Transport Canada Transports Canada

Advisory Circular (AC)

Certification of Transport Category Aeroplanes On Narrow Runways

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this Advisory Circular (AC) is to identify the airworthiness requirements that apply to the certification of Transport Category aeroplanes on narrow runways. If an applicant elects such certification, the airworthiness requirements contained herein will be issued as a Special Conditions - Airworthiness (SCA) to become part of the basis of certification in the aeroplane's Type Certificate.

1.2 Guidance Applicability

This document is applicable to all Transport Canada personnel, delegates and industry.

1.3 Description of Changes

This document, formerly AMA No. 525/12, is reissued as an AC. With the exception of minor editorial changes content is unaltered.

1.4 Termination

This document does not have a terminating action. It will however, be reviewed periodically for suitability of content.

2.0 REFERENCES

2.1 Reference Documents

It is intended that the following reference materials be used in conjunction with this document:

(a) Chapter 525 of the Airworthiness Manual (AWM) — *Transport Category Aeroplanes*;

(b) Federal Aviation Administration Advisory Circular (FAA AC) 150/5300-13, — *Airport Design Standards — Transport Airports*; and

(c) International Civil Aviation Organization (ICAO) Annex 14, Volume 1 Chapter 1.3 — *Aerodrome Design and Operations*.

2.2 Cancelled Document

As of the effective date of this document, AMA No. 525/12 dated 19 November 1999 is cancelled.

3.0 BACKGROUND

3.1 Definition of a Narrow Runway

ICAO Annex 14, Volume 1, Aerodrome Design and Operations, Chapter 1.3 defines an aerodrome reference code depending on aeroplane performance (reference field length, which is defined as the minimum field length required for take-off at maximum take-off weight, sea level, ISA, zero wind and zero runway slope) and aeroplane physical dimensions (wing span and distance between outside edges of the main gear wheels). For example, the DHC-8-100/200/300 series of aeroplanes, the aerodrome reference code is Code Number 2, Code Letter C. Chapter 3.1.9 contains the recommended runway width as a function of Code Number and Code Letter. For the DHC-8-100/200/300 series, the recommended minimum width is 30 m (98 ft)).

Transport Canada publication TP 312, Aerodrome Standards and Recommended Practices, contains the same methodology as the ICAO document. (For example, the recommended minimum width for the DHC-8 100/200/300 series is 30 m (98 ft)).

FAA Advisory Circular 150/5300-13, Change 5 dated 14 February 1997, Airport Design Standards - Transport Airports, Chapter 3, paragraphs 302 relates the runway width to an Airplane Design Group classification (which depends on wingspan), maximum take-off weight, and approach category (which depends on approach speed).

All of the above standards are aerodrome design standards relating the required width of runway to the type of aeroplane, which will use the runway. Although not specifically noted in the standards, it is assumed that the aeroplane performance and handling characteristics requirements contained in the basic airworthiness code are appropriate to the specified minimum width. For runways whose minimum width are narrower than those determined using ICAO Annex 14, Volume 1, 1.3 Reference code, it has been determined that the existing requirements are not adequate and that an SCA is appropriate.

3.2 Previous Requirements

No existing or previous airworthiness requirements or advisory material have been identified with the exception of proposed Air Navigation Orders put forward by the Australian Department of Aviation (DOA). These proposed ANOs were intended to be used to establish the minimum width of runway for each aeroplane type. The minimum width would be specified in the Aeroplane Flight Manual. The proposal was published in 1986 and was used for Australian DOA approval of some Canadian aeroplanes; however it is not known whether the proposal was ever adopted as a rule.

The Australian proposed requirements have not been adopted by Transport Canada. That is, there are no specific requirements or test procedures in current regulations to determine the minimum width of runway for each type of aeroplane. It is considered that the existing requirements are adequate to ensure a satisfactory safety level when operating to the minimum width specified in the aerodrome design standards.

The proposed Australian DOA requirements have been used as a basis for the certification on runways, which are narrower than those specified in the aerodrome design standards.

4.0 AIRWORTHINESS REQUIREMENTS

4.1 Minimum Runway Width

The minimum runway width is that which is sufficient to allow the aeroplane to be safely controllable during take-off and landing using procedures, which can be consistently executed in service by crews of average skill. The width shall be sufficient to prevent any landing gear wheel leaving the runway during take-off and landing in expected operating conditions, including sudden engine failure.

4.2 Determination of Minimum Runway Width

The minimum runway width W, is the greater of the following:

$W = 2((0.5T) + M + D_{take\text{-}off})$; or

$W = 2((0.5T) + D_{land})$

Where:

W = Minimum runway width;

T = Distance between outside edges of the main gear wheels, or the distance between the most outer engines, whichever is greater.

M = Misalignment distance of the nosewheel with the centre of the runway at start of take-off and during the take-off ground roll. It is the greater of the following:

(a) The value demonstrated during test on a representative narrow runway; or

(b) 5 ft for a 100 ft wide runway decreasing linearly to 2.5 ft for a 50 ft runway but not below 2.5 ft for runways less than 50 ft wide.

$D_{take\text{-}off}$ = the maximum lateral deviation distance demonstrated in take-off. It is the greater of the following:

(a) Distance "x" used during the determination of V_{MCG} (see para 4.3).

(b) Maximum deviation determined during demonstration of rejected take-off following engine failure at any speed up to and including V_{MCG}.

(c) Maximum ground deviation in a continued take-off or rejected take-off following any probable failure during the take-off ground roll.

(d) Maximum ground deviation determined during a take-off at the maximum crosswind limit with all engines operating.

D_{land} = the maximum lateral deviation demonstrated during landing. It is the greater of the following:

(a) Maximum deviation during landing at the maximum crosswind limit with all engines operating.

(b) Maximum deviation during landing following sudden engine failure at 200 ft. The nosewheel steering should be disconnected or, at the option of the applicant, the deviation can be determined on a wet runway.

(c) Maximum deviation during landing at the maximum crosswind limits with one engine inoperative if approval of one engine inoperative approaches to narrow runways is requested.

4.3 Minimum Control Speed on the Ground, V_{MCG}

In lieu of the requirements of AWM 525.149(e), V_{MCG} shall be determined as follows:

V_{MCG}, the minimum control speed on the ground, is the calibrated airspeed during the take-off run, at which, when the critical engine is suddenly made inoperative, it is possible to recover control of the aeroplane with the use of primary aerodynamic controls alone (without the use of nosewheel steering) to enable the take-off to be safely continued using normal piloting skill and rudder control forces not exceeding 150 pounds. In the determination of V_{MCG}, assuming that the path of the aeroplane accelerating with all engines operating is along the centreline of the runway, its path from the point at which the critical engine is made inoperative to the point at which recovery to a direction parallel to the centreline is completed may not deviate more than a specified distance "x" feet laterally from the centreline at any point. V_{MCG} must be established with:

(a) The aeroplane in each take-off configuration requested by the applicant or, at the option of the applicant, in the most critical take-off configuration;

(b) Maximum available take-off power or thrust on the operating engines;

(c) The most unfavourable centre of gravity;

(d) The aeroplane trimmed for take-off;

(e) The most unfavourable weight in the range of take-off weights; and

(f) A value of "x" chosen by the applicant but which may not be less than 5 ft.

Note:

This requirement is identical to that of AWM 525 except that the deviation of 30 ft is replaced by "x" which may not be less than 5 ft.

4.4 Directional and Lateral Control

It must be possible to safely land on the runway, without undue pilot skill, following a side-step manoeuvre of 400 ft laterally initiated at a height of 400 ft during a landing approach.

This must be demonstrated with one engine inoperative if approval of one engine inoperative approaches to narrow runways is requested and must consider the most adverse crosswind to be approved for one engine inoperative approach and landing.

4.5 Take-off Performance

The take-off speeds in AWM 525.107, accelerate-stop distance in AWM 525.109, and take-off path in AWM 525.111 (including the take-off distance and take-off run in AWM 525.113) must be determined using an engine failure speed V_{EF} appropriate to the V_{MCG} established in para 4.3.

4.6 Aeroplane Flight Manual (AFM)

The AFM data for operation on narrow runways must contain:

(a) A statement to the effect that the certification of the aeroplane on narrow runways does not constitute operational approval;

(b) Limitations including:

- (i) Minimum runway width;
- (ii) Crosswind limitations;
- (iii) V_{MCG} and the corresponding maximum lateral deviation "x"; and
- (iv) Any other appropriate limitation (e.g. Nosewheel steering must be operative);

(c) Emergency, Abnormal and Normal Procedures as appropriate; and

(d) Take-off performance predicated on a V_{EF} appropriate to the corresponding V_{MCG}.

5.0 HEADQUARTERS CONTACT

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