

AIRWORTHINESS NOTICE

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CONTINUING STRUCTURAL INTEGRITY OF TRANSPORT AEROPLANES

1. Summary The Civil Aviation Authority (CAA) has in the past declared 'lives' for some nominally 'fail safe' aeroplane types pending further evidence. This Notice offers structural review and inspection as an alternative to such 'lifing' provided that the constructor provides a document describing the inspections necessary to ensure that damage and incipient failure can be found before unacceptable structural weakening occurs.
- 2 Introduction
 - 2.1 Transport Aeroplanes are certificated, in respect of their structural integrity throughout their operational life, in accordance with either of the following principles (or a mixture of both):--
 - (a) Aeroplanes or structural members of aeroplanes accepted on a 'Safe Life' principle.
 - (b) Aeroplanes or structural members of airplanes accepted on a 'fail safe or damage tolerant' principle.
 - 2.2 This Notice is not intended to alter the procedures for aeroplanes or structural members of aeroplanes accepted on the 'safe life' principle. For items dealt with under this procedure the 'safe lives' which have been published are still mandatory. That such lives may have to be altered to reflect changing utilisation of aeroplanes and other service experience is also believed to be well understood and practised.
 - 2.3 The purpose of this Notice is to introduce a procedure whereby aeroplanes or structural members of aeroplanes originally certificated to UK or US Fail Safe or Damage Tolerant requirements (BCAR Section D and FAR Part 25) still current in July, 1978, may continue to be certificated in the UK without at some stage having restrictions applied to their operational life.
- 3 The Present UK Certification Position
 - 3.1 UK Certification of early examples of 'fail safe' aeroplanes was given on the assumption that, within the expected operational life time of the aeroplane, any fatigue damage to, or failure of, single structural members would be so gross as

to be readily found during routine maintenance before it caused unacceptable weakening of the structure.

3.2 However, service experience has shown that in some cases special inspections are necessary and that, for aeroplanes kept in service up to (and perhaps in future to well beyond) the maximum operational life expected at the time of original certification, it is necessary to consider more than the damage to, or failure of, a single member in an otherwise sound structure; the possibility of additional weakening (as a result of such causes as accidental damage or imperfect workmanship, corrosion or fatigue of alternative load paths which would not be critical on their own but may be in the event of a single member failing), cannot be ignored.

3.3 To cater for this the CAA has declared 'lives' beyond which it is not prepared to certificate aeroplanes without further evidence. These lives are based either on the fatigue data made available at the time to the CAA or on a proportion of the actual life of the lead life aeroplane, which experience suggests as being safe. Lives have been declared only for those aeroplanes types considered by the CAA as likely otherwise to exceed them.

4. The Future UK Certification Position The continually increasing actual lives of the successful transport aeroplane types has led the CAA to the position that it would have either to 'life' all the present types or be satisfied that their safety could be maintained by some other means. This matter has been considered by the Technical Committee of the Airworthiness Requirements Board (augmented for the purpose by engineering representatives of UK organisations) and taking into account valuable presentations and comment from overseas interests, including official bodies, constructors and operators. This Committee has advised that it is not necessary to fix an overall ultimate life for such aeroplanes provided that steps are taken to ensure that they can be maintained as truly fail safe structures in the presence of the effects of age such as fatigue and corrosion. The Committee has further advised that this should be accepted as being the case if the aeroplanes are maintained with regard to replacements and inspections as recommended for this purpose by their constructors, subject to the satisfaction of the CAA. The CAA accepts this advice and in future will not apply, and where it has already applied, will withdraw, specified lives, subject to the necessary work specified in this Notice being carried out by the constructors before present or future aeroplanes exceed the hours or flights at which, without such work, the CAA considers structural integrity may be in doubt.

5. Structural Integrity Audit and Inspection Document

5.1 The Constructor's Role For each aeroplane type to which this Notice is applicable the necessary work is that the constructor should carry out a "structural integrity audit" in which each area of the structure for which fail-safe characteristics are critical is considered, and the acceptable extent, rate of growth,

and detectability of damage is assessed, together with the probability of damage being present in associated areas. Based on this Audit, an Inspection Document should be drawn up and made available to operators.

5.1.1 The Inspection Document should include:-

- (a) A statement of (or reference to) all the inspections (and replacements, repairs or modifications) considered by the constructor to be necessary to ensure that a safe level of structural strength will be maintained.
- (b) For each location, the thresholds (time/flights, to first inspection) frequencies and type and method of inspections required and the extent of damage which it is aimed to be able to find.
- (c) Reference to the types of operations for which it is considered valid.

NOTE: Its validity may, of course, be varied by reissue from time to time.

5.1.2 The Inspection Document would have to be prepared on the basis of a Structural Integrity Audit (or other process providing similar results) generally acceptable to the Authority, but would not require approval in detail. Guidance on the method of carrying out a Structural Integrity Audit and as to what should be included in the Inspection Document is given in CAA Information Leaflet, Continuing Structural Integrity of Transport Aeroplanes.

5.2 The Role of the CAA On publication of an acceptable Inspection Document by the constructor, the CAA would make compliance with the document, or with approved variations therefrom, mandatory and would then remove any previously applied structural life limitation; likewise the CAA would be prepared to review and might alter the status of any previously applied structural service bulletin which is listed in CAA Additional Directives or the CAA Mandatory Modifications and Inspections Summary. The CAA would then permit operation of the aeroplane so far as structural integrity is concerned, so long as the Audit remained valid.

5.3 The Operator's Role Whilst the responsibility for the Audit and the Inspection Document is placed on the constructor, the Audit, and any subsequent reviews cannot be based solely on his own test experience and analysis; knowledge of service experience is a vital ingredient. The operator will therefore have to satisfy the CAA:-

- (a) that the programme to which his aircraft is maintained incorporates the constructor's recommendations or approved alternatives,
- (b) that he has an adequate system for recording and reporting to the constructor—
 - (i) information on structural defects, operational usage and, where available, service load records, and

- (ii) information on the incorporation of all significant structural repairs and modifications (whether approved on behalf of the constructor or the operator).

5.3.1 Acceptance of the introduction of further high life aeroplanes to an operator's fleet, would depend upon the operator ensuring that an acceptable Inspection Document, including any special additions necessary to cover such particular features as major structural repairs or modifications, was available for the aircraft model. He would also have to have past records of the aeroplane sufficient for this purpose and to enable him to determine the time at which the structural inspections would be required.

6. Applicability The above procedures will be accepted by CAA for application to aeroplane types certificated to UK or US fatigue and fail-safe requirements still current in July, 1978. Their applicability to types of aeroplane certificated to later requirements will be considered after further experience.

/s/

for the Civil Aviation Authority.

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