



# Federal Aviation Administration

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## Memorandum

Date: November 23, 2015

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

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Gregg Neseimeier, ANM-130S

Subject: INFORMATION: Equivalent Level of Safety Finding for Using the Earth Reference System (ERS) Accelerometers in Lieu of the Center of Gravity (CG) Mounted Flight Data Recorder (FDR) Accelerometers on Boeing Company Model 787-8/-9/-10 (Project Nos. TC6918SE-T, PS06-0496, PS06-0497, PS13-0546 and PS14-1031)

Memo No.: TC6918SE-T-SA-10

Reg. Ref.: § 25.1459(a)(2)

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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 the Model 787-8 airplane.

This memo was subsequently revised to extend this ELOS to the Boeing Model 787-9 and 787-10 airplanes.

### **Background**

Boeing has requested to utilize the earth reference system (ERS) accelerometers in lieu of the center of gravity (CG) mounted flight data recorder (FDR) accelerometers required by Title 14, Code of Federal Regulations (14 CFR) 25.1459(a)(2). The ERS sensors will be located slightly outside the longitudinal limits permitted by the rule.

### **Applicable regulation(s)**

§ 21.21(b)(1) and 25.1459(a)(2)

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

§ 25.1459(a)(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)**

The 787 will utilize a methodology for acquiring accelerometer data that is similar to that currently installed and certified on the 777 family of airplanes. The ERS's on the 787 will be located in the aft electronic equipment (EE) bay versus the forward EE bay on the 777. The aft EE bay on the 787 is located just aft of the wing box and approximately 32 inches aft of the CG limit plus 25% mean aerodynamic chord (MAC) point established as the aft limit for sensor location by § 25.1459(a)(2). The 787 inertial system is located in a rigid portion of structure, free from any low-frequency structural bending modes. A correction term will be calculated and applied to the sensor data to compensate for the sensor location being aft of CG.

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

Boeing believes that the method of acquiring Flight Data Recorder accelerometer data on the 787 meets or exceeds the requirements of § 25.1459(a)(2). Boeing will comply with the accelerometer range, sample rate, minimum resolution, and accuracy as specified in 14 CFR Part 91, Appendix E; 14 CFR Part 121, Appendix B; and 14 CFR Part 135, Appendix D.

Validation of the FDR accelerometer data on the 787 will be accomplished during flight test. A triad accelerometer will be mounted at the CG of the airplane in accordance with § 25.1459(a)(2). The data will be recorded and a comparison analysis will be performed between the triad CG data and the IRU accelerometer data for compliance to § 25.1459(a)(2) and 14 CFR part 121 § M121.1.

The FAA has previously granted Boeing an ELOS finding to § 25.1459(a)(2) for the Model 777 airplane. The Model 777 utilizes the air data inertial reference unit (ADIRU) accelerometers in lieu of the CG mounted FDR accelerometers required by the rule. The ERS accomplishes the same inertial function on the 787 as the ADIRU does on the 777. The FAA has reviewed the service history of the Model 777 airplane and has found that the approved vertical acceleration data source has functioned satisfactorily in service to date.

**FAA approval and documentation of the ELOS**

The FAA has approved the aforementioned ELOS finding in project Issue Paper SA-10 or Administrative Collector Issue Paper G-6. 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.

Equivalent Safety Findings have been made for the following regulation(s):  
§ 25.1459(a)(2), "Flight recorders" (documented in TAD ELOS Memo  
TC6918SE-T-SA-10).



Transport Airplane Directorate,  
Aircraft Certification Service

11/24/15

Date

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