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AIRBUS presentation

**Fifteenth meeting of ADS-B study and
implementation task force**

ADS-B - CONTENT

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ADS-B OUT

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ADS-B OUT – in service aircraft status

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ADS-B OUT – FAA mandate – aircraft impact

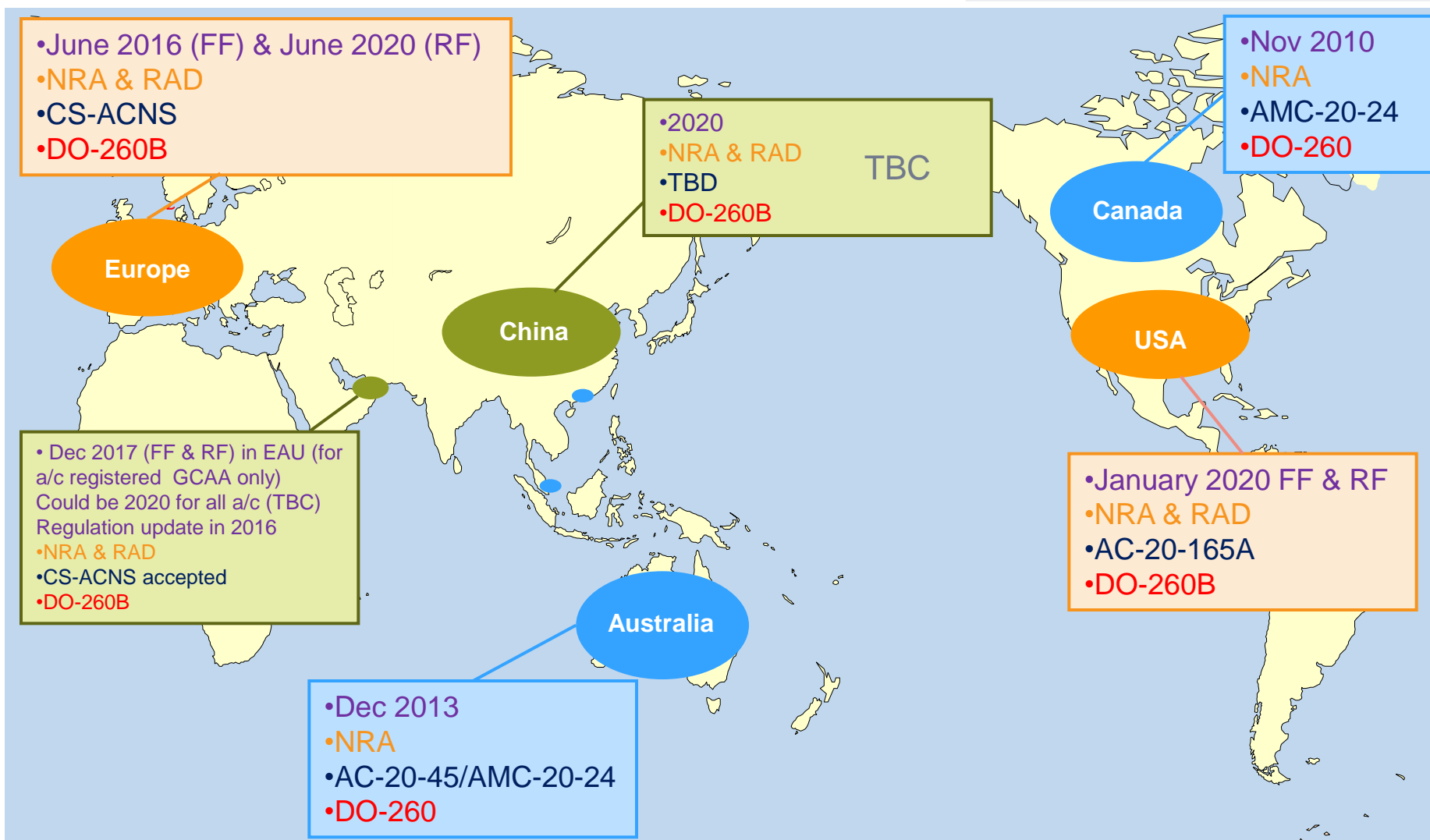
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ADS-B IN

ADS-B - CONTENT

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ADS-B OUT - Mandates



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

**A320
&
A330**

Supplier	P/N	Standard
ACSS	(XS950) 7517800-10100	DO-260A
	(T3CAS std 1.2) 9005000-10202	DO-260A
Rockwell Collins	(TPR-901) 822-1338-021	DO-260
Honeywell	(TPA-67A) 066-01127-1402	DO-260

A380

Honeywell	AESS H04S06	DO-260B
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A350

Honeywell	AESS H05S03	DO-260B
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In line fit, on Airbus aircraft:

- All transponders are ADS-B capable.
- Wiring provisions for ADS-B are basic
- MMR are basic

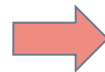
ADS-B OUT - Scope of the modifications for compliance with CS-ACNS & AC-20-165A

Systems level	Aircraft level
Transponders (XPDR): <ul style="list-style-type: none"> •SW update & HW update for DO-260B compliance 	Wiring: <ul style="list-style-type: none"> •XPDR direct link to 2 MMRs (reduced latency) •XPDR link to FWC/SDAC (new failure message) Specific Pin-Promming: <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 Documentation: <ul style="list-style-type: none"> • AFM, FCOM update
MMR <ul style="list-style-type: none"> •Demonstration of compliance (accuracy, availability latency analysis, etc...) 	
FWC/SDAC: <ul style="list-style-type: none"> •New failure message: NAV ADS-B RPTG FAULT 	

ADS-B OUT - 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**

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ACSS	(XS950) 7517800-10100	DO-260A
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Rockwell Collins	(TPR-901) 822-1338-021	DO-260
Honeywell	(TPA-67A) 066-01127-1402	DO-260



P/N	Standard	Certif.
(XS950) 7517800-12401	DO-260B	Certified
(NXT-800) 9008000-10100	DO-260B	Q2 2016
(T3CAS std 2) 9005000-11203	DO-260B	Certified
(TPR-901) 822-1338-225	DO-260B	Certified
(TRA-100B) 066-01212-0101	DO-260B	Q4 2017 (with ISE)

A380

Honeywell	AESS H04S06	DO-260B
Honeywell	AESS H05S03	DO-260B



AESS H04S06	DO-260B
AESS H05S03	DO-260B

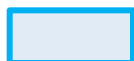
A350

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

TCAS / Transponders configurations

As Honeywell transponder will not be available on time for the mandate, operators must request alternate suppliers → Certification of cross TCAS/ATC configurations are on going.

		TCAS		ACSS		RC		HWL
		ATC		TCAS 2000 (P/N 751-7900-10020)	T3CAS st2 (P/N 9005000-11203)	TTR-2100 (P/N 822-2911-020)	TTR-2100 (P/N 822-2911-021) *	TPA-100B (P/N 940-0351-001)
ACSS	XS-950 (P/N 751-7800-12401)	Certified		Certified	Certified	N/A	N/A	Certified
	NXT-800 (P/N 9008000-10100) **	Q2 2016		Q2 2016	Q2 2016	N/A	N/A	Q2 2016
RC	TPR-901 (P/N 822-1338-225)	N/A		N/A	N/A	Certified	Q2 2016	Certified
HWL	TRA-100B (P/N 066-01212-0101)	N/A		N/A	N/A	N/A	N/A	Q4 2017 (including ISE)



Classic configuration (same TCAS/ATC supplier)



Cross configuration

* RC TCAS P/N change: modification required by EASA (P/N -021 replaces P/N -020)
 ** ACSS Transponder obsolescence scheduled mid 2017 (NXT-800 replaces XS-950)

ADS-B OUT - Program Offerability

- Forward fit
 - Select one transponder supplier
 - Select the “activation of ADS-B OUT compliance for RAD & NRA” option (referenced in AFM)
 - These documentation updates guarantee the certification
 - Operators must select this option to be compliant.

Note:

- « *Activation of ADS-B OUT compliance for RAD & NRA* » means that is not necessary to select the previous option « *Activation of compliance for NRA* »

- Retrofit
 - Contact your KAM (Key Account Manager) for retrofit.
 - Service Bulletins depend of the aircraft configuration
 - GPS, transponder, wiring, documentation update....

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ADS-B OUT – in service aircraft status

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ADS-B OUT – FAA mandate – aircraft impact

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ADS-B IN

ADS-B OUT - ADS-B in-service aircraft status – March 2016

- Status with transponder **DO-260/DO-260A**

Does not include configuration changes managed through STC

Aircraft family	A320		A330/A340		A380	
Total number of a/c	6882		1598		193	
Nb of a/c NOT ADS-B OUT capable	1234	18%	58	3%	0	0%
Nb of a/c ADS-B OUT capable (*)	5648	82%	1540	97%	193	100%
Nb of a/c ADS-B OUT capable without AMC-20-24 compliance (**)	2871	41%	304	20%	0	0%
Nb of a/c ADS-B OUT capable with AMC-20-24 compliance (**)	2777	41%	1236	77%	193	100%

✓ Even if the a/c are ADS-B capable (85%), 49% of them are AMC-20-24 compliant only.

✓ Most operators are waiting for future European & US mandates

(**) the AMC-20-24 compliance means the airline has requested this compliance to Airbus (AFM, FCOM update...)

ADS-B OUT - ADS-B in-service aircraft status – March 2016

• Status of transponder **DO-260B**

Does not include configuration changes managed through STC

Aircraft family	A320		A330/A340		A380	
Total number of a/c	6882		1598		193	
Nb of a/c NOT DO-260B capable	5775	85%	1384	87%	0	0%
Nb of a/c DO-260B capable (*)	1007	15%	214	13%	193	100%
Nb of a/c ADS-B OUT capable without CS-ACNS compliance (**) without	881	13%	189	11%	0	0%
Nb of a/c ADS-B OUT capable with CS-ACNS compliance (**) with	226	2%	25	2%	193	100%

✓ In line-fit, DO-260B is basic on Airbus aircraft
 ✓ For retrofit, most operators could wait until 2020 (European & US mandate)

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)

1/2

➤ 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 (certified since Dec 2015)
- Rockwell Collins decided not to propose a correction in P/N 822-1338-021

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)

2/2

➤ Airline impacted:

- LAN → don't fly the same routes as before.
- KAL (29 A330) → should update their transponder to be DO-260B compliant
- ACI (2 A330 & 1 A320)

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 changes to incoherent data.
 - Investigation status:
 - The root cause is a wrong interpretation of MOPS.
 - Corrective plan:
 - To memorize the Flight ID until the gate (similar to A350 AESS definition)
→ will be corrected in a the next A380 AESS standard (certification planned end 2017 – availability of a Service Bulletin for retrofit: TBD)

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:** [ADS-B data loss](#)

- Description:

- Air Services Australia reports several events of loss of ADS-B Out data
- ADS-B architectures impacted:
 - **DO-260A** and few cases in DO-260
 - **Rockwell Collins MMR GLU-925** and few cases with GLU-920
- Airlines impacted: Qantas, Air Asia

- Investigation status:

- Possible root causes: GPS receiver, Transponder and Ground station
- Based on Qantas data, recordings of GPS HIL (Horizontal Integrity Limit) set to NCD would correlate to the reported ADS-B Out losses

Note: HIL=NCD results in NIC = 0 and the message is discarded by the ADS-B Out ground station

- Advanced DAR customization with the recording of multiple GPS parameters has been proposed to affected A/L to move forward:
 - Rockwell Collins closely investigating the issue with Qantas
 - Airbus waiting for Air Asia DAR customization to support investigation

- Corrective plan:

- No plan for the time being

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ADS-B IN

ADS-B OUT - Difference between CS-ACNS & AC-20-165A

- **CS.ACNS & AC 20-165A** provide guidance for the installation and airworthiness approval of ADS-B Out equipment

Requirements	CS.ACNS	AC-20-165A
Horizontal Position Source / Data Quality	3NM (TMA) and 5NM (en route) separation Integrity ≥ 0.6 NM (NIC ≥ 6), Accuracy $\geq 0,1$ NM (NACp ≥ 7)	Same plus 2.5NM / 2.0NM approach Integrity ≥ 0.2 NM (NIC ≥ 7), Accuracy $\geq 0,05$ NM (NACp ≥ 8)
Position source Availability	No requirement	Availability of the a/c position $>99.9\%$ (For FAA, SBAS meet such requirement)



Current MMRs not compliant with this requirement

ADS-B OUT - MMRs 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	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	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 (but certified on A350 only)
Honeywell	RMA 55B	<ul style="list-style-type: none"> •ILS/GPS •SA On 	Compliant	Compliant with restriction – (availability requirement not met)
Thales	TLS755	<ul style="list-style-type: none"> •ILS/GPS or ILS/MLS/GPS •SA Aware •Production cut off 	Compliant	Compliant with restriction – (availability requirement not met)

ADS-B OUT - MMRs compliance with AC-20-165A - STATUS

- To satisfy the requirement on the aircraft position availability (>99,9%), MMR SBAS capable are necessary for A320 & A330 aircraft families.
 - Launch of new MMR development:
 - Obsolescence reason
 - SBAS capability to answer to the US mandate
 - Certification schedule:
 - Honeywell MMR certification planned Q4 2018
 - Rockwell Collins MMR certification planned Q1 2019
- Exemption period granted by FAA: from Jan 1st 2020 until Dec 31, 2024
 - Only for airlines asking for an exemption (from August 2018 to January 2020) and providing the insurance of an available solution in 2025 (SBAS)

ADS-B OUT - Exemption FAA-2015-0971

GPS source	...	2020	2021	2022	2023	2024	2025	...
GPSSU		Not Compliant (*)						
MMR SA ON		Not compliant but authorized with SAPT use (risk of flight cancellation)					Not compliant	
MMR SA AWARE		Not compliant but authorized					Not compliant	

Not considered as a viable solution

Not considered as a viable solution

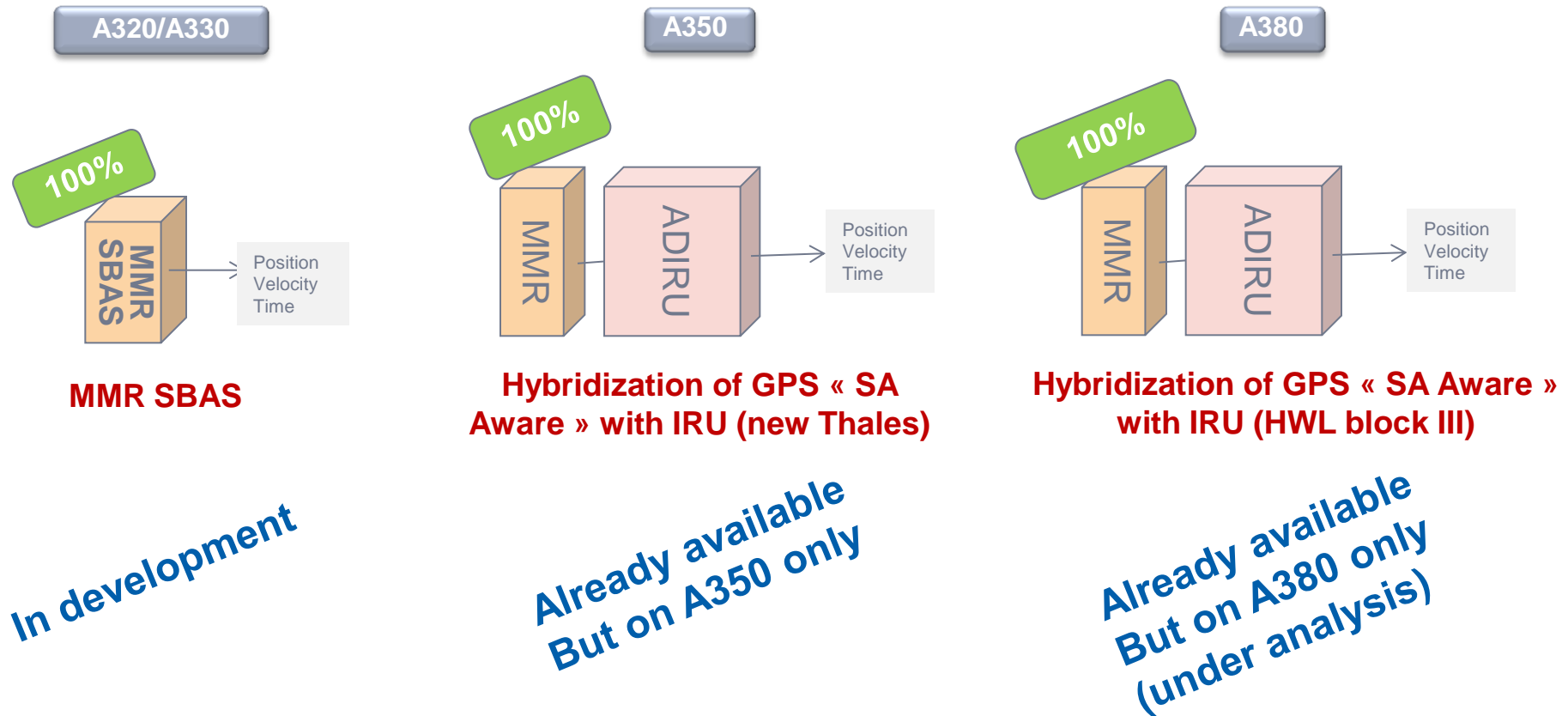
Exemption application required including retrofit plan identified (from August 2018 and before January 2020)

(*) Rocwell Collins MMR GLU920 by SB under review

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

How to comply with US ADS-B availability requirement ?

Forward-fit options



ADS-B OUT - Conclusion

- ADS-B OUT European Mandate for RAD (& 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 for the European mandate
 - Certification of TCAS/ATC cross configurations
- US Mandate for RAD (& NRA) operation planned **2020 (fwd-fit & retrofit)**
 - **Requirement of 99,9% on aircraft position availability difficult to achieve**
 - impact: new MMR development, need SBAS capability
 - certification by 2020 (Honeywell: Q4 2018, Collins: Q1 2019)
 - **Exemption period granted by FAA: from Jan 1st 2020 until Dec 31, 2024**
- Retrofit
 - Depend of the aircraft configuration (many systems impacted)
 - Contact the Key Account Manager

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ADS-B IN

ATSAW

ATSAW

Display of other aircraft ADS-B information in the cockpit



ADS-B IN



OBJECTIVES

➤ Flight efficiency:

- ✧ Flight level,
- ✧ Fuel saving,
- ✧ Runway throughput

➤ Safety

- ✧ Traffic situational awareness,
- ✧ Aircraft identification

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)

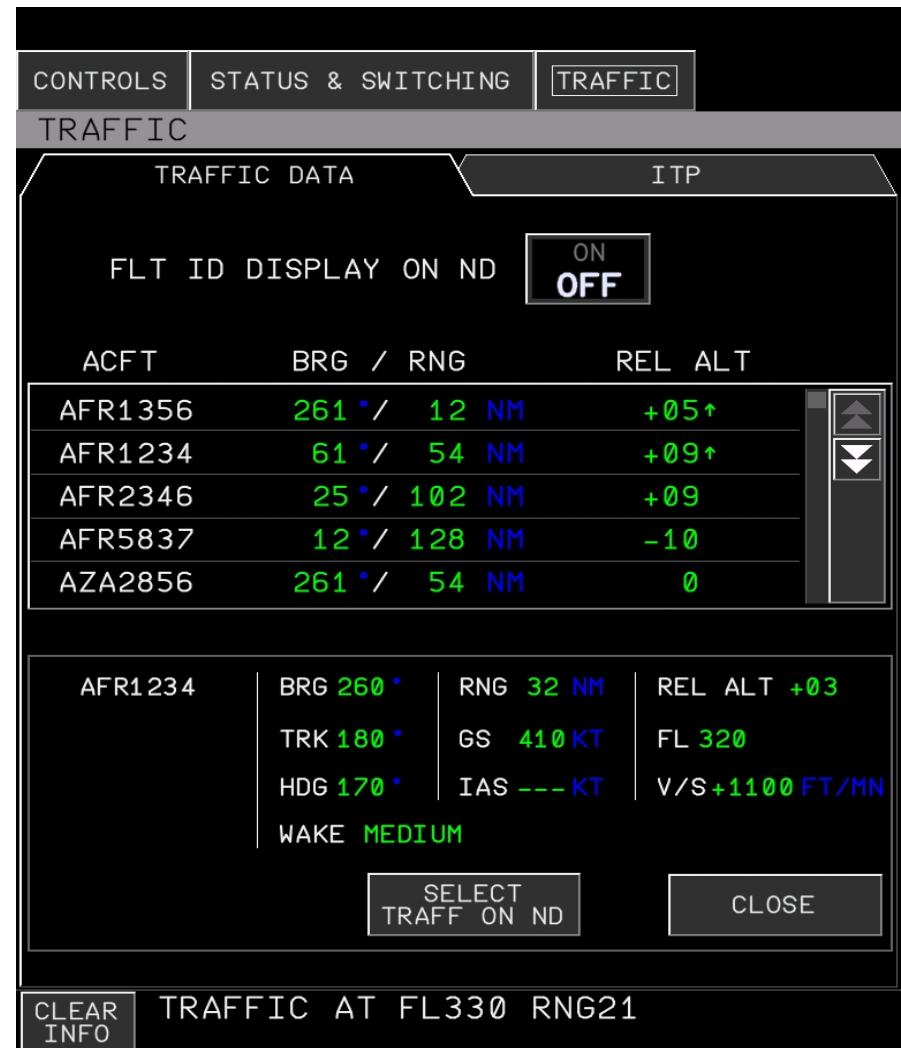
ATSAW – cockpit A350



ATSAW – Traffic Page on MFD

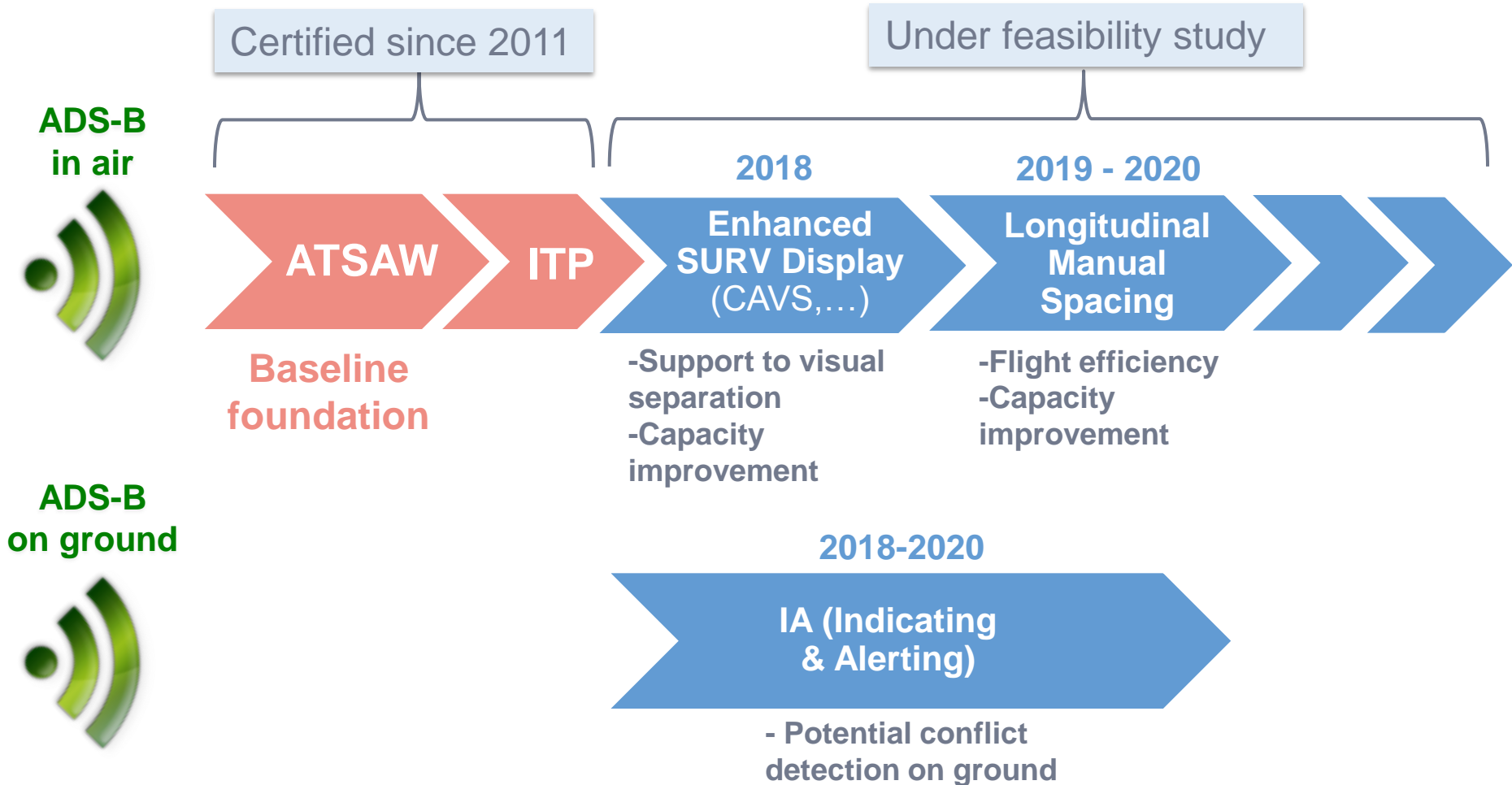
The AESS “TRAFFIC” page on the MFD:

- 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)



Next ADS-B IN applications - Airbus road map

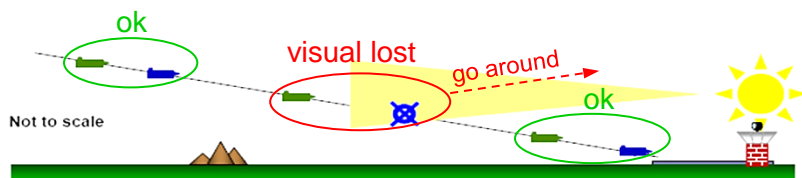
- ATSAW paves the way to future ADS-B IN applications



NEXT ADS-B IN - CDTI Assisted Visual Separation (CAVS)

CDTI Assisted Visual Separation operation (with ATSAW+):

- Flight crew can see the preceding aircraft on cockpit displays
- Flight crew is able to monitor the separation distance precisely
- ➔ Safer and more efficient operations
- ➔ If loss of visual contact, flight crew can continue the procedure with cockpit displays assistance.



Safely perform approach procedures using own separation from the preceding aircraft more efficiently and possibly more regularly to enhance runway capacity

NEXT ADS-B (SESAR) – IA (Indicating & Alerting)

Current evaluated « light » SURF-IA function: Provides an **additional** airborne safety net against runway incursion


- **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

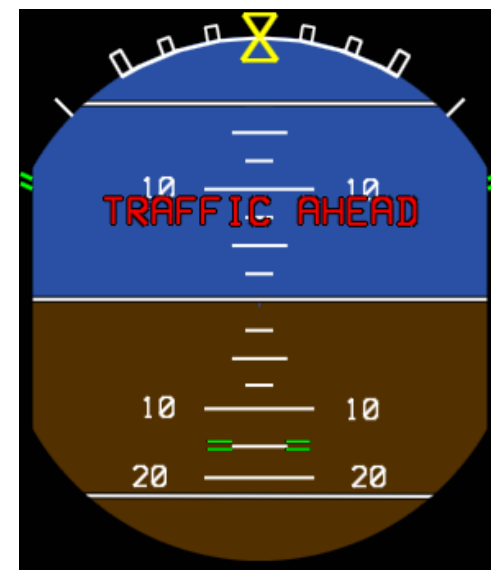
- **Visual and audio messages**

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

- **Validation on-going:**

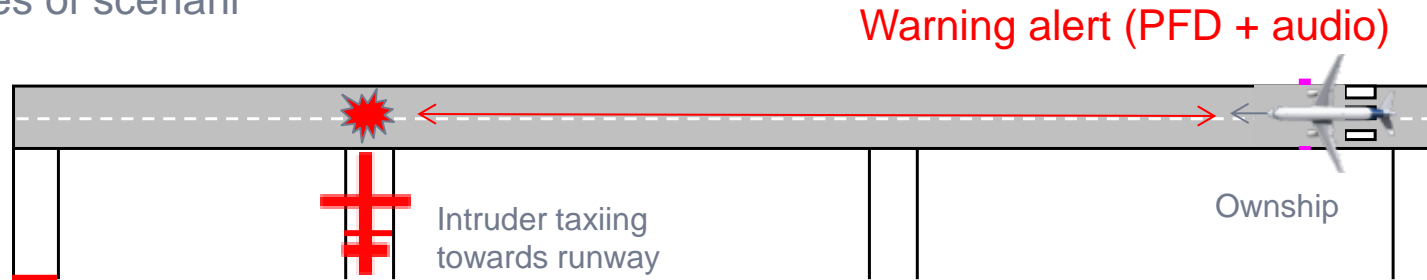
- ADS-B Data Collection from April to September 2016 to confirm that current ADS-B performance is compatible with SURF-IA functions

- **Airbus proposal: Simplified SURF-IA (subset of DO-323) for early deployment on all A/C type including retrofit**

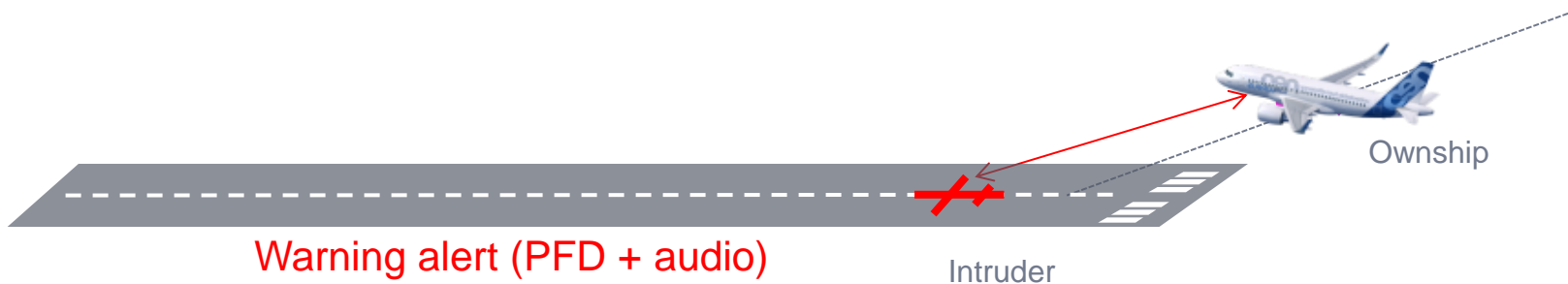


NEXT ADS-B (SESAR) – IA (Indicating & Alerting)

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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