Civil Aviation Authority

# Incorrect Take-off Performance

## 5th June 2019

# Introduction

- Incorrect take-off examples
- Define the errors
- Actions
- Next steps

# Incorrect Take-off

- Boeing 777 at London Heathrow – Full runway length data used for initial calculation, but Flight Crew accepted an intersection departure.
- Boeing 737 at Belfast – Incorrect data entered in the Assumed Temperature field resulting in incorrect take-off thrust
- Airbus A320 at Luton - Intersection departure with full length data used.
- Airbus A320 at Malaga – reciprocal runway data used for departure
- Airbus A320 at Belfast – System anomaly defaulted to wrong runway

# Incorrect Take-off

- Boeing 777 at Paris Charles de Gaulle– Aircraft departed using 100,000kgs lower TOW data
- Airbus A320 at Lisbon - Intersection departure with full length data for reciprocal runway used.
- Airbus A320 at Lisbon - Intersection departure with full length data
- Embraer ERJ 190 at London City – Incorrect take-off thrust setting
- B737-800 India - impacted a low wall at the departure end of the runway in use….

# Incorrect Take-off

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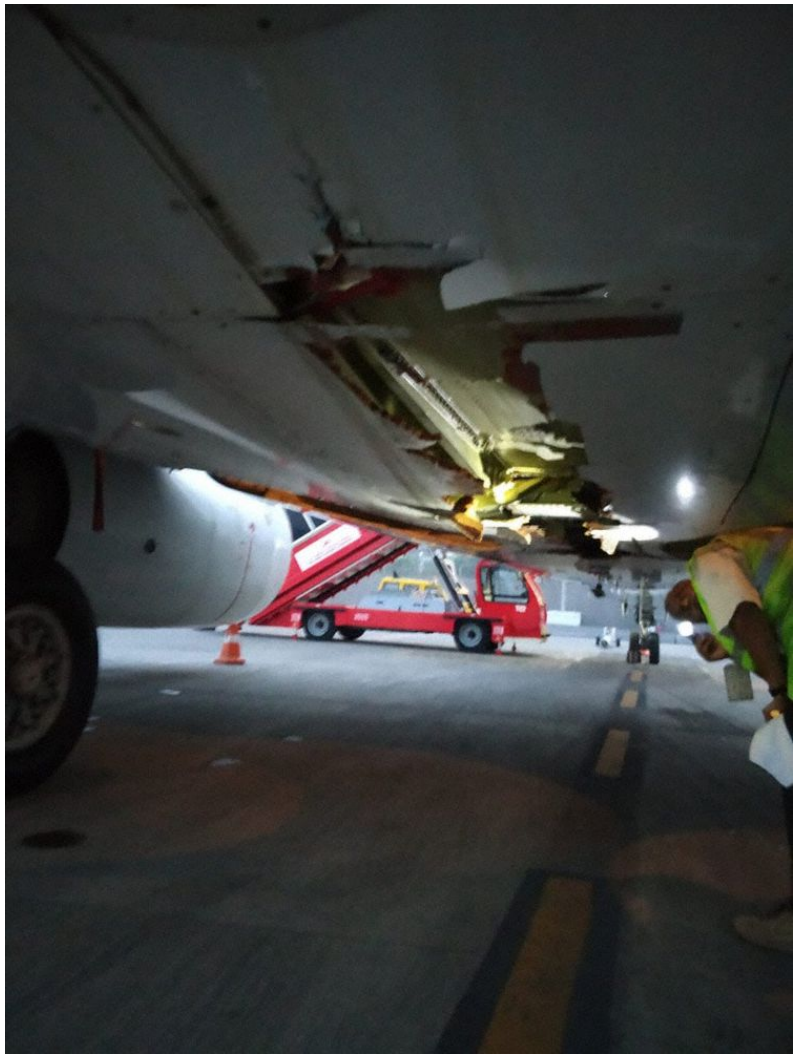

Ref: http://www.avherald.com/h?article=4bedd321&opt=0

# Errors

- Incorrect data entry
- Intersection departures
- Incorrect Flap
- Wrong runway

# Actions and Next steps…..

- UK CAA set up Working Group after BFS event
- Crew awareness/education on criticality
- Operator responsibility (SOP/FDM)
- Technological barriers e.g. acceleration monitor


# Incorrect Take-off Performance

## …. The Next Steps - Technological barriers

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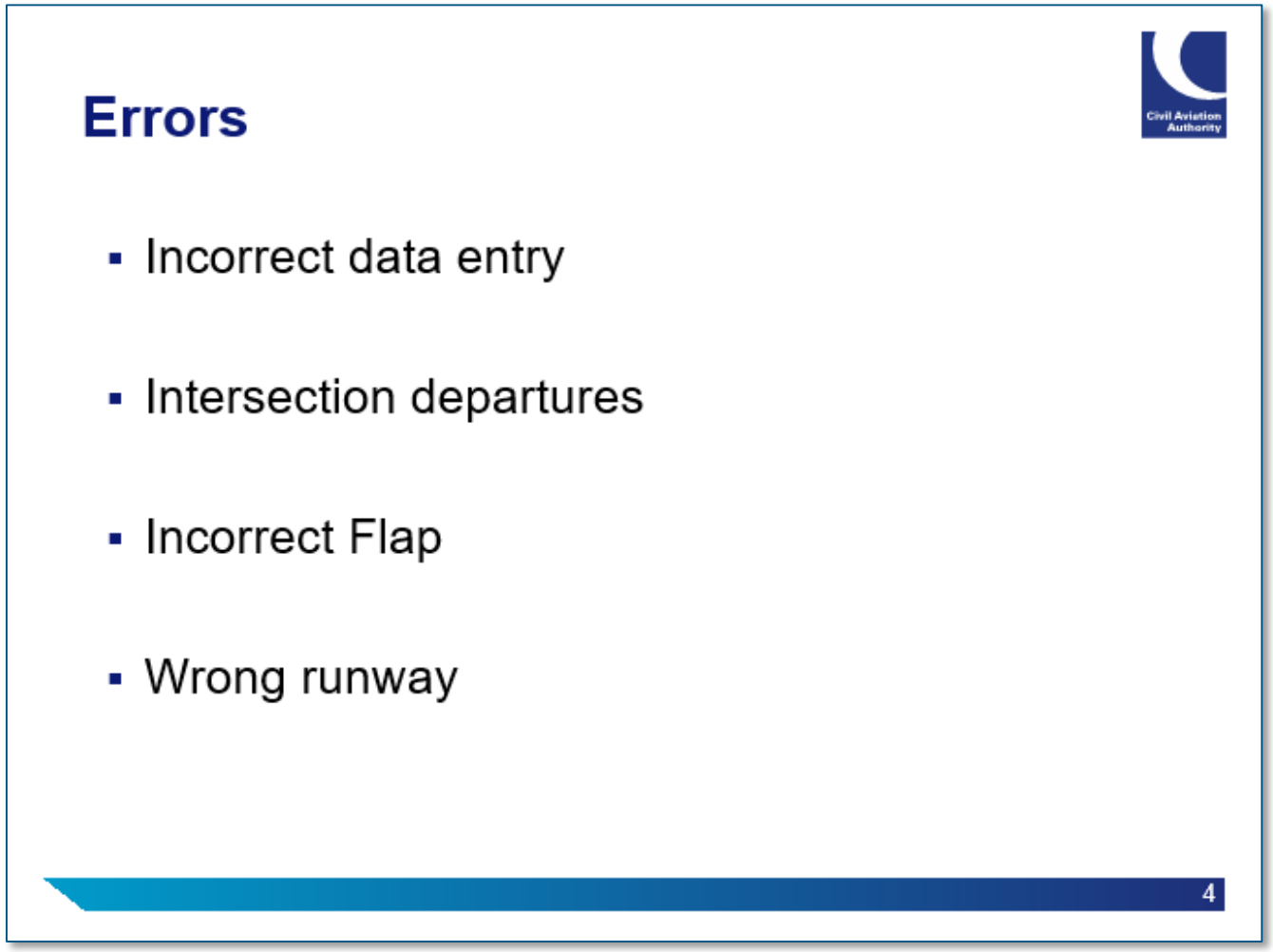
# The issue….




# Take off Events: Contributing factors

- Late change of departure runway
- Time pressure, workload
- Distraction, reduced attention, interruption
- No crosscheck
- SOP not followed or done out of sequence
- Crew new on aircraft type
- Crew unfamiliar with airport
- Airport surface infrastructure, “hot spot”



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# Engagement with Industry on technological barriers

Functions developed to support detection of errors

| FUNCTION | CHECK PERFORMED |
|---|---|
| TO Configuration push button | Trim inside Green Band<br>Flap not in Clean or Full |
| Take-Off Surveillance **TOS1** | FMS entry error<br>Setting of Flap, CG and Trim |
| Take-Off Surveillance **TOS2** | TO distance<br>A/C position with regards to runway |
| Take-Off Monitoring **TOM** | TO acceleration |

## Take Off Surveillance functions

To detect:

- Erroneous configuration
- Entry Gross Error Erroneous
- Aircraft position and performance
- Too low aircraft acceleration



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# Different checks at different phases

PRE FLIGHT | TAXI | T.O. POWER | T.O. ROLL

## Take Off Surveillance functions



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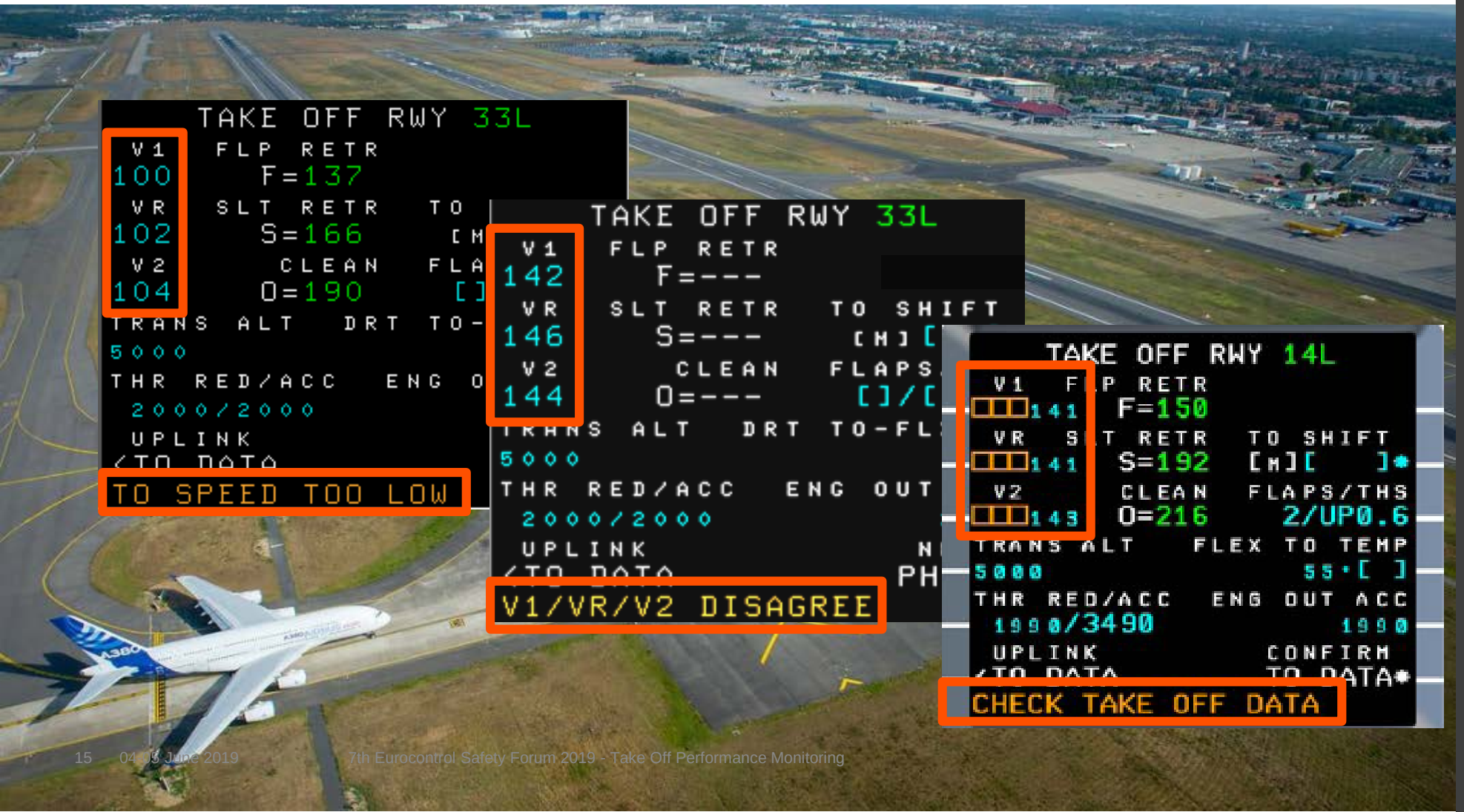
# **Pre-Flight:** Take-Off Surveillance (TOS) 1

PRE FLIGHT | TAXI | T.O. POWER | T.O. ROLL




## Take Off Surveillance functions

Detection of FMS entry errors:

- Erroneous weight (ZFW) and TO speeds
- No TO speeds



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# **Pre-Flight:** Take-Off Surveillance (TOS) 2

PRE FLIGHT | TAXI | T.O. POWER | T.O. ROLL


## Take Off Surveillance functions

Take off distance check to detect:

- Too short runway distance (*RTO not considered*)



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# **Taxi:** Take-Off Surveillance (TOS) 1

PRE FLIGHT | TAXI | T.O. POWER | T.O. ROLL


## Take Off Surveillance functions

ECAM & AUDIO alerts in case of:

- Erroneous TRIM / CG / FLAP setting (*with regards to FMS input*)



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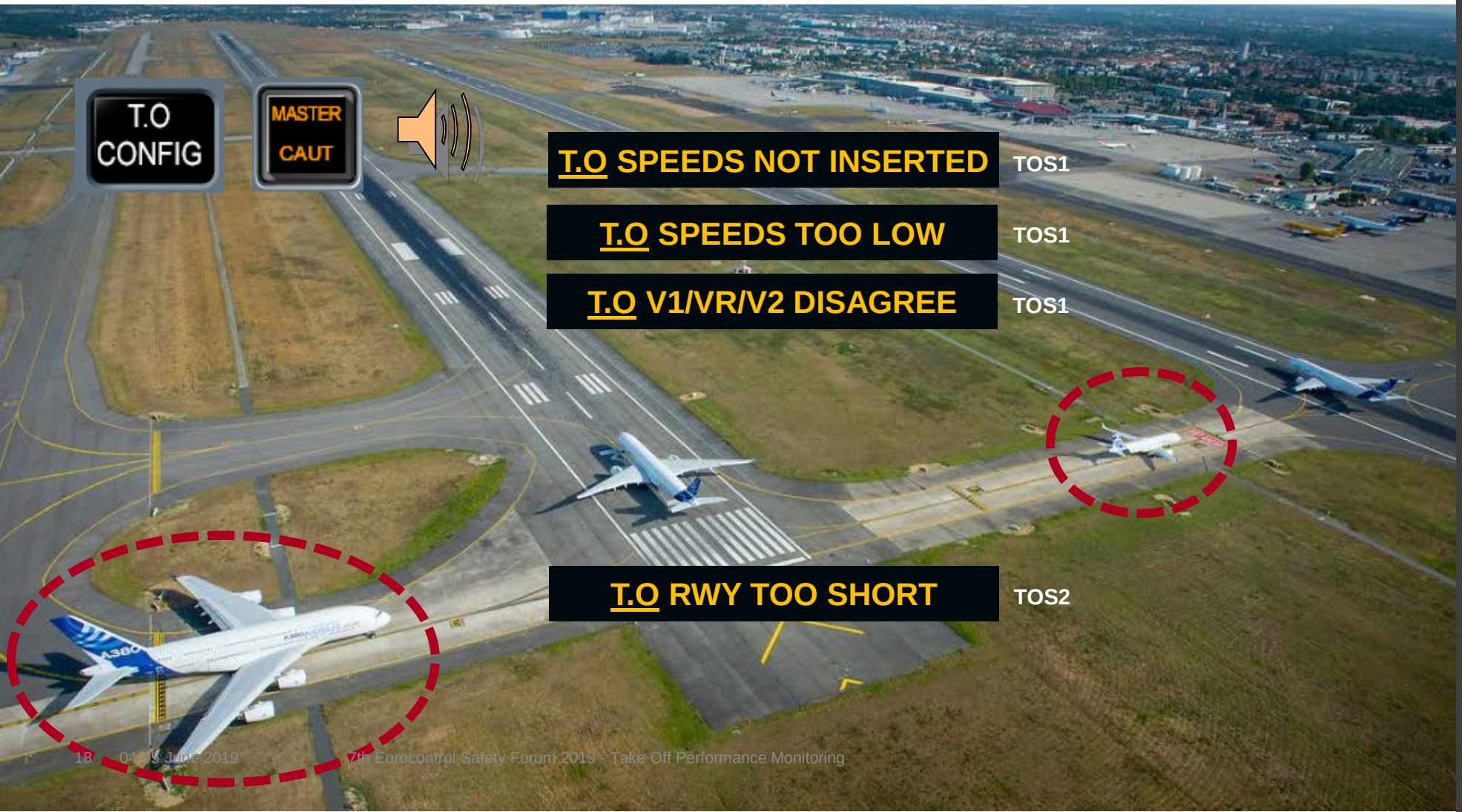
# **Taxi:** Take-Off Surveillance (TOS) 1 & 2

PRE FLIGHT | TAXI | T.O. POWER | T.O. ROLL




## Take Off Surveillance functions

ECAM & AUDIO alerts in case of:

- No TO speeds
- Erroneous TO speeds
- TO distance too short



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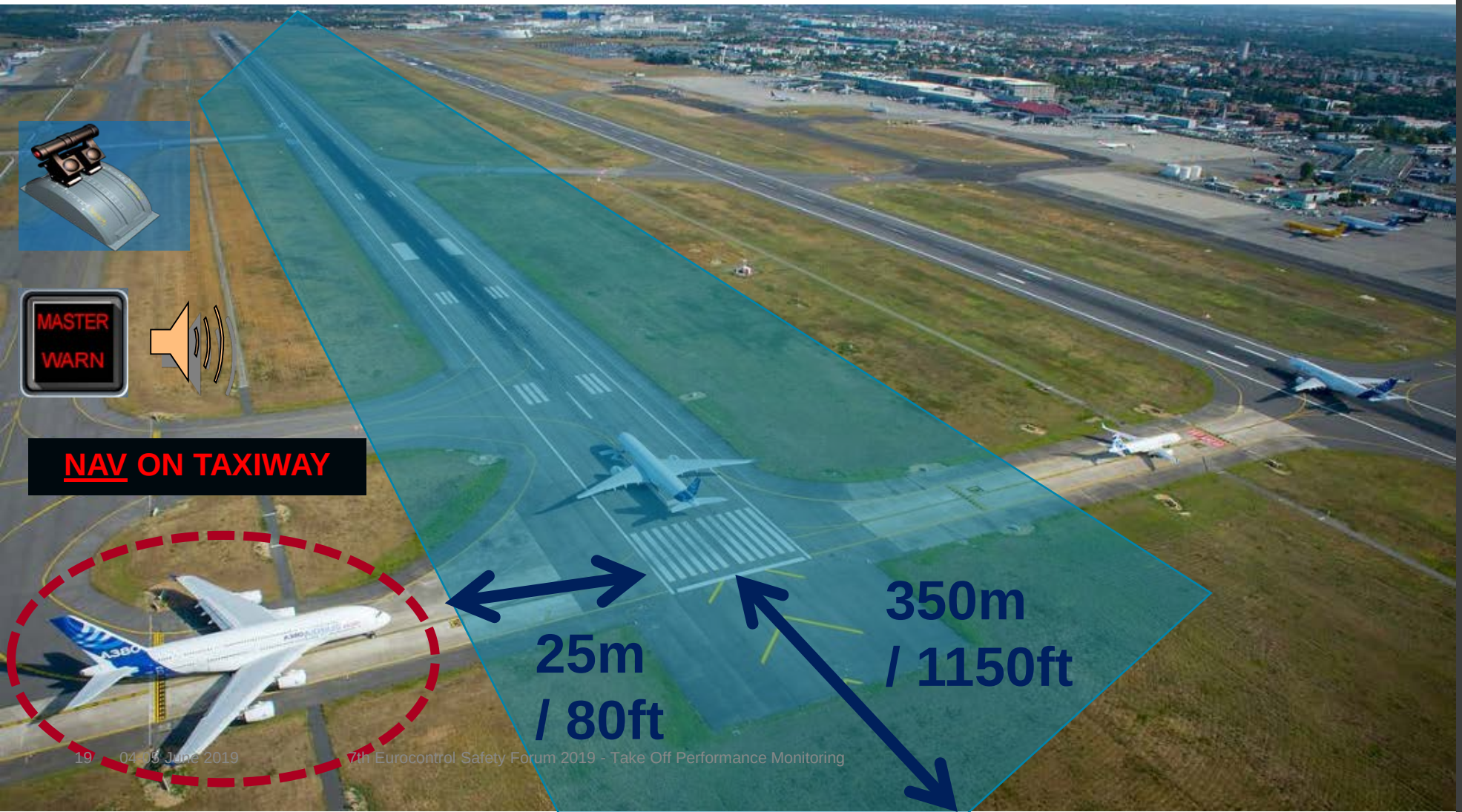
# **Take-Off Power:** Take-Off Surveillance (TOS) 2

PRE FLIGHT | TAXI | **T.O. POWER** | T.O. ROLL




## Take Off Surveillance functions

Aircraft position check to detect:

- Take off initiation on taxiway



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# **Take-Off Power:** Take-Off Surveillance (TOS) 2

PRE FLIGHT | TAXI | **T.O. POWER** | T.O. ROLL


## Take Off Surveillance functions

Aircraft position check to detect:

- Take off initiation not on FMS runway



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# **Take-Off Power:** Take-Off Surveillance (TOS) 2

PRE FLIGHT | TAXI | **T.O. POWER** | T.O. ROLL


## Take Off Surveillance functions

Aircraft position check to detect:

- Expected A/C performance not compatible with available runway distance



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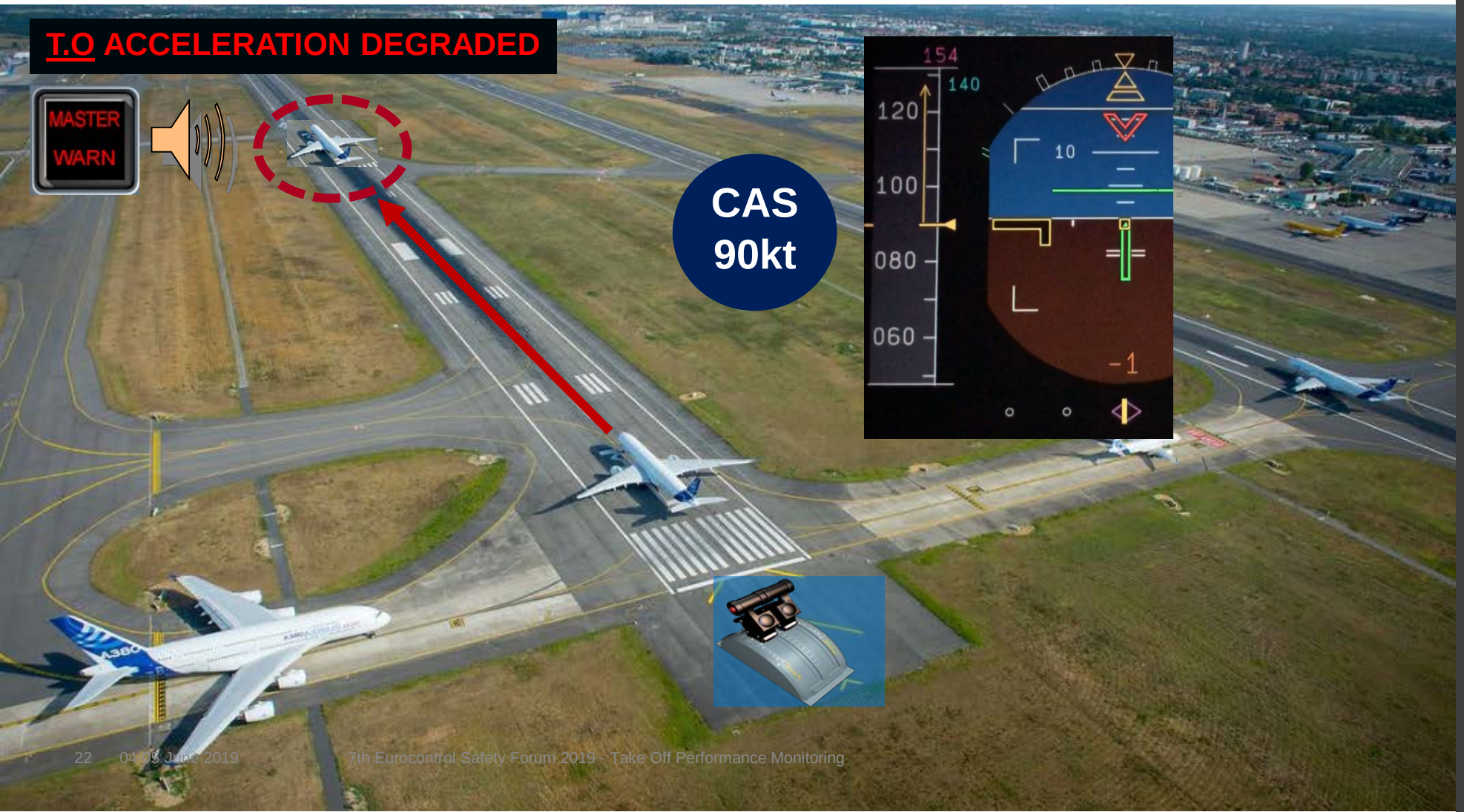
# **Take-Off Roll:** Take-Off Monitoring (TOM)

PRE FLIGHT | TAXI | T.O. POWER | **T.O. ROLL**




## Take Off Surveillance functions

Aircraft acceleration check to detect:

- Abnormal acceleration

Alert at 90kt



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# Return of Experience

- **Airbus A330 at Montego –** Erroneous weight - data entry
- **Airbus A320 at Luton –** Residual runway length (sufficient take off distance)
- **Airbus A320 at Malaga –** Selected runway vs actual runway
- **Airbus A320 at Belfast –** Selected runway vs actual runway
- **Airbus A320 at Lisbon (reciprocal Runway)** – Selected runway vs actual runway
- **Airbus A320 at Lisbon (intersection) –** Residual runway length (sufficient take off distance)

## Take Off Surveillance functions

Could technology have helped??



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# Conclusions

- Most errors can be avoided by **adherence to SOP** and existing technology. However, in service experience shows **errors will still occur**.
- **Contributing factors** include **late changes** before take off and **time pressure**.
- This issue been identified as a concern by the **industry** and **technological barriers** can provide another safety net.
- Airbus **T**ake **O**ff **S**urveillance & **T**ake **O**ff **M**onitoring functions support the industry experience.
- These functions are (being) **developed for the fleet** ➔ but **technical capability** needs to be taken into consideration.

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