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AIRBUS presentation

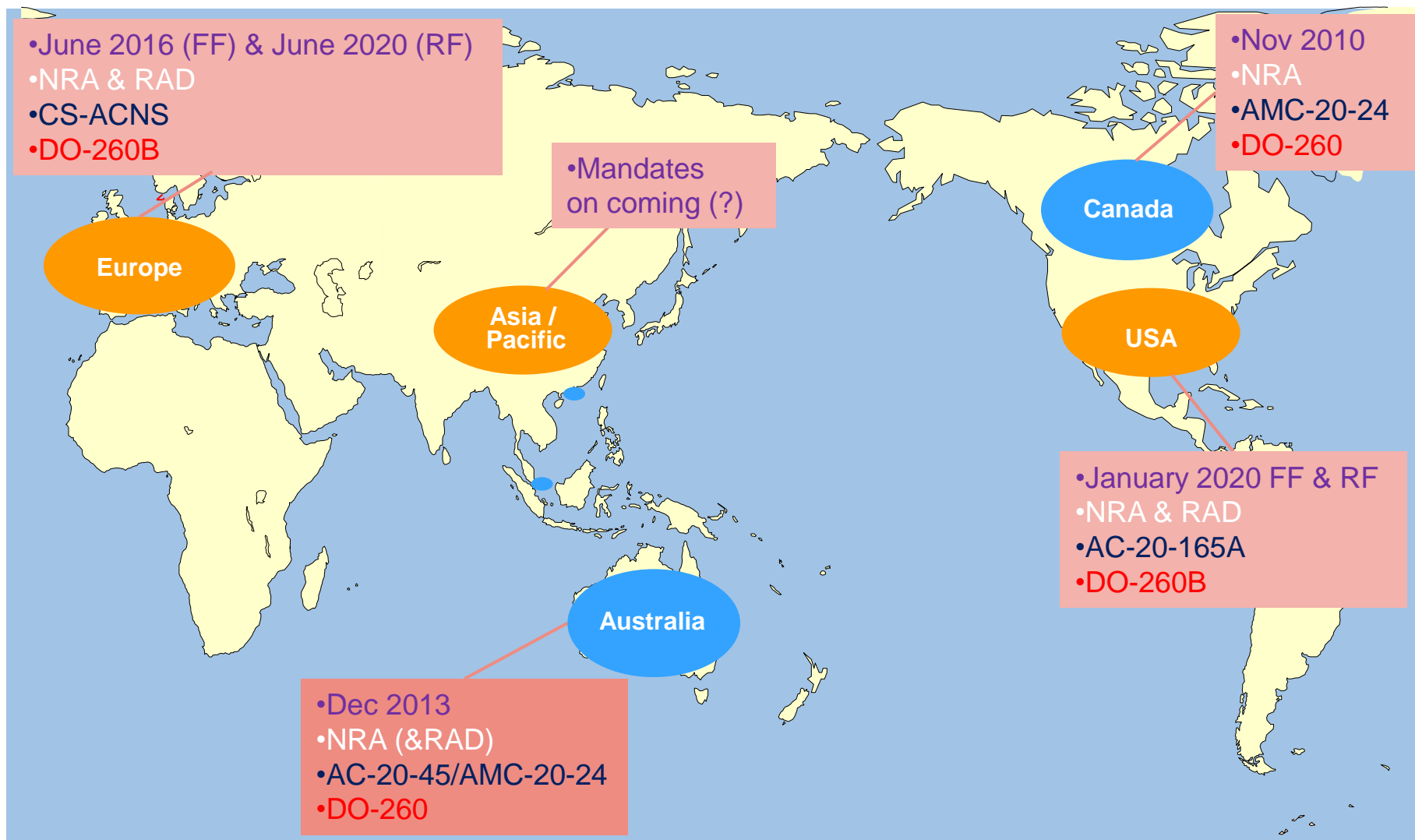
**ADS-B seminar and fourteenth
meeting of ADS-B study and
implementation task force**



ADS-B - CONTENT

1**ADS-B – Introduction****2****ADS-B OUT – for NRA operations****3****ADS-B OUT – for RAD operations (Europe & US mandate)****4****ADS-B IN – ATSAW (Airborne Traffic Situational Awareness)****5****AIRBUS ADS-B Road Map**

ADS-B OUT - Mandates



ADS-B - CONTENT

1**ADS-B – Introduction****2****ADS-B OUT – for NRA operations****3****ADS-B OUT – for RAD operations (Europe & US mandate)****4****ADS-B IN – ATSAW (Airborne Traffic Situational Awareness)****5****AIRBUS ADS-B Road Map**

ADS-B OUT – Airbus aircraft configuration for NRA - Status

	Supplier	P/N	Standard	Comment
A320 & A330	ACSS	7517800-10100	DO-260A	Transponder also used within T3CAS 1.2
	Honeywell	066-01127-1402	DO-260	
	Rockwell Collins	822-1338-021	DO-260	
A380	Honeywell	AESS H04S06	DO-260B	
A350	Honeywell	AESS H05S03	DO-260B	

- **In line fit, on Airbus aircraft:**
 - All transponders are ELS/EHS/ADS-B capable.
 - Wiring provisions for ELS/EHS/ADS-B are basic
 - MMR are basic

ADS-B OUT – Certification status for NRA

ADS-B OUT for NRA operation has been certified on all Airbus aircraft programs by EASA in compliance with AMC-20-24

- To be compliant with AMC-20-24, EASA requires Airbus aircraft documentation update for operational approval:

- ▶ **Update of AFM:** Statement of compliance with AMC 20-24

- ▶ **ADS-B OUT Capability declaration document:**

- Providing description, interoperability, safety and performance demonstration, specificities...etc

- Referenced in AFM.

- These documentation updates guaranty the certification in compliance with AMC-20-24 → proposed as an option on Airbus.

- **Operators have to select this option to be compliant.**

- This certification is needed for operational use if required by regulation

ADS-B OUT - Program Offerability for NRA

- Forward fit
 - Select one of transponder supplier (transponder DO-260 compliant)
 - Select the “activation of compliance” option (referenced in AFM “...comply with Airworthiness requirements for ADS-B OUT in Non Radar Area contained in AMC-20-24....”)

- Retrofit
 - Contact SEUY department for retrofit: upgrade-services.sb-support@airbus.com
 - Service Bulletins depend of the aircraft configuration
 - GPS, transponder, wiring, documentation update....

ADS-B OUT - ADS-B in-service aircraft status

- ADS-B in service installation status (March 2015)

Does not include configuration changes managed through STC

Aircraft family	A320		A330/A340		A380	
Total number of a/c	6411		1529		167	
Nb of a/c NOT ADS-B OUT capable	1124	18%	39	3%	0	0%
Nb of a/c ADS-B OUT capable (*)	5287	82%	1490	97%	167	100%

➤ More the a/c are recent more they are ADS-B OUT capable
 ➤ Increase of ADS-B OUT capability in 1 year
 ➤ Total of Airbus a/c ADS-B OUT capable: 86%

(*) ADS-B OUT capable means the aircraft is equipped with the required equipments (transponder, MMR...)

ADS-B OUT - ADS-B in-service aircraft status

- ADS-B in service installation status (March 2015)

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Nb of a/c ADS-B OUT capable (*)	5287	82%	1490	97%	167	100%
Nb of a/c ADS-B OUT capable without AMC-20-24 compliance (**)	2629	41%	331	21%	5	3%
Nb of a/c ADS-B OUT capable with AMC-20-24 compliance (**)	2658	41%	1159	76%	162	97%

✓ Even if the a/c are ADS-B capable (86%), 49% of them are AMC-20-24 compliant only.
 ✓ Most of operators wait for mandates

(*) the AMC-20-24 compliance has to be requested by airline to Airbus (ATM, FCOM update...)

ADS-B OUT - ADS-B in-service aircraft status

- **ADS-B transmission issues: Erroneous longitudinal data transmitted by Rockwell Collins transponder TPR-901 (P/N: 822-1338-021)**
 - TFU Ref:34.52.33.001 (LR) & Ref:34.52.33.002 (SA)
 - Description:
 - When a/c flies through the international dateline (180° meridian), transponder transmits longitudinal position error. Probability of occurrence: 10% (when it occurs, it persists until the end of the flight)
 - Investigation status:
 - The root cause comes from the alphabeta gamma tracking filter software within the TPR-901
 - Issue is solved by a reset of the transponder on ground.
 - Interim plan:
 - For airlines operating flights with a stopover (beyond the international date-line and before entering the ADS-B airspace), Airbus propose performing a reset on ground.
 - If not, to fly below FL290.
 - Corrective plan:
 - Installation of TPR-901 (P/N: 822-1338-225), DO-260B compliant (certification: Q1 2016).
 - Installation of P/N: 822-1338-022, DO-260 compliant (Collins prevision: Q4 2016 - TBC)

ADS-B OUT - ADS-B in-service aircraft status

- **ADS-B transmission issues: A380 - loss of the Flight ID 30s after landing**

- Description:

- 30 seconds after landing, the Flight ID is not transmitted anymore (and replaced by incoherent data)

- Investigation status:

- The root cause comes from a wrong interpretation of MOPS.

- Corrective plan:

- To memorize the Flight ID until the gate (similar to A350 AESS definition)

or

- To use the Flight ID from CMC when Flight ID from FMS is not available (similar to A320/A330/A340 definition)

→ will be corrected in a next A380 AESS development opportunity (2020 – TBC)

ADS-B OUT - ADS-B in-service aircraft status

- **ADS-B transmission issues: A380 – Unavailability of Geo Alt**

- Description:

- Geometric Altitude is not transmitted
- Note: Geo Alt is not required by AMC-20-24

- Investigation status:

- ADIRU L4.2 doesn't transmit Geo Alt to the transponder.

- Interim plan:

- None

- Corrective plan:

- This issue is corrected in ADIRU L4.3 (Basic in line-fit)
- A Service Bulletin is available to install L4.3

ADS-B OUT - ADS-B in-service aircraft status

- **ADS-B transmission issues:** some others issues have been reported
 - Air Asia, CEBU, Qantas
 - Investigations on going
 - Some issues have been reported by Air Services Australia (i..GPS interference issues)
 - Note to Airlines: The procedure (to officially take into account the issue by our Support Engineering) is to contact them through the “**TechRequest**” tool.

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ADS-B OUT – RAD operations

ADS-B OUT for RAD (*operation in high density airspace*)

- RAD is more demanding (new parameters, better performance...)
- ADS-B regulation:
 - **AC-20-165A (FAA regulation):** Guidance for the installation & airworthiness approval
 - **CS-ACNS (EASA regulation):** Certification specification & acceptable means of compliance
 - Both regulations require transponders to be compliant with **DO-260B**
- Enables to decommission redundant SSRs providing the same level of surveillance service.
- Would be the primary means of surveillance with radar as a back up → US strategy
- Usable in combination with other surveillance sensors (WAM, SSR, or PSR) → Europe strategy

Scope of the modifications for compliance with CS-ACNS & AC-20-165A

Systems level	Aircraft level
<p>Transponders (XPDR):</p> <ul style="list-style-type: none"> •SW update & HW update for DO-260B compliance 	<p>Wiring:</p> <ul style="list-style-type: none"> •XPDR direct link to 2 MMRs (reduced latency) •XPDR link to FWC/SDAC (new failure message) <p>Specific Pin-Promming:</p> <ul style="list-style-type: none"> •GPS antenna position •NACv (navigation accuracy category) •SDA (system design assurance) •Length & width code •A/C category •ADS-B IN capability •ADS-B parity •Antenna monitoring •SDAC P/P to declare the failure on SA •FWC P/P to declare the failure on LR <p>Documentation:</p> <ul style="list-style-type: none"> • AFM, FCOM update
<p>MMR</p> <ul style="list-style-type: none"> •Demonstration of compliance (accuracy, availability latency analysis, etc...) 	
<p>FWC/SDAC:</p> <ul style="list-style-type: none"> •New failure message: NAV ADS-B RPTG FAULT 	

Scope of the modifications for compliance with CS-ACNS & AC-20-165A

Transponders

DO-260 at the minimum for AMC-20-24 compliance



DO-260B at the minimum for CS-ACNS & AC-20-165A compliance

A320 & A330

Supplier	P/N	Standard
ACSS	7517800-10005A	DO-260
	7517800-10100	DO-260A
Honeywell	066-01127-1402	DO-260
Rockwell Collins	822-1338-021	DO-260



P/N	Standard
751-7800-12401	DO-260B
066-01212-0101	DO-260B
822-1338-225	DO-260B

A380

Honeywell	AESS H04S06	DO-260B
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AESS H04S06	DO-260B
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A350

Honeywell	AESS H05S03	DO-260B
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AESS H05S03	DO-260B
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ATA 34 – ADS-B OUT – RAD operations

Minimum standards - Forward-fit schedule

*Remind - European mandate:
Forwarfit: June 8th 2016
Retrofit: June 7th 2020*

	Minimum Standards	2014	2015	2016	2017	2018	2019	2020
XPDR	ACSS T3CAS std2 (-11203)	ON TIME	Certified on SA – Q2 2015 on LR					
	ACSS XS-950 (-12401)	ON TIME	Certified on SA – Q2 2015 on LR					
	RC TPR-901 (-225)	RISK		Q1 2016				
	HWL/SELEX ATC (-xxx)	NOT ON TIME			Q1 2017			
MMR	RC GLU -925 (-430)	See specific analysis						
	HWL RMA-55B	See specific analysis						
	TLS 755	Prod cut off						
	RC GLU-925 (-630 SBAS)	A350 ONLY)						
FWC	H2-F7 (SA)	AVAILABLE						
	T5-0 (LR)	AVAILABLE						
	L13-0 (LR)	AVAILABLE						
SDAC	H2-E4 (SA)	AVAILABLE						

**Eur Mandate
FWD fit**

**US Mandate
FWD + Retrofit**

**Eur Mandate
Retrofit**

Scope of the modifications for compliance with CS-ACNS & AC-20-165A

- **CS.ACNS & AC 20-165A** provide guidance for the installation and airworthiness approval of ADS-B Out equipment
- Requirements are not identical
 - ⇒ AC 20-165A requirements more stringent in terms of expected availability

Requirements	CS.ACNS	AC 20-165A
Aircraft position source Availability	No availability requirement	Availability of the position at >99.9% For FAA, SBAS meet such requirement.

**→ current MMRs
not compliant with
this requirement**

Scope of the modifications for compliance with CS-ACNS & AC-20-165A

Supplier	MMR	comments	CS.ACNS	AC 20-165A
Collins	GLU 920	<ul style="list-style-type: none"> •ILS/GPS •SA On •Production cut off 	Compliant as per Airbus/Supplier analysis. To be submitted to EASA	Compliant with restriction – (availability requirement not met)
	GLU 925 (P/N-430)	<ul style="list-style-type: none"> •ILS/FLS/GLS/GPS •SA Aware 	Compliant as per Airbus/Supplier analysis. To be submitted to EASA	Compliant with restriction – (availability requirement not met)
	GLU 925 (P/N-630)	<ul style="list-style-type: none"> •ILS/FLS/GLS/GPS/SBAS - TSO C145c (will be installed on A350 only) •SA Aware 	Compliant	Compliant
Honeywell	RMA 55B	<ul style="list-style-type: none"> •ILS/GPS •SA On 	Compliant as per Airbus/Supplier analysis. To be submitted to EASA	Compliant with restriction – (availability requirement not met)
Thales	TLS755	<ul style="list-style-type: none"> •ILS/GPS or ILS/MLS/GPS •SA Aware 	Compliant as per Airbus/Supplier analysis. To be submitted to EASA Production cut off	Compliant with restriction – (availability requirement not met) Production cut off

Scope of the modifications for compliance with AC-20-165A

MMR compliance status with AC 20-165A:

- To satisfy the 99,9% requirement on the aircraft position availability, it is necessary to develop a MMR SBAS capable for A320 & A330/A340 aircraft families:
 - Expensive cost (especially for retrofit aspect)
 - Study on going
 - Risk to not be available on time for the mandate
- New MMRs development planned
 - Obsolescence reason
 - SBAS capability in study to answer to the US mandate
 - Certification by 2020
- EQUIP2020 proposed a delay until 2025 to satisfy this requirement
 - Only for airlines asking for an exemption and providing before 2020 the insurance of an available solution in 2025 (SBAS)
 - Don't solve the expensive cost for airlines
- Airbus is also considering the A350 solution on A320/A330 aircraft families
 - A350 Collins MMR SBAS capable or hybridization of GPS with IRU
 - In study only

ADS-B OUT - Program Offerability for RAD & NRA

- Forward fit
 - Select one of transponder supplier (transponder DO-260B compliant)
 - Select the “activation of compliance” (referenced in AFM “...comply with Airworthiness requirements for ADS-B OUT in Non Radar and Radar Area....”)
 - This compliance will cover compliance with AMC-20-24
- Retrofit
 - Contact SEUY department for retrofit (upgrade-services.sb-support@airbus.com)
 - Service Bulletins depend of the aircraft configuration
 - MMR, transponder, wiring,....

ADS-B OUT - Conclusion

- March 2015, **86%** of Airbus aircraft are ADS-B OUT capable – **49%** only have requested the AMC-20-24 compliance → Wait for mandate
- ADS-B OUT European Mandate for RAD (and NRA) operation planned **June 8th 2016 in fwd-fit and June 7th 2020 in retrofit**
 - Requires S/W and H/W transponders change. All Airbus transponders will be updated to be DO-260B compliant
 - Honeywell transponder will not be available on time
 - Development risk identified with Collins transponder (availability planned Q1 2016)
- US Mandate for RAD operation planned **2020 (fwd-fit & retrofit)**
 - Impact of AC-20-165A requirements are under study
 - **Requirement of 99,9% on aircraft position availability difficult to achieve**
 - impact new MMR development, high cost of retrofit
 - A350 solution is considered on A320/A330 aircraft families (hybridization MMR with IRU)
- Lack of visibility on others countries mandates.

ADS-B - CONTENT

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ATSAW



ATSAW
 Display of other aircraft ADS-B information in the cockpit



ADS-B IN: Capability to receive ADS-B data

- ADS-B data received by TCAS
- Need TCAS ADS-B IN capable

For airborne use:

- **ATSAW**
 (Airborne Traffic Situational Awareness)

OBJECTIVES

- ➔ **Flight efficiency:**
 - ↗ Flight level,
 - ↗ Fuel saving,
 - ↗ Runway throughput
- ➔ **Safety**
 - ↗ Traffic situational awareness,
 - ↗ Aircraft identification

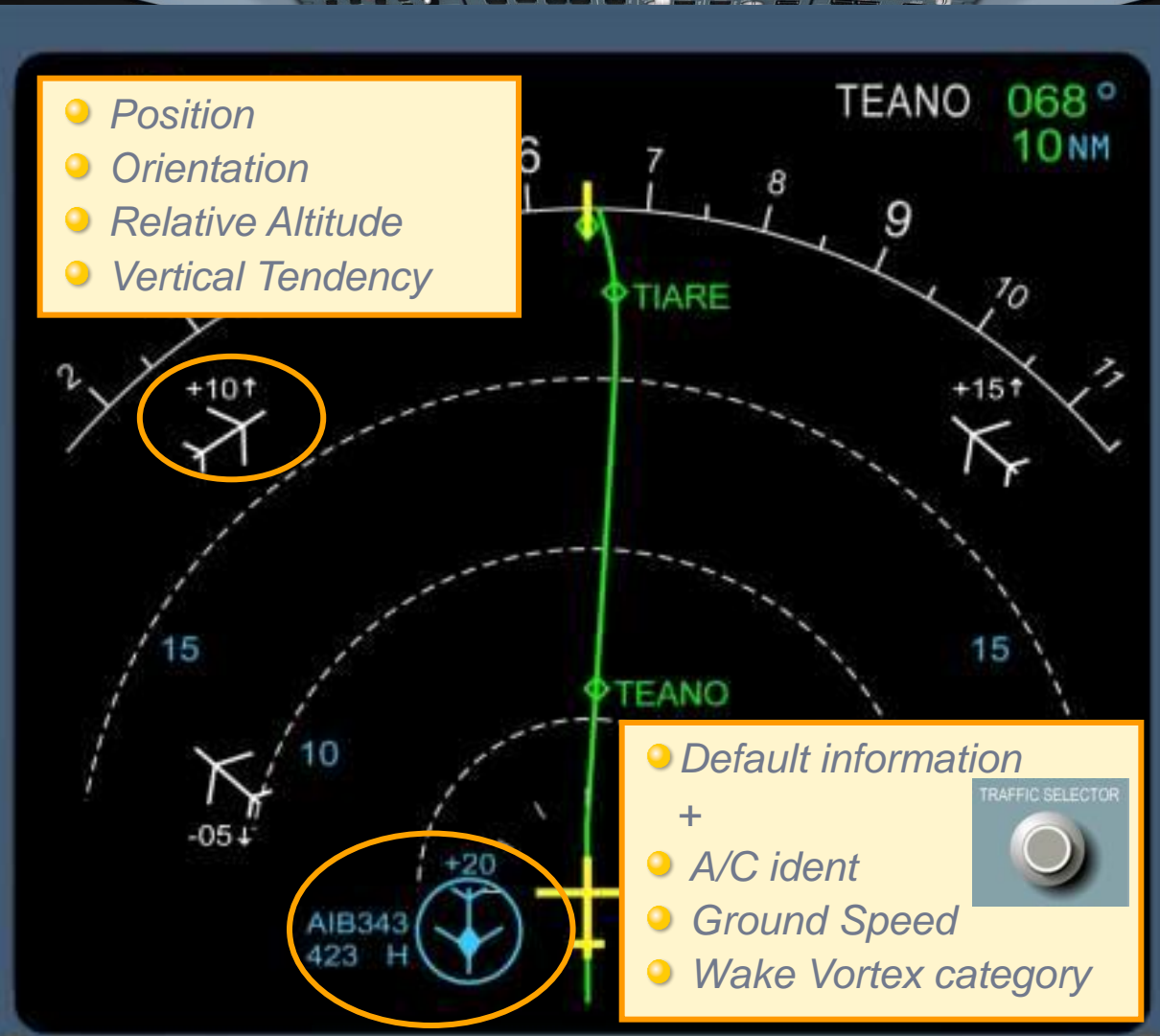
ATSAW – cockpit A350

TRAFFIC SELECTOR



Traffic Selector Switch

- Position
- Orientation
- Relative Altitude
- Vertical Tendency



- Default information
- + Traffic Selector
- A/C ident
- Ground Speed
- Wake Vortex category

TRAFFIC SELECTOR



Traffic page on MFD

STATUS & SWITCHING		TRAFFIC	ITP
TRAFFIC DATA			
T ID DISPLAY ON ND		OFF	
BRG / RNG	REL ALT		
155 261 / 12 NM	+85+		
134 61 / 54 NM	+89+		
146 25 / 182 NM	+89		
137 12 / 120 NM	-10		
156 261 / 54 NM	0		
234 BRG 088 / RNG 35 NM / REL ALT +83			
TRK 188 / GS 418 kt / FL 300			
HDG 178 / 140 / V/S 1189 ft/min			
WAKE VORTEX			
SELECT TRAFFY ON ND		CLOSE	
TRAFFIC AT FL330 RNG21			

ATSAW – Traffic Page on MFD

The AESS “TRAFFIC” page on the MFD:

- provides the traffic information (using ADS-B data coming from others aircraft)
- possibility to inhibit the display of the flight ident
- possibility to display more information for a dedicated aircraft (selection made by pointing the aircraft on the ND)

CONTROLS STATUS & SWITCHING TRAFFIC

TRAFFIC

TRAFFIC DATA ITP

FLT ID DISPLAY ON ND ON OFF

ACFT	BRG / RNG	REL ALT
AFR1356	261° / 12 NM	+05↑
AFR1234	61° / 54 NM	+09↑
AFR2346	25° / 102 NM	+09
AFR5837	12° / 128 NM	-10
AZA2856	261° / 54 NM	0

AFR1234

BRG 260°	RNG 32 NM	REL ALT +03
TRK 180°	GS 410 KT	FL 320
HDG 170°	IAS --- KT	V/S +1100 FT/MN
WAKE MEDIUM		

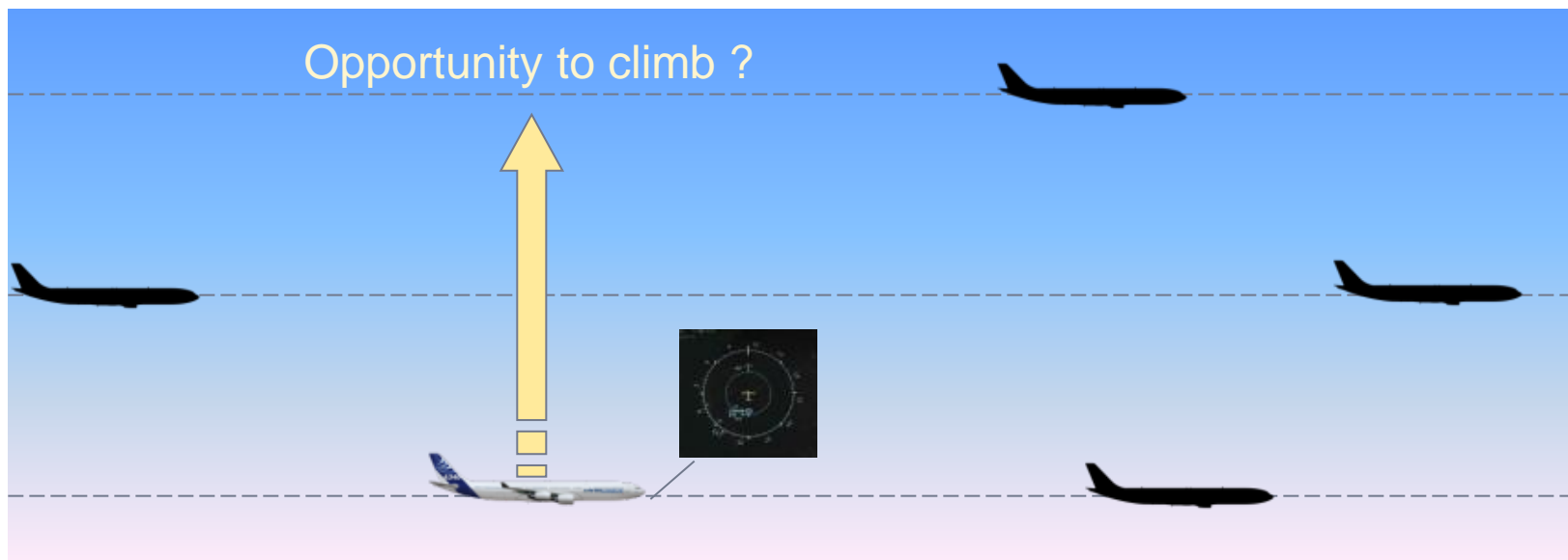
SELECT TRAFF ON ND CLOSE

CLEAR INFO TRAFFIC AT FL330 RNG21

ATSAW

- ATSAW improves flight efficiency

- ➔ Improves cooperation with ATC (better understanding of ATC instructions)
- ➔ Improves the detection of opportunity to Flight Level change in standard separation
 - **Fuel saving**
 - **Reduction of CO2 emission**



ATSAW Certification & Availability

ATSAW is certified on A330/340, A350 & A320 aircraft families

- ATSAW for operations in air (step 2A) will be available with:



▶ **T3CAS** from ACSS

- *Certified on A320 & A330/A340 aircraft family*



▶ **TCAS TPA-100B** from Honeywell

- *Certified on A320 & A330/A340 aircraft family*



▶ **AESS** from Honeywell

- *Certified on A350*

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ADS-B AIRBUS – ROAD MAP

Step 1

ADS-B OUT

- Step 1A for NRA
- Step 1B for RAD (DO-260B)

▶ **CERTIFIED**

▶ **On going**

Step 2

ADS-B IN – ATSAW (in Air)

- ▶ **A320: Certified**
- ▶ **A330/340: Certified**
- ▶ **A350: Certified**
- ▶ **A380: post A350 EIS**

ATSAW paves the way to future ADS-B IN applications

Next steps

- ▶ **All future functions using ADS-B data**
- Airport Surface Alerts (light SURF-IA)

- ▶ **In the frame of SESAR projects**
- ▶ **From 2018 (tbc)**

NEXT STEPS (SESAR) - SURF IA - Context

Reminder about **2 recent events linked with traffic conflicts** on airports:

17th January 2015 at New York-JFK

JetBlue A320 and Caribbean Boeing 737 in runway incursion.

The A320 pilots were forced to cancel their take-off at New York-JFK Airport because a 737 was crossing their runway ahead.

5th July 2014 Barcelona airport

Aerolineas Argentinas Airbus A340-300 taxiing to departure.

UTAir Boeing 767-300 was on short final descending through about 200 feet AGL, when the crew initiated a go-around after spotting the Airbus crossing the runway near the runway



NEXT STEPS (SESAR) – “Light” SURF-IA

Current evaluated « light » SURF-IA function:

- **Coverage:**

- Airport surface (not covered by TCAS alerts)
- Focus on runways area

- **Inputs:**

- ADS-B traffic data (position, ground speed, altitude, direction)
- Airport runways data

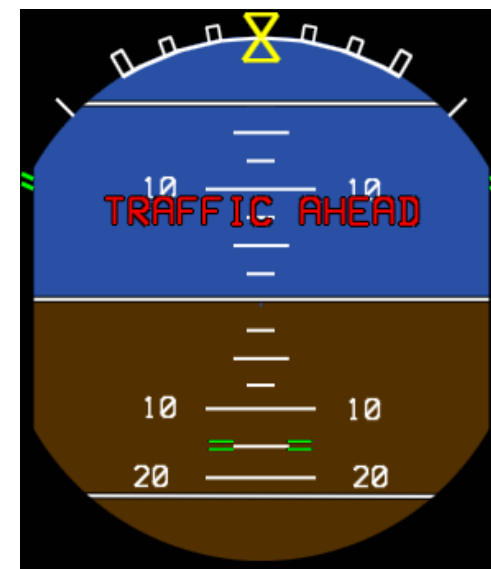
- **Visual and audio messages**

- Warning alert : red message on PFD + Audio message
- Messages support the flight crew to identify the intruder outside (Ex. TRAFFIC AHEAD)

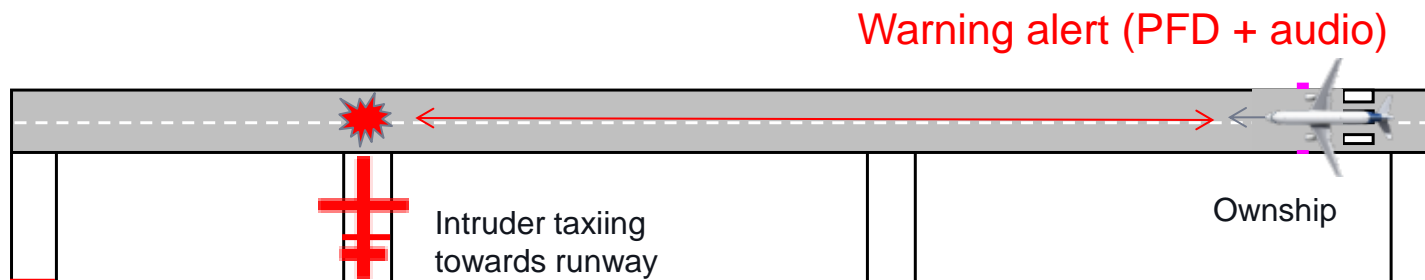
- **Validation on going**

- With Honeywell TCAS prototype (collecting ADS-B traffic and computing ground traffic alerts)
- Validation on A320 simulator (on-going) without traffic display (warning alerts only)

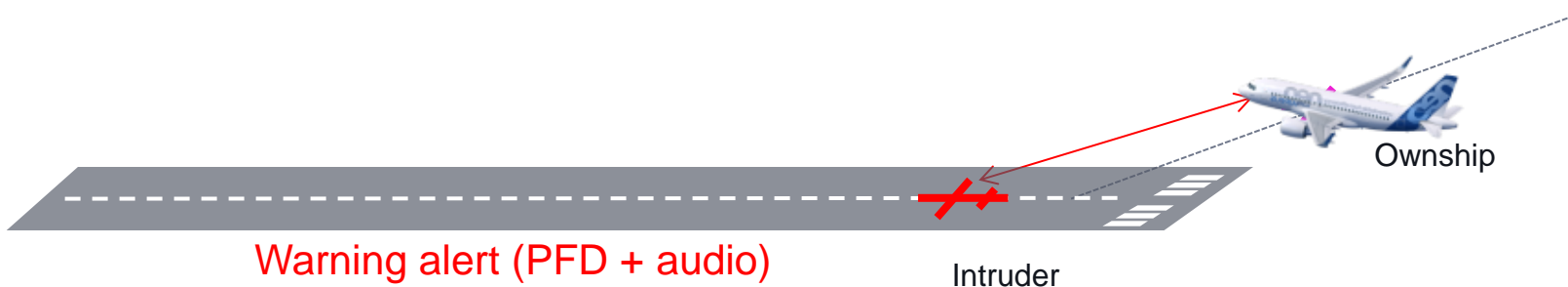
- **Airbus/Honeywell proposal: input for amended SURF-IA for early deployment**



NEXT STEPS (SESAR) – “Light” SURF-IA – Examples of scenarii



Expected crew actions: Stop OR warn ATC OR other action



Expected crew action: Go Around

→ SAFETY BENEFIT

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QUESTIONS?

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