



U.S. Department
of Transportation

**Federal Aviation
Administration**

Memorandum

Subject: Information: Equivalent Level of Safety Finding for the Alenia Aeronautica Model C-27J
FAA Project Number TC03711B-T

Date: June 9, 2010

Reg Ref: 14 CFR 25.1093(b)

From: Manager, Propulsion/Mechanical Systems Branch,
ANM-112
Transport Standards Staff

**Reply to
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ANM-112

To: Manager, International Branch, ANM-116

**ELOS
Memo#:** TC03711B-T-P-1

Background

Title 14, Code of Federal Regulations Section 25.1093(b)(1) requires that each turbine engine must operate throughout the flight power range of the engine without the accumulation of ice causing serious loss of power under the icing conditions specified in Appendix C and in falling and blowing snow within the limitations established for the airplane's operation. This must be shown whether the airplane is certified for flying in icing conditions or not.

Ground tests are also required by § 25.1093(b)(2). Each engine must idle for 30 minutes on the ground, with the air bleed available for engine icing protection at its critical condition, without adverse affect, in an atmosphere that is at a temperature between 15° and 30° F. (between -9° and -1° C) and has a liquid water content not less than 0.3 grams per cubic meter in the form of drops having a mean effective diameter not less than 20 microns, followed by momentary operation at takeoff power or thrust. During the 30 minutes of idle operation the engine may be run-up periodically to a moderate power or thrust setting in a manner acceptable to the Administrator.

The advisory material for showing compliance to the subject requirement doesn't contain provisions for use of analysis in combination with tests as an alternative to a test only approach.

Alenia, with the support of the design partners, have confirmed the intention to use an analytical approach based on SAAB 2000 certification data and test results, claiming close similarity of the C27J air intake system with the SAAB 2000 System.

Applicable regulation(s)

§ 25.1093(b)

Regulation(s) requiring an ELOS

§ 25.1093(b)

Description of compensating design features or alternative standards that allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

The *C-27J* Air Intake Duct Ice Protection System is based on the Saab 2000 intake which has been certified under the Joint Aviation Authority procedures. Both the intakes were jointly designed by GKN Westland Aerospace and Allison Engines (now Rolls Royce Allison Engines). The two intakes share the same geometry except for the foreign object damage duct and the mid-to-lower duct interface. The mid / lower duct interface seal was changed and an analytical evaluation for the effect of ice build up on the seal (the engine certified ingestion limit can not be exceeded) along with the potential impact on the performance of the ice protection system for the mid duct surfaces was accomplished. Additionally, natural icing test flights were used to monitor engine parameter fluctuations which were then compared to those observed during engine certification ice ingestion test.

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation

By way of a flow distribution analytical comparison, a thermal analysis was used to compare the performance of the two inlets over a wide range of operating conditions. This allowed for a performance comparison of the two inlets over a wide range of operating conditions. In two separate conditions a dry air certification test was performed to validate the overall performance of the air intake duct ice protection system.

The Saab 2000 certification approach and certification test results data were also made available by GKN and RR Allison to support the *C-27J* certification;

FAA approval and documentation of the ELOS

The FAA has approved the aforementioned equivalent level of safety finding as documented in Issue Paper P-1. This memorandum provides standardized documentation of the ELOS that is non-proprietary and can be made available to the public. The Transport Airplane Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should be listed in the Type Certificate Data Sheet under the Certification Basis section. [e.g., Equivalent Safety Findings have been made for the following regulation(s):

§ 25.1093(b) requirements applicable to engine torque indications (documented in TAD ELOS Memo TC03711B-T-P-1)]



June 9, 2010

 Manager, Propulsion/Mechanical Systems Branch,
 ANM-112
 Transport Standards Staff

 Date

ELOS Originated by: Standards Staff, Propulsion Branch	Project Engineer: Michael Collins	Routing Symbol: ANM-112
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