

Office of the Minister of Transport
Chair, Cabinet Economic Development Committee

Moving to ADS-B, New Zealand's new, safer aviation surveillance system

Proposal

1. This paper notifies Cabinet of my intention to amend the Civil Aviation Rules to require, from 31 December 2021, that aircraft operating in controlled airspace below 24,500 feet (flight level 245) use Automatic Dependent Surveillance-Broadcast (ADS-B) equipment. ADS-B is a safer aviation surveillance system and will become the main source of information for air traffic control, replacing the existing system.

Executive Summary

2. New Zealand's existing aviation radar surveillance system will reach the end of its operational life in December 2021. Following this, ADS-B will become the main source of information for air traffic management to track and locate, and maintain safe separation of aircraft operating in controlled airspace. This change will impact all aircraft owners and operators who fly in controlled airspace in New Zealand.
3. The move to ADS-B is a key component of the National Airspace and Air Navigation Plan approved by Cabinet in June 2014. The plan is being implemented through the New Southern Sky Programme (NSS), a ten-year, three-stage, programme to modernise New Zealand's aviation system. NSS is led by the Civil Aviation Authority (CAA) in partnership with the Ministry of Transport (the Ministry) and Airways Corporation of New Zealand (Airways).
4. As Minister of Transport, I am empowered to make ordinary rules on civil aviation matters. Rules are the most common form of delegated legislation for aviation and typically contain detailed technical standards, in this case equipment standards for ADS-B.
5. Moving to ADS-B will require equipment compatible with ADS-B surveillance infrastructure to be installed on existing aircraft, for these aircraft to continue operating in controlled airspace. I am notifying Cabinet of my intention to introduce amendments mandating this equipment, as there is an expectation that I will consult further with Cabinet where rules generate significant public or industry interest, or impose new costs.
6. There are two components of ADS-B. ADS-B OUT is primarily used for surveillance and transmits information from equipped aircraft to ground ADS-B receivers used for air traffic control and other aircraft that have ADS-B IN. ADS-B IN uses on-board receivers to collect information from other aircraft to improve a crew's situational awareness. This rule amendment mandates ADS-B OUT only. This is consistent with international practice.
7. NSS has engaged with all affected sectors of the aviation community continuously over the past five years, and signalled the planned move to ADS-B from the outset. However, recent consultation confirmed that there are still several barriers to the approximately 3,800 affected aircraft equipping ahead of this rule amendment coming into force. Many operators view the cost of equipping as disproportionately high (relative to the value of their aircraft) and consider that they will receive limited benefits from ADS-B.

8. To mitigate these costs, Cabinet recently agreed to establish a grant scheme to provide financial assistance to aircraft operators affected by these rule amendments. The grant will cover approximately half the cost of the required equipment. Operators would still be required to pay for installation, certification and testing to ensure the equipment meets the appropriate standard. The grant scheme also incentivises operators to equip with ADS-B IN¹, which provides additional safety benefits, by alerting pilots to other aircraft operating in close vicinity.
9. There is limited capacity for engineering workshops (avionics shops) to manage an influx of aircraft requiring new transponders as the 31 December 2021 deadline approaches. To manage this risk, NSS is working closely with industry to encourage operators to equip early and minimise the risk of a bottleneck at avionics shops ahead of the deadline.
10. NSS is also implementing a communications strategy targeting commercial aviation operators as a priority. The vast majority of these businesses rely on access to controlled airspace and will need to be equipped ahead of these changes, to continue operating.
11. Military aircraft are impacted by the decision to introduce ADS-B in controlled airspace. The New Zealand Defence Force has been actively engaged in NSS and supports ADS-B as the future aviation surveillance system. Given the unique complexities of military aircraft and the longer timeframe for equipping, separate arrangements are being finalised to ensure continuity of military aircraft operations and to allow the Defence Force to conduct certain missions without disclosing their position.

Background

New Zealand is moving to a new, safer aviation surveillance system

12. Aviation surveillance is central to a safe aviation system. It is used to accurately determine aircraft location and altitude, helping air traffic control maintain aircraft separation, manage potential aircraft conflicts, and reduce collision risk.
13. New Zealand currently has an aviation surveillance system of primary and secondary radars. This system ensures that all aircraft flying in controlled airspace² are visible to air traffic control, which manages separation between aircraft. Civil Aviation Rules require that aircraft be fitted with equipment compatible with the surveillance system used by air traffic control.
14. This surveillance infrastructure is owned and maintained by Airways, a state-owned enterprise that provides air navigation services in New Zealand. Maintaining this infrastructure and air traffic control services is funded from charges to the aviation sector (predominantly airlines).
15. The existing radar infrastructure will reach the end of its service life in 2021. Rather than replacing this radar equipment, Airways Corporation of New Zealand (Airways) is installing Automatic Dependent Surveillance-Broadcast (ADS-B) infrastructure. This is consistent with the recommendation of the International Civil Aviation Organization's Global Air Navigation

¹ It is not proposed to mandate ADS-B IN technology. Aircraft operators can receive very useful information from ADS-B IN, but it is not essential for safe and efficient management of air traffic.

² Controlled airspace is where there is a need for an air traffic control service to be provided for safe and efficient aircraft operations. It is usually in place in the immediate vicinity of busier airports, where commercial passenger aircraft are leaving or approaching the airport.

Plan, which many countries are implementing. ADS-B will also be a key building block to introduce future data-rich technology, such as a new air traffic management system and digital control towers.

16. New Zealand's transition to ADS-B was a key component of the National Airspace and Air Navigation Plan (NAANP) approved by Cabinet in June 2014. To replace the current radar system, the NAANP proposed implementing ADS-B sites nationally and a two-phase mandate for all aircraft operating in controlled airspace to equip with ADS-B. The plan is being implemented through the New Southern Sky (NSS) Programme, which is being led by the Civil Aviation Authority (CAA) in partnership with the Ministry of Transport (the Ministry) and Airways.

How ADS-B works and its components

17. ADS-B surveillance requires aircraft to be fitted with equipment that collects and transmits satellite positioning data about their position, speed and direction. ADS-B provides more accurate and frequent data than the existing radar system, delivering safety and operational benefits.
18. In contrast to the existing radar system, ADS-B uses a system of satellites, on-board transponders and ground receivers to provide increased airspace coverage, with greater accuracy. The ADS-B ground infrastructure is now in place across New Zealand and is integrated into the air traffic management system.
19. There are two components of ADS-B. ADS-B OUT is primarily used for surveillance and transmits information from equipped aircraft to ground ADS-B receivers used for air traffic control and other aircraft that have ADS-B IN. ADS-B IN uses on-board receivers to collect information from other aircraft to improve a crew's situational awareness. This rule amendment mandates ADS-B OUT only. This is consistent with international practice.
20. It is possible for some versions of ADS-B OUT technology to be turned off, so that the data they transmit is not visible. Within controlled airspace, or any other areas where ADS-B OUT may be mandated by regulation, this would be prohibited. However, outside of these areas, operators are not required to have their ADS-B OUT system on at all times; they may still wish to do so however, given the safety benefits of being visible to other operators utilising ADS-B IN.
21. ADS-B OUT data is visible to any operator who is using an ADS-B IN system. However, in accordance with the NAANP, the CAA has considered the need for 'discreet' operations, such as in the case of Police enforcement. In these cases, the Civil Aviation Authority can permit the operator (for the purposes of that specific operation) to manage ADS-B OUT transmissions.
22. The safety of these particular operations will be managed by air traffic control, which will ensure separation of aircraft involved in discreet operations, from other aircraft. This approach can be applied to situations such as with Department of Conservation operations, and is a common-place, judicious exemption to the Civil Aviation Rules where the circumstances require it.

Comment

There are several safety and other benefits from moving to ADS-B

23. Transitioning to ADS-B introduces significant safety benefits. Where ADS-B IN is enabled, this improves crews' situational awareness of other ADS-B equipped aircraft in the area, regardless of whether they are in range of a ground receiver. This functionality will assist with integrating new aviation technology such as drones, into New Zealand's airspace, alongside manned aircraft.
24. ADS-B also enables more efficient use of controlled airspace by providing more accurate positioning information. The transition to ADS-B will increase surveillance coverage by 45 percent, compared to the existing radar system. Greater accuracy means shorter flight-times and potentially faster location of aircraft in distress or following an incident.
25. In future, it is likely that air traffic will no longer be dominated by manned aircraft with the ability to operate under traditional visual flight rules. Consequently, new technology such as drones will need to be fully integrated into the aviation system and have automated equipment for locating and avoiding interference with other aircraft.
26. The aviation system is expected to change significantly over the coming decade. ADS-B will help accommodate future 'data-hungry', information-based technologies, like those used by digital air traffic control towers.

Costs avoided to Airways

27. Replacing the existing radar system with ADS-B reduces capital and operating costs for Airways, the current air navigation service provider. Establishing the proposed ADS-B system will require \$18.1 million less capital spending than replacing the existing radar system. The ground system components of ADS-B are also less expensive to install and maintain than those in the existing radar system.
28. The transition to ADS-B further reduces system maintenance costs as these are avoided from 2021 until the end of life of the infrastructure – approximately 25 years. The Crown may also benefit from an increased return from Airways if its operating profit increases due to reduced costs.

Moving to ADS-B requires aircraft operating in controlled airspace to install new equipment

29. Moving to ADS-B will require equipment compatible with ADS-B surveillance infrastructure to be installed on existing aircraft, for these aircraft to continue operating in controlled airspace. This equipment comprises either a transponder and compatible satellite-positioning receiver, or an all-in-one system with a built-in position source.
30. ADS-B relies on aircraft having an ADS-B OUT system fitted to ensure they are visible to air traffic control through information broadcast from the aircraft, received by the ADS-B ground antennae. This information must have sufficient integrity for it to be used to separate aircraft safely in controlled airspace. Aircraft that broadcast inaccurate or incomplete information may not be 'visible' to air traffic controllers, or may provide misleading information about their location and intentions.

31. Since 31 December 2018, aircraft operating above flight level 245 have been required to be fitted with ADS-B equipment. This was the first phase of the transition to ADS-B and predominantly affected commercial aircraft. The proposed rule amendments in this paper will extend this requirement to *all* aircraft operating in controlled airspace, both above and below 24,500 feet.
32. Of aircraft operating below this flight level (approximately 4500 aircraft), an estimated 80 percent fly in controlled airspace and will be required to equip with ADS-B. These are primarily General Aviation aircraft.³
33. As this rule amendment only applies to aircraft operating in controlled airspace, aircraft operating outside this area are not required to equip with ADS-B OUT. However, if these aircraft did elect to equip, this would need to be consistent with the existing equipment and performance requirements.
34. Once Airways has decommissioned the existing radar system, aircraft not fitted with ADS-B OUT will be invisible to the air traffic control system, unless they are within the coverage of the contingency network (consisting of limited radar coverage). The contingency network will back up the ADS-B network in those situations where satellite signals are lost or degraded.
35. The intended contingency system is a Wide-area multi-lateration (WAM) system which will apply to the 'main trunk' of the aviation network. The main trunk includes Auckland, Wellington and Christchurch, along which the vast majority of passenger travel occurs. The contingency system is primarily intended to ensure that, in the event of satellite signal failure, which will result in the loss of ADS-B navigation, all aircraft in the main trunk system can be managed safely by air traffic control.

Aviation sector consultation

36. There has been continuous engagement with the aviation sector on the decision to introduce ADS-B, following the approval of the NAANP in 2014. NSS has engaged with the aviation sector for the past five years and signalled the planned move to ADS-B from the outset.

Recent consultation confirmed cost remains a barrier to aircraft equipping

37. The CAA recently consulted on the proposal to mandate ADS-B for all aircraft in controlled airspace. The primary reasons for consulting on the rule amendments were to understand the barriers associated with moving to ADS-B, inform solutions to address these barriers, and provide Cabinet with sector-informed advice on the likely impacts of this rule change.
38. During the consultation period, the CAA held 18 'roadshow' events where it spoke to 325 people from Whangarei to Invercargill. A total of 803 participants submitted on the proposal (including 651 pro-forma submissions and some organisation submissions). CAA also received 233 multi-choice questionnaires.
39. A consistent theme from consultation was that cost is a barrier to the affected aircraft equipping with ADS-B, particularly for private operators. The cost of equipping varies greatly

³ *General Aviation* includes all civil aviation operations other than scheduled air services (such as regular Air New Zealand operations) and non-scheduled air transport operations for remuneration or hire. It includes aerial work, instructional and pleasure flying.

depending on what work is needed, whether it is combined with other maintenance, and what related features the operator wants to fit.

40. While the cost of equipment has reduced significantly in the last three years, it has plateaued and the base price for a lower-end, civil ADS-B all-in-one system has settled at around NZ\$5,500.
41. In addition to equipment, owners must also pay for installation costs, which vary significantly depending on aircraft type. Including installation, the total estimated cost for aircraft to equip with ADS-B OUT ranges between approximately \$5,500 and \$13,000. This is a proportionally high cost burden to small commercial operators and the general aviation community.
42. There will be costs imposed by the new requirements that go beyond equipage costs of aircraft. For some operators, the cost of equipping an aircraft will be considered too high relative to the aircraft's value, or regarded as uneconomic given the amount of time some aircraft spend in controlled airspace. Similarly, some aircraft may not be flown frequently enough to justify the cost of equipment and installation.
43. While the transition to ADS-B will provide safety benefits to the aviation system as a whole, it presents significant costs and potential operating limitations to some individual operators. Where owners and operators do not choose to upgrade, these aircraft will not be permitted to operate in controlled airspace, which may reduce the aircraft's value.

Supporting arrangements

The decision to introduce a grant scheme mitigates some concern around cost

44. Cabinet recently agreed to establish a grant scheme to provide financial assistance to aircraft operators affected by the proposed rule amendment. A grant will be available to affected aircraft, covering approximately half the cost. Operators will still be required to pay the costs of installation, certification and testing to ensure the equipment meets the appropriate standard.
45. The grant scheme also incentivises these operators to equip with ADS-B IN, by providing an additional (smaller) grant for installing this equipment. While not necessary for the overall functioning of the new surveillance system, this function provides aircraft with greater safety benefits, such as the ability to see other aircraft operating in close vicinity.
46. It is important to note that the current surveillance equipment for individual operators has a limited life, and would require replacement eventually regardless of the shift to ADS-B. The grant scheme takes account of the inconvenience and costs of having to replace this equipment by the date of the proposed mandate (31 December 2021).

Separate arrangements in place for affected military aircraft

47. Military aircraft are impacted by the decision to introduce ADS-B in controlled airspace. The New Zealand Defence Force has been actively engaged in NSS and supports ADS-B as the future aviation surveillance system.
48. Cabinet recently approved funding [GOV-19-MIN-0015 refers] to upgrade military aircraft with a range of new equipment, including ADS-B. Installing ADS-B is a key component of the joint Ministry of Defence and New Zealand Defence Force project to upgrade various

communication, navigation and surveillance systems across military aircraft in order to comply with growing military and civil requirements.⁴ Due to the unique complexities of military aircraft, the cost to government of equipping these aircraft is significantly higher than the costs relating to lower-end civil sector systems.

49. The timeframe for equipping military aircraft with ADS-B is also significantly longer than for civilian aircraft. This means not all military fleets will be equipped ahead of the 31 December 2021 mandate. This is due to several factors, such as the complexity and duration of the process to certify new military equipment.
50. A transitional arrangement for military aircraft was anticipated when the NAANP was initially approved. There are also some challenges presented by the possibility of non-ADS-B equipped foreign State aircraft intending to enter New Zealand airspace. These aircraft may not be equipped due to different State timeframes for equipping, or operational security concerns with the equipment.
51. Without any transitional arrangements in place, the timeframe for equipping presents a risk to the continuity of domestic tasks conducted by military aircraft and the trained state of the New Zealand Defence Force. These tasks range from national contingency operations, such as search and rescue, humanitarian and disaster relief, through to transport in support of State visits. Separate arrangements are being finalised by the New Zealand Defence Force and Airways, supported by the CAA, to accommodate continuity of military aircraft operations and exemptions where operational security is required.

'Discreet' operations

52. ADS-B OUT data is visible to any operator who is using an ADS-B IN system. However, in accordance with the NAANP, the CAA has considered the need for 'discreet' operations, such as in the case of Police enforcement, or Department of Conservation operations.
53. In these cases, the CAA will permit the operator, for the purposes of that specific operation, to manage ADS_B OUT transmissions so as to mask their position. The safety of these particular operations will be managed by air traffic control, which will ensure separation of aircraft involved in discreet operations, from other aircraft. This approach can be applied to situations such as with Department of Conservation operations, and is a common-place, judicious exemption to the Civil Aviation Rules where the circumstances require it.

Risks

Unequipped aircraft are a threat to aviation safety

54. After 31 December 2021, aircraft without ADS-B equipment installed will be invisible to air traffic control (except in areas where limited contingency surveillance remains). This presents significant safety risks for all airspace users, should these aircraft enter controlled airspace.

There is limited capacity nationwide for workshops to install this equipment

55. The uptake of ADS-B OUT among affected aircraft is currently low (as at September 2019, roughly 11 percent of all aircraft on CAA's register). Many operators have been waiting for the

⁴ This refers to the Operational and Regulatory Aviation Compliance Sustainment (ORACS) project.

rule amendment to be signed or a government contribution to be confirmed ahead of equipping.

56. There are a limited number of avionics shops to manage the expected influx of aircraft requiring new ADS-B transponders as the mandate approaches. A backlog beyond the deadline could result in unequipped aircraft being undetected by air traffic control if operating in controlled airspace, which would present significant aviation safety risks.
57. The CAA estimates that by late 2019, at least 120 aircraft a month need to be equipping with ADS-B, if all aircraft flying in controlled airspace are to be equipped prior to the mandate coming into force. Of these aircraft, around 63 a month (about half) will need to be upgraded in avionics shops. Regardless, some aircraft owners may elect not to fly in controlled airspace immediately after the rule change and equip at their own pace.

A communications strategy is being implemented to mitigate these risks

58. A communications strategy has been prepared that provides a framework for encouraging operators to equip with ADS-B OUT. This is necessary given that the rule change offers no scope for flexibility and there is limited capacity for avionics shops to fit aircraft with this equipment.
59. The strategy looks to influence the supply-chain. As technical experts, avionics shops are able to leverage existing relationships with owners and operators to relay information about equipping. The CAA will work with industry to push for increased uptake as soon as a decision is made on whether to progress to rule-making. This will minimise the risk of a bottleneck at the avionics shops due to the 3800 aircraft that will be required to have ADS-B OUT equipment installed and tested on their aircraft by the end of 2021.
60. The communications strategy will target commercial operators as a priority, as these businesses rely on access to controlled airspace. This will be closely followed by non-commercial operators based at controlled aerodromes.

Delaying implementation of the rule change would have significant costs

61. Delaying the mandate beyond 31 December 2021 (say, for 12 months) to allow operators more time to equip their aircraft, would result in significant costs.
62. Airways would incur significant financial costs given it has already invested in ADS-B infrastructure. The current surveillance infrastructure is near end-of-life, and maintaining it beyond 31 December 2021 would introduce further financial and safety risks.
63. There is also no guarantee that a bottleneck would be avoided. When the United States was undertaking a similar process, despite a generous ten year lead time for adopting ADS-B OUT, uptake levels remained low until the Federal Aviation Administration made it absolutely clear that the mandate would not be extended and compliance would be enforced. Operators in New Zealand may assume (as US operators did), that the timeline will continue to be extended, and thus not equip their aircraft.
64. More broadly, delays in using ADS-B technology would delay the wider safety and efficiency benefits this will bring for the aviation system and New Zealand.

Proposed Civil Aviation Rule amendment

65. As Minister of Transport, I am empowered to make ordinary rules on civil aviation matters.⁵ Rules are the most common form of delegated legislation for aviation and typically contain detailed technical standards. In this case these relate to the equipment standards for ADS-B.
66. Introducing mandatory ADS-B OUT below flight level 245 will require a change to Civil Aviation Rule 91. Consistent with my delegations as the Minister of Transport, I am amending Civil Aviation Rule Part 91 to:
- 66.1. allow all controlled airspace in the New Zealand's domestic airspace to be designated as ADS-B mandatory from 31 December 2021
 - 66.2. specify the requirements for ADS-B transponders that must be fitted to aircraft operating in ADS-B mandatory airspace from 31 December 2021
 - 66.3. prohibit operators from knowingly transmitting bad or misleading ADS-B data.
67. There are existing offences in place for transmitting bad data with fines of up to \$5000, and for flying without an approved transponder with fines of up to \$2500. The current rules will be revised to specify that ADS-B is the only approved transponder in controlled airspace from 31 December 2021. Following this amendment to the rule, these offences will affect all operators flying in controlled airspace.
68. Changes may also be required to the corresponding Notice of Requirement, NTC91.258, which specifies the requirements and performance standards for ADS-B equipment.
69. Additional amendments may be required to a range of related Civil Aviation Rules (such as Parts 171 and 172). This is to ensure they are aligned with the primary amendments to Civil Aviation Rule Part 91, and to allow for New Zealand Defence Force discreet operations.

Regulatory Impact Analysis

70. The regulatory impact analysis requirements apply to this proposal. The CAA and Ministry have jointly prepared a Regulatory Impact Analysis (RIA), which is attached as an Appendix.
71. The Ministry's RIA Panel has reviewed the RIA, and considers that the information and analysis summarised meets the quality assurance criteria.

Human rights, gender, and disability implications

72. No human rights, gender, or disability implications arise from this paper.

Legislative implications

73. There are no further legislative implications.

Financial implications

74. There are no further financial implications.

⁵ Rule-making powers and associated procedures are set out in Part 3 of the Civil Aviation Act 1990.

Publicity

75. Pending Cabinet approval, the CAA will develop a Notice of Proposed Rulemaking providing specific details on the proposed rule amendments in Rule Part 91. This will be published on the CAA website, and affected parties will have an opportunity to submit their views.
76. Once I have signed this rule amendment (in my role as Minister of Transport) the new rule part will be published on the CAA website. Affected parties will also be informed on how to comply with the rule changes through an updated advisory circular and direct engagement.
77. Further, affected parties will receive guidance on how to equip with ADS-B and detail of how to certify this equipment, through communications material prepared for the grant scheme.

Departmental consultation

78. The following government agencies were consulted regarding this proposal: New Zealand Defence Force; Ministry of Business, Innovation and Employment; Department of Conservation; and the Treasury. The Department of Prime Minister and Cabinet were informed.

Proactive release of Cabinet paper

79. Following Cabinet agreement to this paper, I intend to release it on the Ministry's website.

Recommendations

80. The Minister of Transport recommends that the Committee:
1. **note** that Cabinet previously agreed, through the National Air Navigation Plan, to introduce a mandatory Automatic Dependent Surveillance-Broadcast OUT (ADS-B OUT)) aviation surveillance system to replace New Zealand's existing aviation surveillance radar infrastructure, which reaches the end of its operational life in 2021
 2. **note** that I intend to amend Civil Aviation Rule Part 91 to:
 3. allow all controlled airspace within New Zealand's domestic airspace to be designated as ADS-B mandatory from 31 December 2021
 4. specify the requirements for ADS-B transponders that must be fitted to aircraft operating in ADS-B mandatory airspace from 31 December 2021
 5. prohibit operators from knowingly transmitting bad or misleading ADS-B data
 6. **note** that additional amendments may be required to a range of related Civil Aviation Rules, to ensure they align with the primary amendments to Civil Aviation Rule Part 91, and to allow for New Zealand Defence Force discreet operations
 7. **note** that separate arrangements are being finalised for military aircraft affected by this rule amendment, given the longer timeframe to equip these aircraft with ADS-B and the requirement for the New Zealand Defence Force to conduct certain missions without disclosing their position
 8. **note** that this paper will be published on the Ministry of Transport's website.

Hon Phil Twyford
Minister of Transport

Dated: _____