

[4910-13]

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR Part 33**

**Docket No.: FAA-2006-25375; Amendment No. 33-23**

**RIN 2120-AI73**

**Airworthiness Standards; Engine Bird Ingestion**

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

**ACTION:** Final rule.

**SUMMARY:** This final rule amends the aircraft turbine engine type certification standards to better address the threat flocking birds present to turbine engine aircraft. These changes will also harmonize FAA and European Aviation Safety Agency (EASA) bird ingestion standards for aircraft turbine engines type certificated by the United States and the EASA countries, and simplify airworthiness approvals for import and export. The changes are necessary to establish uniform international standards and provide an acceptable level of safety for aircraft turbine engines with respect to the current large flocking bird threat.

**DATES:** This amendment becomes effective on [Insert date 30 days after date of publication in the Federal Register].

**FOR FURTHER INFORMATION CONTACT:** Marc Bouthillier, Rulemaking and Policy Branch, Engine and Propeller Directorate, ANE-111, Federal Aviation Administration, 12 New England Executive Park, Burlington, Massachusetts 01803; telephone (781) 238-7120; facsimile (781) 238-7199; e-mail [marc.bouthillier@faa.gov](mailto:marc.bouthillier@faa.gov).

## **SUPPLEMENTARY INFORMATION:**

### **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 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 regulation is within the scope of that authority because it updates the existing regulations for engine bird ingestion.

### **Background**

The FAA adopted new regulations under 14 CFR 33.76 on September 5, 2000, to better address the overall bird ingestion threat to turbine powered aircraft. These requirements were adopted, in part, as a response to NTSB safety recommendation A-76-64, which recommended an increase in the level of bird ingestion capability for aircraft engines.

Based on comments received during that rulemaking effort, the FAA decided to pursue additional rulemaking to address larger flocking birds (mass greater than 1.15 kg/2.5 pounds), since existing engine certification requirements did not specifically address the threat that these size birds, or their growing population, present to airplane operational safety.

### **Summary of the NPRM**

On July 20, 2006, the FAA published a notice of proposed rulemaking (NPRM), "Airworthiness Standards; Engine Bird Ingestion" (71 FR 41184). The NPRM proposed to

amend aircraft turbine engine type certification standards to reflect recent analysis of the threat flocking birds present to turbine engine aircraft. The proposed changes are necessary to establish uniform international standards that provide an adequate level of safety. The comment period closed September 18, 2006.

### **Summary of the final rule**

The final rule adopts new bird ingestion standards for turbine aircraft engines under 14 CFR 33.76. It also provides a detailed description of the rulemaking project including the safety objective and a discussion of the considerations supporting our selection of this course of action.

No changes were made to the final rule from what was proposed in the NPRM.

### **Summary of Comments**

The FAA received comments from Transport Canada Civil Aviation (TCCA) and the National Transportation Safety Board (NTSB).

TCCA fully supports the intent of the proposal. However, NTSB expressed concern with the size of the largest bird upon which the rule is based (8 pounds). NTSB reasoned that flocking birds greater than 8 pounds can exist in the environment, and may have impacted commercial aircraft in the past. NTSB also expressed concern about using de-rated takeoff thrust instead of full rated takeoff thrust value for required tests because full rated thrust can be selected by the flight crew, and because this power setting may be a more severe case than using de-rated takeoff thrust. NTSB suggested the required tests be revised to reflect a worst-case scenario.

The FAA does not concur with these three comments. The safety objective of this rule is to address the expected world fleet rate of catastrophic aircraft events due to multi-engine power loss resulting from multi-engine ingestion of large flocking birds. The various rule parameters

were carefully selected to achieve this goal by devising tests that encompass a sufficient percentage of possible parameter combinations (e.g., bird mass/number, bird speed, engine power setting, target locations, etc.) that would allow the world fleet to operate at this very high level of safety. The database of ingestion events used to determine ingestion rates covers a 30-year period and over 325 million flights. The database analysis enabled the FAA to define the actual threat experienced in service, including a conservative adjustment for potential future increases in ingestion rates. The proposed rule was not intended to encompass the worst possible combination of factors, as this is problematic to predict, and would be beyond the capability of current engine technology. We believe selecting all parameters using a theoretical worst case scenario would be impractical from a design, manufacture, and operational standpoint.

NTSB further suggested incorporating pre-existing fan blade service damage into the required tests because the potential exists for such damage to occur in normal service. The FAA is not adopting this suggestion. Engine type certification requirements are intended for and applied to undamaged products as a baseline. The engine bird ingestion requirements and type certificate (TC) requirements are similar in this regard. This revised rule is based on critical ingestion parameters for the most severe engine bird ingestion events recorded over the past several decades. As such, substantial margin exists for the normal ingestion events seen in service, including service acceptable damage allowed by the Instructions for Continued Airworthiness (ICAs). Also, current Advisory Circular material for ICA compliance specifies the type certificate holder evaluate service-acceptable damage criteria against the type certification requirements, and include appropriate instructions in the ICAs. The overall positive experience of the world fleet indicates that this general approach provides an acceptable level of safety.

NTSB also suggested that the FAA consider bird ingestion event data collected since the bird study cutoff date of 1999. NTSB asserts the 30-year data set used is inadequate to assess the risk associated with bird ingestion. The FAA's decision to proceed with this rulemaking is based on quantitative and qualitative evaluation of the threat observed in service over a lengthy period of time. We concluded that the increasing population of large flocking birds in the environment, and the increasing number of encounters in service, make it necessary to expand the scope of the existing requirements. The data from the 30-year study period covers over 325 million flights and is comprised of data from actual engine bird ingestion events where the bird species, size, and number; aircraft and engine model; flight regime, and outcome are reasonably known. The database covers a broad cross-section of aircraft type and operations and is considered fully adequate to establish engine bird ingestion rates from which the critical ingestion parameters were selected to meet the rule's safety objective. The event data collected since the study period does not appear to indicate a change in the basic threat definition or an increase in the actual rate of occurrence and would not likely affect the outcome of the rulemaking project.

Finally, as suggested by TCCA, the FAA has reviewed the new table included in the amendatory language to ensure it is accurate. The final rule is adopted as proposed.

### **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 that there is no current or new requirement 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 determined that there are no ICAO Standards and Recommended Practices that correspond to these regulations.

## **Regulatory Evaluation, Regulatory Flexibility Determination, International 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 (Public Law 96-354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Public Law 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 (Public Law 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.

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 final rule. The reasoning for this determination follows:

The NPRM regulatory analysis explained that this rule will have a minimal cost impact with positive net benefits because the two U.S. firms to be affected by this rule are already in compliance in order to sell their products in Europe. No comments were received on the NPRM regulatory analysis. Therefore, we conclude that this final rule will have minimal cost impact with positive net benefits and a detailed regulatory analysis is not required.

FAA has, therefore, determined that this final 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 Determination**

The Regulatory Flexibility Act of 1980 (Public Law 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 NPRM Regulatory Flexibility Analysis determined that there were no small entities that would be affected by this rule. We received no comments on the NPRM Regulatory Flexibility Analysis and continue to believe that this final rule will only impact two American manufacturers neither of which is a small entity. Therefore, as the Acting FAA Administrator, I certify that this final rule will not have a significant economic impact on a substantial number of small entities.

### **International Trade Impact Assessment**

The Trade Agreements Act of 1979 (Public Law 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 final rule and determined that it is in accord with the Trade Agreements Act as the final rule uses European standards as the basis for United States regulation.

## **Unfunded Mandates Assessment**

Title II of the Unfunded Mandates Reform Act of 1995 (Public Law 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.

This final rule does not contain such a mandate. The requirements of Title II of the Act 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 Chapter 3, 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.

### **Availability of Rulemaking Documents**

You can get an electronic copy of rulemaking documents using the Internet by—

1. Searching the [Federal](http://www.regulations.gov) eRulemaking Portal (<http://www.regulations.gov>);
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 DOTs 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://www.regulations.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 the FOR FURTHER INFORMATION CONTACT heading at the beginning of the preamble. 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/).

### **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 Chapter I of Title 14, Code of Federal Regulations 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. Amend § 33.76 by revising paragraphs (a) introductory text, (a)(1), (a)(3), (a)(5), the heading of paragraph (b) introductory text, and the heading of paragraph (c) introductory text, and adding paragraph (d) and Table 4 to read as follows:

#### **§ 33.76 – Bird Ingestion**

(a) General. Compliance with paragraphs (b), (c), and (d) of this section shall be in accordance with the following:

(1) Except as specified in paragraph (d) of this section, all ingestion tests must be conducted with the engine stabilized at no less than 100-percent takeoff power or thrust, for test day ambient conditions prior to the ingestion. In addition, the demonstration of compliance must account for engine operation at sea level takeoff conditions on the hottest day that a minimum engine can achieve maximum rated takeoff thrust or power.

\* \* \* \* \*

(3) The impact to the front of the engine from the large single bird, the single largest medium bird which can enter the inlet, and the large flocking bird must be evaluated. Applicants must show that the associated components when struck under the conditions prescribed in paragraphs (b), (c) or (d) of this section, as applicable, will not affect the engine to the extent that the engine cannot comply with the requirements of paragraphs (b)(3), (c)(6) and (d)(4) of this section.

\* \* \* \* \*

(5) Objects that are accepted by the Administrator may be substituted for birds when conducting the bird ingestion tests required by paragraphs (b), (c) and (d) of this section.

\* \* \* \* \*

(b) Large single bird. \* \* \*

(c) Small and medium flocking bird. \* \* \*

(d) Large flocking bird. An engine test will be performed as follows:

(1) Large flocking bird engine tests will be performed using the bird mass and weights in Table 4, and ingested at a bird speed of 200 knots.

(2) Prior to the ingestion, the engine must be stabilized at no less than the mechanical rotor speed of the first exposed stage or stages that, on a standard day, would produce 90 percent of the sea level static maximum rated takeoff power or thrust.

(3) The bird must be targeted on the first exposed rotating stage or stages at a blade airfoil height of not less than 50 percent measured at the leading edge.

(4) Ingestion of a large flocking bird under the conditions prescribed in this paragraph must not cause any of the following:

(i) A sustained reduction of power or thrust to less than 50 percent of maximum rated takeoff power or thrust during the run-on segment specified under paragraph (d)(5)(i) of this section.

(ii) Engine shutdown during the required run-on demonstration specified in paragraph (d)(5) of this section.

(iii) The conditions specified in paragraph (b)(3) of this section.

(5) The following test schedule must be used:

(i) Ingestion followed by 1 minute without power lever movement.

(ii) Followed by 13 minutes at not less than 50 percent of maximum rated takeoff power or thrust.

(iii) Followed by 2 minutes between 30 and 35 percent of maximum rated takeoff power or thrust.

(iv) Followed by 1 minute with power or thrust increased from that set in paragraph (d)(5)(iii) of this section, by between 5 and 10 percent of maximum rated takeoff power or thrust.

(v) Followed by 2 minutes with power or thrust reduced from that set in paragraph (d)(5)(iv) of this section, by between 5 and 10 percent of maximum rated takeoff power or thrust.

(vi) Followed by a minimum of 1 minute at ground idle then engine shutdown.

The durations specified are times at the defined conditions. Power lever movement between each condition will be 10 seconds or less, except that power lever movements allowed within paragraph (d)(5)(ii) of this section are not limited, and for setting power under paragraph (d)(5)(iii) of this section will be 30 seconds or less.

(6) Compliance with the large flocking bird ingestion requirements of this paragraph (d) may also be demonstrated by:

(i) Incorporating the requirements of paragraph (d)(4) and (d)(5) of this section, into the large single bird test demonstration specified in paragraph (b)(1) of this section; or

(ii) Use of an engine subassembly test at the ingestion conditions specified in paragraph (b)(1) of this section if:

(A) All components critical to complying with the requirements of paragraph (d) of this section are included in the subassembly test;

(B) The components of paragraph (d)(6)(ii)(A) of this section are installed in a representative engine for a run-on demonstration in accordance with paragraphs (d)(4) and (d)(5) of this section; except that section (d)(5)(i) is deleted and section (d)(5)(ii) must be 14 minutes in duration after the engine is started and stabilized; and

(C) The dynamic effects that would have been experienced during a full engine ingestion test can be shown to be negligible with respect to meeting the requirements of paragraphs (d)(4) and (d)(5) of this section.

(7) Applicants must show that an unsafe condition will not result if any engine operating limit is exceeded during the run-on period.

TABLE 4 TO § 33.76 – LARGE FLOCKING BIRD MASS AND WEIGHT

Engine Inlet Throat Area square meters/square inches	Bird Quantity	Bird Mass and Weight kg (lbs)
$A < 2.50$ (3875)	None	--
$2.50$ (3875) $\leq A < 3.50$ (5425)	1	1.85 (4.08)
$3.50$ (5425) $\leq A < 3.90$ (6045)	1	2.10 (4.63)
$3.90$ (6045) $\leq A$	1	2.50 (5.51)

Issued in Washington, DC, on October 5, 2007.

Robert A. Sturgell  
Acting Administrator