Australian Government
Civil Aviation Safety Authority

Civil Aviation Advisory Publication

May 2014

New performance provisions for CAO 20.7.1B and CAO 20.7.4

CAAPs provide guidance, interpretation and explanation on complying with the Civil Aviation Regulations (CAR) or Civil Aviation Orders (CAO).

This CAAP provides advisory information to the aviation industry in support of a particular CAR or CAO. Ordinarily, the CAAP will provide additional 'how to' information not found in the source CAR, or elsewhere.

A CAAP is not intended to clarify the intent of a CAR, which must be clear from a reading of the regulation itself, nor may the CAAP contain mandatory requirements not contained in legislation.

Note: *Read this advisory publication in conjunction with the appropriate regulations/orders.*

This CAAP will be of interest to

This Civil Aviation Advisory Publication (CAAP) will be of interest to:

- Operators and pilots who are required to operate their aeroplanes in accordance with section 20.7.1B and 20.7.4 of the Civil Aviation Orders (CAO)
- Operators and pilots of jet aeroplanes with maximum take-off weight between 2 722 kg (6,000 lb) and 5 700 kg (12,500 lb).

Why this publication was written

In February 2014, CAO 20.7.1B and 20.7.4 were amended to incorporate new performance provisions:

- Very light jet aircraft performance
- Landing distance
- Line up allowance
- Required Navigation Performance.

This CAAP has been written to explain these new provisions and assist operators and pilots in complying with them. These CAO amendments were originally detailed in Civil Aviation Safety Authority (CASA) Project CS 11/09. This project was subsequently redesignated as OS 13/03.

Status of this CAAP

This is the first CAAP to be issued on the subject of Aeroplane Weight and Performance Limitations. This CAAP was originally consulted on as CAAP 20.7-1(0).

For further information

For policy advice contact: CASA Standards Division (Telephone 131757).

Contents

1. The relevant regulations and other references

- Subregulation 235 (2) of the Civil Aviation Regulations 1988 (CAR)
- CAO 20.7.1B
- CAO 20.7.4
- Part 91 (forthcoming) of the Civil Aviation Safety Regulations 1998 (CASR)
- Part 121 (forthcoming) of CASR
- Part 135 (forthcoming) of CASR
- Federal Aviation Regulations (FAR) Part 23
- FAR Part 25
- Federal Aviation Administration Safety Alert for Operators number 06012
- Aeronautical Radio Incorporated Specification number 424-17
- Annex 6, Operation of Aircraft to the Chicago Convention.

2. Acronyms

ARINC	Aeronautical Radio Incorporated Specification
ASDA	Accelerate stop distance available
CAAP	Civil Aviation Advisory Publication
CAR	Civil Aviation Regulations 1988
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations 1998
CAO	Civil Aviation Order
FAA	Federal Aviation Administration (USA)
FAR	Federal Aviation Regulations
RNP	Required navigation performance
RPT	Regular public transport
SAFO	Safety alert for Operations
TALPA ARC	Take-off and landing performance assessment aviation rule making committee
TODA	Take-off distance available
TORA	Take-off run available

3. Definitions

Take-off run available: means the length of the runway declared to be available and suitable for the ground run of an aeroplane taking off.

> ***Note:*** *If any part of the take-off run available is lost due to the alignment of the aircraft at the start of the take-off run, account must be taken of the loss.*

Actual landing distance: means the landing distance required for the actual conditions, using the deceleration devices planned to be used for the landing.

> ***Note:*** *Actual landing distance required is explained in "Safety Alert for Operators, SAFO 06012" published by the USA Federal Aviation Administration.*

ARINC 424 RF path terminator: means a segment of a flight path known as radius-to-fix, terminating as specified in *Aeronautical Radio Incorporated Specification (ARINC) 424-17*.

RF leg: means a radius-to-fix leg encoded in the navigation database for an approved Required Navigation Performance (RNP) operation.

4. Very light jet aeroplanes with 2 or more engines

4.1 The US Federal Aviation Administration (FAA) has certificated a small number of types of jet-engine aeroplanes to the normal category standards specified in FAR Part 23. The Cessna 501 and 551 were early examples. The Embraer Phenom 100 is a recent example. In consideration of their jet engines, the FAA imposed many of the take-off performance requirements specified for transport category aircraft in FAR Part 25. In 2009, the FAA announced that it intended to continue its policy of imposing a higher level of take-off performance requirements on jet-engine aeroplanes even though they may be certificated to normal category standards. In the future, new types of jet-engine aeroplanes with a maximum take-off weight above 6,000 lb (2 722 kg) that are to be certificated in the normal category will have to meet the take-off performance requirements specified for the commuter category.

4.2 In Australia, jet-engine aeroplanes with a maximum take-off weight less than 5 700 kg have been required to operate to the weight and performance limitations specified in CAO 20.7.4. This section of the CAO is not compatible with the performance information in the flight manuals of jet-engine aeroplanes. For example, CAO 20.7.4 specifies that the take-off distance is the horizontal distance to accelerate with all engines operating, take-off and climb to a height of 50 feet above the take-off surface. In contrast, the take-off performance information in the flight manuals of jet-engine aeroplanes specifies that the take-off distance is the horizontal distance to take-off and climb to a height of 35 feet above the take-off surface, with one engine assumed to fail at the engine failure recognition speed or take-off decision speed. Similarly, the obstacle clearance information in the flight manuals of jet-engine aeroplanes is not compatible with the requirements in CAO 20.7.4.

4.3 The incompatibility between CAO 20.7.4 and the performance information in the flight manuals of light jet-engine aeroplanes presents a problem particularly for aeroplanes that are used in charter operations. CASA has amended CAO 20.7.4 so that it no longer applies to jet-engined aeroplanes with maximum take-off weight above 2 722 kg. Concurrently CAO 20.7.1B has been amended to include jet-engine aeroplanes with maximum take-off weight between 2 722 kg and 5 700 kg.

4.4 The take-off and landing requirements have been formulated carefully so the new provisions in the CAO, applicable to light jet-engine aeroplanes, are no more onerous than the provisions under which they have been operating in the past and are compatible with the

performance information in these aeroplanes' flight manuals. For example, when these light jet-engine aeroplanes have been operated in accordance with CAO 20.7.4, they have been permitted to use unfactored landing distance information from the flight manual or a manufacturer's data manual. This will continue to be permitted when these aeroplanes commence operating in accordance with CAO 20.7.1B.

4.5 Transfer to CAO 20.7.1B of jet-engine aeroplanes with maximum take-off weight between 2 722 kg and 5 700 kg is consistent with the weight and performance limitations that will be applicable to these aeroplanes when Parts 91, 121 and 135 of CASR commence.

5. Landing distance

5.1 For regular public transport (RPT) operations in jet-engine aeroplanes, the safety factor applicable on a wet runway is different to that applicable on a dry runway. The same is true of RPT and charter operations in a propeller-driven aeroplane.

	Dry runway	**Wet runway**
Propeller-driven aeroplane	1·43	1·67
Jet-engine aeroplane	1·67	1·92

5.2 The landing distance requirements have been amended so the higher safety factor only applies at the time of pre-flight planning, and only if a forecast indicates the runway will be wet at the time of landing. If a forecast indicates the runway will be dry at the time of landing but on arrival (in-flight) the runway is wet, then as this is an in-flight condition, the pre-flight landing distance factors do not apply.

5.3 Actual landing distance

5.3.1 In response to recommendations of the FAA's Take-off and landing performance assessment aviation rule making committee (TALPA ARC), the manufacturers of some jet-engine aeroplanes now supply *actual landing distance* information to help pilots make more accurate in-flight assessments of the landing distance required in unusual situations. *Actual landing distance* information takes into account: reported meteorological and runway surface conditions, runway slope, aircraft configuration, planned approach speed, thrust reversers and any other deceleration devices planned to be used for the landing. The FAA's *Safety Alert For Operators (SAFO 06012)* contains useful information about the recommendations of the TALPA ARC.

5.3.2 *Actual landing distance* information is intended to show landing performance that can realistically be achieved by flight crews in commercial operations. This is distinct from landing performance demonstrated by test pilots during flight tests for aircraft type certification. The safety factor applicable to in-flight *actual landing distance* information is 1.15. The safety factor applied to aircraft type certification for pre-flight planning landing distance is 1.67. Pilots of jet-engine aeroplanes that do not have *actual landing distance* information should continue to make in-flight assessment of landing distance required using the manufacturers landing distance information with an applicable safety factor.

5.3.3 Two major manufacturers, Boeing and Airbus, have introduced a new reference for in-flight landing distance performance, catering for both normal and abnormal system operations. The new distances are referred to by Airbus as Operational Landing Distances (OLD) and In-flight Landing Distance (IFLD) whereas Boeing incorporates the *actual landing distance* in the Performance In-flight section of the Quick Reference Handbook. Both manufacturers have included this data in their respective performance applications. The *actual landing distances* are a realistic representation of operationally achievable landing performance. The representation of this information is generally "unfactored" unless otherwise stated. The CAO 20.7.1B amendment facilitates the adoption of manufacturers' performance applications along with the application of the 1.15 safety factor. The

FAA and EASA have adopted the in-flight landing distance factoring as policy, and along with ICAO are in the process of rulemaking.

6. Line-up allowance

6.1 For approximately 30 years in Australia, the major airlines have been required to determine a line-up allowance for each aircraft type and model and to reduce runway dimensions by that amount when determining runway-limited take-off weights.

6.2 Annex 6, Operation of Aircraft to the Convention on International Civil Aviation (the Chicago Convention) specifies that for aeroplanes of maximum weight 5 700 kg or greater, allowance should be made for the loss of runway due to aligning the aeroplane with the runway centre-line. Part I of Annex 6 to the Chicago Convention states:

> *5.2.8.1 In determining the length of the runway available, account shall be taken of the loss, if any, of runway length due to alignment of the aeroplane prior to take-off.*

6.3 This procedure is to allow for the distance used in taxiing into the runway and lining-up prior to setting thrust for take-off. The basic take-off runway dimension, Take-off Run Available (TORA), is measured from one end of the runway pavement to the other. The other take-off runway dimensions, Take-off Distance Available (TODA) and Accelerate-stop Distance Available (ASDA), are determined by adding the length of any clearway and any stopway respectively to the TORA.

6.4 It is not possible for an aeroplane to make full use of the TORA, TODA and ASDA for the following reasons:

- After the aeroplane has entered the runway and turned to line-up with the centre line, a short length of runway lies behind the aeroplane and cannot be used during the subsequent acceleration.
- In even the most benign situation, an amount of runway equal to the wheelbase of the aeroplane is not available for acceleration in the case of a continued take-off, or deceleration in the case of an accelerate stop.

6.5 CASA has amended CAO 20.7.1B to include a line-up allowance for all aeroplanes with a maximum take-off weight greater than 5 700 kg. This has been achieved by adding a '*Note"* to the definition of ***take-off run available*** stating that account must be taken of any part of the ***take-off run available*** that is lost due to alignment of the aeroplane before take-off.

7. Required Navigation Performance

7.1 Aeroplanes flying certain take-off flight paths designed to RNP criteria are able to be navigated with lateral obstacle clearance less than that currently required for compliance with CAO 20.7.1B. A re-evaluation of the method of evaluating obstacles in the take-off path is warranted in order to recognise the improved accuracy and safety of RNP - Authorisation Required departures.

7.2 Subsection 12 of CAO 20.7.1B was amended in the late 1990s to provide operators the option of either continuing to use the then existing take-off climb requirements or using those of Part I of Annex 6 to the Chicago Convention. The subsection was further amended in 2005 to allow for a limited use of RNP departures and the intention is to build on this option. Aeroplanes that are not equipped for RNP operations, or who do not wish to take advantage of the new provision, are accommodated in CAO 20.7.1B.

7.3 Subsections 12 and 12A of CAO 20.7.1B have been amended to further facilitate operations governed by RNP, with consideration of increased bank angles up to 25°. Subsection 3 of CAO 20.7.1B has been amended to delete the definition of *RNP containment*. Definitions of *RF leg* and *ARINC 424 RF path terminator* have been inserted.

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