Docket No. SA-531

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NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Aircraft Performance Group Chairman

AMA 525/2 Flight in Icing Conditions - Performance

(4 pages)

AIRWORTHINESS MANUAL ADVISORY (AMA)

Subject:

FLIGHT IN ICING CONDITIONS - PERFORMANCE

1. PURPOSE. This advisory information provides guidance for acceptable means, but not the only means, of demonstrating compliance with the performance requirements of Chapter 525 of the Airworthiness Manual, dealing with approval of Transport Category Aeroplanes for flight in icing conditions.

The subject of this advisory material is presently object of international harmonization, and this AMA is issued for use during familiarization/validation programs. When harmonization is completed, this AMA will be amended or revoked after adopting equivalent foreign advisory material.

2. REFERENCE AIRWORTHINESS STANDARDS. Chapter 525: sections 525.101, 525.103, 525.105, 525.115, 525.119, 525.121, 525.125, 525.1093, 525.1419, 525.1525, 525.1581, and Appendix C.

3. BACKGROUND AND DISCUSSION. The equipment design requirements for ice protection are contained in 525.1093 and 525.1419. Advisory Circular 25.73 contains information relating to substantiation of ice protection systems. The AC suggests that the full impact on aircraft performance should be determined for expected ice accretions on unprotected surfaces but does not give any clarifying procedures. Clearly an aircraft designed with extensive ice protection systems suffers less of a performance decrement than an aircraft with less extensive systems. In the past there has been uncertainty about how performance decrements should be determined and how they should be applied with respect to approved AFM procedures and performance.

4. PERFORMANCE DETERMINATION. In general, flight in icing conditions can include take-off and climb, cruise, descent and landing. During the takeoff phase it may be assumed that there is negligible ice accumulation, but operation of the ice protection systems has to be considered. For the other flight phases it should be assumed that the ice protection systems are required and that there may also be ice accumulation on unprotected surfaces.

(a) For takeoff and climb into icing conditions the following should be considered:

(1) Takeoff speeds should retain adequate margins above the minimum reference speeds appropriate to the operating procedures and conditions (e.g. boots cycling, wind bleed air exhaust);

(2) Thrust should be appropriate to the operating procedures and conditions (e.g. bleed loss, power extraction of electrical anti-ice loads);

(3) Drag should be appropriate to the operating configuration (e.g. ice separator flaps open); and

(4) Takeoff performance should be based on the speeds, thrust and drag established above.

(b) For enroute flight in icing conditions or after an icing encounter, the following should be considered:

(1) Enroute climb speed should retain an adequate margin above the minimum reference speed appropriate to operating procedures, conditions and aerodynamic configuration (e.g. ice on unprotected surfaces);

(2) Thrust should be appropriate to the operating procedures and conditions;

(3) Drag and weight increments due to ice accumulation on the unprotected surfaces and drag increment due to ice protection system configuration; and

(4) Enroute climb gradient and flight path data should be based on the speeds, thrust and drag established above.

(c) Following flight in icing conditions, the approach and landing phases may be carried out with ice accumulation and possibly in icing conditions, the following should be considered:

(1) Approach climb, landing climb and landing reference speeds should retain adequate margins above the minimum reference speeds appropriate to the operating procedures, conditions, and aerodynamic configuration (e.g. ice on unprotected surfaces);

(2) Thrust should be appropriate to the operating procedures and conditions (e.g. power available after 8 sec with bleed load);

(3) Drag and weight increments due to ice accumulation on the unprotected surfaces and drag increment due to ice protection system configuration (e.g. ice separator flaps open);

(4) Approach and landing climb gradients and limiting weights should be based on the speeds, thrust and drag established above; and

(5) The landing distance should be established for the appropriate operating procedures (e.g. reference speed at 50 ft).

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