Available Technologies

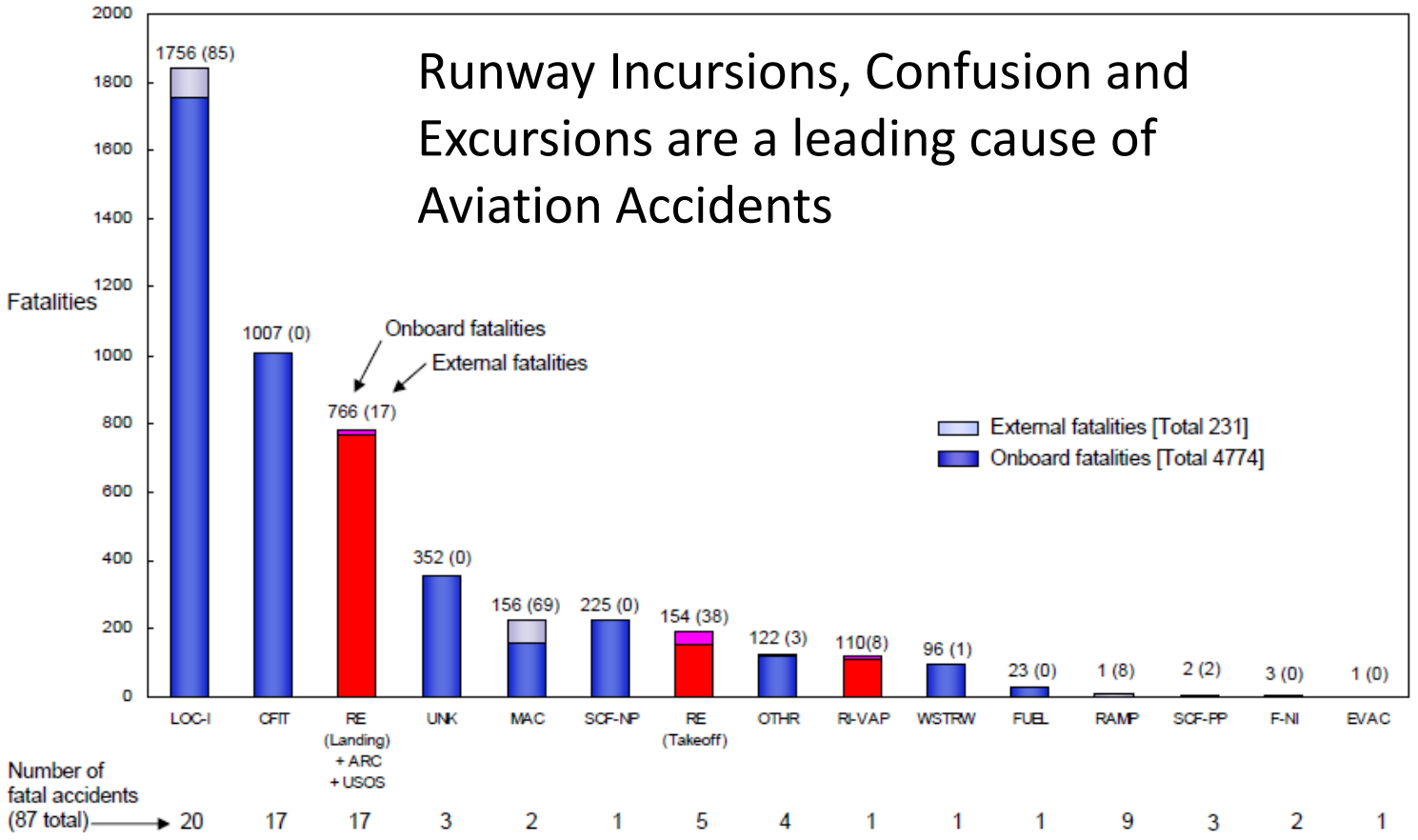
Session 4

Presentation 1

Fatalities by CAST/ICAO Common Taxonomy Team (CICTT) Aviation Occurrence Categories

Fatal Accidents – Worldwide Commercial Jet Fleet – 2001 Through 2010

Runway Incursions, Confusion and Excursions are a leading cause of Aviation Accidents



Note: Principal categories as assigned by CAST.

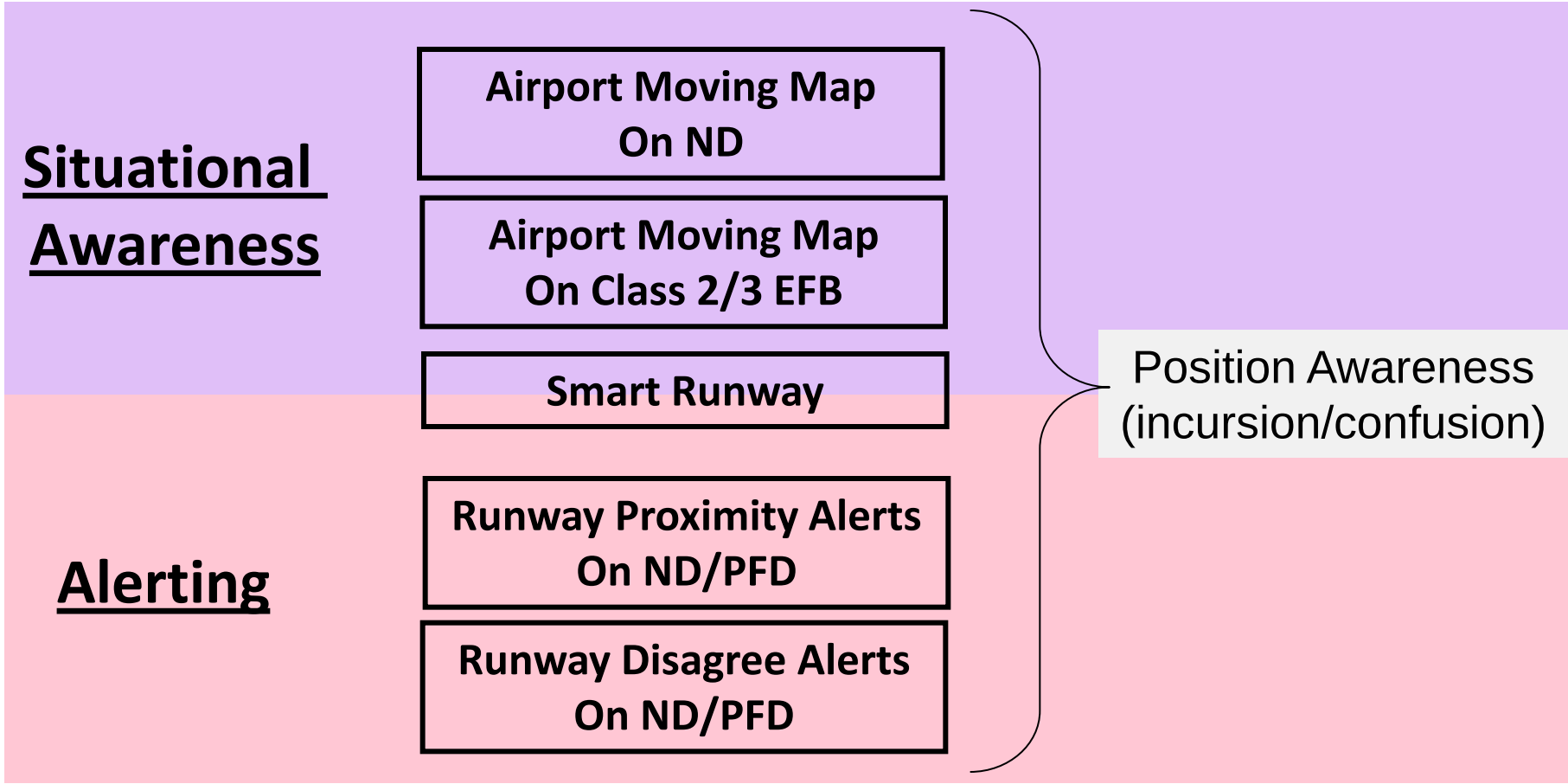
Runway Incursion & Confusion

Runway Incursion & Confusion

Eliminating Runway Incursion and Confusion requires Flight Crew Awareness of:

- Position of Own Ship on the Airport Surface
- Position of Other Traffic on the Airport Surface
- Taxi Route
- Conflicting Traffic

Available Equipage



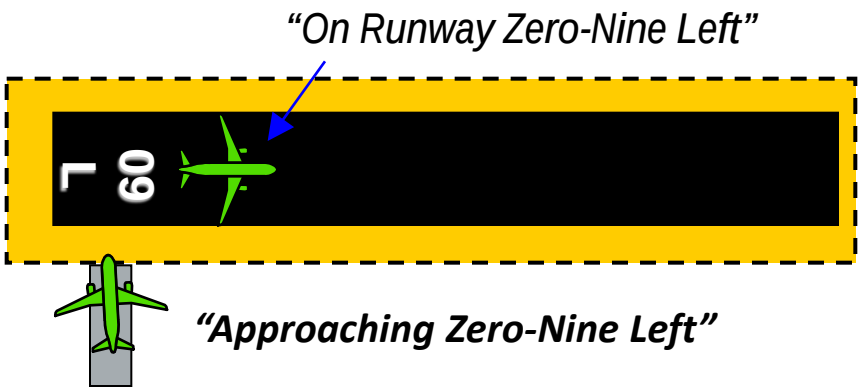
Available Equipage

Positional Awareness via Airport Moving Map (Airbus OANS in-service example)

Runway Proximity

Available Equipage

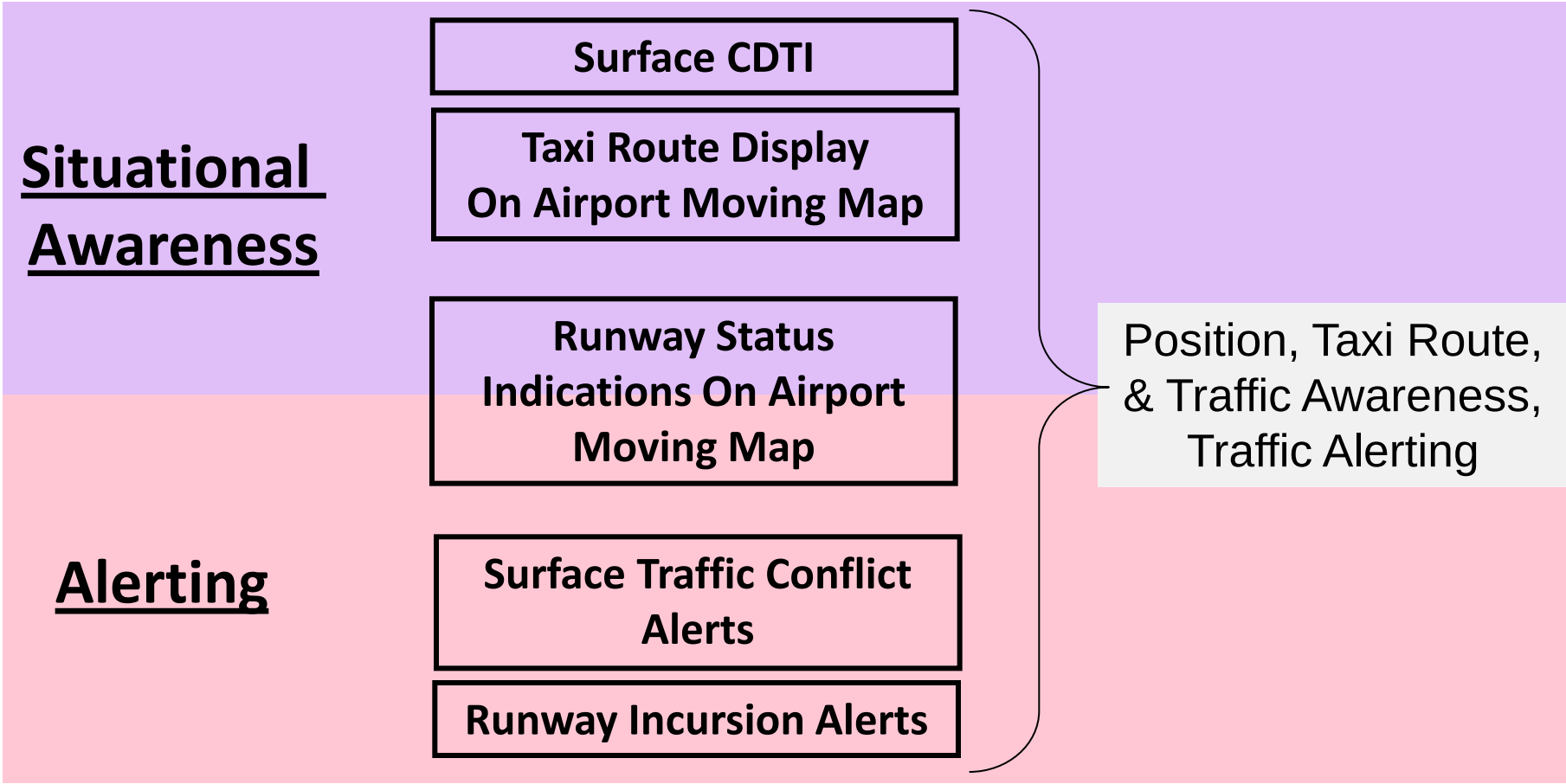
Positional Awareness via TAWS (Honeywell Smart Runway in-service example)



Available Equipage

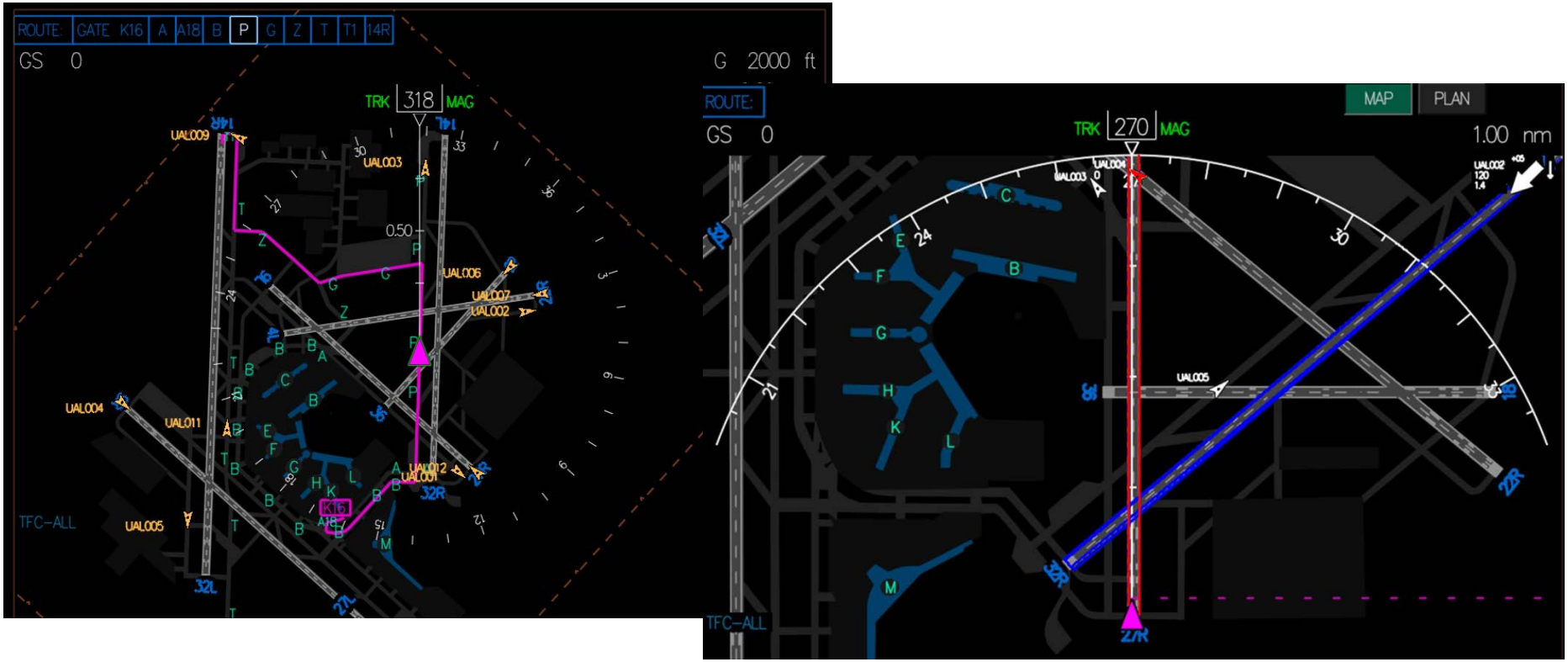
Positional Awareness via FMS (Boeing Runway Disagree Alerting in-service example)

Future Equipage Studies



Future Equipage Studies

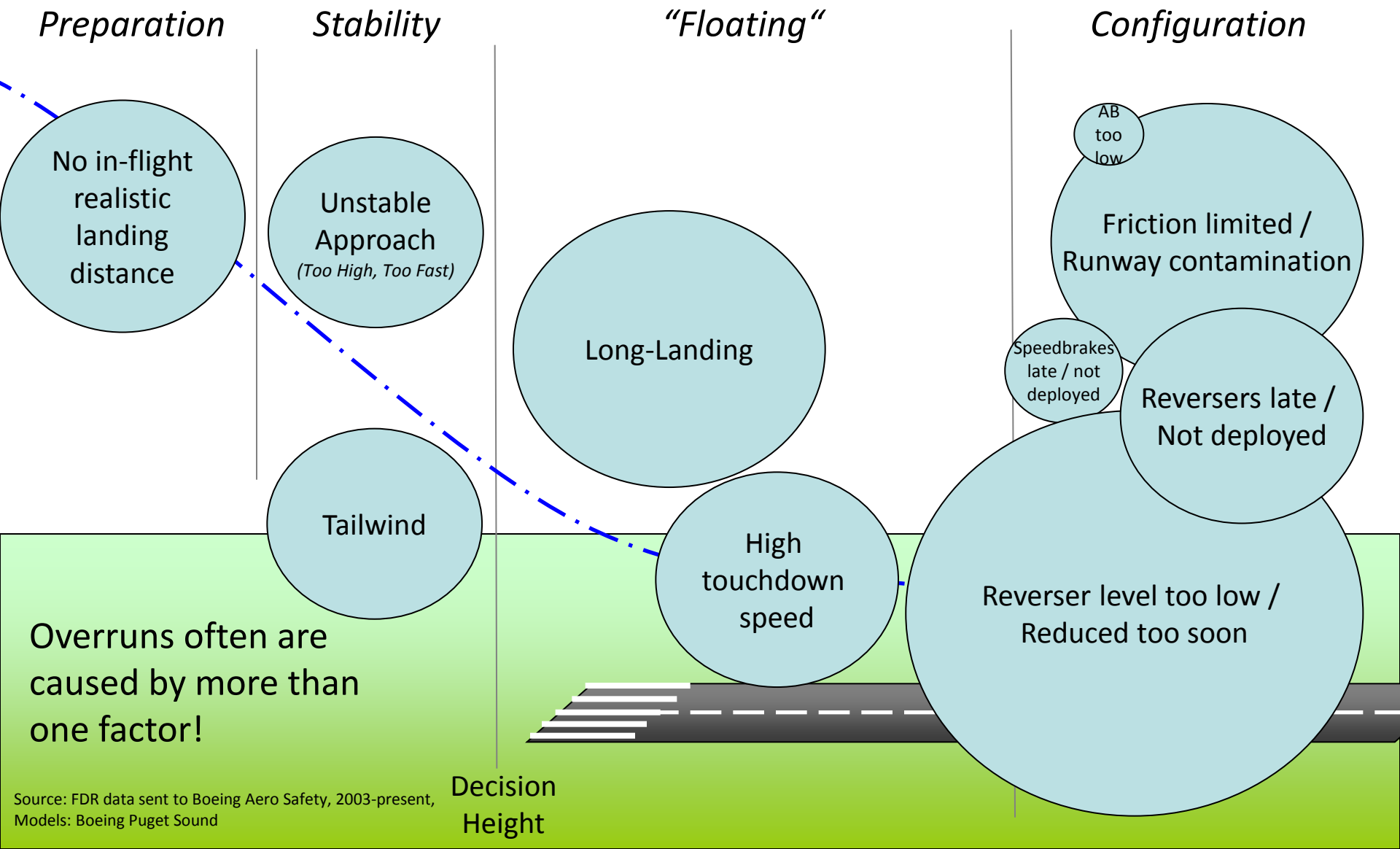
Airport Moving Map with Taxi Route, Traffic, Runway Status Indications and Traffic Conflict Alerting (Boeing concept example)



Runway Excursions

International Coordinating Council of Aerospace Industries Associations

Overrun Characteristics



Source: FDR data sent to Boeing Aero Safety, 2003-present,
Models: Boeing Puget Sound

Overrun Risk Mitigations

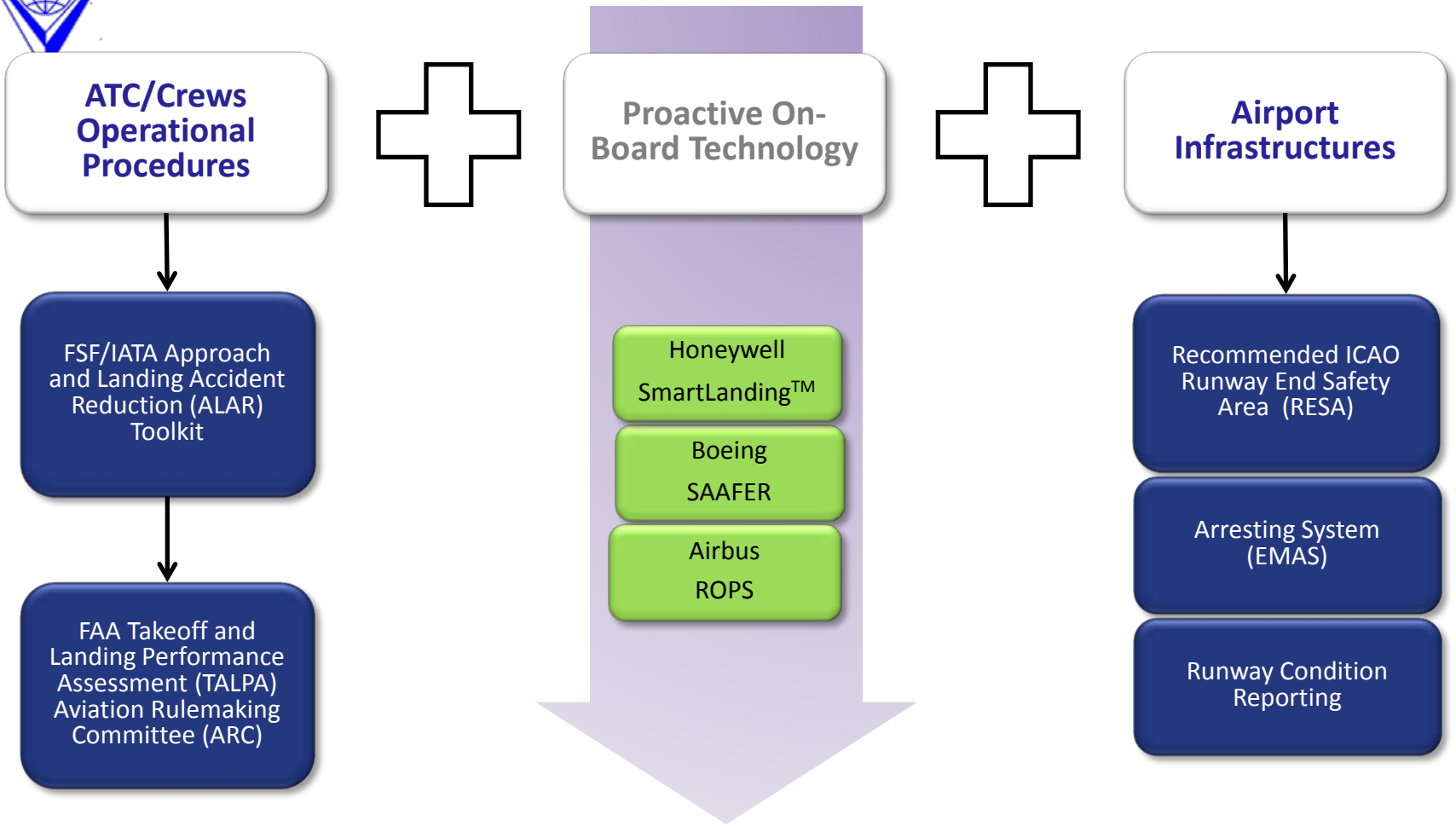
Suggested Operation and Procedural enhancement:

- **Runway conditions reporting**
- **In-flight realistic landing distance calculation**
- **Stabilized approach**
- **Touchdown zone marking**
- **"De-stigmatize" Go- Around**
- **Use *all* deceleration devices**
- **Maintain thrust reverser deployment**

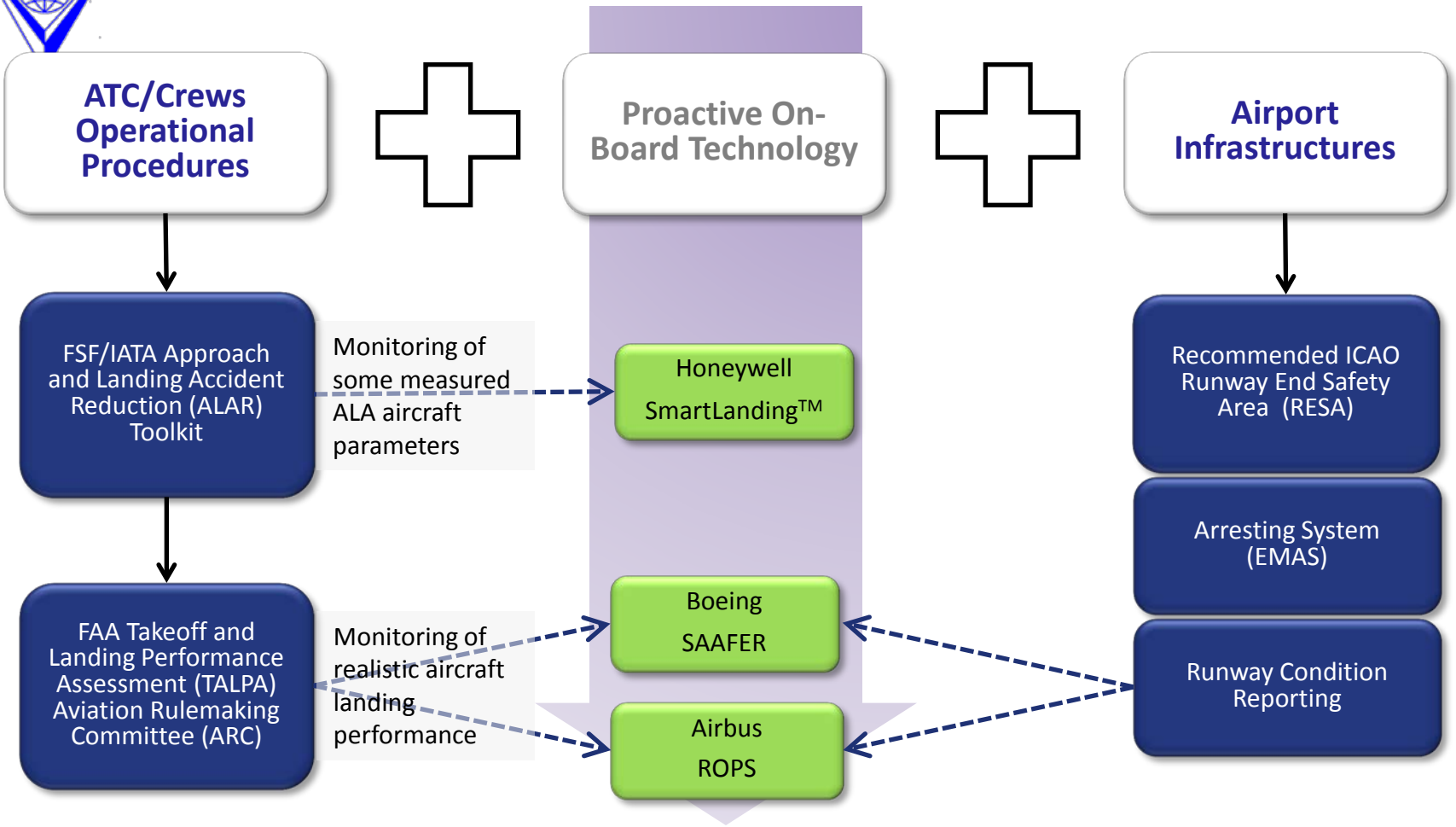
Suggested equipage enhancements:

- **Stability alerting**
- **Real time dynamic performance prediction**
- **Aural and visual Go-Around decision aids**
- **Head-Down and Head-Up visual cues**
- **Real time dynamic performance prediction**
- **Aural and visual Go-Around decision aids**
- **Head-Down and Head-Up visual cues**
- **Flare guidance**
- **Real time dynamic stopping distance estimation**
- **Aural and visual deceleration devices usage aids**
- **Head-Down and Head-Up visual cues**
- **Deceleration alerting**

Source: FDR data sent to Boeing Aero Safety, 2003-present,
Models: Boeing Puget Sound



For Runway Excursion Risk, only a combined prevention approach will be effective

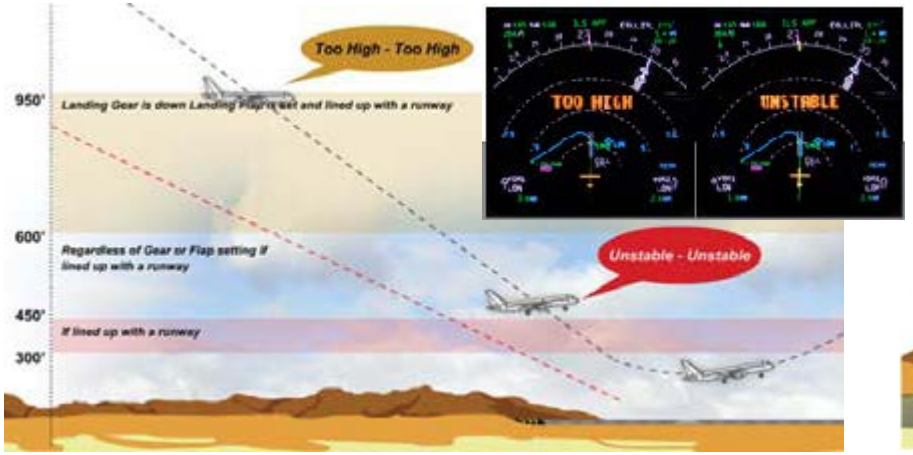


Guidance similar to TCAS & E-GPWS is needed to mitigate runway excursions

Available Equipage – Honeywell Smartlanding™

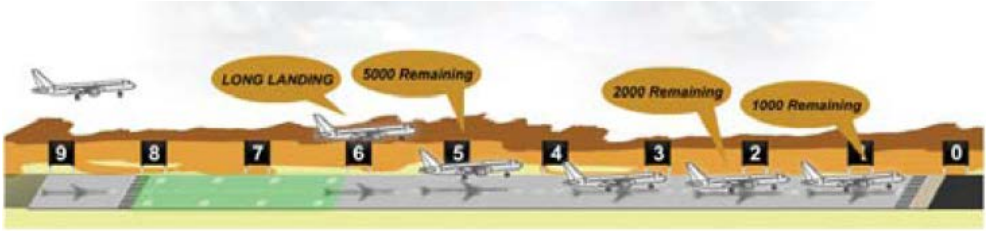
Smartlanding™ is a software upgrade of the Honeywell E-GPWS:

- Monitoring A/C speed and position vs. runway threshold
- Providing visual/aural annunciations to enhance crew awareness of unstabilized approach
- Based on tuning defined by Honeywell (speed, glideslope) or set by airlines (long landing distance)



Smartlanding™ main monitorings:

- « TOO FAST » alert,
- « TOO HIGH » alert,
- « UNSTABLE » alert,
- « LONG LANDING » alert.



As considered as a “non interferent” function, FAA does not request:

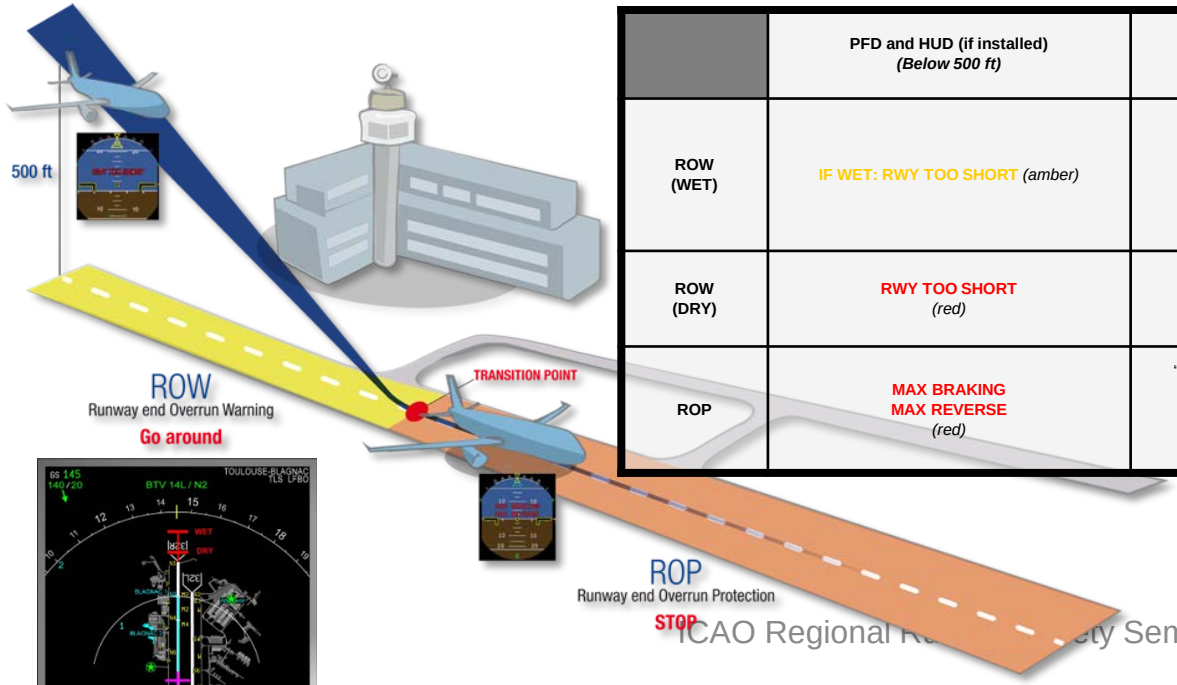
- Demonstration of Smartlanding™ tuning relevance
- Specific training
- Specific SOP in line with exisiting operators ones

TSO approval granted in 2009

Available Equipage – Airbus ROPS

ROPS is a low cost software upgrade of existing avionics computers:

- Continuous real time performance computation of predicted and remaining realistic operational landing distance
- Compare it/them in real time with runway end
- Trigger, only when necessary, clear alerts with simple SOP
- Guarantee and demonstrate both reliability and not excessive margins
- Ensure consistency with FAA TALPA rule and computation philosophy
- Avoid any additional tuning by airline
- In obvious complement of the necessary need to fly stable approach

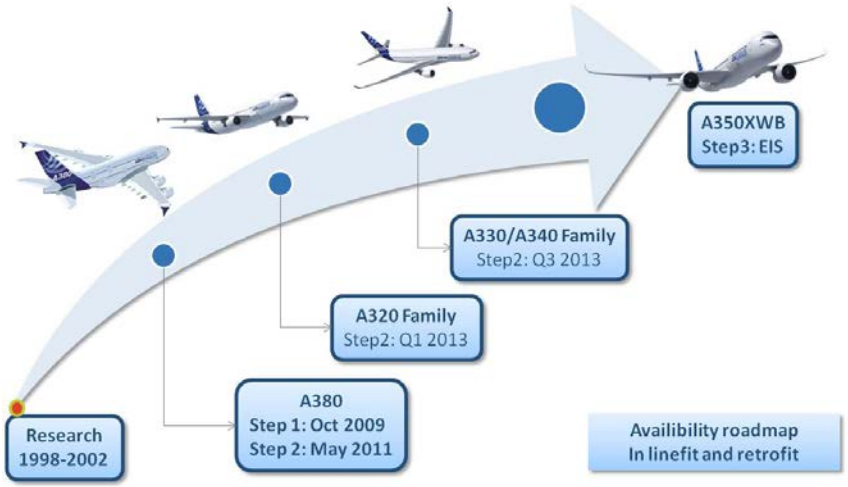


	PFD and HUD (if installed) *(Below 500 ft)*	Audio *(Below 200 ft)*	Crew Actions *(Below 500 ft)*	ND line symbols (if AMM installed)
ROW (WET)	IF WET: RWY TOO SHORT *(amber)*	None	Go-Around if runway is wet / damp or more slippery	WET *(amber)* DRY *(magenta)*
ROW (DRY)	RWY TOO SHORT *(red)*	"RWY TOO SHORT !"	Go-Around	WET *(red)* DRY *(red)*
ROP	MAX BRAKING MAX REVERSE *(red)*	"BRAKE… MAX BRAKING MAX BRAKING" "MAX REVERSE" "KEEP MAX REVERSE"	MAX braking (Auto/Pilot) MAX REV (Pilots)	Red STOP bar Red path

Available Equipage, SOP and Training – Airbus ROPS and OLD

As ROPS is considered as an “interferent” function acting in a critical flight phase, EASA requests:

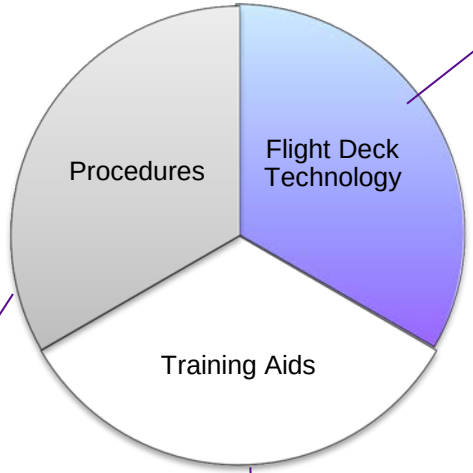
- Demonstration of the relevance of ROPS alerts and protections: no unprotected area, no undue conservatism
- Principle: “If no ROW alert before decision point Then, thanks to ROP and associated SOP, no runway excursion While no significant increase of go-around rate”
- Demonstration of man-machine interface design and operational suitability
- Adequate AFM, FCOM and FCTM



ROPS flight deck technology is supplemented by the on-going implementation in Airbus SOP of in-flight realistic landing distance assessment based on FAA TALPA Operational Landing Distance (OLD) recommendations:

- Available for all Airbus types between mid-2012 (from A320 to A380) and end 2013 (A300-A310)
- Updated training media
- Updated Engineering and Performance On-board Software
- AFM, QRH and FCOM Revisions
- Airbus Type Rating Training based on OLD
- Taking into account FSF ALAR and IATA RERR recommendations

Future Equipage and available SOP and Training – Boeing SAAFER project

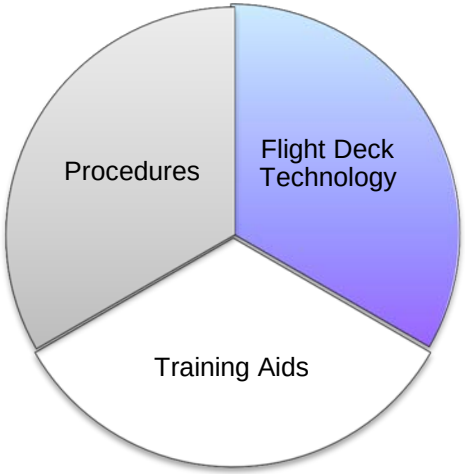


- Enhanced approach planning tools
- Aural & visual runway positional awareness & alerting
- Stability guidance and alerting
- Predicted runway stop location display
- Overrun alerting

For *every* landing:
- Calculate Landing Distance
- Calculate & brief a go-around point
- A thrust reverser callout has been added to the FCTM and the FCOM

Approach & Landing Training Aid video:
- Flying a stable approach
- Runway contamination
- Runway length available vs. required
- Reported conditions vs actual
- Approach speed additives
- Use of deceleration devices

Future Equipage and available SOP and Training – Boeing SAAFER project



Non-Equipage mitigations available:

- Updated Approach Procedures
- Boeing-developed Approach & Landing Training Aid
- Flight Safety Foundation ALAR tool kit
- IATA Runway Excursion Risk Reduction (RERR) toolkit

Equipage mitigations available:

- Heads up Display (HUD)
- Vertical Situation Display (VSD)
- Onboard Performance Tool (OPT)
- Runway Awareness Advisory System (RAAS)

Enhanced in-production and cost-effective retrofit packages starting in 2015

Conclusion

- **Flight deck solutions already exist or are coming**
- **Significant fleet coverage is needed to achieve widespread safety benefit**
- **Bodies starts to recommend installation of such flight deck solutions**
  - *US: NTSB (A-11-28, March 29th 2011)*
  - *Europe: EASA-Eurocontrol EAPPRE (AC05 for aircraft operators – AM03 for aircraft manufacturers)*
- **Harmonization of certification standard is requested**
  - *Current and future airplanes*
  - *High quality runway and airport data (Airport Mapping DB, Terrain DB, etc.)*
  - *TAWS development and deployment lessons learnt*

THANK YOU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