EASA SIB 2016-02: Use of Erroneous Parameters at Take- off

The investigation reports and studies related to a number of accidents and serious incidents worldwide have highlighted a safety issue related to the use of erroneous mass data or take-off performance data. The analysis conducted showed also that various aircraft types have been involved making this a general safety concern. This SIB focuses mainly on errors induced by flight crew when entering data in the Electronic Flight Bag (EFB) or Flight Management system (FMS) during the flight preparation phase.

The presentation below includes an example of erroneous parameters at take off as:

“Detecting Take Off Performance Errors Past TO/GA”

Detecting Take Off Performance Errors Past "TO/GA"

March 2023 “Persisting Challenge for Pilots & Safety Risk Management”

Terminology Used

TOW: the total weight of the aircraft

ZFW: "Zero Fuel Weight", the total weight of the aircraft with no usable fuel added, i.e., weight of aircraft, pilots, cabin crew, passengers, baggage, cargo, and catering.

FLEX or Assumed Temp (AT): Performance calculated at an increased temperature than actual ambient for the purpose of increasing engine life.

V_1 Speed: A maximum speed to reject a take-off and remain within the runway, also the lowest speed to allow a continued take off run to reach a safe rotation speed in an event of an engine failure.

V_R: Rotation speed, it's when the pilot initiates aircraft rotation ensuring in the event of an engine failure the aircraft will lift-off and reach take-off safety speed (V_2) by 35 ft above ground minimum.

V_2: Take off safety speed to allow (if maintained) in the event of an engine failure after V_1 controllable flight characteristics

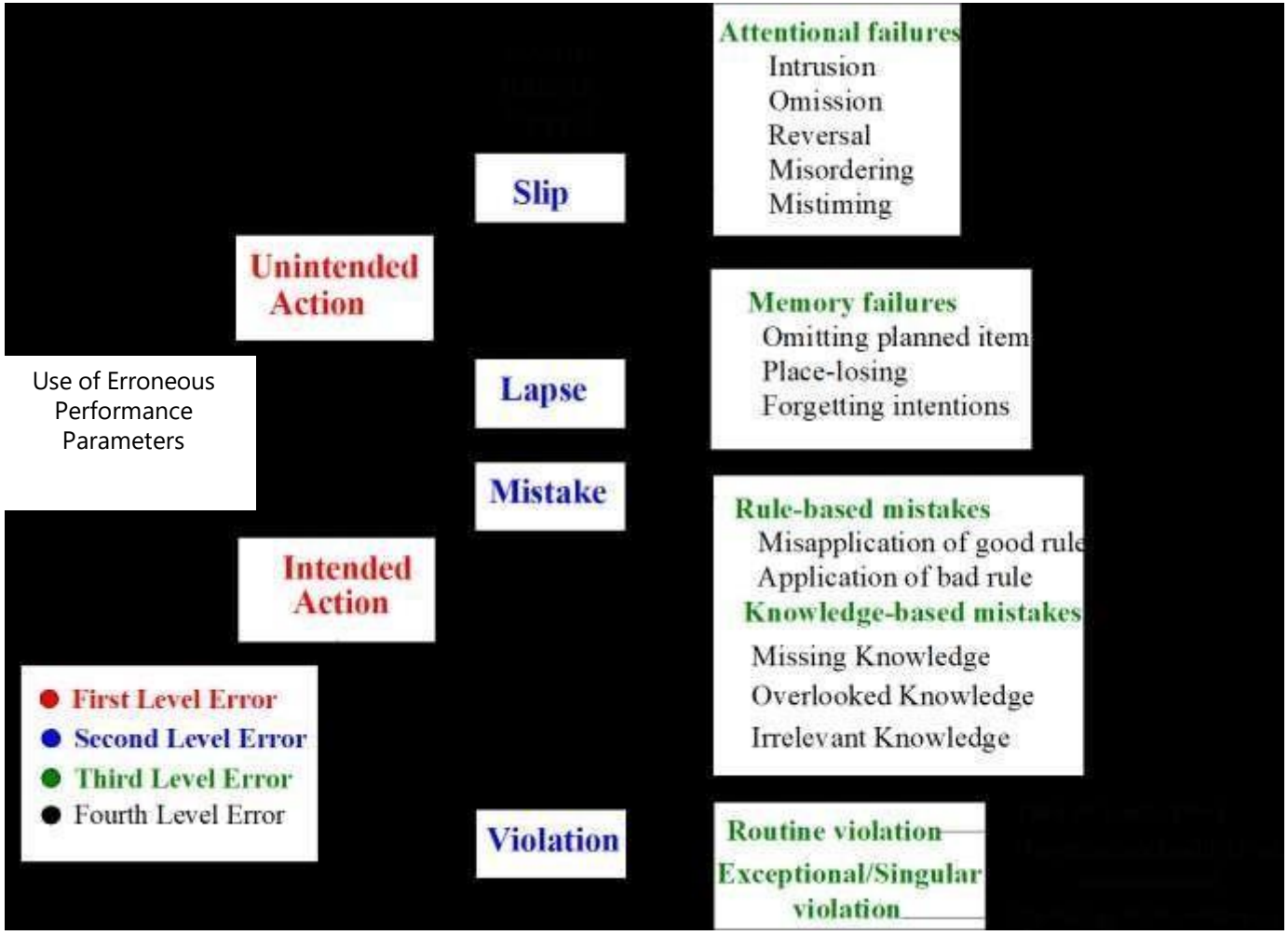
Balanced Field Takeoff: A condition where the accelerate-stop distance required (ASDR) is equal to the Takeoff distance Required (TODR) for the aircraft (1) ***weight***; (2) engine thrust, (3) aircraft configuration; and (4) existing runway condition. To achieve a balanced field takeoff, **V_1** is selected so the remaining takeoff distance with one engine inoperative is equal to the remaining and the required accelerate-stop distance. Engine thrust (affected by temperature and pressure) can be deliberately reduced (Flex and AT) by the pilot when runway conditions permit.

On a balance field take-off weight, the **V_1** for ASDA equals **V_1** TODA.

Settings and Limitations

- This presentation examines a class of errors with large differences between the aircraft actual weight versus the used weights for take off calculations
- Original weight data provided to the Flight Crew being valid.
- A crew override action into the CDU/FMS for V_1; V_R; and V_2 settings.
- Airplanes of Air Transport Category at heavy operational weights.
- Required Balance Field Computations applicable to the runway in use.
- Availability of discarded operational `policies and “SOP” defense measures.
- Human Error paradigm based on “Reason” and other scholars Models.
- Outcome Scenarios are for the high-risk conditions.

Understanding what happens?



Case Review

Highlights of a Tail Strike.

KSA, followed by a HIGH RISK continued flight.

Flight Crew and Organizational Causal Factors were observed

Flight Crew Actions	Organizational control Actions
No Independent check of data	Approved flight continuation for 2 hours with pressurized hull
10 ton less-than-actual weight entry into the OPT and FMS;	No redispatch release after fuel dump initiated then arbitrarily terminated
FMS V_1, V_R, V_2 manually entered using OPT calculations to overwrite FMS displayed dashes	Authorized flight continuation without the use of the Tail Strike abnormal checklist.

Closing Words

1. Errors with Take Off Performance calculations are “fool-proof” resistant.
2. The complexity of the factors associated with performance calculations represents a difficult challenge for a technological (software) design to shield against human error.
3. Detection of performance calculations errors past TO/GA or manual thrust application is possible with heightened reliance on perceptions with visual cues, runway distance awareness; and training to react to the unexpected. Crew reactions varied from “no change to the normal takeoff” to counter strategies such as: (a) rejecting the takeoff; (b) increasing thrust; and (c) slowing or delaying the rotation.
4. Simulator training sessions (like LOFT) can introduce gross weight errors to create lower thrust with invalid V1, VR and V2 values resulting in unbalanced takeoff run distances. The object is to develop best response practices and recovery guidance specific to aircraft manufacture.