



Federal Aviation Administration

Memorandum

Date: November 20, 2015

To: Manager, Boeing Aviation Safety Oversight Office, ANM-100B

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Jim Voytilla, ANM-100B

Subject: INFORMATION: Equivalent Level of Safety Finding for the Fuel Tank Flammability Rule (FTFR) on Boeing Company Models 737 Classic, 737NG, 747-400, 747-8, 757, 767, 777 and 787 Series Airplanes

Memo No.: PS05-0177-P-2

Reg. Ref.: § 25.981, Amendment 25-125

The 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 Boeing Models 737 Classic, 737NG, 747-400, 747-8, 757, 767, 777, and 787 series of airplanes.

This memo is being revised to define 787 series as mentioned in this ELOS as being applicable to the Boeing Model 787-8, 787-9, and 787-10.

Background

Title 14, Code of Federal Regulations (14 CFR) 25.981(b)(2), Amendment 25-125, requires that any fuel tank other than a main fuel tank meet the flammability exposure criteria of Appendix M to 14 CFR part 25 if any portion of the tank is located within the fuselage contour. Paragraph M25.1 of Appendix M requires the fleet average flammability exposure of each fuel tank, as determined in accordance with Appendix N of 14 CFR part 25, not exceed 3 percent of the flammability exposure evaluation time (FEET), as defined in Appendix N. It also requires, if flammability reduction means (FRM) are used, each of the following time periods of that 3 percent may not exceed 1.8 percent of the FEET; (1) when any FRM is operational but the fuel tank is not inert and the tank is flammable; and (2) when any FRM is inoperative and the tank is flammable.

Paragraph M25.1 requires the fleet average flammability exposure, as defined in Appendix N, of each fuel tank not exceed 3 percent of the portion of the FEET occurring during either ground or takeoff/climb phases of flight during warm days. Paragraph N25.3(a) requires the analysis be done in accordance with the FAA Fuel Tank Flammability Assessment Method User's Manual, dated May 2008, document number DOT/FAA/AR-05/8. Paragraph N25.3(a) requires the parameters specified in paragraphs N25.3(b) and (c) be used in the fuel tank flammability exposure "Monte Carlo" analysis. Paragraph N25.3(e) requires the applicant submit to the FAA Oversight Office for approval the fuel tank flammability analysis, including the airplane specific parameters identified under paragraph N25.3(c) and any deviations from the parameters identified in paragraph N25.3(b) that affect flammability exposure, substantiating data, and any airworthiness limitations and other conditions assumed in the analysis.

Boeing notified the FAA that the flammability assessment they used to model the performance of Boeing Models 737 Classic, 737NG, 747-400, 747-8, 757, 767, 777 and 787 series airplanes flammability reduction means using a nitrogen generation system (NGS) includes parameters that are different than those defined in Appendix N and the User's Manual. Boeing identified certain differences in their assessment that were needed to more accurately model the fuel tank flammability of the airplane with an NGS installed.

Boeing requested the FAA accept their Monte Carlo model developed for incorporation of the NGS on Boeing Models 737 Classic, 737NG, 747-400, 747-8, 757, 767, 777 and 787 series airplanes that includes differences in modeling techniques and parameters that are not identical to the FAA Monte Carlo model defined in the User's Manual required by the regulations, but in consideration of the airworthiness limitations incorporated as a condition of this ELOS, produce an overall flammability that meets the flammability exposure required of § 25.981(b).

Applicable regulation(s)

§ 25.981(b)(2)

Regulation(s) requiring an ELOS

§ 25.981(b)(2)

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

In lieu of strict compliance with § 25.981(b)(2), Boeing has requested the FAA approve the use of deviations from the requirements defined in the FTFR rule as well as modifications made to allow modeling of fuel tank flammability when an FRM is used, when showing the design is equivalent with the FAA User's Manual.

Review of the data provided by Boeing showed that when the airplane descent rate defined in the rule is used the flammability levels exceed that required by the rule. Boeing provided data showing current operation of the transport airplane fleet include slower descent rates and the need for holding at altitude during descent due to air traffic considerations. Boeing agreed that future air traffic operations could result in more rapid descents due to improved air traffic systems. Therefore Boeing agreed to monitor U.S. fleet descent rates and to develop service instructions if fleet flammability data approaches the limits defined in the rule. Boeing also incorporated an airworthiness limitation that requires operators to incorporate any design changes needed to maintain fleet flammability below that required by the rule. These limitations assure the flammability of the fleet will meet the limits defined in the rule and provide equivalent safety to the rule. These airworthiness limitations do not require aircraft owners/operators or inspectors to monitor or report descent rates.

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

The FAA determined an ELOS could be made using the deviations and differences in the input parameters listed below based upon the fuel tank flammability exposure of the Boeing 737 Classic, 737NG, 747-400, 747-8, 757, 767, 777 and 787 meeting the levels defined in § 25.981 and appendix N.

Deviations

Airplane Climb Profile
Descent Profile

Differences

Two hour Inhibit of Ambient Temperature Transition
Atmospheric Ambient Temperatures Transition
Refueling Time

Boeing provided substantiation that showed use of their input values for the deviation parameters and the difference parameters listed above resulted in the overall flammability exposure levels meeting the requirements in § 25.981 when combined with the conservatism in their analysis.

Conditions of the ELOS require Boeing to monitor the descent rates of a representative fleet of operators to determine if changes to the air traffic system implemented to improve fuel efficiency and reduce greenhouse gas emissions result in increased fuel tank flammability. Based on this monitoring, Boeing is required to develop design modifications if necessary to maintain the fuel tank flammability within the limits required by the regulations discussed above.

As a condition of this ELOS, as a part of the initial certification or 14 CFR part 26 certification, a critical design configuration control limitation (CDCCL) will be included

in the airworthiness limitations to direct the operators to incorporate NGS improvements when needed as indicated by Boeing. The proposed CDCCL is as follows:

“Fleet average flammability exposure for the center tank of this airplane type must be maintained in accordance with 14 CFR part 25, Appendix M. Boeing will monitor U.S. descent statistics and, if necessary to maintain compliance, will publish service information. If Boeing publishes such service information, this CDCCL requires that operators implement these FAA approved design changes to maintain compliance with 14 CFR part 25, Appendix M.”

Neither aircraft owners/operators nor inspectors are required to monitor or report descent rates as part of this airworthiness limitation.

FAA approval and documentation of the ELOS

The FAA approved the aforementioned ELOS finding in project Issue Paper P-2 or Administrative Collector Issue Paper G-6 for the Boeing 737 Classic, 737NG, 747-400, 747-8, 757, 767, 777 and 787 series airplanes. This memorandum provides standardized documentation of the ELOS that is non-proprietary 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 should be listed in the type certificate data sheet under the Certification Basis section. An example of an appropriate statement is provided below.

Equivalent Safety Findings have been made for the following regulation(s):

14 CFR part 25.981(b)(2) (documented in TAD ELOS Memo PS05-0177-P-2).



Transport Airplane Directorate,
Aircraft Certification Service

12/3/2015

Date

ELOS Originated by SACO:	Sherry Vevea	ANM-140S
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