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Monitoring Landing Overrun Risk using FDM: Tips and Tricks

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European Operators Flight Data Monitoring (EOFDM) Conference

January 2013

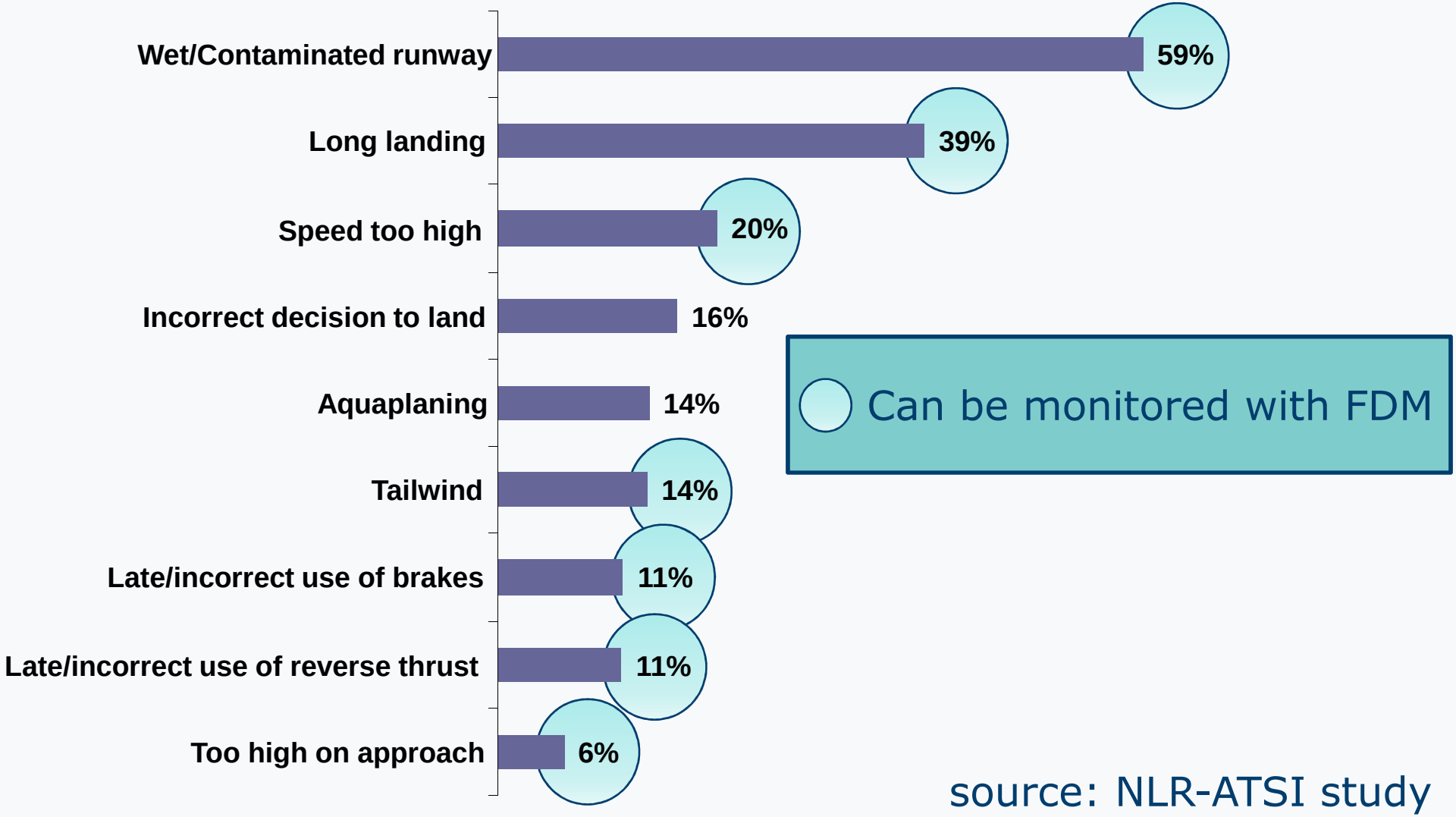
Background

- 1 landing overrun every 8 days worldwide;
- 40% of the cases significant damage to a/c;
- Serious risk to any operator;
- How to monitor and manage this risk using FDM?

Causal factors in runway excursions

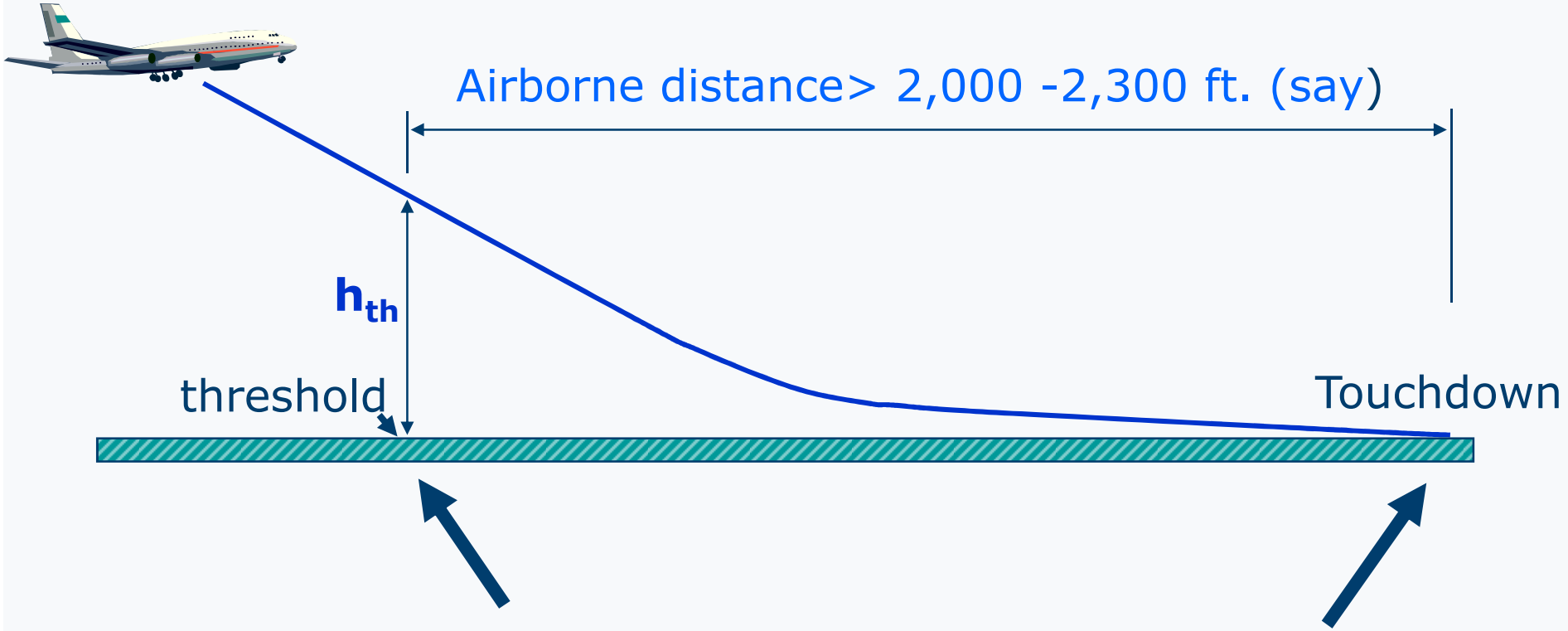
- **Several studies conducted giving a clear picture of the causal factors;**
- **Starting point to define FDM monitoring initiative.**

Landing overrun causal factors



source: NLR-ATSI study

Long landings in FDM



FDM software can have difficulties in defining:

- Threshold crossing
- Touchdown point

Threshold crossing time

- **FDM software can have difficulties in defining threshold crossing time:**
  - **Often assumes fixed RA (50 ft.).**
- **Can be calculated from glideslope deviation and known glideslope antenna position;**
- **Or compare GPS/FMS location data with threshold coordinates, but be carefull:**
  - **LAT-LON coordinates on QAR not always accurate;**
  - **GPS insufficient number of digits;**
  - **GPS LAT and LON sampled separately;**
  - **Check positions plots over google maps.**

Threshold crossing height

- **High when (radio) altitude at the threshold crossing is say 15 ft. above the prescribed height;**
- **FDM software sometimes assumes 50 ft. RA as threshold crossing;**
- **Threshold crossing height can depend on approach type (e.g. PAPI location).**

Touchdown point

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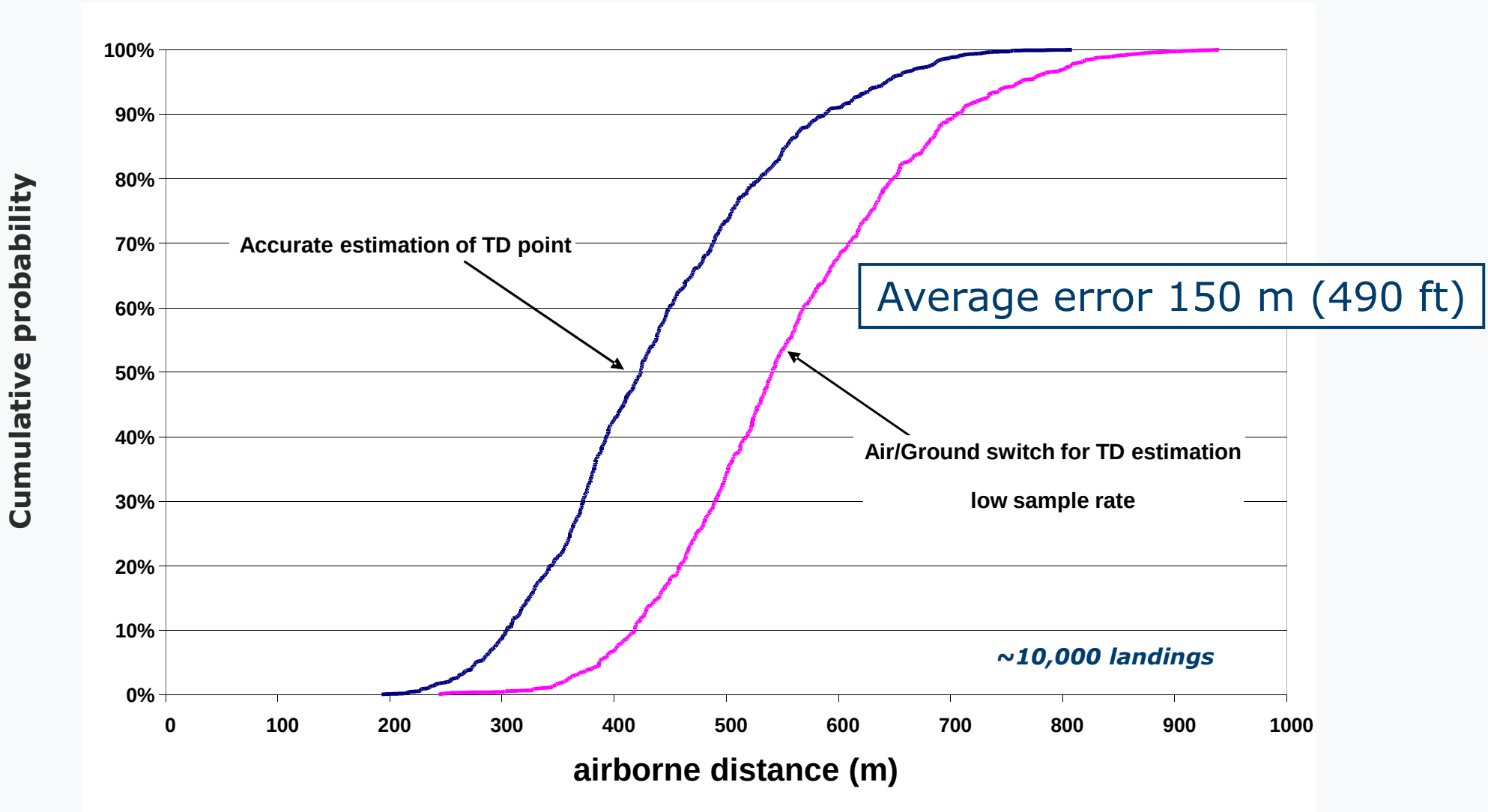
- FDM software normally uses air/ground switch for TD point;
- Check sample rate of A/G switch;
  - Should be at least 5 Hz for meaningful results;
  - Less is too low for TD determination.
- Alternative based on change in normal acceleration.
  - FDM software should be changed for this.

Example error in airborne distance

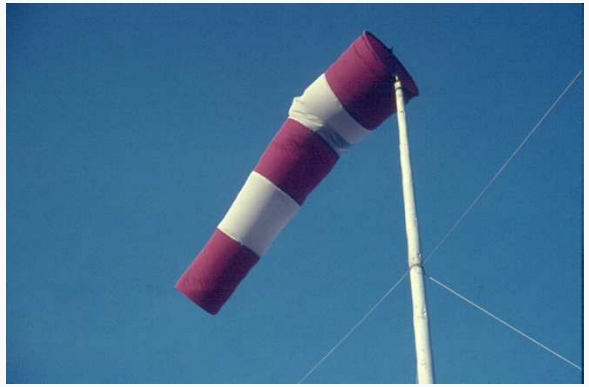


Approach & touchdown speed

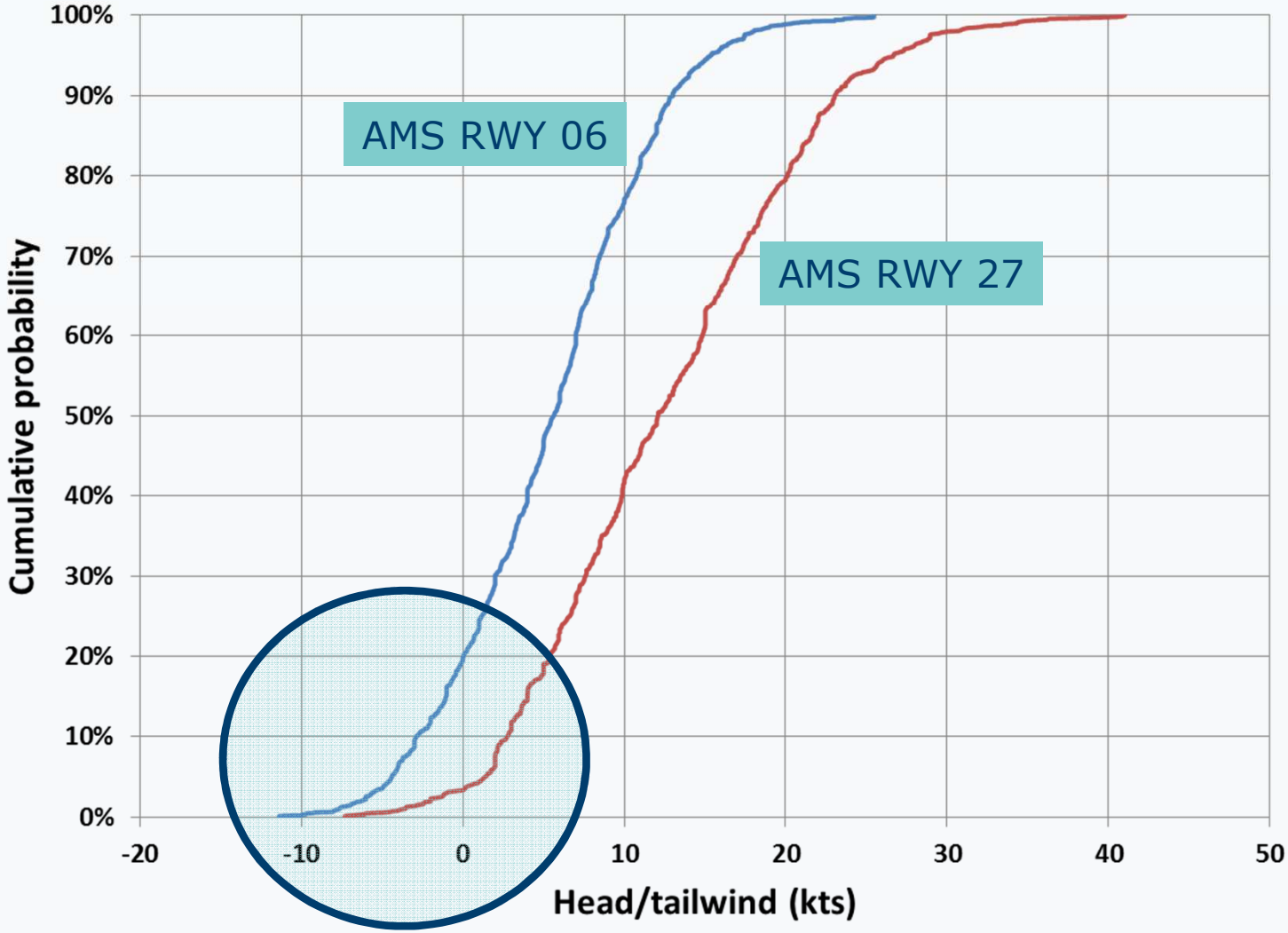
- **Speed during landing monitored by most airlines;**
- **Excess approach speed: FAS at threshold >5-10 kts. ;**
- **Excess touchdown speed: Vref+ gust correction>5 kts;**
- **Analyse frequency distribution of approach/touchdown speed at threshold per rwy.**

Tailwind

- **Monitor tailwind at 33 ft. RA;**
- **Look for tailwind >10-15 kts.;**
- **Tailwind can be estimated by subtracting ground speed from true air speed at 33 ft. RA;**
  - **Compared to wind measurements taken with anemometer, average difference of ±2.1 kts.**



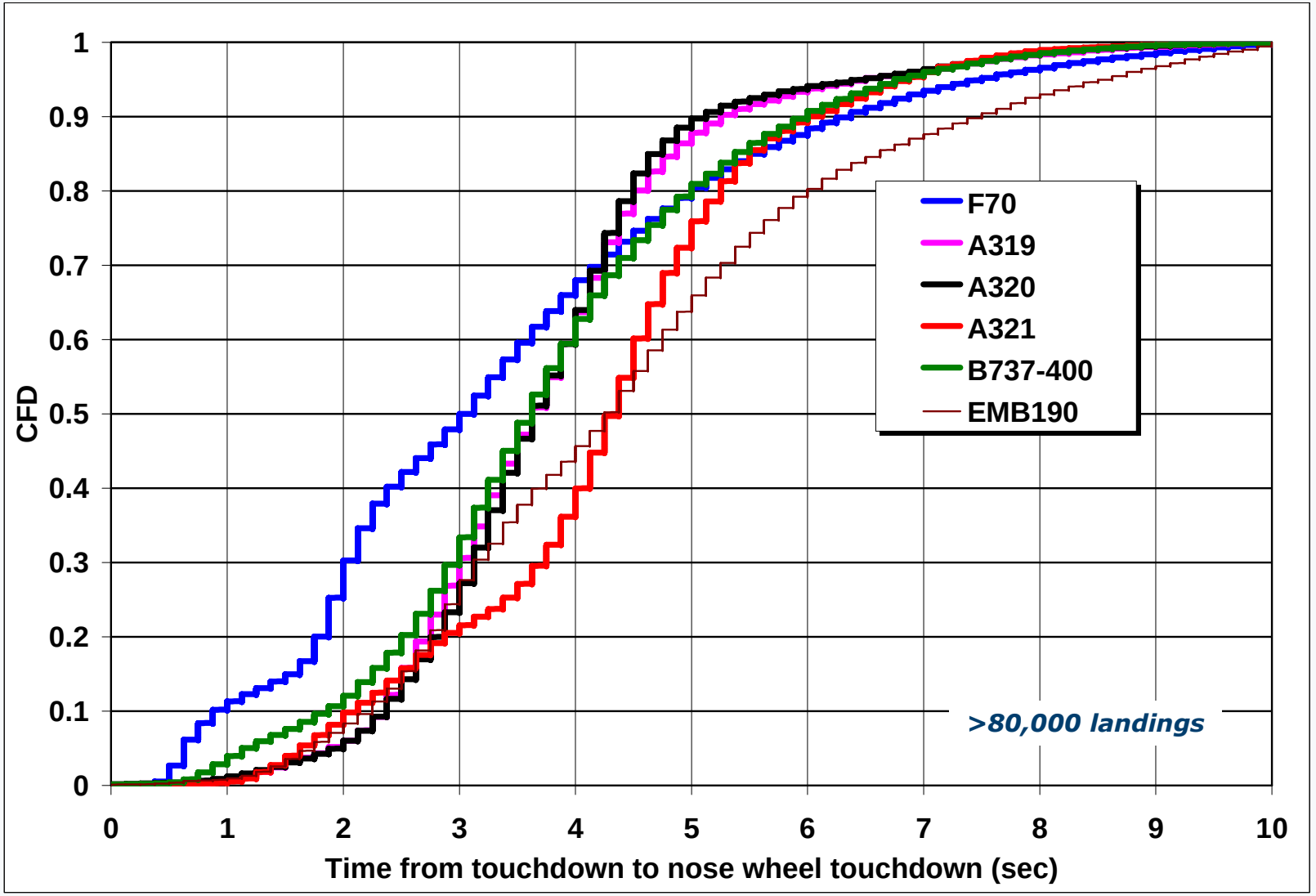
Tailwind analysis example



De-rotation time

- Decelaration levels very low during de-rotation;
- Monitor time from touchdown to nose-wheel ground contact:
  - Also look at pitch attitude at touchdown;
  - Pitch at touchdown can be type specific.
- Look at high de-rotation times (of say more than 5 s).

Example de-rotation time results



Brake/thrust reverse usage

- **Monitor time between touchdown and reverse selection and manual brake application:**
  - **Autobrake activiation time after TD is fixed.**
- **Monitor speed Reverse Thrust reduction.**

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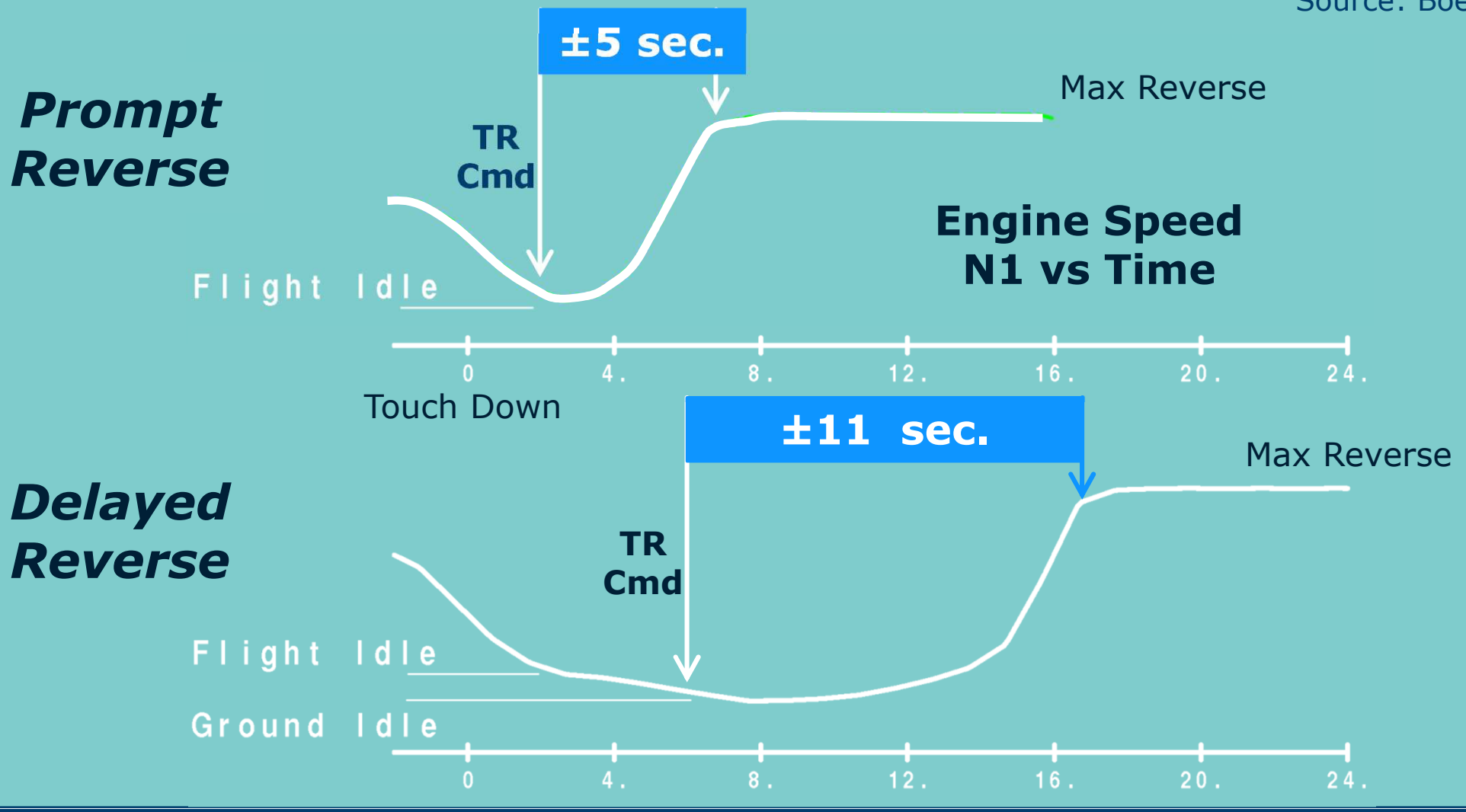
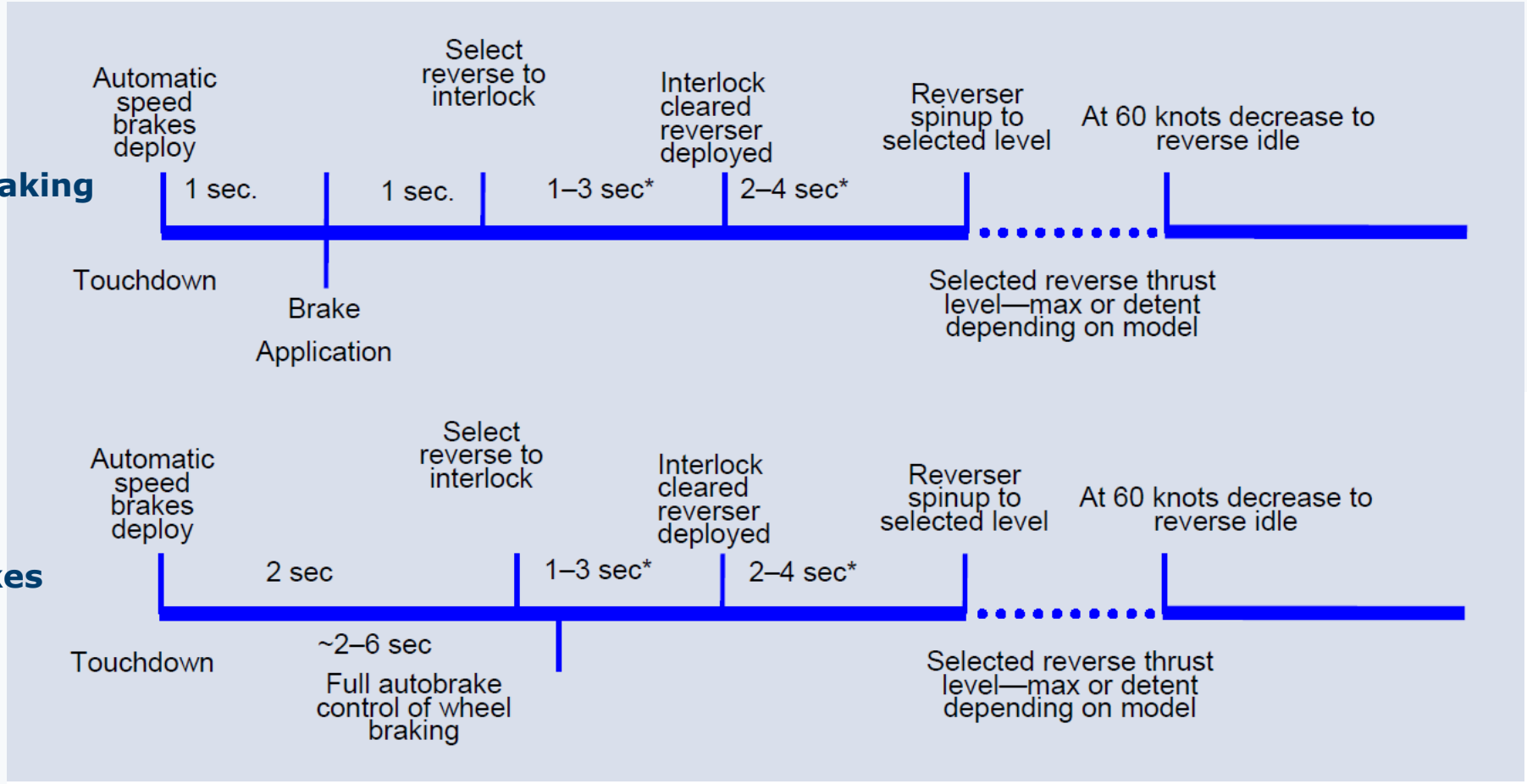
Impact Delayed Thrust Reverser Usage

Source: Boeing



Example ground roll performance assumptions



source: Boeing

Runway condition

- **Runway condition should be considered together with LDA, and achieved deceleration levels;**
- **Can be guesstimated from METAR;**
- **Reverse thrust usage important on slippery runways;**
- **A wet runway is not always slippery!**

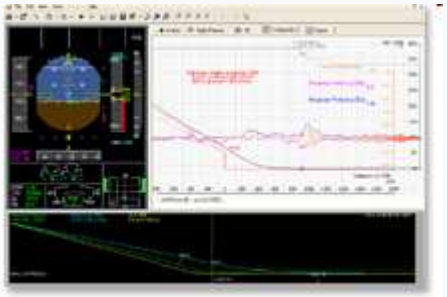
Remaining runway

- **Monitor remaining runway length at GS of 60-40 kt.;**
- **A/C position based on GPS (check accuracy!).**

FDM software limitations

- **Inaccurate threshold crossing point;**
- **Inaccurate touchdown point;**
- **Flexibility (e.g. recording of certain times).**

May need to ask vendors for changes to software.....



Final remarks

- **Flight Data Monitoring can be a power tool for monitoring landing overrun risk;**

- **But be aware of the limitations of your FDM software!**