

**GAS TURBINE ENGINE PARTS SUBJECT TO RETIREMENT OR  
ULTIMATE (SCRAP) LIVES**

1. The design of gas turbine engines in service is such that certain critical parts, notably compressor and turbine discs, experience cyclic variations of stress due to mechanical and thermal effect which are of sufficient magnitude to result in fatigue damage. The failure of these parts, which under operating conditions may possess more energy than can be absorbed by the surrounding engine structure, can result in damage to the aircraft. It is therefore necessary to limit the life of all critical parts in order to prevent fatigue damage developing into complete failure. As fatigue damage is not detectable by current inspection techniques until cracking has begun, and because crack propagation to the point of failure can be unacceptably rapid, it is necessary to determine a safe life for each critical part by extensive testing.
2. These safe lives, also referred to as retirement lives, ultimate lives, scrap lives and low cycle fatigue (LCF) lives, are mandatory limits which must never be exceeded. For the benefit of operators and engine overhaul agencies, manufacturer also publishes this information variously in service bulletins, service memoranda, notices to operators, maintenance manuals, etc. The lives published are accepted by the DCA and are mandatory and all amendments thereto must first be approved. It may be possible to extend the published lives as a result of further testing and this is normally indicated in the publications as an aid to spares provisioning.
3. The Inspection and Test Certificate of an engine issued by a manufacturer or overhaul agency must include reference to a certified statement in which is recorded the life consumed by each of the life-limited parts fitted in the engine up to the time of release. It may be preferable to include this statement in the engine log book but this will be governed by the system adopted by the operator.
4. Operators are responsible for ensuring the parts fitted to the engines being operated do not exceed the published lives. Therefore it is necessary to maintain accurate up to date records of the life consumed by each engine and this may involve recording flying hours, number of landings, 'touch and go' landings and take-offs, air re-starts etc., dependent upon each constructor's definition of a unit of life. In order to preserve continuity of the records, an up to date statement of the life consumed since last release must accompany each engine when dispatched by an operator to an overhaul agency for repair, modification and partial or complete overhaul.
5. When a new type of turbine-engined aircraft is first introduced into service the operator is responsible for determining a 'typical flight cycle', described in engine terms, applicable to its operation. This should be done by sufficient monitoring of service flights, and as necessary training flights, to provide an adequate knowledge of actual engine flight profiles. If these appear to be in any way more severe than those assumed by the engine

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constructor, the operator shall inform the engine manufacturer and the DCA amended approved lives will be published if necessary.

6. Additionally, operators shall monitor a sufficient number of flights at successive intervals of approximately six months (this period may be extended in agreement with the DCA as increased experience permits) during the subsequent life of the aircraft to determine that the current assumptions are not being invalidated by intended or unintended changes to operating techniques, changes of service routes or operational roles, etc. If there is any reason to believe that the flight cyclic fatigue usage may be more adverse than currently assumed, the operator shall inform the engine constructor and the DCA with a view to revision of the approved lives.

Note: (a) As differences between winter and summer operation and differences in the installed position of engines in the aircraft may make significant difference to the usage experienced, these factors should be taken into account in the monitoring programmes. Also because auto-throttle and auto-land systems can affect the envelope of engine speeds used, it is important that any changes to the characteristics of such systems are assessed.

- (b) engine manufacturer is required to publish, in the engine manuals, information concerning the engine flight profile assumed for the establishment of safe lives.
7. Where an operator finds the programme described in paragraph 6 impractical, sufficiently pessimistic assumptions will need to be made in determining, for his particular operation, the safe lives of affected parts, in order to provide for any possible variations of operation likely to occur.
8. Operators must comply with any instructions given by the engine manufacturer's manual. The operator must inform the engine manufacturer of any conditions of their operation which may be at variance with his instructions.