



Federal Aviation Administration

Memorandum

Date: June 24, 2015

To: Manager, New York ACO, ANE-170

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Christopher Alfano, ANE-171

Subject: INFORMATION: Passenger Seating Configuration with Additional 2 Passengers Aft of Overwing Exits on model CL-600-2C10 (CRJ700), FAA Project # AT08045NY-T

ELOS Memo#: AT08045NY-T-C-1

Regulatory Ref: Title 14, Code of Federal Regulations, (14 CFR) 25.807 and 25.813 at Amendment 25-86 and FAA Advisory Circular (AC) 25.807-1

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 Bombardier Aerospace (BA) Model CL-600-2C10 aircraft.

Background

The certification basis for the BA Model CL-600-2C10 (CRJ-700) includes Code of Federal Regulations (14 CFR) part 25 section 25.813 at Amendment 25-86. 14 CFR part 25 section 25.813 requires *"Each required emergency exit must be accessible to the passengers and located where it will afford an effective means of evacuation. Emergency exit distribution must be as uniform as practical, taking passenger distribution into account; however, the size and location of exits on both sides of the cabin need not be symmetrical."*

FAA Advisory Circular (AC) 25.807-1 *"Uniform Distribution of Exits"* contains the relevant guidance on the uniform distribution of exits and effective means of evacuation.

Of note, 14 CFR Part 25 at Amendment 25-72 reorganized some wording from Section 25.807 to Section 25.813, more specifically the wording about uniform distribution and effective evacuation was moved to Section 25.813. However, the FAA AC 25.807-1 still contains the relevant guidance on the uniform distribution of exits and effective means of evacuation.

BA is proposing to reconfigure the interior of the Model CL-600-2C10 (CRJ-700) by reducing the size of the aft cargo compartment, relocating the aft right hand side (RHS) lavatory, and adding a double passenger seat assembly on the RHS of the passenger cabin opposite the existing, aft most, left hand side (LHS) seat row. Cabin overhead bins, passenger signs, lights, gasper system, emergency lighting, etc. will be added where required around the additional 2 passenger seats. This reconfiguration results in an increase of 2 passenger seats in the cabin zone aft of the overwing exits – a dead end zone.

The original type design interior configuration of the Model CL-600-2C10 (CRJ-700) includes a maximum passenger capacity of 78 passengers with 26 of those passengers being seated in a dead-end zone aft of the overwing exits. This layout is in accordance with the FAA AC 25.807-1 which recommends dead-end zone capacities not to exceed 75% of the rating of the single pair of exits bounding that zone. The pair of exits bounding that zone are Type III exits with a rating of 35 according to CFR 25.807 at Amendment 25-86.

Applicable regulation(s)

§ 25.807 and 25.813 at Amendment 25-86

Regulation(s) requiring an ELOS finding

§ 25.813 at Amendment 25-86

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

BA proposes a maximum passenger seating capacity limit of 71 passengers for this new passenger seating configuration where the interior configuration includes the additional double passenger seat assembly aft of the overwing exits. That would be 28 seats aft of the overwing exits compared to the presently approved 26 seats.

The interior configuration features adjacent to the oversize model CL-600-2C10 overwing exit will also remain similar to the initial type design configuration:

- a. oversize access passageway width
- b. seat pitch for the seat rows just forward of, and, just aft of the overwing exit
- c. seat cushion intrusion into exit opening- not exceeding presently approved intrusion dimensions for the seat cushion as per FAA ELOS
- d. enclosed overhead bins
- e. emergency exit marker and locator signage
- f. emergency exit operation signage
- g. floor proximity emergency escape path marking system
- h. no other changes to the oversize Type III exit design dimensions

Each Type III overwing emergency exit and associated exit passageway on the model CL-600-2C10 are oversized. This Type III exit has many design features that are comparable to a Type II exit such as width, height, corner radius, and exit opening area.

The emergency evacuation demonstration in accordance with 14 CFR 25.803 for the model CL-600-2C10 has been compared to other Bombardier CL-600 models. The CL-600-2C10 emergency evacuation numbers show a significant difference in the performance of the oversized Type III overwing exit as compared to the model CL-600-2B19 which has a standard size Type III overwing exit.

The Bombardier analysis presented the flow rates for Evacuees Per Minute (EPM) shows that the oversized Type III overwing exit for the model CL-600-2C10 has improved performance over the standard Type III overwing exit of the model CL-600-2B19. This comparison shows an improvement of 17% EPM based on the emergency evacuation test data.

In the model CL-600-2C10 initial type design interior passenger configuration layout used during the 14 CFR 25.803 emergency evacuation demonstration for initial certification, the aft-most LH passenger was located the farthest away from the overwing emergency exits. In the new interior passenger configuration layout, the aft-most LH & RH passengers are located the farthest away from the overwing emergency exits and the distance from the exit is the same as the initial type design configuration. BA presents that those passengers in the new interior passenger configuration layout are afforded the same chances for escape in an emergency situation as those in the type design configuration. BA notes that the aft flight attendant is located at the same distance from the overwing emergency exits in both configurations.

BA also presented per the guidance of FAA AC 25.807-1, the new interior passenger configuration layout results in an improvement in the uniform distribution of exits when compared to the initial type design configuration used during the 14 CFR 25.803 emergency evacuation demonstration for initial certification.

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

BA proposed compensating features for this ELOS which include the maximum passenger capacity limitation of 71 when the additional double seat assembly is added at the aft most RHS of the cabin, the interior configuration adjacent to the over-wing exits remains similar to the original type design, the characteristics of the over-wing exits including the exit access pathway width are over-size, the egress path distance from the additional seats compared to the existing seats is not increased, and the uniform distribution of exits as per FAA AC 25.807-1 is improved.

BA proposes that the exit performance data is also a compensating feature. That the exit performance data is limited to a comparison of 3 full scale evacuation tests on similar narrow body aeroplanes in the BA fleet. As this is a statistically small sample, adequate conservatism in the analysis must be included to address likely variability in the actual exit performance. BA proposes that this has been considered by evaluating all aspects

of the overall design that contribute to an effective emergency egress capability after the RHS double seat assembly is added at the aft most row to the model CL-600-2C10 interior seating arrangement.

The compensating features identified by BA above support an ELOS against 14 CFR 25.813 at Amendment 25-86 to allow a passenger seating configuration with an additional RHS double passenger seat assembly aft of the Type III overwing exits for their CL-600-2C10 (CRJ-700) model aeroplane.

The model CL-600-2C10 Type Certificate Data Sheet will be revised to include a note to identify the additional limitations on the use of the ELOS:

- If this ELOS is applied to the CL-600-2C10 (CRJ-700) model aeroplane-Series 700 and Series 701, their maximum passenger capacities of 68 passengers and 70 passengers respectively remain unchanged.
- If this ELOS is applied to the CL-600-2C10 (CRJ-700) model aeroplane-Series 702, its maximum passenger capacity would be reduced to 71 passengers from 78 passengers.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project Issue Paper C-1. 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. This ELOS memorandum number should be listed in the type certificate data sheet under the certification basis section.

Original signed by Jeff Gardlin for SM

6/24/15

Transport Airplane Directorate,
Aircraft Certification Service

Date

ELOS Originated by NYACO:	ACO Manager Gaetano Sciortino	Routing Symbol ANE-170
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