

Response to comments on NPA-E-19

1 - Justification of the NPA

Statement of Problem

The current rating structure does not permit use of the engine's full potential for power output in the One Engine Inoperative (OEI) regime.

This NPA introduces new ratings which will enhance rotorcraft safety after an engine failure or precautionary shutdown by making available higher OEI power.

The maximum engine power rating for rotorcraft available under current certification standards contained in JAR-E is the 2 1/2-Minute OEI rating. This NPA establishes type certification standards for the 30-Second OEI and 2-Minute OEI ratings at higher power levels than currently available.

Harmonisation Activity and Status

Harmonisation activities with respect to this subject formally commenced in April 1987, although work had been in progress since 1984.

This NPA has been prepared under the FAA/JAA Harmonisation Work Programme after issuance of the final rule published as FAR 33 Amendment 18.

It has also considered the NPA 29E-8 and NPA 27E-4 which modified JAR-29 and JAR-27, respectively, on the same subject.

This NPA-E-19 contains the JAR-E version of the proposed harmonised rules. Its contents are technically harmonised with the equivalent proposed amendments to FAR Part 33 and relevant Advisory Material.

Regulatory Strategy

The new ratings are intended to make available high OEI power for limited periods during one flight. The 30-Second OEI rating will be automatically invoked and controlled with no necessity for pilot intervention. Warnings will be provided to show that a rating is selected, and end of the permitted period will be announced.

Additional testing and analysis is necessary to demonstrate the engine's capability. The principal elements will be a supplementary cyclic test after completion of the normal 150-hour endurance test and an over-temperature test.

Mandatory maintenance actions necessary after use of the ratings must be described and substantiated.

A method of power assurance must be substantiated to ensure availability of the ratings throughout the life of the engine. This will be complemented by a programme of ex-service sample engine testing.

Description of Proposed New Requirements

This NPA modifies paragraph JAR-E 40 by introducing 30-Second and 2-Minutes OEI Power ratings for multi-engine rotorcraft and, to ensure continued airworthiness, incorporates, in JAR-E 25, requirements for mandatory post-flight inspections and maintenance actions after their use. A power assurance plan, including test of in-service engines, will be necessary. It will be similar in principle to a life management plan for life limited parts.

This NPA modifies paragraph JAR-E 50 by introducing the need for automatic availability and automatic control within the operating limits of the 30-Second OEI ratings, since pilot workload will be very high. The pilot will be able to concentrate upon flying the aircraft without having to concern himself with power scheduling. It is consistent with JAR 29.1143 (f).

This NPA modifies JAR-E 60 by requiring a means or provision for a means to alert the pilot at the start and completion of the 30-Second / 2-Minute OEI time periods and to record each usage in order to permit adequate maintenance following use of these ratings. This is the engine counter-part of similar requirements in JAR 27/29.1305.

This NPA modifies paragraph JAR-E 150 by introducing the conditions which will be applicable to the additional 4 cycle (2 hour) endurance test and by providing pass / fail criteria for the condition of the engine following the additional 4 cycle (2 hour) endurance test. They are intended to ensure that the structural integrity of the engine is not compromised.

This NPA modifies JAR-E 740 to introduce a 4 cycle (2 hour) additional test which substantiates the use of 30-Second and 2-Minute OEI Power ratings and associated operating limits. It also specifies the basic 150-hour endurance test to be considered for certification of engines with the 30-Second and 2-Minute OEI Power ratings whether these ratings are associated with a 30-Minute OEI or a Continuous OEI rating. This combination «150-hour + 2-hour» is imposed by the rules to ensure the necessary severity of the testing at high temperature for these high power ratings.

This NPA does not modify JAR E 820. Consideration of the new OEI ratings in JAR E 820 was made by NPA-E-34. Each application for engines with these 30-Second/2 Minute -OEI ratings should be considered on a case by case basis until formal publication of NPA-E-34.

This NPA modifies JAR-E 830 to exclude turbine temperature conditions associated uniquely with 30-Second / 2-Minute OEI Power ratings when establishing the 20 second transient operating limits associated with other ratings. The concept of separately identified transient operating limits is not applicable for 30-Second / 2-Minute OEI Power ratings.

This NPA does not modify JAR-E 840. Consideration of the new OEI ratings in JAR-E 840 was made by NPA-E-13. Each application for engines with these 30-Second / 2-Minute OEI ratings should be considered on a case by case basis until formal publication of NPA-E-13. (FAA made a similar statement with respect to FAR 33.27 in the preamble to Amendment 18 of FAR 33)

This NPA adds a new paragraph JAR-E 920 which requires an over-temperature test for demonstrating margins in the turbine above the temperature operating limit associated with the 30-Second OEI Power rating.

JAR-E, as modified by this NPA-E-19, is considered as being equivalent to the FAR 33 and associated advisory material as they were proposed to be revised after this harmonisation effort.

The definitions of the new 30-Second / 2-Minute OEI ratings for rotorcraft engines will be incorporated into JAR-1 per NPA-1-3.

2 - Economic impact analysis

The objective of the new 30-Second and 2-Minute OEI ratings is to enhance safety in the event of an engine failure by providing enhanced power capability to the pilot.

This NPA defines the requirements to be complied with by the engine for ensuring an appropriate safety level consistent with the JAR-E requirements.

The cost of required tests and analysis for obtaining approval of these new ratings should be viewed as the price of an additional capability and would be evaluated by the manufacturers based on market potential for these optional ratings.

This NPA is harmonising JAR-E and FAR-33 requirements related to the 30-Second and 2-Minute OEI ratings, reducing the effort for validation of engines and the associated cost.

Therefore it is assumed that there will be no adverse economic impact.

3 - Comments received during the circulation of the NPA

Comments were received from the following organisations :

- Authorities of Austria, Canada, Denmark, France, Germany, United Kingdom and USA ;
- AECMA, ECOGAS, Eurocopter, IFALPA, SBAC and Turboméca.

4 - Response to comments

Five commenters approved without comment.

Many editorial comments were made : when they were agreed and they did not change the interpretation of the texts, they were not individually addressed in this response document.

One commenter thought that the proposals were not harmonised with Amendment 18 of FAR 33 and recommended to temporarily withdraw the proposal of JAR-E 25 (b)(2) until full harmonisation with FAR 33. This statement was not understood as this NPA is the result of the harmonisation effort : the equivalent changes to FAR 33 will be subject to a future NPRM.

One commenter suggested that engines should be yielding enough power at a 2-minute OEI rating to make a single engine fly-away or landing possible, thus making a 30-Second OEI limit unnecessary. These ratings were requested by aircraft manufacturers for performance enhancement in restricted areas beyond what is achieved with the 2 ½ minute OEI rating. This same commenter stated that the additional 30-Second limit puts extra workload on the pilot as he will have to watch two limits instead of one. The 30-Second OEI rating has mandatory engine automatic limiting intentionally provided to reduce pilot workload during transition to OEI operation.

One commenter questioned who would provide under JAR-E 60 (h)(2) the logging system. This requirement is common to JAR 27/29 requirements and its purpose is not to interfere with commercial agreement between engine and aircraft manufacturers.

Some commenters noted errors in the duration of the test of JAR-E 740 (c)(3) : in particular the schedule of (c)(3)(i) gave only 137.5 hours instead of the required 150 hours. This was corrected.

One commenter proposed to add the following words to paragraph (4) of ACJ E 20 (f) : « Especially a MGT active stop should not prevent the engine from reaching the 30-second or 2-Minute OEI power with a cold soaked engine (« power hole » phenomenon). A reference to cold soaked engine was added in the ACJ.

One commenter suggested that the first sentence of paragraph (4)(d)(i) of ACJ E 25 was a « rule » to be transferred into JAR-E 25. This was essentially a repeat of the proposed rule in JAR-E 25 (b)(2) as a means to provide introduction to the advisory material and not a new rule.

One commenter requested a definition of the wording « representative aged engines » (found in paragraph (4)(d)(ii) of ACJ E 25). This was recognised as an appropriate request but this definition is too closely related to the specific design of the considered engine to be able to provide advisory material on a general basis. It is the duty of the manufacturer to provide data.

One commenter noted that the depth of detail in ACJ E 40 was surprising as it is mostly related to aircraft requirements. It noted some errors or contradiction. The text was improved.

One commenter thought that paragraph (1) of ACJ 40 (b)(3) was confusing and irrelevant. The text was simplified but retained as an useful reminder of a basic principle.

One commenter noted in paragraph (1) of ACJ E 50 (f) that the last sentence of « *The required automatic control of the 30-Second OEI power is intended to avoid the need for monitoring engine parameters such as output shaft torque or power, output shaft speed, gas generator speed, and gas path temperatures. Such means for automatic control within the operating limitations should be effective during normal and abnormal operations. Means other than an automatic limiter may be proposed to satisfy this paragraph.* » was conflicting with the rule which imposed an automatic control. Another commenter proposed to add « provided that it can be shown that the limits will not be exceeded » to this same sentence. It was agreed to delete the sentence because of conflict with the rule.

One commenter suggested to delete the last sentence of § (1) in ACJ E 50 (f). This was agreed because it is not really relevant to the subject.

One commenter requested deletion of the first sentence in § (3) of ACJ E 60 (h) because hazardous engine effects are defined in JAR-E 510 and not in AMJ 25.1309 and because it was not consistent with the second sentence of the same paragraph. There are two objectives : one for the overall system (first sentence) and one for the sub-components (second sentence). The sentence was modified to clarify.

One commenter questioned the reference to JAR-E 50 (c) at end of § (3) in ACJ E 60 (h) because it was a reference only valid in relation to another, future, NPA. This was agreed and the sentence was deleted.

One commenter suggested to remove the words « power turbine » in ACJ E 140 because it would be unusual to have accessories driven by the power turbine. This was rejected for this very reason : accessories driven by the gas generator are more usual and do not require specific interpretative material.

One commenter proposed, in paragraph (2) of ACJ E 150 (f) to replace « no failure of any significant engine component becomes evident » by « no failure of any significant engine component occurs during test or during shutdown, or becomes evident during the subsequent tear-down inspection ». This was agreed.

One commenter questioned the adequacy of paragraph (4) of ACJ E 150 (f) when talking of components which are distressed beyond serviceable limits and proposed improved wording. This was agreed.

One commenter suggested to move to ACJ E 40 (b)(3) the second sub-paragraph of § (3) in ACJ E 730 because it is associated with establishing the rating. This was agreed.

One commenter requested better guidance on the acceptance criteria for demonstrating turbine integrity in ACJ E 920. This comment was not understood because the second sub-paragraph of the ACJ proposed the criteria.

One commenter stated that the checking of installed power availability could result in repercussions on aircraft component life usage. This was noted. However, power assurance

methodology is the responsibility of the aircraft manufacturer with the assistance of the engine manufacturer. The aircraft design should be capable of accommodating this aircraft requirement (JAR 27/29.45 (f)). Existing designs already show compliance in this respect.

One commenter was confused about validating the engine performance model. There was nothing unique in this respect with the 30-Second or 2-Minute OEI ratings.