European Union Aviation Safety Agency

Notice of Proposed Amendment 2025-01 (D)

in accordance with Article 6 of MB Decision 01-2022

Proposed amendment to CS-26

Table of contents

Proposed amendments

The amendment(s) is (are) arranged as follows to show deleted, new and unchanged text:

— deleted text is ~~struck through~~;

— new text is highlighted in blue;

— an ellipsis '[…]' indicates that the rest of the text is unchanged.

Amend CS-26 as follows:

Draft certification specifications

SUBPART B — AEROPLANES

CS 26.204 Take-off performance monitoring system

Compliance with point 26.204 of Part-26 is demonstrated by showing compliance with CS 25.704, or with the following.

(a) The take-off performance monitoring system must include the conditions resulting from:

(1) errors in the input and selection of the take-off performance parameters in the aeroplane systems; and

(2) errors on the position and heading of the aeroplane at the start of the take-off.

(b) The system must also include the conditions resulting from insufficient real-time aeroplane performance during the take-off roll for aeroplanes with a maximum take-off mass (MTOM) of 35 000 kg (71 162 lb) or more and certified for:

— transport of passengers with a maximum passenger seating configuration (MPSC) of more than 19; or

— transport of cargo only; or

— transport of passengers and cargo, with one of the following cargo compartments installed on the main deck(s) –

— a large Class B compartment that exceeds the size permitted by CS 25.857(b) at Amendment 8 of CS-25,

— a Class C compartment,

— a Class F compartment.

(c) The system must consider normal take-off configurations and at least dry and wet runway conditions on smooth runways, and, at the option of the applicant, grooved or porous friction course wet runways.

Draft Guidance Material

GM1 26.204 Take-off performance monitoring system

The intention of CS 26.704 is to mitigate the risk of a take-off being performed with an aeroplane that is in an unsafe take-off condition in terms of performance, position and/or heading. An alert to the flight crew should be triggered as early as possible, ideally during the cockpit preparation phase but at the latest before the aeroplane reaches the V_1 speed.

(a) *Performance*. The intent is to mitigate the risk of incidents and accidents that can result from the use of incorrect take-off performance parameters due to either errors made during the performance parameter calculation, or input errors made when entering correctly calculated performance parameters in the aeroplane system(s) (e.g. in the flight management system (FMS) or another system) of. The following errors could be encountered:

— incorrect weight values, including use of an incorrect zero fuel weight (ZFW) value for take-off weight (TOW) calculation, use of an incorrect TOW value (e.g. use of ZFW, empty weight or other value), use of a previous flight TOW, various errors made when using the electronic flight bags (EFBs), typing errors when entering weight values in the FMS and errors in the load sheet provided to the flight crew;

— incorrect pitch trim setting;

— incorrect available runway length, for example not taking into account a notice to airmen (NOTAM) (maintenance work), use of an incorrect runway chart, or an error made during re-calculation after a runway change;

— incorrect assumed temperature for thrust or power reduction calculation, or incorrect thrust or power selection in the FMS (e.g. fix derate);

— incorrect take-off speeds in the FMS or no speeds entered.

(b) *Position and heading*. The intent is to mitigate the risk of incidents and accidents that can result from errors in the positioning or the heading of the aeroplane for initiation of the take-off, for instance take-off from a runway position providing a length shorter than that assumed for the take-off performance parameter calculation (e.g. incorrect runway intersection), take-off from a runway different from the one used for performance calculation and entered in the aeroplane systems (in the FMS or other system), take-off from a taxiway, or an error in the heading (e.g. take-off from opposite QFU).

GM2 26.204 Take-off performance monitoring system

(a) *Take-off performance monitoring system (TOPMS) design minimum features*

The system should be designed to alert the flight crew, as a minimum, to the following conditions.

(1) *Before take-off initiation*.

From cockpit preparation until take-off initiation, errors or inconsistencies exist in the following parameters that are expected to be in the aeroplane systems (in the FMS or other system).

(i) Weight values (e.g. out-of-range or inconsistent values) and CG (e.g. out-of-range or inconsistent values, also consistency with alternate CG limits if applicable).

(ii) Aeroplane configurations (e.g. out-of-range or inconsistent values of pitch trim, flap position, slat position). This should include configurations that would not trigger an alert as requested by CS 25.703 (if applicable) but are nevertheless unsafe for the specific aeroplane weight and CG, and configurations not covered by the conditions specified in CS 25.107(e)(4).

(iii) The predicted take-off distance/run (calculated in compliance with CS 25.113) is not compatible with the take-off distance available, or the predicted accelerate–stop distance (calculated in compliance with CS 25.109) is not compatible with the accelerate–stop distance available. Any take-off runway shift should be taken into account (e.g. when using a runway intersection). The take-off distance available and the accelerate–stop distance available are defined in ICAO Annex 14 Vol. I (Aerodrome Design and Operations).

(iv) Thrust or power selection parameter(s) (e.g. out-of-range or inconsistent values).

(v) Take-off speeds (e.g. out-of-range values, incoherent speeds, insufficient margins with minimum control or stall speeds).

(2) *From take-off initiation*.

(i) *Position*. Take-off is initiated:

(A) from a position on the runway such that the remaining available take-off distance is not compatible with the predicted take-off distance/run or the remaining available accelerate–stop distance is not compatible with the predicted accelerate–stop distance (e.g. positioning on incorrect runway intersection);

(B) from a runway different from the one entered in the aeroplane systems (in the FMS or other system);

(C) from an incorrect runway heading;

(D) outside a runway (e.g. from a taxiway).

(ii) *Real-time aeroplane performance (for aeroplanes that must comply with CS 26.204(b))*. During the take-off roll, the real-time aeroplane performance differs significantly from the planned (or reference) take-off performance such that an unsafe take-off may result. Real-time parameters may be monitored and used to determine whether the take-off will be safe. These parameters may include but may not be limited to:

(A) aeroplane acceleration;

(B) aeroplane ground speed and airspeed;

(C) wheel speed.

The method used by the applicant to determine when the actual performance of the aeroplane is unsafe should be presented to and agreed by EASA. Some examples of methods that may be used are:

(A) real-time acceleration compared with a reference acceleration;

(B) airspeed as a function of time, based on real-time acceleration, compared with a reference;

(C) distance travelled, based on real-time acceleration, compared with a reference.

Note 1. Regardless of the method of distance calculation selected by the applicant, the reference distance should take into account an engine failure at the selected V_1.

Note 2. When comparing real-time with reference acceleration, airspeed or distance parameters, the applicant may assume an appropriate calculation of take-off and accelerate–stop distances prior to take-off initiation. This assumption allows the calculation of an expected acceleration at a given moment during the take-off roll; this expected acceleration can be compared with the actual measured acceleration, and criteria for triggering an alert should be defined and described.

Other methods may be proposed by the applicant.

The alert should be triggered at a speed sufficiently below V_1 in order to ensure the possibility to perform a safe rejected take-off.

(b) *System reliability, availability and integrity*

(1) The TOPMS alerts the flight crew when conditions are identified that pose a risk of an accident or major incident. However, the flight crew remains responsible for the final decision to ensure a safe take-off.

(2) Failure cases may be design-dependent, and hence proposed failure condition classifications will need to be confirmed through a formal TOPMS safety analysis carried out in compliance with CS and AMC 25.1309.

The following basic failure conditions classifications may be considered at the TOPMS equipment level.

(i) Detected or undetected loss of the TOPMS function does not impact the aeroplane behaviour but is considered a reduction in the safety margin. Such a failure condition is considered as having no more than Minor effects.

(ii) Undue (false or inadequate) alert of the TOPMS effect is design-dependent. Such a failure condition is considered as having no more than Major effects.

(3) The following proposed reliability requirements are compatible with the above safety classification, and they should be considered the minimum to be achieved by the TOPMS equipment.

(i) 'Detected loss of TOPMS' (loss of intended function with a failure indication) should be shown to be not more frequent than 10^{-3} per flight hour (reliability design objective).

(ii) 'Undetected loss of TOPMS' (loss of intended function without a failure indication) should be shown to be not more frequent than 10^{-3} per flight hour (reliability design objective).

(4) The probability of undue alert (false or inadequate alert) due to a failure of the TOPMS should be in accordance with the safety objectives associated with the failure conditions classification established through the TOPMS safety analysis.

Based on the worst case (Major classification) of point (2) above, the TOPMS should be developed as a minimum according to a function development assurance level (FDAL) C process, or higher (refer to AMC 25.1309, Paragraph 9, 'Compliance with CS 25.1309' in CS-25, Amendment 28, or subsequent amendment).

A safety analysis of the TOPMS should be performed, taking into account the effect of database errors. Database integrity aspects are addressed in EUROCAE ED-76/RTCA DO-200.

(c) *Design considerations*

(1) Unwanted alerts may be reduced by inhibiting the TOPMS where it is safer to do so, for example after V_1 so that a hazardous rejected take-off is not attempted.

(2) Nuisance alerts should be minimised by correctly setting the alerting threshold.

(3) A TOPMS alert should be adequately prioritised and interference with other installed systems' alerts should be avoided (e.g. runway awareness and advisory system, windshear alerting system, etc).

(4) It should be shown by testing and/or analysis that, for all aeroplane configurations and possible operating conditions, the risk of nuisance alerts is minimised and alerts are triggered when necessary. The applicant should consider at least the following parameters: requested thrust or power settings, feasible weights and CGs, flight control surface positions (e.g. pitch trim, flaps, slats, etc), runway slopes, runway positions, runway winds, runway conditions, temperatures and altitudes.