

**UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
BURLINGTON, MASSACHUSETTS 01803-5229**

In the matter of the petition of

**INTERNATIONAL AERO
ENGINES, LLC**

for exemption from § 33.94(a)(1)
of Title 14, Code of Federal
Regulations

Regulatory Docket No. FAA-2013-0815

DENIAL OF PETITION FOR RECONSIDERATION

By letter dated March 6, 2014, Mr. Marshall S. Filler of the law firm of Obadal, Filler, MacLeod and Klein, P.L.C., 117 North Henry Street, Alexandria, VA 22314-2903, on behalf of International Aero Engines, LLC (IAE, LLC) petitioned for Reconsideration of Denial of Exemption No. 10914 dated January 9, 2014. The proposed exemption, if granted, would enable IAE to change the fan blade failure location from the blade outermost retention groove to the blade platform for its engine model PW1100G-JM in conducting the blade containment test required by § 33.94.

The petitioner requests relief from the following regulation:

Section 33.94(a)(1) at Amendment 33-10, requires that the fan blade fail from the blade outermost retention groove.

The petitioner supports its request for reconsideration with the following information:

In accordance with the requirements of § 11.101 which provides criteria for the FAA to accept a petition, IAE provided significant additional facts and reason why it did not present the facts in its original petition. The additional facts included additional proprietary engineering information in the form of a technical report, which the petitioner asserts shows the probability of the fan blade's failure below the platform is extremely improbable or less.

The petitioner asserted the detailed technical report provides evidence in the form of significant additional data, test results, and analysis which shows the fan blade below platform fracture rate for its PW1100G-JM series turbofan engine is extremely improbable (i.e., less than 1E-09 per flight hour). The petitioner stated the probability of fracture supports the conclusion that safety is not affected and the requested exemption to § 33.94(a)(1) would provide an equivalent level of safety to that provided by the rule.

The petitioner asserts that the fracture rate determination was based on a robust fault tree risk analysis that includes all below platform fracture mechanisms of the PW1100G-JM fan blade, including corrosion, low cycle fatigue, embedded flaws, high cycle fatigue, impact and overstress.

The petitioner states that the data was not provided in the original submittal because § 33.94(a)(1) does not include a probability analysis requirement. The petitioner further asserts that although such a requirement was included in the GE special conditions issued for the GENx, GENx-2B, and GE90-75B/-85B/-76B model turbofan series, there was no indication in that document that this analysis had been performed before the special conditions were issued.

The Petitioner also claims that the request is in the public interest because the new engine will use less fuel. The petitioner acknowledges a statement made by the FAA in its denial that the 26,000-gallon figure is the 20-year fuel savings for each engine, not the per year fuel savings. IAE pointed out that, however, the remaining figures for fuel consumption reduction (192.2 million gallons), cost savings (\$517 million), and reduced carbon dioxide emissions (2.7 billion pounds) are all accurate when the life of the engine program (i.e., 5,000 engines entering into service between 2015 and 2035) is considered in the aggregate. The petitioner further asserts that it is these aggregated public benefits – particularly the reduced carbon dioxide emissions – which support a finding that granting this petition is in the public interest.

Federal Register publication

The FAA determined that good cause existed for waiving the requirement for Federal Register publication. The FAA published a summary of the original petition on November 27, 2013, 78 FR 71024. The FAA considered comments received in its response to IAE's petition.

The FAA's analysis is as follows:

The FAA reviewed the additional information provided by IAE, LLC and concludes that IAE, LLC did not provide sufficient data to reverse the original decision. Specifically, the data provided with the petition for reconsideration does not show safety would not be adversely affected. Additionally, granting this petition is not in the public interest. The reasons for not granting this petition of reconsideration are as follows:

We denied IAE, LLC's original petition for exemption on the basis that IAE, LLC did not show there would be no adverse effect on safety by reducing the amount of fan blade material that must be contained under § 33.94(a)(1). As stated in the January 9, 2014, denial of exemption letter:

Turbofan engines are required to contain the damage incurred from a fan blade failure at the outermost retention groove without catching fire, and without failure of its mounting attachments when operated for at least 15 seconds. This limits the significance of a fan blade failure on an airplane to a major event with a loss of power. We have accepted blade release from the blade platform (inner flow path line) on certain designs when fan blade failure below the inner flow path line has been shown to be extremely improbable; a failure rate of 10^{-9} or less. We have determined that a failure rate of this magnitude is consistent with the aircraft requirements for engine installation, since the combination of fan blade reliability

and the containment requirements of § 33.94 make it extremely improbable that an uncontained blade will cause a hazard to the aircraft.

Any change to engine containment requirements with a probability of failure rate in excess of extremely improbable is considered to be a lower level of safety for the aircraft and engine installation.

In its petition for reconsideration IAE, LLC presented evidence that it conducted a fault tree analysis (FTA) to show that the probability of failure below the fan blade platform would be less than extremely improbable, 10^{-9} per flight hour. The PW1100G fan blade retention system design is a single element metallic dovetail with surface treatments to enhance durability. In order to establish the probability of failure for a single element structure, all failure modes must be considered since there is no back-up structure. The design may incorporate many features that prevent most failures from occurring, but not all failure modes can be anticipated. A single-element structure provides no crack arrest or multiple load path features. Therefore, a crack initiation below the platform of the PW1100G-JM fan blade could result in a fracture that causes a blade release below the platform. As codified in paragraph (c) of § 33.75 Safety analysis, the FAA has determined that the "primary failure of certain single elements cannot be sensibly estimated in numerical terms." IAE, LLC inappropriately applied FTA to calculate a failure probability of extremely improbable. Use of the FTA is applicable for structures with crack arrest features or multiple load paths, not for single element structures.

We have examined the additional data provided by IAE, LLC in its request for reconsideration and determined IAE, LLC has not shown that failure of the fan blade below the platform would be extremely improbable. The probability of failure of a single element structure such as this fan blade cannot be sensibly estimated in numerical terms because it is not possible to anticipate all potential failure modes. Since IAE's blade design from the outermost retention groove to the platform provides no crack arrest or multiple load path features, a crack initiation could result in a fracture that causes a blade release below the platform. Therefore, we affirm our original denial of the petition for exemption from § 33.94(a)(1).

The FAA's Decision:

In consideration of the foregoing, I find that a grant of exemption would adversely affect safety and would not be in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 106(f), 40113 and 44701, International Aero Engines, LLC's petition for reconsideration of Denial of Exemption No. 10914 from 14 CFR § 33.94(a)(1) is hereby denied.

Issued in Washington, DC, on October 8, 2014

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Michael P. Huerta
Administrator