Automatic Dependent Surveillance Broadcast (ADS-B) OUT

Automatic Dependent Surveillance Broadcast OUT[1], based on Mode-S Extended Squitter (1090ES), is the preferred surveillance technology to replace radar for the air transport industry.

SITUATION

Airlines continue to equip their aircraft with ADS-B (OUT) capability. A return on this investment can only be achieved by implementation of enhanced surveillance solutions resulting in more efficient routing, increased airspace capacity and lower cost ATM infrastructure.

IATA POSITION

Where justified by operational and business cases, air traffic control using ground radar surveillance should migrate towards ADS-B (OUT).

New surveillance implementations should consider ADS-B OUT in preference to radar.

In airspace where ADS-B OUT is declared operational, associated radar installations should be decommissioned as soon as operationally feasible and the resulting maintenance and operational savings passed on to airspace users.

KEY CONSIDERATIONS

Precedent has been established for the acceptance of DO-260 avionics for near term application of ADS-B OUT with five nautical mile radar-like separation, provided NAVIGATION UNCERTAINTY CATEGORY (NUC) is computed using HORIZONTAL PROTECTION LIMIT (HPL).

However, DO-260A Change 2 is expected to be the baseline for longer term rulemaking in the U.S.A. with Change 3 being the focus in Europe.

EUROCONTROL will permit the use of DO-260 avionics in its Pioneer Program. However, CASCADE[2] program management confirms that consultative rulemaking scheduled to begin during 2007 is expected to use DO-260A Change 3 as its baseline with a 2015 timeframe.

1 Automatic Dependent Surveillance-Broadcast OUT (ADS-B OUT) is a function on an aircraft or a surface vehicle that periodically broadcasts its state vector (horizontal and vertical position, horizontal and vertical velocity) and other information. Under ADS-B OUT, a vehicle periodically broadcasts its own position without knowing what other vehicles or entities might be receiving it. ADS-B OUT is *automatic* in the sense that no pilot or controller action is required for the information to be transmitted. It is *dependent surveillance* in the sense that the surveillance information depends on the navigation and broadcast capability of the source vehicle. ADS-B OUT is used by ATC for surveillance in a manner similar to the use of conventional radar.

A complementary technology is called ADS-B IN, whereby ADS-B information is received, processed and displayed in the cockpit to provide an enhanced 'see and avoid' surveillance that is superior to TCAS. ADS-B IN also enables a number of advanced applications that can enhance safety, capacity and efficiency. Aircraft can be equipped with ADS-B OUT without having ADS-B IN capability.

2 (Co-operative ATS through Surveillance and Communication Applications Deployed in ECAC - European Civil Aviation Conference).

IATA SUPPORTS

- The global implementation of 1090MHz Extended Squitter (1090ES)[3] ADS-B OUT standard for the provision of radar like service by Air Navigation Service Providers (ANSPs).
- Expeditious implementation of ADS-B OUT.
- The assumption that all air transport aircraft will eventually be fitted with 1090ES transponders.
- The concept that all new ATS automation systems for ADS-B services must be interoperable with Mode-S 1090ES.
- ATS Ground systems that will recognise and provide safety and efficiency benefits to aircraft equipped with RTCA DO-260 and DO-260A transponders.
- The use of DO-260 avionics for radar-like separation provided NUC is computed using HPL.

SUMMARY

- If NUC is based on HPL, then DO-260 and DO-260A standard avionics are similar for ADS-B OUT operations with respect to position integrity.
- DO-260 transponders have been considered by some States to be adequate for ADS-B OUT purposes if the navigation position is provided with HPL and that is used to compute the NUC value.
- For fleet planning purposes, airlines should be aware that systems utilizing DO-260 transponders should have the Navigation Uncertainty Category (NUC) computed using HPL. Otherwise, if there is an option, DO-260A is the preferred transponder compliance.

Supplementary information on separate pages.

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[3] There are three data link solutions for relaying ADS-B position reports, 1090 MHz Mode S Extended Squitter (1090ES), VHF Digital Link (VDL) Mode 4 and Universal Access Transceiver (UAT). IATA supports only 1090 MHz as the global solution for international air traffic services.

SUPPLEMENTARY INFORMATION RELATED TO ADS-B OUT / IN

- RTCA DO-260 / 260A (or EUROCAE ED-102, the European equivalent) specify ADS-B avionic standards.
- DO-260A recognizes the existence of DO-260 as DO-260A version 0.
- RTCA has issued changes 1 and 2 to DO260A and change 1 to DO260.
- RTCA DO-260A change 2 clarifies TIS-B[4] requirements and revises ADS-B IN processing.
- Additional versions of DO-260 are likely to be developed. Possibilities include DO-260B and DO-260C. *Definitions may change as the standard evolves.*
- The FAA TSO[5]-C166 and TSO-C166A are based on RTCA DO-260 and 260A respectively.[6]
- A noteworthy difference between DO-260 and DO-260A is that DO-260 specifies an output position data quality parameter termed Navigation Uncertainty Category (NUC), while DO-260A specifies a position data integrity value termed Navigation Integrity Category (NIC) and a position data accuracy value termed Navigation Accuracy Category for position (NACp).[7]
- For ADS-B OUT operations, some States consider that there are no significant variations between DO-260 and DO-260A transponders.
- Some message formats differ but in general, ground ADS-B receivers can process DO-260 and DO-260A transmissions.
- Limited DO-260A avionics are available. The A380 Honeywell installation is an example.
- In an ADS-B system the important issue to consider is the source of position information. Although present ADS-B standards allow for alternatives to GNSS sources, none of the currently available alternatives meet the requirements for ADS-B for ATC.
- ADS-B OUT utilizes the GNSS receiver HPL output parameter to ensure, with high probability (1-10E-7), that the reported position is within the HPL.
- The HPL value is calculated by the GNSS receiver based on the ability of the receiver to detect an invalid ranging signal from the satellites in view. This is available on TSO C-145a / TSO C-146a GPS receivers. Note however that a significant number of current air transport category aircraft are equipped with TSO C-129a equipment.
- Many TSO C-129 (class C+) units are expected to be HPL compliant. Operators need to confirm the availability and use of HPL on their

[4] Traffic Information Service – Broadcast.
[5] Technical Standard Orders.
[6] Reference should also be made to the European EASA ADS-B Non-Radar Area (NRA) Notice of Proposed Amendment (NPA).
[7] Other areas of difference (in terms of DO-260 transponder implementation) include mode A and discrete emergency codes.

TSO C-129 / TSO C-129a equipped aircraft.

- GNSS receivers also output a parameter termed Horizontal Figure of Merit (HFOM), which is the expected accuracy of the position data *assuming* that all satellites in view are operating correctly.
- Note that HFOM does not protect from satellite ranging errors.
- DO-260 stipulates that the transmitted NUC value should be based on HPL if it is available from the GNSS receiver.
- If HPL is not available, i.e. during RAIM outages, the original version of DO-260 allowed the transmitted NUC to be based on HFOM. However, change 1 to DO-260 disallowed that.[8]
- DO-260A requires that the NIC value is derived from HPL.
- ICAO SARPs for ADS-B (based on DO-260) are published in Amendment 77 to Annex 10.
- As development continues, additional ICAO documentation has relevance, for example, Doc 9871 (1090ES Technical Manual).
- DOC 9871 will supersede Annex 10 Amendment 77 and will include both DO-260 and DO-260A provisions. (Publication during 2007).
- DO-260A has enhancements to support ADS-B IN capabilities.
- DO-260 receivers are inadequate for ADS-B IN, but DO-260A receivers can be used to receive signals from DO-260 equipped aircraft.

==========END==========

[8] EASA ADS-B NRA NPA (and associated material) provide rationale as to why NUC / HFOM is deemed permissible.