International Civil Aviation Organization

The Third Meeting of Automatic Dependent Surveillance – Broadcast (ADS-B) Study and Implementation Task Force (ADS-B TF/3)

Bangkok, 23-25 March 2005

Agenda Item 4: Review States' activities on trials and demonstration of ADS-B

ADS-B REGULATORY ACTIVITY IN AUSTRALIA

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SUMMARY

This working paper provides an overview of recent ADS-B trial and implementation regulatory activity in Australia.

1. Background

1.1 As reported in working papers presented to previous meetings of the Task Force, three major projects are being undertaken in Australia to facilitate the introduction of ADS-B for air traffic services. The three projects are:

- The Burnett Basin Operational Trial:
- The ADS-B Upper Airspace Project (UAP); and
- The ADS-B Lower Airspace Project (LAP).

1.2 This paper provides an update about progress to date on regulatory activity undertaken to support the three projects.

2. The Burnett Basin Operational Trial

2.1 The trial moved into its third and final phase during 2004, with ADS-B data from the Bundaberg ground station being used to provide flight information services to participating aircraft in late August. On 5 December 2004, the Civil Aviation Safety Authority (CASA) approved the use of a 5 NM minimum horizontal separation distance between trial aircraft.

2.2 A copy of the instrument authorising ADS-B separation in the trial is available at http://www.casa.gov.au/rules/miscinst/2004/CASA559.pdf

3. The Upper Airspace Project

3.1 Airservices Australia has committed to deploying a network of ADS-B ground stations across Australia during 2005 under the UAP. This project is expected to provide near-nationwide coverage above FL300, with significant coverage at lower levels.

3.2 The 28 new ground stations will be progressively deployed, with the first UAP equipment scheduled for installation at Bundaberg in July 2005. Commissioning of the UAP network is expected to take place by the end of 2005.

3.3 In support of this project, CASA will consider Design Phase and Implementation Phase Safety Cases presented by Airservices Australia. The Safety Case process will support an application from Airservices Australia for re-issue of its CASR Part 171 (aeronautical telecommunications and radionavigation service providers) certificate to approve the operation of ADS-B ground stations and supporting systems.

3.4 The same Safety Case will also be considered in a review of the CASR Part 172 (air traffic services) Manual of Standards to include separation standards for ADS-B.

4. The Lower Airspace Project

4.1 The Australian Strategic ATM Plan also includes the use of ADS-B at lower levels and a second initiative, the Lower Airspace Project (LAP) has been proposed to provide even greater ADS-B coverage in areas currently not served by radar, as well as replacing the current enroute network of secondary surveillance radars at the end of their service life (in 2009) with ADS-B ground stations. Primary and secondary surveillance radar will be retained in the terminal areas for the foreseeable future.

4.2 In support of the UAP and LAP, CASA has issued a Discussion Paper (DP) addressing the carriage and use of ADS-B. The DP seeks industry comment on various options that CASA could adopt in initiating regulatory changes, and can be viewed at http://rrp.casa.gov.au/download/04_dp.asp.

4.3 The DP was drafted with the assistance of a joint CASA/industry project team and makes a study of the issues surrounding ADS-B in Australia. The paper sets out four main regulatory options, and identifies that informal consultation to date suggests that a phased implementation of aircraft fitment requirements may prove most suitable. CASA considers that industry responses to the options discussed and the parallel development of a business case will be the key to the future development of rules and advisory material. It is expected that further consultation on, and promulgation of, operational rules will support the use of the UAP network at the end of 2005.

4.4 In recent months CASA has issued two Australian Technical Standard Orders (ATSOs) for the certification of ADS-B avionics. ATSO-C1004 is a standard for Mode A/C transponders capable of transmitting ADS-B 1090ES messages, while ATSO-C1005 is a standard for the certification of a stand-alone (non-transponder) ADS-B 1090ES transmitter. Copies of the two ATSOs are included as attachments to this Working Paper and are available at http://www.casa.gov.au/avreg/aircraft/ATSO.htm.

5. Recommendations

5.1 Task Force participants are invited to note the progress of ADS-B regulatory activities in Australia.

ATSO-C1004

Effective Date: 02/10/2003

Australian Technical Standard Order

Subject: AIRBORNE MODE A/C TRANSPONDER EQUIPMENT WITH EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) TRANSMISSION CAPABILITY

1. PURPOSE. This Australian Technical Standard Order (ATSO) prescribes the minimum performance standards (MPS) which airborne Mode A/C Transponder equipment with Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) transmission capability must meet in order to obtain an ATSO authorization or letter of design approval and so be identified with the applicable ATSO marking.

Note: This ATSO provides a standard to build a Mode A/C transponder with the additional ability to provide ADS-B capability. It is not intended to replace existing Mode A/C or Mode S transponder equipment or standards.

2. APPLICABILITY. This ATSO is effective for new applications submitted after the effective date of this ATSO.

3. REQUIREMENTS. New models of airborne Mode A/C Transponder equipment with Extended Squitter ADS-B transmission capability that are to be so identified and that are manufactured on or after the effective date of this ATSO must meet the MPS specified in this paragraphs 3,4 and 5 and in Appendix 1.

a. Functionality. The standards of this ATSO apply to equipment intended to serve as a Mode A/C Transponder that also transmits ADS-B messages to support surveillance applications both in air traffic management systems and in other aircraft equipped to receive ADS-B messages.

b. Failure Condition Classification. Failure of the function defined in paragraph 3a of this ATSO has been determined to be a Major failure condition, and the applicant must ensure the system has a design assurance level commensurate with this failure condition classification.

Note: For a definition of failure condition categories refer to United States Federal Aviation Administration (FAA) Advisory Circular (AC), System Design and Analysis AC 25.1309-1A, Equipment, Systems and Installations in Part 23 Airplanes AC 23.1309-1C or *European Joint Airworthiness Authorities* (*JAA) Advisory Material Joint (AMJ), System Design and Analysis AMJ 25.1309 or later amendments*.

c. Environmental Qualification. The equipment shall be subject to the test conditions specified in RTCA Inc. Document No. RTCA/DO-160D, "Environmental Conditions and Test Procedures for Airborne Equipment", Change 3, dated 29 July 1997, or the most current version.

d. Software Qualification. Software must be developed in accordance with RTCA Inc. Document No. RTCA/DO-178B, “Software Considerations in Airborne Systems and Equipment Certification” dated 1 December 1992, or the most current version.

Software implementing the functions defined in this ATSO must be developed to Level C as defined in RTCA/DO-178B.

e. Fire Protection. All materials used shall be self-extinguishing except for small parts (such as knobs, fasteners, seals, grommets and small electrical parts) that would not contribute significantly to the propagation of a fire.

f. **Deviations.** The Civil Aviation Safety Authority (CASA) has provisions for using alternative or equivalent means of compliance to the criteria set forth in the MPS of this ATSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation per the Civil Aviation Safety Regulation (CASR) 21.609.

4. **MARKING.** Articles manufactured under this ATSO must be marked in accordance with CASR 21.607(c). The following additional markings shall be applied:

a. **Environment.** The environmental categories over which it has been designed to operate, as set forth in Appendix A of RTCA/DO-160D, must be permanently and legibly marked on the equipment. Where an environmental test procedure is not applicable and the test is not conducted, an "X" should be placed in the space assigned for that category.

b. **Class.** The class, which the equipment meets, must be permanently and legibly marked on the equipment. Equipment that meets the requirements of more than one class need only be marked with the class that contains the more severe requirements. When listed in order of severity of requirements, highest first, the classes are 1A or 1B.

c. **Marking.** Each separate component of equipment (antenna, receiver-transmitter, etc.) must be permanently and legibly marked with at least the name of the manufacturer, the ATSO number and the environmental categories over which it is designed to operate.

5. **DATA REQUIREMENTS.**

a. **Application Data.** In addition to the data requirements of CASR 21.605(c) the manufacturer must provide the CASA with one copy of the following technical data:

(1) Manufacturer's operating instructions and equipment limitations. The descriptions of the limitations shall be sufficient to describe the operational capability of the equipment. In particular, operational or installation limitations resulting from specific deviations granted must be described in detail.

(2) Installation procedures and limitations. The descriptions of the limitations shall be sufficient to ensure that the transponder, when installed according to the installation procedures, continues to meet the requirements of this ATSO. The limitations shall identify any unique aspects of the installation. Finally, the limitations shall also include a note with the following statement:

The conditions and tests required for ATSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the ATSO standards. ATSO articles must have separate approval for installation in an aircraft.

(3) Schematic drawings, as applicable to the installation procedures.

(4) Wiring diagrams, as applicable to the installation procedures.

(5) List of the components, by part number, that make up the transponder system complying with the standards prescribed in this ATSO. Manufacturers should include vendor part number cross-references when applicable.

(6) Instructions, in the form of a Component Maintenance Manual (CMM) containing information on the periodic maintenance, calibration and repair for the continued airworthiness of installed transponder, including recommended inspection intervals and service life. Details of deviations granted, as noted in paragraph 5.a.(1) of this ATSO, may also be described in the CMM

(7) Material and process specifications list.

(8) The quality control system description required by CASR 21.605(2)(c) and CASR 21.143(a) including functional test specifications to be used to test each production article to ensure compliance with this ATSO.

(9) Manufacturer's ATSO qualification test report(s).

(10) Nameplate drawing providing the information required by paragraph 4 (Markings) of this ATSO.

(11) A list of all drawings and processes, including revision level, necessary to define the article's design. In the case of a minor change, any revisions to the drawing list need only be made available upon request.

(12) An environmental qualifications form as described in RTCA/DO-160D, or the most current version for each component of the system.

(13) Computer Software. If the article includes a digital computer, the software must be developed in accordance with RTCA Document DO-178B, "Software Considerations in Airborne Systems and Equipment Certification" dated 1 December 1992. In accordance with RTCA/DO-178B, the applicant must submit a Software Aspects of Certification Plan (PSAC) for review and approval.

Note: The CASA recommends that this plan be submitted as early as possible in the certification process. This will allow for early discussion and agreement between the applicant and the CASA on the software level or levels, the verification approach, and the documentation to be prepared and submitted.

b. **Manufacturer's Data**. In addition to the data to be directly furnished to the CASA, each manufacturer must have available for review by the CASA the following technical data:

(1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this ATSO.

(2) Equipment calibration procedures**.**

(3) Corrective maintenance procedures within 12 months after ATSO authorization.

(4) Schematic drawings.

(5) Wiring diagrams.

(6) Material and process specifications.

(7) The results of the environmental qualification tests conducted in accordance with RTCA/DO-160D or the most current version.

(8) If the article includes a digital computer, the appropriate documentation as defined in RTCA/DO-178B or the most current version, including all data supporting the applicable objectives found in Annex A of RTCA/DO-178B, Process Objectives and Outputs by Software Level or the most current version.

c. **Furnished data.**

(1) One copy of the technical data and information specified in paragraphs 5a through 6 of this ATSO and any other data or information necessary for the proper installation, certification and use and/or for continued airworthiness of the transponder, must accompany each article or multiple articles, if furnished to one source, i.e. operator, repair station etc., manufactured under this ATSO.

(2) If the appliance accomplishes any additional functions beyond that described in paragraph 3 of this ATSO, then a copy of the data and information specified in paragraphs 5a(11) through (13) must also go to each person receiving for use one or more articles manufactured under this ATSO.

6. AVAILABILITY OF REFERENCED DOCUMENTS.

a. Copies of the CASRs may be obtained from the CASA or from the CASA internet website at http://www.casa.gov.au.

b. Copies of RTCA Documents may be purchased from RTCA Inc., 1140 Connecticut Avenue, NW, Suite 1020, Washington, D.C. 20036. The RTCA Internet website is http://www.rtca.org/.

c. Copies of FAA Technical Standard Orders (TSOs) and Advisory Circulars (AC) may be obtained from the Federal Aviation Administration (FAA). The relevant FAA Internet website for these documents are:

http://av-info.faa.gov/tso/Technical%20Standard%20Order.htm and
http://www.faa.gov/RegulatoryAdvisory/ac_index.htm respectively.

APPENDIX 1. MINIMUM PERFORMANCE STANDARDS FOR AIRBORNE MODE A/C TRANSPONDER EQUIPMENT WITH EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) TRANSMISSION CAPABILITY

This Appendix prescribes the minimum performance standards (MPS) for airborne Mode A/C Transponder equipment with Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) transmission capability as specified by the CASA in this ATSO.

1. Minimum Performance Standards

Except as amended by this ATSO, all classes of equipment manufactured in accordance with the provisions of this ATSO must meet the requirements of:

a. FAA Technical Standard Order C74c (TSO-C74c), "Airborne ATC Transponder Equipment", dated 20 February 1973 or ATSO 1C74c dated 31 January 2001 or later approved versions. or

b. The sections of RTCA, Inc., Document No. RTCA/DO-181C, "Minimum Operational Performance Standards For Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment", dated 12 June 2001 or later approved version, applicable to a non-Mode S transponder device

Note: Non-Mode S transponder-based ADS-B implementations transmit Downlink Format=18 in lieu of Downlink Format=17. Refer to Subsection 2.2.16.2.6.3 of RTCA/DO-181C.

c. The sections of RTCA, Inc., Document No. RTCA/DO-260, "Minimum Operational Performance Standards For 1090 MHz Automatic Dependent Surveillance – Broadcast (ADS-B)", dated 13 September 2000 or later approved version, applicable to non-Mode S transponder-based subsystems, Stand-Alone Transmitters, and Broadcast-Only Systems. Broadcast-Only systems are defined as Class B Equipment in D0-260 – refer to Table 2-1.

d. Equipment complying with this ATSO is required to transmit only the messages listed below.

(1) Airborne Position

(2) Surface Position

(3) Aircraft Identification and Type

(4) Airborne Velocity, and

(5) Extended Squitter Aircraft Status

e. The Extended Squitter Aircraft Status Message (Type "28") is used to provide additional information regarding aircraft status. Subtype "1" is used specifically to provide Emergency/Priority Status. The special purpose Mode A reply codes 7500, 7600, and 7700 entered into the Transponder may be used to automatically determine the emergency status and enable formatting of the Extended Squitter Aircraft Status Message.

Note: Refer to Table 2-2 of RTCA/DO-260 for the full list of ADS-B Messages.

2. Exceptions

a. In lieu of the requirements in Subsection 2.2 d. of the FAA Standard for Airborne ATC Transponder Equipment in TSO-C74c, the reply characteristics apply over a received signal amplitude range between minimum triggering level and a level of –21 dbm. Refer also to Subsection (a) (2) (i) of TSO-C74c.

b. RTCA/DO-260 states if Horizontal Protection Limit (HPL) information is not available from the navigation data source, then the transmitting ADS-B subsystem shall use Horizontal Figure of Merit (HFOM), Vertical Figure of Merit (VFOM), and Altitude Type to determine the Type Code used in the Airborne Position Message in accordance with Table 2-11.

In lieu of this requirement, if HPL information is not available from the navigation data source, then the transmitting ADS-B subsystem shall use HFOM, VFOM, Altitude Type and Receiver Autonomous Integrity Monitoring (RAIM) availability and integrity alarms applicable to the Non-Precision Approach phase of flight, to determine the ADS-B Type Code.

c. RTCA/DO-260 Appendix A, Subsection A.5.4 is not consistent with DO-260 Subsection 2.2.3.3.2.1. Subsection 2.2.3.3.2.1 shall take precedence, i.e. at power-up initialisation the non-Mode S transponder device shall start operation in a mode in which it transmits no messages until sufficient data is available to initiate ADS-B extended squitter transmissions.

d. DO-181B was superseded by DO-181C on 12 June 2001. DO-181B is referenced in DO-260. References to DO-181B in DO-260 shall be replaced by the appropriate equivalent reference to DO-181C.

3. Equipment Classes

a. Equipment marked, in accordance with Section 4 of this document, as Class 1A must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes exceeding 15,000 feet or must be equipment intended for installation in aircraft that have a normal cruising speed in excess of 175 knots on a standard day.

b. Equipment marked, in accordance with Section 4 of this document, as Class 1B must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes not exceeding 15,000 feet.

4. Options

One or more of the following options may be incorporated in the transponder identified with this ATSO marking:

a. In lieu of providing a pilot interface for the input of own-vehicle Aircraft Identification, Flight Number, or Aircraft Registration for the ADS-B Aircraft Identification and Type Message, manufacturers may elect to provide the means by which the Aircraft Registration marking may be programmed into the transponder during installation. In this case the Aircraft Registration shall be broadcast in the Character Subfield of the ADS-B Aircraft Identification and Type Message. Refer to Subsections 2.2.3.2.5 and 2.2.5.1.11 of RTCA/DO-260.

b. Manufacturers may elect to incorporate Global Positioning System (GPS) equipment in the transponder to provide position, velocity, timing, and integrity data for the extended squitter ADS-B message. GPS equipment provided for this purpose must meet the requirements of either Specification G1 or G2 below.

(1) Specification G1

The GPS equipment must meet the requirements of Class Beta equipment defined in RTCA, Inc., Document No. RTCA/DO-229C, or later version, "Minimum Operational Performance Standards For Global Positioning System/Wide Area Augmentation System Airborne Equipment" dated 28 November 2001. The equipment functional classes are defined in Subsection 1.4.1.

The ability to process Wide Area Augmentation System (WAAS) signals is optional. However the GPS equipment must have Fault Detection and Exclusion capability (See Subsection 1.7.3 of RTCA/DO-229C).

Equipment incorporating this option shall be identified with the suffix "G1", eg Class 1A-G1.

(2) Specification G2

The GPS equipment must meet the requirements of Class A1 equipment defined in TSO-C129a, "Airborne Navigation Supplemental Equipment Using The Global Positioning System (GPS)" dated 20 February 1996 applicable to the provision of source data for the ADS-B message assembly function.

The GPS equipment must incorporate Fault Detection and Exclusion capability as defined in FAA Notice 8110.60 GPS As A Primary Means Of Navigation For Oceanic/Remote Operations.

The GPS receiver shall continuously output the RAIM integrity performance requirements applicable to the Non-Precision Approach phase of flight as detailed in Table 2.1 of RTCA/DO-208. These requirements are repeated in Table 1 following.

Equipment incorporating this option shall be identified with the suffix "G2", eg Class 1A-G2.

Table 1 – RAIM Integrity Performance Requirements

Phase of Flight	**Alarm Limit**	**Maximum Allowable Alarm Rate**	**Time to Alarm**	**Minimum Detection Probability**
RNAV Approach (Non-Precision)	0.3 nmi	0.002/hr	10 sec	0.999

Note: This information will be used by the ADS-B message assembly function to determine the Type Code of the transmitted message as defined in Table 2-11 of RTCA/DO-260.

ATSO-C1005

Effective
Date: 21/12/2004

Australian Technical Standard Order

Subject: Draft - AIRBORNE STAND-ALONE EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) TRANSMIT ONLY EQUIPMENT

1. **PURPOSE.** This Australian Technical Standard Order (ATSO) prescribes the minimum performance standards (MPS) which airborne stand-alone equipment with Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) transmit only equipment must meet in order to obtain an ATSO authorization or letter of design approval and so be identified with the applicable ATSO marking.

2. **APPLICABILITY.** This ATSO is effective for new applications submitted after the effective date of this ATSO.

3. **REQUIREMENTS.** New models of airborne stand-alone Extended Squitter ADS-B transmit only equipment that are to be so identified and that are manufactured on or after the effective date of this ATSO must meet the MPS specified in paragraphs 3,4 and 5 and Appendix 1.

a. **Functionality.** The standards of this ATSO apply to equipment intended to serve as ADS-B transmit only equipment that transmits ADS-B messages to support surveillance applications both in air traffic management systems and in other aircraft equipped to receive ADS-B messages.

b. **Failure Condition Classification.** Failure of the function defined in paragraph 3a of this ATSO has been determined to be a Major failure condition, and the applicant must ensure the system has a design assurance level commensurate with this failure condition classification.

Note: For a definition of failure condition categories refer to United States Federal Aviation Administration (FAA) Advisory Circular (AC), System Design and Analysis AC 25.1309-1A, Equipment, Systems and Installations in Part 23 Airplanes AC 23.1309-1C or *European Joint Airworthiness Authorities* (*JAA) Advisory Material Joint (AMJ), System Design and Analysis AMJ 25.1309 or later amendments*.

c. **Environmental Qualification.** The equipment shall be subject to the test conditions specified in RTCA Inc. Document No. RTCA/DO-160D, "Environmental Conditions and Test Procedures for Airborne Equipment", Change 3, dated 29 July 1997, or the most current version.

d. **Software Qualification.** Software must be developed in accordance with RTCA Inc. Document No. RTCA/DO-178B, “Software Considerations in Airborne Systems and Equipment Certification” dated 1 December 1992, or the most current version.

Software implementing the functions defined in this ATSO must be developed to Level C as defined in RTCA/DO-178B.

e. **Fire Protection.** All materials used shall be self-extinguishing except for small parts (such as knobs, fasteners, seals, grommets and small electrical parts) that would not contribute significantly to the propagation of a fire.

f. **Deviations.** The Civil Aviation Safety Authority (CASA) has provisions for using alternative

or equivalent means of compliance to the criteria set forth in the MPS of this ATSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation per the Civil Aviation Safety Regulation (CASR) 21.609.

4. **MARKING.** Articles manufactured under this ATSO must be marked in accordance with CASR 21.607(c). The following additional markings shall be applied:

a. **Environment.** The environmental categories over which it has been designed to operate, as set forth in Appendix A of RTCA/DO-160D, must be permanently and legibly marked on the equipment. Where an environmental test procedure is not applicable and the test is not conducted, an "X" should be placed in the space assigned for that category.

b. **Class.** The class that the equipment meets must be permanently and legibly marked on the equipment. Equipment that meets the requirements of more than one class need only be marked with the class that contains the more severe requirements. When listed in order of severity of requirements, highest first, the classes are 1A or 1B.

c. **Marking.** Each separate component of equipment (antenna, transmitter, etc.) must be permanently and legibly marked with at least the name of the manufacturer, the ATSO number and the environmental categories over which it is designed to operate.

5. **DATA REQUIREMENTS.**

a. **Application Data.** In addition to the data requirements of CASR 21.605(c) the

manufacturer must provide the CASA with one copy of the following technical data:

(1) Manufacturer's operating instructions and equipment limitations. The descriptions of the limitations shall be sufficient to describe the operational capability of the equipment. In particular, operational or installation limitations resulting from specific deviations granted must be described in detail.

(2) Installation procedures and limitations. The descriptions of the limitations shall be sufficient to ensure that the transponder, when installed according to the installation procedures, continues to meet the requirements of this ATSO. The limitations shall identify any unique aspects of the installation. Finally, the limitations shall also include a note with the following statement:

The conditions and tests required for ATSO approval of this article are minimum performance standards. It is the responsibility of the person installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the ATSO standards. ATSO articles must have separate approval for installation in an aircraft.

(3) Schematic drawings, as applicable to the installation procedures.

(4) Wiring diagrams, as applicable to the installation procedures.

(5) List of the components, by part number, that make up the system complying with the standards prescribed in this ATSO. Manufacturers should include vendor part number cross-references when applicable.

(6) Instructions, in the form of a Component Maintenance Manual (CMM) containing information on the periodic maintenance, calibration and repair for the continued airworthiness of installed equipment, including recommended inspection intervals and service life. Details of deviations granted, as noted in paragraph 5.a.(1) of this ATSO, may also be described in the CMM

(7) Material and process specifications list.

(8) The quality control system description required by CASR 21.605(2)(c) and CASR 21.143(a) including functional test specifications to be used to test each production article to ensure compliance with this ATSO.

(9) Manufacturer's ATSO qualification test report(s).

(10) Nameplate drawing providing the information required by paragraph 4 (Markings) of this ATSO.

(11) A list of all drawings and processes, including revision level, necessary to define the article's design. In the case of a minor change, any revisions to the drawing list need only be made available upon request.

(12) An environmental qualifications form as described in RTCA/DO-160D, or the most current version for each component of the system.

(13) Computer Software. If the article includes a digital computer, the software must be developed in accordance with RTCA Document DO-178B, "Software Considerations in Airborne Systems and Equipment Certification" dated 1 December 1992. In accordance with RTCA/DO-178B, the applicant must submit a Software Aspects of Certification Plan (PSAC) for review and approval.

Note: The CASA recommends that this plan be submitted as early as possible in the certification process. This will allow for early discussion and agreement between the applicant and the CASA on the software level or levels, the verification approach, and the documentation to be prepared and submitted.

b. **Manufacturer's Data**. In addition to the data to be directly furnished to the CASA, each manufacturer must have the following technical data available for review by the CASA:

(1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this ATSO.

(2) Equipment calibration procedures**.**

(3) Corrective maintenance procedures within 12 months after ATSO authorization.

(4) Schematic drawings.

(5) Wiring diagrams.

(6) Material and process specifications.

(7) The results of the environmental qualification tests conducted in accordance with RTCA/DO-160D or the most current version.

(8) If the article includes a digital computer, the appropriate documentation as defined in RTCA/DO-178B or the most current version, including all data supporting the applicable objectives found in Annex A of RTCA/DO-178B, Process Objectives and Outputs by Software Level or the most current version.

c. **Furnished data.**

(1) One copy of the technical data and information specified in paragraph 5 of this ATSO and any other data or information necessary for the proper installation, certification and use and/or for continued airworthiness of the equipment, must accompany each article or multiple articles, if furnished to one source, i.e. operator, repair station etc., manufactured under this ATSO.

(2) If the appliance accomplishes any additional functions beyond that described in paragraph 3 of this ATSO, then a copy of the data and information specified in paragraphs 5a(11) through (13) must also go to each person receiving for use one or more articles manufactured under this ATSO.

(3) One copy of an Interface Control Document describing the output of GPS positional data,

together with authorisation for this document to be released into the public domain. This document shall be in sufficient detail to allow the design of equipment to interface and use the GPS positional data and integrity data that is output.

6. AVAILABILITY OF REFERENCED DOCUMENTS.

a. Copies of the CASRs may be obtained from the CASA or from the CASA internet website at http://www.casa.gov.au.

b. Copies of RTCA Documents may be purchased from RTCA Inc., 1140 Connecticut Avenue, NW, Suite 1020, Washington, D.C. 20036. The RTCA Internet website is http://www.rtca.org/.

c. Copies of FAA Technical Standard Orders (TSOs) and Advisory Circulars (AC) may be obtained from the Federal Aviation Administration (FAA). The relevant FAA Internet website for these documents are:
http://av-info.faa.gov/tso/Technical%20Standard%20Order.htm and
http://www.faa.gov/RegulatoryAdvisory/ac_index.htm respectively.

APPENDIX 1. MINIMUM PERFORMANCE STANDARDS FOR AIRBORNE STAND-ALONE EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) TRANSMIT ONLY EQUIPMENT

This Appendix prescribes the minimum performance standards (MPS) for airborne stand-alone equipment with Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) transmit only capability as specified by the CASA in this ATSO.

1. Minimum Performance Standards

Except as amended by this ATSO, all classes of equipment manufactured in accordance with the provisions of this ATSO must meet the requirements of:

a. The sections of RTCA, Inc., Document No. RTCA/DO-260A, "Minimum Operational Performance Standards For 1090 MHz Automatic Dependent Surveillance – Broadcast (ADS-B)", dated 10 April 2003 or later approved version, applicable to non-Mode S transponder-based subsystems, Stand-Alone Transmitters, and Broadcast-Only Systems. Broadcast-Only systems are defined as Class B Equipment in D0-260A – refer to Table 2-1.

b. Equipment complying with this ATSO is required to transmit the messages listed below.

(1) Airborne Position,

(2) Surface Position,

(3) Aircraft Identification and Type,

(4) Airborne Velocity, and

(5) Aircraft Operational Status Message.

Note: Refer to Table 2-2 of RTCA/DO-260A for the full list of ADS-B Messages.

c. The equipment shall provide, on an external connection point, GPS positional and other data in accordance with paragraph 2.1.2.6 of DO-229C using an approved low cost interface such as RS232.

2. Exceptions

a. The minimum radio frequency (RF) peak output power for Class B0 and B1 equipment shall be 21.0 dBW (125W).

b. RTCA/DO-260A Appendix A, Subsection A.1.5.4 is not consistent with DO- 260A Subsection 2.2.3.3.2.1. Subsection 2.2.3.3.2.1 shall take precedence, i.e. at power-up initialisation the non-Mode S transponder device shall start operation in a mode in which it transmits no messages until sufficient data is available to initiate ADS-B extended squitter transmissions.

3. Equipment Classes

a. Equipment marked, in accordance with Section 4 of this document, as Class 1A must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes exceeding 15,000 feet or must be equipment intended for installation in aircraft that have a normal cruising speed in excess of 175 knots on a standard day.

b. Equipment marked, in accordance with Section 4 of this document, as Class 1B must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes not exceeding 15,000 feet.

4. Options

One or more of the following options may be incorporated in the equipment identified with this ATSO marking:

a. In lieu of providing a pilot interface for the input of own-vehicle Aircraft Identification, Flight Number, or Aircraft Registration for the ADS-B Aircraft Identification and Type Message, manufacturers may elect to provide the means by which the Aircraft Registration marking may be programmed into the transmitter during installation. In this case the Aircraft Registration shall be broadcast in the Character Subfield of the ADS-B Aircraft Identification and Type Message. Refer to Subsections 2.2.3.2.5 and 2.2.5.1.11 of RTCA/DO-260A.

b. Transmission of the Extended Squitter Aircraft Status Message (Type “28”) is optional. This Message is used to provide additional information regarding aircraft status. Subtype “1” is used specifically to provide Emergency/Priority Status. Manufacturers may elect to provide a pilot interface for the input of Emergency/Priority Status, which will then provide data for the transmission of the Extended Squitter Aircraft Status Message.

c. Manufacturers may elect to incorporate Global Positioning System (GPS) equipment in the transponder to provide position, velocity, timing, and integrity data for the extended squitter ADS-B message. GPS equipment provided for this purpose must meet the requirements of Specification G1.

(1) Specification G1

The GPS equipment must meet the requirements of Class B equipment defined in RTCA, Inc., Document No. RTCA/DO-229C, or later version, “Minimum Operational Performance Standards For Global Positioning System/Wide Area Augmentation System Airborne Equipment” dated 28 November 2001. The equipment functional classes are defined in Subsection 1.4.1.

The ability to process Wide Area Augmentation System (WAAS) signals is optional. However the GPS equipment must have Fault Detection and Exclusion capability (See Subsection 1.7.3 of RTCA/DO-229C).

Equipment incorporating this option shall be identified with the suffix “G1”, e.g. Class 1A-G1.

ATSO-C1004

Effective Date: 02/10/2003

Australian Technical Standard Order

Subject: AIRBORNE MODE A/C TRANSPONDER EQUIPMENT WITH EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) TRANSMISSION CAPABILITY

1. PURPOSE. This Australian Technical Standard Order (ATSO) prescribes the minimum performance standards (MPS) which airborne Mode A/C Transponder equipment with Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) transmission capability must meet in order to obtain an ATSO authorization or letter of design approval and so be identified with the applicable ATSO marking.

Note: This ATSO provides a standard to build a Mode A/C transponder with the additional ability to provide ADS-B capability. It is not intended to replace existing Mode A/C or Mode S transponder equipment or standards.

2. APPLICABILITY. This ATSO is effective for new applications submitted after the effective date of this ATSO.

3. REQUIREMENTS. New models of airborne Mode A/C Transponder equipment with Extended Squitter ADS-B transmission capability that are to be so identified and that are manufactured on or after the effective date of this ATSO must meet the MPS specified in this paragraphs 3,4 and 5 and in Appendix 1.

a. Functionality. The standards of this ATSO apply to equipment intended to serve as a Mode A/C Transponder that also transmits ADS-B messages to support surveillance applications both in air traffic management systems and in other aircraft equipped to receive ADS-B messages.

b. Failure Condition Classification. Failure of the function defined in paragraph 3a of this ATSO has been determined to be a Major failure condition, and the applicant must ensure the system has a design assurance level commensurate with this failure condition classification.

Note: For a definition of failure condition categories refer to United States Federal Aviation Administration (FAA) Advisory Circular (AC), System Design and Analysis AC 25.1309-1A, Equipment, Systems and Installations in Part 23 Airplanes AC 23.1309-1C or *European Joint Airworthiness Authorities* (*JAA) Advisory Material Joint (AMJ), System Design and Analysis AMJ 25.1309 or later amendments*.

c. Environmental Qualification. The equipment shall be subject to the test conditions specified in RTCA Inc. Document No. RTCA/DO-160D, "Environmental Conditions and Test Procedures for Airborne Equipment", Change 3, dated 29 July 1997, or the most current version.

d. **Software Qualification.** Software must be developed in accordance with RTCA Inc. Document No. RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification" dated 1 December 1992, or the most current version.

Software implementing the functions defined in this ATSO must be developed to Level C as defined in RTCA/DO-178B.

e. **Fire Protection.** All materials used shall be self-extinguishing except for small parts (such as knobs, fasteners, seals, grommets and small electrical parts) that would not contribute significantly to the propagation of a fire.

f. **Deviations.** The Civil Aviation Safety Authority (CASA) has provisions for using alternative or equivalent means of compliance to the criteria set forth in the MPS of this ATSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation per the Civil Aviation Safety Regulation (CASR) 21.609.

4. **MARKING.** Articles manufactured under this ATSO must be marked in accordance with CASR 21.607(c). The following additional markings shall be applied:

a. **Environment.** The environmental categories over which it has been designed to operate, as set forth in Appendix A of RTCA/DO-160D, must be permanently and legibly marked on the equipment. Where an environmental test procedure is not applicable and the test is not conducted, an "X" should be placed in the space assigned for that category.

b. **Class.** The class, which the equipment meets, must be permanently and legibly marked on the equipment. Equipment that meets the requirements of more than one class need only be marked with the class that contains the more severe requirements. When listed in order of severity of requirements, highest first, the classes are 1A or 1B.

c. **Marking.** Each separate component of equipment (antenna, receiver-transmitter, etc.) must be permanently and legibly marked with at least the name of the manufacturer, the ATSO number and the environmental categories over which it is designed to operate.

5. **DATA REQUIREMENTS.**

a. **Application Data.** In addition to the data requirements of CASR 21.605(c) the manufacturer must provide the CASA with one copy of the following technical data:

(1) Manufacturer's operating instructions and equipment limitations. The descriptions of the limitations shall be sufficient to describe the operational capability of the equipment. In particular, operational or installation limitations resulting from specific deviations granted must be described in detail.

(2) Installation procedures and limitations. The descriptions of the limitations shall be sufficient to ensure that the transponder, when installed according to the installation procedures, continues to meet the requirements of this ATSO. The limitations shall identify any unique aspects of the installation. Finally, the limitations shall also include a note with the following statement:

The conditions and tests required for ATSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or

within a specific type or class of aircraft to determine that the aircraft installation conditions are within the ATSO standards. ATSO articles must have separate approval for installation in an aircraft.

(3) Schematic drawings, as applicable to the installation procedures.

(4) Wiring diagrams, as applicable to the installation procedures.

(5) List of the components, by part number, that make up the transponder system complying with the standards prescribed in this ATSO. Manufacturers should include vendor part number cross-references when applicable.

(6) Instructions, in the form of a Component Maintenance Manual (CMM) containing information on the periodic maintenance, calibration and repair for the continued airworthiness of installed transponder, including recommended inspection intervals and service life. Details of deviations granted, as noted in paragraph 5.a.(1) of this ATSO, may also be described in the CMM

(7) Material and process specifications list.

(8) The quality control system description required by CASR 21.605(2)(c) and CASR 21.143(a) including functional test specifications to be used to test each production article to ensure compliance with this ATSO.

(9) Manufacturer's ATSO qualification test report(s).

(10) Nameplate drawing providing the information required by paragraph 4 (Markings) of this ATSO.

(11) A list of all drawings and processes, including revision level, necessary to define the article's design. In the case of a minor change, any revisions to the drawing list need only be made available upon request.

(12) An environmental qualifications form as described in RTCA/DO-160D, or the most current version for each component of the system.

(13) Computer Software. If the article includes a digital computer, the software must be developed in accordance with RTCA Document DO-178B, "Software Considerations in Airborne Systems and Equipment Certification" dated 1 December 1992. In accordance with RTCA/DO-178B, the applicant must submit a Software Aspects of Certification Plan (PSAC) for review and approval.

Note: The CASA recommends that this plan be submitted as early as possible in the certification process. This will allow for early discussion and agreement between the applicant and the CASA on the software level or levels, the verification approach, and the documentation to be prepared and submitted.

b. **Manufacturer's Data**. In addition to the data to be directly furnished to the CASA, each manufacturer must have available for review by the CASA the following technical data:

(1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this ATSO.

(2) Equipment calibration procedures**.**

(3) Corrective maintenance procedures within 12 months after ATSO authorization.

(4) Schematic drawings.

(5) Wiring diagrams.

(6) Material and process specifications.

(7) The results of the environmental qualification tests conducted in accordance with RTCA/DO-160D or the most current version.

(8) If the article includes a digital computer, the appropriate documentation as defined in RTCA/DO-178B or the most current version, including all data supporting the applicable objectives found in Annex A of RTCA/DO-178B, Process Objectives and Outputs by Software Level or the most current version.

c. **Furnished data.**

(1) One copy of the technical data and information specified in paragraphs 5a through 6 of this ATSO and any other data or information necessary for the proper installation, certification and use and/or for continued airworthiness of the transponder, must accompany each article or multiple articles, if furnished to one source, i.e. operator, repair station etc., manufactured under this ATSO.

(2) If the appliance accomplishes any additional functions beyond that described in paragraph 3 of this ATSO, then a copy of the data and information specified in paragraphs 5a(11) through (13) must also go to each person receiving for use one or more articles manufactured under this ATSO.

6. AVAILABILITY OF REFERENCED DOCUMENTS.

a. Copies of the CASRs may be obtained from the CASA or from the CASA internet website at http://www.casa.gov.au.

b. Copies of RTCA Documents may be purchased from RTCA Inc., 1140 Connecticut Avenue, NW, Suite 1020, Washington, D.C. 20036. The RTCA Internet website is http://www.rtca.org/.

c. Copies of FAA Technical Standard Orders (TSOs) and Advisory Circulars (AC) may be obtained from the Federal Aviation Administration (FAA). The relevant FAA Internet website for these documents are:

http://av-info.faa.gov/tso/Technical%20Standard%20Order.htm and
http://www.faa.gov/RegulatoryAdvisory/ac_index.htm respectively.

APPENDIX 1. MINIMUM PERFORMANCE STANDARDS FOR AIRBORNE MODE A/C TRANSPONDER EQUIPMENT WITH EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) TRANSMISSION CAPABILITY

This Appendix prescribes the minimum performance standards (MPS) for airborne Mode A/C Transponder equipment with Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) transmission capability as specified by the CASA in this ATSO.

1. Minimum Performance Standards

Except as amended by this ATSO, all classes of equipment manufactured in accordance with the provisions of this ATSO must meet the requirements of:

a. FAA Technical Standard Order C74c (TSO-C74c), "Airborne ATC Transponder Equipment", dated 20 February 1973 or ATSO 1C74c dated 31 January 2001 or later approved versions. or

b. The sections of RTCA, Inc., Document No. RTCA/DO-181C, "Minimum Operational Performance Standards For Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment", dated 12 June 2001 or later approved version, applicable to a non-Mode S transponder device

Note: Non-Mode S transponder-based ADS-B implementations transmit Downlink Format=18 in lieu of Downlink Format=17. Refer to Subsection 2.2.16.2.6.3 of RTCA/DO-181C.

c. The sections of RTCA, Inc., Document No. RTCA/DO-260, "Minimum Operational Performance Standards For 1090 MHz Automatic Dependent Surveillance – Broadcast (ADS-B)", dated 13 September 2000 or later approved version, applicable to non-Mode S transponder-based subsystems, Stand-Alone Transmitters, and Broadcast-Only Systems. Broadcast-Only systems are defined as Class B Equipment in D0-260 – refer to Table 2-1.

d. Equipment complying with this ATSO is required to transmit only the messages listed below.

(1) Airborne Position

(2) Surface Position

(3) Aircraft Identification and Type

(4) Airborne Velocity, and

(5) Extended Squitter Aircraft Status

e. The Extended Squitter Aircraft Status Message (Type "28") is used to provide additional information regarding aircraft status. Subtype "1" is used specifically to provide Emergency/Priority Status. The special purpose Mode A reply codes 7500, 7600, and 7700 entered into the Transponder may be used to automatically determine the emergency status and enable formatting of the Extended Squitter Aircraft Status Message.

Note: Refer to Table 2-2 of RTCA/DO-260 for the full list of ADS-B Messages.

2. Exceptions

a. In lieu of the requirements in Subsection 2.2 d. of the FAA Standard for Airborne ATC Transponder Equipment in TSO-C74c, the reply characteristics apply over a received signal amplitude range between minimum triggering level and a level of –21 dbm. Refer also to Subsection (a) (2) (i) of TSO-C74c.

b. RTCA/DO-260 states if Horizontal Protection Limit (HPL) information is not available from the navigation data source, then the transmitting ADS-B subsystem shall use Horizontal Figure of Merit (HFOM), Vertical Figure of Merit (VFOM), and Altitude Type to determine the Type Code used in the Airborne Position Message in accordance with Table 2-11.

In lieu of this requirement, if HPL information is not available from the navigation data source, then the transmitting ADS-B subsystem shall use HFOM, VFOM, Altitude Type and Receiver Autonomous Integrity Monitoring (RAIM) availability and integrity alarms applicable to the Non-Precision Approach phase of flight, to determine the ADS-B Type Code.

c. RTCA/DO-260 Appendix A, Subsection A.5.4 is not consistent with DO-260 Subsection 2.2.3.3.2.1. Subsection 2.2.3.3.2.1 shall take precedence, i.e. at power-up initialisation the non-Mode S transponder device shall start operation in a mode in which it transmits no messages until sufficient data is available to initiate ADS-B extended squitter transmissions.

d. DO-181B was superseded by DO-181C on 12 June 2001. DO-181B is referenced in DO-260. References to DO-181B in DO-260 shall be replaced by the appropriate equivalent reference to DO-181C.

3. Equipment Classes

a. Equipment marked, in accordance with Section 4 of this document, as Class 1A must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes exceeding 15,000 feet or must be equipment intended for installation in aircraft that have a normal cruising speed in excess of 175 knots on a standard day.

b. Equipment marked, in accordance with Section 4 of this document, as Class 1B must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes not exceeding 15,000 feet.

4. Options

One or more of the following options may be incorporated in the transponder identified with this ATSO marking:

a. In lieu of providing a pilot interface for the input of own-vehicle Aircraft Identification, Flight Number, or Aircraft Registration for the ADS-B Aircraft Identification and Type Message, manufacturers may elect to provide the means by which the Aircraft Registration marking may be programmed into the transponder during installation. In this case the Aircraft Registration shall be broadcast in the Character Subfield of the ADS-B Aircraft Identification and Type Message. Refer to Subsections 2.2.3.2.5 and 2.2.5.1.11 of RTCA/DO-260.

b. Manufacturers may elect to incorporate Global Positioning System (GPS) equipment in the transponder to provide position, velocity, timing, and integrity data for the extended squitter ADS-B message. GPS equipment provided for this purpose must meet the requirements of either Specification G1 or G2 below.

(1) Specification G1

The GPS equipment must meet the requirements of Class Beta equipment defined in RTCA, Inc., Document No. RTCA/DO-229C, or later version, "Minimum Operational Performance Standards For Global Positioning System/Wide Area Augmentation System Airborne Equipment" dated 28 November 2001. The equipment functional classes are defined in Subsection 1.4.1.

The ability to process Wide Area Augmentation System (WAAS) signals is optional. However the GPS equipment must have Fault Detection and Exclusion capability (See Subsection 1.7.3 of RTCA/DO-229C).

Equipment incorporating this option shall be identified with the suffix "G1", eg Class 1A-G1.

(2) Specification G2

The GPS equipment must meet the requirements of Class A1 equipment defined in TSO-C129a, "Airborne Navigation Supplemental Equipment Using The Global Positioning System (GPS)" dated 20 February 1996 applicable to the provision of source data for the ADS-B message assembly function.

The GPS equipment must incorporate Fault Detection and Exclusion capability as defined in FAA Notice 8110.60 GPS As A Primary Means Of Navigation For Oceanic/Remote Operations.

The GPS receiver shall continuously output the RAIM integrity performance requirements applicable to the Non-Precision Approach phase of flight as detailed in Table 2.1 of RTCA/DO-208. These requirements are repeated in Table 1 following.

Equipment incorporating this option shall be identified with the suffix "G2", eg Class 1A-G2.

Table 1 – RAIM Integrity Performance Requirements

Phase of Flight	**Alarm Limit**	**Maximum Allowable Alarm Rate**	**Time to Alarm**	**Minimum Detection Probability**
RNAV Approach (Non-Precision)	0.3 nmi	0.002/hr	10 sec	0.999

Note: This information will be used by the ADS-B message assembly function to determine the Type Code of the transmitted message as defined in Table 2-11 of RTCA/DO-260.

ATSO-C1005

Effective
Date: 21/12/2004

Australian Technical Standard Order

Subject: Draft - AIRBORNE STAND-ALONE EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) TRANSMIT ONLY EQUIPMENT

1. PURPOSE. This Australian Technical Standard Order (ATSO) prescribes the minimum performance standards (MPS) which airborne stand-alone equipment with Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) transmit only equipment must meet in order to obtain an ATSO authorization or letter of design approval and so be identified with the applicable ATSO marking.

2. APPLICABILITY. This ATSO is effective for new applications submitted after the effective date of this ATSO.

3. REQUIREMENTS. New models of airborne stand-alone Extended Squitter ADS-B transmit only equipment that are to be so identified and that are manufactured on or after the effective date of this ATSO must meet the MPS specified in paragraphs 3,4 and 5 and Appendix 1.

a. Functionality. The standards of this ATSO apply to equipment intended to serve as ADS-B transmit only equipment that transmits ADS-B messages to support surveillance applications both in air traffic management systems and in other aircraft equipped to receive ADS-B messages.

b. Failure Condition Classification. Failure of the function defined in paragraph 3a of this ATSO has been determined to be a Major failure condition, and the applicant must ensure the system has a design assurance level commensurate with this failure condition classification.

Note: For a definition of failure condition categories refer to United States Federal Aviation Administration (FAA) Advisory Circular (AC), System Design and Analysis AC 25.1309-1A, Equipment, Systems and Installations in Part 23 Airplanes AC 23.1309-1C or *European Joint Airworthiness Authorities* (*JAA) Advisory Material Joint (AMJ), System Design and Analysis AMJ 25.1309 or later amendments.*

c. Environmental Qualification. The equipment shall be subject to the test conditions specified in RTCA Inc. Document No. RTCA/DO-160D, "Environmental Conditions and Test Procedures for Airborne Equipment", Change 3, dated 29 July 1997, or the most current version.

d. **Software Qualification.** Software must be developed in accordance with RTCA Inc. Document No. RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification" dated 1 December 1992, or the most current version.

Software implementing the functions defined in this ATSO must be developed to Level C as defined in RTCA/DO-178B.

e. **Fire Protection.** All materials used shall be self-extinguishing except for small parts (such as knobs, fasteners, seals, grommets and small electrical parts) that would not contribute significantly to the propagation of a fire.

f. **Deviations.** The Civil Aviation Safety Authority (CASA) has provisions for using alternative or equivalent means of compliance to the criteria set forth in the MPS of this ATSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation per the Civil Aviation Safety Regulation (CASR) 21.609.

4. **MARKING.** Articles manufactured under this ATSO must be marked in accordance with CASR 21.607(c). The following additional markings shall be applied:

a. **Environment.** The environmental categories over which it has been designed to operate, as set forth in Appendix A of RTCA/DO-160D, must be permanently and legibly marked on the equipment. Where an environmental test procedure is not applicable and the test is not conducted, an "X" should be placed in the space assigned for that category.

b. **Class.** The class that the equipment meets must be permanently and legibly marked on the equipment. Equipment that meets the requirements of more than one class need only be marked with the class that contains the more severe requirements. When listed in order of severity of requirements, highest first, the classes are 1A or 1B.

c. **Marking.** Each separate component of equipment (antenna, transmitter, etc.) must be permanently and legibly marked with at least the name of the manufacturer, the ATSO number and the environmental categories over which it is designed to operate.

5. **DATA REQUIREMENTS.**

a. **Application Data.** In addition to the data requirements of CASR 21.605(c) the

manufacturer must provide the CASA with one copy of the following technical data:

(1) Manufacturer's operating instructions and equipment limitations. The descriptions of the limitations shall be sufficient to describe the operational capability of the equipment. In particular, operational or installation limitations resulting from specific deviations granted must be described in detail.

(2) Installation procedures and limitations. The descriptions of the limitations shall be sufficient to ensure that the transponder, when installed according to the installation procedures, continues to meet the requirements of this ATSO. The limitations shall identify any unique aspects of the installation. Finally, the limitations shall also include a note with the following statement:

The conditions and tests required for ATSO approval of this article are minimum performance standards. It is the responsibility of the person installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the ATSO standards. ATSO articles must have separate approval

for installation in an aircraft.

(3) Schematic drawings, as applicable to the installation procedures.

(4) Wiring diagrams, as applicable to the installation procedures.

(5) List of the components, by part number, that make up the system complying with the standards prescribed in this ATSO. Manufacturers should include vendor part number cross-references when applicable.

(6) Instructions, in the form of a Component Maintenance Manual (CMM) containing information on the periodic maintenance, calibration and repair for the continued airworthiness of installed equipment, including recommended inspection intervals and service life. Details of deviations granted, as noted in paragraph 5.a.(1) of this ATSO, may also be described in the CMM

(7) Material and process specifications list.

(8) The quality control system description required by CASR 21.605(2)(c) and CASR 21.143(a) including functional test specifications to be used to test each production article to ensure compliance with this ATSO.

(9) Manufacturer's ATSO qualification test report(s).

(10) Nameplate drawing providing the information required by paragraph 4 (Markings) of this ATSO.

(11) A list of all drawings and processes, including revision level, necessary to define the article's design. In the case of a minor change, any revisions to the drawing list need only be made available upon request.

(12) An environmental qualifications form as described in RTCA/DO-160D, or the most current version for each component of the system.

(13) Computer Software. If the article includes a digital computer, the software must be developed in accordance with RTCA Document DO-178B, "Software Considerations in Airborne Systems and Equipment Certification" dated 1 December 1992. In accordance with RTCA/DO-178B, the applicant must submit a Software Aspects of Certification Plan (PSAC) for review and approval.

Note: The CASA recommends that this plan be submitted as early as possible in the certification process. This will allow for early discussion and agreement between the applicant and the CASA on the software level or levels, the verification approach, and the documentation to be prepared and submitted.

b. **Manufacturer's Data.** In addition to the data to be directly furnished to the CASA, each manufacturer must have the following technical data available for review by the CASA:

(1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this ATSO.

(2) Equipment calibration procedures**.**

(3) Corrective maintenance procedures within 12 months after ATSO authorization.

(4) Schematic drawings.

(5) Wiring diagrams.

(6) Material and process specifications.

(7) The results of the environmental qualification tests conducted in accordance with RTCA/DO-160D or the most current version.

(8) If the article includes a digital computer, the appropriate documentation as defined in RTCA/DO-178B or the most current version, including all data supporting the applicable objectives found in Annex A of RTCA/DO-178B, Process Objectives and Outputs by Software Level or the most current version.

c. Furnished data.

(1) One copy of the technical data and information specified in paragraph 5 of this ATSO and any other data or information necessary for the proper installation, certification and use and/or for continued airworthiness of the equipment, must accompany each article or multiple articles, if furnished to one source, i.e. operator, repair station etc., manufactured under this ATSO.

(2) If the appliance accomplishes any additional functions beyond that described in paragraph 3 of this ATSO, then a copy of the data and information specified in paragraphs 5a(11) through (13) must also go to each person receiving for use one or more articles manufactured under this ATSO.

(3) One copy of an Interface Control Document describing the output of GPS positional data, together with authorisation for this document to be released into the public domain. This document shall be in sufficient detail to allow the design of equipment to interface and use the GPS positional data and integrity data that is output.

6. AVAILABILITY OF REFERENCED DOCUMENTS.

a. Copies of the CASRs may be obtained from the CASA or from the CASA internet website at http://www.casa.gov.au.

b. Copies of RTCA Documents may be purchased from RTCA Inc., 1140 Connecticut Avenue, NW, Suite 1020, Washington, D.C. 20036. The RTCA Internet website is http://www.rtca.org/.

c. Copies of FAA Technical Standard Orders (TSOs) and Advisory Circulars (AC) may be obtained from the Federal Aviation Administration (FAA). The relevant FAA Internet website for these documents are:
http://av-info.faa.gov/tso/Technical%20Standard%20Order.htm and
http://www.faa.gov/RegulatoryAdvisory/ac_index.htm respectively.

APPENDIX 1. MINIMUM PERFORMANCE STANDARDS FOR AIRBORNE STAND-ALONE EXTENDED SQUITTER AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) TRANSMIT ONLY EQUIPMENT

This Appendix prescribes the minimum performance standards (MPS) for airborne stand-alone equipment with Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) transmit only capability as specified by the CASA in this ATSO.

1. Minimum Performance Standards

Except as amended by this ATSO, all classes of equipment manufactured in accordance with the provisions of this ATSO must meet the requirements of:

a. The sections of RTCA, Inc., Document No. RTCA/DO-260A, "Minimum Operational Performance Standards For 1090 MHz Automatic Dependent Surveillance – Broadcast (ADS-B)", dated 10 April 2003 or later approved version, applicable to non-Mode S transponder-based subsystems, Stand-Alone Transmitters, and Broadcast-Only Systems. Broadcast-Only systems are defined as Class B Equipment in D0-260A – refer to Table 2-1.

b. Equipment complying with this ATSO is required to transmit the messages listed below.

(1) Airborne Position,

(2) Surface Position,

(3) Aircraft Identification and Type,

(4) Airborne Velocity, and

(5) Aircraft Operational Status Message.

Note: Refer to Table 2-2 of RTCA/DO-260A for the full list of ADS-B Messages.

c. The equipment shall provide, on an external connection point, GPS positional and other data in accordance with paragraph 2.1.2.6 of DO-229C using an approved low cost interface such as RS232.

2. Exceptions

a. The minimum radio frequency (RF) peak output power for Class B0 and B1 equipment shall be 21.0 dBW (125W).

b. RTCA/DO-260A Appendix A, Subsection A.1.5.4 is not consistent with DO-260A Subsection 2.2.3.3.2.1. Subsection 2.2.3.3.2.1 shall take precedence, i.e. at power-up initialisation the non-Mode S transponder device shall start operation in a mode in which it transmits no messages until sufficient data is available to initiate ADS-B extended squitter transmissions.

3. Equipment Classes

a. Equipment marked, in accordance with Section 4 of this document, as Class 1A must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes exceeding 15,000 feet or must be equipment intended for installation in aircraft that have a normal cruising speed in excess of 175 knots on a standard day.

b. Equipment marked, in accordance with Section 4 of this document, as Class

1B must meet all performance and environmental standards for equipment intended for installation in aircraft that operate at altitudes not exceeding 15,000 feet.

4. Options

One or more of the following options may be incorporated in the equipment identified with this ATSO marking:

a. In lieu of providing a pilot interface for the input of own-vehicle Aircraft Identification, Flight Number, or Aircraft Registration for the ADS-B Aircraft Identification and Type Message, manufacturers may elect to provide the means by which the Aircraft Registration marking may be programmed into the transmitter during installation. In this case the Aircraft Registration shall be broadcast in the Character Subfield of the ADS-B Aircraft Identification and Type Message. Refer to Subsections 2.2.3.2.5 and 2.2.5.1.11 of RTCA/DO-260A.

b. Transmission of the Extended Squitter Aircraft Status Message (Type "28") is optional. This Message is used to provide additional information regarding aircraft status. Subtype "1" is used specifically to provide Emergency/Priority Status. Manufacturers may elect to provide a pilot interface for the input of Emergency/Priority Status, which will then provide data for the transmission of the Extended Squitter Aircraft Status Message.

c. Manufacturers may elect to incorporate Global Positioning System (GPS) equipment in the transponder to provide position, velocity, timing, and integrity data for the extended squitter ADS-B message. GPS equipment provided for this purpose must meet the requirements of Specification G1.

(1) Specification G1

The GPS equipment must meet the requirements of Class B equipment defined in RTCA, Inc., Document No. RTCA/DO-229C, or later version, "Minimum Operational Performance Standards For Global Positioning System/Wide Area Augmentation System Airborne Equipment" dated 28 November 2001. The equipment functional classes are defined in Subsection 1.4.1.

The ability to process Wide Area Augmentation System (WAAS) signals is optional. However the GPS equipment must have Fault Detection and Exclusion capability (See Subsection 1.7.3 of RTCA/DO-229C).

Equipment incorporating this option shall be identified with the suffix "G1", e.g. Class 1A-G1.