Erroneous Take-Off Performance Calculations

Safety Risk Assessment - Lite

Description

Incorrect take-off performance calculations can occur due to inaccurate data such as weight and balance figures, environmental and runway conditions, and faulty data entry into the FMS. It can result in lower thrust settings and take-off speeds than required, reducing safety margins.

Main threats

Inaccurate data provided

- Wrong load sheet figures. Including Zero Fuel Weight (ZFW), Take-Off Weight (TOW), Center of gravity (CG)
- Non-accurate environmental conditions. Including (Wind, ambient temperature, QNH, and runway conditions)
- Out-of-date airport database. (Obstacles, Runway distances)

Data Entry procedure

- Incorrect ZFW/TOW is entered in the Electronic Flight Bag (EFB)
- Mistaken flap setting is entered in the EFB
- Wrong Runway distances entered in the EFB

Operational activities

- Reduced thrust take-off
- Take-off from runway intersections

Take-off performance calculations become complex due to multiple manual data entries involved in conserving engine life or reducing taxi time. It increases the chance of errors while calculating the required thrust, speeds, and optimal flap setting, regardless of the calculation method used (EFB or Performance charts).

Is your operation exposed to all these threats?

Errors are the manifestation of threats. Therefore, determining the extent to which errors go unnoticed is key to assessing the risk of an undesired outcome.

How to detect and track unnoticed erroneous performance calculation occurrences?

FDM should be used to follow up on indications of inadequate take-off performance, such as:

- Thrust setting/Abnormal slow acceleration
- Change of thrust setting during take-off roll
- Take-off distance used/remaining runway
- Rotation rate/slow rotation/low rotation
- Speed VR/abnormal or early rotations
- Height above threshold
- CG out of limits

Call To Action. Some of the above flight parameters may not be readily available. However, their implementation within the FDM program scope is encouraged since setting the appropriate set of SPIs is required to monitor take-off performance.
systematically and assess the effectiveness of the preventive controls.

**Preventive controls**

**Policy**
- Flight crew task distribution and crosschecking considerations (independently carrying out performance calculation)
- Official source of Take-off weight and balance data for performance calculations
- Communication channels between Flight crew, dispatch, and ground crew
- Outlined measures against communicating input parameters before data entry in the EFB and creating own crosschecking strategies
- Operational limitations/considerations to perform reduced thrust take-off and/or intersection take-off
- Permitted deviations from last-minute changes and QNH variations.

**Procedures**
- FCOM- Before Start Procedure
  - Final Loadsheet verification
  - Take off performance calculations
  - Crosscheck, and
  - FMS data entry
- FCOM
  - Reduced thrust take-off
  - Take-off from intersections
- Flight crew SOP
  - Use of performance calculation tool in EFB
  - Conventional (Non-digital) Performance calculation Method
  - Last-minute changes in electronic load sheets and take-off distance available
  - Reassuring performance calculations after distractions
- Operational control - SOP (Ground and dispatch)
  - Aircraft loading and final figures transmission
  - Last-minute changes in electronic load sheets.
  - Aircraft database and EFB update

**Training**
- Evidence-based training programs
  - Erroneous performance calculation training scenarios. Including engine failure after V1 and Rejected take-off
  - Considerations on operating limits of minimum control speeds, if applicable
  - Reversion to conventional performance calculation charts

**Technology**
- Take-off Surveillance and monitoring functions *(Available for some aircraft types).*
  - ZFW and takeoff speeds check
  - Lift-off distance check
  - Expected acceleration vs real acceleration of the aircraft comparison
- Data transfer capabilities from the EFB to the FMS

Although the preventive controls may seem robust, it is important to acknowledge their limitations.

**Call to Action.** Assessing the preventive control effectiveness through FDM data, regular safety audit results, and subject matter expert's insights is crucial since a wide range of escalation factors may weaken the existing controls at any time.

**Escalation Factors**
- Last-minute changes (final figures, runways, aerodrome conditions)
- Cockpit distractions/interruptions during cockpit preparation
- Deviation or shortcuts from routine tasks/procedures with the aim of optimizing time and achieving operational goals.
- Time pressure
- EFB/FMS data transfer limitations

It is common to think of errors as threats. This misconception leads to ineffective risk mitigation actions. Errors are typically symptoms of systemic or system-induced issues where the dynamic operational context impacts human performance.

**Call to Action.** Organizations are encouraged to build their risk model to ensure effective risk management of erroneous take-off performance calculations.

Where required, additional preventive controls should be implemented to reduce the exposure or eliminate the escalating factors affecting human performance during critical cockpit preparation activities.