



Civil Aviation Authority

Safety Notice

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Take-off Performance

This Safety Notice contains information that is for guidance and/or awareness.

Recipients are asked to ensure that this Information Notice is copied to all members of their staff who may have an interest in the information (including any 'in-house' or contracted maintenance organisations and relevant outside contractors).

Applicability:	
Aerodromes:	Not primarily affected
Air Traffic:	All – For Awareness of Flight Crew actions
Airspace:	Not primarily affected
Airworthiness:	Not primarily affected
Flight Operations:	All Operators
Licensed/Unlicensed Personnel:	All

1 Introduction

Take-off performance events — including attempted take-offs using incorrect performance data, an incorrect thrust setting, or the wrong runway or intersection — continue to be reported across the global commercial fleet. Although the rate of such events is low, the potential consequences are severe, including tail strike, runway excursion, collision with obstacles, and controlled flight into terrain shortly after take-off.

These events are rarely the result of a single error. They typically arise from a combination of data entry mistakes, late operational changes, time pressure, the absence or omission of an effective independent cross-check, or a distraction causing a breakdown in Standard Operating procedures (SOPs) at a critical point. This Safety Notice draws operators' and crews' attention to specific defences and recommends action to strengthen them. It does not seek to revisit all elements of take-off performance. The objective of the notice is to promulgate the learnings from recent events including procedural, training and safety management system related elements.

2 Background

The take-off is a performance-critical phase of flight. The calculated take-off data — thrust setting (full or reduced/flex), V-speeds, flap/slat configuration, and the assumed runway and intersection — is valid only for a specific set of assumptions. If any of those assumptions is incorrect, or changes without the calculation being revised, the aircraft may not achieve the

required performance and the crew may have no effective indication of the shortfall until late in the take-off roll, or after rotation.

Whilst automated alerting systems are under development, most modern aircraft provide limited automatic protection against the use of erroneous take-off data. A performance calculation based on the wrong runway length, wrong outside air temperature, wrong weight, or wrong flexible/assumed temperature may be accepted and flown by the automation as though it were correct. The principal defences therefore remain procedural and human: disciplined adherence to Standard Operating Procedures (SOPs) and effective cross-checking.

3 Operator Actions

3.1 Recalculation following a runway change or departure intersection change after commencing taxi

A late change of departure runway or same runway, but different intersection which reduces the TODA — issued by ATC after the crew has completed the take-off performance calculation and commenced taxiing — is a recognised high risk scenario. It introduces time pressure and breaks the link between the data already prepared and the runway now to be used. The new runway may have a different length, intersection, slope, obstacle environment and surface condition, resulting in different thrust, V-speeds and configuration requirements.

Operators must ensure SOPs explicitly address a runway or intersection change after taxi has commenced, and crews must apply them. The following principles are recommended:

- **Be clear on the change.** If Air Traffic Control enquire whether an aircraft is capable of an intersection departure, or runway change, SOPs should ensure a cross check between the crew of whether the calculated performance aligns with the request or is a change.
 - A runway change **will** invalidate the existing performance data:
 - If the change involves a **runway change** the take-off performance data must be recalculated. Operators should review their procedures to ensure that this is clear and robust.
 - A change in intersection on the same runway may invalidate the existing performance data:
 - If the **different intersection** departure **DECREASES the TODA** then the take-off performance data must be recalculated. Operators should review their procedures to ensure that this is clear and robust.
 - If the **different intersection** departure **INCREASES the TODA** then this will generally be within the parameters of the calculated performance.
- When the change means that take-off performance must be recalculated:
 - **Stop the aircraft and recalculate.** The aircraft should be stopped (or taxi paused at a suitable point, in coordination with ATC) to allow an unhurried recalculation.
 - **Recompute completely, not partially.** The full take-off calculation should be redone for the new runway and intersection — thrust setting (full or reduced/flex), V-speeds, flap/slat configuration, and stop/obstacle margins — using the actual conditions, rather than mentally adjusting the previous figures.

- **Re-enter and re-brief.** The new runway, V-speeds and thrust setting must be correctly entered in the FMS/MCDU take-off performance page and supporting systems, the flight guidance/configuration updated, and the take-off briefing amended to reflect the new runway, including any change to the departure, stop strategy, and obstacle/terrain considerations
- **Independent cross-check.** Both pilots should independently confirm the new data and its correct entry, applying the same gross error and runway confirmation checks described for the initial calculation
- **Resist time pressure.** Crews must feel empowered to advise ATC that they are not ready, to request additional time, or to decline the runway change, rather than to accept it and depart with un-recalculated or rushed data. SOPs, training and operator safety culture should reinforce that declining or delaying a change is always preferable to un-validated take-off performance.
- **Configuration and threat awareness.** The crew should specifically consider whether the new runway introduces changes to taxi routing, line-up direction, contaminated-runway performance, or obstacle clearance that were not present for the original runway.

3.2 Confirmation of correct runway and intersection upon line up

- Operators should ensure that SOPs contain an unambiguous, sequenced confirmation that the runway designator, intersection and calculated take-off performance all align. This should be designed to ensure facts are verified.

3.3 Standard Operation Procedure adherence during the take-off phase

Failure to set take-off thrust following a technical or environmental distraction has been a factor in a number of incidents. In these events, a thrust level below the calculated required take-off thrust was set and not increased to the required level during the take-off roll.

Selecting or commanding an incorrect thrust setting can result in a low acceleration take-off with degraded obstacle and stop-margin protection. The take-off roll is the last point at which such an error can realistically be detected and corrected.

Operators should review procedures for:

- Correct setting of take-off thrust
- Monitoring that take-off thrust has been set correctly
- Calls and actions in the event that correct take-off thrust is not set by the required gate
- Calls and actions to increase thrust in the event that it is identified late in the take-off roll that acceleration is not normal and continuing the take-off is required
- Technical failures of the autothrust system and OEM recommended actions.

AAIB Bulletin-29891 investigated an incident in which there was a technical failure of the autothrust system at low speed. The take-off was continued with an attempted re-engagement of the autothrust system, but correct take-off thrust was not set. The OEM subsequently advised the AAIB that a failure of the autothrust system at low speed should result in a rejected take-off. This allows time to consider the failure implications fully, as even

if take-off thrust is then correctly set then there will be requirements for subsequent manual thrust selections. Operators should review OEM guidance and their own procedures on this for the types operated.

3.4 Training

Operators should review training programmes to ensure that the items detailed in section 3.1 to 3.3 are incorporated into their training programmes.

Additionally, Human Factors training should be reviewed to ensure that the factors involved in the distractions which may prevent correct thrust setting and subsequent monitoring actions are understood and addressed.

3.5 Flight Data Monitoring

Whilst Flight Data Monitoring may not prevent an individual take-off performance event occurring, the data collected can be invaluable in identifying precursors to prevent future events. Operators should ensure that Flight Data Monitoring (FDM) systems are used as effectively as possible to provide data on take-off performance events to the organisations Safety Management System (SMS).

It is recognised that there are many variations in aircraft operation, the capability of different aircraft to record data and of individual FDM systems. Each operator should review these elements and which events can best inform the SMS. Examples of relevant events to consider may include:

- Thrust set lower than target thrust
- Initial acceleration
- Peak acceleration
- Long take-off roll
- High liftoff pitch attitude
- Low speed after take-off
- Low aircraft height at end of runway
- Aircraft ZFW changed after take-off

If such FDM events are new to an operator's FDM system then, where possible, the event algorithms should be run retrospectively on existing captured data to create a current data set for input to the SMS.

3.6 Safety Management System

Operators should review their SMS to ensure that there is an appropriate function within it to consider all report feeds for take-off performance events.

This action includes:

- Clarity on data feeds within the organisation for take-off performance within the SMS
- System design to ensure effective ownership and review
- Review of policies on which reports are "closed on receipt". An example here would be that, when a loading or loadsheet error report is closed on receipt due to it being perceived as a small gross error, a retraining opportunity with the individual may be missed
- Clear Safety Performance Indicators and objectives for take-off performance

4. Queries

- 4.1 Any queries or requests for further guidance as a result of this communication should be addressed to commsflightops@caa.co.uk.

5 Cancellation

- 5.1 This Safety Notice will remain in force until further notice.