Federal Aviation Administration

Memorandum

Date:	June 14, 2016
To:	Manager, New York ACO, ANE-170
From:	Manager, Transport Airplane Directorate, ANM-100
Prepared by:	Bruce Valentine, ANE-173
Subject:	INFORMATION: Equivalent Level of Safety Finding for Bombardier Inc. Model CSeries CS100 (BD-500-1A10) and CSeries CS300 (BD-500-1A11), FAA Project # TC4948NY-T
ELOS Memo #:	TC4948NY-T-F-28
Regulatory Ref:	§§ 25.161(c) (1)

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 Bombardier Inc. Model CSeries CS100 (BD-500-1A10) and CSeries CS300 (BD-500-1A11) airplanes.

Background

BA provided definitions and information to convey the need for an ESF.

1. Definitions

   Pitch Attitude Limiting (PAP) – The CSeries airplane incorporates a pitch attitude limiting function that will limit the maximum pitch angle that can be attained on ground and in flight.

   Stick Free Longitudinal Trim – The aircraft is considered to be in longitudinal trim when selected trim speed is the same as the required trim speed and the stick is in the neutral position.

2. Required Demonstration Speeds for Stick Free Longitudinal Trim
The CSeries airplane incorporates a pitch attitude limiting function that will limit the maximum pitch angle that can be attained on ground and in flight. The steady state pitch angle upper limit is reduced at low speed. On-ground, the (upper) steady state pitch attitude limit is blended to its in-flight value following transition from on-ground to in-air mode. On landing, the blending is reversed. The lower steady state pitch attitude limit is constant throughout the normal flight envelope.

The PAP limits are chosen to provide an upper and lower pitch attitude limit appropriate for the aircraft design and safe flight.

25.16l(c) (1), requires a demonstration of stick free longitudinal trim at not more than 1.3Vsr, with maximum continuous power and with the flaps retracted and in the takeoff positions.

At low speeds corresponding to light weights, high thrust conditions, the aircraft can reach the PAP nose up pitch attitude limit during a climb. As a result, the minimum speed that can be maintained is limited by the PAP and it will not be possible to demonstrate a stick free longitudinal trim at the speed defined in 25.161(c) (1) for light weight configurations.

In the case of the CSeries aircraft the operational speeds can be up to 15kts above the 1.3Vsrl, at the lighter weights due to limiting conditions, such as minimum control speed limits. BA believes, the requirement to demonstrate stick free longitudinal trim at speeds significantly below the operational speeds has no practical application and is not appropriate.

Applicable regulation(s)

§§ 25.161 (c) (1)

Regulation(s) requiring an ELOS finding

§§ 25.161 (c) (1)

***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)**

Flap reference speeds on the airspeed tape will allow the crew to easily retract flaps in a scheduled manner during departure. For the high thrust light weight conditions pertinent to this

issue paper, this allows a smooth acceleration to higher operational speeds where trim requirements are more relevant.

The Pitch Attitude Protection (PAP) prevents excessively high nose attitudes on departure. For the light weight conditions pertinent to this issue paper, trimming to 1.3 Vsr1 is not possible due to the PAP; however, the PAP prevents what would otherwise be an excessively high nose attitude.

BA proposes that the intent of the 25.161(c) (1) is satisfied by demonstrating stick free longitudinal trim at the appropriate operational speeds for the conditions specified in 25.161(c) (1). For the flaps retracted this would correspond to the final takeoff speed (Vfto) and the all engine operating takeoff speed with flaps in the takeoff position.

BA is requesting an ESF to allow demonstration of stick free longitudinal trim at the operational speeds, in lieu of the speed requirements defined in 25.161(c) (1).

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

Explanation of how the design features provide an equivalent level of safety is provided in the above section.

FAA approval and documentation of the ELOS finding

The FAA has accepted the aforementioned ELOS finding in project Issue Paper F-28, titled Longitudinal Trim. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The Transport Airplane Directorate 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 Type Certificate Data Sheet under the Certification Basis section (TC's & ATC's) or on page 3 of the STC Certificate:

Equivalent Level of Safety Findings have been made for the following regulation(s):
§§ 25.161(c) (1) (documented in ELOS Memorandum TC4948NY-T-F-28)

Manager, Transport Airplane Directorate, Aircraft Certification Service	Date

ELOS Originated by ACO:	ACO Manager (or Project Engineer for ANE-170):	Routing Symbol: