



# Federal Aviation Administration

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## Memorandum

Date: February 18, 2015

To: Manager, New York ACO, ANE-170

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Morton Lee, ANE-173

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for Automatic Takeoff Thrust Control System (ATTCS), Appendix I Thrust Setting, Lack of On/Off Switch and Indication Requirements on BD-500-1A10 and 1A11, FAA Project *TC4948NY-T*

ELOS Memo#: TC4948NY-T-P-06

Regulatory Ref: Title 14, Code of Federal Regulations, (14 CFR) 25.117, 25.119(a), 25.121(d), 25.904, 25.1301, 25.1305, 25.1309, Part 25 Appendix I

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The purpose of 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 BD-500-1A10 and 1A11.

### Background

Title 14 Code of Federal Regulations (14 CFR) part 25 Appendix I 25.4(a) requires that the initial takeoff thrust or power setting on each engine at the beginning of the takeoff roll may not be less than ninety (90) percent of the maximum thrust set by the ATTCS. The ATTCS thrust is the maximum takeoff thrust or power approved for the airplane under existing ambient conditions. The Bombardier BD-500-1A10 and BD-500-1A11 design integrates the ATTCS system (referred to by Bombardier and in this ELOS memo as an Automatic Power Reserve (APR) system) into the engines Full Authority Digital Electronic Control (FADEC). The Bombardier design allows the initial takeoff thrust to be less than 90% of the APR thrust for derated takeoffs.

Appendix I 25.5(b)(4) requires that the airplane manufacturer provide a means for the flight crew to deactivate the automatic function of the APR, including permitting the crew to revert to normal procedures in the event of erratic system operation. The APR installation does not include a readily available means for the flight crew to deactivate the APR. The flight crew must access a page on the flight management system (FMS) and un-check the box to dis-arm the APR function. The APR function is otherwise always armed unless there is a FADEC malfunction.

Appendix I 25.6 (a) requires that the manufacturer provide a means to indicate when the APR is in the armed or ready condition. The BA BD-500-1A10 and -1A11 primary flight displays do not include an Engine Indication and Crew Alerting System (EICAS) indication when the APR is armed, but indicate when the system is not armed.

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

§§ 25.117, 25.119(a), 25.121(d), 25.904, 25.1301, 25.1305, 25.1309, Part 25 Appendix I

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

§§ 25.904 and Appendix I, paragraphs I 25.4(a), I 25.5(b)(4), and I 25.6(a)

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

Appendix I 25.4(a) requires that the takeoff thrust be no less than 90% of the APR thrust. This requirement was primarily intended to minimize crew workload during critical engine and APR failure conditions and to ensure satisfactory all engine performance. By incorporating the APR function into the FADEC, the crew workload is not affected by allowing the takeoff thrust to be less than 90% of the APR for derated takeoffs. The APR will activate the non-event engine and automatically reset engine thrust on the remaining engine to the full APR thrust rating for the ambient condition.

Appendix I 25.5(b)(4) Powerplant Controls requires a means to deactivate a system to permit flight crews to revert to normal procedures in the event of erratic system operation. The APR design complies with 14 CFR sections 25.1301 and 25.1309 for all phases of flight and the integrated FADEC APR thrust control system meets the reliability requirements of Appendix I 25.3. Deactivation is not required to maintain the level of safety required by Appendix I and the applicable part 25 regulations. In the event of a FADEC failure requiring crew action, de-selection of APR function itself is not required for continued safe flight and landing.

Appendix I 25.6 (a) Powerplant Instruments requires indication that the APR is ARMED. The normal state of the APR is in the ARMED condition. Indication of the ARMED condition can be located in the FMS, but no EICAS indication is provided. This is consistent with the dark cockpit philosophy that does not provide indication of a normal condition. If the system is disabled by the crew then indication of the de-selection is given by Fight Management System, and an EICAS status message confirming the crew de-selection of APR is displayed: APR DISARMED (S). In the event of a FADEC (APR) failure, that results in either an engine going sub-idle, an engine instability, or thrust loss, or a loss of function of a non-dispatch engine fault, an EICAS message will be posted to ensure the flightcrew is aware of the failure and can take appropriate action.

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

The APR system design complies with all of the applicable Part 25 installation, reliability and performance requirements except as described in this ELOS memo and ELOS memo TC4948NY-T-P-7.

The fail-safe design features of the ATTCS (APR), combined with appropriate alerts is considered sufficient and acceptable to establish an equivalent level of safety to the requirements of 14 CFR part 25 Appendix I 25.4(a), I 25.5(b)(4), and I 25.6(a).

**FAA approval and documentation of the ELOS finding**

The FAA has approved the aforementioned ELOS finding in project Issue Paper P-06. 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 (TC's & ATC's).

Equivalent Level of Safety Findings has been made for the following regulation(s):  
§§ 25.904, 14 CFR part 25 Appendix I 25.4(a) 25.5(b)(4) and 25.6(a).

(Documented in TAD ELOS Memo TC4948NY-T-P-06)

Original signed by Victor Wicklund

2/18/15

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Transport Airplane Directorate,  
Aircraft Certification Service

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Date

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