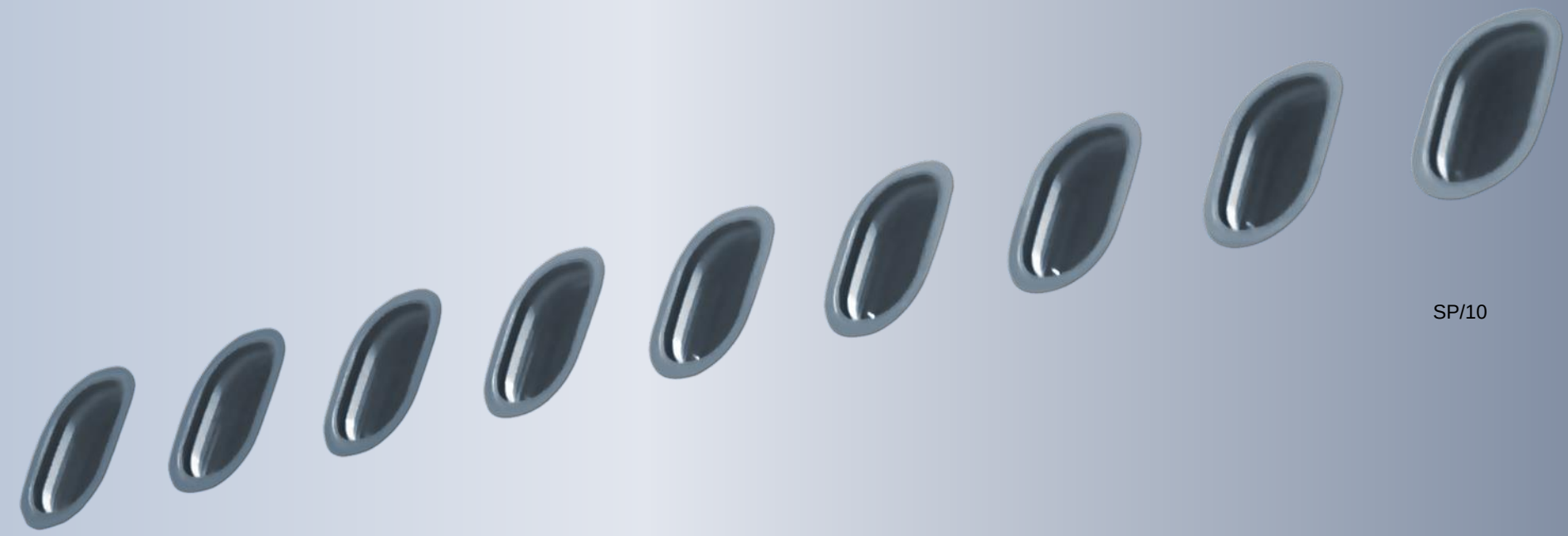


SP/10

ADS-B task force - KOLKATA

ADS-B OUT & IN – AIRBUS STATUS

Presented by
Laurent VIDAL - Surveillance systems manager – Support to sales & programs

AIRBUS

ADS-B Applications

ADS-B OUT

ADS-B IN

ADS-B OUT:
Capability to transmit ADS-B data

- ADS-B data provided by transponder
- Need transponder ADS-B OUT capable

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

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

For ground use:

- ADS-B NRA: Non Radar areas
- ADS-B RAD: Radar areas
- ADS-B APT: Airport surfaces

For airborne use:

ATSAW (Airborne Traffic Situational Awareness)

- Step 2A: ATSAW operation in air
- Step 2B: ATSAW operation on ground

CONTENTS

CONTENTS

ADS-B OUT - Operational Benefits

- **ADS-B NRA (step 1A): used in area not covered by SSR**
  - Traffic management as SSR like
  - Capacity increase by redu
  - Cost effectiveness for airli
- **ADS-B RAD (step 1B): use**
  - Enables to decommission
  surveillance service.
  - Could be the primary mea
  - Usable in combination wit SR)
- **ADS-B APT (step 1C): used on airport surface**
  - New tool for surface movement surveillance
  - Safety enhancement

ADS-B OUT benefits:
- ↗ Flight efficiency
- ↗ Safety

ADS-B OUT - Mandates

- **Canada** (Nav Canada): in the vicinity of Hudson Bay
  - Recommendation for **NRA** operations: **November 2010**
  - **DO-260** at the minimum
- **Australia** (Airservices Australia):
  - Mandate for **NRA & RAD** operations: **December 2013**
  - **DO-260** at the minimum, GPS SA Aware (mandate 2016)
- **Europe** (Eurocontrol):
  - Mandate for **NRA & RAD** operations: 8th **January 2015** (forward fit), 17th **December 2017** (retrofit)
  - **DO-260B** required, **CS.ACNS.ADS-B compliance required**
- **US** (FAA):
  - Mandate for **NRA & RAD** operations: **2020**
  - **DO-260B** required, **AC 20-165A compliance required**

CONTENTS

ADS-B OUT – Airbus aircraft configuration for NRA

- Conditions to transmit ADS-B parameters on Airbus aircraft:

A320 & A330/A340 aircraft family:

- **EHS/ADS-B wiring provision (basic)**
- **Transponders capable of ELS/EHS/ADS-B:**
  - *–ACSS: P/N 7517800-10005A (DO-260)*
    P/N 7517800-10100 (DO-260A)
  - *–Honeywell: P/N 066-01127-1402 (DO-260)*
  - *–Rockwell Collins: P/N 822-1338-021 (DO-260)*
  - ➢ ***All transponders proposed by Airbus in line-fit are ELS/EHS/ADS-B capable.***
- **MMR (any vendor) OR some GPSSU (not all)**
  - ➢ **In line-fit, Airbus aircraft are only fitted with MMR**

A380:

- **EHS/ADS-B parameters provided by AFDX (basic)**
- ***AESS H04S06 (DO-260A)***

- No need of pin programming to activate ADS-B data transmission.
- Need certification for operational use if required by regulation.

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

- As per EASA AMC-20-24 some AIRBUS documentation are required 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.
    - Useful for airline discussions with its Authority
- Others Airbus documentation update (not required by EASA):
  - **FCOM:** System description.
  - **MEL:** As required by regulations.

CONTENTS

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

- ADS-B in service installation status (December 2012)

Does not include configuration changes managed through STC

Aircraft family	A320		A330/A340		A380	
Total number of a/c	5429 (5013) ** *(4624) ******		1324 (1228) *(1152)*		101 (64) *(45)*	
Nb of a/c **NOT** ADS-B OUT **capable**	**1171** (1523) *(1577)*	**22%** (30%) (34%)	**104** (109) *(118)*	**8%** (9%) *(10%)*	**0** (0) *(0)*	**0%** (0%) *(0%)*
Nb of a/c ADS-B OUT **capable** (*)	**4258** (3490) *(3047)*	**78%** (70%) *(66%)*	**1220** (1119) *(1034)*	**92%** (91%) *(90%)*	**101** (64) *(45)*	**100%** (100%) *(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: 81%** (74% in March 2012)

(*) ADS-B OUT capable means the air
(**) status March 2012 (***) status Ma

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

• ADS-B in service installation status (December 2012)

Does not include configuration changes managed through STC

✓Even if the a/c is capable (81%), operators don't request AMC-20-24 compliance if not necessary (21% only)
✓Most of them wait for mandates
➢Authorities are urged to provide mandate.

Aircraft family						
Total number of a/c						
Nb of a/c **NOT** ADS-B OUT capable	**1171** (1523) *(1577)*	**22%** (30%) (34%)	**104** (109) *(118)*	**8%** (9%) *(10%)*	**0** (0) *(0)*	**0%** (0%) *(0%)*
Nb of a/c ADS-B OUT **capable** (*)	**4258** (3490) *(3047)*	**78%** (70%) *(66%)*	**1220** (1119) *(1034)*	**92%** (91%) *(90%)*	**101** (64) *(45)*	**100%** (100%) *(100%)*
Nb of a/c ADS-B OUT **capable without** AMC-20-24 compliance (**)	**3282** (2858) *(2636)*	**60%** (57%) (57%)	**326** (400) *(505)*	**25%** (33%) *(44%)*	**8** (20) *(15)*	**8%** (31%) *(33%)*
Nb of a/c ADS-B OUT **capable with** AMC-20-24 compliance (**)	**976** (632) *(411)*	**18%** (13%) *(9%)*	**894** (719) *(529)*	**67%** (59%) *(46%)*	**93** (44) *(30)*	**92%** (69%) *(67%)*

(*) ADS-B OUT capable means the aircraft is equiped with the required equipments (transponder, MMR…)
(**) the AMC-20-24 compliance has to be requested by airline to Airbus (AFM, FCOM update…)

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

- ADS-B transmission issues
  - Jump issue with Rockwell Collins transponder TPR-901
    - Jump of the aircraft position
    - Probable root cause: alphabetagamma tracking filter too much sensitive
    - Some aircraft have been “blacklisted”
    - Investigation on going – Tests planned April 2013 – Analysis report from Rockwell Collins waited end of April 2013
    - A Service Bulletin exists for Boeing. Request to have the same SB for Airbus.
    - If no results/agreement found, Airbus will replace TPR-901 by others supplier’s transponder

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

- ADS-B transmission issues
  - ➢ Jump back issue due to Honeywell ADIRU HG2030XXXX
    - Frequent jump back of the aircraft position
    - Only seen with current DO-260 transponders
    - Probable root cause: Synchronisation issue between ADIRU HWL and transponder – More significant impact with new HWL ADIRU (TBC)?
    - Action: Airbus investigation with suppliers support (laboratory tests...)
    - Potential solution: Connect directly MMR & transponder (that will be done for all new DO-260B transponders)
      - For ACSS , install transponder DO-260A P/N-10100 (already directly connected with MMR) - Refer SB 320-34-1466 (A320 a/c family) and SB 330-34-3251 (A330)
      - For Honeywell, no solution available before the future HWL DO-260B transponder (end 2015 - TBC)

CONTENTS

ADS-B OUT – RAD application

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

- RAD is more demanding (new parameters, better performance…)
- 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
- Requirements for RAD operations:
  - AC-20-165 (FAA) and CS-ACNS-ADSB (EASA – not published yet)
  - Requirements to be compliant with DO-260B
  - Updates in ADS-B OUT set of messages/performance

DO-260B - Scope of the modifications

Systems level	Aircraft level
XPDR: •SW update •HW update	**Wiring:** •XPDR direct link to 2 MMRs (reduced latency) •XPDR link to FWC/SDAC(new failure) **Specific P/P:** •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:** •AFM, FCOM update
MMR •Demonstration of compliance (accuracy, availability, latency analysis etc..)	
FWC/SDAC: •New failure message: NAV ADS-B RPTG FAULT	
FMS: •Flight id shall be modifiable during the flight	

DO-260B - Min standards and preliminary schedule

Forward-fit preliminary schedule - For information only

Eur Mandate Retrofit

Eur Mandate FWD fit

US Mandate FWD + Retrofit

	Minimum Standards	2012	2013	2014	2015	2016	2017	2018	2019	2020
XPDR	ACSS T3CAS std2	ON TIME								
	ACSS XS-950	ON TIME								
	RC TPR-901	RISK								
	HWL/SELEX ATC	NOT ON TIME								
MMR	RC GLU-925 (-920 & -925)	Workshops (Technical analysis, program decision…)								
	HWL RMA-55B									
	TLS 755									
	RC GLU-925 (-630 SBAS)	NOT PLANNED ON SA/LR/A380								
FWC	H2-F7 (SA)	ON TIME								
	T5-0 (LR)	ON TIME								
	L13-0 (LR)	ON TIME								
SDAC	H2-E4 (SA)	ON TIME								
FMS	HWL FMS2 H2 (SA)	Workshops (Technical analysis, program decision…)								
	TLS FMS2 S4/S5/S6 (SA)									
	HWL FMS2 P2/P3 (LR)									
	TLS T2/T3/T4(LR)									

DO-260B - Compliance status

- **CS.ACNS.ADS-B & 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.ADS-B	AC 20-165A
Position Latency	Total latency TOA<= 1.5s No specific req on GPS latency XPDR lat <=0.6s	Total ADS-B latency from TOM<=2s TOM-TOA <=0.5 sec GPS latency<=0.9s XPDR lat <=0.6s
Position source Availability	No availability requirement	Availability of the position at >99.9% (operational requirement). For FAA, SBAS meet such requirement.
Flight id shall be modifiable during the flight	Required	No specific requirement

→Impact on FMS (retrofit) **→Impact under study**

TOM: Time Of Measurement (time between signal reception by the GPS antenna and signal transmission by the ATC antenna)
TOA: Time Of Applicability (time between entry of GPS calculator and signal transmission by the ATC antenna)

DO-260B - MMR compliance status

Analysis to be done on all MMR

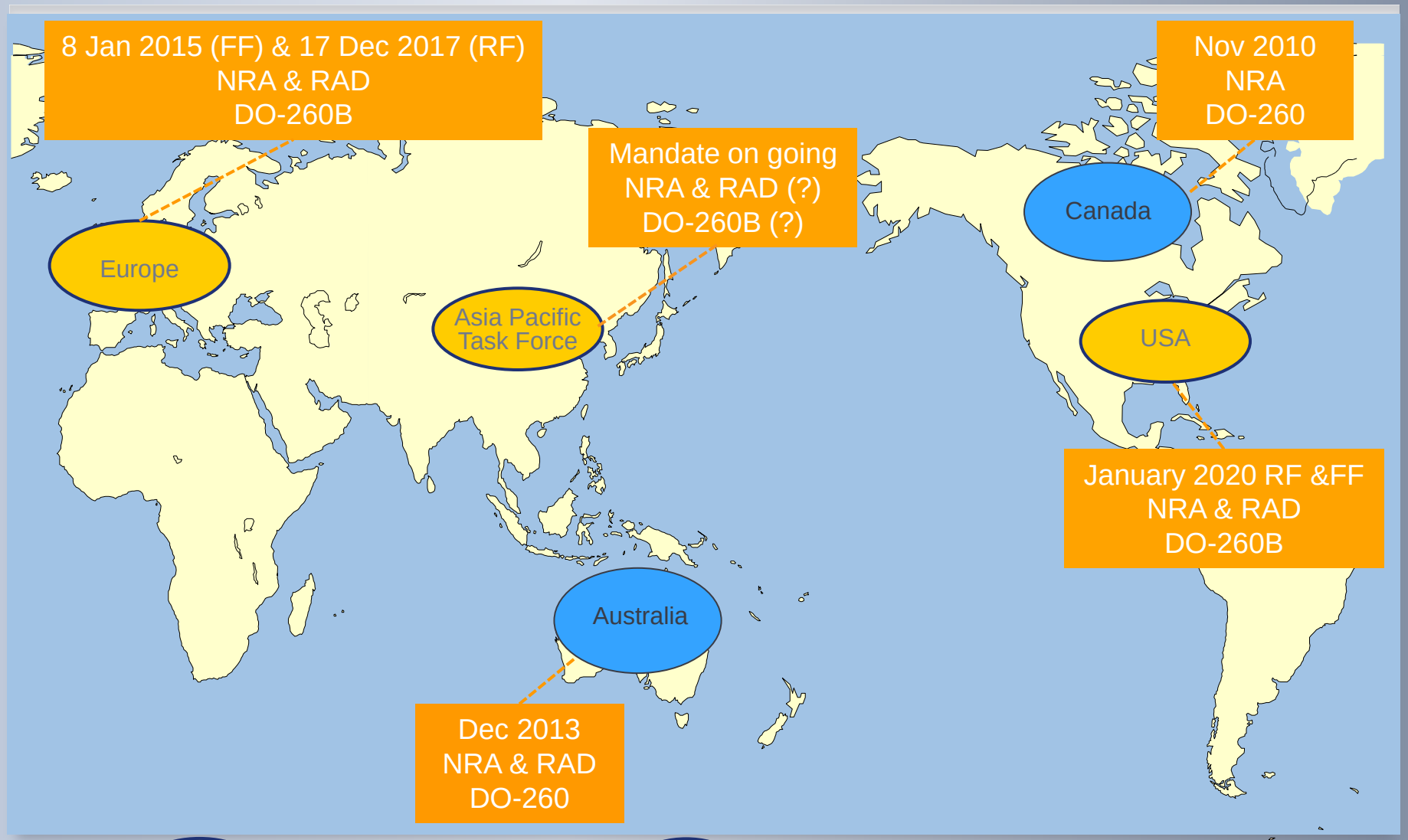
Supplier	MMR	comments	CS.ACNS.ADS-B	AC 20-165A
Collins	**GLU 920**	ILS/GPS - SA On Production cut off in progress	**Should be compliant - Analysis on going to confirm the compliance**	**Compliant with restriction –** (availability requirement not met)
	GLU 925 (P/N-430)	ILS/FLS/GLS/GPS SA Aware	**Should be compliant - Analysis on going to confirm the compliance**	**Compliant with restriction –** (availability requirement not met)
	GLU 925 (P/N-630)	ILS/FLS/GLS/GPS/SBAS - TSO C145c (planned to be installed on A350 only)	**Should be compliant - Analysis on going to confirm the compliance**	**Compliant – due to SBAS capability**
Honeywell	**RMA 55B**	ILS/GPS SA On	**Should be compliant - Analysis on going to confirm the compliance**	**Compliant with restriction –** (availability requirement not met)
Thales	**TLS755**	ILS/GPS or ILS/MLS/GPS SA Aware	**Production cut off**	**Production cut off**

CONTENTS

Conclusion

- End 2012, 81% of Airbus aircraft are ADS-B OUT capable – 21% only have requested the AMC-20-24 compliance → Wait for mandate
- ADS-B OUT European Mandate for RAD operation planned January 2015 in fwd-fit and December 2017 in retrofit
  - Requires S/W and H/W transponders change. All Airbus transponders will be updated to be DO-260B compliant (Honeywell not on time)
  - No major development risk identified in Forward-fit for the time being
    - MMR analysis on going to verify the compliance.
  - Risk on Retro-fit concerning peripheral systems availability
    - Mainly FMS, MMR → costly retrofit
- US Mandate for RAD operation planned 2020 (fwd-fit & retrofit)
  - Impact of AC-20-165A requirements are under study
  - Analysis on going to identify potential risk

ADS-B OUT - Conclusion



Under study or development

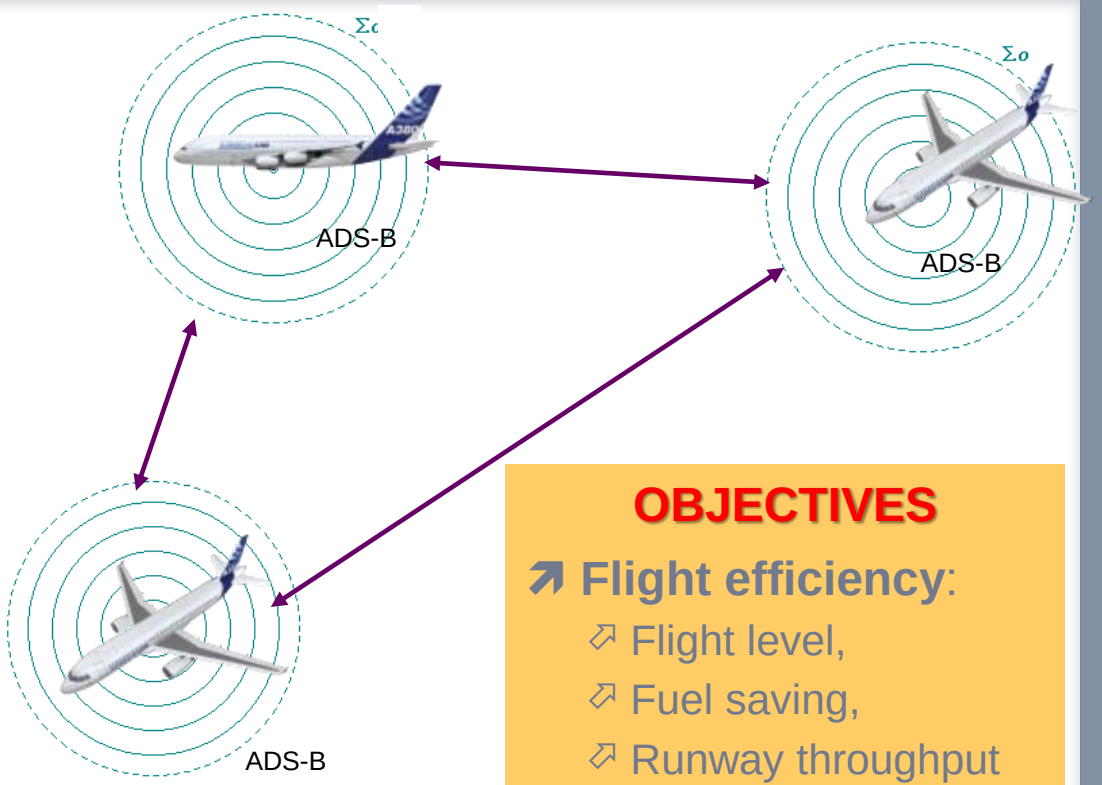
Airbus aircraft already compliant

CONTENTS

ATSAW

ADS-B IN

A/C information is received
- IN the airborne
- into the TCAS



Step 2. ATSAW
Display of other aircraft ADS-B information in the cockpit

- **Step 2A: ATSAW operation in air**
- **Step 2B: ATSAW operation on ground**

OBJECTIVES

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

ATSAW

Traffic Selector Switch

ADS-B Naviga

AIB
323

tional traffic tion on MCDU

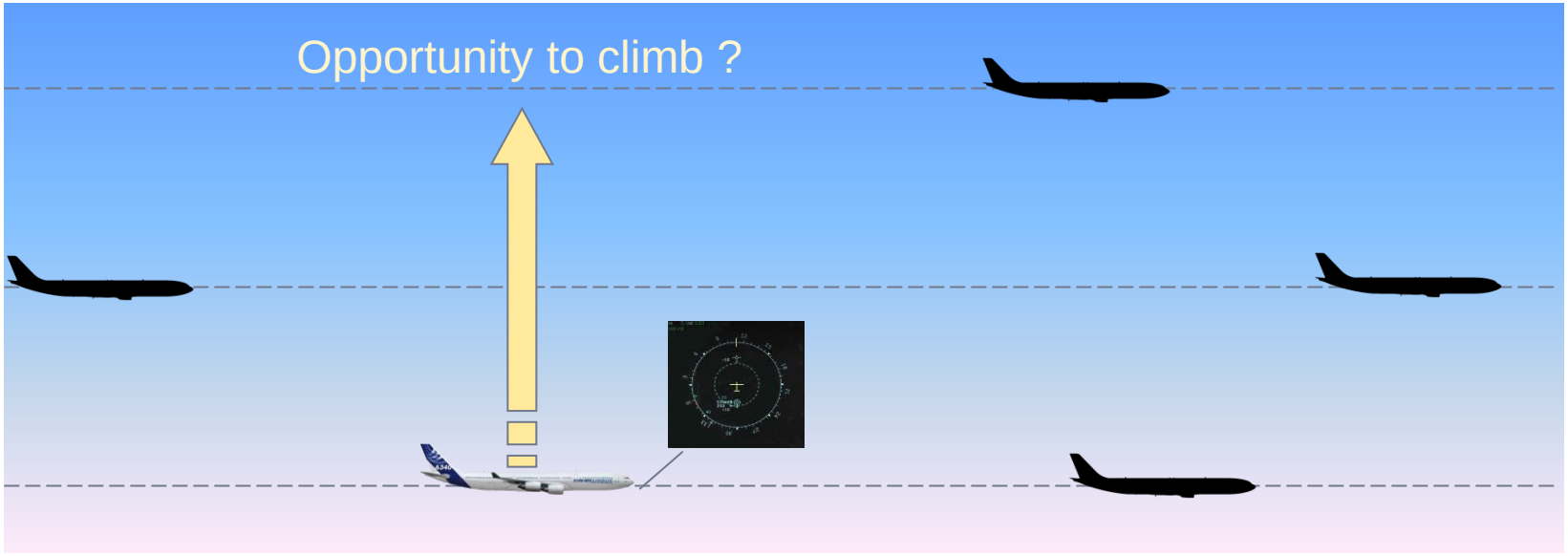
ATSAW

- 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 BENEFITS

- ATSAW reduces pilots workload
  - Reduces mental effort for traffic awareness
- ATSAW improves efficiency in approach
  - Enhances identification and information of target aircraft
    - Increases runway capacity
- ATSAW improves the safety
  - **Awareness of traffic situation**
  - Enhanced identification of target aircraft
  - Runway & taxiway occupancy awareness (ATSAW on ground)
  - **Collision risk anticipation** (ATSAW on ground)
- ATSAW paves the way to future Spacing applications

ATSAW Certification & Availability

ATSAW step 2A is certified on A330/340 & 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*

→ **TCAS TTR-2100 from** Rockwell Collins
  - *Development launched (Certification mid 2015)*

CONTENTS

ADS-B AIRBUS – ROAD MAP

Step 1

ADS-B OUT

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

- ***CERTIFIED***
- ***End 2014 (TBC)***

Step 2

ATSAW (ADS-B IN)

- **Step 2A (ATSAW in Air)**

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

Next steps

- **Step 2B (ATSAW on Ground)**
- Spacing
- Airport Surface Alerts

SESAR

- ***From 2015***

QUESTIONS?

Airbus Contact:

Laurent VIDAL: +33 5 67 19 05 80

laurent.vidal@airbus.com

AIRBUS
AN EADS COMPANY