



International Civil Aviation Organization

**THE FOURTH MEETING OF ADS-B STUDY AND
IMPLEMENTATION TASK FORCE (ADS-B SITF/4)**

Nadi, Fiji, 26-28 October 2005

**Agenda Item 13: Discuss issues observed during the trial and implementation of
ADS-B**

ADS-B CERTIFICATION ISSUE

(Presented and prepared by Greg Dunstone, Airservices Australia)

SUMMARY

This paper discusses certification of ADS-B out avionics.

1. INTRODUCTION

1.1 Today many airliners are transmitting ADS-B messages on 1090 MHz extended squitter in accordance with the technical specifications of ICAO Annex 10 Amendment 77, and the number is increasing every month. This is largely as a result of airlines equipping to meet the requirements of the European Elementary/Enhanced Surveillance mandate. The impact is not limited to Europe - the FAA has detected over 3,500 airframes transmitting ADS-B signals in the USA.

1.2 The transponders that are currently broadcasting ADS-B signals have been by the transponder vendors (such as ACSS, Honeywell, Rockwell Collins etc) as meeting the appropriate standards for this equipment. ATS ground systems around the world rely on the fact that, if a transmission is made, then it is from equipment that has been certified to operate in accord with the ICAO standards.

2. USE OF ADS-B FOR SEPARATION SERVICES

2.1 Airservices Australia wishes to use ADS-B information for the purposes of Air Traffic Control across the continent from 2006. IATA and many Airlines are supportive of our plans to use ADS-B in the Australian ADS-B Upper Airspace Project (UAP) instead of continuing to use procedural ATC methods. Improved efficiency, more frequent preferred levels and greater safety will result. We are aware that many other Air Traffic Service providers are also planning to use ADS-B.

2.2 However, it has also come to our attention that Boeing have included the following in the Airplane Flight Manuals (AFM) of aircraft transmitting ADS-B data

2.3 “Extended Squitter transmission have been demonstrated for proper operation and non-interference but have not been certified.”

2.5 In some states it may be difficult to convince regulators to approve “radar like services” using ADS-B as long as the Boeing AFM includes the “*has not been certified*” statement despite data collection showing that ADS-B data is of high quality and better than ATC radar. In our view, the existing avionics installations meet the requirements for delivery of “radar like services”.

2.6 New avionics may be appropriate for forward fit and to meet new ADS-B applications, but maximum use of existing installations is highly desirable. The FAA-Eurocontrol RFG group is planning to approve an interoperability document in late 2005 (for RTCA & Eurocae) to define the absolute minimum requirements for “radar like services” and is expected to allow existing avionics.

2.7 It may be necessary to encourage Boeing, Airbus and their national regulators to certify existing avionics fitments without the need for retrofit or upgrade. This would be in the interests of all those wishing to benefit from ADS-B radar like services.

2.8 It would also be useful for avionics vendors to formally declare compliance with DO260 and/or DO260A for their products. It can be noted that the FAA’s TSO166 allows compliance with DO260.

3. BACKGROUND MATERIAL

3.1 Additional background material is attached at Appendix A and Appendix B

4. RECOMMENDATIONS

4.1 The meeting is invited to note

- a) the importance of existing avionics being used for delivery of ATC services;
and
- b) that airline customer requests may be needed for Boeing, Airbus and their national regulators to certify existing avionics fitments.

Appendix A: Background material

Certification issues regarding ADS-B Avionics in Boeing and Airbus aircraft

ADS-B technology has been fitted to many aircraft	ADS-B technology has been installed in most new Boeing and Airbus aircraft for the last few years. There are well in excess of 3,500 airframes now fitted. Fitment has often occurred at the same time as Airlines equipped for the European Elementary/Enhanced surveillance mandate. It is extremely desirable that aircraft with existing installations are able to receive the benefits of ADS-B especially use for ATC surveillance (“radar like services”)
ADS-B standards have been in development for some time	ADS-B standards have been defined as follows : RTCA : DO260 - (Sept 2000) RTCA : DO260A – approved 2003 . (DO260A allows DO260 compliance) RTCA DO181C (inc ADS-B transmission RF, rates...) ICAO Annex 10 Amendment 77 July 2002 (ADS-B Messages matching DO260) AEEC: ARINC718A transponder standard (Feb 2002) FAA TSO-C112 (1986), ETSO 2C112a which require DO181C (June 2001), ED73B (Jan 2003) FAA TSO C166 : Which allows both DO260 and DO260A -- approved 2004
Boeing & Airbus need customer demand for ADS-B out certification	Current Boeing AFM says : <i>“Extended Squitter transmissions have been demonstrated for proper operation and non-interference but have not been certified.”</i> Air Traffic Service provider regulators may hesitate to authorise ATC use of ADS-B with this ambiguous wording. To date, to our knowledge, no customer has requested that Boeing or Airbus seek to certify ADS-B capabilities with their regulators. <u>Customer requests to Boeing and Airbus are necessary to trigger the process.</u> Airbus has indicated that such certification is somewhat straightforward but more knowledge of the application minimum requirements is needed. The FAA/ Eurocontrol ADS-B Requirements Focus Group (RFG) is attempting to define these minimum requirements and expects to approve such a document in late 2005. An installation guidance document from FAA or JAA/EASA would also be helpful. Customer requests are required to get this work moving too.
Existing installations provide high quality ADS-B	For an aircraft to receive ADS-B based ATC surveillance services an “ADS-B out” capability is required. ADS-B out is the transmission of position, altitude and integrity data. Both Boeing and Airbus use the position and integrity output of the aircraft GPS receiver

data		to send signals to the aircraft transponder for transmission. Both manufacturers use GNSS receivers which provide high quality positional information and horizontal protection limit (HPL/ HIL)) integrity information. ADS-B capable aircraft have the GNSS receiver connected to the SSR ADS-B capable transponder.
Testing of existing avionics		Current transponders have been certified/tested against RTCA DO 181C (TSOC112) , ICAO Annex 10 Amendment 77 and ED73. The transponders were not certified against a FAA TSO because no TSO existed at the time of installation of the avionics despite an RTCA standard DO260 being in existence. The transponders have also been tested for compliance with the relevant parts of DO260. Whilst it is clear that the provision of ATC radar like services does not need all features of DO260 there is no relevant document that describes the <u>minimum</u> requirement. The RFG is currently writing an “Interoperability document” to define this minimum which should be complete in October 2005.
Is the current ADS-B deployment good enough?		It has been argued by some that DO260 is not good enough since a new standard DO260A has been approved and that as a matter of principle, the latest standard should be used. In this particular case however, the FAA has allowed both DO260 and DO260A to be certified against TSO C166. DO260A requires the independent transmission of accuracy and integrity values. Airservices Australia (and Airbus) believe that the current avionics meets the minimum requirements. Airservices Australia is already using DO260 avionics for ADS-B separation services in Queensland with approval of the Australian regulator. Airservices Australia takes the view that DO260 is good enough because it is as good as “radar”. Airservices Australia has observed ADS-B traffic from Boeing and Airbus aircraft for some time using its ADS-B ground station. DO260A has been written to serve the needs complex air-air applications which have greater needs compared to the Radar like service application and the use of DO260A in forward fit aircraft is supported.
ATC Regulators need to know exactly what is being transmitted today		Certification as fit for an ATC function is decided by the ATC service provider’s regulator. Boeing and Airbus cannot decide or dictate how the receiver of the transmitted data may process or use the data. The regulator’s decision will be based on knowledge of what is transmitted from the aircraft. Aircraft certification of “ADS-B out” capability is one way to obtain that knowledge. Another method could be for Boeing/Airbus to define “what the aircraft does today” and to formally confirm that this is the case. Ie: What is needed is formal confirmation of what the aircraft already transmits rather than certification for a particular operation. Maybe this could be a statement in the flying manual detailing that requirement and the fact that the requirement is met.

ADS-B Benefits will be delayed if current installations considered inadequate		Boeing/Airbus transponders are not yet certified against TSO C166. ie there are <u>NO</u> DO260A avionics available today for Airbus and Boeing aircraft – and there won't be for some time. If DO260 is not allowed for radar like services, ADS-B deployment/ use will be delayed by years AND the existing deployments in aircraft will not be useable in some states.								
		Other related issues								
Part number roll problem		Boeing have suggested that any certification of existing avionics would require a part number roll, regardless of whether any hardware or software changes are required. Airservices Australia does not understand this approach. Airbus believe that if the existing avionics installations are certified for ADS-B radar like services, without any change to the transponder then there is NO need to change the part number. And hence certification can be relatively simple. A part number roll could be expensive for airline customers.								
Boeing unwilling to consider DO260		Boeing have indicated an unwillingness to certify using DO260 since it is claimed (by Boeing) that it is an “out of date” standard. (However, no avionics exist compliant with DO260A for Boeing aircraft). It is not clear that Europe will support DO260A through ICAO and/or EUROCAE Boeing’s unwillingness could be tested by Airline customers.								
Avionics		The aircraft capabilities of both Boeing and Airbus aircraft are almost identical since the avionics are produced by the same vendors : Eg: The transponders are : <table><tr><td>AIRBUS</td><td>BOEING</td></tr><tr><td>ACSS : P/N 7517800-10005A</td><td>P/N 7517800-11006 mod A</td></tr><tr><td>Rockwell Collins : P/N 822-1338-021</td><td>P/N 822-1338-003</td></tr><tr><td>Honeywell : P/N 066-01127-1402</td><td>P/N 066-01127-1602</td></tr></table> • Transponders are compliant with ADS-B requirements of: • DO-181C • Arinc 718A • ICAO annex 10, Amendment 77 for the encoding of BDS 0.5, 0.6, 0.7, 0.8, 0.9 subtype 1. • Transponder software is developed to DO-178B level C including ELS/EHS and Extended squitter.	AIRBUS	BOEING	ACSS : P/N 7517800-10005A	P/N 7517800-11006 mod A	Rockwell Collins : P/N 822-1338-021	P/N 822-1338-003	Honeywell : P/N 066-01127-1402	P/N 066-01127-1602
AIRBUS	BOEING									
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Honeywell : P/N 066-01127-1402	P/N 066-01127-1602									

Airbus testing		• Airbus has performed laboratory testing in 2002/2003 for the certification of ELS/EHS transponders ▶ Check of the emission of BDS 0.5, 0.6, 0.7, 0.8, 0.9 ▶ Verification of some parameters in the BDS ▶ Verification of the source prioritization • Airbus performed flight testing in 2003 ▶ Check of the reception by the ground of BDS 0.5 and 0.9 ▶ Comparison of the content of ADS-B with mode S radar recording
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Attachment B : Minimum requirements for Use of ADS-B for ATC Surveillance

To be useable for ATC in a “radar like” manner ADS-B needs to transmit only the following :

- a) Position
- b) Position Integrity data
- c) Barometric altitude
- d) SPI indication
- e) Emergency flag
- f) Identity

Radar provides all these except positional integrity data which is assumed. ADS-B need not provide more to be as good as radar. ATC systems that receive transmitted integrity data will discard data not meeting the required standard.

Further discussion of these parameters follows:

Parameter	Boeing & Airbus Implementation	Comments
Position	Both Boeing and Airbus output data directly from the GPS MMR. The MMR is TSO129 compliant and outputs HPL. If a GPS satellite is not operating correctly the fault detection and exclusion logic in GNSS receivers eliminates the faulty satellite. If the fault is not eliminated the integrity data transmitted indicates a problem and the data would be discarded by the ATC system. In some rare failure cases the positional data could default to using sources other than GPS. In this case the data transmitted indicates a loss of integrity to ATC.	The positional accuracy is better than radar.
Position Integrity data	Current Boeing and Airbus aircraft transmit this as “Navigational Uncertainty Category” (NUC) as defined in RTCA DO260. Boeing and Airbus aircraft derive NUC from the value of HPL output by the GNSS MMR. It is received on the same “wire” as the positional data. In some transitory cases, HPL might not be available. In these rare cases, the NUC value will be derived from Horizontal figure of Merit (HFOM).	ATC radars have minimal online integrity checks – and the integrity of data from ADS-B is superior. A small risk exists that during this transitory event, a GPS satellite ranging error occurs thus corrupting the positional data – whilst the NUC value remains “good”. The probability of this event is significantly less than the chance of misleading radar data

		being presented to a controller.
Barometric altitude	This is the same data that is transmitted in response to ATC radars – from the same transmitter	No risk. Effectively certified as part of the Elementary Surveillance requirements
SPI	Provided.	
Emergency flags	Aircraft output a flag when the transponder emergency codes are entered.	
Identity	ADS_B outputs a unique airplane code in every message coded at avionics installation. In addition it outputs the Flight callsign entered by the flight crew into the FMS	Effectively certified as part of the Elementary Surveillance requirements This provides is safer than radar which only provides a 4 digit octal code
