Federal Aviation Administration
Aviation Rulemaking Advisory Committee

Transport Airplane and Engine Issue Area
Engine Harmonization Working Group

Task 11 – Safety and Failure Analysis

Task Assignment

[Federal Register: October 20, 1998 (Volume 63, Number 202)]
[Notices]
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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Aviation Rulemaking Advisory Committee; Transport Airplane and Engine Issues--New Tasks

AGENCY: Federal Aviation Administration (**FAA**), DOT.

ACTION: Notice of new task assignments for the Aviation Rulemaking Advisory Committee (ARAC).

SUMMARY: Notice is given of new tasks assigned to and accepted by the Aviation Rulemaking Advisory Committee (ARAC). This notice informs the public of the activities of ARAC.

FOR FURTHER INFORMATION CONTACT:
Stewart R. Miller, Transport Standards Staff (ANM-110), Federal Aviation Administration, 1601 Lind Avenue, SW., Renton, WA 98055-4056; phone (425) 227-1255; fax (425) 227-1320.

SUPPLEMENTARY INFORMATION:

Background

The **FAA** has established an Aviation Rulemaking Advisory Committee to provide advice and recommendations to the **FAA** Administrator, through the Associate Administrator for Regulation and Certification, on the full range of the **FAA**'s rulemaking activities with respect to aviation-related issues. This includes obtaining advice and recommendations on the **FAA**'s commitment to harmonize its Federal Aviation Regulations (FAR) and practices with its trading partners in Europe and Canada.

One area ARAC deals with is Transport Airplane and Engine Issues. These issues involve the airworthiness standards for transport category airplanes and engines in 14 CFR parts 25, 33, and 35 and parallel provisions in 14 CFR parts 121 and 135.

The Tasks

This notice is to inform the public that the **FAA** has asked ARAC to provide advice and recommendation on the following harmonization tasks:

Task 11: Safety and Failure Analysis

1. JAR-E requires a summary listing of all failures which result in major or hazardous effects and an estimate of the probability of

occurrence of these major and hazardous effects. Part 33 requires an assessment of failures which lead to four specified hazards.

2. JAR requires a list of assumptions and the substantiation of those assumptions. Most of the JAR-E assumptions are covered by other Part 33 paragraphs.

3. JAR-E includes a unique hazard, ``toxic bleed air''.

4. While both regulations require analysis to examine malfunctions and single and multiple failures. Part 33 also requires an examination of improper operation.

The **FAA** expects ARAC to submit its recommendation(s) resulting from this task by January 31, 2000.

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Task 12: Endurance Test Requirements Study

Review and evaluate the feasibility and adequacy of harmonizing: (1) FAR 33.87 and JAR-E 740 endurance test requirements, including thrust reverser operation during endurance testing, in consideration of changes in engine technology; and (2) FAR 33.88 and JAR-E 700 overtemperature/excess operating conditions. The Aviation Rulemaking Advisory Committee (ARAC) is specifically tasked to study these issues and document findings in the form of a report.

The **FAA** expects ARAC to submit the report by December 31, 1999.

The report must include industry-provided data for an **FAA** economic analysis. This data should include the effects on small operators and small businesses. The report also should include industry-provided data regarding the record-keeping burden on the public.

Task 13: Fatigue Pressure Test/Analysis

JAR-E 640(b)(2) requires fatigue pressure testing of major engine casings. The FAR's do not have a specific requirement for fatigue pressure tests of major engine casings.

The **FAA** expects ARAC to submit its recommendation(s) resulting from this task by January 31, 1999.

Task 14: Overtorque

JAR-E 820 requires testing at maximum over-torque in combination with maximum turbine-entry and the most critical oil-inlet temperatures for the power turbine to validate transient overtorque values. The **FAA** does not have a specific requirement. Note: The 33.87 endurance test includes requirements that can be used to satisfy JAR-E requirements.

The **FAA** expects ARAC to submit its recommendation(s) resulting from this task by January 31, 1999.

Task 15: Compressor/Fan and Turbine Shafts

1. JAR-E 850 establishes probability limits for shaft failures based on the consequences of the failure. If the consequences of a shaft failure are not readily predictable, a test is required to determine the consequences. FAR 33.27(c)(2)(vi) requires all shaft failures, regardless of failure probability, to be considered when determining rotor integrity requirements.

2. ACJ E 850 provides guidance to determine the likelihood of a failure at a given location on a shaft and also provides guidance for

conducting tests to determine the dynamic characteristics and fatigue capability of the shaft. The FAR's do not provide any guidance material.

The **FAA** expects ARAC to submit its recommendation(s) resulting from this task by January 31, 2000.

Task 16: Electrical and Electronic Engine Control Systems

1. Advisory material exists for JAR-E (AMJ 20X-1). Advisory material does not exist for Part 33, which has caused difficulty during certification programs.

2. AMJ 20X-1 clearly defines the engine/airframe substantiation responsibilities, while FAR material does not define these requirements.

3. JAR-E states that an electronic control system ``should provide for the aircraft at least the equivalent safety, and the related reliability level, as achieved by Engines/Propellers equipped with hydromechanical control and protection systems.'' Part 33 does not state a desired reliability level. Part 33 states that failures must not result in unsafe conditions.

The **FAA** expects ARAC to submit its recommendation(s) resulting from this task by January 31, 2000.

For the above tasks the working group is to review airworthiness, safety, cost, and other relevant factors related to the specified difference, and reach consensus on harmonization of current Part 33/ JAR-E regulations and guidance material.

The **FAA** requests that ARAC draft appropriate regulatory documents with supporting economic and other required analyses, and any other related guidance material or collateral documents to support its recommendations. If the resulting recommendation(s) are one or more notices of proposed rulemaking (NPRM) published by the **FAA**, the **FAA** may ask ARAC to recommend disposition of any substantive comments the **FAA** receives.

Working Group Activity

The Engine Harmonization Working Group is expected to comply with the procedures adopted by ARAC. As part of the procedures, the working group is expected to:

1. Recommend a work plan for completion of the tasks, including the rationale supporting such a plan, for consideration at the meeting of ARAC to consider transport airplane and engine issues held following publication of this notice.

2. Give a detailed conceptual presentation of the proposed recommendations, prior to proceeding with the work stated in item 3 below.

3. Draft appropriate regulatory documents with supporting economic and other required analyses, and/or any other related guidance material or collateral documents the working group determines to be appropriate; or, if new or revised requirements or compliance methods are not recommended, a draft report stating the rationale for not making such recommendations. If the resulting recommendation is one or more notices of proposed rulemaking (NPRM) published by the **FAA**, the **FAA** may ask ARAC to recommend disposition of any substantive comments the **FAA** receives.

4. Provide a status report at each meeting of ARAC held to consider transport airplane and engine issues.

The Secretary of Transportation has determined that the formation and use of ARAC are necessary and in the public interest in connection with the performance of duties imposed on the **FAA** by law.

Meetings of ARAC will be open to the public. Meetings of the Engine Harmonization Working Group will not be open to the public, except to the extent that individuals with an interest and expertise are selected to participate. No public announcement of working group meetings will be made.

Issued in Washington, DC, on October 13, 1998.

Joseph A. Hawkins,

Executive Director, Aviation Rulemaking Advisory Committee.

[FR Doc. 98-28038 Filed 10-19-98; 8:45 am]

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Recommendation Letter

400 Main Street
East Hartford, Connecticut 06108

Pratt & Whitney
A United Technologies Company

April 4, 2000

Federal Aviation Administration
800 Independence Avenue, SW
Washington, D.C. 20591

#11

Attention: Mr. Anthony Fazio, ARM-1

Subject: Request for Formal Economic and Legal Review - ARAC Taskings

Dear Tony,

The Transport Airplane and Engine Issues group is pleased to submit the following documents to the FAA for formal economic and legal review.

- FAR 33.75 Engine Safety Analysis - NPRM and Advisory Circular
- FAR 33, One Engine Inoperative - NPRM and Advisory Circular

These documents have been prepared by the Engine Harmonization Working Group of TAEIG.

Sincerely yours,

Craig R. Bolt

Craig R. Bolt
Assistant Chair, TAEIG

Attachments

Copy: *Marc Bouthillier, FAA-NER
Judith Watson, FAA-NER
*Kris Carpenter, FAA-NWR
*Effie Upshaw, FAA Washington, DC
*Jerry McRoberts, Rolls Royce Allison

*letter only

CRB01_040400

Recommendation

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 33

[Docket No. XXXXX; Notice No. XXXXXX]

RIN 2120-XXXX

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This notice proposes to amend the safety analysis type certification regulation for aircraft turbine engines. This proposal harmonizes the FAA's type certification standards on this issue with requirements of the Joint Aviation Authorities (JAA). The proposed changes, if adopted, would establish a uniform safety analysis regulation for aircraft turbine engines certified in the United States under Title 14 of the Code of Federal Regulations (14 CFR) part 33 and in the JAA countries under Joint Aviation Requirements-Engines (JAR-E), simplifying airworthiness approvals for import and export.

FOR FURTHER INFORMATION CONTACT: Ann Azevedo, Engine and Propeller Standards Staff, ANE-110, Engine and Propeller Directorate, Aircraft Certification Service, FAA, New England Region, 12 New England Executive Park, Burlington, Massachusetts 01803-5299; telephone (781) 238-7117;

fax (781) 238-7199.

SUPPLEMENTARY INFORMATION:

Background

Aviation Rulemaking Advisory Committee (ARAC) Project

The FAA is committed to undertaking and supporting the harmonization of part 33 with JAR-E. In August 1989, as a result of that commitment, the FAA Engine and Propeller Directorate participated in a meeting with the Joint Aviation Authorities (JAA), AIA, and AECMA. The purpose of the meeting was to establish a philosophy, guidelines, and a working relationship regarding the resolution of issues identified as needing to be harmonized, including some where new standards are needed. All parties agreed to work in a partnership to jointly address the harmonization effort task. This partnership was later expanded to include the airworthiness authority of Canada, Transport Canada.

This partnership identified the safety and failure analysis regulations as a Significant Regulatory Difference in need of harmonization.

This proposal has been selected as an ARAC project. The issues were assigned to the Engine Harmonization Working Group (EHWG) of the Transport Airplane and Engine Issues Group (TAEIG) on **YYYY YY, 199Y (---------).** On **XXXX XX, 199X,** the TAEIG recommended to the FAA that it proceed with the rulemaking and associated advisory material. This NPRM and associated advisory material reflect the ARAC recommendations.

The intent of the Safety Analysis regulation

The ultimate objective of the safety analysis regulation is to ensure that the collective risk from all engine failure conditions is acceptably low. The basis is the

concept that an acceptable total engine design risk is achievable by managing the individual risks to acceptable levels. This concept emphasizes reducing the risk of a event proportionally with the severity of the hazard it represents.

Explanation of differences between the regulations

JAR-E 510 is titled "Failure analysis"; §33.75 is titled "Safety analysis." JAR-E 510 currently requires a summary listing of all failures which result in major or hazardous effects, along with an estimate of the probability of occurrence of these major and hazardous effects. Section 33.75 currently requires an assessment that any probable malfunction, failure, or improper operation will not lead to four specific hazards.

JAR-E 510 requires a list of assumptions contained within the failure analysis and the substantiation of those assumptions. Most of the JAR-E 510 assumptions are covered by other part 33 paragraphs.

JAR-E 510 references the specific hazard of toxic bleed air. This hazard is not mentioned in §33.75.

Both regulations require analysis to examine malfunctions and single and multiple failures; however, §33.75 also requires an examination of improper operation.

Outcome of harmonization effort

The harmonized regulation uses the framework of the current JAR-E 510, while including specific hazards as in the current §33.75.

Discussion of Proposed Changes

Under §33.5, a new paragraph (c) is added to reflect the new requirement for the safety analysis assumptions to be included in the engine's installation and operation manual.

Section 33.74 is revised to reflect the new ordering system of the revised §33.75, including the addition of new specific conditions to be evaluated.

Section 33.75 is entirely rewritten under the format of the current JAA equivalent rule to reflect the harmonization activity as described above.

Section 33.76 is revised to reference the specific engine conditions listed as hazardous effects within §33.75. (Note: §33.76 has not been issued at this time.)

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend part 33 of Chapter I, Title 14 of the Code of Federal Regulations as follows:

PART 33 — AIRWORTHINESS STANDARDS: AIRCRAFT ENGINES

1. In §33.5, add paragraph (c) to read as follows:

§33.5 Instruction manual for installing and operating the engine.

* * * * *

(c) Safety analysis assumptions. The assumptions of the safety analysis as described in §33.75(d) with respect to the reliability of safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures that are outside the control of the engine manufacturer.

* * * * *

2. Revise §33.74 to read as follows:

§33.74 Continued rotation.

If any of the engine main rotating systems will continue to rotate after the engine is shutdown for any reason while in flight, and if means to prevent that continued rotation are not provided; then any continued rotation during the maximum period of flight, and in the flight conditions expected to occur with that engine inoperative, must not result in any condition described in §33.75(g)(2)(i) through (vi).

3. Revise §33.75 to read as follows:

§33.75 Safety analysis.

(a) (1) An analysis of the engine, including the control system, shall be carried out in order to assess the likely consequence of all failures that can reasonably be expected to occur. This analysis will take account of –

(i) Aircraft-level devices and procedures assumed to be associated with a typical installation. Such assumptions will be stated in the analysis.

(ii) Consequential secondary failures and latent failures.

(iii) Multiple failures referred to in paragraph (d) of this section or that result in the hazardous engine effects defined in paragraph (g)(2) of this section.

(2) A summary shall be made of those failures that could result in major engine effects or hazardous engine effects as defined in paragraph (g) of this section, together with an estimate of the probability of occurrence of those effects.

(3) It shall be shown that hazardous engine effects are not predicted to occur at a rate in excess of that defined as extremely remote (probability range of 10^{-7} to 10^{-9} per engine flight hour). The estimated probability for individual failures may be insufficiently precise to enable the total rate for hazardous engine effects to be assessed. For engine certification, it is acceptable to consider that the intent of this paragraph is achieved if the probability of a hazardous engine effect arising from an individual failure can be predicted to be not greater than 10^{-8} per engine flight hour. It will also be accepted that, in dealing with probabilities of this low order of magnitude, absolute proof is not possible and reliance must be placed on engineering judgment and previous experience combined with sound design and test philosophies.

(4) It shall be shown that major engine effects are not predicted to occur at a rate in excess of that defined as remote (probability range of 10^{-5} to 10^{-7} per engine flight hour).

(b) If significant doubt exists as to the effects of failures and likely combination of failures, any assumption may be required to be verified by test.

(c) It is recognized that the probability of primary failures of certain single elements (for example, disks) cannot be sensibly estimated in numerical terms. If the failure of such elements is likely to result in hazardous engine effects, reliance must be placed on meeting prescribed integrity requirements. These instances shall be stated in the safety analysis.

(d) If reliance is placed on a safety system, such as safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures, to

prevent a failure progressing to hazardous engine effects, the possibility of a safety system failure in combination with a basic engine failure shall be covered. If items of a safety system are outside the control of the engine manufacturer, the assumptions of the safety analysis with respect to the reliability of these parts shall be clearly stated in the analysis and identified in the installation instructions under §33.5.

(e) If the acceptability of the safety analysis is dependent on one or more of the following items, they shall be identified in the analysis and appropriately substantiated.

(1) Maintenance actions being carried out at stated intervals. This includes the verification of the serviceability of items which could fail in a latent manner. These maintenance intervals must be published in the appropriate manuals. Additionally, if errors in maintenance of the engine, including the control system, could lead to hazardous engine effects, the appropriate procedures shall be included in the relevant engine manuals.

(2) Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The details of this satisfactory functioning must be published in the appropriate manual.

(3) The provisions of specific instrumentation not otherwise required.

(f) If applicable, the safety analysis shall also include, but is not limited to, investigation of:

(1) indicating equipment;

(2) manual and automatic controls;

(3) compressor bleed systems;

(4) refrigerant injection systems;

(5) gas temperature control systems;

(6) engine speed, power, or thrust governors and fuel control systems;

(7) engine overspeed, overtemp, or topping limiters;

(8) propeller control systems; and

(9) engine or propeller thrust reversal systems.

(g) Unless otherwise approved by the Administrator and stated in the safety analysis, for compliance with part 33, the following failure definitions apply to the engine:

(1) An engine failure in which the only consequence is partial or complete loss of thrust or power (and associated engine services) from the engine shall be regarded as a minor engine effect.

(2) The following effects shall be regarded as hazardous engine effects:

(i) Non-containment of high-energy debris,

(ii) Concentration of toxic products in the engine bleed air for the cabin sufficient to incapacitate crew or passengers,

(iii) Significant thrust in the opposite direction to that commanded by the pilot,

(iv) Uncontrolled fire,

(v) Failure of the engine mount system leading to inadvertent engine separation,

(vi) Release of the propeller by the engine, if applicable,

(vii) Complete inability to shut the engine down.

(3) An effect falling between those covered in (g)(1) and (2) shall be regarded as a major engine effect.

4. Section 33.76 is amended to revise paragraph (b)(3) to read as follows:

§33.76 Bird ingestion.

* * * * *

(b) * * *

(3) Ingestion of a single large bird tested under the conditions prescribed in this section must not result in any condition described in §33.75(g)(2).

* * * * *

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: GUIDANCE MATERIAL FOR 14 CFR 33.75, SAFETY ANALYSIS.

Date: 12/13/99
Initiated By: Ann Azevedo, ANE-110

AC No: DRAFT 33.75-1
Change:

1. **PURPOSE**. This advisory circular (AC) describes acceptable methods, but not the only methods, for demonstrating compliance with the requirements of Title 14 of the Code of Federal Regulations (14 CFR) §33. Like all AC material, this AC is not, in itself, mandatory and does not constitute a regulation. While these guidelines are not mandatory, they are derived from extensive Federal Aviation Administration (FAA) and industry experience in determining compliance with the pertinent regulations. This AC will be incorporated into AC 33-2, Aircraft Type Certification Handbook, at a later date.

2. **RELATED READING MATERIAL**.

a. AC 25.1309-1A, System Design Analysis, 6/21/88.

b. Draft Significant Airworthiness Information Bulletin (SAIB) to be issued by ANE on multi-engine maintenance.

c. Joint Airworthiness Authority (JAA) AMJ 25.1309, System Design and Analysis, xx/xx/xx.

d. Society of Automotive Engineers (SAE), Document No. ARP 4754, Certification Considerations for Highly-Integrated or Complex Aircraft Systems, issued November 1996.

e. SAE Document No. ARP 926A, Fault/Failure Analysis Procedure.

f. SAE Document No. ARP 4761, Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment, issued December 1996.

g. Carter, A.D.S., Mechanical Reliability (2nd ed.). Macmillan, 1986.

h. Systematic Safety Assessment (CAA Leaflet AD/IL/0092/1-7).

3. **APPLICABILITY**. This document is applicable to all turbine aircraft engines regulated by part 33.

4. **DEFINITIONS**. For the purposes of this AC, the following definitions are provided.

a. Analysis. A specific and detailed qualitative and/or quantitative evaluation of the engine offered for certification to determine compliance with §33.75. Examples include: Fault Tree Analysis (FTA), Failure Mode and Effects Analysis (FMEA) and Markov Analysis.

b. Assessment. A more general or broad evaluation of the engine which may include the results of the analysis completed, as well as any other information, to support compliance with §33.75.

c. Check. An examination, inspection and/or test to determine the physical integrity and/or the functional capability of an item.

d. Error. An omission or incorrect action by a crew member or people in charge of the maintenance or a mistake in requirements, design or implementation. An error may result in a failure but is not a failure in and of itself.

e. External Event. An occurrence originating apart from the engine or aircraft, including but not limited to icing or bird strikes.

f. Failure Condition. A condition with a direct, consequential engine-level effect, caused or contributed to by one or more failures. Examples include limitation of thrust to idle or oil exhaustion.

g. Failure Mode. The cause of the failure or the manner in which an item or function can fail. Examples include failures due to corrosion or fatigue, or failure in jammed open position.

h. Redundancy. Multiple independent methods incorporated to accomplish a given function, each one of which is sufficient to accomplish the function.

i. System. A combination of inter-related items arranged to perform a specific function(s).

j. Toxic Products. Products that act as or have the effect of a poison when humans are exposed to them.

5. **BACKGROUND**.

a. The ultimate objective of a safety analysis is to ensure that the risk to the aircraft from all engine failure conditions is within an acceptable range. The basis is the concept that an acceptable total engine design risk is achievable by managing the individual major and hazardous engine risks to acceptable levels. This concept emphasizes reducing the likelihood or probability of an event proportionally with the severity of its effects. The safety analysis should support the engine design goals such that there would not be major or hazardous engine effects occurring that exceed the required probability of occurrence as a result of engine failure modes.

b. Compliance with §33.75 should be shown by a safety analysis substantiated, when necessary, by appropriate testing and/or comparable service experience. An assessment may range from a simple report that offers descriptive details associated with a failure condition, an interpretation of test results, a comparison of two similar components or assemblies, other qualitative information, to a detailed safety analysis.

c. The depth and scope of an acceptable safety assessment depend on the complexity and criticality of the functions performed by the system(s), components or assemblies under consideration; the severity of related failure conditions; the uniqueness of the design and extent of relevant service experience; the number and complexity of the identified failures; and the detectability of contributing failures.

6. **SECTION 33.75 - GENERAL**.

a. Section 33.75 defines the engine-level failure conditions and presumed severity levels. Aircraft-level failure classifications are not directly applicable to engine safety assessments since the aircraft may have features that could reduce or increase the consequences of an engine failure condition. Additionally, the same type-certificated engine may be used in a variety of installations, each with different aircraft-level failure classifications.

b. Since aircraft-level requirements for individual failure conditions may be more severe than the engine-level requirements, due to installation effects, there should be early coordination between the engine manufacturer and the aircraft manufacturer, as well as the relevant FAA certification offices, to ensure that the engine may be installed in the aircraft. It is the aim of the FAA to help ensure the engine applicant is aware of possibly more restrictive regulations in the installed condition.

7. **SECTION 33.75(a)(1)**.

a. Rule Text. The regulation in §33.75(a)(1) reads as follows: **"An analysis of the engine, including the control system, shall be carried out in order to assess the likely consequence of all failures that can reasonably be expected to occur. This analysis will take account of –**

(i) Aircraft-level devices and procedures assumed to be associated with a typical installation. Such assumptions will be stated in the analysis.

(ii) Consequential secondary failures and latent failures.

(iii) Multiple failures referred to in paragraph (d) of this section or that result in the hazardous engine effects defined in paragraph (g)(2) of this section."

b. Guidance.

(1) The reference to "typical installation" in paragraph 33.75(a)(1)(i) does not imply that the aircraft-level effects are known, but that assumptions of typical aircraft devices and procedures, such as fire-extinguishing equipment, annunciation devices, etc., are clearly stated in the analysis. Such assumptions should be included in the installation instructions under paragraph 33.5(c). Regulations within the aircraft paragraphs of 14CFR (Parts 23, 25, 27, and 29) contain aircraft-level device requirements. These regulations include xx.1305, Powerplant instruments.

(2) In showing compliance with §33.75(a)(1), a component level safety analysis may be an auditable part of the design process or may be conducted specifically for demonstration of compliance with this rule.

(3) The possible latency period of failures is included in the probabilistic calculations of failure rates.

8. **SECTIONS 33.75(a)(2) and 33.75(a)(3).**

a. Rule Text for §33.75(a)(2). The regulation in §33.75(a)(2) reads as follows: **"A summary shall be made of those failures that could result in major engine effects or**

hazardous engine effects as defined in paragraph (g) of this section, together with an estimate of the probability of occurrence of those effects."

b. Rule Text for §33.75(a)(3). The regulation in §33.75(a)(3) reads as follows: **"It shall be shown that hazardous engine effects are not predicted to occur at a rate in excess of that defined as extremely remote (probability range of 10^{-7} to 10^{-9} per engine flight hour). The estimated probability for individual failures may be insufficiently precise to enable the total rate for hazardous engine effects to be assessed. For engine certification, it is acceptable to consider that the intent of this paragraph is achieved if the probability of a hazardous engine effect arising from an individual failure can be predicted to be not greater than 10^{-8} per engine flight hour. It will also be accepted that, in dealing with probabilities of this low order of magnitude, absolute proof is not possible and reliance must be placed on engineering judgment and previous experience combined with sound design and test philosophies."**

c. Guidance.

(1) The occurrence rate of hazardous engine effects applies to each individual effect. The 10^{-7} to 10^{-9} range of probabilities for each hazardous engine effect applies to the summation of the probabilities of this hazardous engine effect arising from individual failure modes or combinations of failure modes other than the failure of critical components (i.e., disks, hubs, spacers). For example, the total rate of occurrence of uncontrolled fires, obtained by adding up the individual failure modes and combination of

failure modes leading to an uncontrolled fire, should not exceed 10^{-7}.

(2) When considering primary failures of certain single elements such as critical components, the numerical failure rate cannot be sensibly estimated. If the failure of such elements is likely to result in hazardous engine effects, reliance must be placed on their meeting the prescribed integrity requirements, such as §§33.14, 33.15 and 33.27, among others. These requirements are considered to support a design goal that, among other goals, primary LCF failure of the component should be extremely improbable (remote?) throughout its operational life. There is no requirement to include the estimated primary failure rates of such single elements in the summation of failures for each hazardous engine effect due to the difficulty in producing and substantiating such an estimate.

9. **SECTION 33.75(a)(4)**.

a. Rule Text. The regulation in §33.75(a)(4) reads as follows: **"It shall be shown that major engine effects are not predicted to occur at a rate in excess of that defined as remote (probability range of 10^{-5} to 10^{-7} per engine flight hour)."**

b. Guidance. Compliance with (a)(4) can be shown if the individual failures or combinations of failures resulting in major engine effects have probabilities in the range of 10^{-5} to 10^{-7}. No summation of probabilities of failure modes resulting in the same major engine effect is required to show compliance with this rule.

10. **SECTION 33.75(b)**.

a. Rule Text. The regulation in §33.75(b) reads as follows: **"If significant doubt exists as to the effects of failures and likely combination of failures, any assumption may be required to be verified by test."**

b. Guidance. Prediction of the likely progression of some engine failures may rely extensively upon engineering judgment and is not susceptible to absolute proof. If there is some question of the validity of such engineering judgment, to the extent that the conclusions of the analysis could be invalid, additional substantiation may be required. Additional substantiation may consist of reference to previous relevant service experience, engineering analysis, material, component, rig or engine test or a combination of the above. If significant doubt exists over the validity of the substantiation so provided, additional testing or other validation may be required.

11. **SECTION 33.75(c)**.

a. Rule Text. The regulation in §33.75(c) reads as follows: **"It is recognized that the probability of primary failures of certain single elements (for example, disks) cannot be sensibly estimated in numerical terms. If the failure of such elements is likely to result in hazardous engine effects, reliance must be placed on meeting prescribed integrity requirements. These instances shall be stated in the safety analysis."**

b. Guidance. The intent of this section is self-evident.

12. SECTION 33.75(d).

a. Rule Text. The regulation in §33.75(d) reads as follows: **"If reliance is placed on a safety system, such as safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures, to prevent a failure progressing to hazardous engine effects, the possibility of a safety system failure in combination with a basic engine failure shall be covered. If items of a safety system are outside the control of the engine manufacturer, the assumptions of the safety analysis with respect to the reliability of these parts shall be clearly stated in the analysis and identified in the installation instructions under §33.5."**

b. Guidance. The safety system failure may be present as a latent failure, occur simultaneously with the basic engine failure, or occur subsequent to the engine failure.

13. SECTIONS 33.75(e) and 33.75(e)(1).

a. Rule Text for §33.75(e). The regulation in §33.75(e) reads as follows: **"If the acceptability of the safety analysis is dependent on one or more of the following items, they shall be identified in the analysis and appropriately substantiated."**

b. Rule Text for §33.75(e)(1). The regulation in §33.75(e)(1) reads as follows: **"Maintenance actions being carried out at stated intervals. This includes the verification of the serviceability of items which could fail in a latent manner. These maintenance intervals must be published in the appropriate manuals. Additionally, if errors in maintenance of the engine, including the control system, could lead to**

hazardous engine effects, the appropriate procedures shall be included in the relevant engine manuals."

c. Guidance.

(1) There should be general statements in the analysis summary that refer to regular maintenance in a shop as well as on the line. If specific failure rates rely on special or unique maintenance checks, those should be explicitly stated in the analysis.

(2) The engine maintenance manual, overhaul manual, or other relevant manuals may serve as the appropriate substantiation for (e)(1) above. A listing of all possible incorrect maintenance actions is not required.

d. Maintenance error lessons learned. Maintenance errors have contributed to hazardous or catastrophic effects at the aircraft level. Many of these events have arisen due to similar maintenance actions being performed on multiple engines during the same maintenance availability by one maintenance crew, and are thus primarily an aircraft-level concern. If appropriate, consideration should be given to communicating strategies against performing contemporaneous maintenance of multiple engines (see Significant Airworthiness Information Bulletin (SAIB) on multi-engine maintenance [ANE to release], ETOPS requirements, etc.) Consideration should be given to mitigating the effects of maintenance errors in the design phase. Components undergoing frequent maintenance should be designed to facilitate the maintenance and correct re-assembly. However, completely eliminating sources of maintenance error during design is not possible.

(1) The following list of multiple engine maintenance errors was constructed from situations that have repeatedly occurred in service and have caused one or more serious events:

(a) Failure to restore oil system or borescope access integrity after routine maintenance (oil chip detector or filter check). Similar consideration should be given to other systems.

(b) Mis-installation of O-rings.

(c) Servicing with incorrect fluids.

(2) Improper maintenance on parts such as disks, hubs, and spacers has led to failures resulting in hazardous effects. Examples of this which have occurred in service are overlooking existing cracks or damage during inspection and failure to apply or incorrect application of protective coatings (e.g., anti-gallant, anti-corrosive).

14. **SECTION 33.75(e)(2)**.

a. Rule Text. The regulation in §33.75(e)(2) reads as follows: **"Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The details of this satisfactory functioning must be published in the appropriate manual."**

b. Guidance. If specific failure rates rely on special or unique maintenance checks for protective devices, those should be explicitly stated in the analysis.

15. **SECTION 33.75(e)(3)**.

a. Rule Text. The regulation in §33.75(e)(3) reads as follows: **"The provisions of specific instrumentation not otherwise required."**

b. Guidance. The intent of this section is self-evident.

16. **SECTION 33.75(f)**.

a. Rule Text. The regulation in §33.75(f) reads as follows: **"If applicable, the safety analysis shall also include, but is not limited to, investigation of:**

(1) indicating equipment;

(2) manual and automatic controls;

(3) compressor bleed systems;

(4) refrigerant injection systems;

(5) gas temperature control systems;

(6) engine speed, power, or thrust governors and fuel control systems;

(7) engine overspeed, overtemp, or topping limiters;

(8) propeller control systems; and

(9) engine or propeller thrust reversal systems."

b. Guidance. The safety analysis is not limited to the items listed in §33.75(f).

17. **SECTION 33.75(g)(1)**.

a. Rule Text. The regulation in §33.75(g)(1) reads as follows: **"Unless otherwise approved by the Administrator and stated in the safety analysis, for compliance with part 33, the following failure definitions apply to the engine:**

(1) An engine failure in which the only consequence is partial or complete loss of thrust or power (and associated engine services) from the engine shall be regarded as a minor engine effect."

b. Guidance.

(1) It is generally recognized that engine failures involving complete loss of thrust or power from the affected engine can be expected to occur in service, and that, for the purposes of the engine safety analysis, the aircraft is assumed to be capable of controlled flight following such an event. Therefore, for the purpose of the engine safety analysis and engine certification, engine failure with no effect other than loss of thrust and services may be regarded as a comparatively safe failure with a minor engine effect. This assumption may be revisited during aircraft certification, where installation effects such as engine redundancy may be fully taken into consideration. This reexamination applies only to aircraft certification and is not intended to impact engine certification.

(2) The failure to achieve any given power or thrust rating for which the engine is certificated should be both covered in the safety analysis and regarded as a minor engine effect. This assumption may be revisited during aircraft certification, particularly multi-engine rotorcraft certification. This reexamination applies only to aircraft certification and is not intended to impact engine certification.

18. **SECTION 33.75(g)(2).**

a. Rule Text for §33.75(g)(2)(i). The regulation in §33.75(g)(2)(i) reads as follows:

"The following effects shall be regarded as hazardous engine effects:

(i) Non-containment of high-energy debris,"

b. Guidance for §33.75(g)(2)(i).

(1) Uncontained debris covers a large spectrum of energy levels due to the various sizes and velocities of parts released by the engine. The engine has a containment structure which is designed to contain the release of a single blade and its consequences, and which is often adequate to contain additional released blades and static parts. The engine containment structure is not expected to contain major rotating parts should they fracture. Disks, hubs, impellers, large rotating seals, and other similar large rotating components should therefore always be considered to represent potential high-energy debris. Generally, multiple blades released, if uncontained, have used up most of their energy defeating the containment structure, and may typically be considered as low-energy debris.

(2) Fan blades may have significant residual energy after defeating the containment structure, depending on the specifics of engine size, bypass ratio, and other design elements. The choice of whether to include fan blade uncontainment under high energy (and thus, hazardous engine effects) or low energy (major engine effects) should be carefully considered.

(3) The engine casings generally provide the engine containment structure, as well as being pressure vessels. Thus, casing rupture due to pressure loads is inherently not contained by the normal blade containment provisions. Service experience has shown that the rupture of the highest pressure casings (compressor delivery pressure) can generate high-energy debris.

c. Rule Text for §33.75(g)(2)(ii). The regulation in §33.75(g)(2)(ii) reads as follows: **"Concentration of toxic products in the engine bleed air for the cabin sufficient to incapacitate crew or passengers,"**

d. Guidance for §33.75(g)(2)(ii).

(1) This effect may be interpreted as the generation and delivery of sufficient toxic products as a result of abnormal engine operation that could incapacitate the crew or passengers during the subject flight. This means that the flow of toxic products would either be so quick-acting as to be impossible to stop prior to incapacitation, and/or that there would be no effective means to stop the flow of toxic products to the crew compartment or passenger cabin, and/or that the toxic products would be undetectable prior to incapacitation. The toxic products could result, for example, from the degradation of abradable materials in the compressor when rubbed by rotating blades or the degradation of oil which would leak into the compressor air flow.

(2) No assumptions of cabin air dilution or mixing should be made in this engine-level analysis; those items can only be properly evaluated during aircraft certification. The intent of paragraph §33.75(g)(2)(ii) is to address the relative concentration of toxic

products in the engine bleed air delivery. The hazardous engine effect of toxic products relates to significant concentrations of toxic products, with "significant" defined as concentrations sufficient to incapacitate persons exposed to those concentrations.

(3) Since these concentrations are of interest to the installer, information on delivery rates and concentrations of toxic products in the engine bleed air for the cabin should be provided to the installer as part of the installation instructions.

e. Rule Text for §33.75(g)(2)(iii). The regulation in §33.75(g)(2)(iii) reads as follows: **"Significant thrust in the opposite direction to that commanded by the pilot,"**

f. Guidance for §33.75(g)(2)(iii). Engine failures resulting in significant thrust in the opposite direction to that commanded by the pilot can, depending on the flight phase, result in a hazardous condition relating to aircraft controllability. Those failures, if applicable to part 33 certification, that could be classified as hazardous engine events include:

(1) Uncommanded thrust reverser deployment;

(2) Reverse propeller pitch in flight; or

(3) High forward thrust when reverse thrust is commanded.

g. Rule Text for §33.75(g)(2)(iv). The regulation in §33.75(g)(2)(iv) reads as follows: **"Uncontrolled fire,"**

h. Guidance for §33.75(g)(2)(iv). An uncontrolled fire should be interpreted in this context as an extensive or persistent fire which is not effectively confined to a designated fire zone. Provision for flammable fluid drainage, fire containment, fire detection, and fire

extinguishing may be taken into account when assessing the severity of the effects of a fire.

i. Rule Text for §33.75(g)(2)(v) and (vi). The regulation in §33.75(g)(2)(v) and (vi) reads as follows:

(v) "Failure of the engine mount system leading to inadvertent engine separation,"

(vi) "Release of the propeller by the engine, if applicable,"

j. Guidance for §33.75(g)(2)(v) and (vi). The intent of these paragraphs is self-evident.

k. Rule Text for §33.75(g)(2)(vii). The regulation in §33.75(g)(2)(vii) reads as follows: **"Complete inability to shut the engine down."**

l. Guidance for §33.75(g)(2)(vii).

(1) Complete inability to shut down the engine is regarded as a hazardous engine effect due to the potential circumstances in which continued running of the engine, even at low thrust or power, represents a hazard. These circumstances include the inhibition of safe evacuation of passengers and crew, directional control problems during landing due to the inability to eliminate thrust or power, or the inability to ensure safe shut down when required following a failure.

(2) It is acceptable to take allowance for aircraft-supplied equipment (fuel cutoff means, etc.) to protect against the "complete inability" to shut down the engine. Furthermore, the inclusion of "complete inability to shut the engine down" as a hazardous

engine effect is not intended to preclude hardware or software intended to protect against inadvertent engine shutdown, including aircraft logic to mitigate against the inadvertent shutdown of all engines.

19. **SECTION 33.75(g)(3)**.

a. Rule Text. The regulation in §33.75(g)(3) reads as follows: **"An effect falling between those covered in (g)(1) and (2) shall be regarded as a major engine effect."**

b. Guidance. The following list is a guide to the scope of major engine effects. Major engine effects are likely to significantly increase crew workload, or reduce the safety margins between the engine operating condition and a hazardous engine failure. These items may not be applicable to all engines and the list is not intended to be exhaustive. Furthermore, engine design variations may result in changes to the classification of these failure conditions.

(1) Controlled fires (i.e., those brought under control by shutting down the engine or by on-board extinguishing systems).

(2) Case burnthrough where it can be shown that there is no propagation to hazardous engine effects.

(3) Release of low-energy parts where it can be shown that there is no propagation to hazardous engine effects.

(4) Vibration levels that result in crew discomfort.

(5) Concentration of toxic products in the engine bleed air for the cabin sufficient to degrade crew performance. Note: This item may be interpreted as the generation and delivery of toxic products as a result of abnormal engine operation that would incapacitate the crew or passengers, except that the toxic products are slow-enough acting and/or are readily detectable so as to be stopped by crew action prior to incapacitation. Possible reductions in crew capabilities due to their exposure while acting in identifying and stopping the toxic products shall be considered, if appropriate. Since these concentrations are of interest to the installer, information on delivery rates and concentrations of toxic products in the engine bleed air for the cabin should be provided to the installer as part of the installation instructions.

(6) Thrust in the opposite direction to that commanded by the pilot, below the level defined as hazardous.

(7) Generation of thrust greater than maximum rated thrust.

(8) Loss of engine support loadpath integrity.

(9) Significant uncontrollable thrust oscillation.

20. **OTHER CONSIDERATIONS**.

a. Improper operation. Errors in operation of the engine have resulted in hazardous or catastrophic effects at the aircraft level which otherwise would have been less serious. Consideration should be given to mitigating the effects of improper operation or to providing operating instructions that reduce the likelihood of improper operation. In

particular, abnormal engine symptoms and their desired response or appropriate procedures for trouble shooting for these symptoms should be communicated to the installer (reference §33.5).

b. Assembly. Parts, the incorrect assembly of which could result in hazardous engine effects, should be designed so as to minimize the risk of incorrect assembly, or, if this is not practical, be permanently marked so as to indicate their correct position when assembled. Additional information on this subject may be found in JAR-E Section 110.

21. ANALYTICAL TECHNIQUES.

a. The depth and scope of an acceptable safety assessment depends on the complexity and criticality of the functions performed by the system(s), components or assemblies under consideration, the severity of related failure conditions, the uniqueness of the design and extent of relevant service experience, the number and complexity of the identified causal failure scenarios, and the detectability of contributing failures.

b. This section describes various techniques for performing a safety analysis. Other comparable techniques exist and may be proposed by an applicant. Variations and/or combinations of these techniques are also acceptable. For derivative engines, it is acceptable to limit the scope of the analysis to modified components or operating conditions and their effects on the rest of the engine. Early agreement between the applicant and the engine certification office should be reached on the scope and methods of assessment to be used.

c. Various methods for assessing the causes, severity levels, and likelihood of potential failure conditions are available to support experienced engineering judgment. The various types of analyses are based on either inductive or deductive approaches. Brief descriptions of typical methods are provided below. More detailed descriptions of analytical techniques may be found in the documents referenced in paragraph 2 of this AC, Related Reading Material.

(1) Failure Modes and Effects Analysis (FMEA). A structured, inductive, bottom-up analysis which is used to evaluate the effects on the engine system of each possible element or component failure. When properly formatted, it will aid in identifying latent failures and the possible causes of each failure mode.

(2) Fault tree or Dependence Diagram (Reliability Block Diagram) Analyses. Structured, deductive, top-down analyses which are used to identify the conditions, failures, and events that would cause each defined failure condition. These are graphical methods of identifying the logical relationship between each particular failure condition and the primary element or component failures, other events, or their combinations that can cause the failure condition. A Fault Tree Analysis is failure oriented, and is conducted from the perspective of which failures must occur to cause a defined failure condition. A Dependence Diagram Analysis is success-oriented, and is conducted from the perspective of which failures must not occur to preclude a defined failure condition.

{AE1}

Mr. Ron Priddy
President, Operations
National Air Carrier Association
1100 Wilson Blvd., Suite 1700
Arlington, VA 22209

Dear Mr. Priddy:

The Federal Aviation Administration (FAA) recently completed a regulatory program review. That review focused on prioritizing rulemaking initiatives to more efficiently and effectively use limited industry and regulatory rulemaking resources. The review resulted in an internal Regulation and Certification Rulemaking Priority List that will guide our rulemaking activities, including the tasking of initiatives to the Aviation Rulemaking Advisory Committee (ARAC). Part of the review determined if some rulemaking initiatives could be addressed by other than regulatory means, and considered products of ARAC that have been or are about to be forwarded to us as recommendations.

The Regulatory Agenda will continue to be the vehicle the FAA uses to communicate its rulemaking program to the public and the U.S. government. However, the FAA also wanted to identify for ARAC those ARAC rulemaking initiatives it is considering to handle by alternative actions (see the attached list). At this time, we have not yet determined what those alternative actions may be. We also have not eliminated the possibility that some of these actions in the future could be addressed through rulemaking when resources are available.

If you have any questions, please feel free to contact Gerri Robinson at (202) 267-9678 or gerri.robinson@faa.gov.

Sincerely,

Anthony F. Fazio
Executive Director, Aviation Rulemaking Advisory Committee

Enclosure

cc:
William W. Edmunds, Air Carrier Operation Issues
Sarah MacLeod, Air Carrier/General Aviation Maintenance Issues
James L. Crook, Air Traffic Issues
William H. Schultz, Aircraft Certification Procedures Issues
Ian Redhead, Airport Certification Issues

Billy Glover, Occupant Safety Issues
John Tigue, General Aviation Certification and Operations Issues
David Hilton, Noise Certification Issues
John Swihart, Rotorcraft Issues
Roland B. Liddell, Training and Qualification Issues
Craig Bolt, Transport Airplane and Engine Issues

ARAC Projects that will be handled by Alternative Actions rather than Rulemaking

(Beta) Reverse Thrust and propeller Pitch Setting below the Flight Regime (25.1155)
Fire Protection (33.17)
Rotor Integrity--Overspeed (33.27)
Safety Analysis (33.75)
Rotor Integrity – Over-torque (33.84)
2 Minute/30 Second One Engine Inoperative (OEI) (33.XX)
Bird Strike (25.775, 25.571, 25.631)
Casting Factors (25.621)
Certification of New Propulsion Technologies on Part 23 Airplanes
Electrical and Electronic Engine Control Systems (33.28)
Fast Track Harmonization Project: Engine and APU Loads Conditions (25.361, 25.362)
Fire Protection of Engine Cowling (25.1193(e)(3))
Flight Loads Validation (25.301)
Fuel Vent System Fire Protection (Part 25 and Retrofit Rule for Part 121, 125, and 135)
Ground Gust Conditions (25.415)
Harmonization of Airworthiness Standards Flight Rules, Static Lateral-Directional Stability, and Speed Increase and Recovery Characteristics (25.107(e)(1)(iv), 25.177©, 25.253(a)(3)(4)(50)). Note: 25.107(a)(b)(d) were enveloping tasks also included in this project—They will be included in the enveloping NPRM)
Harmonization of Part 1 Definitions Fireproof and Fire Resistant (25.1)
Jet and High Performance Part 23 Airplanes
Load and Dynamics (Continuous Turbulence Loads) (25.302, 25.305, 25.341 (b), etc.)
Restart Capability (25.903(e))

Standardization of Improved Small Airplane Normal Category Stall Characteristics Requirements (23.777, 23.781, 23.1141, 23.1309, 23.1337, 25.1305)

ATTC (25.904/App I)
Cargo Compartment Fire Extinguishing or Suppression Systems (25.851(b), 25.855, 25.857)
Proof of Structure (25.307)
High Altitude Flight (25.365(d))
Fatigue and Damage Tolerance (25.571)
Material Prosperities (25.604)

FAA Action: Airworthiness Standards: Safety Analysis; Final rule - FAA-2006-25376

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1 and 33

[Docket No. XXXXX; Notice No. XXXXXX]

RIN 2120-XXXX

Airworthiness Standards: Aircraft Engines One-Engine-Inoperative (OEI) Ratings, Type Certification Standards

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This notice proposes to amend the 30-second OEI and 2-minute OEI ratings type certification standards for rotorcraft turbine engines of Title 14, Code of Federal Regulations (14 CFR), parts 1 and 33. This proposal revises the ratings' standards to reflect recent analyses defining the ratings and lessons learnt through several completed engine certifications and service experience. This proposal also harmonizes the Federal Aviation Administration (FAA) type certification standards for the ratings with requirements being processed by the European Joint Aviation Authorities (JAA) and Transport Canada. The proposed changes if adopted would establish nearly uniform certification standards for the ratings for rotorcraft turbine engines certified in the United States under 14 CFR part 33 and in the JAA countries under Joint Aviation Requirements-Engines (JAR-E), simplifying airworthiness approvals for import and export.

DATES: Comments to be submitted on or before [TBD date 90 days after the date of publication in the Federal Register].

ADDRESSES: Comments on this notice should be mailed, in triplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-10), Docket No. XXXX , Room 915G, 800 Independence Avenue, SW., Washington, DC 20591. Comments submitted must be marked: "Docket No. XXXX." Comment may also be sent electronically to the following internet address: 9-NPRM-CMTS@faa.dot.gov. Comments may be examined in Room 915G on weekdays except Federal holidays, between 8:30 a.m. and 5:00 p.m.

FOR FURTHER INFORMATION CONTACT: Mr. Chung Hsieh, Engine and Propeller Standards Staff, ANE-110, Engine and Propeller Directorate, Aircraft Certification Service, FAA, New England Region, 12 New England Executive Park, Burlington, Massachusetts 01803-5229; (781) 238-7115; Fax (781) 238-7199.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in the making of the proposed rule by submitting such written data, views, or arguments as they may desire. Comments relating to the environmental, energy, federalism, or economic impact that might result from adopting the proposals in this notice are also invited. Substantive comments should be accompanied by cost estimates. Comments must identify the regulatory docket number and be submitted in triplicate to the Rules Docket address specified above.

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All comments received, as well as report summarizing each substantive public contact with the FAA personnel on this rulemaking, will be filed in the docket. The docket is available for public inspection before and after the comment closing date.

All comments received on or before the closing date will be considered by the Administrator before taking action on this proposed rulemaking. Late-filed comments will be considered to the extent practicable. The proposals contained in this notice may be changed in light of comments received.

Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this notice must include a pre-addressed, stamped postcard with those comments on which the following statement is made: "Comments to Docket No. XXXX." The postcard will be date stamped and mailed to the commenter.

Availability of NPRMs

An electronic copy of this document may be downloaded using a modem and suitable communications software from the FAA regulations section of the Fedworld electronic bulletin board service (telephone: 703-321-3339), the Federal Register's electronic bulletin board service (telephone: 202-512-1661), or the FAA's Aviation Rulemaking Advisory Committee Bulletin Board service (800)-322-2722 or (202)-267-5948.

Internet users may reach the FAA's webpage at http:\\www.faa.gov/avr/arm/nprm/nprm.htm or the Federal Register's webpage at http://www.access.gpo.gov/su_docs/aces/aces140.html for access to recently published rulemaking documents.

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Any person may obtain a copy of this NPRM by submitting a request to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267-9680. Communications must identify the Docket Number of this NPRM.

Persons interested in being placed on the mailing list for future NPRMs should request from the above office, a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

Statement of the problem

Part 33 of Title 14 of the code of Federal Reguatlions (14 CFR part 33, hereafter "part 33") prescribes airworthiness standards for the issue of type certificates, and changes to those certificates, for aircraft engines. Part E of the Joint Aviation Requirements (JAR-E) prescribes corresponding airworthiness standards of the European Joint Aviation Authorities (JAA). The airworthiness standards for 30-second and 2-minute OEI ratings were adopted to part 33 as Amendment 18 on May 30 and effective August 19, 1996. The corresponding airworthiness standards for these two ratings in JAR-E are prescribed in Notice of Proposed Amendment NPA–E-19, and the standards for each engine certification application that requested the ratings were prescribed by individual special conditions. While the standards in part 33 and JAA special conditions for the ratings are similar, they differ in certain regulations. Non-uniform standards impose a regulatory hardship on applicants seeking certification under both sets of standards, in the form of additional costs and delays in the time required for certification.

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As part of its commitment to promote harmonization of part 33 and JAR-E, the FAA with the cooperation the JAA and Transport Canada (TCA), the harmonization Terms of Reference (TOR) for "2-minute and 30-second One-Engine-Out Ratings" were prepared on in April 1992 to review and harmonize the Federal Aviation Regulations (FAR) and JAR requirements and interpretations for the ratings. This task was assigned to the Engine Harmonization Working Group (EHWG) of the Aviation Rulemaking Advisory Committee (ARAC). The working group consisting of authorities from the FAA, JAA, TCA and industry representative from the US and JAA countries has been organized. The group had been assigned the task of harmonizing the airworthiness standards associated with these two ratings in various section of part 33 and JAR-E regulations.
On [insert date], the EHGW reported their recommendations to the ARAC, which recommended that the FAA proceed with rulemaking. This NPRM reflects the ARAC recommendations. A corresponding NPA was published on December 20, 1999.

General Discussion of the proposals

The following proposals were developed and agreed to by the working group. The proposed part 33 changes contain language that would be common to the language proposed for JAR-E, thereby establishing equivalency and creating consistency between the two regulations.

§ 1.1 Definitions

The 30-second and 2-minute OEI ratings are intended for use only for continuation of the one-flight operation after the failure or shut down of one engine in multiengine rotorcraft during takeoff or landing. The usage of a power level at each of the ratings is

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limited in duration for 30 seconds and 2 minutes, respectively. Even though these ratings have been intended for one usage per flight in an emergency during the takeoff or landing phase of flight, the certification requirements have been defined around the worst case scenario involving the possible use of these ratings three times in one flight (i.e., for the event at takeoff, balked landing, and final landing).

The proposal would revise the usage in the rated 30-second and rated 2-minutes OEI rating powers to include engine "shutdown" in addition to "failure" as stated in the current definition. Since these two engine conditions (failure and shutdown) are generally applicable to OEI ratings for rotorcraft engines, the conditions under which the rated 2½-minute OEI, 30-minute OEI and Continuous OEI rating power may be used are therefore revised to include "engine shutdown". In addition, to be consistent with the usage definition of 30-second OEI and 2-minute OEI ratings, the period of use for 2 ½-minute OEI rating is revised from "a period of use " to "periods of use". Certain editorial changes were also made to the OEI rating definitions for clarification purposes.

§ 33.5 Instruction manual for installing and operating the engine.

The proposed amendment would add a new paragraph 33.5 (b)(4), applicable to rotorcraft engines having one or more OEI ratings, to provide engine data in supporting aircraft power availability requirements, such as § 27.45(f) and § 29.45(f). Because the power assurance will not include a topping check to the highest OEI rating power level due to potential rapid engine hardware deterioration, the applicant would provide the necessary engine performance characteristics and variability to enable the installer to establish power assurance procedures in which the extrapolation of engine power run from

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a lower power check level to the highest OEI rating power can be achieved. The engine database would be expected to include a thermodynamic model, experience gained during development and certification testing, and service experience gained from engines of similar design, whenever applicable.

§ 33.29 Instrument connection

The revised paragraph 33.29(c) would specify that a means or a provision for a means must be provided to record the entry into the defined 30-second OEI and 2-minute OEI rating power bands, and to indicate to the pilot the entry into the power bands, the corresponding impending time expiration, and the time expiration point. The automatic recording system must record the number of usage and the time of each usage, or accumulated time, including any exceedence of 30-second and/or 2-minute OEI operating limitations or relevant time limitations. It should also provide a means to alert the maintenance personnel that the usage and/or exceedence of the 30-second and/or 2-minute OEI ratings have taken place. The required means for alerting the pilot and maintenance personnel, and automatic recording must not be capable of being reset in flight, and can only be reset by maintenance personnel after retrieval of recorded data. The proposal would delete the redundant design requirements of paragraph 33.29(c)(2) and replace it by the automatic data recording requirements of the existing paragraph 33.29(c)(3) with a minor wording change for clarification. This proposal would add a new requirements designated as new paragraph 33.29(c)(3) for a means to alert maintenance personnel when the engines has been operated at the rating powers, and to retrieve the recorded engine data, The new paragraph 33.29(c)(4) would specify the requirements for verification of

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the proper operation of indicating, recording and retrieval systems. And a new paragraph 33.29(c)(5) is added to limit the reset of the recordings on ground by maintenance personnel only.

§ 33.67 Fuel system

The flight and operating conditions requiring use of 30-second OEI rating may create a high pilot workload to maintain safe flight. Therefore the rating power must be applied and controlled by an automatic means that requires no pilot input or control other than termination command. This automatic control requirement is intended to avoid the need for monitoring engine parameters during the OEI operation, such as output shaft torque or power, output shaft speed, gas producer speed, and gas path temperature. Once the system is activated, it automatically controls the 30-second OEI power and prevents the engine from exceeding its specified operating limits.

The proposed change would clarify the intent of "automatic control" that is to control the engine operating conditions not to exceed its operating limits specified in the engine's type certificate data sheet associated with the ratings. However, the applicant's design should not limit the time duration at the OEI ratings, thus allowing the pilot to deal with emergency cases (e.g., FAR 91.3(b)).

§ 33.87 Endurance test

For rotorcraft engine having 30-second and 2-minute OEI ratings, all applicable paragraphs of 33.87(a) must be considered in running the test under paragraph 33.87(f). However, for reducing test complexity, and for improved flexibility needed to attain the key parameters (speed, temperature and torque) during the test, the proposal would allow

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that the maximum air bleed for engine and aircraft services under paragraph 33.87(a)(5) need not be used for the tests under paragraph 33.87(f)(1) through (f)(8) if the applicant can show by test or analysis based on test that the validity of the endurance test is preserved. The analysis should include, but not limited to, (1) the effect of the bleed air extraction to the engine secondary air system which provides cooling air to various engine components, and (2) the thermodynamic cycle effects of bleed (e.g., core speed to output shaft speed changes), and (3) that the engine's ability to meet the teardown inspection requirements of subparagraph 33.93(b)(2) is not enhanced. Similarly, this proposal would allow that the accessory drives and mounting attachments may not be loaded in meeting the requirements of paragraph 33.87(a)(6), when running the tests under paragraph 33.87(f)(1) through (f)(8), if the applicant can substantiate that there is no significant effect to the durability of any accessory drive or engine component. However, if the power turbine accessory drives are not loaded, the equivalent power must be added to the required power at the output drive so that the power turbine rotor assembly is operated at or above the same levels as it would be if the power turbine accessory drives were loaded.

Paragraph 33.87(f) currently contains the endurance test requirement for engines, for which the 30-second OEI and 2-minute OEI ratings are desired. This proposal would clarify the intent of test schedule for the first test sequence of the existing paragraph 33.87(f)(4) test by adding a new sentence, "However, where the greatest is the 30-minute OEI power, that sixty-five minute period shall consist of 30 minutes at 30 minute OEI power followed by 35 minutes at whichever is the greater of continuous OEI power and

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maximum continuous power". The proposal would also clarify the idle condition of paragraph 33.87(f)(8) as flight idle.

In addition. this proposal would specify that the four test sequences of the two-hour test under §33.87(f) are to be run continuously without stoppage. In the event of a stop occurring, the interrupted sequence needs to be repeated in full or can be re-started from the interrupt point if there are technical justifications acceptable to the FAA. If it is determined that the sequence needs not to be repeated in its entirety, the test should be re-started from a point where the engine thermal condition would be the same as at the time of interruption. If an excessive number of interruptions occur, the applicant would be required to repeat the entire §33.87(f) test.

Finally, the test schedule under 33.87(c) for 30-minute OEI rating would be revised such that the schedules for that rating in part 33 and JAR-E are identical.

§ 33.88 Engine overtemperature test

The approval of 30-second and 2-minute OEI ratings for engine without incorporating a means to limit temperature is not possible by the requirements in §33.67(d), The existing paragraph 33.88(b) is no longer valid, and therefore, it is deleted. The proposal would incorporate the existing test requirements in paragraph 33.88(c) into the new paragraph 33.88(b)which is applicable only for engines having the 30-second OEI and 2-minute OEI ratings combination as well as incorporating a means for automatic temperature control to limit temperature. For all other ratings including OEI ratings other than the combination specified above, paragraph 33.88(a) applies regardless whether the engine is equipped with an automatic temperature control or not.

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§ 33.93 Teardown inspection

In meeting the teardown inspection requirements after the 2-hour endurance tests of paragraph 33.87(f), the applicant is expected to show that no failure of any significant engine component becomes evident during the test, during shutdown or during the subsequent teardown inspection. For components which are distressed beyond serviceable limits by this test, it must be shown that the inspections and mandatory maintenance actions for these components, specified in the Instruction for Continued Airworthiness, are adequate for maintaining their continued airworthiness. Additionally, the component condition should be evaluated against a minimum hardware condition that can be expected for in-service engines. For the purpose of paragraph 33.93(b)(2), the engine parts that are deemed significant are those that can affect structural integrity, including, but not limited to, mounts, cases, bearing supports, shafts, and rotors. This proposal would delete the reference of the above mentioned components from the existing rule to emphasize that applicant needs to consider any engine component deterioration after the test that affects structural integrity of the engine.

Appendix A33.4 Airworthiness Limitation Section

The concept of the 30-Second OEI and 2-Minute OEI ratings is that of limited use in service followed by mandatory inspection and maintenance action. It assumes that some engine parts or components may not be suitable for further use and will need to be replaced after the application of these ratings. The mandatory maintenance following the use of 30-second, or 2-minute OEI, or both ratings must be capable of identifying and correcting any component distress which could significantly reduce subsequent engine

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reliability or prevent the engine from achieving the 30-second and 2 -minute OEI rating powers and the ability to sustain operation necessary to complete continued safe OEI flight during the service life of the engine.

The required inspections and maintenance actions are normally determined through certification testing and supplemented by development testing and service experience of engines of the same type or of similar design at the time of certification. However, differences may exist in hardware condition and power availability characteristics from in-service engines after certification that have not experienced any usage of the 30-second or 2-minute OEI ratings versus similar parameters that existed prior to the two-hour supplementary test of Section 33.87(f). Similarly, differences may exist in hardware condition and power assurance characteristics from in-service engines after usage of the 30-second or 2 minute OEI ratings versus similar parameters observed following the two-hour supplementary test of Section 33.87(f). Therefore, the required inspections and maintenance for a certified engine may need to be evolved after entering service, based on its service experience. The intent of the proposed in-service evaluation program specified in the Airworthiness Limitation Section is to obtain relevant data concerning engine hardware condition and power availability at various stages in the life of the hardware critical to the achievement of the rating, and to compare that data to corresponding data observed during the certification process that defined the airworthiness instructions. To achieve the objective of the program, it is essential for engine manufacturer to undertake the necessary actions including instructions in engine Instructions for Continued Airworthiness (ICA), to make sure that the operators are aware of the need and

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understand the procedures to properly collect and return the information necessary for the engine manufacturer to monitor the adequacy of the prescribed mandatory maintenance actions.

The proposal would require that, for rotorcraft engines with 30-second and 2-minute OEI ratings, the Airworthiness Limitations Section of the ICA is required to prescribe the mandatory post-flight inspection and maintenance actions which are applicable following the use of either of these two ratings, or both, regardless of the frequency, prior to next flight, and that the adequacy of the required inspections and maintenance actions must be validated. This proposal would also require a mandatory in-service engine evaluation program to assure the continued adequacy of the airworthiness instructions. The program must be provided by the applicant and be approved by the cognizant Aircraft Certification Office (ACO) prior to certification. In addition, the program must include the definition of data to be provided by operators to support the applicant in completing the engine in service evaluation program.

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), there are no requirements for information collection associated with this proposed rule.

Regulatory Evaluation Summary

TBD

International Trade Impact Analysis

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The proposed rule would have little or no effect on international trade for either U.S. firms marketing turbine engines in foreign markets or foreign firms marketing turbine engines in the U.S.

Regulatory Flexibility Determination

TBD

Federalism Implications

The regulations proposed herein would not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this proposal would not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

For the reasons discussed above, including the findings in the Regulatory Evaluation and the International Trade Impact Assessment, the FAA has determined that this proposed regulation is not significant under Executive Order 12866. In addition, the FAA certifies that this proposal, if adopted, would not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This proposal is not considered significant under DOT Regulatory Policies and Procedures (44 FR 11034, February 26, 1979). An initial regulatory evaluation of the proposal, including a Regulatory Flexibility Determination and International Trade Impact Assessment, has been placed in the docket. A copy may be

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obtained by contacting the person identified under "FOR FURTHER INFORMATION CONTACT."

List of Subjects

14 CFR Part 1

Airmen, Flights, Balloons, Parachutes, Aircraft Pilots, Pilots, Transportation, Agreements, Kites, Air safety, Safety, Aviation safety, Air transportation, Air carriers, Aircraft, Airports, Airplanes, Helicopters, Rotorcraft, Heliports, Engines, and Ratings.

14 CFR Part 33

Air transportation, Aircraft, Aviation safety, Safety.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend 14 CFR Part 1 and Part 33 of the Federal Aviation Regulations as follows:

PART 1 - DEFINITIONS AND ABBREVIATIONS

1. The authority citation for Part 1 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701

2. Section 1.1 definitions are amended in alphabetical order of "Rated 30-second OEI power", "Rated 2-minute OEI power", "Rated 30-minute power", and "Rated 2 1/2-minute OEI power" and "Rated continuous OEI power" as follows:

§ 1.1 General definitions.

* * * * *

"Rated 30-Second OEI Power," with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes

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and temperatures within the operating limitations established for the engine under Part 33 of this chapter, for continuation of the one-flight operation after the failure or shutdown of one engine in multiengine rotorcraft, for up to three periods of use no longer than 30 seconds each in any one flight, and followed by mandatory inspection and prescribed maintenance action.

"Rated 2-Minute OEI Power," with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under Part 33 of this chapter, for continuation of the one-flight operation after the failure or shutdown of one engine in multiengine rotorcraft, for up to three periods of use no longer than 2 minutes each in any one flight, and followed by mandatory inspection and prescribed maintenance action.

"Rated continuous OEI power," with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under Part 33 of this chapter, and limited in use to the time required to complete the flight after the failure or shutdown of one engine of a multiengine rotorcraft.

"Rated 30-minute OEI power," with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under Part 33 of this chapter, and limited in use to one period of use no longer than 30 minutes after the failure or shutdown of one engine of a multiengine rotorcraft.

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"Rated 2 1/2-minute OEI power," with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under Part 33 of this chapter for periods of use no longer than 2 1/2 minutes each after the failure or shutdown of one engine of a multiengine rotorcraft.

* * * * *

PART 33 - AIRWORTHINESS STANDARDS: AIRCRAFT ENGINES

3. The authority citation for part 33 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701-44702, 44704

4. Section 33.5 is amended by adding a new paragraph (c)(4) as follows:

§ 33.5 Instruction manual for installing and operating the engine.

* * * * *

(b) * * *

(1) * * *

(2) * * *

(3) * * *

(4) For rotorcraft engines having one or more OEI ratings, data shall be provided on engine performance characteristics and variability to enable the aircraft manufacturer to establish aircraft power assurance procedures.

5. Section 33.29 (c) is amended by revising the text to read as follows:

§ 33.29 Instrument Connection.

* * * * *

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(c) Each rotorcraft turbine engine having a 30-second OEI rating and a 2-minute OEI rating must have means or provisions for means to:

(1) Alert the pilot when the engine is at the 30-second OEI and the 2-minute OEI power levels, when the event begins, and when the time interval expires;

(2) Automatically record each usage and duration of power at the 30-second OEI and 2-minute OEI levels;

(3) Alert maintenance personnel in a positive manner that the engine has been operated at either or both of the 30-second and 2-minute OEI power levels, and permit retrieval of the recorded data; and

(4) Enable routine verification of the proper operation of the above means.

(d) The means, or provisions for means of paragraph (c) must not be capable of being reset in flight.

6. Section 33.67 is amended by revising the text of paragraph (d) to read as follows:

§ 33.67 Fuel system

* * * * *

(d) Rotorcraft engines having a 30-second OEI rating must incorporate means or provisions for means for automatic availability and automatic control of the 30-second OEI power within its operating limitations.

7. Section 33.87 is amended by revising the text of paragraph (c) and (a)(5), (a)(6), (f)(4) and (f)(8) to read as follows:

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§ 33.87 Endurance test.

(a) * * * * * *

* * * * * *

(5) Maximum air bleed for engine and aircraft services must be used during at least one-fifth of the runs, except for the final 120 minute test required under paragraph (f) of this section, provided the validity of the test is not compromised. However, for these runs, the power or thrust or the rotor shaft rotational speed may be less than 100 percent of the value associated with the particular operation being tested if the Administrator finds that the validity of the endurance test is not compromised.

(6) Each accessory drive and mounting attachment must be loaded, except for the final 120 minute test required under paragraph (f) of this section. The load imposed by each accessory used only for aircraft service must be the limit load specified by the applicant for the engine drive and attachment point during rated maximum continuous power or thrust and higher output. The endurance test of any accessory drive and mounting attachment under load may be accomplished on a separate rig if the validity of the test is confirmed by an approved analysis. For the test under paragraph (f) of this section, the accessory drives and mounting attachments may not be loaded when running the tests under paragraph (f)(1) through (f)(8) if the applicant can substantiate that there is no significant effect to the durability of any accessory drive or engine component. However, the equivalent engine output power extraction from the power turbine rotor assembly must be added to the engine shaft output.

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* * * * *

(c) *Rotorcraft engines for which a 30-minute OEI power rating is desired.* For each rotorcraft engine for which a 30-minute OEI power rating is desired, the applicant must conduct the following series of tests:

(1) * * * * * *

(2) *Rated maximum continuous and takeoff power.* Thirty minutes at-

(i) Rated maximum continuous power during fifteen of the twenty-five 6-hous endurance test cycles; and

(ii) Rated takeoff power during ten of the twenty-five 6-hour endurance test cycles.

(3) Rated maximum continuous power, One hour at rated maximum continuous power.

(4) Rated 30-minute OEI power. Thirty minutes at rated 30-minute OEI power.

(5) *Incremental cruise power.* Two hours and 30 minutes at the successive power lever positions corresponding with not less than 12 approximately equal speed and time increments between maximum continuous engine rotational speed and ground or minimum idle rotational speed. For engines operating at constant speed, power may be varied in place of speed. If there are significant peak vibrations anywhere between ground idle and maximum continuous conditions, the number of increments chosen must be changed to increase the amount of running conducted while being subjected to the peak vibrations up to not more than 50 percent of the total time spent in incremental running.

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(6) *Acceleration and deceleration runs.* Thirty minutes of accelerations and decelerations, consisting of six cycles from idling power to rated takeoff power and maintained at the takeoff power lever position for 30 seconds and at the idling power lever position for approximately 4 1/2 minutes. In complying with this paragraph, the power control lever must be moved from one extreme position to the other in not more than 1 second, except that if different regimes of control operations are incorporated necessitating scheduling of the power control lever motion in going from one extreme position to the other, a longer period of time is acceptable, but not more than 2 seconds.

(7) *Starts.* One hundred starts, of which 25 starts must be preceded by at least a two-hour engine shutdown. There must be at least 10 false engine starts, pausing for the applicant's specified minimum fuel drainage time, before attempting a normal start. There must be at least 10 normal restarts with not longer than 15 minutes since engine shutdown. The remaining starts may be made after completing the 150 hours of endurance testing.

(f) Rotorcraft Engines for which 30-Second OEI and 2-Minute OEI ratings are desired. For each rotorcraft engine for which 30-Second OEI and 2-Minute OEI power ratings are desired, and following completion of the tests under paragraphs (b), (c), (d), or (e) of this section, the applicant may disassemble the tested engine to the extent necessary to show compliance with the requirements of § 33.93(a). The tested engine must then be reassembled using the same parts used during the test runs of paragraphs (b), (c), (d), or (e) of this section, except those parts described as consumables in the Instructions for Continued Airworthiness. The applicant must

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then conduct the following test sequence for times, for a total time of not less than 120 minutes. The tests required in paragraphs (f)(1) through (f)(7) must be run continuously. If a stop occurs during these tests, the interrupted sequence must be repeated unless it is shown that the severity of the test is not reduced if it were continued.

* * * * *

(4) 30-minute OEI power, continuous OEI power, or maximum continuous power. Five minutes at whichever is the greatest of rated 30-minute OEI power, rated continuous OEI power, or rated maximum continuous power, except that, during the first test sequence, this period shall be 65 minutes. However, where the greatest is the 30-minute OEI power, that sixty-five minute period shall consist of 30 minutes at 30 minute OEI power followed by 35 minutes at whichever is the greater of continuous OEI power and maximum continuous power.

* * * * *

(8) Idle. One minute at flight idle.

8. § 33.88 is amended by deleting paragraph (b); by redesignating (c) and (d) as paragraph (b) and (c), respectively; and by revising the text of the new paragraph (a) and (b) as follows:

§ 33.88 Engine overtemperature test.

(a) In additional to the test requirements for the ratings as provided in paragraph (b) of this section, each engine must run for 5 minutes at maximum permissible rpm with the gas temperature at least 75 deg. F (42 deg. C) higher than the maximum rating's

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steady-state operating limit. Following this run, the turbine assembly must be within serviceable limits.

(b) Each engine for which 30-second OEI and 2-minute OEI ratings are desired, that incorporates a means for automatic temperature control within its operating limitations in accordance with 33.67(d) of this part, must be run for a period of 4 minutes at the maximum power-on rpm with the gas temperature at least 35 deg. F (19 deg. C) higher than the maximum operating limit at 30-Second OEI rating. Following this run, the turbine assembly may exhibit distress beyond the limits for an overtemperature condition provided the engine is shown by analysis or test, as found necessary by the Administrator, to maintain the integrity of the turbine assembly.

(c) A separate test vehicle may be used for each test condition.

9. Section 33.93 is amended by revising the text of the new paragraph (c) as follows:

§ 33.93 Teardown inspection.

(a) * * * * * *

(b) * * * * * *

(1) * * * * * *

(2) Each engine may exhibit deterioration in excess of that permitted in paragraph (a)(2) of this section including some engine parts or components that may be unsuitable for further use. The applicant must show by inspection, analysis, test, or by any combination thereof as found necessary by the Administrator, that structural integrity of the engine is maintained; or

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* * * * * * * * *

10. A33.4 of the Appendix A to part 33 is amended by revising the text to read as follows:

Appendix A33.4 Airworthiness Limitation Section

(a) The Instruction for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document.

(1) For all engines this section must set forth each mandatory replacement time, inspection interval, and related procedure required for type certification. If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principal manual.

(2) This section must contain a legible statement in a prominent location that reads: "The Airworthiness Limitations section is FAA approved and specifies maintenance required under Secs. 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved."

(b) For engines having 30-second and 2-minute OEI ratings,

(1) The Airworthiness Limitation Section must also prescribe the mandatory post-flight inspections and maintenance actions associated with any use of either 30-second or 2-minute OEI ratings. The adequacy of these inspections and maintenance actions must be validated, and

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(2) The applicant must establish an in-service engine evaluation program to assure the continued adequacy of the data of §33.5 pertaining to power availability, and the instructions for the mandatory post-flight inspections and maintenance actions. The program must include service engine tests or equivalent service engine test experience on engines of similar design and/or evaluations of service usage of the 30-second/2-minute OEI ratings.

Issued in Washington, DC on

Elizabeth Erickson
Director
Aircraft Certification Services

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[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 33

[Docket No. XXXXX; Notice No. XXXXXX]

RIN 2120-XXXX

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This notice proposes to amend the safety analysis type certification regulation for aircraft turbine engines. This proposal harmonizes the FAA's type certification standards on this issue with requirements of the Joint Aviation Authorities (JAA). The proposed changes, if adopted, would establish a uniform safety analysis regulation for aircraft turbine engines certified in the United States under Title 14 of the Code of Federal Regulations (14 CFR) part 33 and in the JAA countries under Joint Aviation Requirements-Engines (JAR-E), simplifying airworthiness approvals for import and export.

FOR FURTHER INFORMATION CONTACT: Ann Azevedo, Engine and Propeller Standards Staff, ANE-110, Engine and Propeller Directorate, Aircraft Certification Service, FAA, New England Region, 12 New England Executive Park, Burlington, Massachusetts 01803-5299; telephone (781) 238-7117;

fax (781) 238-7199.

SUPPLEMENTARY INFORMATION:

Background

Aviation Rulemaking Advisory Committee (ARAC) Project

The FAA is committed to undertaking and supporting the harmonization of part 33 with JAR-E. In August 1989, as a result of that commitment, the FAA Engine and Propeller Directorate participated in a meeting with the Joint Aviation Authorities (JAA), AIA, and AECMA. The purpose of the meeting was to establish a philosophy, guidelines, and a working relationship regarding the resolution of issues identified as needing to be harmonized, including some where new standards are needed. All parties agreed to work in a partnership to jointly address the harmonization effort task. This partnership was later expanded to include the airworthiness authority of Canada, Transport Canada.

This partnership identified the safety and failure analysis regulations as a Significant Regulatory Difference in need of harmonization.

This proposal has been selected as an ARAC project. The issues were assigned to the Engine Harmonization Working Group (EHWG) of the Transport Airplane and Engine Issues Group (TAEIG) on **YYYY YY, 199Y (———). On XXXX XX, 199X,** the TAEIG recommended to the FAA that it proceed with the rulemaking and associated advisory material. This NPRM and associated advisory material reflect the ARAC recommendations.

The intent of the Safety Analysis regulation

The ultimate objective of the safety analysis regulation is to ensure that the collective risk from all engine failure conditions is acceptably low. The basis is the

concept that an acceptable total engine design risk is achievable by managing the individual risks to acceptable levels. This concept emphasizes reducing the risk of a event proportionally with the severity of the hazard it represents.

Explanation of differences between the regulations

JAR-E 510 is titled "Failure analysis"; §33.75 is titled "Safety analysis." JAR-E 510 currently requires a summary listing of all failures which result in major or hazardous effects, along with an estimate of the probability of occurrence of these major and hazardous effects. Section 33.75 currently requires an assessment that any probable malfunction, failure, or improper operation will not lead to four specific hazards.

JAR-E 510 requires a list of assumptions contained within the failure analysis and the substantiation of those assumptions. Most of the JAR-E 510 assumptions are covered by other part 33 paragraphs.

JAR-E 510 references the specific hazard of toxic bleed air. This hazard is not mentioned in §33.75.

Both regulations require analysis to examine malfunctions and single and multiple failures; however, §33.75 also requires an examination of improper operation.

Outcome of harmonization effort

The harmonized regulation uses the framework of the current JAR-E 510, while including specific hazards as in the current §33.75.

Discussion of Proposed Changes

Under §33.5, a new paragraph (c) is added to reflect the new requirement for the safety analysis assumptions to be included in the engine's installation and operation manual.

Section 33.74 is revised to reflect the new ordering system of the revised §33.75, including the addition of new specific conditions to be evaluated.

Section 33.75 is entirely rewritten under the format of the current JAA equivalent rule to reflect the harmonization activity as described above.

Section 33.76 is revised to reference the specific engine conditions listed as hazardous effects within §33.75. (Note: §33.76 has not been issued at this time.)

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend part 33 of Chapter I, Title 14 of the Code of Federal Regulations as follows:

PART 33 — AIRWORTHINESS STANDARDS: AIRCRAFT ENGINES

1. In §33.5, add paragraph (c) to read as follows:

§33.5 Instruction manual for installing and operating the engine.

* * * * *

(c) Safety analysis assumptions. The assumptions of the safety analysis as described in §33.75(d) with respect to the reliability of safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures that are outside the control of the engine manufacturer.

* * * * *

2. Revise §33.74 to read as follows:

§33.74 Continued rotation.

If any of the engine main rotating systems will continue to rotate after the engine is shutdown for any reason while in flight, and if means to prevent that continued rotation are not provided; then any continued rotation during the maximum period of flight, and in the flight conditions expected to occur with that engine inoperative, must not result in any condition described in §33.75(g)(2)(i) through (vi).

3. Revise §33.75 to read as follows:

§33.75 Safety analysis.

(a) (1) An analysis of the engine, including the control system, shall be carried out in order to assess the likely consequence of all failures that can reasonably be expected to occur. This analysis will take account of –

(i) Aircraft-level devices and procedures assumed to be associated with a typical installation. Such assumptions will be stated in the analysis.

(ii) Consequential secondary failures and latent failures.

(iii) Multiple failures referred to in paragraph (d) of this section or that result in the hazardous engine effects defined in paragraph (g)(2) of this section.

(2) A summary shall be made of those failures that could result in major engine effects or hazardous engine effects as defined in paragraph (g) of this section, together with an estimate of the probability of occurrence of those effects.

(3) It shall be shown that hazardous engine effects are not predicted to occur at a rate in excess of that defined as extremely remote (probability range of 10^{-7} to 10^{-9} per engine flight hour). The estimated probability for individual failures may be insufficiently precise to enable the total rate for hazardous engine effects to be assessed. For engine certification, it is acceptable to consider that the intent of this paragraph is achieved if the probability of a hazardous engine effect arising from an individual failure can be predicted to be not greater than 10^{-8} per engine flight hour. It will also be accepted that, in dealing with probabilities of this low order of magnitude, absolute proof is not possible and reliance must be placed on engineering judgment and previous experience combined with sound design and test philosophies.

(4) It shall be shown that major engine effects are not predicted to occur at a rate in excess of that defined as remote (probability range of 10^{-5} to 10^{-7} per engine flight hour).

(b) If significant doubt exists as to the effects of failures and likely combination of failures, any assumption may be required to be verified by test.

(c) It is recognized that the probability of primary failures of certain single elements (for example, disks) cannot be sensibly estimated in numerical terms. If the failure of such elements is likely to result in hazardous engine effects, reliance must be placed on meeting prescribed integrity requirements. These instances shall be stated in the safety analysis.

(d) If reliance is placed on a safety system, such as safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures, to

prevent a failure progressing to hazardous engine effects, the possibility of a safety system failure in combination with a basic engine failure shall be covered. If items of a safety system are outside the control of the engine manufacturer, the assumptions of the safety analysis with respect to the reliability of these parts shall be clearly stated in the analysis and identified in the installation instructions under §33.5.

(e) If the acceptability of the safety analysis is dependent on one or more of the following items, they shall be identified in the analysis and appropriately substantiated.

(1) Maintenance actions being carried out at stated intervals. This includes the verification of the serviceability of items which could fail in a latent manner. These maintenance intervals must be published in the appropriate manuals. Additionally, if errors in maintenance of the engine, including the control system, could lead to hazardous engine effects, the appropriate procedures shall be included in the relevant engine manuals.

(2) Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The details of this satisfactory functioning must be published in the appropriate manual.

(3) The provisions of specific instrumentation not otherwise required.

(f) If applicable, the safety analysis shall also include, but is not limited to, investigation of:

(1) indicating equipment;

(2) manual and automatic controls;

(3) compressor bleed systems;

(4) refrigerant injection systems;

(5) gas temperature control systems;

(6) engine speed, power, or thrust governors and fuel control systems;

(7) engine overspeed, overtemp, or topping limiters;

(8) propeller control systems; and

(9) engine or propeller thrust reversal systems.

(g) Unless otherwise approved by the Administrator and stated in the safety analysis, for compliance with part 33, the following failure definitions apply to the engine:

(1) An engine failure in which the only consequence is partial or complete loss of thrust or power (and associated engine services) from the engine shall be regarded as a minor engine effect.

(2) The following effects shall be regarded as hazardous engine effects:

(i) Non-containment of high-energy debris,

(ii) Concentration of toxic products in the engine bleed air for the cabin sufficient to incapacitate crew or passengers,

(iii) Significant thrust in the opposite direction to that commanded by the pilot,

(iv) Uncontrolled fire,

(v) Failure of the engine mount system leading to inadvertent engine separation,

(vi) Release of the propeller by the engine, if applicable,

(vii) Complete inability to shut the engine down.

(3) An effect falling between those covered in (g)(1) and (2) shall be regarded as a major engine effect.

4. Section 33.76 is amended to revise paragraph (b)(3) to read as follows:

§33.76 Bird ingestion.

* * * * *

(b) * * *

(3) Ingestion of a single large bird tested under the conditions prescribed in this section must not result in any condition described in §33.75(g)(2).

* * * * *

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: **GUIDANCE MATERIAL FOR 14 CFR 33.75, SAFETY ANALYSIS.**	Date: 12/13/99 Initiated By: Ann Azevedo, ANE-110	AC No: DRAFT 33.75-1 Change:

1. **PURPOSE**. This advisory circular (AC) describes acceptable methods, but not the only methods, for demonstrating compliance with the requirements of Title 14 of the Code of Federal Regulations (14 CFR) §33. Like all AC material, this AC is not, in itself, mandatory and does not constitute a regulation. While these guidelines are not mandatory, they are derived from extensive Federal Aviation Administration (FAA) and industry experience in determining compliance with the pertinent regulations. This AC will be incorporated into AC 33-2, Aircraft Type Certification Handbook, at a later date.

2. **RELATED READING MATERIAL**.

a. AC 25.1309-1A, System Design Analysis, 6/21/88.

b. Draft Significant Airworthiness Information Bulletin (SAIB) to be issued by ANE on multi-engine maintenance.

c. Joint Airworthiness Authority (JAA) AMJ 25.1309, System Design and Analysis, xx/xx/xx.

d. Society of Automotive Engineers (SAE), Document No. ARP 4754, Certification Considerations for Highly-Integrated or Complex Aircraft Systems, issued November 1996.

e. SAE Document No. ARP 926A, Fault/Failure Analysis Procedure.

f. SAE Document No. ARP 4761, Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment, issued December 1996.

g. Carter, A.D.S., Mechanical Reliability (2nd ed.). Macmillan, 1986.

h. Systematic Safety Assessment (CAA Leaflet AD/IL/0092/1-7).

3. **APPLICABILITY**. This document is applicable to all turbine aircraft engines regulated by part 33.

4. **DEFINITIONS**. For the purposes of this AC, the following definitions are provided.

a. Analysis. A specific and detailed qualitative and/or quantitative evaluation of the engine offered for certification to determine compliance with §33.75. Examples include: Fault Tree Analysis (FTA), Failure Mode and Effects Analysis (FMEA) and Markov Analysis.

b. Assessment. A more general or broad evaluation of the engine which may include the results of the analysis completed, as well as any other information, to support compliance with §33.75.

c. Check. An examination, inspection and/or test to determine the physical integrity and/or the functional capability of an item.

d. Error. An omission or incorrect action by a crew member or people in charge of the maintenance or a mistake in requirements, design or implementation. An error may result in a failure but is not a failure in and of itself.

e. External Event. An occurrence originating apart from the engine or aircraft, including but not limited to icing or bird strikes.

f. Failure Condition. A condition with a direct, consequential engine-level effect, caused or contributed to by one or more failures. Examples include limitation of thrust to idle or oil exhaustion.

g. Failure Mode. The cause of the failure or the manner in which an item or function can fail. Examples include failures due to corrosion or fatigue, or failure in jammed open position.

h. Redundancy. Multiple independent methods incorporated to accomplish a given function, each one of which is sufficient to accomplish the function.

i. System. A combination of inter-related items arranged to perform a specific function(s).

j. Toxic Products. Products that act as or have the effect of a poison when humans are exposed to them.

5. **BACKGROUND**.

a. The ultimate objective of a safety analysis is to ensure that the risk to the aircraft from all engine failure conditions is within an acceptable range. The basis is the concept that an acceptable total engine design risk is achievable by managing the individual major and hazardous engine risks to acceptable levels. This concept emphasizes reducing the likelihood or probability of an event proportionally with the severity of its effects. The safety analysis should support the engine design goals such that there would not be major or hazardous engine effects occurring that exceed the required probability of occurrence as a result of engine failure modes.

b. Compliance with §33.75 should be shown by a safety analysis substantiated, when necessary, by appropriate testing and/or comparable service experience. An assessment may range from a simple report that offers descriptive details associated with a failure condition, an interpretation of test results, a comparison of two similar components or assemblies, other qualitative information, to a detailed safety analysis.

c. The depth and scope of an acceptable safety assessment depend on the complexity and criticality of the functions performed by the system(s), components or assemblies under consideration; the severity of related failure conditions; the uniqueness of the design and extent of relevant service experience; the number and complexity of the identified failures; and the detectability of contributing failures.

6. **SECTION 33.75 - GENERAL.**

a. Section 33.75 defines the engine-level failure conditions and presumed severity levels. Aircraft-level failure classifications are not directly applicable to engine safety assessments since the aircraft may have features that could reduce or increase the consequences of an engine failure condition. Additionally, the same type-certificated engine may be used in a variety of installations, each with different aircraft-level failure classifications.

b. Since aircraft-level requirements for individual failure conditions may be more severe than the engine-level requirements, due to installation effects, there should be early coordination between the engine manufacturer and the aircraft manufacturer, as well as the relevant FAA certification offices, to ensure that the engine may be installed in the aircraft. It is the aim of the FAA to help ensure the engine applicant is aware of possibly more restrictive regulations in the installed condition.

7. **SECTION 33.75(a)(1)**.

a. Rule Text. The regulation in §33.75(a)(1) reads as follows: **"An analysis of the engine, including the control system, shall be carried out in order to assess the likely consequence of all failures that can reasonably he expected to occur. This analysis will take account of –**

(i) Aircraft-level devices and procedures assumed to be associated with a typical installation. Such assumptions will be stated in the analysis.

(ii) Consequential secondary failures and latent failures.

(iii) Multiple failures referred to in paragraph (d) of this section or that result in the hazardous engine effects defined in paragraph (g)(2) of this section."

b. Guidance.

(1) The reference to "typical installation" in paragraph 33.75(a)(1)(i) does not imply that the aircraft-level effects are known, but that assumptions of typical aircraft devices and procedures, such as fire-extinguishing equipment, annunciation devices, etc., are clearly stated in the analysis. Such assumptions should be included in the installation instructions under paragraph 33.5(c). Regulations within the aircraft paragraphs of 14CFR (Parts 23, 25, 27, and 29) contain aircraft-level device requirements. These regulations include xx.1305, Powerplant instruments.

(2) In showing compliance with §33.75(a)(1), a component level safety analysis may be an auditable part of the design process or may be conducted specifically for demonstration of compliance with this rule.

(3) The possible latency period of failures is included in the probabilistic calculations of failure rates.

8. **SECTIONS 33.75(a)(2) and 33.75(a)(3)**.

a. Rule Text for §33.75(a)(2). The regulation in §33.75(a)(2) reads as follows: **"A summary shall be made of those failures that could result in major engine effects or**

hazardous engine effects as defined in paragraph (g) of this section, together with an estimate of the probability of occurrence of those effects."

b. Rule Text for §33.75(a)(3). The regulation in §33.75(a)(3) reads as follows: **"It shall be shown that hazardous engine effects are not predicted to occur at a rate in excess of that defined as extremely remote (probability range of 10^{-7} to 10^{-9} per engine flight hour). The estimated probability for individual failures may be insufficiently precise to enable the total rate for hazardous engine effects to be assessed. For engine certification, it is acceptable to consider that the intent of this paragraph is achieved if the probability of a hazardous engine effect arising from an individual failure can be predicted to be not greater than 10^{-8} per engine flight hour. It will also be accepted that, in dealing with probabilities of this low order of magnitude, absolute proof is not possible and reliance must be placed on engineering judgment and previous experience combined with sound design and test philosophies."**

c. Guidance.

(1) The occurrence rate of hazardous engine effects applies to each individual effect. The 10^{-7} to 10^{-9} range of probabilities for each hazardous engine effect applies to the summation of the probabilities of this hazardous engine effect arising from individual failure modes or combinations of failure modes other than the failure of critical components (i.e., disks, hubs, spacers). For example, the total rate of occurrence of uncontrolled fires, obtained by adding up the individual failure modes and combination of

failure modes leading to an uncontrolled fire, should not exceed 10^{-7}.

(2) When considering primary failures of certain single elements such as critical components, the numerical failure rate cannot be sensibly estimated. If the failure of such elements is likely to result in hazardous engine effects, reliance must be placed on their meeting the prescribed integrity requirements, such as §§33.14, 33.15 and 33.27, among others. These requirements are considered to support a design goal that, among other goals, primary LCF failure of the component should be extremely improbable (remote?) throughout its operational life. There is no requirement to include the estimated primary failure rates of such single elements in the summation of failures for each hazardous engine effect due to the difficulty in producing and substantiating such an estimate.

9. **SECTION 33.75(a)(4).**

a. Rule Text. The regulation in §33.75(a)(4) reads as follows: **"It shall be shown that major engine effects are not predicted to occur at a rate in excess of that defined as remote (probability range of 10^{-5} to 10^{-7} per engine flight hour)."**

b. Guidance. Compliance with (a)(4) can be shown if the individual failures or combinations of failures resulting in major engine effects have probabilities in the range of 10^{-5} to 10^{-7}. No summation of probabilities of failure modes resulting in the same major engine effect is required to show compliance with this rule.

10. **SECTION 33.75(h).**

a. Rule Text. The regulation in §33.75(b) reads as follows: **"If significant doubt exists as to the effects of failures and likely combination of failures, any assumption may be required to be verified by test."**

b. Guidance. Prediction of the likely progression of some engine failures may rely extensively upon engineering judgment and is not susceptible to absolute proof. If there is some question of the validity of such engineering judgment, to the extent that the conclusions of the analysis could be invalid, additional substantiation may be required. Additional substantiation may consist of reference to previous relevant service experience, engineering analysis, material, component, rig or engine test or a combination of the above. If significant doubt exists over the validity of the substantiation so provided, additional testing or other validation may be required.

11. **SECTION 33.75(c).**

a. Rule Text. The regulation in §33.75(c) reads as follows: **"It is recognized that the probability of primary failures of certain single elements (for example, disks) cannot be sensibly estimated in numerical terms. If the failure of such elements is likely to result in hazardous engine effects, reliance must be placed on meeting prescribed integrity requirements. These instances shall be stated in the safety analysis."**

b. Guidance. The intent of this section is self-evident.

12. SECTION 33.75(d).

a. Rule Text. The regulation in §33.75(d) reads as follows: **"If reliance is placed on a safety system, such as safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures, to prevent a failure progressing to hazardous engine effects, the possibility of a safety system failure in combination with a basic engine failure shall be covered. If items of a safety system are outside the control of the engine manufacturer, the assumptions of the safety analysis with respect to the reliability of these parts shall be clearly stated in the analysis and identified in the installation instructions under §33.5."**

b. Guidance. The safety system failure may be present as a latent failure, occur simultaneously with the basic engine failure, or occur subsequent to the engine failure.

13. SECTIONS 33.75(e) and 33.75(e)(1).

a. Rule Text for §33.75(e). The regulation in §33.75(e) reads as follows: **"If the acceptability of the safety analysis is dependent on one or more of the following items, they shall be identified in the analysis and appropriately substantiated."**

b. Rule Text for §33.75(e)(1). The regulation in §33.75(e)(1) reads as follows: **"Maintenance actions being carried out at stated intervals. This includes the verification of the serviceability of items which could fail in a latent manner. These maintenance intervals must be published in the appropriate manuals. Additionally, if errors in maintenance of the engine, including the control system, could lead to**

hazardous engine effects, the appropriate procedures shall be included in the relevant engine manuals."

c. Guidance.

(1) There should be general statements in the analysis summary that refer to regular maintenance in a shop as well as on the line. If specific failure rates rely on special or unique maintenance checks, those should be explicitly stated in the analysis.

(2) The engine maintenance manual, overhaul manual, or other relevant manuals may serve as the appropriate substantiation for (e)(1) above. A listing of all possible incorrect maintenance actions is not required.

d. Maintenance error lessons learned. Maintenance errors have contributed to hazardous or catastrophic effects at the aircraft level. Many of these events have arisen due to similar maintenance actions being performed on multiple engines during the same maintenance availability by one maintenance crew, and are thus primarily an aircraft-level concern. If appropriate, consideration should be given to communicating strategies against performing contemporaneous maintenance of multiple engines (see Significant Airworthiness Information Bulletin (SAIB) on multi-engine maintenance [ANE to release], ETOPS requirements, etc.) Consideration should be given to mitigating the effects of maintenance errors in the design phase. Components undergoing frequent maintenance should be designed to facilitate the maintenance and correct re-assembly. However, completely eliminating sources of maintenance error during design is not possible.

(1) The following list of multiple engine maintenance errors was constructed from situations that have repeatedly occurred in service and have caused one or more serious events:

(a) Failure to restore oil system or borescope access integrity after routine maintenance (oil chip detector or filter check). Similar consideration should be given to other systems.

(b) Mis-installation of O-rings.

(c) Servicing with incorrect fluids.

(2) Improper maintenance on parts such as disks, hubs, and spacers has led to failures resulting in hazardous effects. Examples of this which have occurred in service are overlooking existing cracks or damage during inspection and failure to apply or incorrect application of protective coatings (e.g., anti-gallant, anti-corrosive).

14. **SECTION 33.75(e)(2)**.

a. Rule Text. The regulation in §33.75(e)(2) reads as follows: **"Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The details of this satisfactory functioning must be published in the appropriate manual."**

b. Guidance. If specific failure rates rely on special or unique maintenance checks for protective devices, those should be explicitly stated in the analysis.

15. **SECTION 33.75(e)(3)**.

a. Rule Text. The regulation in §33.75(e)(3) reads as follows: **"The provisions of specific instrumentation not otherwise required."**

b. Guidance. The intent of this section is self-evident.

16. **SECTION 33.75(f)**.

a. Rule Text. The regulation in §33.75(f) reads as follows: **"If applicable, the safety analysis shall also include, but is not limited to, investigation of:**

(1) indicating equipment;

(2) manual and automatic controls;

(3) compressor bleed systems;

(4) refrigerant injection systems;

(5) gas temperature control systems;

(6) engine speed, power, or thrust governors and fuel control systems;

(7) engine overspeed, overtemp, or topping limiters;

(8) propeller control systems; and

(9) engine or propeller thrust reversal systems."

b. Guidance. The safety analysis is not limited to the items listed in §33.75(f).

17. **SECTION 33.75(g)(1)**.

a. Rule Text. The regulation in §33.75(g)(1) reads as follows: **"Unless otherwise approved by the Administrator and stated in the safety analysis, for compliance with part 33, the following failure definitions apply to the engine:**

(1) An engine failure in which the only consequence is partial or complete loss of thrust or power (and associated engine services) from the engine shall be regarded as a minor engine effect."

b. Guidance.

(1) It is generally recognized that engine failures involving complete loss of thrust or power from the affected engine can be expected to occur in service, and that, for the purposes of the engine safety analysis, the aircraft is assumed to be capable of controlled flight following such an event. Therefore, for the purpose of the engine safety analysis and engine certification, engine failure with no effect other than loss of thrust and services may be regarded as a comparatively safe failure with a minor engine effect. This assumption may be revisited during aircraft certification, where installation effects such as engine redundancy may be fully taken into consideration. This reexamination applies only to aircraft certification and is not intended to impact engine certification.

(2) The failure to achieve any given power or thrust rating for which the engine is certificated should be both covered in the safety analysis and regarded as a minor engine effect. This assumption may be revisited during aircraft certification, particularly multi-engine rotorcraft certification. This reexamination applies only to aircraft certification and is not intended to impact engine certification.

18. **SECTION 33.75(g)(2)**.

a. Rule Text for §33.75(g)(2)(i). The regulation in §33.75(g)(2)(i) reads as follows:

"The following effects shall be regarded as hazardous engine effects:

(i) Non-containment of high-energy debris,"

b. Guidance for §33.75(g)(2)(i).

(1) Uncontained debris covers a large spectrum of energy levels due to the various sizes and velocities of parts released by the engine. The engine has a containment structure which is designed to contain the release of a single blade and its consequences, and which is often adequate to contain additional released blades and static parts. The engine containment structure is not expected to contain major rotating parts should they fracture. Disks, hubs, impellers, large rotating seals, and other similar large rotating components should therefore always be considered to represent potential high-energy debris. Generally, multiple blades released, if uncontained, have used up most of their energy defeating the containment structure, and may typically be considered as low-energy debris.

(2) Fan blades may have significant residual energy after defeating the containment structure, depending on the specifics of engine size, bypass ratio, and other design elements. The choice of whether to include fan blade uncontainment under high energy (and thus, hazardous engine effects) or low energy (major engine effects) should be carefully considered.

(3) The engine casings generally provide the engine containment structure, as well as being pressure vessels. Thus, casing rupture due to pressure loads is inherently not contained by the normal blade containment provisions. Service experience has shown that the rupture of the highest pressure casings (compressor delivery pressure) can generate high-energy debris.

c. Rule Text for §33.75(g)(2)(ii). The regulation in §33.75(g)(2)(ii) reads as follows: **"Concentration of toxic products in the engine bleed air for the cabin sufficient to incapacitate crew or passengers,"**

d. Guidance for §33.75(g)(2)(ii).

(1) This effect may be interpreted as the generation and delivery of sufficient toxic products as a result of abnormal engine operation that could incapacitate the crew or passengers during the subject flight. This means that the flow of toxic products would either be so quick-acting as to be impossible to stop prior to incapacitation, and/or that there would be no effective means to stop the flow of toxic products to the crew compartment or passenger cabin, and/or that the toxic products would be undetectable prior to incapacitation. The toxic products could result, for example, from the degradation of abradable materials in the compressor when rubbed by rotating blades or the degradation of oil which would leak into the compressor air flow.

(2) No assumptions of cabin air dilution or mixing should be made in this engine-level analysis; those items can only be properly evaluated during aircraft certification. The intent of paragraph §33.75(g)(2)(ii) is to address the relative concentration of toxic

products in the engine bleed air delivery. The hazardous engine effect of toxic products relates to significant concentrations of toxic products, with "significant" defined as concentrations sufficient to incapacitate persons exposed to those concentrations.

(3) Since these concentrations are of interest to the installer, information on delivery rates and concentrations of toxic products in the engine bleed air for the cabin should be provided to the installer as part of the installation instructions.

e. Rule Text for §33.75(g)(2)(iii). The regulation in §33.75(g)(2)(iii) reads as follows:

"Significant thrust in the opposite direction to that commanded by the pilot,"

f. Guidance for §33.75(g)(2)(iii). Engine failures resulting in significant thrust in the opposite direction to that commanded by the pilot can, depending on the flight phase, result in a hazardous condition relating to aircraft controllability. Those failures, if applicable to part 33 certification, that could be classified as hazardous engine events include:

(1) Uncommanded thrust reverser deployment;

(2) Reverse propeller pitch in flight; or

(3) High forward thrust when reverse thrust is commanded.

g. Rule Text for §33.75(g)(2)(iv). The regulation in §33.75(g)(2)(iv) reads as follows:

"Uncontrolled fire,"

h. Guidance for §33.75(g)(2)(iv). An uncontrolled fire should be interpreted in this context as an extensive or persistent fire which is not effectively confined to a designated fire zone. Provision for flammable fluid drainage, fire containment, fire detection, and fire

extinguishing may be taken into account when assessing the severity of the effects of a fire.

i. Rule Text for §33.75(g)(2)(v) and (vi). The regulation in §33.75(g)(2)(v) and (vi) reads as follows:

(v) "Failure of the engine mount system leading to inadvertent engine separation,"

(vi) "Release of the propeller by the engine, if applicable,"

j. Guidance for §33.75(g)(2)(v) and (vi). The intent of these paragraphs is self-evident.

k. Rule Text for §33.75(g)(2)(vii). The regulation in §33.75(g)(2)(vii) reads as follows: **"Complete inability to shut the engine down."**

l. Guidance for §33.75(g)(2)(vii).

(1) Complete inability to shut down the engine is regarded as a hazardous engine effect due to the potential circumstances in which continued running of the engine, even at low thrust or power, represents a hazard. These circumstances include the inhibition of safe evacuation of passengers and crew, directional control problems during landing due to the inability to eliminate thrust or power, or the inability to ensure safe shut down when required following a failure.

(2) It is acceptable to take allowance for aircraft-supplied equipment (fuel cutoff means, etc.) to protect against the "complete inability" to shut down the engine. Furthermore, the inclusion of "complete inability to shut the engine down" as a hazardous

engine effect is not intended to preclude hardware or software intended to protect against inadvertent engine shutdown, including aircraft logic to mitigate against the inadvertent shutdown of all engines.

19. **SECTION 33.75(g)(3)**.

a. Rule Text. The regulation in §33.75(g)(3) reads as follows: **"An effect falling between those covered in (g)(1) and (2) shall be regarded as a major engine effect."**

b. Guidance. The following list is a guide to the scope of major engine effects. Major engine effects are likely to significantly increase crew workload, or reduce the safety margins between the engine operating condition and a hazardous engine failure. These items may not be applicable to all engines and the list is not intended to be exhaustive. Furthermore, engine design variations may result in changes to the classification of these failure conditions.

(1) Controlled fires (i.e., those brought under control by shutting down the engine or by on-board extinguishing systems).

(2) Case burnthrough where it can be shown that there is no propagation to hazardous engine effects.

(3) Release of low-energy parts where it can be shown that there is no propagation to hazardous engine effects.

(4) Vibration levels that result in crew discomfort.

(5) Concentration of toxic products in the engine bleed air for the cabin sufficient to degrade crew performance. Note: This item may be interpreted as the generation and delivery of toxic products as a result of abnormal engine operation that would incapacitate the crew or passengers, except that the toxic products are slow-enough acting and/or are readily detectable so as to be stopped by crew action prior to incapacitation. Possible reductions in crew capabilities due to their exposure while acting in identifying and stopping the toxic products shall be considered, if appropriate. Since these concentrations are of interest to the installer, information on delivery rates and concentrations of toxic products in the engine bleed air for the cabin should be provided to the installer as part of the installation instructions.

(6) Thrust in the opposite direction to that commanded by the pilot, below the level defined as hazardous.

(7) Generation of thrust greater than maximum rated thrust.

(8) Loss of engine support loadpath integrity.

(9) Significant uncontrollable thrust oscillation.

20. **OTHER CONSIDERATIONS**.

a. Improper operation. Errors in operation of the engine have resulted in hazardous or catastrophic effects at the aircraft level which otherwise would have been less serious. Consideration should be given to mitigating the effects of improper operation or to providing operating instructions that reduce the likelihood of improper operation. In

particular, abnormal engine symptoms and their desired response or appropriate procedures for trouble shooting for these symptoms should be communicated to the installer (reference §33.5).

b. Assembly. Parts, the incorrect assembly of which could result in hazardous engine effects, should be designed so as to minimize the risk of incorrect assembly, or, if this is not practical, be permanently marked so as to indicate their correct position when assembled. Additional information on this subject may be found in JAR-E Section 110.

21. ANALYTICAL TECHNIQUES.

a. The depth and scope of an acceptable safety assessment depends on the complexity and criticality of the functions performed by the system(s), components or assemblies under consideration, the severity of related failure conditions, the uniqueness of the design and extent of relevant service experience, the number and complexity of the identified causal failure scenarios, and the detectability of contributing failures.

b. This section describes various techniques for performing a safety analysis. Other comparable techniques exist and may be proposed by an applicant. Variations and/or combinations of these techniques are also acceptable. For derivative engines, it is acceptable to limit the scope of the analysis to modified components or operating conditions and their effects on the rest of the engine. Early agreement between the applicant and the engine certification office should be reached on the scope and methods of assessment to be used.

c. Various methods for assessing the causes, severity levels, and likelihood of potential failure conditions are available to support experienced engineering judgment. The various types of analyses are based on either inductive or deductive approaches. Brief descriptions of typical methods are provided below. More detailed descriptions of analytical techniques may be found in the documents referenced in paragraph 2 of this AC, Related Reading Material.

(1) Failure Modes and Effects Analysis (FMEA). A structured, inductive, bottom-up analysis which is used to evaluate the effects on the engine system of each possible element or component failure. When properly formatted, it will aid in identifying latent failures and the possible causes of each failure mode.

(2) Fault tree or Dependence Diagram (Reliability Block Diagram) Analyses. Structured, deductive, top-down analyses which are used to identify the conditions, failures, and events that would cause each defined failure condition. These are graphical methods of identifying the logical relationship between each particular failure condition and the primary element or component failures, other events, or their combinations that can cause the failure condition. A Fault Tree Analysis is failure oriented, and is conducted from the perspective of which failures must occur to cause a defined failure condition. A Dependence Diagram Analysis is success-oriented, and is conducted from the perspective of whicb failures must not occur to preclude a defined failure condition.

SIGNATURE

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Certification of 30-Second and 2-Minute One-Engine-Inoperative (OEI) Ratings for Rotorcraft Engines	Date:	AC No: 33.XX
	Initiated By: ANE-110	Change:

1. **PURPOSE** This advisory circular (AC) provides information and guidance on acceptable methods, but not the only methods of compliance for demonstrating compliance with the specific requirements applicable to 30-second and 2-minute One-Engine-Inoperative (OEI) rotorcraft engine ratings in part 33 of the Federal Aviation Regulations, Title 14 of the Code of Federal Regulations (CFR). Although this AC does refer to regulatory requirements that are mandatory, this AC is not, in itself, mandatory. This AC neither changes any regulatory requirements nor authorizes changes in or deviations from the regulatory certification requirements.

2. RELATED REGULATIONS and REFERENCES.

a. 14 CFR Part 21, Certification Procedures for Products and Parts

b. 14 CFR Part 27, Airworthiness Standards: Normal category rotorcraft, §27.45(f)

c. 14 CFR Part 29, Airworthiness Standards: Transport category rotorcraft, §29.45(f).

d. 14 CFR Part 33, Airworthiness Standards: Aircraft Engines

e. 14 CFR Part 91, General operating and flight rules, §91.3

f. Society of Automotive Engineering, Aerospace Recommended Practice, Certification Considerations for Highly-integrated or Complex Aircraft Systems, SAE ARP 4754

3. BACKGROUND.

a. The Amendment 18 of FAR 33, published in Federal Registrar on June 19, 1996, incorporated definitions of the 30-second and 2-minute OEI ratings for rotorcraft engines

in FAR 1.1, and specific type certification standards for the ratings in part 33 of 14 CFR. §33.4, 33.7, 33.29, 33.67, 33.85, 33.87, 33.88 and 33.93 were revised by this Amendment.

b. The 30-Second OEI rating provides a short burst of high power to complete the takeoff, or effect a rejected takeoff, should an engine failure occur at critical decision point so that the rotorcraft can lift clear of any obstructions in the flight path and climb out, or alternatively, to reject takeoff. Similarly, this rating also provides adequate power for rotorcraft to execute a safe landing or a balked landing if an engine fails at any point down to and including the landing decision point. The 2-minute OEI rating provides adequate power for the rotorcraft to climb out from takeoff or balked landing to a safe altitude and airspeed.

c. The ratings are optional and to be selected by the engine manufacturers among the OEI ratings available in part 33, §33.7. The significant difference between the 30-second/2-minute OEI rating and other OEI ratings of duration of 2 1/2 minutes or longer is that of limited use in service with mandatory inspection/maintenance requirement after each use of those two rating powers.

d. The subject of the type certification standards for those OEI ratings was identified as one where differences existed between the part 33 of the FAR and the Joint Aviation Requirements - Engines (JAR-E). A working group composed of representative of the Federal Aviation Administration (FAA), the Joint Aviation Authorities (JAA), Transport Canada and industry worked to produce a set of harmonized certification requirements that was incorporated into part 33 of 14 CFR. This AC is intended to provide guidance in implementing these requirements during certification.

4. GUIDANCE

§33.5 Instruction manual for installing and operating the engine.

Power performance data for rotorcraft engines having one or more OEI ratings:

(a) For rotorcraft engines having one or more OEI ratings, the applicant should provide, in the installation instructions the necessary engine data to support the installer for meeting the power availability requirements of §27.45(f) or §29.45(f). These data should include the effects of those installation losses that can be defined at the engine level. Such installation losses should include customer bleed, customer power extraction, and others as appropriate up to and including the highest power rating.

(b) The objective of this requirement is to allow the installer to ensure that the engine is capable of obtaining and sustaining the OEI ratings within the associated operating limitations. The required engine data are intended to be used for establishing a procedure for trending of individual engine performance by the operator. These data should support maintenance procedures, intervals, and standards applicable to the engine including

sensors and indicating systems, to detect those latent or dormant conditions which are not detectable through the normal rotorcraft power assurance procedures (e.g. fuel control maximum flow capability, measured turbine temperature, speed limits, etc. - -), or because the procedure will not include a topping check to the highest OEI rating power level. The dormant failures, which could lead to non availability of the rated power of the OEI ratings, should be analyzed and the results of this review should be part of the data required under 33.5(4). The adequacy of these procedures, intervals and standards, should be validated on the basis of the engine and engine systems failure modes and effects analysis (FMEA). The engine database should include a thermodynamic model, experience gained during development and certification testing, and field experience gained with this engine type or engine of similar design, when applicable.

(c.) In order to satisfy the power availability requirements of FAR 27/29.45(f) the data required under FAR 33.5 should enable the installer to establish power assurance procedures in which the extrapolation of power assurance results can be achieved from a lower power check level to the highest OEI rating power. The performance extrapolation may be accomplished by comparing the performance characteristics with the minimum acceptable engine performance in a deteriorated state. The establishment of the minimum acceptable engine performance characteristics depends on the existence of a reliable database. In a mature engine program, it is possible to use the new production engine acceptance test data, engine-to-engine variation, and also testing on engines prior to overhaul to determine the effects of deterioration. Thus, an up-to date minimum engine performance characteristic can be maintained.

For a completely new design engine, or a remote derivative of an existing design, it may be somewhat difficult to establish the initial database. The experience from engine development and certification tests could be used. This experience usually includes several thousand hours of running time to schedules which are often far more rigorous than normal commercial service. The information gathered from these tests could provide a sufficient data base for the assessment of in-service engines including the rate of deterioration. The testing of engines in production will eventually establish engine-to-engine variation, but an estimated worst variation should be assumed initially, based on the experience of engines of the same or similar design.

(d) The applicant should also provide information on methods by which to assure that engine limiter settings would not prevent the engine from reaching 30-Second or 2-Minute OEI power. These engine limiter settings may include engine speed, measured gas temperature, fuel flow, and torque.

§33.7 Engine ratings and operating limitations

(a) The 30-Second and 2-Minute OEI power ratings for rotorcraft engines are two separate ratings, however they are associated in a combined structure of 2.5 minutes duration, composed of 30 seconds at the 30-Second OEI power immediately followed by

2 minutes at the 2-Minute OEI rating power with regards to the terms of the test requirements and advisory material.

(b) The 30-Second and 2-Minute OEI ratings are optional ratings that may be specifically requested by the engine manufacturer, and are intended for use only for continuation of the one-flight operation after the failure of one engine in multiengine rotorcraft during takeoff, climb, or landing. The 30-Second OEI rating provides a short burst of high power to complete the takeoff, or to effect a rejected takeoff, should an engine failure occur at the critical decision point, so that the rotorcraft can lift clear of any obstructions in the flight path and climb out, or alternatively, to reject the takeoff. Similarly, this rating also provides adequate power for rotorcraft to execute a safe landing or a balked landing if an engine fails at any point down to and including the landing decision point. The 2-Minute OEI rating provides adequate power for the rotorcraft to climb out from takeoff to a safe altitude and airspeed or to perform a balked landing. The usage of a power level at each of the ratings is limited in duration.

(c) While the 30-Second and 2-Minute OEI ratings were originally conceived as high power ratings, using the available margins in the engine design, and followed by a mandatory engine overhaul, the experience has shown that the manufacturers provide engines which have different capabilities and use a different amount of the margins. Therefore, some flexibilities are possible in defining the mandatory maintenance actions, provided they are appropriately validated during certification.

(d) These ratings have been intended for one usage per flight in an emergency during the takeoff or landing phases. Nevertheless, the certification requirements have been defined around the worst case scenario involving the possible use of these ratings three times in one flight (i.e., the event at takeoff, balked landing, and final landing.). While not initially intended, it is recognized that the ratings could also be inadvertently used in some unexpected, non-critical conditions like an engine failure in a rotorcraft flying at a high speed cruise. In all cases, the required mandatory maintenance actions apply after any use of the rating powers.

(e) In some circumstances, the highest power used during a 2.5 minute duration OEI event might be lower than the 30-Second OEI power band but still inside the certified power of the 30-Second and 2-Minute OEI ratings power combination. In this case, it is permissible to extend the use of the 2-Minute OEI rating power to a total duration of 2.5 minutes. However, the additional 30 seconds period will be considered as a derated 30-Second OEI rating. For the required mandatory maintenance actions, see section (a) and (b) under § 33.4 of this AC and Appendix A33.4 (Airworthiness Limitations Section).

(f) The 30-Second and 2-Minute OEI power ratings must account for deterioration observed from the applicable portion of the two-hour supplementary test of Section 33.87(f). Refer to section (b) and (c) advisory material of 33.93 for additional guidance.

§33.14 Start-stop cyclic stress (low-cycle fatigue)

(a) Rotorcraft engines for which the 30-Second OEI and 2-Minute OEI ratings are desired, the applicant should provide a method to account for the low cycle fatigue effects from the usage of those two OEI ratings during the life of the engine. This may be accomplished by adding a reasonable anticipated finite numbers of cycles to the expended life of components for each of the two OEI power ratings, or by using appropriate life reduction factor(s) for engine components for each usage of the OEI rating power.

§ 33.29 Instrument Connection.

(a) The required means, provided by the engine manufacturer or by the rotorcraft manufacturer, are intended to automatically record the entry into and subsequent usage of the defined power levels, and to enable the pilot to be automatically alerted to the entry into the power levels and the corresponding impending time expiration and time expiration point. The automatic recording should be compatible with the maintenance instructions prescribed for these ratings. In particular, it should record the number of usage and time of each usage, or accumulated time, including any exceedence of 30-Second and/or 2-Minute OEI operating limitations or relevant time limitations. It should also provide a means to alert the maintenance personnel that usage and/or exceedence of the 30-Second and/or 2-Minute OEI ratings have taken place. See also paragraph (e) of §33.7 guidance of this AC regarding exceedence of the 2 minute time limitation at 2-minute OEI power.

(b) The overall development assurance level of the recording and retrieval system should be consistent with its classification of at least hazardous based on failure condition classification as defined in SAE ARP 4754. The development assurance level(s) of the components of the systems used to record usage and to retrieve the record of the 2-Minute and 30-Second OEI powers should be based on the criticality of the function(s) performed within the recording and retrieval system as determined through a system safety analysis (SSA). The overall system assurance level can be achieved based on an appropriate combination of system architecture and component assurance levels. The objective is to ensure that the information needed for the mandatory maintenance action is available after the use of OEI powers and to avoid continued operation of the engine in a potentially unsafe condition.

If the recording or retrieval system is not part of the engine, the engine type certificate holder is responsible for specifying, in the installation instructions, the required failure condition classification, system design features and interface requirements (e.g., reliability, design assurance level, software level, lightning and high energy radiated frequency, etc.), for the OEI engine data recording and retrieval system. If software is used for recording and data retrieval, the specified requirements must comply with 33.28(e)/JAR E-50(c).

(c) The recording systems should only be able to be reset by the maintenance personnel

and not by the flight crew in order to prevent further engine operation without having taken the prescribed mandatory post-flight inspection and maintenance actions.

(d) For the purpose of complying with 33.29(c), the 30-Second OEI power level is considered to be reached whenever one or more of the operating limitations applicable to the 2-Minute OEI power are exceeded. The 2-Minute OEI power level is considered to be reached whenever one or more of the operating limitations applicable to the next lower OEI rating, or other engine rating, are exceeded.

§ 33.67 Fuel system

(a) The 30-Second OEI rating is intended to provide a rotorcraft with a power reserve in the event of one engine becoming inoperative. The flight and operating conditions requiring use of this rating may create a high pilot workload to maintain safe flight. Therefore the 30-Second OEI rating must be applied and controlled by an automatic means that requires no pilot input or control other than termination command. Once activated, it automatically controls the 30-Second OEI power and prevents the engine from exceeding its limits, specified in the engine's type certificate data sheet associated with this rating. Because the 30-second OEI rating could already use almost all the available margins in the engine design, it is considered that exceeding the limits associated to this rating could result in an engine failure, which would be unacceptable in a critical flight condition with already a failed engine. This required automatic control of the 30-Second OEI power within its operating limitations is intended to avoid the need for monitoring engine parameters such as output shaft torque or power, output shaft speed, gas producer speed, and gas path temperature. 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. The engine manufacturer should not put a hard limiter on the time limit criteria, thus allowing the pilot to deal with emergency cases (e.g., §91.3(b)).

(b) The means for automatic control within the limits should not prevent the engine from reaching and maintaining its 30-Second OEI power.

§ 33.83 Vibration test

(a) §33.83 (b) prescribe the required ranges of power, and both the physical and corrected rotational speeds for vibration survey. For 2-minutes OEI rating, the test speed should be from the minimum rotational speed up to 103 percent of the maximum physical and corrected rotational speed permitted for the rating. For 30-second OEI rating, the test speed should be from the minimum rotational speed up to 100 percent of the maximum physical and corrected rotational speed permitted for the rating. All other requirements in §33.83 (b) apply to both OEI ratings.

§ 33.85 Calibration tests.

(a) Since the rotorcraft engine operation at 30-Second and 2- minute OEI ratings could significantly affect engine hardware conditions, these engine rating powers are therefore not required to comply with §33.85(a), (b), and (c). However the calibration test requirements of the short time OEI ratings (less than 2 1/2 minutes) could be satisfactorily substantiated during the endurance test without compromising the purpose of the calibration test.

(b) Any available information from tests of Section 33.87(f), 33.88, and 33.90 should also be used for establishing the engine characteristics throughout the engine's operating envelope. In particular, the power for the 30-Second and 2-Minute OEI ratings must reflect the rated power deterioration that is observed from the pre-test calibration prior to the additional endurance test of 33.87(f) through and including the third application of 30-Second rated power -- the power deterioration through the third application is expected to be the best indicator of the worst case power deterioration that could occur during actual usage of the rating, and thus should be reflected in the data given to the aircraft manufacturer to define performance characteristics of the aircraft system. In the event of power deterioration exceeding 10% at the 30-Second rating over the course of the 2-hour test, the mode of deterioration must be evaluated to ensure that the availability of 30-Second rated power in service will not be compromised by deterioration variability.

§ 33.87 Endurance test.

(a) A two-hour supplementary test of Section 33.87 (f) is added to the basic 150-hour endurance test for the rotorcraft engines for which the 30-Second OEI and 2-Minute OEI ratings are desired. The test must run on the same engine parts after completing 150-hour endurance test except for those parts defined as consumable. It is recommended that the applicant disassembles the tested engine and inspects the engine components at the conclusion of the 150-hour test but prior to the supplementary test, using the criteria specified in Section 33.93 (a). Then engine shall be subject to a second teardown inspection after completing the supplementary test, using the criteria specified in Section 33.93(b). If the applicant elects not to disassemble and inspect the engine prior to starting the supplemental test, then the teardown inspection requirements of Section 33.93(a) apply on completion of the test. The level of component cleaning to facilitate inspection prior to rebuild for the additional 2-hour endurance test must be acceptable by the cognizant ACO. It must also be shown that any cleaning during the teardown inspection, or replacement of consumable parts, will not enhance the engine's ability to meet the 33.93(b) requirements of the additional endurance test.

(b) The four test sequences are to be run continuously for the required two-hour test duration without stoppage. In the event of a stop occurring, the interrupted sequence needs to be repeated in full or can be re-started from the interrupt point if there are technical justifications acceptable to the cognizant ACO. If it is determined that the sequence needs not to be repeated in its entirety, the test should be re-started from a point where the engine thermal condition would be the same as at the time of interruption. If an

excessive number of interruptions occur, the applicant would be required to repeat the entire test.

(c) The power level of test condition (f)(4) is intended to demonstrate the highest en-route power, OEI, or non-OEI power. During scheduled accelerations and deceleration, the power or thrust control lever should be moved from one extreme position to the other in a time not more than one second. All applicable paragraphs of 33.87(a) including (a)(1) through (a)(6) must be considered in running the two-hour test.

However, for reducing test complexity, and for improved flexibility needed to attain the key parameters (speed, temperature and torque) during the test of paragraph 33.87(f), maximum air bleed for engine and aircraft services under (a)(5) need not be used if the applicant can show by test or analysis based on test that the engine's ability to meet the teardown inspection requirements of subparagraph 33.93(b)(2) is not enhanced. The analysis should include (1) the effect of the bleed air extraction to the engine secondary air system which provides cooling air to various engine components, and (2) the thermodynamic cycle effects of bleed (e.g., core speed to output shaft speed changes).

If the power turbine accessory drives are not loaded, the equivalent power must be added (as required in 33.87(a)(6)) to the required power at the output drive so that the power turbine rotor assembly is operated at or above the same levels as it would be if the power turbine accessory drives were loaded.

(d) The engine operating limitations of 30-Second and 2- minute OEI ratings defined in the type certification data sheets (TCDS) will be based on the minimum values obtained during the applications of the 2 hour test of Section 33.87(f). Due allowance should be made for stabilization time and the limits of accuracy for the instrumentation or automatic controlling system declared in accordance with Section 33.29(c) and 33.67(d).

§ 33.88 Engine overtemperature test.

(a) For the purpose of the test, the maximum power-on rpm is normally the steady state rotor speed associated with 30-Second OEI rating. However, this speed will be substituted by the transient rotor speed if the engine characteristic transient speed stabilization exceeds 3 seconds during the transition to 30-Second OEI rating power.

(b) The gas temperature increase for conducting the test (e.g. 75 degrees F in (a) or 35 degrees F in (b)) is based on turbine inlet gas temperature at the location immediately in front of the first stage high pressure turbine rotor.

(c) After the overtemperature test, the turbine assembly may exhibit distress beyond serviceable limits provided that no burst, no blade failure and no other significant failure of any engine component would occur, or become evident during the test, during shutdown, or during the subsequent teardown inspection. In the event that any potential failure becomes evident, this shall be analyzed and it shall be established by analysis or test that

the cause is not such that in service the OEI rating structure would not be satisfactorily achieved.

§ 33.93 Teardown inspection.

(a) After the additional endurance tests of section 33.87(f), the applicant should show that no failure of any significant engine component is evident during the test, during shutdown, or the subsequent teardown inspection. In the event that any failure is evident, this should be analyzed and it should be established by test or analysis or both that the cause is corrected, or certain limitations are imposed to the engine as appropriate. For the purpose of this Section, the engine parts that are deemed significant are those that can affect structural integrity, including, but not limited to mounts, cases, bearing supports, shafts, and rotors.

(b) For components which are distressed beyond serviceable limits by this test, it must be shown that the inspections and mandatory maintenance actions for these components, specified in the Instruction for these components, are adequate for maintaining continued airworthiness. The instructions should include means for proper identification of these component conditions, and appropriately defined maintenance actions. The component deterioration during the test in terms of performance effects, should be determined. The component distress seen as a result of the additional test should not indicate potentially hazardous condition. In addition to visible physical damage, non-visible damage should be assessed -- such damage may include but not necessarily be limited to the effects of creep, stress rupture, metallurgical effects, life usage, etc. This overall evaluation should then be considered when defining and justifying the inspections and mandatory maintenance actions for Continued Airworthiness Instructions.

§ 33.4 Instructions for Continued Airworthiness.

Inspection and maintenance requirements for rotorcraft engines having 30-Second and 2-Minute OEI power ratings.

(a) The maintenance actions are determined through certification testing including, where applicable, endurance tests, overspeed tests, overtemperature tests, maintenance tests and supplemented by development testing and service experience of engines of the same or similar design. Servicing information should cover maintenance details regarding servicing points, inspections, adjustments, tests, and replacement of components if required. The mandatory inspection and maintenance actions for a certified engine considered under the Appendix A33.4(b)(1) may also evolve after entering service, based on its service experience.

(b) For rotorcraft engines with 30-Second and 2-Minute OEI ratings, the Airworthiness Limitations section of the Instructions for Continued Airworthiness are required to prescribe the mandatory post-flight inspection and maintenance actions which are applicable following the use of either of these two ratings, or both, regardless of the

frequency, prior to next flight. If the 2-Minute OEI rating time period is extended to 2 1/2 minutes, the additional 30-Second period is considered as a derated 30-Second OEI rating, and the maintenance actions prescribed for the 30-Second OEI rating should be used. Alternately, the applicant may seek approval for prescribing a different set of inspection and maintenance actions for time exceedence of engine operation at the 2-Minute OEI rating, if this is appropriately justified and validated. For instance, if the engine is essentially the same as one which has a 2 ½-minute OEI rating equivalent to the new 2-Minute rating, then the maintenance considerations of the 2 ½-Minute OEI rating might also be applicable after use of the 2-Minute OEI rating for up to 2 ½ minutes. If only the accumulated usage time is to be recorded under 33.29(c)(2), the inspection and maintenance action prescribed as required by 33.4 must always be based on the total recorded time duration regardless the number of application at the ratings used in one flight.

(c) The 30-Second and 2-Minute OEI ratings were originally intended to safely use available engine design margins for brief periods of exposure with resulting allowable component deterioration beyond serviceable limits and not available for further use. The extent to which use of the ratings cause component damage or life reduction is primarily a function of engine design margins, application exposure level and duration, hardware condition prior to use, and operating environment. Because engine operation conditions and time recording are requirements for this rating, the maintenance actions can be related directly to an actual documented usage level, time, and, if applicable, known condition prior to rating application (hours/cycles/prior rating exposure, etc.). Depending on the actual operating parameters such as temperature and time exposure which are recorded during usage of these ratings in accordance with §33.29, it is possible to predefine a maintenance action and decrement of the remaining time before overhaul or component replacement, based on the type, level and duration of exposure. If the mandatory maintenance instructions result in no maintenance action, then the minimum requirement would be the interpretation of recorded event data and documentation of the data in the maintenance log(s). The Instructions for continued airworthiness should also include the definition of data to be provided by the operator to support the applicant in completing the engine in service evaluation program.

Validation of mandatory post-flight inspection and maintenance actions

(d) At any time during its service life the engine must be maintained in a condition so that the 30-Second and 2 -minute OEI ratings can be attained and sustained. This requirement has a bearing on both power assurance procedures and instructions for continued airworthiness. The mandatory maintenance following the use of 30-Second or 2-Minute OEI rating should be capable of identifying and correcting any component distress which could significantly reduce subsequent engine reliability or prevent the engine from achieving or sustaining further application of the OEI ratings. The applicant should provide evidence by endurance test results, analysis based on test data of the endurance tests, and/or other certification tests and service experience of similar type and design of engines to show that the power at 30-Second and 2-Minute OEI ratings is achievable and

can be sustained for the respective duration at any time between overhauls or major maintenance of the engine.

(e) Essential to the establishment of mandatory maintenance instructions is a thorough knowledge of the potential damage incurred with use of the 30-Second and 2-Minute OEI ratings, and more importantly the remaining margin to component failure or reduced engine performance due to use of these OEI ratings. The certification procedures for 30-Second and 2-Minute OEI ratings emphasize demonstrating design adequacy by endurance testing and by specific margin tests for turbine temperature, rotor speeds, etc. An understanding of operating margins to various failure modes when operating at the 30-Second and 2-Minute OEI ratings is needed for establishing adequate Instructions for Continued Airworthiness. These failure modes and margins should be determined and validated by appropriate methods or experience which may include but not be limited to:

- Design Analytical Predictions
- Service Experience of Identical or Similar Design
- Actual Test or Service Failure Experience
- Results of OEI Certification Tests
- Dedicated Engine and Component Tests
- FMEA Predictions

(f) Understanding of failure modes may come by service experience where hardware distress or failure was caused by known exceedence operation. Alternatively either component or engine level exceedence testing could be useful in evaluating failure mode margins, indications, power decay characteristics and severity. Approaches to establishing failure margins is very design and experience dependent and could vary greatly between engine types. One test method which illustrates the objective of failure margin assessment from the 30-Second OEI rating condition is to progressively increase engine fuel flow to the point where either an abrupt failure occurs or where power begins to decay due to component degradation. Results of such a test could establish margins to and consequence of component failure. This could be useful in establishing the appropriate maintenance instructions. Potential failure modes are design dependent however most would be related to excessive turbine temperature or engine overtorque. Some potential failure modes could include but not be limited to:

- Blade Stress Rupture
- Vane Distortion / area change
- Case distortion
- Disc, Spacer, or Seal Growth / Rub
- Creep
- Incipient Melting
- Rub Induced HCF
- Blade Release

(g) The 30-Second and 2-Minute OEI ratings are intended to safely use available engine design margins for brief periods of exposure with resulting allowable component deterioration beyond serviceable limits. The extent to which use of the ratings cause component damage or life and reliability reduction is primarily a function of engine design margins, application exposure level and duration, hardware condition prior to use and operating environment. Because engine operation conditions and time recording are requirements for this rating the maintenance actions can be related directly to an actual documented usage level, time, and if applicable, known condition prior to rating application (hours / cycles / prior rating exposure etc.). The mandatory maintenance actions may range from one extreme to the other of:

- Recording Parameters and Times in Maintenance Records
- Visual Inspection (s) and Results
- Power Assurance / Trend Check
- Reduction in Time to Overhaul or Component Change
- Addition of Special Inspection and Intervals
- Module Change / Overhaul
- Engine Removal / Overhaul

(h) The mandatory maintenance actions should provide inspection procedures which can reliably ascertain component distress and their continued airworthiness, define life reduction or require certain component replacement, repair or overhaul. Derivative engines with extensive service history can draw upon that experience coupled with OEI testing and failure mode / margin knowledge to establish maintenance requirements with a high degree of confidence. A new type design may have to rely on design / FMEA predictions, development / certification / flight test, and dedicated failure mode test experience to form the basis for establishing OEI usage maintenance requirements. These initial requirements could later be altered based upon documented service experience and or additional development test.

(i) The engine manufacturer should undertake the necessary actions including instructions in engine manuals, to make sure that the operators are aware of the need and understand the procedures to properly collect and return the information necessary for the engine manufacturer to monitor the adequacy of the prescribed mandatory maintenance actions.

Program to Validate Continued Airworthiness Instructions and Power Availability

(j) In order to comply with Section 33.4, Appendix A, an in-service engine evaluation program to assure the continued adequacy of the airworthiness instructions and of power availability must be provided and be approved by the cognizant Aircraft Certification Office (ACO) prior to certification.

The intent of this program is to obtain relevant data concerning engine hardware condition and power availability at various stages in the life of the engine hardware critical to the achievement of the ratings and to compare that data to corresponding data observed

during the certification process that defined the airworthiness instructions. Differences may exist in hardware condition and power availability characteristics from in-service engines that have not experienced any usage of the 30-Second or 2-Minute OEI ratings versus similar parameters that existed prior to the two-hour supplementary test of Section 33.87(f).

Similarly, differences may exist in hardware condition and power assurance characteristics from in-service engines after usage of the 30-Second or 2-Minute OEI ratings versus similar parameters observed following the two-hour supplementary test of Section 33.87(f).

Proper definition of the continued airworthiness instructions is expected to have anticipated and accounted for such in-service conditions -- this program should however be structured to validate that such in-service differences are properly accounted for. If the data obtained during the execution of the program indicates that the in-service differences are not properly accounted for, then the data from the program or from additional engine testing should be used to modify the instructions as appropriate.

(k) When the continued airworthiness instructions for usage of the 30-Second or 2-Minute OEI ratings are defined during the certification process, data are available from multiple sources that should be considered when defining the in-service engine evaluation program. These sources of data may include, but are not limited to the following areas:

- Whether the engine is a new type design, a derivative, or a derivative that already incorporates 30-Second and 2-Minute OEI ratings.
- Degree of applicable service experience on identical or similar designs.
- Certification and development test results -- this data will indicate if the ratings are aggressive or conservative and whether the use of the ratings causes additional distress or no distress to the engine hardware.
- Knowledge of failure modes and margins to failure.

The in-service engine evaluation program must include some type of service engine testing and/or evaluations of service usage of the 30-Second/2-Minute Ratings – although equivalent service engine test experience on engines of similar design is acceptable as an alternative. This part of the program would consist of, but not be limited to, one or more of the following elements.

- Scheduled tests of in-service engines (3 applications of 30-Second OEI rated power), while either installed in the rotorcraft or in an engine test cell. For selected representative aged engines the program would include number and frequency of samples, as well as inspection/test requirements. Such requirements may include recording of data with respect to available power, power assurance validation, and hardware condition before/after 30-Second and 2-Minute OEI rating usage.

- Unscheduled tests of engines of opportunity (3 applications of 30-Second OEI rated power). The program may include actions to be taken when engines become available that meet certain predetermined criteria. Definition of selection criteria for representative aged engines should be included in the program. Inspection/test requirements on such engines **should** include **the** recording of data with respect to available power and the identification of the hardware condition before/after 30-Second and 2-Minute OEI rating usage.
- Service usage of 30-Second/2-Minute OEI rated power. This may include recorded power available data, post usage power available data, and results of the mandatory maintenance and inspection actions.
- The equivalent service test on engines of similar design is acceptable, although representativity must be assessed.

The aircraft certification testing of the 30-second and/or 2-minute OEI ratings could also provide additional recorded data with respect to available power, post-usage power available data and results of hardware maintenance and inspection of the engine(s) to support the program. In addition to the in-service engine tests, the in-service engine evaluation program may also include test evidence from development or certification test to reduce, but not eliminate, the number of service engines required for the in-service engine evaluation program.

During the execution of the in-service engine evaluation program, the continuing airworthiness instructions should be modified as needed based on the results obtained. Similarly if circumstances warrant, the program itself may need to be modified as additional in-service data becomes available.

(l) The information or actions needed from the operator to support this in-service engine evaluation program of paragraph (b)(2) may be prescribed in the Airworthiness Limitations section.

Jay J. Pardee
Manager, Engine and Propeller Directorate
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Part VII

Department of Transportation

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14 CFR Part 33

Airworthiness Standards: Safety Analysis; Final Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration.

14 CFR Part 33

[Docket No. FAA–2006–25376; Amendment No. 33–24]

RIN 2120–A174

Airworthiness Standards: Safety Analysis

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: The FAA is amending the safety analysis type certification standard for turbine aircraft engines. This rule establishes a nearly uniform safety analysis standard for turbine aircraft engines certified in the United States under part 33 and in European countries under the Certification Specifications for Engines, thereby simplifying airworthiness approvals for import and export.

DATES: This amendment becomes effective November 5, 2007.

FOR FURTHER INFORMATION CONTACT: Robert Grant, Engine and Propeller Directorate, Engine and Propeller Directorate Standards Staff, ANE–110, Federal Aviation Administration, 12 New England Executive Park, Burlington, Massachusetts 01803–5299; telephone: (781) 238–7757; facsimile: (781) 238–7199; e-mail: *robert.grant@faa.gov.*

SUPPLEMENTARY INFORMATION:

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by:

(1) Searching the Department of Transportation's electronic Docket Management System (DMS) Web page (*http://dms.dot.gov/search*);

(2) Visiting the FAA's Regulations and Policies Web page at *http://www.faa.gov/regulations_policies/;* or

(3) Accessing the Government Printing Office's Web page at *http://www.gpoaccess.gov/fr/index.html.*

You can also get a copy by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the amendment number or docket number of this rulemaking.

Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–78) or you may visit *http://dms.dot.gov.*

Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. If you are a small entity and you have a question regarding this document, you may contact your local FAA official, or the person listed under **FOR FURTHER INFORMATION CONTACT**. You can find out more about SBREFA on the Internet at *http://www.faa.gov/regulations_policies/rulemaking/sbre_act/.*

Authority for This Rulemaking

The FAA's authority to issue rules regarding aviation safety is found in Title 49 of the United States Code. Subtitle I, Section 106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in Subtitle VII, Part A, Subpart III, Section 44701, ''General requirements.'' Under that section, Congress charges the FAA with promoting safe flight of civil aircraft in air commerce by prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce, including minimum safety standards for aircraft engines. This rule is within the scope of that authority because it updates the existing regulations for the safety analysis type certification standard for turbine aircraft engines.

Background

On July 18, 2006, the FAA published a notice of proposed rulemaking (NPRM) entitled Airworthiness Standards: Safety Analysis (71 FR 40675). The NPRM proposed to establish engine safety analysis requirements consistent with those adopted by the European Aviation Safety Agency (EASA) in its Certification Specifications for Engines (CS–E).

These new engine safety analysis requirements will ensure that the collective risk from all engine failure conditions is acceptably low. Early coordination between the engine manufacturer and the appropriate FAA certification offices is necessary to determine if more restrictive aircraft standards will apply to the installed engine.

Summary of Comments

The FAA received three comment letters in response to the NPRM. The commenters included General Electric, Rolls-Royce, and Transport Canada Civil Aviation (TCCA).

The commenters supported the rule, but suggested minor changes. Two commenters requested changes to make our regulation more consistent with EASA's regulation. In response, we made changes to paragraphs 33.75(a)(2) and (c) and added a new paragraph (e)(4). A few comments requested changes that go beyond the scope of the proposed rule. We made no changes to the rule in response to these comments.

Discussion of the Final Rule

Section 33.74

We revised § 33.74 to update a reference to § 33.75 that incorporates changes to the hazardous engine effects in § 33.75.

General Electric asserted that an acceptable probability range for a hazardous condition should be added to this section for consistency with the new § 33.75.

We do not agree. The change to § 33.74 is limited to updating the reference to § 33.75 to reflect changes to hazardous engine effects in § 33.75(g)(2)(i) through (g)(2)(vi). The suggested change is beyond the scope of this rulemaking. No changes were made to the rule due to this comment.

Section 33.75

This final rule establishes engine safety analysis requirements consistent with those adopted by the EASA in its Certification Specifications for Engines. These new engine safety analysis requirements will ensure that the collective risk from all engine failure conditions is acceptably low.

Section 33.75(a)

Rolls-Royce noted that the equivalent EASA rule for engine safety analysis requires that any engine part whose failure could result in a hazardous engine effect must be clearly identified.

We agree and changed § 33.75(a)(2) to more clearly identify engine parts whose failure could result in a hazardous engine effect. This change harmonizes § 33.75(a) with CS–E 510(a).

Section 33.75(c)

Rolls-Royce commented that the equivalent EASA rule specifically referenced the CS–E section that

contains integrity requirements. Rolls-Royce believes that the proposed FAA rule will create confusion by not specifying the section where integrity requirements are located.

We agree and changed § 33.75(c) to directly reference part 33 integrity requirements in §§ 33.15, 33.27, and 33.70. This change harmonizes § 33.75(c) with CS–E 510(c).

Section 33.75(e)

TCCA noted that one of the items that a safety analysis depends on is present in the EASA regulations but not in the proposed text of § 33.75(e). TCCA suggested adding a statement to § 33.75(e) referencing ''Flight crew actions to be specified in the operating instructions established under § 33.5.''

We agree with this comment. When the safety analysis depends on action by the flight crew, an appropriate reference should be made to § 33.5. Therefore, we added new paragraph (e)(4) to § 33.75. This change harmonizes § 33.75(e)(4) with CS–E 510(e)(4).

Section 33.75(f)

Rolls Royce noted that it did not understand the significance of the differences between the EASA standard CS–E 510(f) and § 33.75(f) regarding items that must be investigated in the safety analysis. Specifically, CS–E 510(f)(2) lists ''aircraft-supplied data or electrical power'' as an item that must be considered in the safety analysis while § 33.75(f)(2) does not include this item and, instead, references ''manual and automatic controls.''

We believe that the assessment of failures of aircraft data or power required by the EASA rule is beyond the scope of § 33.75, which applies only to single-engine failure assessments. Within § 33.75, the effect of an engine failure is assessed, including the effects of manual and automatic control failures. No changes were made to the rule due to this comment.

Section 33.75(g)

Rolls-Royce requested clarification or deletion of the wording in § 33.75(g), ''Unless otherwise approved by the FAA and stated in the safety analysis'' as there is no corresponding wording in CS–E 510(g).

We recognize the difference in this case between FAA and EASA regulations and believe there is a need to keep the current wording in § 33.75(g). The current wording in § 33.75(g) allows for recognition of cases where the applicant may show that certain defined hazards may be of lesser or greater severity due to the applicant's design. No changes were made to the rule due to this comment.

Section 33.75(g)(1)

Rolls-Royce commented that in some installations (for example, single-engine aircraft) complete loss of power or thrust in a single engine can lead to an event more severe than a minor engine effect. Rolls-Royce requested a change to the rule to allow for this situation.

We do not agree with the requested change. Within part 33, the effects of engine failures are assessed at the engine level. In aircraft certification, how the engine is installed in the aircraft is considered in the evaluation of the effect on the aircraft of engine failures. No changes were made to the rule due to this comment.

Section 33.75(g)(2)

Section 33.75(g)(2) provides a list of effects that will be regarded as hazardous engine effects. TCCA recommends rewording the hazardous engine effects related to engine shutdown to emphasize the need for basic engine fuel control. TCCA also believes that no credit is given for aircraft-installed means to shut down the engine. TCCA, therefore, suggested that FAA change the wording of § 33.75(g)(2)(vii), which currently reads ''Complete inability to shut the engine down,'' to read ''Lose the capability to shut down the engine.''

We disagree with the suggested change in the rule language. The intent of § 33.75(g)(2) is to define hazardous engine effects not to govern the means to control the hazardous engine effect. Section 33.75(a)(1)(i) allows aircraft-level devices assumed to be associated with a typical installation to be taken into account in the safety analysis. No changes were made to the rule due to this comment.

Rulemaking Analyses and Notices

Paperwork Reduction Act

An agency may not collect or sponsor the collection of information, nor may it impose an information collection requirement unless it displays a currently valid Office of Management and Budget (OMB) control number.

There are no current or new requirements for information collection associated with this amendment.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified no differences with these regulations.

Economic Assessment, Regulatory Flexibility Determination, Trade Impact Assessment, and Unfunded Mandates Assessment

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act requires agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this final rule. We suggest readers seeking greater detail read the full regulatory evaluation, a copy of which we have placed in the docket for this rulemaking.

In conducting these analyses, FAA has determined that this final rule: (1) Has benefits that justify its costs, (2) is not an economically ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, (3) is not ''significant'' as defined in DOT's Regulatory Policies and Procedures; (4) will not have a significant economic impact on a substantial number of small entities; (5) will not create unnecessary obstacles to the foreign commerce of the United States; and (6) will not impose an unfunded mandate on state, local, or tribal governments, or on the private sector by exceeding the threshold identified above. These analyses are summarized below.

Benefit Cost Summary

The FAA estimates that over the next 10 years, the total quantitative benefits

from implementing this final rule are roughly $0.7 million ($0.5 million present value). In contrast to these potential benefits, the estimated cost of compliance is approximately $0.4 million ($0.3 million present value).

Accordingly, this final rule is cost beneficial due to the overall reduction in compliance cost while maintaining the same level of safety.

Who Is Potentially Affected by This Rulemaking

Part 33 Engine Manufacturers.

Assumptions

Period of analysis—2007 through 2016.

Discount rate—7%.

Benefits

We evaluate the benefits that will occur from harmonization and estimate them in terms of cost savings for new and amended type certificates. The cost savings are the result of the number of hours saved from a common certification process.

The total benefits of this final rule are $0.7 million ($0.5 million present value). The benefits are comprised of benefits from certifying new type designs of $82,125 ($59,632 present value) and benefits from certifying amended type designs of $589,875 ($428,314 present value).

Costs

One part 33 turbine engine manufacturer told the FAA that it will incur additional certification costs as a result of this final rule. According to this manufacturer, it will certificate one new engine every two years, and this final rule will require an additional 1,000 engineering hours to certify each engine. The estimated biannual cost equals the 1,000 hours multiplied by the burdened hourly cost for a certification engineer ($75.00). When the biannual costs are summed over a 10-year period, the total costs are $375,000 ($272,291 present value).

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration.'' The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA.

However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The FAA uses the size standards from the Small Business Administration for Air Transportation and Aircraft Manufacturing specifying companies having less than 1,500 employees as small entities in its classification. There are part 33 engine manufacturers who qualify as small businesses but will not incur costs associated with this final rule. These manufacturers will realize a prorated portion of the cost saving resulting from a single harmonized certification procedure. Although one manufacturer will incur costs as a result of this rule, this manufacturer employs more than 1,500 employees and is not considered a small entity. Therefore, as the FAA Administrator, I certify that this final rule will not have a significant economic impact on a substantial number of small entities.

Trade Impact Assessment

The Trade Agreements Act of 1979 prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards.

This final rule considers and incorporates an international standard as the basis of a FAA regulation. Thus this final rule complies with the Trade Agreements Act of 1979 and does not create unnecessary obstacles to international trade.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub.L. 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (adjusted annually for inflation with the base year 1995) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.'' The FAA currently uses an inflation-adjusted value of $128.1 million in lieu of $100 million.

The FAA has assessed the potential effect of this final rule and determined that it does not contain such a mandate. Therefore, the requirements of Title II of the Unfunded Mandates Reform Act of 1995 do not apply.

Executive Order 13132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action will not have a substantial direct effect on the States, or the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government, and therefore does not have federalism implications.

Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 312d and involves no extraordinary circumstances.

Regulations that Significantly Affect Energy Supply, Distribution, or Use

The FAA has analyzed this final rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). We have determined that it is not a ''significant energy action'' under the executive order because it is not a ''significant regulatory action'' under Executive Order 12866, and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

List of Subjects in 14 CFR Part 33

Air transportation, Aircraft, Aviation safety, Safety.

The Amendment

■ In consideration of the foregoing, the Federal Aviation Administration amends part 33 of Title 14 Code of Federal Regulations (14 CFR part 33) as follows:

PART 33—AIRWORTHINESS STANDARDS: AIRCRAFT ENGINES

■ 1. The authority citation for part 33 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44704.

■ 2. In § 33.5, add paragraph (c) to read as follows:

§ 33.5 Instruction manual for installing and operating the engine.

* * * * *

(c) Safety analysis assumptions. The assumptions of the safety analysis as described in § 33.75(d) with respect to the reliability of safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures that are outside the control of the engine manufacturer.

■ 3. Revise § 33.74 to read as follows:

§ 33.74 Continued rotation.

If any of the engine main rotating systems continue to rotate after the engine is shutdown for any reason while in flight, and if means to prevent that continued rotation are not provided, then any continued rotation during the maximum period of flight, and in the flight conditions expected to occur with that engine inoperative, may not result in any condition described in § 33.75(g)(2)(i) through (vi) of this part.

■ 4. Revise § 33.75 to read as follows:

§ 33.75 Safety analysis.

(a) (1) The applicant must analyze the engine, including the control system, to assess the likely consequences of all failures that can reasonably be expected to occur. This analysis will take into account, if applicable:

(i) Aircraft-level devices and procedures assumed to be associated with a typical installation. Such assumptions must be stated in the analysis.

(ii) Consequential secondary failures and latent failures.

(iii) Multiple failures referred to in paragraph (d) of this section or that result in the hazardous engine effects defined in paragraph (g)(2) of this section.

(2) The applicant must summarize those failures that could result in major engine effects or hazardous engine effects, as defined in paragraph (g) of this section, and estimate the probability of occurrence of those effects. Any engine part the failure of which could reasonably result in a hazardous engine effect must be clearly identified in this summary.

(3) The applicant must show that hazardous engine effects are predicted to occur at a rate not in excess of that defined as extremely remote (probability range of 10^{-7} to 10^{-9} per engine flight hour). Since the estimated probability for individual failures may be insufficiently precise to enable the applicant to assess the total rate for hazardous engine effects, compliance may be shown by demonstrating that the probability of a hazardous engine effect arising from an individual failure can be predicted to be not greater than 10^{-8} per engine flight hour. In dealing with probabilities of this low order of magnitude, absolute proof is not possible, and compliance may be shown by reliance on engineering judgment and previous experience combined with sound design and test philosophies.

(4) The applicant must show that major engine effects are predicted to occur at a rate not in excess of that defined as remote (probability range of 10^{-5} to 10^{-7} per engine flight hour).

(b) The FAA may require that any assumption as to the effects of failures and likely combination of failures be verified by test.

(c) The primary failure of certain single elements cannot be sensibly estimated in numerical terms. If the failure of such elements is likely to result in hazardous engine effects, then compliance may be shown by reliance on the prescribed integrity requirements of §§ 33.15, 33.27, and 33.70 as applicable. These instances must be stated in the safety analysis.

(d) If reliance is placed on a safety system to prevent a failure from progressing to hazardous engine effects, the possibility of a safety system failure in combination with a basic engine failure must be included in the analysis. Such a safety system may include safety devices, instrumentation, early warning devices, maintenance checks, and other similar equipment or procedures. If items of a safety system are outside the control of the engine manufacturer, the assumptions of the safety analysis with respect to the reliability of these parts must be clearly stated in the analysis and identified in the installation instructions under § 33.5 of this part.

(e) If the safety analysis depends on one or more of the following items, those items must be identified in the analysis and appropriately substantiated.

(1) Maintenance actions being carried out at stated intervals. This includes the verification of the serviceability of items that could fail in a latent manner. When necessary to prevent hazardous engine effects, these maintenance actions and intervals must be published in the instructions for continued airworthiness required under § 33.4 of this part. Additionally, if errors in maintenance of the engine, including the control system, could lead to hazardous engine effects, the appropriate procedures must be included in the relevant engine manuals.

(2) Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The details of this satisfactory functioning must be published in the appropriate manual.

(3) The provisions of specific instrumentation not otherwise required.

(4) Flight crew actions to be specified in the operating instructions established under § 33.5.

(f) If applicable, the safety analysis must also include, but not be limited to, investigation of the following:

(1) Indicating equipment;

(2) Manual and automatic controls;

(3) Compressor bleed systems;

(4) Refrigerant injection systems;

(5) Gas temperature control systems;

(6) Engine speed, power, or thrust governors and fuel control systems;

(7) Engine overspeed, overtemperature, or topping limiters;

(8) Propeller control systems; and

(9) Engine or propeller thrust reversal systems.

(g) Unless otherwise approved by the FAA and stated in the safety analysis, for compliance with part 33, the following failure definitions apply to the engine:

(1) An engine failure in which the only consequence is partial or complete loss of thrust or power (and associated engine services) from the engine will be regarded as a minor engine effect.

(2) The following effects will be regarded as hazardous engine effects:

(i) Non-containment of high-energy debris;

(ii) Concentration of toxic products in the engine bleed air intended for the cabin sufficient to incapacitate crew or passengers;

(iii) Significant thrust in the opposite direction to that commanded by the pilot;

(iv) Uncontrolled fire;

(v) Failure of the engine mount system leading to inadvertent engine separation;

(vi) Release of the propeller by the engine, if applicable; and

(vii) Complete inability to shut the engine down.

(3) An effect whose severity falls between those effects covered in paragraphs (g)(1) and (g)(2) of this section will be regarded as a major engine effect.

■ 5. Amend § 33.76 to revise paragraph (b)(3) to read as follows:

§ 33.76 Bird ingestion.

* * * * *

(b) * * *

(3) Ingestion of a single large bird tested under the conditions prescribed in this section may not result in any condition described in § 33.75(g)(2) of this part.

* * * * *

Issued in Washington, DC on August 27, 2007.

Marion Blakey,

Administrator.

[FR Doc. E7–17372 Filed 8–31–07; 8:45 am]

BILLING CODE 4910–13–P

Proposed Rules

Federal Register
Vol. 72, No. 86
Friday, May 4, 2007

This section of the FEDERAL REGISTER contains notices to the public of the proposed issuance of rules and regulations. The purpose of these notices is to give interested persons an opportunity to participate in the rule making prior to the adoption of the final rules.

DEPARTMENT OF AGRICULTURE

Agricultural Marketing Service

7 CFR Part 955

[Docket No. AMS–FV–07–0040; FV07–955–1]

Vidalia Onions Grown in Georgia; Continuance Referendum

AGENCY: Agricultural Marketing Service, USDA.

ACTION: Referendum order.

SUMMARY: This document directs that a referendum be conducted among eligible growers of Vidalia onions in Georgia, to determine whether they favor continuance of the marketing order regulating the handling of Vidalia onions grown in the production area.

DATES: The referendum will be conducted from September 10 to September 28, 2007. To vote in this referendum, growers must have been producing Vidalia onions within the designated production area in Georgia during the period January 1, 2006, through December 31, 2006.

ADDRESSES: Copies of the marketing order may be obtained from the office of the referendum agents at the Southeast Marketing Field Office, Marketing Order Administration Branch, Fruit and Vegetable Division, Agricultural Marketing Service, U.S. Department of Agriculture, 799 Overlook Dr., Suite A, Winter Haven, FL 33884–1671, Fax: (863) 325–8793, or the Office of the Docket Clerk, Marketing Order Administration Branch, Fruit and Vegetable Programs, AMS, USDA, 1400 Independence Avenue, SW., STOP 0237, Washington, DC 20250–0237; Fax: (202) 720–8938, or Internet: *http://www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT: Doris Jamieson, Marketing Specialist, or Christian D. Nissen, Regional Manager, Southeast Marketing Field Office, Marketing Order Administration Branch, Fruit and Vegetable Programs, AMS, USDA; Telephone: (863) 324–3375, Fax: (863) 325–8793 or E-mail: *Doris.Jamieson@usda.gov* or *Christian.Nissen@usda.gov,* respectively.

SUPPLEMENTARY INFORMATION: Pursuant to Marketing Agreement and Order No. 955 (7 CFR part 955), hereinafter referred to as the ''order,'' and the applicable provisions of the Agricultural Marketing Agreement Act of 1937, as amended (7 U.S.C. 601–674), hereinafter referred to as the ''Act,'' it is hereby directed that a referendum be conducted to ascertain whether continuance of the order is favored by the growers. The referendum shall be conducted from September 10 to September 28, 2007, among Vidalia onion growers in the production area. Only growers that were engaged in the production of Vidalia onions in Georgia, during the period of January 1 to December 31, 2006, may participate in the continuance referendum.

USDA has determined that continuance referenda are an effective means for determining whether growers favor continuation of marketing order programs. USDA would consider termination of the order if less than two-thirds of the growers voting in the referendum, and growers of less than two-thirds of the volume of Vidalia onions represented in the referendum favor continuance. In evaluating the merits of continuance versus termination, USDA will consider the results of the continuance referendum and other relevant information regarding operation of the order. USDA will evaluate the order's relative benefits and disadvantages to growers, handlers, and consumers to determine whether continuing the order would tend to effectuate the declared policy of the Act.

In accordance with the Paperwork Reduction Act of 1995 (44 U.S.C. Chapter 35), the ballot materials to be used in the referendum herein ordered, are currently approved by the Office of Management and Budget (OMB), under OMB No. 0581–0178, Vegetable and Specialty Crops. It has been estimated that it will take an average of 20 minutes for each of the approximately 101 growers of Vidalia onions in Georgia to cast a ballot. Participation is voluntary. Ballots postmarked after September 28, 2007, will not be included in the vote tabulation.

Christian D. Nissen and Doris Jamieson of the Southeast Marketing Field Office, Fruit and Vegetable Programs, AMS, USDA, are hereby designated as the referendum agents of the Secretary of Agriculture to conduct this referendum. The procedure applicable to the referendum shall be the ''Procedure for the Conduct of Referenda in Connection With Marketing Orders for Fruits, Vegetables, and Nuts Pursuant to the Agricultural Marketing Agreement Act of 1937, as Amended'' (7 CFR part 900.400 *et seq*).

Ballots will be mailed to all growers of record and may also be obtained from the referendum agents, or from their appointees.

List of Subjects in 7 CFR Part 955

Marketing agreements, Onions, Reporting and recordkeeping requirements.

Authority: 7 U.S.C. 601–674.

Dated: May 1, 2007.

Lloyd C. Day,

Administrator, Agricultural Marketing Service.

[FR Doc. E7–8573 Filed 5–3–07; 8:45 am]

BILLING CODE 3410–02–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1 and 33

[Docket No. FAA–2007–27899; Notice No. 07–05]

RIN 2120–AI96

Airworthiness Standards: Rotorcraft Turbine Engines One-Engine-Inoperative (OEI) Ratings, Type Certification Standards

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: The Federal Aviation Administration (FAA) is proposing to amend OEI rating definitions and type certification standards for 30-second OEI, 2-minute OEI, and 30-minute OEI ratings for rotorcraft turbine engines. This proposed rule, if adopted, would revise the ratings' standards to reflect recent analyses of the ratings' usage and lessons learned from completed engine

certifications and service experience. This proposal harmonizes FAA type certification standards for these ratings with the requirements of the European Aviation Safety Agency in the Certification Specifications for Engines (CS–E) and with proposed requirements for Transport Canada Civil Aviation. If adopted, the proposed changes would establish nearly uniform certification standards for ratings for rotorcraft turbine engines certificated in the United States under part 33 and in European countries under CS–E, thus simplifying airworthiness approvals for import and export.

DATES: Send your comments on or before August 2, 2007.

ADDRESSES: You may send comments, identified by Docket No. FAA–2007–27899, using any of the following methods:

- *DOT Docket Web site:* Go to *http://dms.dot.gov* and follow the instructions for sending your comments electronically.
- *Government-wide rulemaking Web site:* Go to *http://www.regulations.gov* and follow the instructions for sending your comments electronically.
- *Mail:* Docket Management Facility; U.S. Department of Transportation, 400 Seventh Street, SW., Nassif Building, Room PL–401, Washington, DC 20590–0001.
- *Fax:* 1–202–493–2251.
- *Hand Delivery:* Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

For more information on the rulemaking process, see the **SUPPLEMENTARY INFORMATION** section of this document.

Privacy: We will post all comments we receive, without change, to *http://dms.dot.gov,* including any personal information that you provide. For more information, see the Privacy Act discussion in the **SUPPLEMENTARY INFORMATION** section of this document.

Docket: To read background documents or comments received, go to *http://dms.dot.gov* at any time or to Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Dorina Mihail, Engine and Propeller Standards Staff, ANE–110, Engine and Propeller Directorate, Aircraft Certification Service, FAA, New England Region, 12 New England Executive Park, Burlington, Massachusetts 01803–5229; (781) 238–7153; facsimile: (781) 238–7199; e-mail: *dorina.mihail@faa.gov.*

SUPPLEMENTARY INFORMATION:

Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. We also invite comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. We ask that you send us two copies of written comments.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. The docket is available for public inspection before and after the comment closing date. If you wish to review the docket in person, go to the address in the **ADDRESSES** section of this preamble between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. You may also review the docket using the Internet at the Web address in the **ADDRESSES** section.

Privacy Act: Using the search function of our docket Web site, anyone can find and read the comments received into any of our dockets, including the name of the individual sending the comment (or signing the comment on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477–78) or you may visit *http://dms.dot.gov.*

Before acting on this proposal, we will consider all comments we receive on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay. We may change this proposal in light of the comments we receive.

If you want the FAA to acknowledge receipt of your comments on this proposal, include with your comments a pre-addressed, stamped postcard on which the docket number appears. We will stamp the date on the postcard and mail it to you.

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by:

1. Searching the Department of Transportation's electronic Docket Management System (DMS) Web page (*http://dms.dot.gov/search*):

2. Visiting the FAA's Regulations and Policies Web page at *http://www.faa.gov/regulations_policies/*; or

3. Accessing the Government Printing Office's Web page at *http://www.access.gpo.gov/su_docs/aces/aces140.html.*

You can also get a copy by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the docket number, notice number, or amendment number of this rulemaking.

Background

The One-Engine-Inoperative (OEI) rating powers provide rotorcraft with higher than takeoff and maximum continuous rating powers during takeoff, cruise, and landing when one or more engines of a multi-engine rotorcraft fails or is shutdown. These OEI rating powers enable the rotorcraft to continue safe flight until it reaches a suitable landing site. Part 33 prescribes airworthiness standards for 30-second OEI, 2-minute OEI, 2½-minute OEI, 30-minute OEI, and other OEI ratings for the issuance of type certificates for rotorcraft turbine engines. All OEI ratings are optional ratings that engine manufacturers may select from those specified in § 33.7.

The Certifications Specifications—Engines prescribe corresponding airworthiness standards of the European Aviation Safety Agency for these ratings. While these standards are similar, they differ in certain regulations. Non-uniform standards impose a regulatory hardship on applicants seeking certification under both sets of standards in the form of additional costs and delays in the time required for certification.

The FAA is committed to promoting harmonization. As part of this commitment, the FAA, with the European Joint Aviation Authorities (JAA) and Transport Canada Civil Aviation, developed a harmonized Terms of Reference for ''2-Minute and 30-Second One-Engine-Out Ratings'' in April 1992. The Terms of Reference established a joint effort to review and harmonize the requirements and interpretations for OEI ratings under part 33 and the corresponding Joint Aviation Requirements—Engines (JAR–E). The Aviation Rulemaking Advisory Committee (ARAC) assigned the task of harmonizing the differing OEI ratings to its Engine Harmonization Working Group, which consisted of representatives from the FAA, JAA, TC,

as well as from U.S., Canadian, and European industries.

On February 29, 2000, the Engine Harmonization Working Group reported its recommendations to the ARAC, which recommended that the FAA proceed with rulemaking. This NPRM reflects the ARAC recommendations.

Section-by-Section Discussion of the Proposals

The working group developed and agreed to the following proposals. The proposed changes to parts 1 and 33 contain language similar to that proposed for JAR–E, and subsequently adopted in the CS–E, thereby establishing equivalency and creating consistency between the regulations.

Section 1.1 Definitions

The current definitions of rated OEI powers refer to engine failure but not to engine shutdown. We are proposing, therefore, to revise the definition of rated 30-second OEI, rated 2-minute OEI, rated 2½-minute OEI, rated 30-minute OEI, and rated continuous OEI powers to include engine shutdown. In addition, to be consistent with the usage definitions of 30-second OEI and 2-minute OEI ratings, we are proposing to revise the ''period of use'' for the 2½-minute OEI rating from ''a period of use'' to ''periods of use.''

Section 33.5 Instruction Manual for Installing and Operating the Engine

We are proposing to add a new § 33.5(b)(4), applicable to rotorcraft engines having one or more OEI ratings, which would require applicants to provide engine data to aircraft manufacturers in support of aircraft power availability requirements, such as those specified in §§ 27.45(f) and 29.45(f). Since the power assurance data will not include a check of the highest OEI rating power level due to potential rapid engine hardware deterioration, the applicant must provide the necessary engine performance characteristics and variability to the engine installer. This data will enable the installer to establish power assurance procedures that enable the extrapolation of data to the highest OEI rating power. The engine database should include: a thermodynamic model; data gained from experience during development and certification testing; and data derived from service experience from engines of similar design, whenever applicable.

Section 33.29 Instrument Connection

We are proposing to revise § 33.29(c) to specify that the applicant must provide a means or a provision for a means to record the entry into the defined 30-second OEI and 2-minute OEI rating power bands. The applicant, for example, an engine manufacturer, may satisfy ''a means'' by providing a recorder to record entry into the OEI power bands. Alternatively, the applicant may fulfill ''a provision for a means'' by specifying that the installer provide a recorder to record entry into the OEI power bands.

The revised proposal would also require a means to indicate to the pilot the entry into the power bands, the corresponding impending time expiration, and the time expiration point. The automatic recording system must record the number of usages of 30-second OEI and/or 2-minute OEI rating powers and the time of each usage, or accumulated time, including any exceedance of 30-second OEI and 2-minute OEI operating limitations or relevant time limitations.

The automatic recording system should also provide a means to alert the maintenance personnel that the usage and/or exceedance of the 30-second and 2-minute OEI ratings has taken place. The required means for alerting the pilot, maintenance personnel, and the automatic recording system must not be capable of being reset in flight and must only be reset by maintenance personnel after retrieval of recorded data.

The proposal would delete the redundant design requirements of § 33.29(c)(2). The automatic data recording requirements of the existing § 33.29(c)(3), with a minor wording change for clarification, will become the new § 33.29(c)(2).

This proposal would add a new requirement designated as new § 33.29(c)(3) to alert maintenance personnel when the engines have been operated at the rating powers and of the need to retrieve the recorded engine data. A new § 33.29(c)(4) would specify the requirements for verification of the proper operation of indicating, recording, and retrieval systems. In addition, a new § 33.29(d) would specify resetting the recording on the ground only.

Section 33.67 Fuel System

The operating conditions requiring the use of 30-second OEI ratings may require the pilot to perform simultaneous actions to maintain safe flight. Therefore, an automatic means that does not require pilot input or control, other than a termination command, must apply and control the rating power. This automatic control requirement is intended to avoid the need for the pilot to monitor engine parameters, such as output shaft torque or power, output shaft speed, gas producer speed, and gas path temperature, during the OEI operation. Once the system is activated, it automatically controls the 30-second OEI power and prevents the engine from exceeding its specified operating limits.

We are proposing to revise § 33.67(d) to clarify that the intent of the proposed ''automatic control'' is to control the engine operating conditions, which should not exceed the engine's operating limits. The applicant's design, however, should not limit the time at which OEI power is used. This will enable the pilot to exceed OEI time limitations to safely land the rotorcraft in an in-flight emergency as permitted by § 91.3(b).

Section 33.87 Endurance Test

For rotorcraft engines having 30-second and 2-minute OEI ratings, the applicant must consider all applicable paragraphs of § 33.87(a) in running the tests under § 33.87(f). However, to reduce test complexity, and to improve the flexibility needed to attain the key parameters (speed, temperature and torque) during the tests, we are proposing to allow that the maximum air bleed for engine and aircraft services under § 33.87(a)(5) need not be used for the tests under § 33.87(f)(1) through (f)(8) if the applicant can show by testing, or analysis based on testing, that the validity of the endurance test is preserved. The analysis should include, but is not limited to (1) The effect of the bleed air extraction on the engine secondary air system that provides cooling air to various engine components, and (2) the thermodynamic cycle effects of bleed (*e.g.*, core speed to output shaft speed changes) which may enhance the engine's ability to meet the teardown inspection requirements of § 33.93(b)(2).

This proposal would allow the applicant to run the tests under §§ 33.87(f)(1) through (f)(8) without loading the accessory drives and mounting attachments if the applicant can substantiate that the durability of any accessory drive or engine component is not significantly affected. However, to meet the requirements of § 33.87(a)(6) without the power turbine accessory drives loaded during the test, the applicant must add equivalent power required for loading these accessory drives. This power must be added to the output drive shaft so that the power turbine rotor assembly is operated at or above the levels as when the power turbine accessory drives are loaded.

This proposal would clarify the intent of the test schedule for the first test sequence of the existing § 33.87(f)(4) test

by adding a new sentence, ''However, where the greatest is the 30-minute OEI power, that sixty-five minute period shall consist of 30 minutes at 30-minute OEI power followed by 35 minutes at whichever is the greater of continuous OEI power or maximum continuous power.'' The proposal would also clarify the idle condition of § 33.87(f)(8) as flight idle.

This proposal would specify that the four test sequences of the 2-hour test under § 33.87(f) are to be run continuously without stoppage. If a stop occurs, the applicant typically would need to repeat the interrupted sequence in full. However, the sequence may be re-started from the interrupt point if there are technical justifications acceptable to the FAA. If the FAA determines that the sequence need not be repeated in its entirety, then the test should be re-started from a point where the engine thermal condition would be the same as at the time of interruption. If an excessive number of interruptions occur, the applicant would be required to repeat the entire § 33.87(f) test.

Additionally, we are proposing to revise the test schedule under § 33.87(c) for the 30-minute OEI rating to agree with the schedule in CS–E. The result would be the harmonization of the endurance test schedule for engines having a 30-minute OEI rating. The proposal would replace the existing § 33.87(c)(2) with a thirty-minute test at (a) Rated maximum continuous power during fifteen of the twenty-five 6-hour endurance test cycles; and (b) rated takeoff power during ten of the twenty-five 6-hour endurance test cycles. The existing § 33.87(c)(2) would be redesignated § 33.87(c)(4). The duration of the test in the existing § 33.87(c)(3) would be reduced from 2 hours to 1 hour. The existing § 33.87(c)(4) would be redesignated as § 33.87(c)(5) with the number of time and speed increments increased from 12 to 15, and with total running time increased from 2 hours to 2 hours and 30 minutes. The existing § 33.87(c)(5) and (c)(6) would be redesignated as § 33.87(c)(6) and (c)(7), respectively.

Section 33.88 Engine Overtemperature Test

We are proposing to delete the existing § 33.88(b), which refers to obtaining OEI ratings when the engine does not incorporate a means to limit gas temperature. This paragraph is not needed because the new § 33.67(d) requires automatic control of the 30-second OEI power within its gas temperature limit. The proposal would incorporate the existing test requirements in § 33.88(c) into the new § 33.88(b), which applies only to engines having the combined 30-second OEI and 2-minute OEI ratings. We are proposing to revise § 33.88(a) to apply to all other ratings, including all OEI ratings other than the combination specified above, regardless of whether the engine is equipped with an automatic temperature control.

Section 33.93 Teardown Inspection

In meeting the teardown inspection requirements after the 2-hour endurance tests of § 33.87(f), the applicant would be required to show that no failure of any significant engine component becomes evident during the test, shutdown, or the subsequent teardown inspection. For components that are distressed beyond serviceable limits by this test, the applicant must show that the inspections and mandatory maintenance actions for these components, specified in the Instructions for Continued Airworthiness (ICA), are adequate for maintaining their continued airworthiness.

Additionally, the applicant would need to evaluate component condition against a minimum hardware condition that can be expected for in-service engines. For the purpose of § 33.93(b)(2), engine parts that can affect structural integrity include, but are not limited to, mounts, cases, bearing supports, shafts, and rotors. We are proposing to remove the reference in § 33.93(b)(2) to the above mentioned components to emphasize that after the test the applicant needs to consider deterioration of any engine component that could affect the structural integrity of the engine, not just those listed above.

Appendix A33.4 Airworthiness Limitation Section

We are proposing to revise A33.4, Airworthiness Limitations Section (ALS), by adding a new paragraph for rotorcraft engines having 30-second OEI and 2-minute OEI ratings. For these engines, we will require the applicant to prescribe mandatory post-flight inspection and maintenance actions in the ALS of the ICA following the use of these ratings. We will also require the applicant to create a mandatory in-service engine evaluation program to ensure the continued adequacy of the airworthiness instructions for the engines.

The concept of the 30-second OEI and 2-minute OEI ratings is that of limited use in service followed by mandatory inspection and maintenance. This concept assumes that some engine parts or components may not be suitable for further use and will need to be replaced after the application of these ratings. The mandatory inspections and maintenance actions following the use of 30-second OEI, or 2-minute OEI ratings, must be capable of (1) Identifying and correcting any component distress that could significantly reduce subsequent engine reliability or prevent the engine from achieving 30-second OEI and 2-minute OEI rating powers; and (2) maintaining the engine in condition for safe OEI flight. This proposal requires the applicant to prescribe the mandatory post-flight inspection and maintenance actions in the ALS of the ICA following the use of either of these two ratings, prior to next flight, regardless of the frequency of usage and the condition of the engine. The applicant must validate the adequacy of the required inspections and maintenance actions.

The required inspections and maintenance actions are normally determined through certification testing supplemented by development testing and service experience of engines of the same type with similar design at the time of certification. Differences, however, may exist in hardware conditions and power availability characteristics between in-service engines and the conditions and characteristics of the engine prior to the § 33.87(f) tests. Similarly, differences may exist in power assurance characteristics for in-service engines after usage of 30-second or 2-minute OEI ratings and the characteristics observed following the § 33.87(f) tests.

Therefore, we are proposing an in-service evaluation program in the ALS to obtain relevant data concerning the condition of hardware and power availability at various stages in the life of the engine. The data should be compared with corresponding data observed during certification that defined the post-flight inspection and maintenance actions. If the data obtained from the in-service program indicates that the in-service differences are not properly accounted for, then this data should be used to modify the instructions as appropriate. To achieve the objectives of the program, the engine manufacturer must ensure that operators understand and are aware of the need for the procedures to properly collect and return information needed by the manufacturer.

Rulemaking Analyses and Notices

Authority for This Rulemaking

The FAA's authority to issue rules on aviation safety is found in Title 49 of the United States Code. Subtitle I, Section

106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in Subtitle VII, Part A, Subpart III, Section 44701, ''General Requirements.'' Under that section, the FAA is charged with prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce, including minimum safety standards for aircraft engines. This regulation is within the scope of that authority because it updates the existing regulations for rotorcraft engine OEI ratings.

Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. We have determined there are no new information collection requirements associated with this proposed rule.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA determined there are no ICAO Standards and Recommended Practices that correspond to these proposed regulations.

Executive Order 12866 and DOT Regulatory Policies and Procedures

Executive Order 12866, ''Regulatory Planning and Review,'' dated September 30, 1993 (58 FR 51736) directs the FAA to assess both the costs and the benefits of a regulatory change. We are not allowed to propose or adopt a regulation unless we make a reasoned determination that the benefits of the intended regulation justify the costs. Our assessment of this rulemaking indicates that its economic impact is minimal because U.S. turbine rotorcraft manufacturers are already manufacturing rotorcraft turbine engines according to European requirements that are equivalent to these proposed requirements. Because the costs and benefits of this action do not make it a ''significant regulatory action'' as defined in the Order, we have not prepared a ''regulatory evaluation,'' which is the written cost/benefit analysis ordinarily required for all rulemaking under the DOT Regulatory Policies and Procedures. We do not need to do a full evaluation where the economic impact of a rule is minimal.

Economic Evaluation, Regulatory Flexibility Determination, Trade Impact Assessment, and Unfunded Mandates Assessment

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency propose or adopt a regulation only upon a determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act also requires agencies to consider international standards and, where appropriate, use them as the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this proposed rule.

Department of Transportation Order DOT 2100.5 prescribes policies and procedures for simplification, analysis, and review of regulations. If the expected cost impact is so minimal that a proposed or final rule does not warrant a full evaluation, this order permits that a statement to that effect and the basis for it be included in the preamble if a full regulatory evaluation of the cost and benefits is not prepared. Such a determination has been made for this proposed rule. The reasoning for this determination follows.

This proposed rule harmonizes FAA airworthiness standards for the 30-second and 2-minute OEI ratings with similar requirements already adopted by EASA and being processed by Transport Canada. Because the OEI ratings are optional, manufacturers will provide this capability only if they expect to recover any additional costs in the marketplace. The FAA estimates that this rule would affect 8 engine models, approximately 100 helicopters, and that there would be approximately 3 OEI events per year. The total estimated cost of the proposed rule over 20 years is approximately $619,000 in present value cost (in 2005 dollars). These optional costs would only be incurred if the manufacturer believes the enhanced capability benefits exceed the costs. The FAA has not attempted to quantify the cost savings that may accrue due to harmonization of this rule, beyond noting that they contribute to a large potential harmonization savings. Safety after an engine failure or shutdown under this rule would be at least equivalent to operational safety under the previous regulations.

The FAA finds that the expected outcome of the proposed rule would have a minimal impact with positive net benefits, and, therefore, we did not prepare a full regulatory evaluation. The FAA requests comments with supporting justification about our determination of minimal impact. The FAA has, therefore, determined that this proposed rule is not a ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, and is not ''significant'' as defined in DOT's Regulatory Policies and Procedures.

Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) of 1980 (Pub. L. 96–354) directs the FAA to fit regulatory requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to the regulation. We are required to determine whether a proposed or final action will have a ''significant economic impact on a substantial number of small entities'' as they are defined in the Act. If we find the action will have a significant impact, we must do a ''regulatory flexibility analysis.''

However, if an agency determines that a proposed rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

All U.S. multi-turbine engine rotorcraft manufacturers exceed the Small Business Administration small-entity criteria of 1,500 employees for aircraft manufacturers. Currently manufactured U.S. twin-turbine engine rotorcraft type certificate holders include: Bell Helicopter Textron, Sikorsky Aircraft Corporation, and MD Helicopters, Inc. In addition, all of the U.S. rotorcraft engine manufacturers exceed the Small Business

Administration small-entity criteria of 1,000 employees for aircraft engine manufacturers. There are four U.S. engine manufacturers that produce turbine engines for rotorcraft: (1) General Electric, GE Transportation, (2) Rolls-Royce Allison, Allison Engines, Inc., (3) Light Helicopter Turbine Engine Company (a partnership of Rolls-Royce and Honeywell), and (4) Honeywell International, Inc. Given that there are no small-entity manufacturers of twin-engine rotorcraft or of rotorcraft engines and the rule would impose only minimal costs, the FAA certifies that this proposed rule would not have a significant economic impact on a substantial number of small entities. The FAA invites comments regarding this determination.

International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39) prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this rulemaking and has determined that it uses the European international standards as the regulation basis and is in accord with the Trade Agreements Act.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in a $100 million or more expenditure (adjusted annually for inflation with the base year 1995) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.'' The FAA currently uses an inflation-adjusted value of $128.1 million in lieu of $100 million.

This proposed rule does not contain such a mandate. The requirements of Title II of the Act, therefore, do not apply.

Executive Order 13132, Federalism

The FAA analyzed this proposed rule under the principles and criteria of Executive Order 13132, Federalism. We have determined that this action would not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government, and therefore would not have federalism implications.

Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this proposed rulemaking action qualifies for the categorical exclusion identified in Chapter 3, paragraph 312d, and involves no extraordinary circumstances.

Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA analyzed this NPRM under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). We determined that it is not a ''significant energy action'' under the executive order because it is not a ''significant regulatory action'' under Executive Order 12866, and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

List of Subjects

14 CFR Part 1

Air transportation, Aircraft, Aviation safety, Engines, Helicopters, Ratings, Rotorcraft, Safety.

14 CFR Part 33

Air transportation, Aircraft, Aviation safety, Engines, Ratings, Rotorcraft, Safety.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend parts 1 and 33 of Title 14, Code of Federal Regulations as follows:

PART 1—DEFINITIONS AND ABBREVIATIONS

1. The authority citation for part 1 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701.

2. Amend § 1.1 by revising the definitions for ''Rated 30-second OEI power,'' ''Rated 2-minute OEI power,'' ''Rated continuous OEI power,'' ''Rated 30-minute OEI power,'' and ''Rated 2½-minute OEI power,'' to read as follows:

§ 1.1 General definitions.

* * * * *

Rated 30-second OEI Power, with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under Part 33 of this chapter, for continuation of one flight operation after the failure or shutdown of one engine in multiengine rotorcraft, for up to three periods of use no longer than 30 seconds each in any one flight, and followed by mandatory inspection and prescribed maintenance action.

Rated 2-minute OEI Power, with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under Part 33 of this chapter, for continuation of one flight operation after the failure or shutdown of one engine in multiengine rotorcraft, for up to three periods of use no longer than 2 minutes each in any one flight, and followed by mandatory inspection and prescribed maintenance action.

Rated continuous OEI power, with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under Part 33 of this chapter, and limited in use to the time required to complete the flight after the failure or shutdown of one engine of a multiengine rotorcraft.

* * * * *

Rated 30-minute OEI power, with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under Part 33 of this chapter, and limited in use to one period of use no longer than 30 minutes after the failure or shutdown of one engine of a multiengine rotorcraft.

Rated 2½-minute OEI power, with respect to rotorcraft turbine engines, means the approved brake horsepower developed under static conditions at specified altitudes and temperatures within the operating limitations established for the engine under Part 33 of this chapter for periods of use no longer than 2½ minutes each after the failure or shutdown of one engine of a multiengine rotorcraft.

* * * * *

PART 33—AIRWORTHINESS STANDARDS: AIRCRAFT ENGINES

3. The authority citation for part 33 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44704.

4. Amend § 33.5 to add a new paragraph (b)(4) to read as follows:

§ 33.5 Instruction manual for installing and operating the engine.

* * * * *

(b) * * *

(4) For rotorcraft engines having one or more OEI ratings, applicants must provide data on engine performance characteristics and variability to enable the aircraft manufacturer to establish aircraft power assurance procedures.

5. Amend § 33.29 by revising paragraph (c) and adding paragraph (d) to read as follows:

§ 33.29 Instrument connection.

* * * * *

(c) Each rotorcraft turbine engine having a 30-second OEI rating and a 2-minute OEI rating must have a means or a provision for a means to:

(1) Alert the pilot when the engine is at the 30-second OEI and the 2-minute OEI power levels, when the event begins, and when the time interval expires;

(2) Automatically record each usage and duration of power at the 30-second OEI and 2-minute OEI levels;

(3) Alert maintenance personnel in a positive manner that the engine has been operated at either or both of the 30-second and 2-minute OEI power levels, and permit retrieval of the recorded data; and

(4) Enable routine verification of the proper operation of the above means.

(d) The means, or the provision for a means, of paragraph (c) of this section must not be capable of being reset in flight.

6. Revise § 33.67(d) to read as follows:

§ 33.67 Fuel system.

* * * * *

(d) Rotorcraft engines having a 30-second OEI rating must incorporate a means, or a provision for a means, for automatic availability and automatic control of the 30-second OEI power within its operating limitations.

7. Amend § 33.87 by redesignating paragraphs (c)(2), (c)(4), (c)(5), and (c)(6) as paragraphs (c)(4), (c)(5), (c)(6), and (c)(7) respectively, by adding new paragraph (c)(2), and by revising paragraphs (a)(5), (a)(6), (c)(3), newly redesignated paragraphs (c)(4) through (c)(7), (f) introductory text, (f)(4) and (f)(8) to read as follows:

§ 33.87 Endurance test.

(a) * * *

(5) Maximum air bleed for engine and aircraft services must be used during at least one-fifth of the runs, except for the final 120-minute test required under paragraph (f) of this section, provided the validity of the test is not compromised. However, for these runs, the power or thrust or the rotor shaft rotational speed may be less than 100 percent of the value associated with the particular operation being tested if the FAA finds that the validity of the endurance test is not compromised.

(6) Each accessory drive and mounting attachment must be loaded in accordance with paragraphs (a)(6)(i) and (ii) of this section, except as permitted by paragraph (a)(6)(iii) of this section for the final 120-minute test required under paragraph (f) of this section.

(i) The load imposed by each accessory used only for aircraft service must be the limit load specified by the applicant for the engine drive and attachment point during rated maximum continuous power or thrust and higher output.

(ii) The endurance test of any accessory drive and mounting attachment under load may be accomplished on a separate rig if the validity of the test is confirmed by an approved analysis.

(iii) The applicant is not required to load the accessory drives and mounting attachments when running the tests under paragraphs (f)(1) through (f)(8) of this section if the applicant can substantiate that there is no significant effect on the durability of any accessory drive or engine component. However, the applicant must add the equivalent engine output power extraction from the power turbine rotor assembly to the engine shaft output.

* * * * *

(c) * * *

(2) *Rated maximum continuous and takeoff power.* Thirty minutes at—

(i) Rated maximum continuous power during fifteen of the twenty-five 6-hour endurance test cycles; and

(ii) Rated takeoff power during ten of the twenty-five 6-hour endurance test cycles.

(3) *Rated maximum continuous power.* One hour at rated maximum continuous power.

(4) *Rated 30-minute OEI power.* Thirty minutes at rated 30-minute OEI power.

(5) *Incremental cruise power.* Two hours and 30 minutes at the successive power lever positions corresponding with not less than 15 approximately equal speed and time increments between maximum continuous engine rotational speed and ground or minimum idle rotational speed. For engines operating at constant speed, power may be varied in place of speed. If there are significant peak vibrations anywhere between ground idle and maximum continuous conditions, the number of increments chosen must be changed to increase the amount of running conducted while subject to peak vibrations up to not more than 50 percent of the total time spent in incremental running.

(6) *Acceleration and deceleration runs.* Thirty minutes of accelerations and decelerations, consisting of six cycles from idling power to rated takeoff power and maintained at the takeoff power lever position for 30 seconds and at the idling power lever position for approximately 4½ minutes. In complying with this paragraph, the power control lever must be moved from one extreme position to the other in not more than one second. If, however, different regimes of control operations are incorporated that necessitate scheduling of the power control lever motion from one extreme position to the other, then a longer period of time is acceptable, but not more than 2 seconds.

(7) *Starts.* One hundred starts, of which 25 starts must be preceded by at least a two-hour engine shutdown. There must be at least 10 false engine starts, pausing for the applicant's specified minimum fuel drainage time, before attempting a normal start. There must be at least 10 normal restarts not more than 15 minutes after engine shutdown. The remaining starts may be made after completing the 150 hours of endurance testing.

* * * * *

(f) *Rotorcraft Engines for which 30-second OEI and 2-minute OEI ratings are desired.* For each rotorcraft engine for which 30-second OEI and 2-minute OEI power ratings are desired, and following completion of the tests under paragraphs (b), (c), (d), or (e) of this section, the applicant may disassemble the tested engine to the extent necessary to show compliance with the requirements of § 33.93(a). The tested engine must then be reassembled using the same parts used during the test runs of paragraphs (b), (c), (d), or (e) of this section, except those parts described as consumables in the Instructions for Continued Airworthiness. Additionally, the tests required in paragraphs (f)(1) through (f)(7) of this section must be run continuously. If a stop occurs during these tests, the interrupted sequence must be repeated unless the applicant shows that the severity of the test would

not be reduced if it were continued. The applicant must conduct the following test sequence four times, for a total time of not less than 120 minutes:

* * * * *

(4) 30-minute OEI power, continuous OEI power, or maximum continuous power. Five minutes at whichever is the greatest of rated 30-minute OEI power, rated continuous OEI power, or rated maximum continuous power, except that, during the first test sequence, this period shall be 65 minutes. However, where the greatest rating power is 30-minute OEI power, that sixty-five minute period shall consist of 30 minutes at 30-minute OEI power followed by 35 minutes at whichever is the greater of continuous OEI power or maximum continuous power.

* * * * *

(8) *Idle.* One minute at flight idle.

* * * * *

8. Amend § 33.88 by removing paragraph (b), redesignating (c) and (d) as paragraphs (b) and (c), respectively; and revising the text of the paragraph (a) and the new paragraph (b) to read as follows:

§ 33.88 Engine overtemperature test.

(a) In addition to the test requirements for the ratings as provided in paragraph (b) of this section, each engine must run for 5 minutes at maximum permissible rpm with the gas temperature at least 75 °F (42 °C) higher than the maximum rating's steady-state operating limit. Following this run, the turbine assembly must be within serviceable limits.

(b) Each engine for which 30-second OEI and 2-minute OEI ratings are desired, that incorporates a means for automatic temperature control within its operating limitations in accordance with § 33.67(d), must run for a period of 4 minutes at the maximum power-on rpm with the gas temperature at least 35 °F (19 °C) higher than the maximum operating limit at 30-second OEI rating. Following this run, the turbine assembly may exhibit distress beyond the limits for an overtemperature condition provided the engine is shown by analysis or test, as found necessary by the FAA, to maintain the integrity of the turbine assembly.

* * * * *

9. Revise § 33.93(b)(2) to read as follows:

§ 33.93 Teardown inspection.

* * * * *

(b) * * *

(2) Each engine may exhibit deterioration in excess of that permitted in paragraph (a)(2) of this section, including some engine parts or components that may be unsuitable for further use. The applicant must show by inspection, analysis, test, or by any combination thereof as found necessary by the FAA, that structural integrity of the engine is maintained; or

* * * * *

10. Amend Appendix A to part 33 by revising A33.4 to read as follows:

Appendix A to Part 33—Instructions for Continued Airworthiness

* * * * *

A33.4 AIRWORTHINESS LIMITATIONS SECTION

The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the manual.

(a) For all engines:

(1) The Airworthiness Limitations section must set forth each mandatory replacement time, inspection interval, and related procedure required for type certification. If the Instructions for Continued Airworthiness consist of multiple documents, the section required under this paragraph must be included in the principal manual.

(2) This section must contain a legible statement in a prominent location that reads: ''The Airworthiness Limitations section is FAA approved and specifies maintenance required under §§ 43.16 and 91.403 of Title 14 of the Code of Federal Regulations unless an alternative program has been FAA approved.''

(b) For rotorcraft engines having 30-second OEI and 2-minute OEI ratings:

(1) The Airworthiness Limitations section must also prescribe the mandatory post-flight inspections and maintenance actions associated with any use of either 30-second OEI or 2-minute OEI ratings. The applicant must validate the adequacy of these inspections and maintenance actions; and

(2) The applicant must establish an in-service engine evaluation program to ensure the continued adequacy of the data for § 33.5(b)(4) pertaining to power availability and the adequacy of the instructions for mandatory post flight inspection and maintenance actions. The program must include service engine tests or equivalent service engine test experience on engines of similar design and evaluations of service usage of the 30-second OEI or 2-minute OEI ratings.

Issued in Washington, DC, on April 13, 2007.

John J. Hickey,

Director, Aircraft Certification Service.

[FR Doc. E7–7943 Filed 5–3–07; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF HOMELAND SECURITY

Coast Guard

33 CFR Part 100

[CGD05–07–032]

RIN 1625–AA08

Special Local Regulations for Marine Events; Pamlico River, Washington, NC

AGENCY: Coast Guard, DHS.

ACTION: Notice of proposed rulemaking.

SUMMARY: The Coast Guard proposes to establish temporary special local regulations for the ''SBIP—Fountain Powerboats Kilo Run and Super Boat Grand Prix'', a marine event to be held August 3 and August 5, 2007, on the waters of the Pamlico River, near Washington, North Carolina. These special local regulations are necessary to provide for the safety of life on navigable waters during the event. This action is intended to restrict vessel traffic in portions of the Pamlico River during the event.

DATES: Comments and related material must reach the Coast Guard on or before June 4, 2007.

ADDRESSES: You may mail comments and related material to Commander (dpi), Fifth Coast Guard District, 431 Crawford Street, Portsmouth, Virginia 23704–5004; hand-deliver them to Room 415 at the same address between 9 a.m. and 2 p.m., Monday through Friday, except Federal holidays; fax them to (757) 398–6203; or e-mail them to *Dennis.M.Sens@uscg.mil.* The Inspections and Investigations Branch, Fifth Coast Guard District, maintains the public docket for this rulemaking. Comments and material received from the public, as well as documents indicated in this preamble as being available in the docket, will become part of this docket and will be available for inspection or copying at the above address between 9 a.m. and 2 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Dennis Sens, Project Manager, Inspections and Investigations Branch, at (757) 398–6204.

SUPPLEMENTARY INFORMATION:

Request for Comments

We encourage you to participate in this rulemaking by submitting comments and related material. If you do so, please include your name and address, identify the docket number for this rulemaking (CGD05–07–032),