# Federal Aviation Administration

# Memorandum

Date: July 1, 2011

To: Manager, Seattle Aircraft Certification Office, ANM-100S

From: Manager, Transport Airplane Directorate, ANM-112

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Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Fire Safety Requirements for the GEnx-1B Engine Fan Case Compartment and Power Door Opening System (PDOS) on the Boeing Model 787-8, Project No. PS06-0414

Memo No.: PS06-0414-P-34

Reg. Ref.: §§ 21.21(b)(1), 25.1181(a)(6), 25.1181(b), 25.1182, and 25.1183(a)

This purpose of this memorandum is to inform the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate (TAD) on the establishment of an equivalent level of safety (ELOS) finding for the Boeing Model 787-8 series of airplanes.

**Background**

Title 14, Code of Federal Regulations (14 CFR) 25.1181(a)(6) specifically designates the compressor section of turbine engines as a fire zone. Section 25.1181(b) requires that each fire zone meet the requirements of §§ 25.863, 25.865, 25.867, 25.869, and 25.1185 through 25.1203. The fan case compartment is considered to be a compressor section of a turbine engine, which is identified as a designated fire zone in § 25.1181(a)(6).

Section 25.1182 requires nacelle areas immediately behind engine firewalls to meet §§ 25.1103(b), 25.1165(d) and (e), 25.1183, 25.1185(c), 25.1187, 25.1189, and 25.1195 through 25.1203, including those regulations concerned with designated fire zones. Section 25.1183 requires components of fluid systems located within fire zones to be at least fire resistant, and requires them to be fireproof under certain conditions.

Boeing proposes that the current design of the 787-8 GEnx-1B engine has compensating design features that show the GEnx-1B engine fan compartment is equivalently safe to the fire detection and extinguishing requirements of §§ 25.1181(a)(6), 25.1181(b) and 25.1182 for the fan case compartment and § 25.1183(a) for certain components of the power door opening system (PDOS) and has proposed an equivalent level of safety finding for these areas.

**Applicable regulation(s)**

§§ 21.21(b)(1), 25.1181(a)(6), 25.1181(b), 25.1182, and 25.1183(a)

**Regulation(s) requiring an ELOS finding**

§§ 25.1181(b), 25.1182, and 25.1183(a)

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

The features that support an equivalent level of safety finding for the elimination of fire detection and extinguishers in these areas of the design are as follows:

For the fan case compartment-

- The accessory gear box is not located in the fan case compartment.
- Although the PDOS has components that are not fire resistant, it is a closed system containing approximately 1.16 gallons of engine oil, and is depressurized in flight. An equivalent safety for the non-fire resistant tubing is discussed in issue paper P-34.
- The applicant has demonstrated that no ignition sources are present within the zone during normal and foreseeable failure conditions other than low energy electrical wiring. (Note: The FAA considered foreseeable failure conditions to include a large, prolonged fire impinging on any area of the fire zone's firewall or cowls.)

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

Section 25.1181(a) lists those regions of the engine that have historically contained both ignition sources and potential flammable fluid leakage, and defines these as "designated fire zones." Designated fire zones are required to meet the regulations listed in § 25.1181(b). The "compressor and accessory sections of the turbine engine," listed in § 25.1181(a)(6) include the compartment surrounding the fan case.

Section 25.1182 prescribes requirements for nacelle areas behind firewalls. The fan case compartment is located behind engine firewalls, and are subject to regulations listed in § 25.1182. Those regulations include some of the regulations listed in § 25.1181(b) for fire zones, including the requirement for detection and extinguishing.

Both §§ 25.1181 and 25.1182 are designed to minimize the spread of the engine fire that starts in a fire zone, to adjacent compartments. The design of the fan compartment has been found to have an equivalent level of safety to a compartment that includes fire detection and extinguishing. This finding is based on the compartment having no ignition sources and the

incorporation of design features that minimize available flammable fluid that would otherwise feed the fire (if ignited) during flight.

**FAA approval and documentation of the ELOS finding:**

The FAA has approved the aforementioned ELOS finding in project Issue Paper P-34. This memorandum provides standardized documentation of the ELOS finding that is nonproprietary and can be made available to the public. The TAD has assigned a unique ELOS memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS memorandum number must be listed in the Type Certificate Data Sheet under the Certification Basis section.

An example of an appropriate statement is provided below.

ELOS findings have been made for the following regulation(s):

The portion of §§ 25.1181(b) and 25.1182 that requires compliance with the fire detection and extinguishing requirements defined in §§ 25.1195 through 25.1203 for the fan case compartment, and § 25.1183(a) for those components of the PDOS that do not meet the fire resistant requirements (documented in ELOS Memo PS06-0414-P-34).

August 8, 2011

f. Manager, Transport Airplane Directorate,
Aircraft Certification Service

Date

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| ELOS Originated By Seattle ACO: | Project Engineer Sherry Vevea | Routing Symbol ANM-140S |