

Response to comments on NPA-E-35

1 - Justification of the NPA

JAR-E 640 was a significant difference between JAR-E and FAR 33. Since FAR 33 did not have a specific pressure load requirement the subject became part of the engine harmonisation programme. It was also recognised that Special Conditions had modified the pressure test requirement for recent JAA certifications; these modifications have been reflected in the revised rule.

This NPA also reflects the JAA (and FAA) policy of ensuring that the advisory material does not contain any elements of rulemaking. Consequently, the new rule contains significant parts of the original ACJ. The rule itself is now a clear statement of the safety objective and the advisory material outlines both acceptable means of compliance and provide additional supporting material.

The principal change is the acknowledgement that analysis is an acceptable means of compliance for the static pressure case. Such an approach was already acceptable for the fatigue case. This is justified by the fact that there was no known failure of static pressure tests which indicates that the design and analysis methods for defining the engine components required to address this requirement were not satisfactory. Additionally, US Industry had usually demonstrated compliance by analysis and subsequent service experience had demonstrated a similar level of safety to those parts tested under JAA rules. The criteria for an acceptable analytical method are now contained in the ACJ.

The 'no-burst' requirement of JAR-E 640 (a) (1) (ii) no longer contains a 2X factor on the Normal Working Pressure. During the development of the Special Condition in the late 1970's it was established that the 2X factor on the Normal Working Pressure was an unnecessarily severe test condition and that, provided 1.5X the Maximum Working Pressure could be demonstrated, it would provide an adequate margin to achieve the safety objective of the requirement. Engines certified to this Special Condition have demonstrated safe operation for over twenty years accumulating many millions of service hours.

The test time for the static pressure case has been reduced from 5 minute to 1 minute. It is accepted that once a stabilised condition is achieved, any adverse effect would be demonstrated within the 1 minute period. This also alleviates the practical difficulties in some large component tests of maintaining a stabilised pressure over a long period because of leakage from rig facility parts.

The proposal incorporates a change to the definition of Maximum Working Pressure by limiting this pressure to that which is 'likely to be encountered in service'. This effectively provides an alleviation which is compensated by an increase in the factor to be applied in this case from 1.0 to 1.1. This recognises that the likelihood of

encountering the extreme conditions are sufficiently remote to be discounted for the purpose of this rule.

The definitions of the pressures which need to be considered have been rewritten to aid clarity and also included the 'Notes' contained in the original ACJ.

When the parts are cast, welded or made of composite material, paragraph 2.1 (d) of current ACJ E 640 is now covered by the new requirement of JAR-E 640 (c)(1) addressing minimum material properties and adverse geometry.

Paragraph 2.2 of current ACJ E 640 addressing deflection measurements is now covered under the new requirements of JAR-E 640 (a)(1) on distortion and associated ACJ E 640 in paragraph (2)(a).

Paragraph 2.6 of current ACJ E 640 addressed « oil tank ». More general wording was proposed in paragraph (1)(d) of new ACJ E 640.

The words « pressure loads of any other type which cannot be regarded as being satisfactorily substantiated in the Engine Endurance Test » found in current JAR-E 640 (b) were not retained. The 150 hour test of JAR-E 740 was not designed to test the pressure loads. The new requirements of JAR-E 640 considers any pressure load with the addition of other loads. The deletion of these words makes the requirements more severe.

Paragraph (a) of the current JAR-E 640 rule was deleted because it was recognised as being procedural in nature and adequately covered by normal certification practice. JAR-E is not a procedural code and should not specify the working methods between the applicant and the authority.

2 - Economic impact analysis

The proposal does not change fundamentally the current JAR-E rules as they were interpreted and applied. It clarifies the safety objective, ensures that there is no rulemaking by advisory material and reflects the current certification practice. Therefore, no adverse economic impact is anticipated.

3 - Comments received during the circulation of the NPA

Comments were received from the following organisations :

- Authorities of Canada, Denmark, Germany and United Kingdom
- AECMA, ECOGAS, SBAC and Snecma

4 - Response to comments

Five commenters approved the proposal.

One commenter, although supporting the proposal, requested additional explanation and justification in order to have a full understanding of the rationale behind the proposals and for providing an historic record to justify the changes. This was agreed : the justification part of the NPA was improved.

One commenter suggested to retain the current paragraph JAR-E 640 (a). This was rejected as explained in the justification of the NPA.

One commenter requested justification for deletion of the words « pressure loads of any other type which cannot be regarded as being satisfactorily substantiated in the Engine Endurance Test ». This was added to the justification part of the NPA.

One commenter suggested to retain, in the proposed paragraph JAR-E 640 (b), the words « safe fatigue life » as found in current JAR-E 640 (b). Because the new rule addresses only critical parts, the « safe » aspect would appear in JAR-E 515 (a). However, the comment was accepted for clarity and having a clear pass / fail criteria for JAR-E 640 (b). This same commenter questioned whether any fatigue scatter factors are to be applied as described in paragraph 3.4 of current ACJ E 640. The comment was retained and a new paragraph (3)(c) in ACJ E 640 was proposed.

One commenter noted that the alleviation to the 2.0 times pressure requirements from the current paragraph 2.1 (b) of the ACJ E 640 did not cover all aspects of the Equivalent Safety Finding (ESF) approved on many engine certification programmes. This ESF allowed for waiving the ultimate load test based on extrapolation of the proof test. This was in fact necessary for complying with current rule which only considered « tests ». This proposal allows tests, analysis or combination..

One commenter suggested to reinstate the equivalent of paragraph 2.1 (d) of the current ACJ E 640 (cast and welded parts) and to include composite materials. It is considered that the new JAR-E 640 (c)(1) covers these issues. The justification of the NPA was improved.

One commenter requested a justification for the change in test duration (1 minute instead of 5) and for the removal of the deflection measurements. This is done in the justification of the NPA and this is consistent with current certification practice.

One commenter requested a justification for deletion of reference to oil tanks (which can be found in paragraph 2.6 of current ACJ E 640). Paragraph (1)(d) of proposed ACJ E 640 was changed to address the comment.

One commenter suggested to change the sub-title of the proposed JAR-E 640 (b) from « fatigue pressure loads » to « cyclic pressure loads ». This was not agreed because the intent was to address « fatigue ».

One commenter found that the proposed JAR-E 640 (a)(1)(iii) and (2)(iii) were not consistent (« normal working pressure » or « maximum possible pressure ») and proposed to change (a)(2)(iii) into « maximum working pressure ». This was not agreed because in the first case (JAR-E 640 (a)(1)) the rule is addressing the normal operation, when in the

second case (JAR-E 640 (a)(2)) the rule is addressing a failure situation and therefore should consider the maximum possible pressure. In addition, this was the result of a long harmonisation effort with FAR 33.