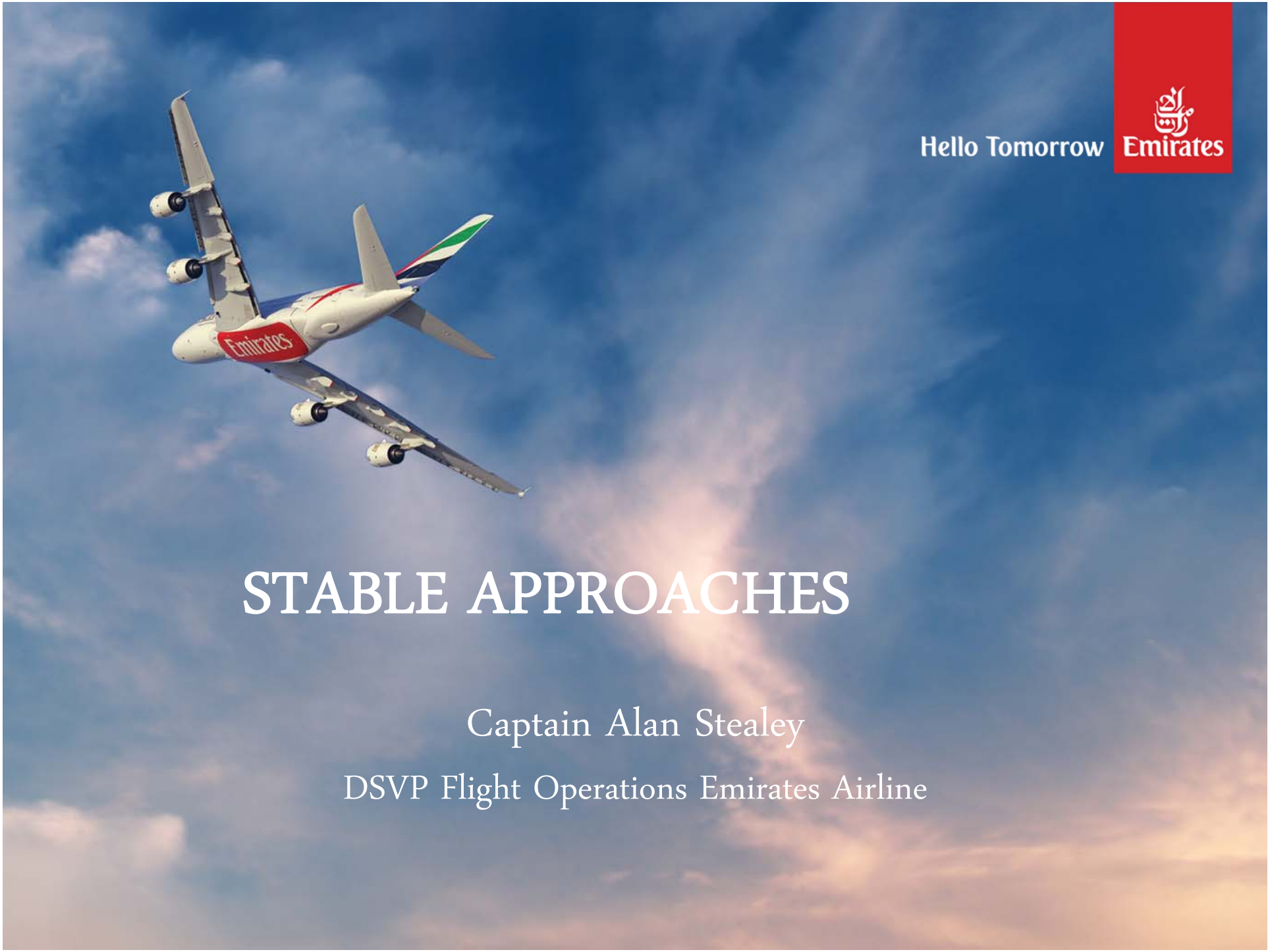

STABLE APPROACHES

Captain Alan Stealey

DSVP Flight Operations Emirates Airline

RUNWAY EXCURSIONS – no room for error

IATA **RUNWAY EXCURSION ANALYSIS REPORT 2004-2009**

- The greatest runway excursion risk and the greatest risk of fatalities occurred during the landing phase
- The most common single factor in landing excursions was an unstable approach and an associated failure to go-around

- The majority of runway excursions included a significant element of human factors, especially in flying skills and decision-making

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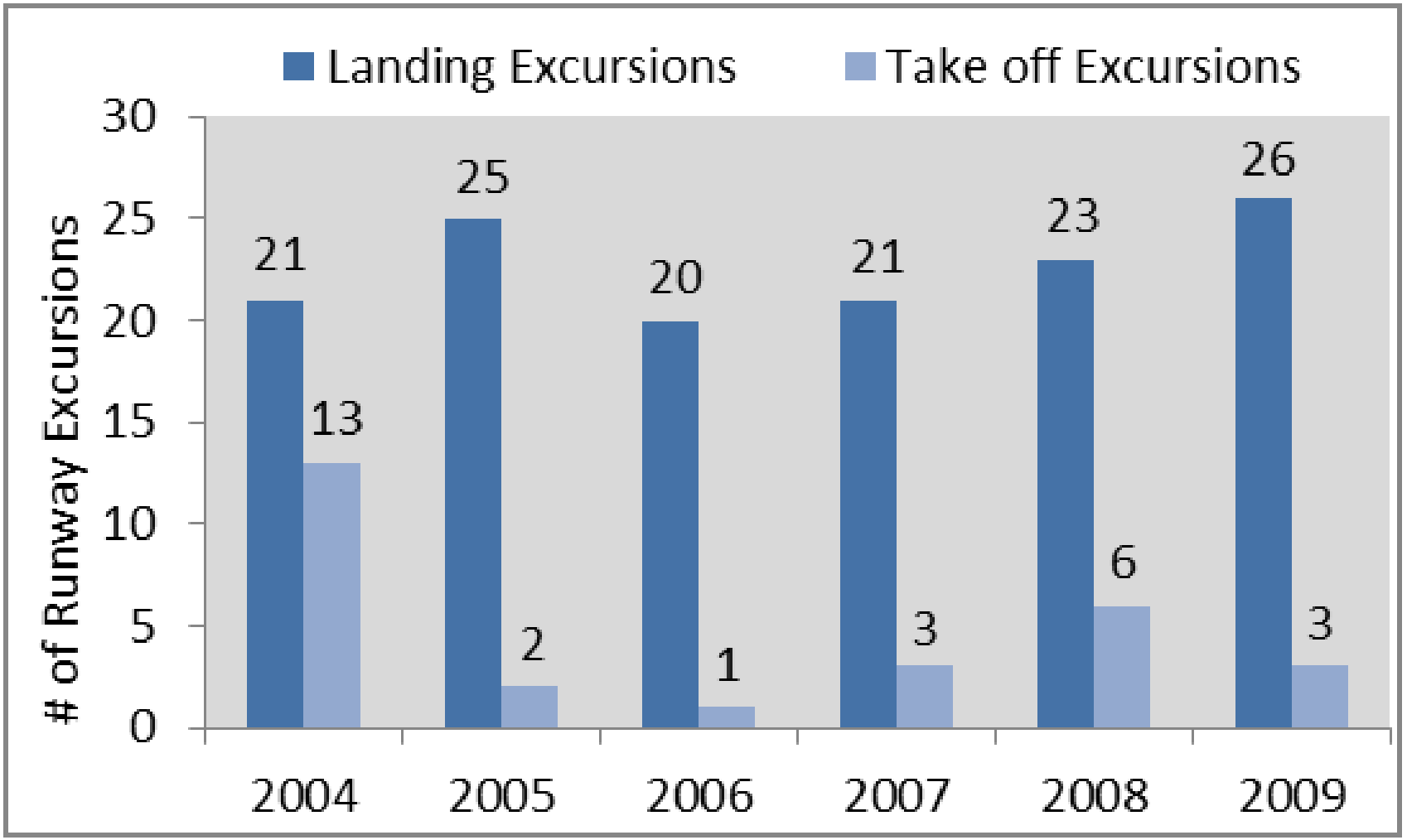
- From 2009 to 2013, 58% of all accidents occurred in the runway environment. The most frequent type of accident is runway excursion, representing 23% of all accidents over the period

IATA Runway Excursion Data 2004-2009



EMIRATES – APPROACH STABILISATION

Approach Stabilisation

- Approaches shall be flown so as to be stabilised in accordance with the criteria below (next slide). If an ATC request such as track shortening or speed is likely to result in an unstable approach then it is to be declined.
- Unique approach procedures or abnormal conditions that require a deviation from any of the elements of a stable approach described below require a special briefing, and shall be briefed in advance.
- Automated approach monitor system alerts and cautions (where embodied) should be verified and actioned in accordance with this policy.
- If the requirements below (next slide), as applicable, are not met then an immediate go around shall be flown.

EMIRATES – STABLE APPROACH CRITERIA

Stable Approach Criteria

- An approach is considered to be stable when all of the following conditions are met:
  - All briefings and checklists have been actioned.
  - The aircraft is in the planned landing configuration (Note 1).
  - The aircraft is on the correct flight path (Note 2).
  - The aircraft speed is not more than final approach speed +10 KIAS and not less than VREF (Note 3).
  - Power setting is appropriate for the aircraft configuration.

- **Note 1:** Planned landing configuration is: landing gear down and locked, landing flap set and speedbrake armed.
- **Note 2:** An aircraft is considered to be on the correct flight path if it is within the approach path laid down in the fleet specific FCOM.
- **Note 3:** As adjusted by minimum ground speed techniques where applicable and excluding momentary excursions (a momentary excursion is defined as a deviation lasting only a few seconds and where every indication is that it will return within the stabilised criteria).

EMIRATES – STABLE APPROACH REQUIREMENTS

Stable Approach Requirements

- The landing gear should be down and locked, and the landing flap selected, no later than 1,500ft. AAL.
- At 1,000ft. AAL: if the criteria in Stable Approach Criteria are not met then a go-around shall be flown, unless:
  - The aircraft speed does not meet the criterion but can reasonably be expected to be achieved by 500ft. AAL and the power set is appropriate to achieve this; or
  - The aircraft is in the planned landing configuration and all landing actions have been completed but the landing checklist has not yet been completed.
- In which case the approach may be continued to not less than 500ft. AAL while these criteria are achieved.
- At 500ft. AAL: If any of the criteria in Stable Approach Criteria are not met then PM shall announce "GO AROUND" and an immediate go-around shall be flown.

  If a stable approach destabilises below 500ft. AAL then PM shall announce "GO AROUND" and an immediate go-around shall be flown.
- If a valid "Long Landing" alert (Smart Landing-equipped aircraft) or a Runway Overrun Warning relevant to the current runway state (A380) is activated, then the PM shall announce "GO AROUND" and an immediate go-around shall be flown.

GO AROUNDS FROM UNSTABILISED APPROACHES

Setting the culture

- A 'go around' from an unstabilised approach is mandated
- Pilots who 'go around' are not subject to any measures – there may be a debrief, but that's all
- Pilots who do not 'go around' from an unstabilised approach will be taken off the line and undergo retraining

- In the industry 97% of unstabilised approaches result in a landing – in Emirates it is close to 0%!

Technology – Safety Enhancements

Industry Leader

- SmartRunway
- SmartLanding
- PBN

- Future Systems
  - SmartTake-off
  - Ground Collision Avoidance (TSAS)

New Technologies to Enhance Safety

- SmartRunway
  - Runway Incursion Prevention
- SmartLanding
  - Runway Excursion Prevention

Mitigates runway incidents and accidents - the largest category of aircraft accidents globally

- SmartTraffic
  - TCAS Version 7.1
  - Hybrid Surveillance
  - ADS-B In / CDTI

Reduces Mid Air Collision Risk by factor of 4.

Enhanced traffic situational awareness

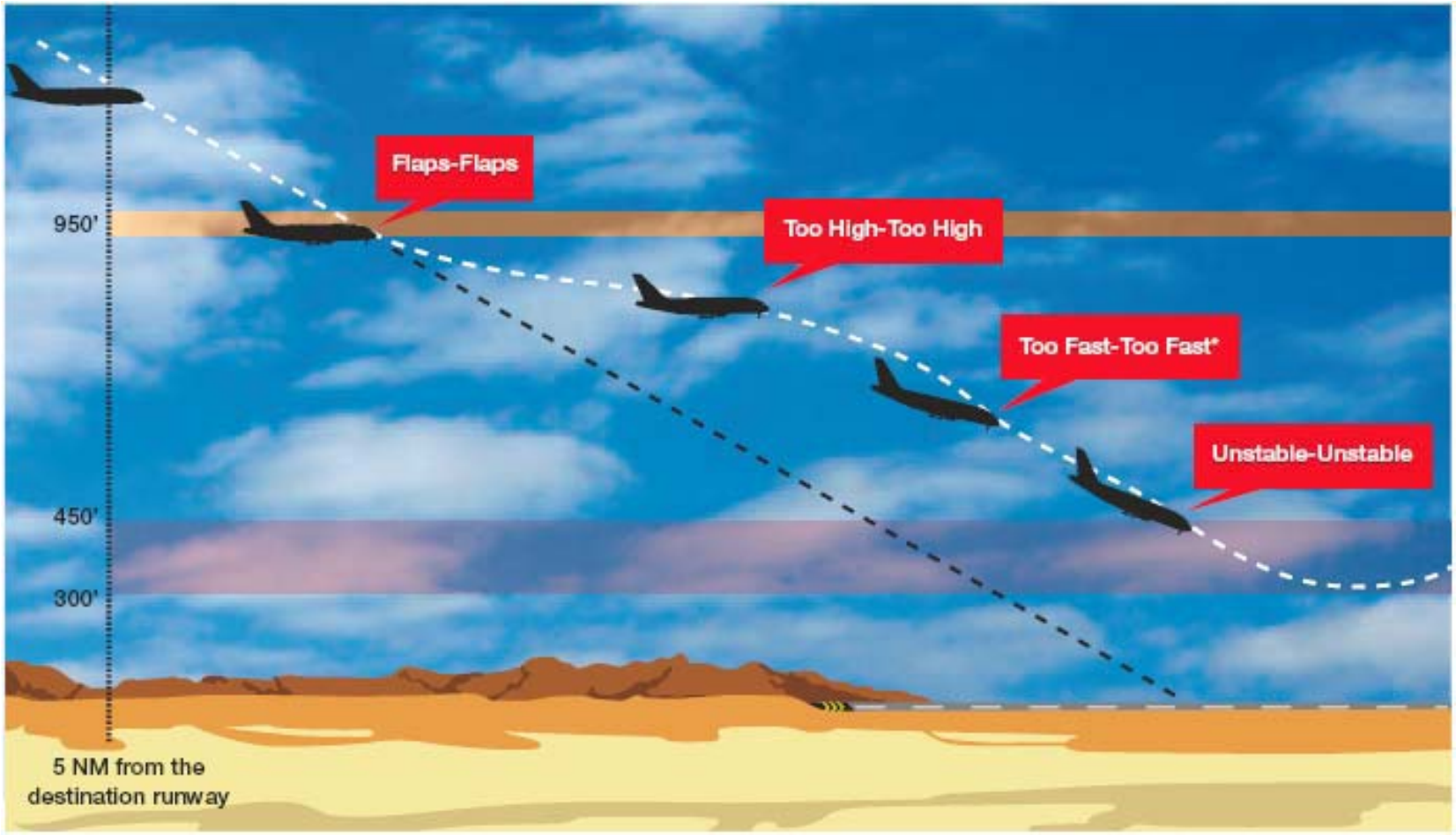
- SmartTakeoff*
  - Takeoff Performance Monitoring

Mitigates takeoff overruns and tail strikes

*Under development - Emirates is actively involved in SmartTakeoff development with Honeywell

Honeywell – SmartLanding

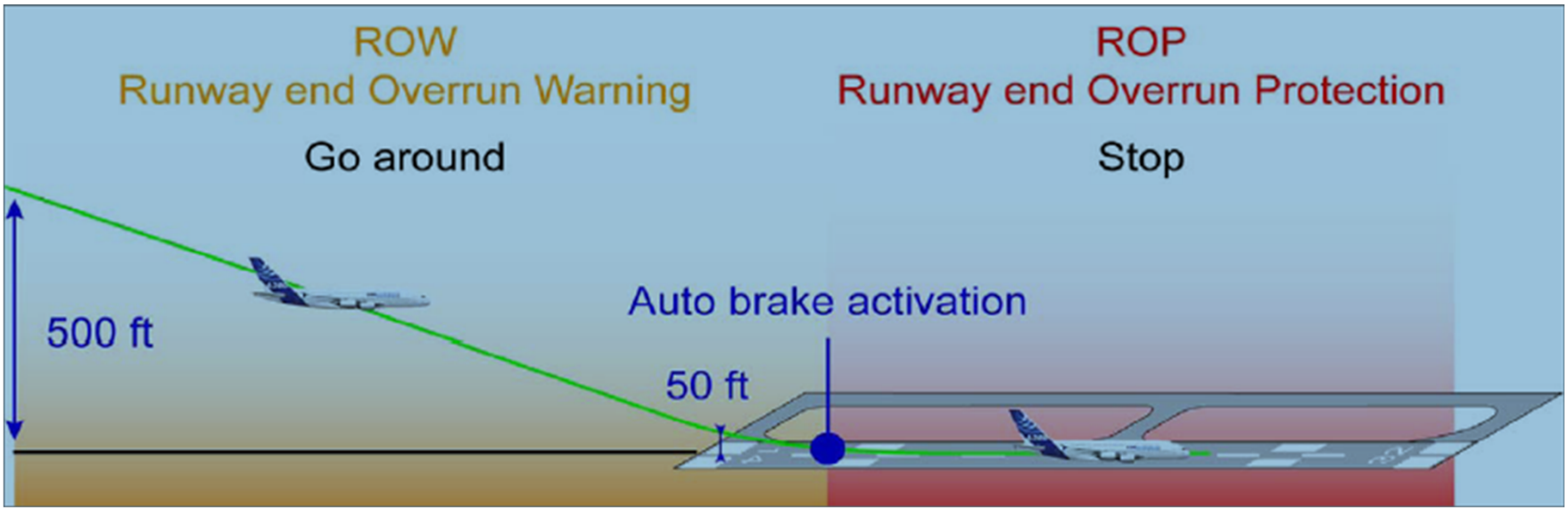
Unstabilised Approach



NOW FITTED TO AIRBUS & B777 FLEETS

A380 - Brake To Vacate - ROW & ROP

Brake to Vacate also includes runway excursion warnings

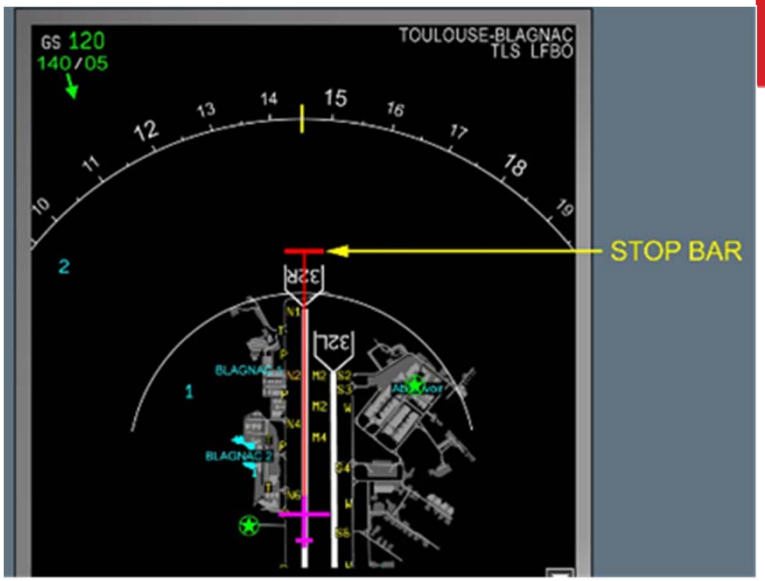


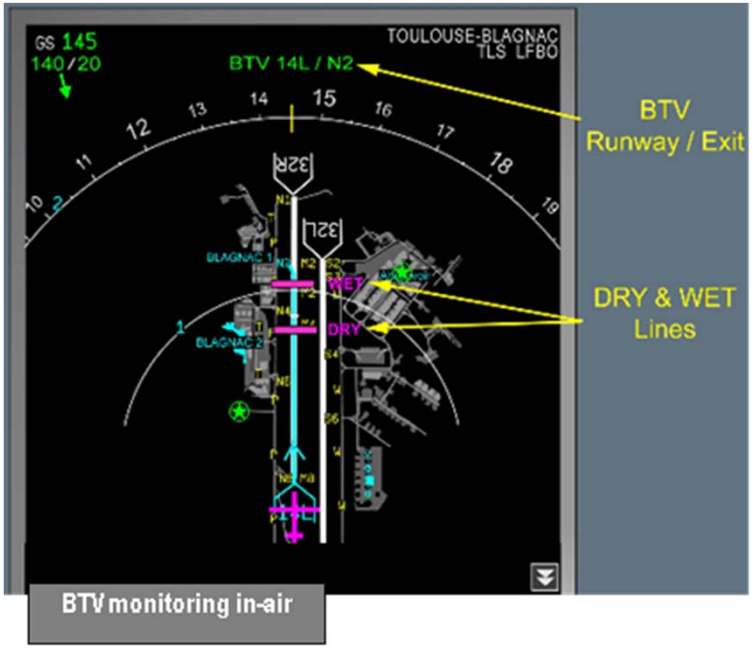
NOW FITTED ACROSS THE A380 FLEET

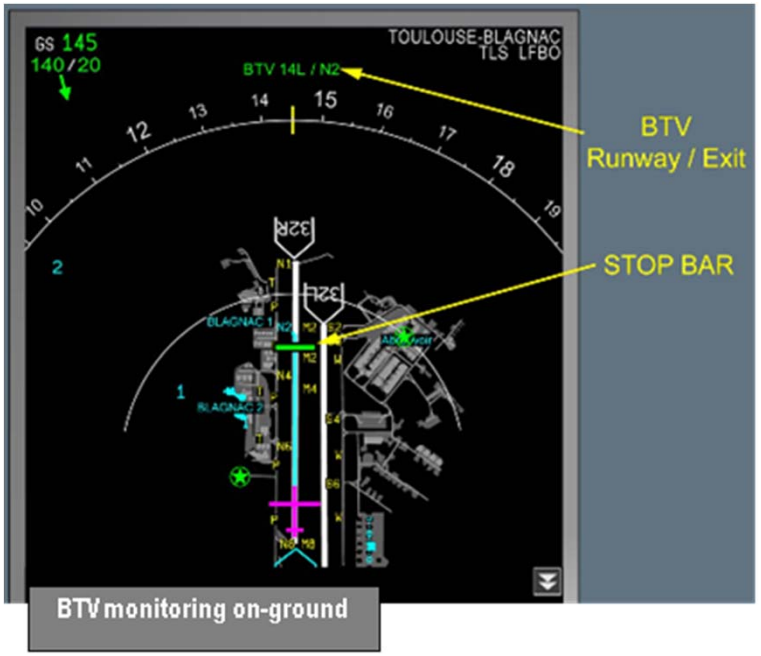
A380 – Brake to Vacate Displays

Latest technology to:

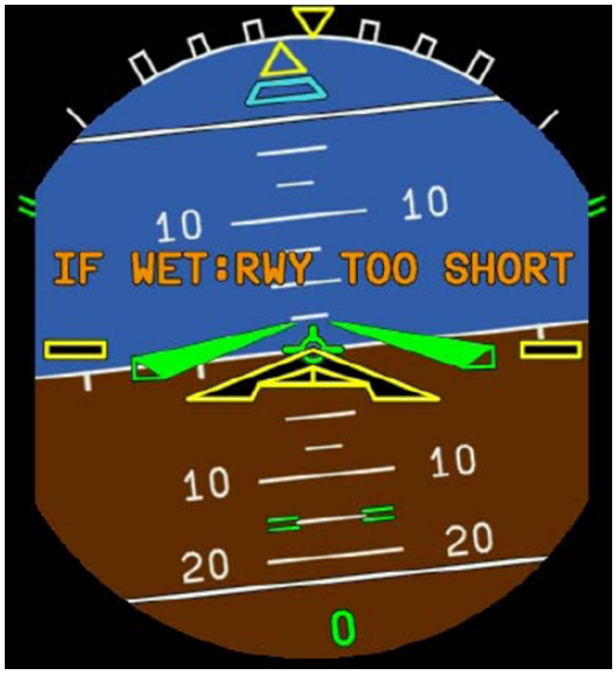
- Maximise effective braking
- Inform crew of unsafe situations
- Increase runway utilisation

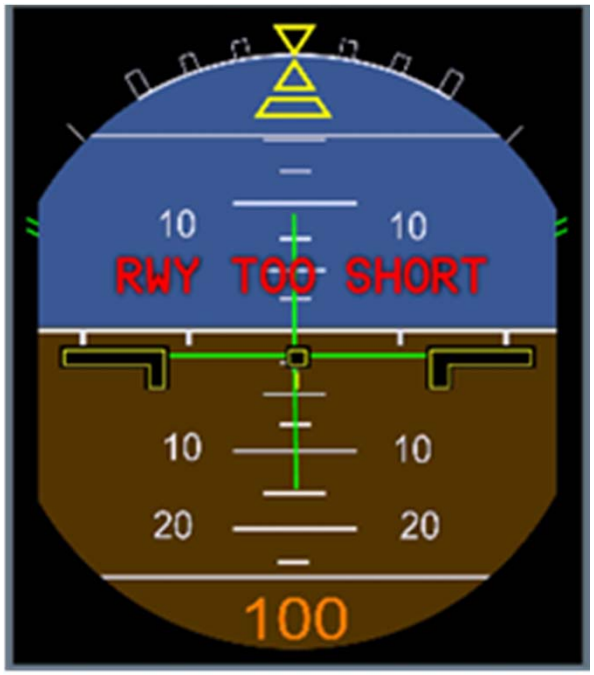






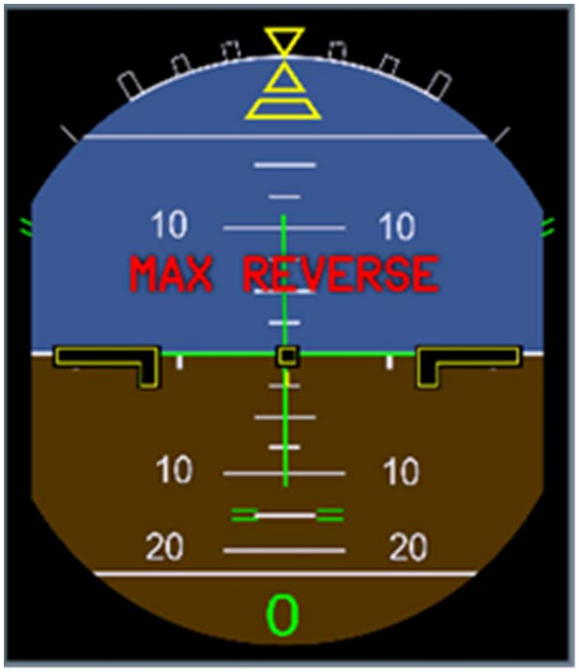
A380 – Brake To Vacate Warnings





ROW – Runway end Overrun Warning
(Airborne Warning)

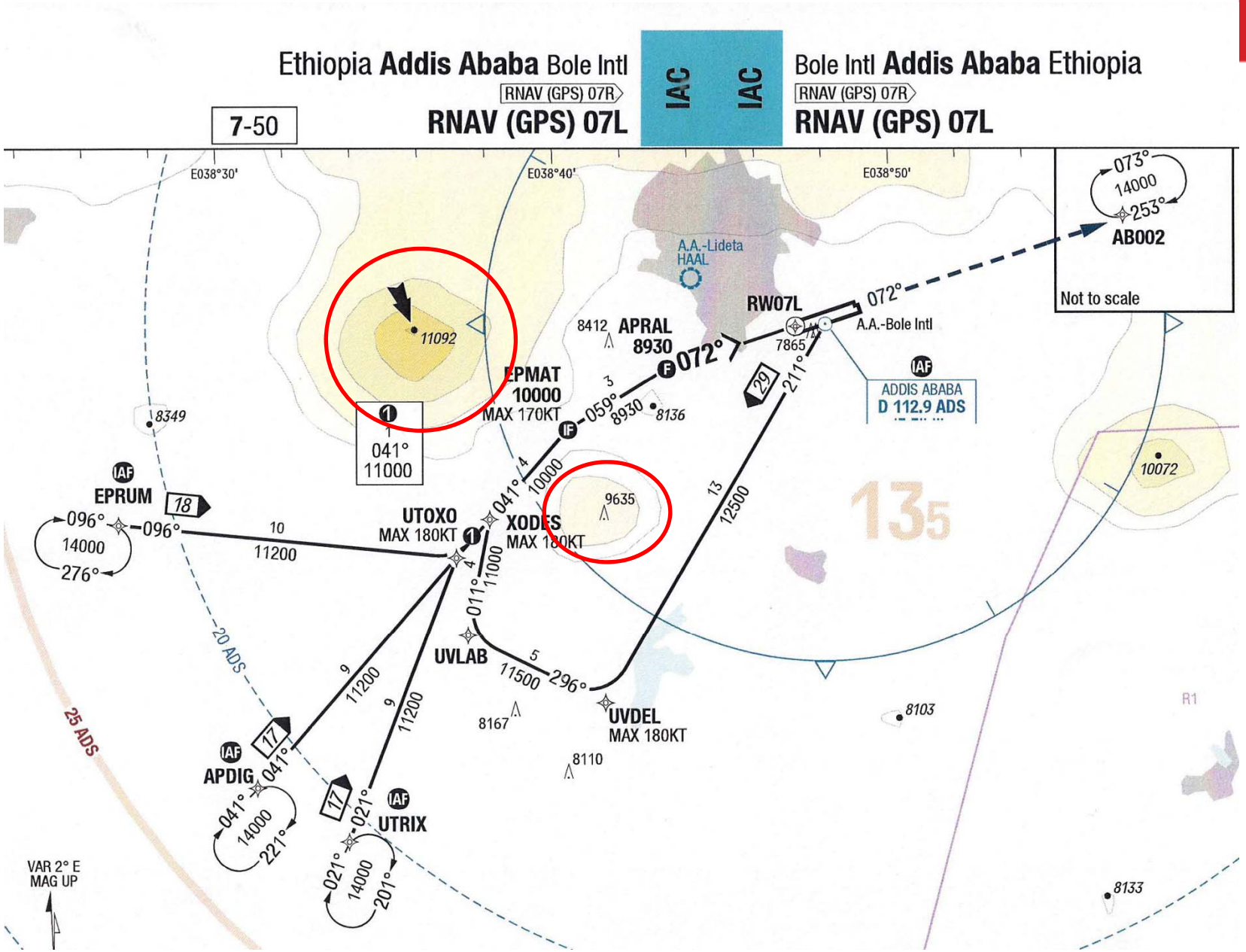
ROP – Runway end
Overrun Protection
(Ground Warning)



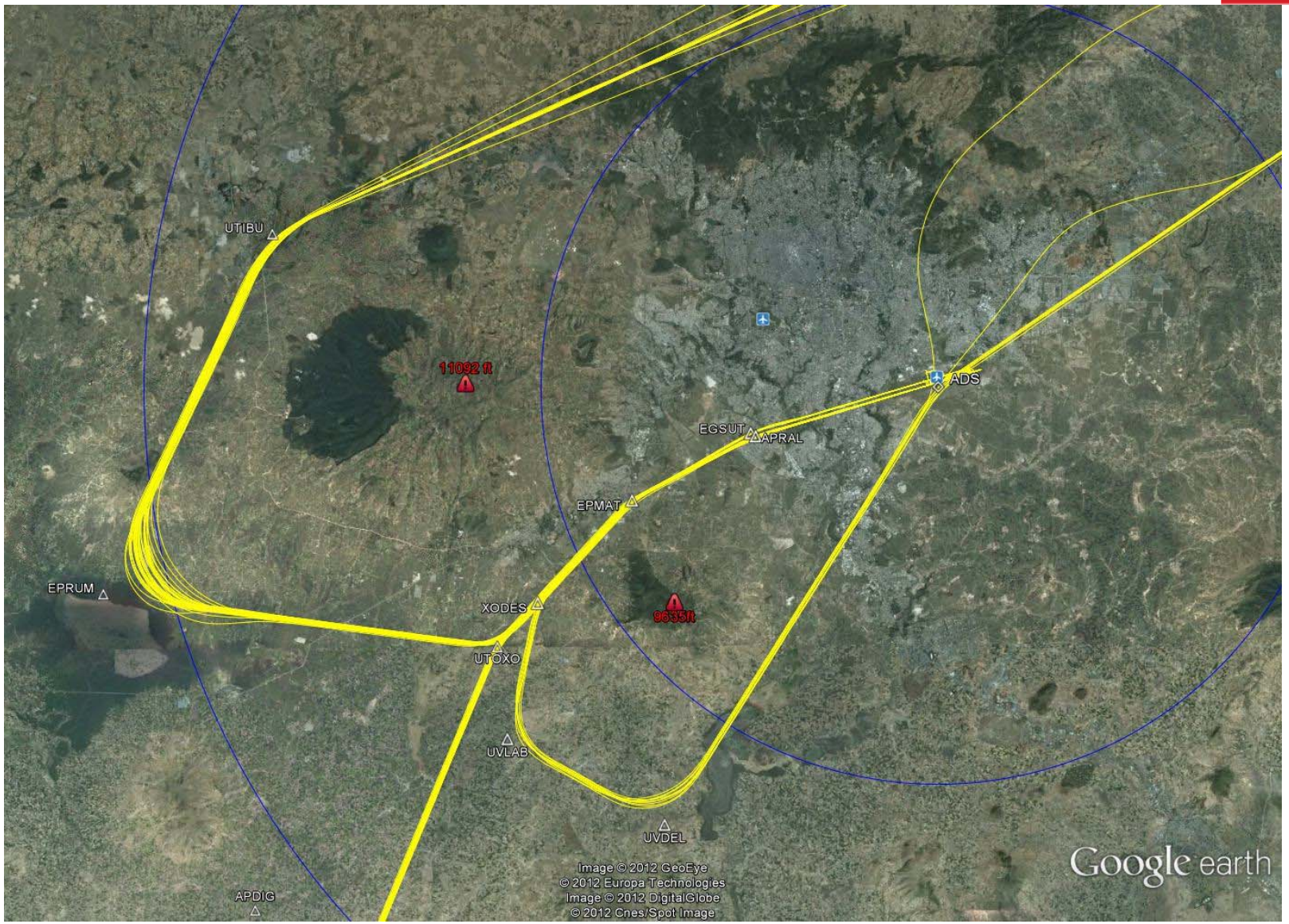
Performance Based Navigation (PBN) Approaches

- Can remove the need for the traditional non-precision approaches (VOR/NDB) or visual approaches
- More accurate than VOR/NDB/visual approaches
- Can be tailored to individual airports (e.g. curved, offset approaches etc.)
- Helps to stabilise the approach
- Examples:-
  - JFK – Carnarsie Approach
  - ADD – RNAV Approach

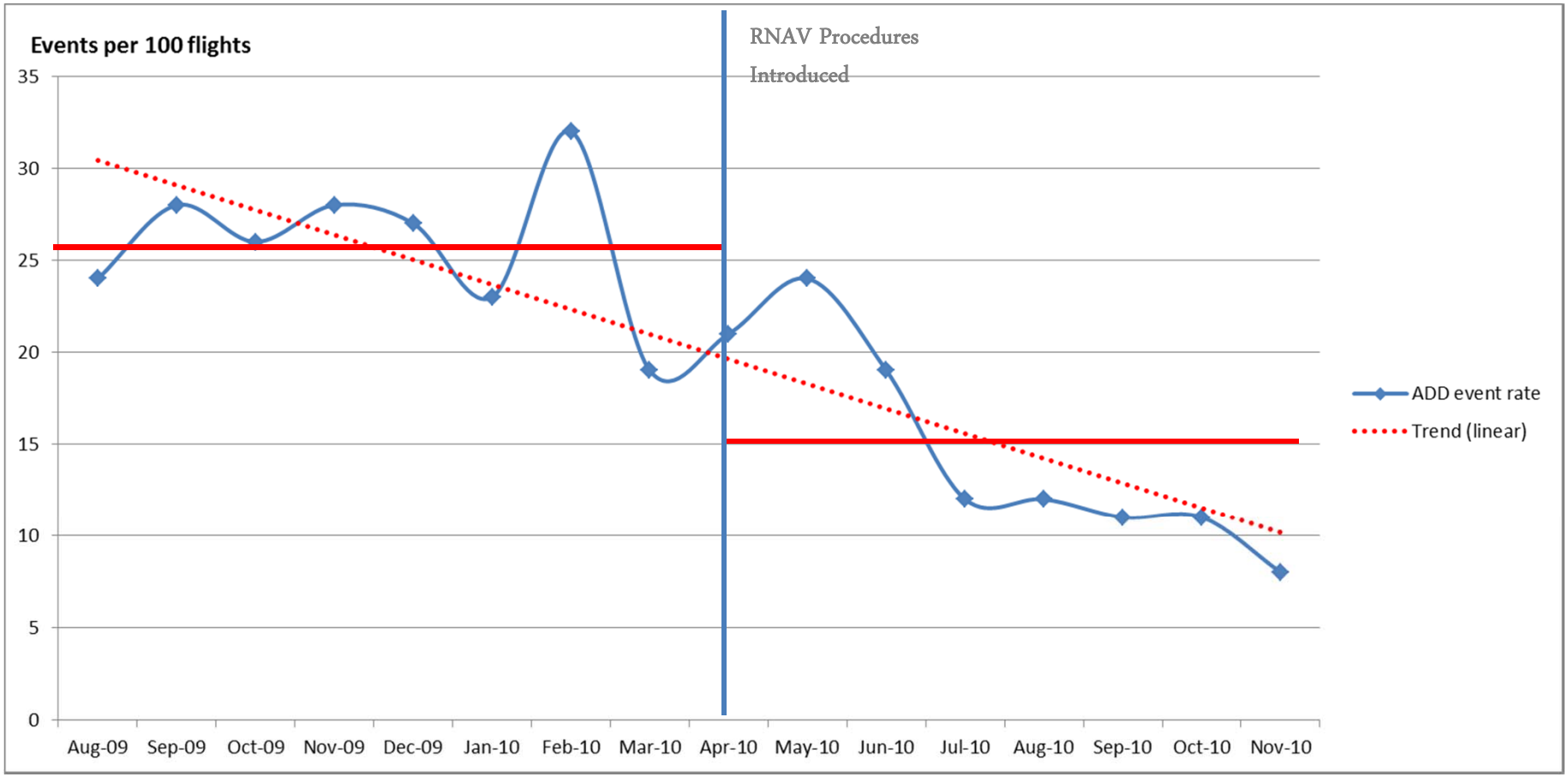
Addis Ababa – Offset RNAV Approach



Addis Ababa – RNAV Approach



Addis Ababa – Reduction in events



Thank you