Proposed Mandate for ADS-B above Flight Level 245

Discussion Document
February 2016
Contents
1. Glossary of acronyms and terms ........................................................................................................ 3
2. Summary ............................................................................................................................................... 5
3. Providing feedback ............................................................................................................................... 6
4. Surveillance and New Southern Sky ...................................................................................................... 7
5. ADS-B OUT ......................................................................................................................................... 8
   Why ADS-B? ....................................................................................................................................... 8
   Universal Access Transceiver (UAT) system ....................................................................................... 9
6. Surveillance in New Zealand .................................................................................................................. 10
   The rationale for change ..................................................................................................................... 10
   Proposed ADS-B OUT coverage ........................................................................................................... 12
   Contingency requirements .................................................................................................................... 12
7. Implementing ADS-B OUT in New Zealand: issues and options ......................................................... 14
   ADS-B OUT mandate - a phased approach ......................................................................................... 14
   Why impose a mandate? ...................................................................................................................... 14
   What area of airspace does the proposed mandate effect? ................................................................. 15
   Forward fit: Requiring newly registered aircraft to be ADS-B OUT compliant ahead of the mandate ............................................................................................................................................ 15
   Equipment .......................................................................................................................................... 16
   System compatibility .............................................................................................................................. 17
   Installation of ADS-B OUT equipment: capacity and capability ....................................................... 17
   Installation, testing, and certification ................................................................................................. 18
   Cost of equipping ............................................................................................................................... 19
   Current equipage levels ....................................................................................................................... 20
   Training, information and education ................................................................................................. 20
   Attachment one: Feedback form ........................................................................................................... 21
   Appendix two: Feedback Form ............................................................................................................ 23
## 1. Glossary of acronyms and terms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADS-B</td>
<td>Automatic Dependent Surveillance - Broadcast</td>
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<tr>
<td>ADS-B OUT and ADS-B-IN</td>
<td>ADS-B OUT refers to information being broadcast out by the aircraft’s transponder. ADS-B IN refers to information received by the transponder.</td>
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<tr>
<td>AML STC</td>
<td>Approved Model List Supplemental type certificate, which allows a single STC to address several different type certificates. It provides a more efficient process compared to multiple approvals of, for example, installations that are largely similar or identical for several different aircraft models.</td>
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<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
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<td>ATM</td>
<td>Air Traffic Management</td>
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<td>CAA</td>
<td>Civil Aviation Authority</td>
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<td>CAR</td>
<td>Civil Aviation Rule</td>
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<tr>
<td>FIR</td>
<td>Flight Information Region</td>
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<td>FIS</td>
<td>Flight Information Service</td>
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<td>Flight Level 245 (FL 245)</td>
<td>Flight Level 245 is the boundary between upper and lower airspace in the New Zealand domestic FIR.</td>
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<td>FMS</td>
<td>Flight Management System</td>
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<tr>
<td>GA VFR</td>
<td>General Aviation aircraft that operate under Visual Flight Rules</td>
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<tr>
<td>GNSS</td>
<td>Global Navigation Satellite System, a general term referring to a navigation satellite system including the US GPS network, the Chinese BeiDou, Russian GLONASS and European Galileo systems.</td>
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<tr>
<td>GPS</td>
<td>Global Positioning System - one type of GNSS, owned and operated by the US Government. GPS is the only GNSS providing coverage to New Zealand.</td>
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<td>IFR</td>
<td>Instrument Flight Rules</td>
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<td>MLAT</td>
<td>Multilateration: is a ground-based surveillance system. A network of ground stations interrogate and receive replies from aircraft SSR</td>
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<tr>
<td>Term</td>
<td>Description</td>
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<tr>
<td>transponders</td>
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<tr>
<td>Mode A/C transponder</td>
<td>Mode A/C refers to transponders currently mandated in parts of New Zealand airspace. Mode A provides an aircraft identity code; Mode C provides altitude in 100 ft increments.</td>
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<tr>
<td>Mode S transponder</td>
<td>Mode S(elect) transponders are the next generation on from Mode A/C. Mode S provides a much larger number of identification codes, altitude in 25 ft increments, and a range of Downlink Airborne Parameters (DAPs) depending on the aircraft avionics and surveillance system characteristics.</td>
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<tr>
<td>NSS</td>
<td>New Southern Sky</td>
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<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
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<td>PBN</td>
<td>Performance based navigation</td>
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<td>PSR</td>
<td>Primary surveillance radar. PSR is a non-co-operative surveillance system: it does not rely on information from the aircraft.</td>
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<td>SBAS</td>
<td>Satellite-based augmentation system. SBAS measures small variations in the GPS signals and provides regular corrections to aircraft receivers within the specific geographic service areas covered by the system’s ground stations. New Zealand is not currently covered by an SBAS service area.</td>
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<tr>
<td>SSR</td>
<td>Secondary surveillance radar, SSR is a co-operative surveillance system, meaning that it relies on a response from an aircraft transponder.</td>
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<tr>
<td>TIS</td>
<td>Traffic Information Service</td>
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<td>TSO</td>
<td>Technical Service Order, issued by the FAA and provides the performance parameters for equipment certification.</td>
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<tr>
<td>UAT</td>
<td>Universal Access Transceiver</td>
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<td>WAAS</td>
<td>Wide area augmentation system – see SBAS.</td>
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2. Summary

The Civil Aviation Authority (CAA) is currently developing policy and rule changes to support the replacement of New Zealand’s aviation surveillance radar infrastructure, which will reach the end of its operational life in 2021.

The proposal includes implementing Automatic Dependent Surveillance – Broadcast (ADS-B) OUT as the principle surveillance system in New Zealand. The ADS-B OUT implementation project is a foundation project under New Southern Sky (NSS), a ten year programme to modernise New Zealand’s aviation system.

NSS proposes that ADS-B OUT will be required on all aircraft operating in **controlled airspace above Fight Level 245 (FL 245) after 31 December 2018** and all controlled airspace by 31 December 2021.

**This discussion paper considers the ADS-B OUT mandate for controlled airspace above FL 245 only** (referred to in the document as “above FL 245”).

A separate discussion document will be provided for ADS-B OUT in controlled airspace below FL 245 in 2017.

This discussion document sets out a series of issues and questions about mandating ADS-B above FL 245, including:

- A proposal for a performance-based rule for ADS-B OUT
- Identifying the preferred performance standards for ADS-B OUT systems for use above FL 245
- Assessing the impact of the proposal on operators of aircraft flying above FL 245: costs, avionics integration, benefits, risks, and any additional issues that we should consider
- Options for facilitating the introduction and uptake of ADS-B above FL 245
- Aligning the ADS-B OUT and PBN GPS receiver requirements

A summary of the issues and questions for consideration can be found at attachment one.
3. Providing feedback

This document includes questions to guide your feedback. If you wish to comment on issues not covered by the questions, please use additional sheets. We welcome your comments on any aspect of the implementation of ADS-B OUT above FL 245 in New Zealand.

All questions are collated in a feedback form attached at Appendix One.

You can provide written feedback on the electronic feedback form (that collates the questions in this document) at http://www.caa.govt.nz/nss/index.htm

We may be able to arrange additional meetings on request. Please contact Katie Gunatunga (contact details below) with your preferred date and location.

The closing date for feedback is close of business on Friday, 18 March 2016. Feedback can be provided by:

Email: docket@caa.govt.nz  please use “ADS-B” in the subject line

Post: Katie Gunatunga, Policy Advisor
Civil Aviation Authority
PO Box 3555
Wellington 6140

Phone: 04 830 0525

Please note that, once received, all submissions become public information that can be requested under the Official Information Act 1982. Please indicate clearly if any parts of your submission are commercially sensitive, or if for any other reason you would not want that information to be disclosed.

We will consider and analyse all submissions received in response to this document. The information you provide will feed directly into the development of new rules and any changes to existing rules to cover the new surveillance system.

Consultation on any news rules for surveillance and/or navigation will be done using the Notice of Proposed Rule Making (NPRM) process. You can sign up at https://notifications.caa.govt.nz/ to be notified of the NRPM consultation document. If you attend a meeting and/or make a submission on this document, you’ll automatically be included in the NPRM consultation.

If you do not want to be included in the NPRM consultation, please make that clear in your submission.
4. Surveillance and New Southern Sky

New Southern Sky (NSS) is a ten year programme to modernise New Zealand’s aviation system. NSS aims to align work by all the key stakeholders to maximise the benefits for the whole aviation sector, and improve safety, capacity and efficiency. NSS was approved by Cabinet in May 2014. The replacement of the current surveillance system is one of the NSS foundation projects.

In the surveillance area, the NSS programme includes the following key steps:

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<tr>
<td>Planning for progressive implementation of ADS-B OUT, including proposed rule development and training and education programme development</td>
<td>ADS-B OUT mandatory airspace above FL 245 with supporting network of ADS-B OUT ground stations. The use of ADS-B in controlled airspace above FL245 is contingent on the existing secondary surveillance system being operational.</td>
<td>ADS-B OUT mandatory in all controlled airspace from the end of 2021 supported by back-up ground surveillance network. Some provision for controlled airspace to be designated for transit lanes and special areas and procedures for non-ADS-B OUT equipped aircraft via a contingency plan. Options for this stage will be consulted on at a later date.</td>
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</table>

ADS-B OUT and performance based navigation (PBN) both rely on the GNSS. It is therefore critical that the ADS-B OUT work aligns with the PBN implementation programme.

For more information on New Southern Sky, the wider surveillance project and the dependencies between surveillance and navigation modernisation, please visit [www.nss.govt.nz](http://www.nss.govt.nz).
5. ADS-B OUT

ADS-B OUT is a Global Positioning Satellite (GPS) dependent surveillance system. The aircraft receives data from navigation satellites and then broadcasts information on its identification, position, altitude, speed and other relevant data up to twice a second.

The data received by ground stations is then transmitted to the air traffic management (ATM) system for display to air traffic controllers who use it to separate aircraft in controlled airspace. ADS-B OUT equipped aircraft that are outside controlled airspace but within ADS-B OUT coverage areas will be visible to (but not controlled by) air traffic services.

*Figure 1: How ADS-B OUT works*

There are two types of ADS-B transmissions: ADS-B IN and ADS-B OUT. ADS-B OUT is the transmission out of the aircraft to other aircraft or the ground receiving stations. ADS-B IN enables an equipped aircraft to receive information from other aircraft, and can be used for self-separation where both signals have adequate integrity.

There are no plans to make ADS-B IN mandatory in New Zealand. Self-separation is unlikely to be adopted in this country for many years. ADS-B IN may become viable in New Zealand once the majority of the fleet that operate in controlled airspace are ADS-B OUT equipped. Other ADS-B IN options also include Traffic Information Service (TIS) and Flight Information Service (FIS) as offered in the United States; however these services require ground infrastructure systems that are not cost-effective for New Zealand.

**Why ADS-B?**

The International Civil Aviation Organization (ICAO), a United Nations specialised agency, specifies ADS-B OUT 1090 ES as the preferred surveillance system in the ICAO Global Air Navigation Plan as it is safer, provides richer and more accurate data to air traffic controllers, and enables more efficient use of airspace in combination with PBN. ADS-B OUT is already mandated in a number of countries including Australia, the United States, the United Kingdom, European nations, and Canada.
Benefits of ADS-B OUT

ADS-B OUT using the 1090 ES system has several key benefits:

- The surveillance data are more accurate than radar. This enables improved safety and more efficient use of congested airspace. It will help New Zealand prepare for significant increases in aviation traffic in the future by facilitating closer spacing of IFR aircraft within airspace that is not currently provided with a surveillance service, especially when combined with PBN procedures.
- The ground system components of ADS-B are less expensive to install and maintain when compared to the current secondary surveillance radar system. In New Zealand this will result in a greater coverage area (see figure 5) where air traffic services will have visibility of ADS-B OUT equipped aircraft outside of controlled airspace.
- ADS-B OUT is a broadcast system, and there maybe options in future (via ADS-B IN) for aircraft to have greater awareness of other aircraft in the vicinity.

As New Zealand proposes to adopt ADS-B OUT as its main surveillance data source, a mandate is necessary to ensure that aircraft flying in controlled airspace above FL245 are all appropriately equipped and are visible to air traffic control services.

Costs of ADS-B OUT

There are costs associated with the introduction of ADS-B OUT, most notably the cost of equipping aircraft and certification of the modification. The Costs of equipping section (see page 20), explores these issues in more detail.

Universal Access Transceiver (UAT) system

New Zealand will not implement the Universal Access Transceiver system (UAT) that is in use in the United States and proposed for South Korea. New Zealand will follow the ICAO Global Air Navigation Plan (GANP) and the ICAO Asia Pacific Surveillance Strategy, both of which include surveillance system modernisation based on the 1090 ES ADS-B system.

UAT equipment will not meet New Zealand rule requirements as it operates on the 978 MHz frequency. UAT equipment, or aircraft equipped with UAT may be described as ADS-B OUT capable. It’s important that aircraft operators are aware of the difference between the systems and do not purchase or install UAT equipment.
6. Surveillance in New Zealand

The primary purpose of an air traffic service is to prevent collisions between aircraft, and expediting and maintaining an orderly flow of air traffic. In the 1960s, radar became a widespread means of giving air traffic controllers visibility of aircraft, allowing closer and safer aircraft spacing and greater efficiency. Surveillance technology is moving on from radar to systems using satellite-derived data to provide more accurate information.

The current proposal would have surveillance in New Zealand consisting of the following:

- ADS-B as the main surveillance system.
- A non-GPS dependent contingency network to cover the main trunk route, defined as being between Auckland, Wellington and Christchurch. Queenstown may be added to this requirement later.
- Non-cooperative surveillance at Auckland, Wellington and Christchurch airports to provide a safety net for aircraft without functioning transponders, and to provide awareness of aircraft incursions into that airspace. Queenstown may be added to this requirement later.

The rationale for change

New Zealand’s current surveillance radar system reaches the end of its operational life in 2021. We have the opportunity to upgrade our surveillance capability to realise safety and efficiency benefits.

There are currently three surveillance systems in place in New Zealand:

- Primary surveillance radar
- Secondary surveillance radar
- Multilateration systems

Under the current proposal outlined in the NSS, ADS-B would become the main surveillance system for all controlled airspace after 2021.

As a first step, the approach outlined in this document is to mandate ADS-B in controlled airspace above FL245 in addition to the existing surveillance systems. Figure 2 and 3 shows the difference in coverage area above FL 245 between the existing secondary surveillance radar (SSR) and wide area multilateration (WAM) surveillance area and the coverage area that will be available when ADS-B is provided above FL 245. This shows that introduction of ADS-B will ensure that the entire New Zealand Domestic FIR will be covered.

Primary Surveillance Radar (PSR)

Primary radar will provide a degree of surveillance contingency in its coverage area as it is not GNSS dependent. Figures 2 show the theoretical area of the current primary radars.

*Figure 2: Current primary radar*
Secondary Surveillance Radar (SSR)
Radar surveillance coverage of most controlled en-route and terminal airspace is provided by SSR. A SSR system interrogates transponders on the aircraft fitted with Mode A/C transponders to report altitude and identity to via the radar system for use by air traffic controllers. The information is considerably more detailed than that provided by primary radar, and the coverage area is significantly larger. Figure 3 show the theoretical coverage of the current SSR.

Figure 3: current secondary radar

Source: Airways

Wide Area Multilateration
The area around Queenstown is covered by a WAM system due to the mountainous terrain environment not being suitable for radar. WAM provides a ‘radar-like’ picture to air traffic controllers.

Figure 4 shows the theoretical extent of WAM coverage in the southern region including Queenstown.
**Proposed ADS-B OUT coverage**

Compared to radar, ADS-B OUT provides much richer and more accurate information and enables safer and more accurate control of aircraft and covers the entire New Zealand Domestic FIR.

Figure 5 shows the current surveillance coverage using SSR and WAM and Figure 6 shows the ADS-B surveillance coverage available above FL 245.

**Contingency requirements**

NSS includes an expectation that New Zealand will have a contingency surveillance system. The system would, in the case of a GNSS outage:

- enable all airborne aircraft to be safely recovered; and
- provide continuity of service on the main trunk routes between Auckland, Wellington and Christchurch. Queenstown may be added to this requirement later.
Airways’ safety case includes consideration of the need for an underlying non-GNSS dependent contingency surveillance system to provide limited coverage in the event of GNSS signal loss on the airframe or widespread signal loss; and retention of vectoring and procedural separation processes.

Until 2021, PSR and SSR will provide contingency surveillance for aircraft above FL 245 as the radars will still be operational. Contingency arrangements for once the existing PSR and SSR are decommissioned will be considered as part of the assessment of a mandate for ADS-B in all controlled airspace after 2021.
7. Implementing ADS-B OUT in New Zealand: issues and options

This section covers the key aspects of the proposal to move to ADS-B OUT as the main surveillance system above FL 245 in New Zealand domestic FIR from 31 December 2018, and includes a series of questions about those proposals.

The issues covered are:

- **The ADS-B OUT mandate**: when and where ADS-B OUT will be required, and how the rule will give effect to that.
- **Equipment**: the equipment that will be required on-board aircraft.
- **Cost of ADS-B OUT**: options for addressing the cost barrier for aircraft owners and operators.
- **Facilitating the transition**: training, education, information and advice.

**ADS-B OUT mandate - a phased approach**

NSS proposes that operational ADS-B OUT will be required in aircraft operating in controlled airspace above FL 245 after 31 December 2018. This will primarily affect commercial passenger and freight aircraft and a smaller number of privately owned and operated aircraft.

The rationale for requiring ADS-B OUT above FL 245 first is to facilitate a smooth transition to the new surveillance system. This approach focuses on the aircraft that can use and benefit from the system as soon as the ADS-B OUT ground receivers are in place.

The benefits include:

- significantly improved surveillance coverage
- improved safety, particularly in airspace with more traffic
- best equipped, best served: a better likelihood of getting preferred levels
- ATC can provide better support in unusual or emergency situations, including search and rescue, through more frequent and more accurate position reporting
- implementation of a cost-effective, efficient solution for the whole aviation industry.

**Why impose a mandate?**

A mandate means that all aircraft must legally comply, unless authorised otherwise. It provides consistency across the fleet above FL 245, and limits the number of aircraft not visible to the ADS-B OUT system and outside radar range. It also means that the aircraft equipment will conform to a minimum performance standard.

Voluntary compliance with an ADS-B OUT standard would be a more flexible option; however the time taken for the whole fleet to equip may not align with the end of life of the current radar network. There may be safety issues introduced by aircraft with highly variant levels of equipage and performance.

A phased mandate does mean that aircraft not currently equipped would need to install ADS-B OUT (and a compatible GPS receiver if necessary) by the deadline.
The CAA will not allow permanent exemptions to the mandate. Although exceptions may be available for aircraft that are reaching the end of their operational lives and are due to be retired soon after the mandate.

**What area of airspace does the proposed mandate effect?**

It is proposed that all controlled airspace above FL 245 will be ADS-B Mandatory from December 2018. There are two areas of uncontrolled airspace above FL 245 that will not be affected by the proposed mandate these area are:

- An area of uncontrolled airspace around Aoraki/Mt Cook
- An area of uncontrolled airspace between FL245 and FL285 around Fiordland.

**Q1. What is your view on the mandating of ADS-B OUT in controlled airspace above FL 245 as a first step in ADS-B implementation?**

**Q2. What do you see as the benefits of an ADS-B mandate? What are the risks?**

**Q3. Is the proposed mandate date of 31 December 2018 feasible? Why, or why not?**

**Forward fit: Requiring newly registered aircraft to be ADS-B OUT compliant ahead of the mandate**

Forward fit refers to a transitional requirement for some operators to fit approved equipment to their aircraft before the mandate comes into effect. Forward fit can be used in a number of ways:

- Requiring all newly registered and newly imported aircraft that will require ADS-B OUT equipment to be fitted at the time of registration; and/or
- Requiring owners to fit ADS-B OUT compatible transponders and/or GNSS receivers when replacing older equipment.

Operators would need sufficient warning of a date for a forward fit requirement, so that they ensure that ADS-B OUT is installed in any new aircraft that they are planning to purchase. The CAA is proposing a forward fit requirement come into force on the 1 July 2017.

The reasons for forward fit requirements include:

- Removing the need for recertification of new aircraft through the CAA (this depends on Original Equipment Manufacturer (OEM) having certified the system to meet ADS-B OUT compliance aligned with the relevant TSO standards or the purchaser negotiating for the correct equipment to be installed by the OEM).
- Accelerating the fleet equipage overall.
- Ensuring that new aircraft arrive fitted with the right equipment.
- The aircraft will be subject to a single approval process by the CAA rather than requiring an additional certification following ADS-B OUT fitment.
The potential costs and risks of a forward fit requirement include:

- Bringing forward the cost of equipage for owners importing aircraft.
- Owners will not have the choice of waiting for lower-cost options to reach the market.
- Owners will not enjoy the full benefits of ADS-B OUT functionality until the infrastructure is fully operational.
- Owners of imported aircraft may be challenged by distance from the manufacturer/vendor if the ADS-B OUT equipment is faulty, incorrectly installed, or not fit for purpose in New Zealand.

Q4. Do you support the inclusion of forward fit requirements for aircraft flying above FL245 from the 1 July 2017 in the ADS-B OUT rule? Why or why not?

Equipment
Consistent with the ICAO recommendations and implementation undertaken by other states, New Zealand will introduce the 1090 MHz extended squitter ADS-B OUT system.

Airways have indicated that basic system requirements, based on currently available equipment, are likely to be:

- A transponder that meets the standard set in RTCA DO 260 (TSO-C166) or above; and
- A GNSS receiver that meets the standard set by TSO-C 145, 146 or 196, or equivalent;

We anticipate that aircraft subject to forward fit requirements would need to meet the following performance levels:

- GNSS receiver(s): TSO-C145 or TSO-C146, or 196
- ADS-B transponder: DO-260(b) or above

The intention is to ensure that aircraft currently fitted with this equipment, provided it is correctly installed and fully operational, will comply with the ADS-B OUT system requirements as of the mandate dates, and will remain compliant for the foreseeable future.

Mode A/C transponders cannot be used in an ADS-B OUT surveillance environment and will not comply with the functional and performance requirements.

Work by the Civil Aviation Safety Authority (CASA) in Australia indicates that TSO-C129 GNSS receivers are unlikely to meet the ADS-B OUT surveillance system requirements for the majority of aircraft. These units do not generally have fault detection and exclusion\(^1\), so may not provide the continuity of service required by the ADS-B OUT surveillance system.

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\(^1\) Fault detection (FD) enables a GNSS receiver to identify satellite signals that lack integrity, and then cease to provide GNSS information. Fault detection and exclusion (FDE) enables the receiver to
The number of GNSS receivers required on an aircraft will depend on what other operations it conducts. For example, aircraft that are used for operations requiring performance based navigation and/or regular passenger transport are already required to carry two independent GNSS receivers.

The CAA will be able to provide information on the exact equipage requirements in the near future, including alignment with the requirements that may arise from updating the rules and equipment requirements for GNSS IFR and PBN.

**System compatibility**

It is critical that the transponder and receiver are compatible and, when used together will provide accurate data. There are system compatibility issues with some combinations of transponder and receiver; therefore correct installation and testing will be important.

The CAA will provide guidance on proven combinations and known system compatibility problems through advisory circulars, the CAA website and information for operators, engineers and avionics suppliers.

Q5. What equipment do you currently have on your aircraft? Please comment on both transponder(s) and GNSS receiver(s)

Q6. What impact would the proposed performance standards have on your aircraft/operations?

Q7. What comments do you have regarding the GNSS receiver and system compatibility issues?

**Installation of ADS-B OUT equipment: capacity and capability**

While the physical installation of ADS-B OUT transponders may be straightforward, experience in Australia and the United States indicates that there can be issues with ensuring the two units are properly integrated and provide accurate information. As ADS-B OUT data will be used for separating aircraft in controlled airspace, accurate ADS-B OUT data is safety-critical.

Australia and the United States have both reported a lack of appropriately qualified engineers is a significant issue in achieving ADS-B OUT mandate dates.

The CAA recently surveyed licensed aviation maintenance engineers to determine the capacity and capability to support the introduction of ADS-B OUT. The findings indicate that there are a limited number of engineers who have training and experience in fitting ADS-B OUT. The shortage is particularly acute when considering integrated avionics systems installed in aircraft with a flight management system (FMS).

Airways reports that among the 130 aircraft that broadcast ADS-B OUT signals in February 2015, 25 (19 per cent) were transmitting inaccurate and/or insufficient data. In such cases, Airways contacts the CAA to follow up with the operator to report the problem and can flag the data from that aircraft as unreliable.

exclude problematic signals and continue to operate, providing it has sufficient alternative signals available.
Apart from some large aircraft, there are few aircraft currently operating in New Zealand that are equipped for ADS-B OUT – that is, carrying a transponder that is or could be upgraded to 1090 MHz ES capability, and a TSO-C145 or C-146 GNSS unit or equivalent.  

There are several options that could address the need for a consistent standard of ADS-B OUT installation:

- Require that installation of ADS-B OUT is done only by licensed aviation maintenance engineers with an avionics rating and demonstrated capability with ADS-B OUT system installation and testing.
- Have a rule provision that allows the CAA to refuse to certify an improper installation as well as approve proper installations.
- Ensure that airways have processes in place to deal with bad data within the ATM system.

Q8. What other comments do you have regarding the standard of installation and testing of ADS-B OUT systems?

Installation, testing, and certification

Through its southern surveillance network, and ground ADS-B at Auckland, Airways is already monitoring the quality of ADS-B OUT information transmitted by 1090 MHz-equipped aircraft.

Issues:

Based on current data, approximately 19 per cent of ADS-B equipped aircraft in New Zealand are transmitting data that would be unlikely to be able to be used by controllers in an ADS-B environment. Examples include aircraft transmitting:

- NIC/NAC values outside the permitted limits and therefore filtered out by the ATM system
- Invalid/incorrect flight identification
- Invalid or incorrect Mode S addresses
- Bad ADS-B data, such as position, speed, altitude
- Avionics problems identified through a mismatch between ATC expectation and surveillance data – namely that the data being received does not match the filed route information, or coordinated information.

The air traffic management (ATM) system will exclude data that does not meet its integrity, continuity, accuracy, and availability requirements. In an ADS-B OUT environment, aircraft whose data are not acceptable to the ATM system will be invisible to controllers, unless they are in an SSR environment and can revert to Mode S, or are in a primary radar environment and can be seen as a target only.

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2 Some large jets are equipped with TSO-C129 GNSS receivers; however these are integrated into flight management systems that provide the functionality comparable to that of a TSO-C145 GPS receiver.
Options

We propose that the new rule would, like the Australian and United States rules, make it an offence to knowingly transmit bad data from ADS-B or Mode S transponders.

Airways and CAA would establish a protocol to identify aircraft transmitting bad data and the CAA contact the owner/operator to advise them of their responsibilities. This would require a transfer of information between the two agencies. Privacy and confidentiality issues would be considered as part of this process.

Q9. Do you agree with the need to address transmission of bad data?
Q10. Are there any other issues with transmission of data that we should consider as part of this project? If so, please provide details.
Q11. Do you agree with the option proposed? If not, why not?

Cost of equipping

There are two sets of costs to operators for ADS-B OUT:

- equipage: the transponder and the GNSS unit; and
- the installation, testing, and certification expenses.

The actual cost may vary significantly depending on, for example, the equipment already installed, the age of the aircraft, and the complexity of the installation.

The Castalia economic analysis of the National Airspace and Air Navigation Plan estimated an overall equipage cost to operators (excluding installation, testing and certification) of $19,466,321, comprising $16,712,747 for GNSS equipage and $3,753,574 for ADS-B OUT.

The actual cost may vary significantly between different aircraft depending on, for example, the equipment already installed, the age of the aircraft, and the complexity of the installation.

The CAA acknowledges that the cost of equipment is a barrier to operators adopting ADS-B OUT, and could result in a range of impacts, including (but not limited to):

- Cost impact – cost of equipment, installation and maintenance
- Effect on business – commercial operations considerations of cost impacts on financial viability of the operation
- Access limitations – unequipped aircraft will not have access to upper airspace
- Equity – cost impacts will accrue to those flying above FL 245.

The performance-based rule offers the potential for lower cost yet safe and compatible equipment to be allowed in New Zealand; however the CAA cannot guarantee that these types of equipment will be available before the mandate dates. Operators who are able to and choose to equip now may pay more; however they will be assured that their systems will comply at and beyond the mandate and will not face delays with supply or installation of the equipment.
**Current equipage levels**

An examination of the aircraft register and approvals already granted to aircraft to use ADS-B OUT show that larger commercial aircraft are either already equipped with Mode S extended squitter transponders either as standard equipment present on delivery, or retrofits.

However, some aircraft operating above FL 245 are not yet equipped due to a number of factors: limited coverage provided by the current network of ADS-B OUT receivers in New Zealand; operators waiting for details of when they will need to equip, and with what standard of equipment; and cost. The last point is particularly salient when considering older aircraft with a limited operational lifespan where the cost may not be justifiable.

Q12. Do you agree with the issues identified regarding the cost of equipage?
Q13. Are there other costs that you would include in this section?
Q14. Considering your operation in particular, what would assist you most in installing ADS-B OUT? Please consider cost, information and training, time, access to avionics engineering services, and any other things that would assist.
Q15. In particular, what incentives, if any, would encourage early installation of ADS-B OUT? Please consider equipment costs, installation, and processes such as certification.
Q16. Please provide any other comments regarding the cost of moving to ADS-B OUT.

**Training, information and education**

New technology comes with the need for information, training and education for those who are involved with its use. In the case of ADS-B OUT, this will include:

- Operators who fly above FL 245: equipment and operational requirements.
- Air traffic control providers.
- Avionics suppliers and engineers.

The introduction of ADS-B OUT will be an opportunity to review and, where necessary, strengthen existing safety messages to ensure they reflect the new operating environment. These may include (but not be limited to):

- Identifying and addressing any safety risks that may arise from the ADS-B OUT mandate, for example an increased reluctance to request entry to controlled airspace or requesting assistance from air traffic services.

Q17. What, if any, specific topics would you specifically like to have covered regarding the transition to ADS-B OUT?
Q18. What would be the best ways for CAA to provide this information to you, for example, Vector magazine, the New Southern Sky website, seminars/workshops, mailouts?
Q19. What other comments or observations do you have regarding training, education and information around the transition to ADS-B OUT?
Attachment one: Feedback form

The questions posed throughout this document are collated below. The questions posed throughout this document are collated above. This feedback form is also available as a separate document on our website at http://www.caa.govt.nz/index.html.

Q 1  What is your view on the mandating of ADS-B OUT in controlled airspace above FL 245 as a first step in ADS-B implementation?

Q 2  What do you see as the benefits of an ADS-B mandate? What are the risks?

Q 3  Is the proposed mandate date of 31 December 2018 feasible? Why, or why not?

Q 4  Do you support the inclusion of forward fit requirements for aircraft flying above FL245 from the 1 July 2017 in the ADS-B OUT rule? Why or why not?

Q 5  What equipment do you currently have on your aircraft? Please comment on both transponder(s) and GNSS receiver(s)

Q 6  What impact would the proposed performance standards have on your aircraft/operations?

Q 7  What comments do you have regarding the GNSS receiver and system compatibility issues?

Q 8  What other comments do you have regarding the standard of installation and testing of ADS-B OUT systems?

Q 9  Do you agree with the need to address transmission of bad data?

Q 10 Are there any other issues with transmission of data that we should consider as part of this project? If so, please provide details.

Q 11 Do you agree with the option proposed? If not, why not?

Q 12 Do you agree with the issues identified regarding the cost of equipage?

Q 13 Are there other costs that you would include in this section?

Q 14 Considering your operation in particular, what would assist you most in installing ADS-B OUT? Please consider cost, information and training, time, access to avionics engineering services, and any other things that would assist.

Q 15 In particular, what incentives, if any, would encourage early installation of ADS-B OUT? Please consider equipment costs, installation, and processes such as certification.

Q 16 Please provide any other comments regarding the cost of moving to ADS-B OUT.

Q 17 What, if any, specific topics would you specifically like to have covered regarding the transition to ADS-B OUT?
Q 18 What would be the best ways for CAA to provide this information to you, for example, Vector magazine, the New Southern Sky website, seminars/workshops, mailouts?

Q 19 What other comments or observations do you have regarding training, education and information around the transition to ADS-B OUT?
Appendix two: Feedback Form

The questions posed throughout this document are collated above. This feedback form is also available as a separate document on our website at http://www.caa.govt.nz/index.html. We are also interested in any views you may have that are not covered by these questions.

Please submit your response by Friday 18 March, 2016 to:

E-mail: docket@caa.govt.nz please use “ADSB” in the subject line  Post: Katie Gunatunga
Policy Advisor
Civil Aviation Authority
PO Box 3555
Wellington 6140

Submitter’s details:
   Individual □  Organisation □ (please tick one)

Name:

Contact information:

Email:

Address:

Telephone:

Type of operation: