

Notice of Requirement NTC 91.258

Automatic Dependent Surveillance-Broadcast (ADS-B) systems

Revision 2

Preliminary

The Director of Civil Aviation issues the following requirements (“the requirements”) relating to ADS-B systems under section 28(5) of the Civil Aviation Act 1990 and civil aviation rule (rule) 91.258.

Purpose

The purpose of this notice is to specify the requirements determined by the Director referred to in rule 91.258, regarding:

- the equipment for ADS-B systems comprising a 1090 MHz Mode S Extended Squitter transponder, a compatible GNSS position source and a barometric altitude pressure system;
- the performance standards for an ADS-B system;
- installation and approval of ADS-B system;
- the minimum message set elements that may be broadcast by ADS-B systems;

- any conditions relating to ADS-B OUT system or design change requirements or combinations of position source and transponder; and
- testing and power output.

General

Civil Aviation Authority (CAA) notices contain approvals and requirements including the detail about the approvals, standards, conditions, procedures and technical specifications that have been approved or determined by the Director under the civil aviation rules. These details must be complied with by parties to whom it applies. They apply in particular circumstances to particular aviation document holders as specified in the notice.

CAA notices are issued under the rules made according to section 28(5) of the Civil Aviation Act. This section permits the Minister of Transport to make ordinary rules, on any terms and conditions specified in the rules:

- to require or provide for a matter to be determined, or undertaken or approved by the Authority, the Director or another person; or
- to empower the Authority, Director, or another person to impose requirements or conditions as to the performance of any activity, including but not limited to any procedures to be followed.

Notices support a performance-based approach to regulation, and improve the flexibility and responsiveness of the rules. They may be used where performance-based regulation is the appropriate way to achieve the desired regulatory outcome, for example, in circumstances where new technological changes or challenges require more flexibility than prescribing requirements in the rules (and rule making may get quickly outdated), or where there is a need to respond to safety issues which the rules do not adequately deal with.

These requirements set out in this notice must be complied with.

Related Rules

Rules 91.255, 91.257, 91.257A

Rules 91.258, 91.258A

Effective Date

This CAA Notice comes into effect on [date].

Issue of CAA Notice

Signed by
Director of Civil Aviation

Date

Revision History

Versions	Amendment	Effective date
Revision 1	Original version	20 July 2018
Revision 2	Amendment 1	xx

Automatic Dependent Surveillance-Broadcast (ADS-B) systems

1. Application

These requirements apply to:

- (1) every operator of aircraft operating in transponder mandatory controlled airspace ~~within transponder mandatory airspace~~ above flight level 245 designated under Part 71 in the New Zealand FIR;
- (2) every installation of an ADS-B system referred to in rule 91.255;
- (3) every person operating an aircraft in transponder mandatory controlled airspace ~~within transponder mandatory airspace~~ below flight level 245 designated under Part 71 in the New Zealand FIR, if the aircraft has an ADS-B system already installed; and
- (4) any new installation of ADS-B system in aircraft in transponder mandatory controlled airspace ~~within transponder mandatory airspace~~ below flight level 245 designated under Part 71 in the New Zealand FIR.

2. Performance standards of ADS-B system and equipment

ADS-B transmission rate

- (a) An ADS-B system must transmit updates at least once every second.

ADS-B Position transmission latency

- (b) An ADS-B system must transmit the aircraft's geometric position no later than 2.0 seconds from the time of measurement of the position to the time of transmission.
- (c) Within the 2.0 second total latency allocation, a maximum of 0.6 seconds can be uncompensated latency. The ADS-B system must compensate for any latency above 0.6 seconds up to the maximum 2.0 seconds total by extrapolating the geometric position to the time of message transmission.

ADS-B system performance requirements

(d) Except as provided in paragraph (e), ADS-B systems must meet these minimum performance requirements set as at 5NM:

- (1) the NACp figure must be 5 or greater:
- (2) the NACv figure must be 1 or greater:
- (3) the NIC figure must be 5 or greater:
- (4) the SDA must be 2 or greater: and
- (5) the SIL for TSO-C166a must be 2 or greater:
- (6) the SIL for TSO-C166b must be 3 or greater:
- (7) any changes in NACp, NACv, SDA and SIL must be broadcast within (10) seconds:
- (8) changes in NIC must be broadcast within (12) seconds.

(e) An ADS-B transponder certificated to TSO-C166 must provide a NUC figure of 4 or greater.

ADS-B system standards

(f) The following performance standards meet the performance requirements for transponders and position sources specified in paragraph (d):

Transponder

- (1) TSO-C166 or demonstrate performance equivalent to that standard – Conditions: Allowed to operate in the New Zealand Flight FIR if fitted before 31 December 2018 and meets the performance requirements set out in clause 2(e); or
- (2) TSO-C166a or demonstrate performance equivalent to that standard – Conditions: Allowed to operate in the New Zealand FIR if fitted before 31 December 2018 and meets the performance requirements set out in clause 2(d); or

- (3) TSO-C166b or demonstrate performance equivalent to that standard and meets the performance requirements set out in clause 2(d).

Position Source

(g) The position source must be capable of Fault Detection and Exclusion (FDE) or equivalent capability by compliance with any of the following requirements:

Requirements

- (1) TSO-C129 or demonstrate performance equivalent to–
Conditions: Only with a letter of acceptance from OEM accepted by the Director for FDE; or
- (2) TSO-C145() or demonstrate performance equivalent to that standard; or
- (3) TSO-C146() or demonstrate performance equivalent to that standard; or
- (4) TSO-C196() or demonstrate performance equivalent to that standard; or
- (5) any position source approved by the Director, as used in a proven combination with a transponder providing a TSO-C166b compliant ADS-B system –
 - (i) as certified STC or approved modification; or
 - (ii) as an OEM recommended combination.

3. Power requirements

(a) A transponder that transmits ADS-B data that operates within controlled airspace designated under Part 71 within the New Zealand FIR must have an output power of ~~at least 125W~~ that meets the requirements of the appropriate class of equipment per TSO-C112() (DO-181()) and TSO-C166() (DO-260()) measured at the end of the coaxial cable where it connects to the antenna.

(b) Pursuant to ICAO Annex 10 volume IV –

- (1) output power is not to be less than 18.5 dBW (70 W) for aircraft not exceeding 15000 ft altitude or 175 kt true airspeed (TAS);
- (2) output power is not to be less than 21.0 dBW (125 W) for aircraft exceeding 15000 ft altitude or 175 kt true airspeed (TAS);
- (3) output power is not to be greater than 27.0 dBW (500 W).

Note: Class 1 and Class 2 transponders are often used in documentation to indicate these requirements. In TSO-C112 Class 1 refers to equipment with a minimum of 125 W output power at the antenna and Class 2 refers to equipment with a minimum of 70 W at the antenna.

4. ADS-B system approval requirements

- (a) The Director's approval for an ADS-B system is not required if an ADS-B system meets the performance requirements of clause 2(d) or 2(e) of this notice and the following criteria:
- (1) the transponder is TSO-C166b, or TSO C166 or TSO C166a if fitted before the commencement date of the rules; and
 - (2) the GNSS position source is –
 - (i) certified TSO-C145() or TSO-C146() or TSO-C196; or
 - (ii) approved by the Director for use in combination with a TSO-C112() transponder, producing a TSO-C166b compliant ADS-B system; and
 - (3) the combination of the transponder and position source is –
 - (i) a proven combination as a certified STC or approved modification; or
 - (ii) an OEM recommended combination; or
 - (iii) from the FAA approved combinations list as published on the FAA website; and
 - (4) the ADS-B system has been installed using Acceptable Technical Data as defined by Civil Aviation Rule Part 21 and the

appropriate modification documentation has been completed;
and

- (5) post installation testing proves that the ADS-B system meets the required accuracy parameters specified in this notice.

(b) ADS-B transponders must be installed by a Group 3 suitably rated Licensed Aircraft Maintenance Engineer holding a Radio category Group 3 or an equivalent authorised person in a maintenance organisation under Part 145.

(c) Approval of the Director regarding an ADS-B system referred to in this clause does not apply to the New Zealand Defence Force.

5. Minimum broadcast message element set for ADS-B Out

(d) The Director approves the ADS-B message set elements set out in Tables 1 and 2 and their use as mandatory (M) or optional (O) elements for TSO-C166, TSO-C166a and TSO-C166b transponders or any transponder demonstrating equivalent performance in the following aviation conditions:

Mandatory for airborne movements:

- (1) 1.3, 1.4, 1.5¹, 1.6, 1.7, 2.4, 2.5, 2.6, 2.7, 2.8, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, 2.17, 2.18, 2.19, 2.20, 2.21, 2.22, 2.23, 2.24, 2.25, 2.26

Mandatory for surface movements:

- (2) 1.6, 1.9, 2.0, 2.1, 2.2², 2.3², 2.9, 2.10

Optional for airborne and surface movements:

- (3) 1.1, 1.2, 1.7, 1.8, 2.13, 2.15, 2.16, 2.17, 2.18, 2.21

¹ Mandatory for DO-260A and DO-260B, optional with DO-260

² It is not required to provide both “Ground track” (2.2) and “Heading” (2.3) as long as one of the two is provided per the requirements of DO-260()

Table 1 – Message Set Elements for TSO – C166(b) Transponders (new or replacement) and compatible GNSS (Refer to F1)

			Mandatory (M)/Optional (O)/ (-) Not referenced
	Message Element	Meaning	DO-260B
1.1	ADS-B capability	Only the 1090 ADS-B In message (which indicates if the aircraft has the ability to receive 1090 ES ADS-B messages installed):	O
1.2	Airspeed	True airspeed or indicated airspeed. The airspeed source should be approved to output airspeed data	O
1.3	Barometric Pressure Altitude	This indicates the aircraft's barometric pressure altitude referenced to standard sea level pressure of 29.92 inches or 1013.2 hectopascals:	M
1.4	Call Sign Flight ID	This is the radiotelephony call sign assigned to an aircraft for voice communication purposes sometimes called "flight identification" or "flight ID". For general aviation aircraft it is normally the national registration number; for airline aircraft, it is usually the company identification and flight number; and for the military it is usually numbers and code words with special significance for the operation conducted.	M
1.5	Emergency Status	This alerts ATC that the aircraft is experiencing emergency conditions and indicates the type of emergency so the aircraft can take appropriate action. Applicable emergency codes are found in ICAO 12/07/15 Appendix A Annex 10 Volume 4, Surveillance Radar and Collision Avoidance Systems:	M
1.6	Emitter Category	This provides an indication of the aircraft's size and performance capabilities and are defined in TSO-C166b. It is designed to provide information on the wake turbulence that an aircraft produces:	M

1.7	Geometric Altitude	This is a measure of altitude provided by a satellite-based position service and is not affected by atmospheric pressure. It is only available with a GNSS position source:	OM
1.8	Geometric Vertical Accuracy (GVA)	This indicates the 95 percent accuracy of the reported vertical position (geometric altitude) within an associated allowance:	O
1.9	GNSS Antenna Offset and Position Offset Applied (POA) (DO-260B)	The GNSS antenna offset indicates the longitudinal distance between the most forward part of the aircraft and the GNSS antenna and the lateral distance between the longitudinal center line of the aircraft and the GNSS antenna:	M
2.0	Position Offset Applied (POA) (DO-260A)	Indicates antenna offset is applied, but no quantitative value)	-
2.01	Ground speed 'Movement'	This provides ATC with the aircraft's speed over the ground:	M
2.2	Ground Track Angle "Heading/Ground Track"	This is the direction of the horizontal velocity vector over the ground and must be transmitted while on the ground in order to complete velocity information:	M
2.23	Heading	This indicates the direction in which the nose of the aircraft is pointing and must be transmitted while on the ground to complete velocity information:	M
2.34	Horizontal Velocity "East/West Velocity" and "North/South Velocity"	This provides the rate at which an aircraft changes its horizontal position with a clearly stated direction and is expressed with north/south velocity and east/west velocity while airborne and a combination of ground speed, heading, ground track while on the ground:	M
2.45	ICAO 24-bit Address	This is a unique address assigned to an aircraft during the registration process and are defined blocks of addresses for countries or states worldwide. Additional information regarding the address can be found in ICAO Annex 10, Part 1, Volume	M

		III, appendix to Chapter 9 , a World-Wide Scheme for the Allocation, Assignment and Application of Aircraft Addresses:	
2.56	IFR Capability “ <i>IFR Capability Flag</i> ”	This parameter existed in TSO-C166a compliant equipment but was removed from TSO-C166b equipment:	
2.67	IDENT “ <i>IDENT Switch Active</i> ”	This is a flag manually set by the pilot at the request of ATC in ATCRBS, Mode S and ADS-B messages and highlights the aircraft on the controller’s screen:	M
2.78	Latitude and Longitude (<i>Airborne</i>) “ <i>Encoded Latitude</i> ” & “ <i>Encoded Longitude</i> ”	These are derived from the position source and provide a geometric based position)	M
2.89	Latitude and Longitude (<i>Surface</i>)	As above, in row 2.7	M
2.910	Length and Width of Aircraft	This provides ATC and other aircraft with quick reference to the aircraft’s dimensions while on the surface:	M
2.1011	Mode 3/A Code “ <i>Mode A (4060) Code</i> ”	This is a four digit number. Secondary surveillance radars and ADS-B will concurrently provide surveillance so the Mode 3/A code is included in the ADS-B message:	M
2.1112	Navigation Accuracy Category for Position (NACp)	The NACp specifies the accuracy of the aircraft’s horizontal position information (latitude and longitude) transmitted from the aircraft’s avionics. The ADS-B equipment derives a NACp value from the position source’s accuracy output such as the HFOM from the GNSS. The NACp specifies with 95 percent probability that the reported information is correct within an associated allowance:	M

2.123	Navigation Accuracy Category for Velocity (NACv)	The NACv is an estimate of the accuracy of the horizontal geometric velocity output.	M
2.134	Navigation Integrity Category (NIC)	The NIC parameter specifies a position integrity containment radius. NIC is reported so surveillance applications such as ATC or other aircraft may determine whether the reported geometric position has an acceptable level of integrity for the intended use. The NIC parameter is closely associated with the SIL. NIC values range from 0 to 11:	M
2.145	NIC Baro "Barometric Integrity Code (NICBARO)"	NIC Baro indicates if pressure altitude is provided by a single Gilham encoder or another altitude source. Because of the potential for an undetected error in the Gilham encoding, many Gilham installations are cross checked against a second altitude source. NIC Baro annotates the status of this cross-check:	M
2.156	Position	These parameters are derived from the position source and provide a geometric based position:	M
2.167	Receiving ATC Services (DO-260A)	This parameter is a bit set in the ADS-B system of an aircraft indicating that the Mode A code is not set to "1200". This parameter existed in TSO-C166a compliant equipment but was removed from TSO-C166b equipment:	-
2.178	Single Antenna Bit	This parameter indicates if the ADS-B equipment is transmitting through a single antenna:	M
2.189	Source Integrity Level (DO-260B) / Surveillance Integrity Level (DO-260A) (SIL)	The SIL field defines the probability of the reported horizontal position exceeding the radius of containment defined by the NIC, without alerting. -	M
2.1920	SIL Supp	The SIL Supp defines whether the reported SIL probability is based on a per-hour probability or a per-sample probability:	M

2.201	System Design Assurance (SDA)	The SDA parameter defines the failure condition that the ADS-B system is designed to support. The supported failure condition will indicate the probability of an ADS-B system malfunction causing false or misleading position information or position quality metrics to be transmitted:	M
2.242	TCAS Installed and Operational "TCAS Operational" (DO-260B)	This parameter indicates whether the aircraft is fitted with a TCAS II and if the TCAS II is turned on and operating in a mode that can generate resolution advisory alerts:	M
2.223	TCAS Traffic Status "TCAS/ACAS Resolution Advisory Active"	This parameter indicates if a TCAS II equipped aircraft is currently generating a TCAS resolution advisory:	M
2.234	Trajectory Change Report Capability	This information is permanently set to "zero" in TSO-C166b equipment. No installation interface is required.	M
2.245	Vertical Rate	The vertical rate is the barometric or geometric rate at which the aircraft is climbing or descending, measured in feet per minute. The vertical rate is typically generated by an air data computer or GNSs position source or equipment:	M
2.256	Version Number	The applicable TSO Minimum Operational Performance Standard level is communicated through the version number which is fixed at the time the ADS-B equipment is manufactured. Version 2 applies to ADS-B equipment that meets MOPS documents RTCA/DO-260B with corrigendum 1 or RTCA/DO-282B with corrigendum 1:	M

Table 2 – Message Set Elements for TSO-C166() or TSO-C166a Transponders – Existing (refer to F(2) and (3))

	Message Element	Meaning	Mandatory (M) / Optional (O) / (-) Not referenced	
			DO-260	DO-260A
1.1	ADS-B capability "1090ES IN"	Only the 1090 ADS-B In message (which indicates if the aircraft has the ability to receive 1090 ES ADS-B messages installed):	-	-
1.2	Airspeed	True airspeed or indicated airspeed. The airspeed source should be approved to output airspeed data	O	O
1.3	Barometric Pressure Altitude	This indicates the aircraft's barometric pressure altitude referenced to standard sea level pressure of 29.92 inches or 1013.2 hectopascals:	M	M
1.4	Call Sign Flight ID	This is the radiotelephony call sign assigned to an aircraft for voice communication purposes sometimes called "flight identification" or "flight ID". For general aviation aircraft it is normally the national registration number; for airline aircraft, it is usually the company identification and flight number; and for the military it is usually numbers and code words with special significance for the operation conducted.	M	M
1.5	Emergency Status	This alerts ATC that the aircraft is experiencing emergency conditions and indicates the type of emergency so the aircraft can take appropriate action. Applicable emergency codes are found in ICAO 12/07/15 AC 20-165B Appendix A Annex 10 Volume 4, Surveillance Radar and Collision Avoidance Systems:	O	M
1.6	Emitter Category	This provides an indication of the aircraft's size and performance capabilities and are defined in TSO-C166b. It is designed to provide information on the wake turbulence that an aircraft produces:	M	M

1.7	Geometric Altitude “GNSS Height Above the Ellipsoid”	This is a measure of altitude provided by a satellite-based position service and is not affected by atmospheric pressure. It is only available with a GNSS position source:	M	M
1.8	Geometric Vertical Accuracy (GVA)	This indicates the 95 percent accuracy of the reported vertical position (geometric altitude) within an associated allowance:	-	-
1.9	GNSS Antenna Offset (DO-260B)	The GNSS antenna offset indicates the longitudinal distance between the most forward part of the aircraft and the GNSS antenna and the lateral distance between the longitudinal center line of the aircraft and the GNSS antenna:	-	-
2.0	Position Offset Applied (POA) (DO-260A)	Indicates antenna offset is applied, but no quantitative value)	-	M
2.1	Ground Speed “Movement”	This provides ATC with the aircraft’s speed over the ground:	M	M for surface only
2.2	Ground Track Angle “Heading/ Ground Track”	This is the direction of the horizontal velocity vector over the ground and must be transmitted while on the ground in order to complete velocity information:	M for surface	M for surface only
2.3	Heading	This indicates the direction in which the nose of the aircraft is pointing and must be transmitted while on the ground to complete velocity information:	M	M
2.4	Horizontal Velocity “East/West Velocity” and “North/South Velocity”	This provides the rate at which an aircraft changes its horizontal position with a clearly stated direction and is expressed with north/south velocity and east/west velocity while airborne and a combination of ground speed, heading, ground track while on the ground:	M	M
2.5	ICAO 24-bit Address	This is a unique address assigned to an aircraft during the registration process and are defined blocks of addresses for countries or states worldwide. Additional information regarding the address can be found in ICAO Annex 10, Part 1, Volume III, appendix to Chapter 9 , a World-Wide Scheme for the Allocation,	M	M

		Assignment and Application of Aircraft Addresses:		
2.6	IFR Capability “ <i>IFR Capability Flag</i> ”	This parameter existed in TSO-C166a compliant equipment but was removed from TSO-C166b equipment:	M	M
2.7	IDENT “ <i>IDENT Switch Active</i> ”	This is a flag manually set by the pilot at the request of ATC in ATCRBS, Mode S and ADS-B messages and highlights the aircraft on the controller’s screen:	-	M
2.8	Latitude and Longitude <i>(Airborne)</i> “ <i>Encoded Latitude</i> ” & “ <i>Encoded Longitude</i> ”	These are derived from the position source and provide a geometric based position	M	M
2.9	Latitude and Longitude <i>(Surface)</i>	As above, in row 2.8	M	M
2.10	Length and Width of Aircraft	This provides ATC and other aircraft with quick reference to the aircraft’s dimensions while on the surface:	-	M for surface only
2.11 ³	Mode 3/A Code “ <i>Mode A (4060) Code</i> ”	This is a four digit number. Secondary surveillance radars and ADS-B will concurrently provide surveillance so the Mode 3/A code is included in the ADS-B message:	-	M
2.12	Navigation Accuracy Category for Position (NACp)	The NACp specifies the accuracy of the aircraft’s horizontal position information (latitude and longitude) transmitted from the aircraft’s avionics. The ADS-B equipment derives a NACp value from the position source’s accuracy output such as the HFOM ⁴ from the GNSS. The NACp specifies with 95 percent probability that the reported information is correct within an associated allowance:	-	M

³ M for DO 260 Change 1.

⁴ Acronym stands for Horizontal Figure of Merit.

2.13	Navigation Accuracy Category for Velocity (NACv)	The NACv is an estimate of the accuracy of the horizontal geometric velocity output.	M	M
2.14	Navigation Integrity Category (NIC)	The NIC parameter specifies a position integrity containment radius. NIC is reported so surveillance applications such as ATC or other aircraft may determine whether the reported geometric position has an acceptable level of integrity for the intended use. The NIC parameter is closely associated with the SIL. NIC values range from 0 to 11:	-	M
2.15	NIC Baro “ <i>Barometric Integrity Code (NICBARO)</i> ”	NIC Baro indicates if pressure altitude is provided by a single Gilham encoder or another altitude source. Because of the potential for an undetected error in the Gilham encoding, many Gilham installations are cross checked against a second altitude source. NIC Baro annotates the status of this cross-check.	-	M
2.16	Position	These parameters are derived from the position source and provide a geometric based position:	M	M
2.17	Receiving ATC Services	This parameter is a bit set in the ADS-B system of an aircraft indicating that the Mode A code is not set to “1200”. This parameter existed in TSO-C166a compliant equipment but was removed from TSO-C166b equipment:	-	M
2.18	Single Antenna Bit “ <i>Single Antenna</i> ”	This parameter indicates if the ADS-B equipment is transmitting through a single antenna:	M	M
2.19	Source Integrity Level (DO-260B) / Surveillance Integrity Level (DO-260A) (SIL)	The SIL field defines the probability of the reported horizontal position exceeding the radius of containment defined by the NIC, without alerting, assuming no avionics faults	-	M
2.20	SIL Supp	The SIL Supp defines whether the reported SIL probability is based on a per-hour probability or a per-sample probability:	-	-

2.21	System Design Assurance (SDA)	The SDA parameter defines the failure condition that the ADS-B system is designed to support. The supported failure condition will indicate the probability of an ADS-B system malfunction causing false or misleading position information or position quality metrics to be transmitted:	-	-
2.22	TCAS Installed and Operational "TCAS Operational" (DO-260B)	This parameter indicates whether the aircraft is fitted with a TCAS II and if the TCAS II is turned on and operating in a mode that can generate resolution advisory alerts:	M	M
2.23	TCAS Traffic Status "TCAS/ACAS Resolution Advisory Active"	This parameter indicates if a TCAS II equipped aircraft is currently generating a TCAS resolution advisory:	-	M
2.24	Trajectory Change Report Capability	This information is permanently set to "zero" in TSO-C166b equipment. No installation interface is required.	-	M
2.25	Vertical Rate	The vertical rate is the barometric or geometric rate at which the aircraft is climbing or descending, measured in feet per minute. The vertical rate is typically generated by an air data computer or GNSs position source or equipment:	M	M
2.26	Version Number	The applicable TSO Minimum Operational Performance Standard level is communicated through the version number which is fixed at the time the ADS-B equipment is manufactured.	-	M

END