

**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](mailto: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/](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/](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.*

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