Grant of Exemption

Exemption No. 7953

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, DC 20591

In the matter of the petition of GENERAL ELECTRIC AIRCRAFT ENGINES for an exemption from § 33.73(b) of Title 14, Code of Federal Regulations	Regulatory Docket No. FAA-2002-11845

GRANT OF EXEMPTION

By letter dated March 11, 2002, General Electric Aircraft Engines (GEAE), General Electric Company, P.O. Box 156301, One Neumann Way, Cincinnati, OH 45215-6301, petitioned the Federal Aviation Administration (FAA) for an exemption from §33.73(b) of Title 14, Code of Federal Regulations (14 CFR). The proposed exemption, if granted, would exempt the GE90-110B1, GE90-113B, and GE90-115B engine models from meeting the 5-second thrust response requirement to accommodate a control system enhancement made to optimize engine operability at high-corrected core airflow conditions.

The petitioner requests relief from the following regulation:

Section 33.73(b) prescribes that the design and construction of the engine must enable an increase from the fixed minimum flight idle power lever position when provided, or if not provided, from not more than 15 percent of the rated takeoff power or thrust available to 95 percent rated takeoff power or thrust in not over 5 seconds. The 5-second power or thrust response must occur from a stabilized static condition using only the bleed air and accessories loads necessary to run the engine. This takeoff rating is specified by the applicant and need not include thrust augmentation.

The petitioner supports its request with the following information:

The petitioner states that in June 2000 GEAE made application for an amended type certificate for the certification of the GE90 growth engines; GE90-110B1, GE90-113B, and GE90-115B engine models. These models are higher thrust derivatives of the currently certified GE90-76B, -77B, -85B, -90B, and -94B engine models that are listed on type certificate E00049EN.

With the pursuit of increased fuel efficiency and subsequent increased turbofan engine bypass ratios it has become increasingly difficult to balance acceleration time with other operational characteristics of the engine. There is a trade-off between engine durability, engine operability and engine acceleration time, all associated with the rate at which fuel is introduced to the engine.

The overarching engine power responsiveness requirement for the engine/aircraft combination is stated in 14 CFR Part 25, § 25.119, which states;

> Landing climb: All-engines-operating.
> "In the landing configuration, the steady gradient of climb may not be less than 3.2 percent, with--
> (a) The engines at the power or thrust that is available eight seconds after initiation of movement of the power or thrust controls from the minimum flight idle to the go-around power or thrust setting; and ..."

Background:

For the GE90-110B1, GE90-113B, and GE90-115B /Boeing 777-300ER application, the airframer has determined that the "power or thrust that" must be available 8 seconds after throttle movement, in order to fulfill the requirements of § 25.119 and attain the required climb gradient, is 80% of maximum takeoff as shown below:

> (Excerpt from Airframer Engine Specification)
>
> Acceleration
>
> For a thrust command change completed in one (1) second or less, from essentially stabilized/minimum tolerance (fan and core speed) approach-idle thrust (not to exceed Table II(C) values) to maximum takeoff, at calibrated airspeeds up to 150 knots, the Engine thrust level achieved eight (8) seconds after starting the thrust command change shall not be less than the thrust indicated below:

Altitude, feet	% of Full rated T/O* Thrust after 8 Seconds
-2,000 to 15,000	80

* % of the highest rating planned for FAR 25 certification.

Reason for Request:

This exemption is being requested to accommodate a control system enhancement made to optimize engine operability characteristics at high corrected core airflow conditions. This control change reduces the acceleration rate at the top end of the acceleration, after reaching 80% but prior to attaining 95% of takeoff thrust, resulting in an acceleration time from 15 to 95% of takeoff thrust that is greater than 5 seconds.

A summary of the petition was published in the Federal Register on May 13, 2002, (67 FR 32080). No comments were received.

The FAA's analysis/summary is as follows:

As stated in the preamble to Amendment 4 to Part 33 "The intent of § 33.73(b) is to establish minimum engine thrust response characteristics, and not to deal with airplane performance characteristics." For modern transport category twin-engine installations the engines are sized in order to achieve the required aircraft climb capability during a one-engine-out scenario. Therefore, the airplane should be able to achieve a 3.2% climb gradient at lower engine power than on a similar transport category aircraft with 3 or 4 engines installed. This is due to the relatively high single engine thrust to weight ratio for transport category twin-engine applications. Although the requirements of 14 CFR Part 33 and Part 25 overlap in some respects, it is clear that the intent of §33.73(b) is to eliminate from consideration the specific aircraft application (installation losses and parasitic loads) by requiring a specific engine acceleration time period. However, the FAA recognizes that for certain new engine designs that consideration of thrust response related to a specific installation can be considered provided that an installation limitation is established for those engine models upon certification.

Thus, the FAA can consider GE's request for exemption if it can be shown that the GE90 growth engines have sufficient thrust response when installed on the B777-300ER model aircraft. This showing will provide the FAA with reasonable assurance that the specific aircraft/engine combinations will meet the climb gradient required under §25.119, which will ensure that safety of flight is not adversely affected. Furthermore, it is also understood that if this exemption is granted it will not affect any other 14 CFR Part 25 requirements.

The FAA finds that GEAE has shown that the time of 6.25 seconds necessary to accelerate the GE90 growth engines from 15% of takeoff rated thrust to 95% of takeoff rated thrust provides a level of safety at least equal to that provided by the rule as described in FAR 33.73(b) when the engine is installed on a B777-300ER model aircraft. This assessment is based on test and analysis.

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator (14 CFR § 11.53), General Electric Aircraft Engines is granted an exemption from 14 CFR § 33.73(b) to the extent necessary to allow GEAE to exceed the 5 second acceleration time from 15% to 95% of takeoff thrust, in accordance with the data submitted in GEAE Technical Memorandum TM 2002-141, titled "GE90-115B FAR 33.73(b) Exemption Report," subject to the following conditions and limitations:

- The GE90-110B1, GE90-113B, and GE90-115B engine models are limited to installation on the B777-300ER model aircraft only with respect to the installed power response characteristics. Any significant bill-of-material changes that could significantly and adversely affect power response will have to be assessed against this exemption.

Issued in Burlingon, MA, on January 15,2003.

Jay J. Pardee, Manager
Engine and Propeller Directorate
Aircraft Certification Service