RTCA Special Committee 186, Working Group 3

ADS-B 1090ES MOPS

Meeting #19

RTCA, Washington DC
7 December 2005

"It's The Integrity, SILLY"
The A380 is Reported by AirServices Austrailia to be Reporting a SIL=0

Gary Furr, L-3/Titan, FAA Technical Center
Stan Jones, Mitre CAASD

SUMMARY

This Working Paper shows that AirServices Austraila acquired and tracked the new Airbus A380 as it reportedly broadcast DO-260A compliant 1090 Extended Squitters, but with a value of SIL set to ZERO (0).

ADS-B News and Features

2005

- ADS-B tracks the historic arrival of the A380 in Sydney
- 1090MHz ADS-B Avionics and Avionics Manufacturers' plans by Andrew Rose, Llanbury Consulting
- General Aviation Cockpit Traffic Display System Demonstrated (20 August 2005)
- ADS-B and TCAS - What are the functions of these two systems in aircraft? (26 July 2005)
- Cockpit Display of Traffic Information (6 April 2005)
- ADS-B Cockpit Display Testing Begins (8 February 2005)
- International ADS-B fleet grows (12 January 2005)

2004

- Jetstar's first ADS-B Equipped Airbus Enters Service - (1 December 2004)
- First Upper Airspace ADS-B Ground Stations Up and Running
- ADS-B vs Radar
- ADS-B enters operational use in Queensland
- Cutting edge aircraft tracking system commissioned
- GPS monitoring system to be upgraded to support ADS-B air traffic control services
- Airborne air traffic display systems to be trialled in Australia
- First Sunshine Express Aircraft Joins ADS-B Fleet
- Media Release - Nationwide aircraft monitoring to become reality - (30 March 2004)
- Ultralight joins ADS-B Fleet
- Air Traffic Controllers begin ADS-B Familiarisation
- More Asia-Pacific Airlines Flying with ADS-B
- ADS-B Program Continues to forge ahead

2003

- ADS-B Integration Complete
- CASA Approves Standards for New ADS-B Transponders
- "The Future of Air Traffic Management" Press Release from Minister for Transport and Regional Services
- Airservices Australia plans nationwide ADS-B deployment
- ADS-B ground station 'sees' UPS freighter
- Media Release - Partnership to deliver low-cost, advanced air traffic surveillance equipment for general aviation - (16 May 2003)
- Regional Airliner and Rescue Helicopter join ADS-B Fleet - (May 2003)
- ADS-B News Brief - (April 2003)
- Australia's first ADS-B equipped aircraft - (16 January 2003)

2002

ADS-B tracks the historic arrival of the A380 in Sydney

The world's largest passenger jet, the Airbus A380, touched down in Sydney for the first time on 13 November as part of a 5-day promotional visit to Australia for Qantas.

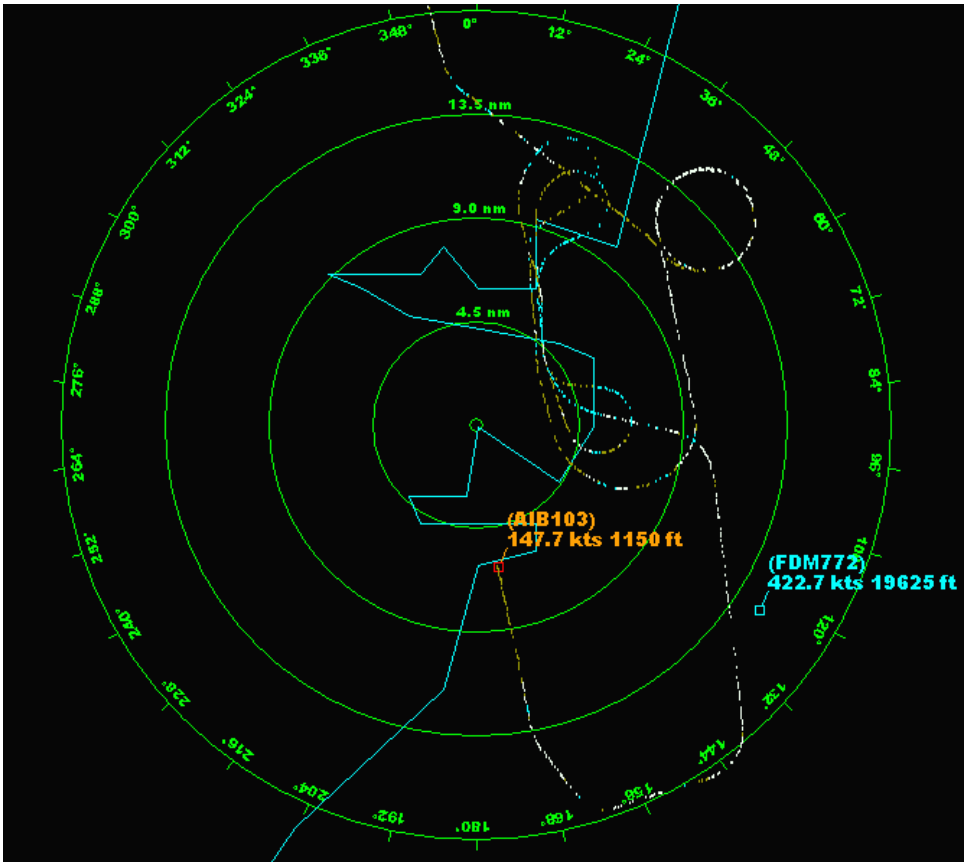
The A380 carries the latest in Mode S Extended Squitter Automatic Dependent Surveillance Broadcast (ADS-B) technology which automatically transmits position and altitude data to ground stations and to other aircraft.

Prior to landing, the giant airliner made several passes over Sydney Harbour whilst it was tracked by a portable ADS-B ground station and a simple antenna positioned at Sydney airport.

"Airbus is an enthusiastic supporter of ADS-B and sees it as an enabling technology for numerous applications including air to air surveillance," said Greg Dunstone Airservices Australia's ADS-B Program Manager.

"The fitment of Mode S Extended Squitter ADS-B to the most modern airliner in the world demonstrates that commitment," he said.

Airservices Australia is installing 28 ADS-B ground stations in remote regions of the country to provide improved air traffic control services to aircraft equipped with ADS-B. Most new Boeing and Airbus aircraft are fitted with Mode S Extended Squitter ADS-B technology.



ADS-B plot shows the A380 manoeuvring over Sydney Harbour during a photo shoot

The following email stream was initiated by Kojo Owusu of AirServices Austraila, and all emails appear here in the order that they were sent and received.

11/15/2005 06:27 PM
From: Kojo.Owusu@AirservicesAustralia.com
To: vaorlandojr@aol.com, Ronnie Jones/AWA/FAA@FAA, eric.potier@eurocontrol.int rhsaffel@rockwellcollins.com, ruyjr.brandao@honeywell.com, TBevNichols@aol.com mikael.ponnau@aviation-civile.gouv.fr, , roland.mallwitz@dfs.de, gligler@pmei.com, Ken.Carpenter@atc.qinetiq.com, Richard.Pugh@nats.co.uk
Cc: Greg.Dunstone@AirservicesAustralia.com, GRAEME.WARD@casa.gov.au Robert.Brown@AirservicesAustralia.com, MPaydar@icao.int

Subject: DO-260A SIL

The A380 is currently touring our region and was detected by our ADS-B ground stations. We were pleasantly surprised to find that it is equipped with a DO-260A compliant transponder.

The data we received from the aircraft is good. However, it is broadcasting a SIL of zero. It appears there is still some uncertainty about how SIL should be encoded. With the current configuration of our system, ADS-B messages will not be processed by the ATM system if the reported SIL is 0 or 1.

I was wondering whether anyone was aware of any further guidance on the setting of SIL, in addition to what is provided in DO-260A and D0-242A. I could not find specific references to this issue in FAA TSO-C166.

How are manufacturers addressing the issue?

Do we need to provide additional material in the revised ICAO Annex 10 material or in the new Technical Manual on this topic?

Any information you could provide on this issue would be appreciated.

Regards,
Kojo

11/16/2005 07:31 AM
From: Ronnie Jones/AWA/FAA
To: Thomas Pagano/ACT/FAA@FAA, Gary CTR Furr/ACT/CNTR/FAA@FAA, gligler@pmei.com, Gene CTR Wong/AWA/CNTR/FAA@FAA
cc:
Subject: Fw: DO-260A SIL

FYI -

I have already responded to Kojo, indicating that TSO-C166A is in the works as well as Change 1 to DO-260A and also the STP MOPS and an updated ADS-B Advisory Circular may also clarify the situation with the setting of SIL.

Ron Jones

From: gary.ctr.furr@faa.gov [mailto:gary.ctr.furr@faa.gov]
Sent: Thursday, 17 November 2005 1:03 AM
To: Ronnie.Jones@faa.gov; Dunstone, Greg; Owusu-akyeampong, Kojo; Richard.Jennings@faa.gov; sjones@mitre.org
Cc: gene.ctr.wong@faa.gov; gligler@pmei.com; thomas.pagano@faa.gov; vaorlandojr@aol.com
Subject: Re: Fw: DO-260A SIL

Gentlemen:

The following Note was drafted some time ago for inclusion in the draft of TSO C166A, Appendix 1 for continuing changes to DO-260A.

Since the SIL is intended to reflect the integrity of the navigation source of the position information broadcast, the SIL value transmitted should be indicative of the true integrity of the ADS-B position data. A problem for installations that include currently available GNSS receivers and FMS systems is that SIL is not output by these systems. With the lack of SIL information being provided by the navigation source, implementers should not arbitrarily set a SIL value of zero indicating unknown integrity. It is suggested, unless there is a tightly coupled navigation source where SIL can be unambiguously determined, that the ADS-B Transmitting Subsystem provision for the static setting of SIL as part of the installation procedure. The value for SIL is determined by the integrity level of the navigation sources that would be used by the ADS-B Transmitting Subsystem.

Unfortunately, the wheels at the FAA grind slowly and TSO C166A is still in the process of being reviewed internally in the FAA prior to posting in the Federal Register "any day now!!"

It appears that RTCA SC-186 WG-3 (meeting 7 December at RTCA) will get a chance to approve the set of changes that are currently identified in the draft TSO C166A as being ready to publish in a "Change 1" to DO-260A, and this might actually happen prior to the FAA being ready to publish TSO C166A. Bottom line is that I'm not sure as I write this that the Appendix to TSO C166A will actually be required by the time the TSO is approved, but one way or another, the above information on SIL, as well as all the other changes will be published.

Regards,
Gary Furr

From: Owusu-akyeampong, Kojo [mailto:Kojo.Owusu@AirservicesAustralia.com]
Sent: Thursday, November 17, 2005 2:10 AM
To: gary.ctr.furr@faa.gov; Ronnie.Jones@faa.gov
Cc: gene.ctr.wong@faa.gov; gligler@pmei.com; thomas.pagano@faa.gov; vaorlandojr@aol.com; Dunstone, Greg; Richard.Jennings@faa.gov; Jones, Stanley R.
Subject: RE: Fw: DO-260A SIL

Ron, Gary,

Thank you for your responses. I have some comments.

1. In the absence of a SIL value from the position sensor, the transponder will probably have sufficient information to determine SIL if the implementation is based on GPS. For example, if the transponder is receiving HPL (or HIL – ARINC Label 130), which is based on a 10-7 possibility (Ref DO-242) of exceeding the containment radius without an alert, then the SIL may be set to 3.

Some argue that the integrity of the HPL containment radius should be set to 10-5 to allow for the integrity of on-board processing systems. In that case the transponder can output a SIL of 2 for all positions based on HPL.

In the absence of HPL (possibly due to insufficient satellites being available), the GPS receiver will output HFOM. In this case the transponder can continue to output NAC based on HFOM and set SIL to 0 and NIC to 0 (unknown containment radius).

2. The other consideration is whether we need four values of SIL. If the probability of exceeding the containment radius was specified to be say 10-5, then the containment radius could be adjusted accordingly. It this case the position sensor would only output a containment radius based on the pre-determined integrity level.

For comparison, accuracy (NACp) is simply specified to a 95% confidence level, and only one value is output. We do not require the output of different values of accuracy based on 68%, 95%, and 99.7% confidence levels (i.e. the 1, 2, and 3 sigma levels for a normal distribution).

I hope this will stimulate some discussion. I am trying to understand the issue a bit better.

Best Regards,

Kojo

11/17/2005 09:12 AM

From: "Jones, Stanley R." <sjones@mitre.org>
To: Kojo.Owusu@AirservicesAustralia.com, Gary CTR Furr/ACT/CNTR/FAA@FAA, Ronnie Jones/AWA/FAA@FAA
Cc: Gene CTR Wong/AWA/CNTR/FAA@FAA, gligler@pmei.com, Thomas Pagano/ACT/FAA@FAA, vaorlandojr@aol.com, sjones@mitre.org Greg.Dunstone@AirservicesAustralia.com, Richard Jennings/ASO/FAA@FAA,

Subject: RE: Fw: DO-260A SIL

All,
Just a couple of comments. First, in the draft TSO since the 1090ES format only supports one SIL value, I have been assuming this should be limited by the level of SW/HW certification level of 10^-5/hr or a SIL = 2 even though the NAV source is a SIL = 3. This is a slight over bound of the reported containment radius (the 10^-5/hr Rc is 0.78*Rc for 10^-7/hr) but this is usually lost in the encoding quantization intervals for NIC so no real penalty results. So I would add a note that the reported SIL should be the lesser of the NAV source or SW/HW SIL. Second, and this may be a nit, when the HPL is unavailable, although NIC = 0, the SIL value for this report is unchanged (it does not need to go to zero also). Third, I see no operational need to go to four SIL levels - as discussed above, we can't even use the three we now have for NAV and equipment encoding. Hope this helps.

Stan