U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject:	INFORMATION: Equivalent Level of Safety Finding (ELOS) for Hydraulic System Proof Pressure Test Bombardier Aerospace Model BD-100-1A11	Date:	July 1, 2004
		Reg Ref	§ 25.1435, Amdt. 25-72
From:	Manager, Transport Airplane Directorate, Propulsion/Mechnical Systems, ANM-112	Reply to Attn. of:	Dan Parrillo ANE-171
To:	Manager, New York ACO	ELOS Memo #	AT3532NY-S-1

The purpose of this memorandum is to inform the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate on the establishment of an equivalent level of safety finding for the Bombardier Aerospace model BD-100-1A11.

Background

Bombardier has applied for an amended type certificate to add a model BD-700-1A11 (Global Express 5000) airplane to Type Certificate T00003NY. The Global Express 5000 is a derivative of the BD-700-1A10 (Global Express). The aircraft can be described by two standard option modifications to the basic Global Express:

a. Forward Fuselage Deplug and above floor avionics rack, and

b. Aft Fuel Tank Removal, Center Fuel Tank Limitation and Automatic Fuel Recirculation System.

As a result of these modifications tubing in the hydraulic systems is shortened. The system remains architecturally identical to the original Global Expressas controls and indications. The only difference is a 32 inch shortening of the nose landing gear and ram air turbine lines in straight section soft tubing. This design change requires a hydraulic system proof pressure test to show compliance to § 25.1435(b)(1), Amendment 25-72. The purpose of the hydraulic system proof pressure test required by § 25.1435(b)(1) is to show adequate separation between hydraulic system elements and structure or other systems; and to show that there will be no permanent detrimental deformation that would prevent the system from performing its intended function.

Section 25.1435(c)(3), Amdt. 25-104, allows the hydraulic system proof pressure test to be conducted at the *system relief pressure* or 1.25 times the design operating pressure if a system pressure relief device is not part of the system design. The rule also requires the complete hydraulic system(s) to be functionally tested on the airplane in normal operation over the range of motion of all associated user systems.

Bombardier proposes using hydraulic system test pressure data from the original Global Express program as related to 14 CFR 25.1435(b)(1), of not less than 3400 psig for this program.

Applicable regulation(s)

Section 14 CFR 25.1435(b)(1), Amendment 25-72 states:

A complete hydraulic system must be static tested to show that it can withstand a pressure of 1.5 times the design operating pressure without a deformation of any part of the system that would prevent it from performing its intended function. Clearance between structural members and hydraulic system elements must be adequate and there must be no permanent detrimental deformation. For the purpose of this test, the pressure relief valve may be made inoperable to permit application of the required pressure.

Section 14 CFR 25.1435(c)(3), Amendment 25-104 states:

The complete hydraulic system(s) must be functionally tested on the airplane in normal operation over the range of motion of all associated user systems. The test must be conducted at the system relief pressure or 1.25 times the DOP if a system pressure relief device is not part of the system design. Clearances between hydraulic system elements and other systems or structural elements must remain adequate and there must be no detrimental effects. **]**

Regulation(s) requiring an ELOS

Section 14 CFR 25.1435(b)(1), Amendment 25-72

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

This equivalent safety finding is being considered based on the requirements for hydraulic systems proof pressure testing in 14 CFR part 25.1435, Amendment 25-104. Changes to the hydraulic system in this BD 700-1A11 program are not in locations where there is relative motion of the user systems, other systems, or airplane components; therefore, actuation system operation over the entire range of motion should not have any effect on the proof pressure test for this program. The proposed proof pressure test at 3400 psig provides an equivalent level of safety to the proof pressure requirement in § 25.1435(b)(1) at 4500 psig for the design changes to the hydraulic system in this airplane based on the level of safety provided by the regulation as revised by Amendment 25-104.

In addition, in this case testing at this lower pressure has the added benefit of allowing a more complete test because a test pressure of 4500 psig would require portions of the hydraulic system to be disconnected or blocked off from the test pressure to prevent structural overload from the actuators.

Note: The consideration of hydraulic system proof pressure testing at the system relief pressure and range of motion of the user system, other systems, or airplane components in the area of the hydraulic system has been formally and explicitly addressed in 14 CFR part 25, Amendment 25-104. Range of motion of the user system, other systems, or airplane components in the area of hydraulic system has to be considered when evaluating an equivalent safety finding to hydraulic system proof pressure tests requirements of § 25.1435(b)(1).

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

As stated above, changes to the hydraulic system in this program are not in locations where there is relative motion of the user systems, other systems, or airplane components. Therefore, actuation system operation over the entire range of motion should not have any effect on the proof pressure test for this airplane program. Bombardier has proposed using data from the original Global Express proof pressure test at 3400 psig. This provides an equivalent level of safety to the 1.5 times design operating pressure requirement required of § 25.1435(b)(1) for the design changes to the hydraulic system in this airplane when considering the intent of the earlier regulation and the level of safety allowing for the use of system relief pressure in the more recent standard.

FAA approval and documentation of the ELOS

The FAA has approved the aforementioned Equivalent Level of Safety Finding addressed in issue paper S-1. This memorandum provides standardized documentation of the ELOS that is non-proprietary and can be made available to the public. The Transport Airplane Directorate has assigned a unique ELOS Memorandum number 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) or in the limitations and conditions section of the STC Certificate.

Equivalent Safety Findings have been made for the following regulation(s): § 25.1435(b)(1) Hydraulic System Proof Pressure Test (documented in TAD ELOS Memo AT3532NY-S-1)

/s/ Neil D. Schalekamp	7/1/2004
Manager, Transport Standards Staff, Propulsion/Mechanical Systems Branch, ANM-112	Date

ELOS Originated by NYACO:	Name Dan Parrillo	Routing Symbol ANE-172