeroplane and in 6.4.2 for the helicopter]:

...

c) appropriate details of modifications and repairs”.

3.3.1.2 The objective of this section is to provide guidance to aircraft operators by setting out acceptable procedures for the retention of modification and repair data and records. (The corresponding guidance for the maintenance organizations which perform modification and repairs should be found in the Chapter 4 of Part IV of this Manual)

3.3.1.3 Modifications and repairs may be designed by the operator of the aircraft into which they are incorporated. In such a case, the responsible airworthiness authority would normally issue the design approval to the operator. In the more general case, however, the holder of the design approval and the aircraft operator may be different. Annex 6 places responsibility for the retention of modification and repair data and records on both the approval holder and the operator. In the case where the aircraft operator is also the design holder, the operator must retain both sets of records. (See Part III, Chapters 5 and 6 for the design holder responsibilities regarding the retention of modification/repairs data).

3.3.1.4 In some cases, the aircraft operator may contract the installation of a modification or repair to a separate organization. Information on retention of associated records by the installer may be found in Part IV, Chapter 1, Section 1.10.4 “Maintenance Records” of this manual, in conjunction with the relevant paragraphs of the Chapter 4 of this Part IV.

### 3.3.2 Responsibilities of aircraft operators

3.3.2.1 The airworthiness authority of the State of Registry should require that the aircraft operator retain records identifying any modification or repair incorporated on the aircraft, together with records of design approval and return-to-service approval. Retention of the records is required so that the modification and repair status of the aircraft may be readily established at any time. This may be necessary if an airworthiness deficiency is detected with a modification or repair requiring corrective measures or inspections and to ensure compatibility when making additional design changes to the aircraft.

3.3.2.2 The records required will vary with the complexity of the design change. In addition to the records of design approval and return-to-service approval, the following lists the kind of data that may be included, as applicable:

- a) a master drawing list and the individual drawings, photographs, specifications and records which identify the design change and locate it on the aeroplane;
- b) mass and moment change records; and
- c) a record of any change in electrical load caused by incorporation of the design change.

Part of the records should include a Supplemental Type Certificate (STC) or equivalent document, or service bulletin or structural repair manual reference, if applicable.

3.3.2.3 Annex 6, Part I, 8.4.2 and Part III, Section II, 6.4.2 require that the details of modifications and repairs to an aeroplane and its major components be retained for a minimum period of 90 days after the unit to which they refer has been permanently withdrawn from service. Annex 6, Part I, 8.4.3 and Part III, Section II, 6.4.3 require that in the event of a temporary change of operator, the records shall be made available to the new operator; and, in the event of any permanent change of operator, the records shall be transferred to the new operator.

3.3.2.4 Supplements to the approved flight manual, maintenance instructions, instructions for continuing airworthiness and repair instructions pertaining to a modification or repair are operating data that the operator should incorporate into the existing operating data for the aeroplane. Since these supplements become a permanent part of the operator's operating instructions or instructions for continuing airworthiness, they need not be retained as part of the records required by Annex 6, Part I, 8.4.1c) and Part III, Section II, 6.4.1c). The operator should record the incorporation of the required supplements in the appropriate revision logs.

3.3.2.5 The record retention requirements for minor modifications and repairs are much simplified. It is nevertheless necessary for the aeroplane operator to retain sufficient records to:

- a) identify the modification or repair and record that it has been classified as minor;
- b) record its location on the aeroplane;
- c) record mass and moment change, if significant; and
- d) record the return-to-service approval.

*Note.— For categorisation of repairs see Part III, Chapter 6.3 Repair Categories of this Manual.*

## CHAPTER 4.— APPROVAL OF MAINTENANCE ORGANIZATIONS

This chapter provides descriptive guidance to airworthiness authorities on the issues to be considered in approval of organizations for the maintenance of aircraft.

### 4.1 General

#### 4.1.1 Operator

4.1.1.1 Annex 6, Part I, 8.1.1 and Part III, Section II, 6.1.1 place an obligation on the operator to ensure that the aeroplanes operated are maintained in an airworthy condition. Paragraph 8.1.2 for aeroplanes and 6.1.2 for helicopters require that an aircraft shall not be operated unless it is maintained and released by an approved maintenance organization or an equivalent system. A State, taking into account the complexity of aircraft and the degree of likely maintenance activity, may accept a system deemed to be equivalent in terms of continuing airworthiness. In this case, the certifying personnel must be licensed individually in accordance with Annex 1, Chapter 4.

4.1.1.2 Annex 6, Part I, 8.2 and Part III, Section II, 6.2 include requirements for an operator to ensure that a maintenance control manual is provided for the use and guidance of maintenance and operational personnel. The operator is required to ensure that the manual is amended and revised as necessary and that copies of the changes are distributed to holders of the manual.

4.1.1.3 Annex 6, Part I, 11.2 and Part III, Section II, 9.2 specify the subjects to be included in the operator's maintenance control manual.

4.1.1.4 Annex 6, Part I, 8.3 and Part III, Section II, 6.3 place an obligation on operators to provide a maintenance programme approved by the State of Registry for use and guidance of maintenance and operational personnel and to ensure that the maintenance of their aeroplanes is performed in accordance with this maintenance programme.

4.1.1.5 Taken together, Annex 6, Part I, 8.2 and 8.3 and Part III, Section II, 6.2 and 6.3 effectively place an obligation on operators to have maintenance programmes and systems of maintenance control.

4.1.1.6 Although an operator may include a maintenance facility within its organization, many operators now contract maintenance to a separate organization. This chapter therefore deals with approved maintenance organizations and Chapter 1 of this Part addresses the operator's maintenance responsibilities for the issuance of an Air Operator Certificate.

#### 4.1.2 Maintenance organizations

4.1.2.1 Annex 6, Part I, Section 8.7 contains requirements for approved maintenance organizations as referred to under 8.1.2 and Part III, Section II, 6.1.2. In summary, the requirements are regulating:

- a) approval of the organization;
- b) maintenance organization's procedures manual;
- c) maintenance procedures and quality assurance system;
- d) facilities;

- e) personnel;
- f) records; and
- g) maintenance release.

## **4.2 Overview of the criteria on which approval of maintenance organizations is based**

### 4.2.1 Issuance of approval

4.2.1.1 It is strongly recommended that approval be granted only to a whole organization headed by its chief executive officer (CEO), who should be responsible to the CAA for ensuring compliance with the terms and conditions of the approval. This approach provides a guarantee to the CAA that responsibility for corrective action for any deficiencies identified by the CAA is vested at the highest level in the organization's management structure, thus ensuring that the necessary executive authority (including finance, where applicable) will be available. This might not be the case, for example, if the approval is vested only in the inspection department of an organization.

4.2.1.2 To support the CEO there should be a group of key personnel, nominated to the CAA, who are appropriately qualified and experienced to manage the various aspects of the activities included in the approval.

### 4.2.2 Systems of inspection and quality management

4.2.2.1 To satisfy the obligation of States under Part I of Annex 6, aircraft cannot be released to service following scheduled or unscheduled maintenance unless certifications are made by appropriately licensed and approved personnel that the tasks have been completed satisfactorily and in accordance with the procedures described in the maintenance organization's procedures manual. There are three generally accepted methods of meeting this requirement:

- a) licensed personnel either complete the task, or are responsible for its completion, and issue the necessary certification;
- b) the staff of a production department complete the task, with a separate inspection department responsible for the necessary certification; or
- c) the staff of the production department complete the task to approved quality control standards and also issue the necessary certification, while a separate quality assurance department performs sample audits to determine that the approved procedures are being adhered to and that the final product is satisfactory.

*Note.— It is not uncommon to find various combinations of a), b) and c) in organizations.*

4.2.2.2 Of the three methods described above, c) is considered the optimum for the present generation of large transport aircraft. Before considering this topic further, it is necessary for the purposes of this Chapter, to provide definitions of quality, quality control and quality assurance:

- a) quality of a product or service is the degree to which it meets the requirements of the customer, including the relevant airworthiness requirements;
- b) quality control is a management system for programming and coordinating the ongoing quality and improvement efforts of the various groups in an organization to permit the completion of aircraft maintenance in accordance with the requirements of the airworthiness authority and any specific requirements of the organization or customer; and
- c) quality assurance is the overall authority for the supervision of quality standards to verify that the standards are appropriately complied with and, if necessary, to initiate corrective and preventive actions for improvement of the system functioning.

4.2.2.3 In practical terms, it is very difficult to manage quality control in circumstances where completion of a task and determination of compliance with the associated quality requirements are responsibilities of separate persons (as in 4.2.2.2 b) above). The highest standard of quality of aircraft maintenance is very much dependent on the competence of the personnel who complete the tasks; it is not something that can be "inspected-in". Thus responsibility for quality control management is best vested in a competent production work force which completes the tasks and is qualified to accept responsibility for certification of them, in accordance with prescribed procedures.

4.2.2.4 No system of quality management is complete without an element of quality assurance. This provides, through an independent audit system, the necessary feedback to the management of the approved organization to ensure that:

- a) through product sampling, the requirements of the customer, including those related to airworthiness, are being satisfied;
- b) the procedures of the organization are being complied with and that they remain appropriate for the undertakings of the organization; and
- c) the organization remains in compliance with the requirements and conditions of the approval granted by the airworthiness authority.

4.2.2.5 Further guidance material on quality management is provided in Section 4.3 of this Part.

#### 4.2.3 The purpose of the maintenance organization's procedures manual

4.2.3.1 Annex 6, Part I, 8.7.2 places an obligation on the approved maintenance organization to provide a maintenance organization's procedures manual.

4.2.3.2 The purpose of the procedures manual for an approved maintenance organization is threefold:

- a) to provide to the personnel the necessary information to enable them to fulfil their various roles in complying with the terms and conditions of the approval and the relevant airworthiness requirements;
- b) to provide airworthiness management for the maintenance activities undertaken by the organization; and

- c) to substantiate to the airworthiness authority how the activities included in the approval and the relevant airworthiness requirements will be satisfied.

4.2.3.3 It is recommended that the airworthiness authority consider the provision of this manual as an integral part of the approval of the organization. The manual and the subsequent amendments to the manual should therefore be acceptable to the CAA.

4.2.3.4 In the case of large organizations, it may be more appropriate for the manual to be divided into two or more volumes. The first volume would contain the essential requirements for management of the approval and compliance with the appropriate airworthiness requirements, including the control of the contents of the other volumes.

4.2.3.5 Further guidance on a maintenance organization's procedures manual is provided in Section 4.4 of this part.

#### 4.2.4 Personnel

4.2.4.1 The organization should employ sufficient personnel to plan, perform, supervise and inspect the activities included in the approval. Because organizations engaged in aircraft maintenance for commercial reasons are under constant pressure to achieve maximum work throughput, it is important to determine that such organizations have the necessary personnel to match the anticipated workload without any reduction in the standards accepted by the airworthiness authority.

4.2.4.2 Annex 6, Part I, 8.7.6.3 requires the approved maintenance organization to establish the competence of maintenance personnel in accordance with a procedure and to a level acceptable to the airworthiness authority. It also states that the person signing a maintenance release shall be qualified in accordance with Annex 1. It is important to realize that aircraft maintenance is an integrated activity, involving technical records, planning, supervision, quality control or quality assurance personnel, mechanics and specialist technicians such as non-destructive test personnel. Procedures should exist to ensure that these persons are assessed for competence in relation to their particular role within the organization.

#### 4.2.5 Training policy

4.2.5.1 Annex 6, Part I, 8.7.6.4 requires that "The maintenance organization shall ensure that all maintenance personnel receive initial and continuation training appropriate to their assigned tasks and responsibilities." Air transport is an industry which, more than most, has to adapt to technology in a constant state of evolution. Training provided to personnel engaged in aircraft maintenance needs to mirror this state of change.

4.2.5.2 It is strongly recommended that policies for initial and refresher training be considered in the assessment for approval by the airworthiness authority. Consideration should be given to the needs of mechanics, quality control and quality assurance personnel, supervisors, planners and technical records personnel as well as of those persons signing a maintenance release.

4.2.5.3 It is important to note that training should not be limited to providing knowledge of the products which are maintained by the organization. There is a need to ensure that all personnel are given training on the company procedures associated with the approval. Where the organization utilizes specialized techniques such as non-destructive inspection or novel methods of repair, appropriate training should be provided.

4.2.5.4 Human Factors aspects are recognized to be an essential element in any aviation activity. The training programme is required to include training in knowledge and skills related to human performance, including coordination with other maintenance personnel and flight crew (guidance material relating to such training may be found in the *Human Factors Training Manual* (Doc 9683)).

#### 4.2.6 Maintenance release

4.2.6.1 Annex 6, Part I, 8.8 and Part III, Section II, 6.7 state that a maintenance release shall be completed and signed to certify that the maintenance work performed has been completed satisfactorily and in accordance with procedures described in the maintenance organization's procedures manual.

4.2.6.2 A maintenance release shall contain a certification including:

- a) the basic details of the maintenance carried out;
- b) the date such maintenance was completed;
- c) when applicable, the identity of the approved maintenance organization; and
- d) the identity of the person or persons signing the release.

4.2.6.3 A maintenance release, which certifies that the maintenance work has been completed in a satisfactory manner, is necessary before flight at the completion of any package of maintenance specified by the customer in accordance with such customer's responsibility. (see Chapter 1 "*Air Operator Certificate-Airworthiness Aspects*" of this Part). This package of maintenance may include any one or a combination of the following elements:

- a) a check or inspection from the operator's aircraft maintenance programme;
- b) implementation of Airworthiness Directives, Components Overhauls, repairs, modifications, engine changes, aircraft component replacements and defects rectification.

This maintenance release should not be confused with the action that must be taken by the operator to give evidence that the aircraft is airworthy and fit to undertake a specific flight.

4.2.6.4 In all the cases, this maintenance release to service (for the aircraft or for the component) means only that the work ordered by the customer (being most of the time the aircraft operator) has been completed satisfactorily by the approved maintenance organization. It does not mean that the work ordered by the customer was sufficient to ensure the airworthiness of the aircraft or the component. The responsibility to get the aircraft airworthy or to install onboard only airworthy components remains with the aircraft operator.

#### 4.2.6.5 Deferred Maintenance

4.2.6.5.1 As stated previously, the operator is responsible to ensure the airworthiness of the aircraft and the serviceability of both operational and emergency equipment by:

- a) the accomplishment of pre-flight inspections;

- b) the rectification to an approved standard of any defects and damage affecting safe operation, taking into account the approved minimum equipment list and configuration deviation list if available for the aircraft type;
- c) the analysis of the effectiveness of the operator's approved aircraft maintenance programme;
- d) the accomplishment of any operational directives, Airworthiness Directive and any continued airworthiness requirement made mandatory by the CAA; and
- e) the accomplishment of modifications and repairs in accordance with a standard approved by the CAA.

4.2.6.5.2 Therefore, it is vital that the operator should be informed when the maintenance organization could not fully comply with the operator's work order, due for example to the operator's time limitations (time constraints not acceptable for the maintenance organization) or to a lack of components or tools.

4.2.6.5.3 Normally, a maintenance release cannot be delivered in the case on non-compliance, therefore the approved maintenance organization should follow a procedure which states what actions the mechanic, supervisor and certifying staff should take to bring the matter to the attention of the relevant person in charge of the coordination between the operator and the approved maintenance organization.

4.2.6.5.4 The operator should agree to the deferment of full compliance, then the maintenance release may be issued by the approved maintenance organization subject to details of deferment being endorsed on the certificate including the operator's acceptance.

4.2.6.5.5 Whether or not the aircraft operator has the authority to defer maintenance is an issue between the aircraft operator and its CAA.

#### 4.2.7 Qualification of persons signing a maintenance release

4.2.7.1 ICAO requirements for the licensing of a person signing the maintenance release are provided in Annex 1. In relation to approved maintenance organizations, the qualification of certifying personnel employed by the organization shall be equivalent to the qualification required in Annex 1 for licensed individuals. Airworthiness authorities should give particular attention to this point in their national requirements for approval of maintenance organizations.

4.2.7.2 For airworthiness authorities that issue aircraft maintenance (technician/engineer/mechanic) licences, possession of an appropriate licence demonstrates a level of knowledge and experience which may be appropriate as a basic qualification. For airworthiness authorities that do not issue licences, it is important to ensure that proper procedures and training exist for qualifying the persons who will be signing the maintenance release.

4.2.7.3 All certifying personnel signing a maintenance release should be familiar with the relevant company systems and procedures, and have appropriate knowledge of the aircraft or component being maintained. It is important that compliance with this requirement is determined before a certifying authorization is granted.



## 4.2.8 Facility requirements

4.2.8.1 Facilities appropriate to the planned work should be available. These include access equipment and, in particular, protection from adverse weather conditions. Specialized workshops should be segregated to ensure that environmental or work area contamination is unlikely to occur. Because aircraft maintenance is document-intensive, adequate office facilities should be available for personnel engaged in the management of quality, planning and technical records.

4.2.8.2 Storage facilities should be provided for parts, equipment, tools and material. Storage conditions should be such that unauthorized access to serviceable parts is prevented and that there is complete segregation of serviceable and unserviceable parts. The facilities should provide security and prevent deterioration and damage to stored items.

## 4.2.9 Equipment, tools, material, and airworthiness and maintenance data

4.2.9.1 Equipment, tools, material, and airworthiness and maintenance data should be available for completion of the scope of activities included in the approval granted by the airworthiness authority. For maintenance organizations that are not also aircraft operators, it is not uncommon to expect some specialized equipment, tools and data in respect of a particular variant of an aircraft type to be provided by the operator. An airworthiness authority which accepts an arrangement of this nature should ensure that the activity is controlled by proper contractual arrangement between the maintenance organization and the operator. The approved maintenance organization should show that all tools and equipment as specified in the approved data can be made available when needed.

4.2.9.2 Much of the tooling and equipment associated with aircraft maintenance is subject to periodic calibration. The calibration procedures should be acceptable to the airworthiness authority and the actual standards themselves traceable to international standards acceptable to the State concerned.

4.2.9.3 All tools and equipment that are required to be controlled in terms of servicing or calibration should be clearly identified and listed in a control register including any personal tools and equipment that the organization agrees can be used. Where the manufacturer specifies a particular tool and equipment, then that tool or equipment should be used, unless otherwise agreed by the CAA in a particular case via a procedure specified in the approved maintenance organization's procedures manual.

4.2.9.4 The control of these tools and equipment requires that the approved maintenance organization has a procedure to inspect/maintain and, where appropriate, calibrate such items on a regular basis and indicate to users that the item is within any inspection or service calibration time-limit.

4.2.9.5 A clear system of labeling all tooling, equipment and test equipment is therefore necessary giving information on when the next inspection or service or calibration is due and if the item is unserviceable for any other reason where it may not be obvious. A register should be maintained for all precision tools and equipment together with a record of calibrations and standards used.

4.2.9.6 Inspection, maintenance and calibration on a regular basis should be in accordance with the equipment manufacturer's instructions except otherwise as accepted by the CAA.

#### 4.2.10 Contract and subcontract

It is accepted practice for operators to contract their maintenance requirements to approved maintenance organizations. In some States, it is accepted practice to permit approved maintenance organizations to subcontract work to organizations which are either not approved by the airworthiness authority or not approved for the activities under consideration. In the acceptance of this practice, consideration should be given to the following points (see also more details in the 4.2.11.3 below):

- a) the organization has its approval extended to include the subcontracted work; it assesses the competence of the subcontractor;
- b) the approved organization retains responsibility for quality control and release of subcontracted activities, according to the appropriate airworthiness requirements; and
- c) necessary procedures should be in place for the control of subcontracted activities, together with terms of reference for the personnel responsible for their management.

#### 4.2.11 Component and material supplier's evaluation and subcontractor control procedure by the approved maintenance organization

This paragraph mainly regards the component and material supplier's evaluation carried out by the approved maintenance organization and the control exercised by this approved maintenance organization on the its approved or non approved contractors. The ultimate goal of the approved maintenance organization is to make sure that:

- a) the received component/material from its supplier is airworthy and/or
- b) the contracted maintenance work has been performed according to its own standards.

This component may come from a supplier (with out any maintenance work contracted) or from a contractor (approved or not) in this latter case generally a maintenance task has been ordered.

4.2.11.1 *Assessment of the Suppliers (no maintenance services are provided)*.. The approved maintenance organization should assess its suppliers (questionnaire, audit etc.), implement procedures in order to retain/withdraw the authorization to use such suppliers, and establish special instructions concerning the expected component/part release document (airworthiness tag, conformity statement). These documents may depend on the supplier origin (manufacturer, retailer, airline, distributors, maintenance workshop etc.).

4.2.11.2 *Assessment of the Approved Subcontractors (maintenance services are provided by these approved maintenance organizations also called approved workshops)*. Before using those approved contractors, the maintenance organization should describe how the following items are satisfactorily dealt with (not an exhaustive list of items):

- a) the approved workshops reference list (only those included in this list can be contracted to work)
- b) the control of the scope of activity of the approved workshops towards the maintenance services sought by the approved maintenance organization

- c) the means internally implemented so that only those approved workshops could be used as workshops (checking the list of the approved workshops chosen from lists issued by the CAA)

4.2.11.3 *Assessment of the Unapproved Subcontractors (maintenance services are provided by these unapproved maintenance organizations)*. The quality assurance system of the approved maintenance organization should include all the subcontracted activities. All human resources, the means and the procedures used by the subcontractor should have been treated (and controlled) in the same way as the ones coming from the approved maintenance organization (those human resources, means and procedures are supposed to have already been accepted by the Authority in the framework of its approval). Special attention should be paid to the release to service procedure. The maintenance release is finally signed under the approval of the approved maintenance organization. The internal control activity of the subcontracting activities should be audited by the approved maintenance organization.

#### 4.2.12 Inspection and acceptance of aircraft components and material from outside contractors

This paragraph mainly concerns the compliance of materials in general (equipment, components, standard parts, materials) received from suppliers/subcontractors (external sources). This paragraph refers to the acceptance of materials stated as compliant ones.

4.2.12.1 The approved maintenance organization may obtain component/material from various sources:

- a) from suppliers/distributors (purchase/hiring new materials or used /maintained materials);
- b) from other approved maintenance organizations (maintained components);
- c) from unapproved workshops but under cover of its own quality system (maintained components); or
- d) from maintenance workshops of the approved maintenance organization (internally maintained components).

4.2.12.2 In all these cases, the approved maintenance organization which receives the product should define and implement reception procedures for components, standard parts, materials, new components or used maintained components. The reception procedures should, at a minimum, include the following:

- a) authorization procedure for reception control and acceptance;
- b) process of administrative control of the components and materials;
- c) identification of the type of acceptable documents depending on the situation (e.g. new/used components, materials, ingredients, standard parts, approved subcontracting, non approved subcontracting under cover of the organization, standard exchange, maintenance by a workshop of the organization, serviceable removed component...).
- d) Procedure of physical control;

- e) Procedure of acceptance (identification of the material, marking, tagging, register, taking into account the storage limits, the life limits, the storage specificity, record of the acceptance); and
- f) Procedure for treatment of suspected unapproved parts (“bogus parts”) (record, notification to the CAA ...).

### **4.3 Safety management**

Annex 6, Part I, 8.7.3.1 requires the States to establish a safety programme in order to achieve an acceptable level of safety in the maintenance of the aircraft. Paragraph 8.7.3.3 of Part I requires the States, as part of their safety programme, to ensure from 1 January 2009 that the maintenance organizations implement a safety management system acceptable to the State.

*Note.— Guidance on both the safety programme applicable to the States and the safety management system applicable to the maintenance organization, is contained in the Safety Management Manual (SMM) (ICAO Doc 9859).*

### **4.4 Quality management**

#### **4.4.1 General**

4.4.1.1 In recognition of the key importance of this activity in continuing airworthiness, it is essential for the manager of the quality department to have direct access to the CEO on quality issues.

4.4.1.2 The maintenance organization’s systems for quality control and assurance should take into account all of the facilities and procedures utilized to ensure continuing airworthiness, where activities take place affecting the airworthiness of the aircraft and product quality for subjects not directly related to airworthiness. Quality control should therefore be effective throughout the maintenance of aircraft and quality auditing should ensure that control is being properly applied and achieving satisfactory results.

4.4.1.3 The organization’s quality control policies and systems should be described in the approved maintenance organization manual, together with the quality assurance audit programme in respect of product, facility and procedures.

#### **4.4.2 Procedures and personnel qualifications**

4.4.2.1 Staff assigned to quality control and assurance duties should be:

- a) sufficiently experienced in the company systems and procedures and technically knowledgeable of the aircraft being maintained so as to enable them to perform their duties satisfactorily;
- b) experienced in the techniques of quality control and assurance or receive suitable training before taking up their duties; and
- c) given clearly defined terms of reference and responsibility within the organization and having reporting lines to senior management.

*Note.— This is particularly important where quality assurance personnel are also expected to perform other duties in the organization.*

4.4.2.2 The department responsible for quality control and assurance should arrange for independent quality audit checks to be carried out in accordance with the audit programme. Emphasis should be placed on the company systems employed to achieve and ensure airworthiness, their suitability and effectiveness. The scope of quality checks within the organization should be based on the guidelines given in 4.4.2.3 below.

4.4.2.3 All quality checks should be recorded and assessed and any criticisms forwarded to the person responsible for the particular facility or procedure for corrective action. There should be a feedback system for confirming to the quality assurance staff that corrective and preventive action has been taken and to ensure that persons concerned with any audit deficiency are made aware of both the adverse report and the outcome.

## **4.5 Maintenance organization's procedures manual**

*Note.— The maintenance organization's procedures manual is a document which provides details of the organizational structure, management responsibilities, maintenance procedures and quality assurance or inspection systems to be observed by the organization.*

### 4.5.1 General

The maintenance organization's procedures manual specified in Annex 6, Part I, 8.7.2 should provide clear guidance to personnel on how the activities included in the airworthiness authority approval are managed, on their personal responsibilities and on how compliance with the appropriate continuing airworthiness requirements is achieved. It should also include a statement of the organization's policies and objectives. If the maintenance organization is also the operator, the maintenance organization's procedures manual and the operator's maintenance control manual may be combined. The content of the procedures manual is outlined in 4.5.2 below.

### 4.5.2 Content of the maintenance organization's procedures manual

4.5.2.1 Annex 6, Part I, 8.7.2 requires the following information to be included in the manual:

- a) a general description of the scope of work authorized under the organization's terms of approval;
- b) a description of the organization's procedures and quality or inspection system in accordance with 8.7.3;
- c) a general description of the organization's facilities;
- d) the names, tasks, duties and responsibilities of the person or persons are required to ensure the maintenance organization is in compliance with Annex 6, Part I, 8.7.3;
- e) a description of the procedures used to establish the competence of maintenance personnel as required by 8.7.5.3;

- f) a description of the method used for the completion and retention of the maintenance records required by 8.7.6. The records shall show that all requirements for signing of the maintenance release have been met. The records shall be kept for a minimum period of one year after signing of the maintenance release;
- g) a description of the procedure for preparing the maintenance release and the circumstances under which the release is to be signed;
- h) the personnel authorized to sign the maintenance release and the scope of their authorization. The person signing the maintenance release shall be qualified in accordance with Annex 1;
- i) a description, when applicable, of the additional procedures for complying with an operator's maintenance procedures and requirements;
- j) a description of the procedures in respect of aeroplanes of over 5 700 kg maximum certificated take-off mass and helicopters of over 3 175 kg maximum certificated take-off mass, whereby information on faults, malfunctions, defects and other occurrences which cause or might cause adverse effects on the continuing airworthiness of the aircraft is transmitted to the organization responsible for the type design of that aircraft and to the operator's airworthiness authority; and

*Note.— Guidance on “interpretation of the organization responsible for the type design” is contained in Part III, Chapter 4 - Section 4.2 of this Manual.*

- k) a description of the procedure for receiving, amending and distributing within the maintenance organization all necessary airworthiness data from the Type Certificate holder or type design organization;
- l) if the manual is also used to comply with the requirements of Annex 6, Part I, 11.3 or Part III, Section II, 6.3, the maintenance programme should be included.

4.5.2.2. Notwithstanding the above requirements, consideration should be given to including the following in the procedures manual:

a) *Management*

- 1) a statement signed by the CEO confirming that the manual defines the organization's procedures and associated personnel responsibilities and will be complied with at all times;
- 2) an organization chart showing the associated chains of responsibility of the persons nominated in accordance with 4.5.2.1d) above;
- 3) notification procedures to the airworthiness authority regarding changes to the organization's activities/approval/location/personnel;
- 4) liaison or contractual arrangements with other organizations which provide services associated with the approval; and
- 5) amendment procedures for the manual.

b) *Maintenance procedures*

- 1) supplier evaluation procedure;
- 2) acceptance/inspection of aircraft components and material from outside contractors;
- 3) storage, labelling/tagging and release of aircraft components and material to aircraft maintenance;
- 4) acceptance of tools and equipment;
- 5) calibration of tools and equipment;
- 6) use of tools and equipment by staff (including alternate tools);
- 7) cleanliness standards of maintenance facilities;
- 8) maintenance instructions and relationship to aircraft/aircraft component manufacturers' service information including updating and availability to staff;
- 9) repair procedure;
- 10) procedures for compliance with an operator's aircraft maintenance programme;
- 11) airworthiness directives procedure;
- 12) optional modification procedure;
- 13) maintenance documentation in use and completion of same;
- 14) technical record control;
- 15) procedures for handling of defects arising during maintenance;
- 16) issue of the maintenance release required by Annex 6, Part I, 8.8 and Part III, Section II, 6.7;
- 17) records for the operator (if the organization is not an operator itself);
- 18) reporting of defects and other occurrences as required by the airworthiness authority (Part III, Chapter 4, Section 4.4 refers);
- 19) return of defective aircraft components to store;
- 20) control of defective components sent to outside contractors for overhaul, etc.;
- 21) control of computer maintenance record systems;
- 22) reference to specific maintenance procedures such as engine running procedures, aircraft pressure run procedures, aircraft towing procedures; and aircraft taxiing procedures;

- 23) sub-contract procedures;
  - 24) human factors; and
  - 25) manpower resources.
- c) *Line maintenance procedures* (when applicable)
- 1) line maintenance control of aircraft components tools, equipment, etc.;
  - 2) line maintenance procedures related to servicing/ fuelling/de-icing, etc.;
  - 3) line maintenance control of defects and repetitive defects;
  - 4) line procedure for pooled parts and loan parts; and
  - 5) line procedure for return of defective parts removed from aircraft.
- d) *Quality system procedures*
- 1) quality audit of organization procedures;
  - 2) quality audit of aircraft;
  - 3) quality audit findings remedial action procedure;
  - 4) the qualification and training procedures for personnel issuing a maintenance release (“certifying staff”);
  - 5) records of certifying staff;
  - 6) the qualification and training procedures for quality audit personnel;
  - 7) the qualification and training procedures for mechanics;
  - 8) exemption process control;
  - 9) concession control for deviation from organization’s procedures;
  - 10) qualification procedure for specialized activities such as non-destructive testing (NDT), welding, etc.;
  - 11) control of manufacturer’s working teams based at the premises of the organization, engaged in tasks which interface with activities included in the approval; and
  - 12) quality audit of sub-contractors (or acceptance of accreditation by third parties, e.g. use of NDT organizations approved by a State regulatory body other than the airworthiness authority).
- e) *Examples of standard documents.* Examples of standard documents used by the organization which are associated with activities undertaken under the terms and conditions of the approval, such as:



- 1) technical record control; or
- 2) rectification of defects.

#### 4.5.3 Quality assurance audit procedures

The lists which follows is not exhaustive, but includes the principal audit checks which need to be considered.

##### 4.5.3.1 Checks on aircraft, while undergoing scheduled maintenance, for:

- a) compliance with maintenance programme and mandatory continuing airworthiness requirements and ensuring that only work instructions reflecting the latest amendment standards are used;
- b) completion of work instructions including the transfer of defects to additional worksheets, their control, and final collation. Action taken in respect of items carried forward, not completed during the particular inspection or maintenance task;
- c) compliance with manufacturers' and the organization's standard specifications and procedures;
- d) standards of inspection and workmanship;
- e) condition of corrosion prevention and control treatments and other protective processes;
- f) aircraft maintenance which is not limited to the normal working day; procedures adopted during shift changeover of personnel to ensure continuity of inspection and responses; and
- g) precautions taken to ensure that, on completion of any work or maintenance, all aircraft are checked for loose tools and miscellaneous small items such as split pins, wire, rivets, nuts, bolts and other debris, and for general cleanliness and housekeeping.

##### 4.5.3.2 Checks on airworthiness data for:

- a) adequacy of aircraft manuals and other technical information appropriate to each aircraft type, including engines, propellers and other equipment, and the continuing receipt of revisions and amendments. Availability of continuing airworthiness data, e.g., Airworthiness Directives, life limits, etc.;
- b) assessment of manufacturer's service information, determining its application to aircraft types maintained and the recording of compliance or embodiment;
- c) maintenance of a register of manuals and technical literature held within the organization, their locations and current amendment status; and
- d) assurance that all the organization's manuals and documents, both technical and procedural, are kept up to date.

#### 4.5.3.3 Checks on stores and storage procedures for:

- a) the adequacy of stores and storage conditions for rotatable components, small parts, perishable items, flammable fluids, engines and bulky assemblies in accordance with the specifications adopted by the organization;
- b) the procedure for examining incoming components, materials and items for conformity with order, release documentation and procurement from sources approved by the organization;
- c) the “batch recording” of goods received and identification of raw materials, the acceptance of part life items into stores, requisition procedures for issue of items from stores;
- d) labelling procedures, including the use of serviceable/unserviceable/repairable labels and their certification and final disposal after installation, and labelling procedures for components which are serviceable but “part life” only;
- e) the internal release procedure to be used when components are to be forwarded to other locations within the organization;
- f) the procedure to be adopted for the release of goods or overhauled items to other organizations (this procedure should also cover items being sent away for rectification or calibration);
- g) the procedure for the requisitioning of tools together with the system for ensuring that the location of tools, and their calibration and maintenance status, is known at all times; and
- h) control of shelf life and storage conditions in the stores; control of the free-issue dispensing of standard parts, identification and segregation.

#### 4.5.3.4 Checks on maintenance facilities for:

- a) cleanliness, state of repair and correct functioning of hangars, hangar facilities and special equipment and the maintenance of mobile equipment;
- b) adequacy and functioning of special services and techniques including welding, non-destructive inspection (NDI), weighing, painting;
- c) viewer/printer equipment provided for use with microfiche, microfilm and compact disk, ensuring that regular maintenance takes place and an acceptable standard of screen reproduction and printed copy is achieved;
- d) the adequacy of special tools and equipment appropriate to each type of aircraft, including engines, propellers and other equipment;
- e) the calibration and maintenance of tools and measuring equipment; and
- f) environmental controls.

4.5.3.5 Checks on the organization's general airworthiness control procedures for:

- a) monitoring the practices of the organization in respect of scheduling or pre-planning maintenance tasks to be carried out in the open air and adequacy of the facilities provided;
- b) operation of the system for service difficulty reporting required by the airworthiness authority (Part III, Chapter 4, Section 4.4 refers);
- c) authorization of personnel to issue maintenance releases in respect of inspections and maintenance tasks; the effectiveness and adequacy of training, including continuation training and the recording of personnel experience, training and qualifications for grant of authorization;
- d) the effectiveness of technical instructions issued to maintenance personnel;
- e) the adequacy of personnel in terms of qualifications, numbers and ability in all areas required to support the activities included in the approval granted by the airworthiness authority;
- f) the efficacy and completeness of the quality audit programme;
- g) maintaining logbooks and other required records and ensuring that these documents are assessed in accordance with the requirements of the State (ICAO requirements in respect of the preservation of records are contained in Annex 6, Part I, 8.7.6);
- h) ensuring that repairs are only carried out in accordance with approved repair schemes and practices;
- i) control of sub-contractors;
- j) control of activities sub-contracted to it, such as management of the operator's maintenance programme;
- k) monitoring "Exemption process control" (paragraph 4.5.2.2. d)8) above) and monitoring "Concession control for deviation from organization's procedures" (paragraph 4.5.2.2. d) 9) above); and
- l) follow-up internal reporting/occurrences.

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**PART V.— GUIDANCE ON TRANSFER OF AIRCRAFT,  
INTERNATIONAL LEASE ARRANGEMENTS AND ARTICLE 83BIS AGREEMENT**

**CHAPTER 1.— GUIDANCE ON TRANSFER OF AIRCRAFT**

**1.1 General**

This guidance material is intended to define the minimum requirements for aircraft owners, airlines and regulatory authorities who are planning or preparing to transfer an aircraft between operators. The material contains recommended methods and practices which could be used during preparation and organization of an aircraft transfer. The proposed requirements are intended to be used as minima; additional requirements may be demanded by the purchaser.

**1.2 Maintenance aspects of aircraft transfer**

1.2.1 Records and documentation

1.2.1.1 General

1.2.1.1.1 Before a used aircraft is introduced into an operator's fleet, the receiving operator should review the records to ensure they provide the current maintenance information necessary to phase the aircraft into the operator's maintenance programme. This includes records such as the documentation of the current status of ADs, the current status of the last scheduled inspections required by the approved maintenance programme (including the requirements contained in the ALS, e.g., the life-limited parts, the supplemental structural inspection documents, the damage-tolerance inspection, certification maintenance requirements), the major repairs and major modifications.

*Note.— For categorisation of repairs see Part III, Chapter 6.3 Repair Categories of this Manual.*

1.2.1.1.2 If the aircraft is being transferred to another operator but remains on the registry of the same State, the records from the transferring operator should be acceptable as valid unless obvious discrepancies are apparent. This does not eliminate the need to check records, but may reduce the depth of the review. The transferring operator should provide a written statement that the records are correct.

1.2.1.1.3 If the aircraft is being transferred from another State, it may be necessary to evaluate the previous operator's maintenance scheduling and record-keeping system to ensure the validity of the records. This may require communication between the two regulatory authorities concerned.

1.2.1.1.4 The general quality of the current status presented by the transferring operator should be evaluated. The following are recommendations for such an evaluation, and more particularly for the validity of the current status of life-limited parts and AD compliance:

- a) If the State of the operator is an ICAO signatory, the operator's records should meet ICAO requirements and a record of current status would be acceptable;

*Note.— ICAO record-keeping requirements are specified in Annex 6, Part I, Chapter 8 (Aeroplanes) and Part III, Section II, Chapter 6 (Helicopters).*

- b) A spot check of visible ADs and of the in-service history would be indicative of the accuracy of those records;
- c) A spot check of source records for the record-keeping system of the transferring operator would indicate the quality of those records;
- d) The state of the transferring operator's shop records would be indicative of the integrity of the operator's record-keeping system;
- e) Significant errors or omissions in a records status report would indicate inadequate records and record-keeping system.

1.2.1.1.5 *Part numbers.* Records should accurately reflect the manufacturer's part number as applicable. In the event that the operator utilizes a part numbering system other than the manufacturer's system, a complete cross-reference should be provided with the records. If alternative part numbers are recorded, technical substantiation should be available to support the part substitution.

1.2.1.1.6 *Serial numbers.* All components and assemblies controlled by serial numbers should have their serial numbers recorded in the maintenance records. In the event that the operator utilizes a serial numbering system other than the manufacturer's system, a complete cross-reference should be provided with the records.

1.2.1.1.7 *Dates.* All records should be properly dated with reference to an installation or maintenance function accomplishment. If the date format is numeric, the system should use a day/month/year format to date the records.

#### 1.2.1.2 Record-keeping requirements for airworthiness directives

Each operator should maintain the current status of applicable ADs for a particular airframe, engine, propeller, rotor or appliance. This record should:

- a) identify the particular airframe, engine, propeller, rotor or appliance;
- b) identify the applicable AD (including amendment number, if required) of the State of the transferring operator, including a cross reference to the AD of the State of Design and any deviations thereof if applicable;
- c) indicate the date, the flight hours, the flight cycles, the landings, etc. (as appropriate) when the AD was accomplished and when the next recurring inspection or action is due (if applicable);
- d) describe the method of compliance (if more than one method is specified in the AD); and
- e) show the appropriate measuring parameters (flight hours, flight cycles, landings, calendar times, etc.).

*Note.— Current status information is required to be maintained as long as the airframe, engine, propeller, rotor or appliance is used or intended to be used by the operator. ICAO requirements for retention of records are specified in Annex 6, Part I, Chapter 8 (Aeroplanes) and Part III, Section II, Chapter 6 (Helicopters).*

### 1.2.1.3 Record-keeping requirements for life-limited parts

1.2.1.3.1 Each operator should maintain the current status of life-limited parts. If the operator obtained such parts new from the manufacturer, the current status will be based upon the operator's in-service history of the part. If the part has been obtained from a previous operator, the current status will be based on the status from the previous operator(s) plus the present operator's in-service history. The current status of life-limited parts is required upon each transfer throughout the operating life of the part. When such parts are transferred, the previous operator should produce an in-service history for life-limited parts, irrespective of the operator's governing regulations. When life-limited parts are transferred between operators, a written statement by the previous operator, attesting to the current status of life-limited parts should also be provided.

1.2.1.3.2 When the in-service history required for the establishment of the of current status for life-limited parts are lost or destroyed, an equivalent level of safety may be determined by consideration of other records available, such as technical records, utilization reports, manufacturer's information or presentation of other evidence. If review of other available documentation reveals significant errors or omissions that prevent the development of a current status for the life-limited part(s), the part(s) in question should be retired from service until the time the history can be rebuilt. It is the operator's responsibility to notify the regulatory authority when such records are lost or destroyed and to initiate an immediate search for records from which the current status of the life-limited part(s) can be determined.

1.2.1.3.3 Not all life-limited parts will necessarily be marked with part and serial numbers. For aircraft manufactured in the United States, for instance, specific requirements for life-limited parts to be marked with part and serial numbers have only existed since the early 1980s. Operators should be able to track life-limited parts manufactured prior to the early 1980s, although such parts may not be serialized items. Special attention should be paid to parts that can be transferred from one aircraft to another.

1.2.1.3.4 Operators may receive life-limited parts from a repair station that has a system to determine the current status of such life-limited parts. This system should be recognized as a factor in the substantiation of the current status of life-limited parts.

### 1.2.1.4 Maintenance programme

1.2.1.4.1 The maintenance programme should include the following:

- a) *Approval.* The approval or acceptance of the maintenance programme by the associated regulatory authority should be identified.
- b) *Traceability.* The maintenance programme should be identified and be traceable to its approved minimum requirements standard, e.g. maintenance review board (MRB) report, the manufacturer's recommended maintenance programme or recommended tasks. In the event that the programme fails to meet the minimum requirement standard, all areas of such differences should be identified and corrective action taken on the aircraft or to the programme as necessary. The minimum standard is understood to mean only minimum required tasks and not the intervals.
- c) *Documentation.* A printed copy of the maintenance schedule should be provided, identifying all tasks and functions in such a manner as to permit traceability to the corresponding work cards. This includes sampling programme tasks.

1.2.1.4.2 The maintenance/inspection programme may change for aircraft transferred from one operator to another. The integration or bridging plan for the two programmes should be presented to the (receiving, if applicable) airworthiness authority.

#### 1.2.1.5 Service bulletins

All service bulletins that have been incorporated should be listed, together with accomplishment dates (date, flight hours, flight cycles, landings, etc. as appropriate). If options are available, the option complied with should also be indicated. When a service bulletin involves recurring action, the times or dates, as applicable, of the last action and the next action due should be provided.

#### 1.2.1.6 Modifications

1.2.1.6.1 All modifications performed since the original aircraft delivery that are still existent on the aircraft should have been carried out in accordance with the requirements of the airworthiness authority of the State of Registry at the time of their incorporation.

1.2.1.6.2 A list of such modifications should be provided indicating their classification and supported by appropriate documentation. In the case of a major modification, this documentation should include as a minimum:

- a) the document defining the modification;
- b) the certification basis; and
- c) the approval of the relevant authority.

#### 1.2.1.7 Repairs

All major repairs performed since original aircraft delivery and which are still existent upon the aircraft should be listed and demonstrated to be in compliance with the requirements of the airworthiness authority of the State of Registry at the time of their incorporation. If additional action is required, e.g. recurring inspection, this should also be indicated.

#### 1.2.1.8 Extended diversion time operations

The maintenance programme may need to be supplemented and some modifications or service bulletins may need to be embodied in consideration of the special requirements of extended diversion time operations. The following items should be reviewed to ensure that they are adequate for extended diversion time operations:

- a) *Maintenance programme.* A status of the changes which were made in order to substantiate the incorporation of the configuration maintenance and procedures (CMP) standard in the aeroplanes used in extended diversion time operations should be provided. This can be an extract of the maintenance programme status.

- b) *Modifications and service bulletins.* A list of the titles and identification numbers of all modifications, additions and changes which were made in order to substantiate the incorporation of the configuration maintenance and procedures (CMP) standard in the aeroplanes used in extended diversion time operations should be provided. This can be an extract of the status of modifications and service bulletins.

#### 1.2.1.9 Deferred items

All deferred items which are still existent should be listed and demonstrated to be acceptable to the airworthiness authority of the State of Registry at the time of the aircraft transfer.

#### 1.2.1.10 Storage

These considerations are not normally part of the operator's continuing airworthiness programme. Nevertheless, a specific maintenance programme may need to be implemented in consideration of the special requirements of aircraft storage.

#### 1.2.1.11 Transfer of records

When an aircraft, airframe, engine, propeller, rotor or appliance is transferred to a new operator, the original records of these products should accompany the transfer. Such records should include the current status of AD's, life-limited parts, scheduled maintenance tasks, modifications, repairs, service bulletins, deferred items, specific extended diversion time operations and storage tasks. They should clearly identify the person responsible for the data in the report and the date associated with the records.

#### 1.2.1.12 Lost records

In the event that required maintenance records have been lost or destroyed, alternative proof should be provided that the tasks in question have been performed. This may require the inspection of the aircraft, powerplant, components or appliances.

### 1.2.2 Document presentation

A standard method of presenting the records is encouraged. It is recommended that the summary of records and other pertinent information be compiled into a book or other concise document in order to simplify, as much as possible, the record review process. An outline of the recommended format can be found in Appendix A to this chapter.

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## APPENDIX A.— OUTLINE FOR DOCUMENT PRESENTATION

### *Section 1.— Status summary and data certification*

This section should begin with a statement of certification from the transferring operator or owner that the information presented is true and correct, and a general presentation of the aircraft (aircraft type and model, manufacturer serial number, registration mark, accumulated times, installed engines, auxiliary power unit, etc.) including:

- a) the certification basis;
- b) a general statement of the current status of non-repetitive ADs, such as:

“All applicable airworthiness directives through (specify date, issue, etc.) have been incorporated as listed on the (specify name of operator) airworthiness directive summary (specify date) with the exception of those directives requiring initial or repetitive action.”;
- c) a general statement of the current status of repetitive ADs, such as:

“All airworthiness directives listed on the (specify operator) airworthiness directive control summary dated (specify date) require initial or repetitive action at the date, time or cycles listed.”;
- d) a statement of the extent of the operator’s direct operational and maintenance control of the aircraft and a list of major repairs accomplished during that time, such as:

“This aircraft has been under the direct operational and maintenance control of (specify operator) since (specify date). During this time the aircraft underwent the following major repairs/modifications in accordance with approved technical data documented in the aircraft records. (List all major repairs/modifications)”;

In addition to the above statement, a listing of all the major repairs/ modifications incorporated by previous operators including the approved technical data documented in the aircraft records should be supplied if applicable;
- e) a statement regarding the accomplishment of the last major inspection, such as:

“The last (specify type of major inspection) was accomplished by (specify operator/maintenance organization) between (specify date) and (specify date) at (specify operator/maintenance organization) maintenance facility in (specify city, State). Airframe total hours and total cycles were \_\_\_”;
- f) a statement regarding the current status of the installed engines and any spare engines, such as:

“The following engines are currently installed on the aircraft with the total accumulated and remaining hours and cycles listed for each (list engines.) The (specify operator) life-limited parts report has been prepared using the (list manufacturer’s controlling document), and reflect accurate accumulated lives of the life-limited parts as of the engine time/cycles noted above”;

and
- g) a statement regarding the current component status, such as:

“The components/inspection times listed on the (specify operator) component control summary represent the latest component installation information as of (specify date)”.

Section 1 should be signed by the senior airline official responsible for aircraft maintenance record-keeping.

*Section 2.— The aircraft sale agreement*

This section should contain a copy of the sale agreement. Economic or monetary information may be deleted for the purposes of this presentation.

*Section 3.— Operating authority*

This page should contain a copy of the operating authority issued by the responsible regulatory authority of the last operator, if different from the new operator. This is used to establish the rules under which the aeroplane was operated and maintained.

*Section 4.— Aircraft certificates*

This section should contain a copy of the aircraft certificates, including the export certificate of airworthiness (if any), the current certificate of airworthiness, the current certificate of aircraft registration, the certificate of noise limitation, the radio license, the maintenance release certificate, etc.

*Section 5.— Current inspection status summary*

This page should give a summary of the current inspection status of the aircraft at the time of transfer. It should list:

- a) the aircraft total time in flight hours, flight cycles, landings, calendar time, etc.;
- b) the time (in flight hours, flight cycles, landings, calendar time, etc. as appropriate) since the last major scheduled maintenance or inspection;
- c) the scheduled major inspection intervals and the time remaining to the next inspection; and
- d) the engines by position and serial number. The listing should show the time since new, cycles since new and the time and/or cycles remaining to the next life-limited part removal for each engine.

*Section 6.— Summary of current status of life-limited parts*

This section should contain a listing of all the airframe and powerplant life-limited components/parts installed on the aircraft at the time of transfer. The listing should contain the name of the component/part, the installed location or position of the component/part, the component/part number, the component/part serial number, the required retirement time of the component/part, the current accumulated lives (in flight hours, flight cycles, landings, calendar times, etc. as appropriate) and remaining lives before the required retirement times of the component/part is reached.

*Section 7.— Current status of airworthiness directives*

This section should contain a listing of each AD applicable to the aeroplane, powerplants, components and appliances. Recurring ADs should be listed separately. The listing should contain:

- a) the AD number and revision date of the State of the transferring operator, including a cross reference to the AD of the State of Design, if applicable;
- b) a concise description of the required action;
- c) the method of compliance;
- d) the time in service and the date of AD accomplishment; and
- e) for ADs having requirements for recurring actions the date of AD accomplishment and when the next recurring action is due (date, flight hours, flight cycles, etc.).

*Section 8.— Aircraft maintenance programme integration*

This section should contain the maintenance programme and a listing of each maintenance task included in this maintenance programme, the scheduled inspection interval, together with the last accomplishment applicable to the aircraft, powerplant, components and appliances. The listing should contain:

- a) the maintenance task number, including a cross reference to the TC holder's maintenance task number in case of a different maintenance programme developed by the operator or one of its subcontracted maintenance organizations, if applicable;
- b) a cross reference to the applicable work cards;
- c) a description of the action performed; and
- d) the date of last accomplishment and the times in service if applicable.

If the maintenance/inspection programme is to be changed for the aircraft, the integration or bridging plan for the two programmes should be presented here. For an integration plan, a listing of each scheduled maintenance/inspection item under both the old and new programmes should be shown along with the method of transfer or bridging from one to the other.

*Section 9.— Modifications, repairs, service bulletins*

This section should contain a listing of each modification, repair or Service Bulletin embodied on the aircraft. If additional action is required, e.g. recurring inspection, this should also be indicated. The listing should contain:

- a) the modification, repair, or service bulletin number and revision date, including a cross reference to the TC holder's modification, engineering repair approvals or service bulletin number in case of engineering orders developed by the operator or one of its subcontracted maintenance organizations, if applicable;
- b) a description of the action performed;

- c) the date of accomplishment; and
- d) for service bulletins/engineering orders having requirements for recurring actions, the times in service.

*Section 10.— Extended diversion time operations status (when applicable)*

This section should contain a listing of each extended diversion time operations configuration and maintenance requirement embodied on the aircraft, powerplant, components and appliances. The listing should contain:

- a) the modification, service bulletin number and revision date, including a cross reference to the TC holder's modification/service bulletin number in case of engineering orders developed by the operator or one of its subcontracted maintenance organizations, if applicable;
- b) a description of the action performed;
- c) the date of accomplishment;
- d) for service bulletins/engineering orders having requirements for recurring actions, the times in service;
- e) the maintenance task number, including a cross reference to the TC holder's maintenance task number in case of a different maintenance programme developed by the operator or one of its subcontracted maintenance organizations, if applicable;
- f) a cross reference to the applicable work cards;
- g) a concise description of the action performed; and
- h) the date of last accomplishment and the times in service if applicable.

*Section 11.— Deferred items.*

This section should reference the maintenance log book pages listing the deferred items and should contain a listing of each deferred item to be embodied on the aircraft, powerplant, components and appliances. The listing should contain:

- a) the deferred item identification number (and revision number/date, if any);
- b) a description of the action to be performed; and
- c) the times in service and the date when the accomplishment was initially scheduled.

*Section 12.— Storage (when applicable)*

This section should contain a listing of each maintenance requirement to be performed on the aircraft, powerplant, components and appliances at the time, during and at the end of the storage. If recurring inspection is required, this should also be indicated. The listing should contain:

- a) the maintenance task number, including a cross reference to the TC holder's maintenance task number in case of a different storage programme developed by the operator or one of its subcontracted maintenance organizations, if applicable.;
- b) a cross reference to the applicable work cards;
- c) a description of the action performed; and
- d) the date of last accomplishment.

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## CHAPTER 2.— GUIDANCE ON INTERNATIONAL LEASE ARRANGEMENTS

### 2.1 General

2.1.1 This guidance material is intended to define the minimum requirements for aircraft owners, airlines and regulatory authorities who are planning or preparing to lease an aircraft across international boundaries. The material contains recommended methods and practices which could be used during the preparation and organization of an aircraft lease or an international aircraft transfer on top of those mentioned in Chapter 1 of this part. The proposed requirements are intended to be used as minima; additional requirements may be demanded by the lessor or purchaser.

2.1.2 Historically, there have been a number of difficulties associated with the international leasing of aircraft, usually caused by differing national airworthiness standards, differing national operational standards, differing build standards; and non-standard application of the above.

2.1.3 Prior to entering into lease, charter, or interchange arrangements, authorities should give due consideration to the objectives of continuing airworthiness and to the transfer of information as required in:

- a) Annex 6, Part I, 8.3 and 11.3 — Maintenance programme;
- b) Annex 6, Part I, 8.4 — Maintenance records;
- c) Annex 6, Part I, 8.5 — Continuing airworthiness information;
- d) Annex 6, Part I, 8.6 — Modifications and repairs;
- e) Annex 6, Part I, 8.7.2 — Maintenance organization's procedures manual;
- f) Annex 6, Part I, 8.7.6 — Records;
- g) Annex 6, Part I, 8.8 — Maintenance release;
- h) Annex 6, Part I, 11.2 — Operator's maintenance control manual; and
- i) Annex 8, Part II, 4.2 — Responsibilities of Contracting States in respect of continuing airworthiness.

In so doing, authorities should also take into account the type and length of lease etc., and should develop administrative procedures and arrangements between the States involved to ensure that the continuing airworthiness of the aircraft is maintained.

2.1.4 Documentation should be provided to establish the national regulations under which the maintenance and operation of the aircraft have been carried out. This should also include, where applicable, details of any deviations from, or exemptions issued against, those regulations.

2.1.5 Irrespective of the various types of arrangements and categories of lease, charter and interchange, this Chapter will discuss the following issues in relation to the transfer of aircraft between the State of Registry and the State of the Operator:

- a) acceptance of the type design;
- b) maintenance;
- c) approval for extended diversion time operations (if applicable);
- d) information on faults, malfunctions and defects and other occurrences;
- e) mandatory continuing airworthiness information; and
- f) distribution of mandatory continuing airworthiness information.

## **2.2 Records and documentation**

### 2.2.1 General

2.2.1.1 In addition to Chapter 1.2.1 of this Part, regarding aircraft records and documentation consideration should be given as indicated in the following paragraphs.

2.2.1.2 *Governing requirement.* Prior to initiation of the lease, representatives of both parties should coordinate the scope and content requirements of the technical logs and the aircraft journey log book that will eventually be required upon aircraft return or further transfer. The governing record-keeping regulation under which the aircraft records should be maintained should be determined prior to initiation of the lease or transfer.

2.2.1.3 *Language.* All aircraft records should be maintained in a language which is acceptable to the authority of the State of the Operator. For practical purposes another language may be used; however, a translation to a language acceptable to the authority of the State of the Operation may be required at the time of transfer. The translation of past records need only be accomplished when required by the authority of the State of the Operator.

#### 2.2.1.4 *Documentation requirements*

2.2.1.4.1 Documentation requirements for incoming components and parts should be identified in the operator's manual to support its purchasing and receiving inspection functions. This includes, but is not limited to, documentation of AD compliance, time on life-limits, descriptions of work performed and certification of new and repaired parts. Once these requirements are satisfied and the essential information is entered into the operator's records system, the only source documentation required to be retained is that necessary to:

- a) satisfy the requirements of the responsible authority;
- b) support the operator's continuing analysis and surveillance system; and
- c) support future maintenance on the affected parts.

However, operators are advised to retain or archive documentation of AD compliance, life-limited part service times and other information which may be useful in the future.

### 2.2.2 Additional record-keeping requirements for airworthiness directives

In addition to 1.2.1.2 of this Part, the requirements of the authority will determine the specific data required as part of a maintenance record. An operator is normally not required to retain actual work documents to show accomplishment of the work on a given airframe, engine, propeller, rotor or appliance in order to document AD compliance unless such records are otherwise called for by the requirements of the authority of the State of Registry.

### 2.2.3 Addition to the transfer of records

In addition to 1.2.1.11 of this Part, when an aircraft, airframe, engine, propeller, rotor or appliance is leased, the associated records should be transferred as if the transaction were a sale. By agreement between the lessee and the lessor, some records, such as work cards and inspection records, may be retained by the owner; however, the lessee has a responsibility to review the records retained by the owner and to ensure that the summary information used to support the airworthiness of the item is complete and accurate.

### 2.2.4 Addition to the recommended format of the documentation

As an amendment to Appendix A to Chapter 1 of this Part *Section 2.— The aircraft sale agreement*, this section should refer to the lease agreement and contain a copy of this agreement. Economic or monetary information may be deleted for the purposes of this presentation.

## **2.3 Minimum airworthiness provisions for leasing agreements**

In the area of airworthiness provisions, the lease agreement should ensure at least that:

- a) the lessor and lessee are properly identified;
- b) the aircraft subject to the lease agreement is identified by aircraft make and model, registration number and manufacturer's serial number;
- c) the effective dates of the lease are properly identified;
- d) the person having operational control is specifically identified;
- e) the State of Registry, the applicable airworthiness code and the regulations under which the aircraft will be maintained are identified;
- f) the responsibilities for the accomplishment of maintenance in accordance with the designated regulations are specifically identified;
- g) the responsibilities for keeping the aircraft maintenance records in accordance with the designated regulations are specifically identified;
- h) the maintenance/inspection programme that will be utilized is specifically identified; and



- i) the lessor and lessee clearly identify a coordination mechanism, periodic meetings may be arranged to ensure that the continuing airworthiness of the aircraft is maintained.

## **2.4 Acceptance of the type design**

2.4.1 The laws of the State of Registry generally prescribe the airworthiness and the design-related operational requirements for aircraft registered in that State and operated by an operator under its jurisdiction. However, the laws of the State of the Operator may also require that foreign-registered aircraft utilized by operators under its jurisdiction comply with the same airworthiness and design-related operational requirements, as if they were registered in that State.

2.4.2 The States of Registry and of the operator should, when prescribing the airworthiness and design-related operational requirements, consider the following when an aircraft is transferred from the State of Registry to the State of the Operator:

- a) the period of time for which the aircraft is to be transferred;
- b) the differences between the type certification basis of the State of Registry and that of the State of the Operator;
- c) the differences between the design-related operational requirements of the State of Registry and those of the State of the Operator; and
- d) the responsibilities of the State of Registry and the State of the Operator with respect to the approval of:
  - 1) changes to the type design, including those required to take into consideration the differences stated in b) and c); and
  - 2) repairs which require a design approval before implementation.

2.4.3 In accordance with Annex 8, the State of Registry, unless otherwise transferred under Article 83*bis*, is responsible for ensuring that the aircraft, and any modification to it, complies with an approved design. To preserve this responsibility, the State of the Operator should not endorse the implementation of any change without prior approval by the State of Registry.

2.4.4 To carry out their respective functions, States could enter into bilateral airworthiness and transfer of aircraft agreement which describes procedures for:

- a) the approval of the modifications to the type design;
- b) the embodiment of the modifications and repairs; and
- c) the record-keeping of the modifications and repairs.

## **2.5 Maintenance**

2.5.1 Although the maintenance programme is usually approved by the State of Registry (Annex 6, Part I, 8.3), the legislation of a State may require it to approve the maintenance programme for all aircraft

operated by the operators of that State. Other factors may, by necessity or for convenience, lead to the use of a third State's maintenance programme, in the case of transferred aircraft.

2.5.2 Some of the factors influencing the selection of the maintenance programme to be applied when aircraft are transferred are:

- a) the period of time for which the aircraft is transferred;
- b) the differences between the maintenance requirements of the State of Registry and those of the State of the Operator and the compatibility of their approved maintenance programmes;
- c) the different requirements regarding the approval or acceptance of the maintenance programme by the State of the Operator or of the State of Registry;
- d) the distance between the place where the aircraft is operated and the State of the Operator, i.e. the aircraft may be operated in a third State for the duration of the transfer; and
- e) any changes in the aircraft utilization or environmental conditions.

2.5.3 Arrangements and procedures regarding the maintenance, the performance and certification of maintenance, including the signing of maintenance releases and the record-keeping should be acceptable to both the State of Registry and the State of the Operator. These arrangements and procedures could be developed on a case-by-case basis or be the subject of a bilateral airworthiness or transfer agreement.

## **2.6 Approval for extended diversion time operations**

2.6.1 The approval for conducting extended diversion time operations applies to an individual operator and to a specific airframe-engine combination of that operator's fleet. The approval is not transferable with the aeroplane.

2.6.2 The original operator that has authority for extended diversion time operations, in transferring an aeroplane under a wet lease arrangement with an acquiring operator, retains this authority.

2.6.3 In the case of an original operator that has authority for extended diversion time operations, transferring an aeroplane under a dry lease arrangement, the acquiring operator should obtain the authority to conduct extended diversion time operations from the State of the acquiring operator.

2.6.4 Arrangements and procedures regarding the approval of extended diversion time operations with a transferred aircraft should primarily be acceptable to the State of the Operator. Where applicable, the experience of the original operator being used to approve the new operator's extended diversion time operations should be clearly identified in the transfer arrangements.

*Note 1.— Dry/wet lease is defined in the Manual of Procedures for Operations Inspection Certification and Continued Surveillance (Doc 8335).*

*Note 2.— General guidance material on the continuing airworthiness requirements for extended diversion time operations is contained in Chapter 2 of Part IV of this Manual.*

## **2.7 Information on faults, malfunctions and defects and other occurrences**

2.7.1 Annex 8, Part II, 4.2.3 requires the State of Registry, in respect of aeroplanes over 5 700 kg and helicopters over 3 175 kg maximum certificated take-off mass, to ensure that there exists a system whereby information on faults, malfunctions, defects and other occurrences is transferred to the organization responsible for the type design. Furthermore, 4.2.4 of the same document requires Contracting States to establish which type of service information is to be reported by operators, organizations responsible for type design and maintenance organizations.

2.7.2 It is clear from the above that the State of Registry is responsible for ensuring the transfer of information on defects to the organization responsible for the type design. For an operator of an aircraft subject to a transfer, it may not be appropriate, convenient or enforceable to report defects according to the system of the State of Registry. Specific arrangements between the State of Registry and the State of the Operator should therefore be developed to ensure that the information on defects for the aircraft is transferred to the organization responsible for the type design.

2.7.3 At the time an aircraft is transferred, the two authorities and the operators involved should decide which reporting systems and procedures apply, to ensure that the information is transmitted to the organization responsible for the type design and, as required, to the State of Registry.

2.7.4 When aircraft are transferred, some of the factors influencing the selection of the system to be used for reporting information on defects are:

- a) the period of time for which the aircraft is transferred;
- b) the compatibility/differences between the reporting system of the State of Registry and that of the State of the Operator;
- c) the possible absence of a reporting system in the State of the Operator or the State of Registry; and
- d) the regulatory requirements of the States involved.

## **2.8 Mandatory continuing airworthiness information**

2.8.1 Under Article 31 to the Convention, the State of Registry has prime regulatory responsibility for the airworthiness of the aircraft on its Registry. If the State of Registry is also the State of Design, it will normally be the originator of mandatory continuing airworthiness information, such as Airworthiness Directives.

2.8.2 If the State of Registry is not the State of Design, it should have procedures in place to respond to mandatory continuing airworthiness information received from the State of Design and should decide whether the information will be made mandatory for aircraft on its registry. When made mandatory, the State of Registry will either issue its own mandatory information or require compliance with that issued by the State of Design.

2.8.3 Notwithstanding 2.8.1 and 2.8.2, the State of Registry, without being the State of Design, may issue mandatory continuing airworthiness information applicable to aircraft registered in its State.

2.8.4 Similarly, the State of the Operator may, by virtue of an agreement with the State of Registry, require mandatory continuing airworthiness information it has issued to be applicable to aircraft operated in its State. In such cases, the content of 2.4.3 of this Part should also be considered before the implementation of the information.

## **2.9 Distribution of mandatory continuing airworthiness information**

2.9.1 The mandatory continuing airworthiness information issued by the State of Registry in the form of an Airworthiness Directive or equivalent, or issued by the State of Design and made mandatory by the State of Registry, should be made available to affected operators by the State of Registry. Some States disseminate this mandatory information directly to each registered owner of an affected aircraft on their registries and rely on the registered owner to transmit the information to the operator. Other States make the information available through the offices of their airworthiness authorities or also publish the information and make it available by subscription.

2.9.2 As described in Section 2.8 above, the mandatory continuing airworthiness information issued, in certain circumstances, by the State of the Operator, and made mandatory on aircraft registered in another State and operated in the State of the Operator, should be made available to affected operators by the State of the Operator.

2.9.3 When an aircraft is leased to an operator in another State, distribution of mandatory continuing airworthiness information by the State of Registry may be accomplished by making the mandatory documents available to the registered aircraft owner, who should be responsible for transmitting them to the aircraft operator.

## **2.10 Continuing validity of the certificate of airworthiness**

When an aircraft is leased to an operator in another State, the regulation for continuing validity of the Certificate of Airworthiness of the State of Registry should be complied with by the operator.

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## **CHAPTER 3.— GUIDANCE ON THE AIRWORTHINESS ASPECTS OF THE IMPLEMENTATION OF ARTICLE 83bis.**

### **3.1 General**

3.1.1 The material in this chapter is intended to provide guidance to States on meeting their continuing airworthiness responsibilities when they are involved, either as the State of the Operator or the State of Registry, in the transfer of aircraft under an Article 83bis agreement. In consideration of the complexity of these agreements and the numerous potential problems that may occur, States should use this material as guidance when they are considering entering into such agreements. The material contains recommended methods and practices which could be used during the preparation and organization of an aircraft transfer under Article 83bis in addition to those mentioned in Chapter 1 and 2 of this part. The proposed requirements are intended to be used as minima; additional requirements may be demanded by the lessor or purchaser.

3.1.2 With the adoption of Article 83bis, the State of Registry may, by an agreement with the State of the Operator, transfer to the State of the Operator all or part of functions and duties as the State of Registry in respect of an aircraft, which is operated pursuant to an arrangement for the lease, charter or interchange of the aircraft or any similar arrangements by an operator which has its principal place of business or his residence outside the State of Registry, under the Article 12 (Rules of the air), Article 30 (Aircraft radio equipment), Article 31 (Certificates of airworthiness) and Article 32(a) (Licenses of personnel). The State of Registry shall be relieved of responsibility in respect of the functions and duties transferred.

3.1.3 The guidance material in this document only deals with airworthiness-related matters. However, there are other areas that should be considered prior to entering into such an agreement. Additional ICAO guidance materials can be found in the *Manual of Procedures for Operations Inspection, Certification and Continued Surveillance* (Doc 8335). Chapter 10 of this document advises of legal and practical operational problems to be considered by the authorities in the certification of an operator proposing to utilize leased aircraft.

3.1.4 When preparing a transfer agreement, States may consider to review actual agreements registered with ICAO and published via ICAO channels. However it is strongly advised not to use these agreements as a template. The basis for these agreements reflect national regulations, procedures and policies existing in the involved States which might differ from those in other States.

### **3.2 Guidance on the implementation of Article 83bis**

#### **3.2.1 General**

3.2.1.1 The Protocol relating to Article 83bis (Doc 9318) came into force on 20 June 1997 in respect of the States which had ratified it. According to Article 8 bis, all or part of the duties and functions pertaining to Articles 12, 30, 31 and 32(a) of the Chicago Convention may be transferred from the State of Registry to the State of the Operator. This section focuses on the responsibilities associated with Article 31 (Certificates of Airworthiness) of the Convention.

3.2.1.2 Any type of commercial arrangement for cross-border lease, charter or interchange of aircraft, or any similar arrangement, may give rise to an 83bis agreement. It should be noted that Article 83bis refers, among other things, to “lease” in general, not excluding wet leases in principle. Nevertheless the

application of Article 83bis to wet lease arrangements would then require that foreign wet-leased aircraft concerned be operated under the lessee's AOC. Such cases are rare, in view of the difficulty for the State of lessee, as State of the Operator, to implement the operational requirements of Annex 6 to the Convention.

3.2.1.3 Additional information on the implementation of Article 83bis can be found in:

- a) ICAO Doc 9318 — *Protocol Relating to an Amendment to the Convention on International Civil Aviation (Article 83 bis)*;
- b) ICAO Circular 295 — *Guidance on the Implementation of Article 83 bis of the Convention on International Civil Aviation (Circ 295)*; and
- c) EC 2/82, LE 4/55-99/54 dated 14 May 1999, "Study on aircraft leasing and material on the implementation of Article 83bis".

### 3.2.2 Agreement considerations

3.2.2.1 Prior to entering into any transfer agreement, and with reference to Assembly Resolutions A23-3 and A23-13, States of Registry must ensure that their national legislation actually allows them to divest themselves of the functions and duties of aircraft on their Registry that are proposed for a transfer agreement. Furthermore, as State of the Operator, States should ensure that their national legislation will apply to any foreign-registered aircraft contemplated under a transfer agreement.

3.2.2.2 States should not enter into an 83bis agreement if the State of the Operator is not capable of adequately performing the duties and functions to be transferred under the agreement.

3.2.2.3 Although the issuance of an AOC is required by Annex 6 for international commercial operations, an AOC will not apply to a transfer agreement addressing the transfer of general aviation aircraft.

### 3.2.3 The Article 83bis agreement

An Article 83bis agreement between the State of Registry and the State of the Operator specifies the duties and functions to be transferred by the State of Registry. Those duties and functions not specified in the agreement are deemed to remain with the State of Registry.

### 3.2.4 Duration of the agreement

The duration of the agreement on the transfer of responsibilities should not exceed the period covered by the corresponding commercial arrangement (for example, a lease). Accordingly, the period of validity of the transfer of duties and functions by the State of Registry should be mentioned in the agreement, taking into consideration that the registration of the aircraft concerned will not be changed.

### 3.2.5 Contents of the agreement

3.2.5.1 The aircraft concerned should be clearly identified in the agreement by including reference to the aircraft type, registration, and serial numbers.

3.2.5.2 Authorities concerned shall give special consideration to the objectives of continuing airworthiness and to the transfer of information as required in Annex 6, Part I, 8.3 to 8.8, as well as in Annex 8, Part II, Chapter 4.

3.2.5.3 Authorities concerned should clearly identify a coordination mechanism on continuing airworthiness issues in the agreement. Periodic meetings may be arranged between States involved to ensure that the continuing airworthiness of the aircraft is maintained in accordance with the Annexes referred to in 3.2.5.2.

*Note.— Additional guidance regarding operational surveillance may be found in the Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335), Chapter 10 — Lease, Charter and Interchange Operations.*

### 3.2.6 Level of agreement signature

3.2.6.1 The level of authority for signing transfer agreements should be equivalent to that required for administrative arrangements between aviation authorities, consistent with the national practice respecting binding agreements.

3.2.6.2 Implementation of Article 83bis may be made through administrative agreements or arrangements between civil aviation authorities, usually signed at the level of Director General, so long as such administrative agreements or arrangements are binding under the legal practice of both countries. If such administrative agreements or arrangements are not binding within both countries, consideration should be given to more formal binding agreements (e.g. bilateral agreements).

### 3.2.7 Registration of the agreement with ICAO

3.2.7.1 The transfer of responsibilities per the agreement will not be recognized by other Contracting States until:

- a) the agreement has been registered with the Council and made public pursuant to Article 83 of the Chicago Convention (see Doc 6685 “Rules for Registration with ICAO of Aeronautical Agreements or Arrangements”); or
- b) the existence and the scope of the agreement have been directly communicated to the authorities of the other Contracting States into or over which the transferred aircraft may be flown by a State party to the agreement, usually the State of the Operator.

Direct notification of a transfer agreement may be preferable for the State. However, in certain circumstances, for instance in case of short-term agreements, the States’ obligation to register such agreements with ICAO remains unaffected under Article 83 of the Convention. The registered agreements are published in the quarterly List of Agreements and Arrangements Concerning International Aviation Registered with ICAO, which is issued by ICAO.

3.2.7.2 Upon registration or notification, the State of Registry shall be relieved of responsibility in respect of the functions and duties duly transferred to the State of the Operator, and the latter shall comply with them in accordance with its own laws and regulations.

### 3.2.8 Contracting State responsibilities

3.2.8.1 With reference to Article 33 of the Convention, States which have ratified Article 83*bis* should ensure that their national legislation recognizes the validity of Certificates of Airworthiness issued or validated by the State of the Operator in accordance with Article 83*bis*.

3.2.8.2 States which have ratified Article 83*bis* should ensure that the information they have received concerning the existence of transfer agreements relating to aircraft operating to/from their territory is promptly relayed to the authorities involved in inspection. Adequate procedures need to be developed and implemented for that purpose.

3.2.8.3 For the purpose of identifying the States responsible for safety oversight on the occasion of any verification process such as ramp inspections, a certified true copy of the transfer agreement should be carried on board the aircraft at all times while the transfer agreement is in force. It is also recommended that a certified true copy of the AOC under which the aircraft is operated, and in which it should be listed, be carried on board.

3.2.8.4 In case the aircraft is to enter the airspace of Contracting States which are not parties to Article 83*bis*, or which are parties but have not been duly advised about a transfer agreement in accordance with this provision, the certificates and licenses on board the aircraft should be issued or rendered valid by the State of Registry as the latter would, in this case, remain fully responsible in regard of Articles 30, 31 and 32 (a) of the Convention despite the transfer agreement with the State of the Operator.

### 3.3 Acceptance of the type design

As stated in 2.4.3 above, under Article 83*bis* the State of Registry can transfer to the State of the Operator its responsibility for ensuring that the aircraft and any modification/repair to it, complies with an approved design. The bilateral agreements mentioned in 2.4.4 of this Part may include any transfer of partial or complete responsibilities between the State of Registry and that of the Operator as outlined in Chapter 3 of this Part.

### 3.4 Maintenance

3.4.1 The transfer and acceptance of the transfer by the State of the Operator of specific responsibilities of the State of Registry are subject to national regulations, procedures and policies. These individual responsibilities may include:

- a) approval of maintenance programme;
- b) acceptance of the maintenance control manual;
- c) maintenance record keeping;
- d) procedures for the continued validity of a Certificate of Airworthiness; or
- e) performance and certification of maintenance including maintenance release procedures.

3.4.2 Allocation of specific responsibilities arranged between the State of Registry and the State of Operator shall be defined and published in an appendix to the transfer agreement.



### **3.5 Extended diversion time operations**

In cases where an aircraft to be transferred under an *83bis* agreement has previously been operated, or will be operated under extended diversion time operations approval, the State of the Operator receiving the aircraft shall consider the guidance material of Chapter 2.6 of this Part.

### **3.6 Information on faults, malfunctions, defects and other occurrences**

In accordance with Chapter 2.7 of this Part and depending on national regulations, procedures and policies, State of Registry and State of Operator shall allocate individual responsibilities of each party and publish them in an appendix to the transfer agreement.

### **3.7 Mandatory continuing airworthiness information (MCAI)**

3.7.1 Where an aircraft is transferred from the State of Registry to the State of the Operator, irrespective of the fact that either State could be the State of Design, unnecessary cost may arise if the State of Registry and the State of the Operator impose different mandatory continuing airworthiness information on the same aircraft. It is therefore recommended that:

- a) before entering into a transfer agreement, the authorities of the State of Registry and of the State of the Operator, in consultation with the registered owner and the operator of transferred aircraft, determine which of the States' mandatory continuing airworthiness information will apply to the transferred aircraft; and
- b) the States involved in aircraft transfer develop administrative procedures to this effect.

### **3.8 Distribution of mandatory continuing airworthiness information**

If the State of Registry has an agreement with the State of the Operator to provide surveillance and assistance, or if the State of the Operator wishes to be kept informed regarding transferred aircraft operated by its operators, then the State of Registry should also transmit the mandatory continuing airworthiness information documents to the State of the Operator.

### **3.9 Continuing validity of the certificate of airworthiness**

Arrangements and procedures regarding the continuing validity of the Certificate of Airworthiness should be acceptable to both the State of Registry and the State of the Operator. These arrangements and procedures should be the subject of the transfer agreement.

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