



Federal Aviation Administration

Memorandum

Date: February 27, 2013

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

From: Manager, Transport Airplane Directorate (TAD), ANM-100

Prepared by: Ana Martinez Hueto, ANM-150S

Subject: INFORMATION: Equivalent Level of Safety for Dynamic Test Requirements for Multiple Occupant Side-Facing Seats on Boeing Model 777, Federal Aviation Administration (FAA) Project Number ST11811SE-T

ELOS Memo #: ST11811SE-T-C-1

Regulatory Ref: §§ 25.562, 25.785 and Special Conditions 25-295-SC

This memorandum informs 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 777 model airplane.

Background

Altitude Aerospace Interiors Limited has applied for the re-pitch of the "KUPE" side facing premium economy class passenger seats in the Boeing Model 777-300ER aircraft. These seats will be installed at an angle of 23° to the aircraft centerline and will include inflatable restraint systems for occupant restraint and injury protection.

Title 14, Code of Federal Regulations (14 CFR) 25.785(d) and Special Condition No. 25-295-SC require that each occupant of a seat that makes more than an 18° angle with the vertical plane containing the airplane centerline must be protected from head injury by a safety belt and an energy absorbing rest that will support the arms, shoulders, head, and spine, or by a safety belt and shoulder harness that will prevent the head from contacting any injurious object.

Amendment 25-15 to part 25, dated October 24, 1967, introduced the subject of side-facing seats and a requirement that each occupant in a side-facing seat must be protected from head injury by a safety belt and a cushioned rest that will support the arms, shoulders, head, and spine.

Subsequently, Amendment 25-20, dated April 23, 1969, clarified the definition of sideward facing seats to require that each occupant of a seat that makes more than an 18° angle with the vertical plane containing the airplane centerline, must be protected from head injury by a safety belt and an energy absorbing rest that will support the arms, shoulders, head, and spine, or by a safety belt and shoulder harness that will prevent the head from contacting any injurious object. The FAA concluded that an 18° angle would provide an adequate level of safety based on tests that were performed at that time and thus adopted that standard.

Part 25 was amended June 16, 1988, by Amendment 25-64 to revise the emergency landing conditions that must be considered in the design of the airplane. Amendment 25-64 revised the static load conditions in § 25.561, and added a new § 25.562 that required dynamic testing for all seats approved for occupancy during takeoff and landing. The intent of Amendment 25-64 is to provide an improved level of safety for occupants on transport category airplanes. Because most seating are forward-facing on transport category airplanes, the pass/fail criteria developed in Amendment 25-64 focused primarily on these seats.

Applicable regulation(s)

§§ 25.562, 25.785 and Special Conditions 25-295-SC

Regulation(s) requiring an ELOS finding

§§ 25.562, 25.785 and Special Conditions 25-295-SC

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

- The Altitude Aerospace-designed "KUPE" side facing seats are installed without a support wall/structure due to the mitigating factors of a shallow installation angle and that the occupant is free to orient to the longitudinal axis of the airplane during the applications of emergency landing loads.
- Installation of inflatable lapbelts meeting the requirements of Special Conditions No. 25-187A-SC, Boeing Model 777 Series Airplanes; Seats With Inflatable Lapbelts.
- Qualitative (visual) evaluation of the anthropomorphic test devices (ATD) motion exhibits similar behavior during all dynamic tests between the proposed seat installation for occupant injury protection and that of a typical forward facing seat installation.
- The following armrests will be either removed or placed in a locked position for taxi, takeoff and landing phases of flight. Orientation will be controlled by placards and defined within the airline's cabin crew operating procedures and instructions requiring approval by their regulatory agency.
 - The center and aisle armrests on the outboard seat installations will either be removed or locked in the "up" position.

- The center armrest on the center seat installations will either be removed or locked in the “down” position.
- The seat installation and seat deformations can not impede rapid evacuation from the seat to the nearest required passenger aisle. Maintenance of an 18 inch post-deformation aisle clearance above 25 inches from the floor will be demonstrated. Deformations from dynamic tests will be used to evaluate all egress paths which will include egress paths forward and aft through the main aisle.

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

Because of the above unique design features, during the application of emergency landing loads, there is nothing to inhibit the occupant from aligning with the longitudinal axis of the airplane, nor do the armrests dynamically interact with the moving ATD in any manner significantly different than would be expected for a forward-facing seat installation, and the seat installation and seat deformations do not impede the rapid evacuation to all egress paths. Altitude Aerospace Interiors Limited will show this behavior through tests. So this design has an ELOS to a normal forward-facing seat installation of no more than 0°.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project Issue Paper C-1, Dynamic Test Requirements for Multiple Occupant Side-Facing Seats. This memorandum provides standardized documentation of the ELOS finding 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 finding. This ELOS memorandum number should be listed in the Limitations and Conditions section of the supplemental type certificate (STC) in accordance with the statement below:

ELOS findings have been made for the following regulations:

§§ 25.562, 25.785 and Special Conditions 25-295-SC (documented in ELOS Memo ST11811SE-T-C-1)



 Transport Airplane Directorate,
 Aircraft Certification Service

February 27, 2013

 Date

ELOS Originated by Seattle ACO:	Ana Martinez Hueto	ANM-150S
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