



Federal Aviation Administration

Memorandum

Date: April 22, 2014

To: Manager, Engine Certification Office, ANE-140

From: Manager, Engine and Propeller Directorate, ANE-100

Prepared by: Walter Meibaum, ANE-141

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for General Electric Company GEnx-1B/P1 Series Engine Models

ELOS Memo#: 8040-ELOS-12-NE02 Rev 1

Regulatory Ref: 14 CFR 21.21 and 33.68

This memorandum has been revised to expand the applicability of this equivalent level of safety (ELOS) finding to include the GEnx-1B70C/P1 engine model and any future GEnx-1B/P1 engine models that meet the criteria in this memorandum.

The original memorandum, dated June 14, 2012, informed the Engine Certification Office of an evaluation made by the Engine and Propeller Directorate on the establishment of an ELOS for the GEnx-1B75/P1 series engine models, including GEnx-1B54/P1, GEnx 1B58/P1, GEnx-1B64/P1, GEnx-1B67/P1, GEnx-1B70/P1, GEnx-1B70/72/P1, GEnx-1B70/75/P1, GEnx-1B74/75/P1, and GEnx-1B75/P1.

Background

The General Electric Company (GE) proposed to show an ELOS to induction system icing requirements of § 33.68 using a combination of engine tests and analyses for the GEnx-1B75/P1 series engine models. Prior engine certification tests completed during the GEnx-1 B70 product improvement program (PIP) certification were used to show compliance to six of the eight required certification test conditions. Analysis showed the GEnx-1B75/P1 series engine models were within the capabilities demonstrated during the certification of the GEnx-1 B70 for the other two conditions.

Applicable regulation(s)

14 CFR 21.21, 33.68

Regulation(s) requiring an ELOS finding

14 CFR 33.68

Description of compensating design features or alternative Methods of Compliance (MoC) which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

The FAA certified the original GENx-1B70 series engine models, finding compliance to the requirements of § 33.68 based on an engine test, consistent with Advisory Circular (AC) 20-147. This AC is commonly used as a template for the testing, and requires completion of several standard test conditions defined by Part 25 appendix C called 'table points', as well as requires the applicant to do a critical point analysis to ensure the engine is tested in the most critical icing environment.

The GENx-1B70 PIP certification test in accordance with the requirements of § 33.68(a) consisted of only six of the eight planned certification test points, due to weather limitations during testing. The outstanding test points were both AC 20-147 table points. GE subsequently provided an analysis supported by engine and component tests to establish acceptable engine performance for these remaining certification points.

The original GENx-1B70 and GENx-1B70 PIP icing certification tests were run at conditions representative of GENx-1B75/P1 power management ratings and were applicable to GENx-1B75/P1 series engine models certification.

GE used comparative analysis similar to that performed for the GENx-1B70 PIP certification, for the two untested, outstanding certification conditions for the GENx-1B75/P1. The analysis was an engine transient model comparison of tested baseline engines and the intended GENx-1B75/P1 type design.

Explanation of how design features or alternative Methods of Compliance (MoC) provide an equivalent level of safety to the level of safety intended by the regulation

GE used the data from the prior GENx-1B70 certification test and engineering data to calibrate and scale the intended GENx-1B75/P1 type design transient engine model. The baseline transient model was scaled for ice-sheds during accelerations to takeoff power at the two outstanding icing certification test conditions. The changes required to match the baseline transient model simulations to demonstrated engine performance during the ice shed events were applied to the intended GENx-1B75/P1 type design transient model to evaluate that engine's tolerance to accreted ice sheds.

GE used the scaled transient model of the intended type design and ice accretions projected for each icing condition to assess engine accelerations from ground idle to takeoff power. Engine performance, including booster anti-ice performance characteristics, and the change in compressor discharge temperature were evaluated against the capabilities previously established through successful certification ice-shed testing conducted on GENx-1B, as well as GENx-2B.

FAA approval and documentation of the ELOS finding:

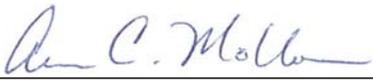
The FAA has approved the aforementioned equivalent level of safety finding in GENx-1B75/PI Issue Paper P-2. This memorandum provides standardized documentation of the ELOS finding that is nonproprietary and can be made available to the public. The Engine and Propeller Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS.

This ELOS is applicable to GE's GENx-1B/PI series engine models. If GE applies later for a change to the type certificate to include another closely related model incorporating the same configuration, this ELOS would apply to that model as well, providing the certification basis is the same or contains later amendments that satisfy the certification basis discussed in the section titled "Type Certification Basis".

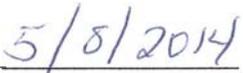
This ELOS Memorandum number must be listed in the Type Certificate Data Sheet under the Certification Basis section (TCs & ATCs) or in the Limitations and Conditions section of the STC. An example of an appropriate statement is provided below.

Equivalent Level of Safety Findings have been made for the following regulations:

14 CFR 33.68 Induction System Icing (documented in ELOS Memo 8040-ELOS-12-NE02 Rev 1).



 Manager, Engine & Propeller Directorate
 Aircraft Certification Service



 Date

ELOS Originated by ACO: Engine Certification Office	ACO Manager: Thomas Boudreau	Routing Symbol: ANE-140
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