Australian Government
Civil Aviation Safety Authority

SUMMARY OF PROPOSED CHANGE

New standards for Automatic Dependent Surveillance – Broadcast (ADS-B) equipment for VFR aircraft

Civil Aviation Order 20.18 (Aircraft equipment — basic operational requirements)

CASA 61/14 – Direction – use of ADS-B in foreign aircraft engaged in private operations

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Executive summary

Automatic Dependent Surveillance - Broadcast (ADS-B) enables aircraft to detect each other, as well as be seen on ATC surveillance systems. This detection capability can enhance pilot situation awareness and can be more effective than voice alerted see and avoid.

CASA sees value and a safety benefit if more VFR aircraft have ADS-B equipment. To encourage this, industry is being consulted on new technical standards aimed specifically for voluntary fitment in VFR aircraft. These new ADS-B equipment standards may not be suitable for ATC surveillance separation in controlled airspace, but will provide an enhanced situation awareness capability.

The new technical standards include 'portable' Electronic Conspicuity (EC) devices, self-contained Traffic Awareness Beacon System (TABS) devices, and the ability to integrate a TABS position source with a Mode S transponder. Also proposed is the ability for non-TSO transponder and ADS-B equipment to be used in a range of aircraft, including Light Sport Aircraft (LSA); experimental category aircraft; and certain balloons, gliders and other small aircraft.

Each of these options allow the aircraft to be seen by other aircraft equipped with ADS-B IN capability (such as a tablet device or fixed cockpit display). The overall aim is for IFR and VFR pilots to have enhanced awareness about other aircraft, particularly during operations in regional areas and non-controlled airspace.

There are no changes to the IFR ADS-B equipment standards.

Introduction

CASA is proposing to amend the standards and requirements for ADS-B) equipment used in aircraft operated under the visual flight rules (VFR) (VFR aircraft).

The proposal would expand the existing standards to permit the use of lower cost ADS-B equipment that could, on a voluntary basis, be used in VFR aircraft - primarily to enhance situation awareness and therefore improve flight safety.

Situation awareness, especially for VFR pilots is achieved through an effective visual scan to see, and avoid, other aircraft particularly when operating in non-controlled airspace. To enhance safety and improve situation awareness, procedures and systems are used to assist flight crew to detect other aircraft and take appropriate avoiding action. These include:

- voice alerting {traffic broadcasts from air traffic services (ATS)}, pilot-to-pilot communication, and
- electronic alerting.

Electronic alerting in Australia currently includes:

- aircraft collision avoidance system (ACAS) - despite ACAS being primarily an anti-collision safety net.
- custom air-to-air detection systems - for example Flight Alarm (FLARM): a collision avoidance system originally designed for gliders.
- custom electronic flight bag (EFB) applications – that broadcast and receive aircraft position information that shows relevant traffic information on the EFB display.

Compared to other forms of electronic alerting, ADS-B has great potential for enhancing situation awareness as the following benefits describe.

- Access to information from a large pool of aircraft already transmitting ADS-B position information.
- ADS-B uses a global non-proprietary transmission standard.
- ADS-B provides direct aircraft-to-aircraft information exchange (i.e. no intermediate processing necessary).
- With an extensive network of ground receiver stations already in place, ADS-B potentially enhances the provision of air traffic services across Australia - including directed traffic information, flight following, airspace access and provision of surveillance separation services.
- Through satellite and terrestrial ADS-B receivers, significantly enhanced search and rescue capability.

Of increasing relevance to aircraft separation is the growth and development of drones and urban mobility transport, which are likely to rely on electronic 'sense and avoid' surveillance capability systems to avoid conventionally piloted aircraft and other non-piloted aircraft. ADS-B is an enabler for such ‘sense-and-avoid’ capabilities.

ADS-B equipped aircraft can have a transmit capability and a receive capability. The transmit capability is referred to as ADS-B OUT. A system that is capable of detecting ADS-B transmissions from another aircraft is referred to as ADS-B IN. An aircraft that has ADS-B OUT capability enables other aircraft (equipped with ADS-B IN) and services (such as ATC) to be aware of the ADS-B OUT aircraft's position. Pilots of aircraft that have ADS-B IN capability can see information on a display that shows the position of aircraft that transmit ADS-B signals.

For Australian aircraft, ADS-B standards and requirements are specified in Civil Aviation Order (CAO) 20.18. The requirements for foreign-registered aircraft engaged in private operations in Australian airspace are specified in instrument CASA 61/14. The existing standards are designed to enable air traffic control (ATC) surveillance separation.

Since 2017, aircraft in Australia operating under the instrument flight rules (IFR aircraft) have been required to be ADS-B OUT equipped, according to standards in CAO 20.18. This means many Australian aircraft are already transmitting ADS-B position messages that are potentially useable for enhancing situation awareness. VFR aircraft may fit ADS-B OUT equipment that meets CAO 20.18 standards, though there is no compulsion to do so.

The uptake of ADS-B OUT equipped VFR aircraft is low. Responses to a 2018 CASA survey revealed only 126 out of 879 VFR aircraft of all types were reported as fitted with ADS-B OUT equipment.

Cost is understood to be a significant factor in the decision to fit ADS-B equipment in a VFR aircraft. This was identified by respondents to Discussion Paper (DP) 1701 AS – *Voluntary fitment of ADS-B technology in VFR aircraft* – published on the Consultation Hub 15 December 2017 - 23 February 2018.

The aim of this proposal is to address the cost factor and thereby encourage voluntary fitment of ADS-B technology within the VFR community by specifying additional technical standards for ADS-B equipment. These standards would allow:

- for certain types of aircraft, ADS-B equipment that is technically compliant with, but not formally authorised, to the relevant standard (in this document - 'non-TSO' equipment)
- for VFR operations in non-controlled airspace, equipment of a standard suitable for situation awareness and not necessarily suitable for ATC surveillance and separation.

CASA is also conducting a project to introduce Part 43 of the Civil Aviation Safety Regulations 1998 (CASR). This Part would include methods to reduce the maintenance costs of general aviation aircraft and, in some situations, reduce the cost of installing aircraft equipment such as ADS-B.

These two measures would support an increased level of ADS-B OUT fitment in VFR aircraft, and thereby maximise the potential of ADS-B technology to enhance aviation safety, by enhancing situation awareness especially in regional areas and in non-controlled airspace.

Purpose and scope of the proposed amendments

ADS-B for VFR aircraft remains voluntary

The fitment of ADS-B equipment for VFR aircraft would be voluntary. There is no intention to mandate ADS-B in VFR aircraft.

General

The proposed amendments are intended to:

- for VFR aircraft — add ADS-B OUT technical standards to the existing ADS-B standards;
  Together, the existing and proposed technical standards represent the entire range of globally available 1090MHz ADS-B standards
- for operators of light sport aircraft (LSA), aircraft with an experimental certificate and aircraft to which certain '95-series' Civil Aviation Orders apply — 'Fast-track' the future standards in Part 91 of CASR allowing transponder or ADS-B equipment meeting an appropriate technical standard, but without having formal authorisation (**non-TSO** equipment).

Summary of proposed ADS-B capability for VFR aircraft

The following table summarises existing and proposed ADS-B equipment standards for use in aircraft, in which airspace it can be used, and any associated requirements or restrictions.

What	Who	Where useable	Requirements	Notes
Existing Std CAO 20.18 (IFR) standard	Any IFR or VFR aircraft	Any class of airspace		Enables air-to-air surveillance and ATC surveillance separation services. Operation in Class A airspace would require special permission.

What	Who	Where useable	Requirements	Notes
Proposed Std (a) Mode S transponder with Class B Traffic Awareness Beacon System (TABS) position source. (b) Equipment transmits SIL[1] = 1.	A VFR aircraft to which all of the following applies: (a) The aircraft has a maximum certificated take-off weight of no more than 5 700kg. (b) The aircraft has a maximum cruising speed not exceeding 250kt. (c) The aircraft is not used for RPT or charter operations.	Class C (radar surveillance), D, E & G airspace		Operation in radar Class C airspace allowed by virtue of the Mode S transponder. The ADS-B transmission will be suitable only for air-to-air situation awareness and ATC situation awareness.
Proposed Std (a) Mode S transponder with Class B TABS position source. (b) Equipment eligible for and transmits SIL ≥ 2.		Class C, D, E & G airspace		The combination of Mode S transponder and higher integrity GNSS position. source makes the aircraft eligible for ATS surveillance separation based on ADS-B or SSR/radar.
Proposed Std Integrated TABS device that includes integrated Class A TABS and Class B TABS functionality		Class D, E & G airspace	Cannot substitute for a transponder where one is required for access to Class A, B, or C airspace.	May be used instead of a Mode A/C or S transponder for operations in Class E airspace. An integrated TABS device enables air-to-air situation awareness and possibly ATC situation awareness and is visible to ACAS.
Proposed Std Electronic Conspicuity (EC) transmitting device	Any VFR aircraft	Class D, E & G airspace	For operations in Class E airspace, or Class G airspace above 10,000ft — the aircraft must also be equipped with a Mode A/C or Mode S Transponder.	An EC device cannot substitute for a transponder where one is required for access to Class A, B, or C airspace. An EC device cannot be operated simultaneously with a Mode S transponder outputting ADS-B. An EC device enables

[1] SIL means Surveillance or Source Integrity Limit (the specific variant depending on the referenced technical standard) and is a numeric value between 0 and 3 that indicates the position source's probability of exceeding the reported integrity value. It is one of the messages transmitted by a modern ADS-B transmitting equipment. SIL is a static (unchanging) value, normally specified by the equipment manufacturer and normally set by the installer at the time of equipment installation.

What	Who	Where useable	Requirements	Notes
				air-to-air situation awareness and possibly ATC situation awareness.

Annexes to this SPC provide detailed explanations of each proposed standard and the associated operating requirements or restrictions. They are:

- Annex A — Draft 'Civil Aviation Order 20.18 Amendment Instrument 2019 (No. 1)'
- Annex B — Tabular comparison between the current Mode S transponder and ADS-B requirements and proposed changes within CAO 20.18
- Annex C — Table describing usage scenarios for different ADS-B options
- Annex D — Table comparing technical and performance differences between the various ADS-B options

The annexes are available on the CASA Consultation Hub.

Proposal allowing technically capable, but not formally authorised transponder and ADS-B equipment in certain aircraft

CASA proposes to "fast-track" the implementation of Part 91 Manual of Standards (MOS) section 30.88 standards for LSA and aircraft with an experimental certificate. These standards would allow the use of non-TSO, but otherwise technically compliant, transponder and ADS-B equipment.

Fast-track access to these standards would enable eligible aircraft operators to access a variety of relevant transponder and ADS-B equipment useable in other parts of the world, but currently not useable in Australia.

Further, CASA proposes to expand the eligibility criteria to include:

- aircraft with an experimental certificate issued under regulation 21.190 of CASR (aircraft accepted under an ABAA)
- aircraft to which certain '95-series' Civil Aviation Orders apply.

Consistent with practice in other countries, CASA also proposes that users of non-TSO transponder and ADS-B equipment would be required to have a certifying statement of conformance (however described) from the equipment manufacturer showing that the equipment has a performance equivalent to authorised equipment of the same kind or purpose. The aim of this requirement is to assure users, installers and CASA that the equipment is fit for purpose.

Eligibility for use

Under the fast-track implementation proposal, non-TSO transponder and ADS-B equipment would be useable in:

- an LSA for which a special certificate of airworthiness has been issued and is in force under regulation 21.186 of CASR

- an LSA for which an experimental certificate has been issued and is in force under paragraph 21.191 (j) or (k) of CASR
- any other aircraft for which an experimental certificate has been issued and is in force under paragraph 21.191 (g) or (h) of CASR
- an aircraft for which an experimental certificate has been issued and is in force under subregulation 21.190 (1) of CASR (*amateur-built category aircraft accepted under an ABAA*)
- an aircraft that is:
  - a power-assisted sailplane, or a powered sailplane, or a sailplane, to which Civil Aviation Order (CAO) 95.4 applies
  - a glider engaged in charter operations, to which CAO 95.4.1 applies
  - a hang-glider to which CAO 95.8 applies
  - a low-momentum ultralight aeroplane to which CAO 95.10 applies
  - a gyroplane having an empty weight not in excess of 250 kg to which CAO 95.12 applies
  - a 2 place gyroplane, or a single-place gyroplane, certificated as a light sport aircraft to which CAO 95.12.1 applies
  - a weight shift controlled aeroplane, or a powered parachute, to which CAO 95.32 applies
  - a manned balloon, or a hot air airship, engaged in private operations, to which CAO 95.54 applies
  - an ultralight aeroplane to which CAO 95.55 applies.

Airspace where non-TSO equipment would be useable

Non-TSO equipment would be useable wherever equivalent, but authorised transponder or ADS-B equipment is permitted.

Having a formally authorised or non-TSO transponder or ADS-B equipment would not overcome or override any other requirements for access to controlled airspace. For example, there would be no change to the requirement for a Controlled Airspace Endorsement if the holder of a Recreational Pilot Licence wishes to enter or operate in controlled airspace.

Is non-TSO equipment ADS-B equipment available?

There is a range of non-TSO ADS-B equipment available on the market.

Proposed amendments do not deal with installation matters

In this consultation, CASA is not proposing changes to the requirements for equipment installation in type-certified aircraft. This matter would be addressed in due course under CASA's Part 43 project. For further information, please visit the project website at https://www.casa.gov.au/standard-page/casr-part-43-maintenance-aircraft-private-and-aerial-work-operations

Proposed amendments would not alter existing Mode S transponder fitment requirements

CASA is not proposing any changes to existing CAO 20.18 requirements to install a Mode S transponder in new aircraft or when an existing Mode A/C transponder needs to be replaced.

In specific circumstances, Section 9E of CAO 20.18 requires all aircraft (IFR and VFR), to carry a serviceable, ADS-B compatible, Mode S transponder.

There are a number of minor changes to section 9E (Carriage of Mode S transponder equipment) of CAO 20.81. These are only to recognise the additional ADS-B standard for a Mode S transponder fitted with a TABS position source, and a house-keeping amendment to remove reference to an implementation date which has now passed.

IFR Mode S and ADS-B standards to remain applicable for VFR in certain circumstances

CASA proposes to retain the existing CAO 20.18 standards for the following circumstances:

- For all IFR aircraft
- For VFR aircraft operations above FL 290

House-keeping updates to the existing IFR ADS-B standards

Several house-keeping updates are proposed to the existing standards for ADS-B equipment detailed in Section 9B and Appendix XI of CAO 20.18. In particular, to remove references to implementation dates which have now passed, to detail additional ways for ADS-B equipment to flag transmissions as not meeting appropriate standards, and to reference the latest overseas standards for ADS-B OUT as being suitable for use in Australia. For the latter, the intention is for aircraft fitted with equipment meeting mandated United States and European standards for ADS-B OUT to be taken as meeting Australian requirements.

Complementary amendments to other Civil Aviation Orders and directions pertaining to ADS-B

CAO 20.18 applies only to Australian registered aircraft. To make the Australian ADS-B requirements apply to foreign registered aircraft engaged in private operations, CASA issued directions and requirements equivalent to CAO 20.18 within instrument CASA 61/14. Requirements for foreign registered aircraft in other classes of operation are reflected in the CAO 82-series.

The proposal is to update instrument CASA 61/14 to reflect the amendments that are finally adopted within CAO 20.18. CASA is not proposing to update the ADS-B requirements in the CAO 82-series as the proposed VFR ADS-B standards would not apply to the aircraft operated under these CAOs. The revised CAO 20.18 standards, including adopted VFR ADS-B standards, would be incorporated in Part 91 of CASR and any other relevant CASRs that replace the CAOs.

Update to the general Direction to carry a transponder in a VFR aircraft

Instrument CASA 316/98 sets the requirement for an aircraft to carry a Mode A/C transponder for VFR operations:

- within Radar coverage within Class A, B or C airspaces
  or
- when the aircraft is capable of powering a transponder (for operations in Class E airspace.)

This instrument is out-of-date and does not reflect contemporary requirements. It does not account for a more recent requirement within CAO 20.18 for:

- a Mode S transponder, in certain circumstances to be fitted instead of a Mode A/C transponder,
  or
- ADS-B transmitting equipment to be fitted for any operation at or above FL290.

The instrument also does not reflect the longstanding (at least since 2003) practice requiring aircraft capable of powering a transponder to be fitted with a transponder when operating at or above 10 000 ft AMSL in Class G airspace. The practice is reflected as a general Mode S transponder requirement within CAO 20.18.

Importantly, instrument CASA 316/98 inhibits the proposal to allow an integrated TABS device to be used in lieu of a transponder within Class E and Class G airspace.

To address these issues, CASA proposes to incorporate the provisions of instrument CASA 316/98 as a new Section 9BA in CAO 20.18, but with amendments to address the issues mentioned above.

ADS-B IN

This SPC focusses on standards for ADS-B OUT, as this component of an ADS-B OUT/IN system is the most critical in terms of ensuring compatibility and reducing the possibility of interference or unacceptable performance.

Another essential component of the air-to-air 'system' is being able to detect ADS-B transmissions from other aircraft - generally referred to as 'ADS-B IN'. ADS-B IN capability can be achieved in several ways:

- A Mode S transponder with integrated ADS-B OUT and ADS-B IN capability.
- A specific ADS-B IN component permanently installed in the aircraft.
- A portable ADS-B IN device mounted (in some way) on the aircraft.

An ADS-B IN receiver normally requires a suitable display of traffic information. This display may be part of an aircraft's Electronic Flight Instrument System (EFIS) or a separate tablet computer running an ADS-B traffic display application.

There is no intention to mandate ADS-B IN. Any suitable and 1090MHz-compatible ADS-B IN equipment will be useable in Australia. For example, equipment meeting the (E)TSO-C195a, RTCA/DO-317A or EUROCAE ED-194 would be appropriate for ADS-B IN capability equipment that is permanently installed in a type-certified aircraft.

CASA encourages aircraft owners and owners wanting to gain the full benefits of ADS-B technology to install a suitable ADS-B IN capability.

Previous consultations

Discussion Paper 1701AS

CASA published a discussion paper (DP) 1701AS — Voluntary fitment of ADS-B technology in VFR aircraft — on the CASA Consultation Hub from 15 December 2017 to 23 February 2018.

The DP discussed potential options for increasing the voluntary fitment rate of ADS-B across Australia's fleet of aircraft that operate under the VFR. The options included:

- reducing the cost of installing equipment
- allowing equipment that meets technical standards but without formal authorisation
- allowing equipment meeting a lower cost Traffic Awareness Beacon System (TABS) technical standard
- developing Australian Technical Standards Orders for lower cost ADS-B equipment.

CASA received a total of 80 submissions from pilots, aircraft owners, flying associations, maintenance organisations, and an air traffic service provider. 61 respondents consented to have their comments published on the CASA website. Nearly half the respondents (48%) said the proposals were a positive incentive to install ADS-B equipment in their aircraft. Seventy-three percent said that 1090MHz ADS-B equipment (vs other types of ADS-B equipment - e.g. UAT) would be the appropriate technology for fitment in VFR aircraft. Seventy-eight percent agreed that the proposal would be an appropriate cost saving measure.

Based on the positive feedback, CASA informed industry on 20 September 2018 through the Summary of Consultation that it intended to proceed with formal rule making.

Part 91 of CASR – where it applies to aircraft transponders and surveillance equipment

In mid-2018, CASA consulted on the provisions allowing non-TSO, but functionally equivalent, transponder and surveillance equipment in LSA and aircraft with an experimental certificate.

This matter was part of the broad consultation on proposed Part 91 of CASR and the Part 91 MOS for general operating and flight rules. Specifically, section 30.88 of the consulted MOS covered the transponder and surveillance equipment provisions for LSA and aircraft with an experimental certificate.

At the conclusion of consultation, CASA announced that it would make Part 91 of CASR and the MOS, with a commencement date of March 2021.

Impact on industry

CASA considers the proposals will have a positive impact on flight safety - specifically because the technology can enhance situation awareness in flight.

Flight crew must maintain vigilance to see and avoid other aircraft, particularly when operating in non-controlled airspace and on a Common Traffic Advisory Frequency Area (CTAF). ‘See and avoid’ is most effective when flight crew have warning of a potential conflict and know exactly where to look. This is where surveillance technology like ADS-B together with a suitable traffic display or aural warning system can be beneficial.

The success of surveillance technology is directly dependent on the number of participating aircraft. The more aircraft participating actively transmitting their position the more effective the system and resulting safety benefits. Current CASA regulations only allow VFR aircraft to use ADS-B equipment suitable for ATC separation (that is, CAO 20.18 compliant). This excludes a range of lower cost equipment that can provide accurate position information, but without the integrity level or output power required for provision of ATC separation.

The proposals in this SPC aim to introduce technical standards that permit lower cost ADS-B equipment to be utilised by VFR aircraft in non-controlled airspace.

Apart from enhancing pilot-to-pilot situation awareness, increased use of ADS-B OUT equipment in VFR aircraft will have a positive benefit to safety because it enhances the provision of ATS to both VFR and IFR aircraft. Across Australia, there is an extensive network of ADS-B receiver stations connected to the ATS surveillance system. The coverage of this network far exceeds the coverage of the conventional SSR/Radar network. This means VFR aircraft fitted with ADS-B transmitting equipment would be more readily detectable by ATS than if only fitted with a transponder. The benefits of greater adoption of ADS-B technology in VFR aircraft include:

- opportunity for flight following services over a broader area of Australian airspace than is currently possible
- potential for enhanced search and rescue response through precise location detection via both ground and satellite-based ADS-B receiver networks
- better situation awareness for ATS in their provision of traffic information services to IFR aircraft
- potential opportunity for enabling automated safety net alerting such as automated alerting when an aircraft is likely to penetrate controlled airspace without clearance, or deviate into a danger area or restricted area
- facilitating clearance into controlled airspace because the controller has better awareness of the relative positions of aircraft.

Increased use of ADS-B transmitting equipment in VFR aircraft also has the benefit of making these aircraft detectable by UAVs or RPAS, which are increasingly being fitted with ADS-B sense-and-avoid capability.

While potentially of lower cost, the additional equipment options have inherent limitations. In addition to having lower data integrity, Electronic Conspicuity (EC) devices and integrated Traffic Awareness Beacon System (TABS) devices transmit at power levels significantly less than is required for a normal transponder (maximum 40-70 watts vs minimum 125 watts). This means EC and integrated TABS devices are detectable at shorter ranges than a standard ATC transponder and are affected by airframe shielding as well as other propagation limitations. The impact is that EC and TABS devices, while useful for short range air-air applications or ATC situation awareness, may not provide the continuity of detection necessary for ATC separation services. This means an EC or integrated TABS device cannot replace a transponder-based system for operations in airspace where ATC provides surveillance separation to VFR aircraft (e.g. Class C airspace).

Unlike the previous standards which limited an operator's purchasing options to fully certified IFR capable avionics (lowest end around A$5,000.00 plus installation), the proposed standards allow options starting at portable EC devices costing around A$1,000.00.

To reiterate, the proposed equipment standards are solely aimed at voluntary adoption. There is no intention to impose any obligation on the operators of VFR aircraft to install ADS-B equipment. Operators are free to make choices based on personal perception of the safety benefits of being electronically visible to other airspace users.

Safety risk analysis

A CASA and Airservices assessment has found there are no significant risks to the ATM system arising from the use of low cost, ADS-B situation awareness equipment in Australian Classes D, E and G airspace. On the contrary, the proposals are expected to improve safety thus reducing safety risk in certain areas. The risk of not implementing this proposal should be taken into consideration.

Regulation impact statement

The introduction of ADS-B standards for VFR aircraft would introduce flexibility for the types of equipment that would be installed in VFR aircraft. It is likely to provide a benefit to VFR aircraft owners and operators and there would be no negative impact as the fitment of such equipment would be voluntary. CASA would submit a preliminary impact assessment to the Office of Best Practice Regulation and expects that a Regulation Impact Statement would not be required because no negative impact is anticipated from the introduction of the standards for the voluntary fitment ADS-B to VFR aircraft.

Closing date for comment

CASA will consider all comments received as part of this consultation process and incorporate changes as appropriate. Comments on the draft new technical standards should be submitted through the online response form by close of business 13 March 2020.

Appendix A

Detailed technical standards and requirements for VFR ADS-B equipment

A.1 New Standard: Mode S transponder with Class B TABS position source device

CASA proposes to allow a Mode S transponder connected to a Class B Traffic Awareness Beacon System (TABS) position source device[2] – thus enabling ADS-B OUT functionality.

The following technical requirements would apply:

- Class B TABS position source device must meets the relevant standards specified in (E)TSO-C199
  - The type of GPS used in the position source determines a transmitted SIL from the associated transponder (for example see A1.2.5.6 of TSO-C199). For example:
    - A Class B TABS with a position source compliant with (E)TSO-C145, (E)TSO-C146, (E)TSO-C196, TSO-C204, TSO-C205 or TSO- 206 may be eligible to set a SIL value of 2 or 3.
    - A Class B TABS position source with a commercial off-the-shelf GPS is normally set to SIL=1
  - CASA proposes different airspace/use entitlements for different transmitted SIL values - dependent the capability of the particular Class B TABS.
  - See the section below for the associated capability with each transmitted SIL
- Transponder must be Mode S with extended squitter capability and must authorised in accordance with (E)TSO-C166B or later version.
  - A transponder meeting an earlier version of this TSO standard - though acceptable for IFR-capable ADS-B OUT equipment - will not be acceptable for the proposed equipment configuration
    - This is because equipment of an earlier standard does not transmit a SIL or System Design Assurance (SDA) value - thus making it difficult for air traffic services to distinguish between an aircraft with a Class B TABS position source suitable or not suitable for receiving ATC separation services.
- The transponder and Class B TABS position source device must be correctly paired - in other words compatible with each other. The equipment manufacturer will have to assert that particular equipment combinations can be paired.
- The aircraft's transponder must be set to transmit a SIL value appropriate to the GNSS receiver used by the Class B TABS position source and in accordance with the manufacturer's installation instructions. paragraph A1.2.5.6 of (E)TSO-C199 provides specific technical details

A.1.1 Eligibility for use of Mode S transponder/Class B TABS configuration

CASA proposes transponder/Class B TABS ADS-B OUT configuration will be useable in a VFR aircraft to which all of the following applies:

- VFR flight below FL290
- The aircraft has a maximum certificated take-off weight of no more than 5 700kg

[2] The FAA and EASA have respectively issued TSO-C199 and ETSO-C199 — technical standards for traffic awareness beacon system. The technical standards specify two Classes of TABS: Class A TABS - a device with transponder, altitude source, and ADS-B OUT transmitting functionality; Class B TABS - a device with Global Navigation Satellite System (GNSS) position source functionality. A TABS may have either functionality or both functionalities.

- The aircraft has a maximum cruising speed not exceeding 250kt
- The aircraft is not used for RPT or charter operations.

CASA proposes the speed and take-off weight limits for consistency with overseas practice (EASA) for the same equipment.

A.1.2 In which airspace will a Mode S transponder/Class B TABS configuration be useable?

Mode S transponder with Class B TABS transmitting SIL of 1

CASA proposes that eligible VFR aircraft with Mode S transponder with Class B TABS position source transmitting SIL=1 will be useable in Class C, D, E & G airspace. Access to Class C surveillance airspace will be by virtue of the aircraft's Mode S transponder, but not its ADS-B capability. The ADS-B position information from the aircraft will be useable for situation awareness by both ATS and other aircraft equipped with ADS-B IN. However, this ADS-B position information would not be useable for ATC surveillance separation.

Mode S transponder with Class B TABS transmitting SIL of 2 or 3

CASA proposes that eligible VFR aircraft with Mode S transponder and Class B TABS position source that is eligible according to ETSO-C199 to transmit a SIL of 2 or 3 will be useable for situation awareness as well as ATC surveillance separation.

This proposal is unique, as other nations generally only allow the use of ATC surveillance separation if the position source is certified to an equivalent of the IFR standard.

A.1.3 Are Class B TABS position sources available?

Currently, there is at least one Class B TABS position source of the type and functionality mentioned in this section. The equipment manufacturer's installation instructions currently only allow the SIL=3 capability be implemented in LSA and Experimental aircraft. For type-certificated aircraft, SIL=1 must be set.

CASA would require equipment to be installed and utilised strictly in accordance with the manufacturer's instructions.

A.2 New Standard: Integrated TABS device

For optional use in certain VFR aircraft, CASA proposes TABS ADS-B OUT equipment with integrated Class A TABS and Class B TABS[3] functionality (integrated TABS device) will meet the standards of (E)TSO-C199[4].

A.2.1 Eligibility for use of TABS

CASA proposes an integrated TABS device will be useable in a VFR aircraft to which all of the following applies:

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[3] According to the relevant Technical Standards Order (TSO-C199), 'Class A' refers to the transponder, altitude source, and ADS-B OUT transmitting functionality of a TABS; while 'Class B' refers to the Global Navigation Satellite System (GNSS) position source functionality.

[4] **(E)TSO** means FAA Technical Standard Order and/or European Technical Standard Order.

- VFR flight below FL290.
- The aircraft has a maximum certificated take-off weight of no more than 5 700kg.
- The aircraft has a maximum cruising speed not exceeding 250kt.
- The aircraft is not used for RPT or charter operations.

The speed and MTOW limits are proposed for consistency with overseas practice (EASA) for the same equipment. Further, the speed limit is to account for a lower peak output power being permissible in a TABS compared to a standard transponder (70W vs 125W).

A.2.2 In which airspace can a TABS be used?

CASA proposes that an eligible aircraft will be able to operate an integrated TABS device in Class D, E & G airspace.

It is also proposed that eligible aircraft will be able to use an integrated TABS device instead of a transponder for VFR operations in Class E airspace, or at or above 10 000ft AMSL in Class G airspace.

A TABS cannot substitute for a transponder or IFR-standard ADS-B OUT equipment, where one or the other is required for operations in Class A or C airspace.

A.2.3 Is an integrated TABS device available?

Currently, CASA is not aware of any integrated TABS being available. The reason for CASA proposing the use of an integrated TABS is to cater for possibility that CASA's proposal provides an incentive for a manufacturer to bring a device to the market.

A.3 New Standard: Electronic Conspicuity (EC) device

CASA proposes Electronic Conspicuity (EC) devices with transmit functionality that meet the following standards:

- The technical specifications specified in the 2nd edition of UK CAA Advisory Publication (CAP) 1391 dated April 2018, or later version as in force from time to time.
- The EC device uses a TABS Class B position source.
- In accordance with CAP 1391 the EC device must be capable of and must transmit a Source Integrity Level (SIL) value of one (1).
- Despite the standards in CAP 1391, the device, by design, is eligible for and transmits a SDA[5] value of one (1).
- The EC device uses a barometric encoder for altitude information.

'Electronic Conspicuity' is an umbrella term for a range of technologies that can help airspace users be more aware of other aircraft in the same airspace. At the most basic level, aircraft equipped with an EC device effectively signal their presence to other airspace users, turning the ‘see and avoid’ concept into ‘see, **be seen**, and avoid.’ Some EC devices are capable of receive

[5] SDA is a numeric value between 0 and 3 that indicates the probability of an ADS-B equipment fault causing false or misleading position information to be transmitted. It is one of the messages transmitted by a modern ADS-B transmitting equipment. SDA is a static (unchanging) value, normally specified by the equipment manufacturer and either pre-set by the manufacturer or set by the equipment installer.

position information from other aircraft. This alerts pilots to the presence of other aircraft, which may assist the pilot to visually acquire the aircraft and take avoiding action as necessary.

A.3.1 Eligibility for use of EC transmitting devices

CASA proposes EC devices that transmit ADS-B messages may be used in any VFR aircraft.

A.3.2 In which airspace will an EC transmitting device be useable?

CASA proposes that an EC device can be operated in any airspace below FL290. Within that airspace limit, an EC device can be operated in the transmitting mode concurrently with the aircraft's Mode A/C or S transponder, but not if the Mode S transponder is transmitting ADS-B.

However, an EC transmitting will not be able to substitute for a transponder, where the aircraft operation requires a transponder - for example VFR operations in Class C and E airspace and above 10 000 ft AMSL in Class G airspace.

A.3.3 EC device in use

CASA envisages an EC device, particularly one with both transmit and receive functionality, having prime utility in Class G airspace (including CTAF areas). The EC device would be linked to a suitable display (e.g. Tablet with Electronic Flight Bag (EFB) application, or indicator light system) or an aural warning system. The concept is for this system to enhance a pilot's situation awareness, but in no way to replace the essential requirement for an effective visual scan outside the aircraft.

A.3.4 Are EC devices available?

Currently, there are EC products currently available for purchase. At least one product is a portable combined transmitter/receiver device able to transmit ADS-B position and receive ADS-B position messages from both IFR-standard ADS-B transmitting equipment and other EC transmitting devices. The product can connect with a tablet device and provide ADS-B traffic information for display on Electronic Flight Bag (EFB) applications.