

Regulatory Impact Statement: ADS-B OUT Mandate above FL 245

Agency Disclosure Statement

1. This Regulatory Impact Statement (RIS) has been prepared by the Civil Aviation Authority with input from Airways New Zealand.
2. In May 2014, Cabinet agreed to the National Airspace and Air Navigation Plan (NAANP) that provided the basis for the New Southern Sky Programme (NSS). This plan includes the replacement of our current radar-based system of surveillance with Automatic Dependent Surveillance –Broadcast (ADS-B). The current radar system will reach the end of its operational life at the end of 2021.
3. Surveillance is a critical safety system within aviation as it provides data that is used by air traffic controllers for the safe separation of aircraft.
4. ADS-B OUT is a system that provides data from the aircraft to the air traffic management system, where it can be used to maintain separation between aircraft in controlled airspace. ADS-B OUT requires specific equipment to be fitted to aircraft in order to provide the required data. ADS-B OUT is the globally-accepted method for a modern surveillance system. It was the basis of the NAANP proposals for modernising surveillance, consulted on in 2013 and approved by Cabinet in May 2014.
5. This RIS is an analysis of regulatory options to introduce ADS-B OUT; specifically, the proposal in the NAANP that all aircraft flying in controlled airspace above 24,500 ft (FL 245) to be equipped with ADS-B OUT by 31 December 2018.¹
6. This RIS recommends that a rule be adopted that mandates ADS-B OUT in controlled airspace above FL 245 by 31 December 2018, with a forward fit requirement. This option will support a safe, phased transition to ADS-B, setting minimum standards that can be enforced, and maintain the already high level of ADS-B OUT equipment on board aircraft. The impact on the operators of the fleet above FL 245 will be minimal overall, though some operators will need to equip their aircraft with ADS-B systems. The NAANP proposed a mandate to ensure system integrity through the change process of this safety critical system.

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¹ A second phase – extending ADS-B to all controlled airspace by the end of 2021 – is a project with a different risk profile and a number of alternative regulatory options. For this reason it will be covered in a separate project and RIS.

Executive summary

7. The National Airspace and Air Navigation Plan (NAANP) sets out a ten year, three stage plan for modernising New Zealand's aviation system. The NAANP is being implemented through the New Southern Sky (NSS) programme. Cabinet agreed to the NAANP in May 2014.
8. A key change signalled in the NAANP is the updating of the surveillance system - information about where aircraft are located that is fed into the air traffic management system (ATM) and used to keep aircraft separated in controlled airspace (i.e., airspace where an air traffic control service is provided). Surveillance is a critical part of the aviation system and is central to safety.
9. The NAANP proposes that the current radar surveillance system be replaced with an ADS-B OUT surveillance system. The current system reaches the end of its operational life in 2021. ADS-B OUT is the International Civil Aviation Organization (ICAO) recommended and internationally recognised standard for modern surveillance that delivers safety and operational benefits.
10. The NAANP proposal is for the transition to ADS-B to occur in two phases: firstly for operators that fly above FL 245 from 31 December 2018 (Phase 1), and secondly for all operators that fly in controlled airspace from 31 December 2021 (Phase 2). This RIS concerns a rule change to enact the first of those two phases.
11. Airways New Zealand (Airways), as infrastructure owner, has invested in the ground infrastructure required to meet the proposal described in the NAANP. However, aircraft operators are not currently required to equip their aircraft with equipment compatible with Airways' proposed new system.
12. This RIS considers the regulatory proposal for implementing the first phase of the proposed ADS-B-OUT mandate. The proposal considers options for dealing with technical specifications of equipment, installation requirements, a proposal to prohibit knowingly transmitting bad ADS-B data, and forward fit requirements so that new and newly imported aircraft would meet the ADS-B OUT technical requirements if they are to be flown in ADS-B OUT mandated airspace.
13. The rationale for a phased approach is to support the safe transition from the current system to an ADS-B environment, while the current radar system remains in place. It allows the new system to be introduced and used by the best-equipped aircraft, before extending the system to all users in controlled airspace when the current radar comes out of service in 2021.
14. The overall cost of this proposal is low as approximately 98 per cent of aircraft that fly above FL245 are already equipped for ADS-B OUT. Although the majority of aircraft are already equipped this does not necessarily mean that all these aircraft will transmit information that meets the minimum requirements for the ATM system.

15. The Civil Aviation Authority (CAA) is currently advising operators that if the equipment is certified to a certain standard then the equipment should meet or exceed the intended rule and anything less is at risk of not meeting future rules. A rule will formalise the minimum requirements of equipment that will be compatible with Airways ground infrastructure, and enable CAA to require those minimum standards through certification, and to enforce the standards where necessary.
16. Furthermore, regulation is required to ensure all aircraft have the necessary equipage correctly installed on their aircraft by the date proposed in the NAANP.
17. The preferred option is for a Civil Aviation Rule (rules) that provides for:
 - the requirement that the equipment meets specified performance standards;
 - the establishment of ADS-B OUT mandatory airspace in a phased way: first in controlled airspace above FL 245 from 31 December 2018:
 - a forward fit requirement that any new installations or replacement of existing ADS-B transponders occurring after 31 December 2017 would need to comply with the current technical standard for ADS-B transponders. This would also apply to aircraft ordered new for use in New Zealand;
 - making it an offence for an operator to knowingly transmit bad or misleading ADS-B OUT data from an aircraft; and
 - for the CAA to be able to issue exemptions for operators that fly above FL 245 provided the operator can demonstrate a plan to equip or retire the aircraft. Exemptions would be operator, aircraft and operation specific; be time limited, and include conditions as necessary to mitigate any risk associated with an unequipped aircraft operating above FL 245.
18. The proposed Rule will also provide the regulatory framework for Phase 2 of the transition towards ADS-B OUT.

Background and Status Quo

New Southern Sky

19. New Zealand is currently undertaking the New Southern Sky (NSS) programme². As part of this, the Government released the National Airspace and Air Navigation Plan (NAANP) to set out the steps that need to be taken to manage the transition to the new technologies.
20. The NAANP specifically addresses the need to replace the current radar system by the end of 2021, when the current system reaches the end of its operational life.³

² The NSS is an ambitious ten-year plan to modernise the airspace and use of air navigation in New Zealand. NSS was approved by Cabinet in early 2014. NSS will enable shorter flight times, improved safety and lower carbon emissions for more than 10 million air travellers every year.

³ The surveillance infrastructure is owned and maintained by Airways Corporation.

21. New Zealand is currently served by three primary surveillance radars⁴ at Auckland, Wellington, and Christchurch Airports. Six secondary surveillance radars⁵ provide additional coverage and information to Air Traffic Control (ATC).
22. New Southern Sky (NSS) proposes:
 - implementation of ADS-B sites nationally, to replace the current secondary surveillance network;
 - a contingency system to provide back-up to ADS-B OUT in the event of loss of the satellite signal either on an individual aircraft (equipment failure), or across the system as a whole; and
 - a mandate from 31 December 2018 for all aircraft that operate above FL 245 to be equipped with ADS-B OUT compatible equipment (Phase 1) and from 31 December 2021 for all aircraft in controlled airspace to be ADS-B OUT equipped (Phase 2).

What is ADS-B OUT?

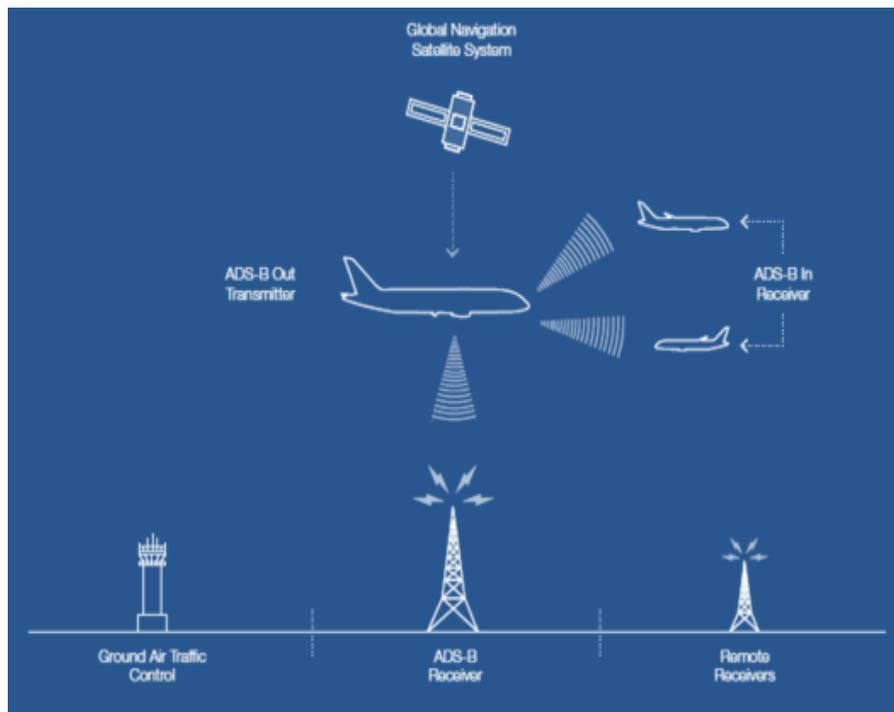
23. ADS-B OUT is a satellite dependent surveillance system. An aircraft equipped with ADS-B OUT receives data from navigation satellites via a GPS receiver, which then feeds data to a transponder. As such, the ADS-B system comprises two essential components: the global navigation satellite systems (GNSS) receiver and the ADS-B transponder.
24. The system broadcasts information about the aircraft, including identification, position, altitude, speed, intention and other relevant data, to ADS-B ground stations every second. The broadcast system is the ADS-B OUT transponder fitted on the aircraft. The broadcast does not depend on the ground system interrogating the aircraft's system; it occurs continuously and automatically.
25. Data received by ground stations is then transmitted to the air traffic management (ATM) system for display to air traffic control (ATC) where it is used primarily 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 (ATS).
26. The benefits of ADS-B OUT include:
 - significantly improved surveillance coverage compared to existing radar systems, particularly at low altitudes; improved safety, particularly in airspace with more traffic, as ADS-B OUT provides more precise position information on a more frequent basis. It refreshes up to twice every second compared to every five seconds for radar;
 - ATC may be able to provide improved levels of support in unusual or emergency situations, including search and rescue, through more accurate position reporting which may help locate a distressed or downed aircraft;

⁴ Primary surveillance radar measure only the range and bearing of targets by detecting reflected radio signals (uncooperative targets).

⁵ Secondary surveillance radar relies on targets equipped with a radar transponder, that replies to each interrogation signal by transmitting a response containing encoded data

- allows for the implementation of a superior technology that is an efficient and safe replacement for the current radar network; and
- alignment of New Zealand’s surveillance system with recommendations for system modernisation from the International Civil Aviation Organization (ICAO), and global and regional practice in surveillance system modernisation.

Figure 1: How ADS-B OUT works



Source: Boeing Commercial, Aero Magazine

27. Some operators may also install equipment into the aircraft to receive ADS-B data. This is called ADS-B IN. The NAANP recognises that while ADS-B IN could benefit crew of equipped aircraft, it is not an essential component of the future surveillance system and will not be required in the rules.
28. The Civil Aviation Authority (CAA) and Airways have agreed a set of safety conditions that will ensure that the necessary system redundancy is maintained throughout the transition from radar to ADS-B OUT.
29. The mandating of ADS-B OUT above FL 245 is an important first step. It provides for the implementation of the new system, including identification and addressing of any emerging issues, using a uniformly-equipped fleet; and ensures that new aircraft entering the system can be safely integrated into the ADS-B surveillance environment.
30. Airways will develop a safety case, to be approved by the CAA, before the current radar system decommissioning begins, and as a back-up contingency system is being implemented. This process is scheduled to begin in July 2019.

Economic benefits to New Zealand of NSS and ADS-B

31. An independent report by Castalia Strategic Advisors was commissioned to assess the economic implications of the proposals in the NAANP. Castalia estimated the net benefit of all the changes encompassed by the NAANP at \$2 billion.
32. The direct benefits of the introduction of ADS-B relate primarily to capital and operating savings for Airways. As the existing radar system comes to the end of its life, there may be an increased risk of radar outages and operational maintenance costs to Airways.
33. Airways owns and maintains all of New Zealand's aviation surveillance infrastructure. It has secured a provider for the new ADS-B OUT surveillance system and has a strategy for decommissioning the existing radar system.
34. Airways' capital expenditure decisions for 2017-2019 are based on the assumption that the 2018 ADS-B OUT mandate will occur. A large capital expenditure project has already been committed that would not be required if ADS-B OUT is not mandatory above FL 245 after 2018. The new system is estimated to cost \$44m (\$32m has been committed for the 2017-2019 pricing round and \$12m is proposed in the following pricing round). This investment is expected to provide \$31m of new customer benefits and avoid \$21m of costs to maintain the radar current system.
35. There are also indirect benefits to operators from the mandating of ADS-B as they will be able to take full advantage of performance-based navigation (PBN). The NAANP provides for the implementation of PBN, a concept whereby aircraft can navigate more directly resulting in lower fuel burn and shorter track miles.
36. PBN alone is expected to realise \$1.5 billion of the potential benefits from the NAANP. ADS-B will support realisation of the PBN benefits. More accurate surveillance information will allow more precise management of aircraft using PBN, resulting in the greatest possible safety and efficiency gains and resulting benefits.

Costs associated with ADS-B

37. There are costs associated with the introduction of ADS-B OUT, most notably the cost of equipping aircraft and certification of the modification. Airways data indicate that approximately 98 percent of flights in controlled airspace above FL 245 are undertaken by aircraft already equipped with ADS-B OUT.
38. Around 34 aircraft, belonging to 6 operators are known to frequently fly above FL 245 and have yet to be fitted with ADS-B OUT. Exemptions from the rules may be available if the aircraft will not be operating in New Zealand after 2021 or for discreet operations⁶.

⁶ Information transmitted via ADS-B is not encoded and can be readily received and interpreted by any person with the correct receiver. Some operators, such as Defence and Police or other operators carrying out sensitive operations, may wish to turn off ADS-B to preclude others being able to see the identity and flight parameters of the aircraft. Airways has procedures to safely manage such discreet operations.

39. The cost of equipping aircraft that do not already carry ADS-B OUT is highly variable. Some of these aircraft (such as older commercial aircraft) have complex systems that will require significant modifications in order to install ADS-B OUT. Operators may choose to include ADS-B OUT as part of a general update of aircraft systems, in which case the cost for ADS-B OUT alone is difficult to determine.
40. Installation and certification costs will depend on the specific requirements for each aircraft. The CAA has estimated a wide range from \$10,000 to \$750,000. The lower bound represents stand-alone equipment that would allow most medium to large aircraft to comply with the proposed rule. However, operators of larger aircraft may prefer more expensive systems that can be integrated with existing cockpit hardware, or comprise part of a full refit of the aircraft's avionics system. In the latter case, ADS-B would not account for the entire cost indicated.
41. There are costs to Airways for the replacement of the radar system. These costs include the capital expenditure programme outlined above.

Problem definition

42. Current rules require aircraft operators to have their aircraft equipped with transponders that are compatible with the current radar system if they fly within controlled airspace.
43. Cabinet agreed in the NAANP that the technology used in New Zealand for surveillance change from being radar-based to being based on ADS-B. Once Airways moves to ADS-B ground infrastructure as proposed in the NAANP, the current rule specifications will not align with the technology actually used.
44. The change from radar based to satellite based surveillance technology is a major change to a safety critical aviation system. Without proper testing and management of an area of controlled airspace prior to the decommissioning of the existing radar system, there is a risk that the integrity of the surveillance system will be compromised.
45. Although many operators that are currently flying above FL 245 have voluntarily equipped⁷ their aircraft with equipment that will operate in an ADS-B surveillance system, there is a risk that the equipment may be installed incorrectly and therefore transmit bad or misleading data. This would put additional resource requirements on Airways to manage the aircraft, and delay or reduce the safety and efficiency benefits to operators.

Objectives

46. The aim of the proposal is to provide a regulatory framework for the safe and effective introduction of ADS-B into the New Zealand Flight Information Region.

⁷ The voluntary equipage is likely due both the benefits of ADS-B to the operator and the expected 2018 mandate that was signalled in the NAANP.

47. The primary objectives are to:
- ensure the integrity of the surveillance system during the transition to ADS-B;
 - set the required performance level of aircraft equipment compatible with the ADS-B surveillance system; and
 - minimise costs and unnecessary regulatory impost on industry.

Options

48. In determining the approach to address the objectives, the Civil Aviation Authority (CAA) considered a number of regulatory approaches. These options are:
- 1) status quo;
 - 2) regulations to set the standards for ADS-B equipment;
 - 3) a rule requiring forward fit of ADS-B OUT from 31 December 2017 for new aircraft, or new or replacement ADS-B installations in aircraft, that are certificated to fly above FL 245.
 - 4) a rule providing for mandating ADS-B in:
 - a) designated airspace on aircraft above FL 245 from 31 December 2018
 - b) all controlled airspace from 31 December 2021 only; or
 - 5) a rule mandating for ADS-B OUT, prohibiting operators from knowingly transmitting bad data, and providing a forward fit requirement from 31 December 2017 (**preferred option**).

Option 1: Status Quo

49. Under the status quo, the CAA has rules requiring all aircraft that fly within controlled airspace in the New Zealand Flight Information Region (NZFIR) have a transponder that is compatible with Airways' existing SSR surveillance system. There are also rules with regard to transponder mandatory airspace and being able to designate controlled airspace. The current rules require equipment that is compatible with the radar ground infrastructure rather than ADS-B OUT equipment. The rules will therefore not align with the proposed new technology that will be the primary surveillance system in New Zealand for above FL 245 after 2018 as proposed in the NAANP.
50. As the current radar array heads towards end of life, there is an increased risk of outages of the radar system. From 2018, Airways will consider ADS-B OUT the primary surveillance system for operators above FL 245 and the radar array will only operate as a safety net. Under the status quo, the rules will not require that operators are equipped with equipment that is compatible with Airways' primary surveillance system. This could undermine the integrity of this safety critical system.

Option 2: Regulation that set standards for ADS-B transmission

51. This option would provide rules that:
 - set the performance standard for ADS-B equipage on the aircraft that is compatible with the ATM system; and
 - prohibit operators from knowingly transmitting bad data.
52. Operators would need to demonstrate that the equipment on board their aircraft meets the performance requirements and is of sufficient quality and integrity to allow the safe separation of aircraft, to minimise the workload on controllers, and to maximise the efficiency benefits of ADS-B.
53. If the ADS-B OUT equipment is incorrectly installed or tested, ADS-B OUT data from the aircraft to Airways can be incomplete or misleading. This means that the data does not provide accurate information regarding the position of the aircraft. Airways can identify the aircraft and advise the operator that the data is bad; however, there is no current requirement for the CAA to require that operators ensure that ADS-B OUT data is accurate.
54. These safety considerations are the primary driver for a proposal to make it an offence to knowingly transmit bad ADS-B OUT data.
55. The Civil Aviation Act 1990 mandates the making of rules for the purposes of assisting with aviation safety. Although operators are already installing equipment based on guidance provided by other authorities, a rule will provide the ability for the CAA to enforce the requirements in this safety critical system.

Option 3: A rule requiring forward fit of ADS-B OUT twelve months out from the mandated date, for new installations of ADS-B or new aircraft that are certificated to fly above FL 245.

56. The proposed forward fit requirement would mean that after 31 December 2017 any:
 - a. new ADS-B installations
 - b. replacement of existing transponders
 - c. installation of second-hand equipment
 - d. new aircraft ordered for use in New Zealandthat will be operated above FL 245, must comply with the current technical standard for ADS-B transponders.
57. The current technical standard for ADS-B transponders is TSO-166b. This is a revision of the original technical standard: TSO-166. TSO-166b offers richer data for surveillance purposes, so is preferred for new installations.
58. Equipment meeting the original standard, TSO166, will be acceptable to the Airways surveillance system, so early adopters of ADS-B technology will not be disadvantaged in operational or economic terms by the forward fit proposal. Used aircraft that are imported already equipped to the original standard will also be able to

continue to use that system, provided they meet the other performance requirements set in the rule.

59. The technical standard may be further revised in the future. Any future iterations would need to be considered to determine if the changes are relevant to the New Zealand operating environment and aviation system. This proposal does not entail an automatic requirement that future installations of ADS-B transponders will need to meet the latest standard at the time of installation.
60. The benefits of requiring a forward fit include:
- new aircraft will arrive in New Zealand fitted with the ADS-B-OUT equipment that is compatible with the ATM system, in order to avoid cost for operators related to CAA certification processes, reduce the risk of additional cost to operators, and improve CAA's ability to efficiently certify new aircraft and newly fitted ADS-B systems;
 - reducing the likelihood that operators will need to upgrade their transponder equipment again in the short to medium term: the requirement is to equip once, and to equip appropriately; and
 - facilitating a move toward the current standard in ADS-B systems to improve overall fleet capability.
61. The costs associated with forward fit are similar to those of phasing in the mandate, in that it will require earlier investment for some operators. However, it does offer protection from aircraft being inappropriately fitted at the time of purchase and registration and then requiring later refit. It also ensures a consistent minimum standard of aircraft equipage which will assist a safe transition to an ADS-B environment. As all new equipment produced to a technical standard must comply with the current technical standard, the only cost implication for operators is that they will not be able to fit second-hand equipment that complies with the previous standard.

Option 4: A rule providing for mandating ADS-B and requiring ADS-B equipage on aircraft operating in designated airspace

62. There are two options to implementing ADS-B OUT in designated airspace and the associated equipment requirements and standards: a phased implementation (Option 4(a)), or a single mandate for use of ADS-B OUT in controlled airspace, at the time the current radar system is finally decommissioned (Option 4(b)).

Option 4(a): A phased approach: ADS-B mandatory above FL 245 from 31 December 2018

63. The proposed 2018 mandate is set at FL 245, as it is the boundary between upper and lower airspace. During the ADS-B transition, the rule will only require operators that fly above FL 245 to be ADS-B OUT equipped. Any operators that are unable to equip prior to the mandate could either feasibly amend their flight plans so that they do not fly above FL 245 or seek an exemption.
64. The rationale for introducing ADS-B OUT above FL 245 first is to facilitate a smooth transition from the current 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, and providing a safe environment in which the ADS-B OUT system can be installed, made operational, and any implementation issues identified and assessed while a radar system remains in place.

65. Although 98 percent of the flights taking place above FL 245 are already equipped, there are still 2 percent (around 34 aircraft) that will be required to be equipped by the mandate. The CAA may grant exemptions for some of these operations if, for example, the operator is planning to retire the aircraft before 2021, or if they have scheduled a major aircraft system upgrade after 31 December 2018, or if they provide a credible and more cost-effective plan for installing ADS-B OUT.
66. The two phase transition allows Airways the opportunity to manage end-of-life risks of the current radar system and also to assess the impact of a national surveillance system change while the country still has a fully functioning SSR safety net. This approach has been adopted by other States and has been the basis for Airways' planning and investment decisions, and would be consistent with the safety criteria established under NSS for aviation system changes.
67. This option does introduce an additional regulatory mechanism, and will impose some compliance costs on operators that are not yet equipped; however, since ADS-B OUT equipment will be needed for this kind of operation by 2021 in any case this option will bring the investment forward rather than impose a new cost altogether (unless an exemption is granted).

Option 4(b): A rule requiring ADS-B in all controlled airspace from 31 December 2021 only

68. Under this option the CAA would not proceed with the proposed 2018 mandate as signalled in the NAANP, but would develop a rule proposal for all operators in controlled airspace at all levels to be equipped with ADS-B OUT by the end of 2021, at which point the current radar system will be fully decommissioned.
69. This option would have the benefit of a simpler, single phase approach to regulation. Most aircraft above FL 245 are already equipped, indicating that voluntary early uptake may be sufficient to get aircraft that fly above FL 245 equipped. Operators would have a longer period to plan for equipage, and could choose to equip later without needing to apply for an exemption from the CAA.
70. The cost benefit analysis of a rule to mandate all controlled airspace from 31 December 2021 has yet to be developed and this is planned for 2017. However, this option presents potential safety and policy risks around a major change to core aviation safety infrastructure. Specifically, this option could:
 - result in unhappy stakeholders due to the last minute change in approach from what was proposed in the NAANP and is expected by Industry;
 - result in financial impacts for Airways who have made financial decisions based on the indicative 2018 mandate outlined in the NAANP as described on page 5;
 - result in some operators and aircraft buyers or importers less likely to equip until just before the existing radar is decommissioned, adding to the complexity of managing non-equipped aircraft through the transition; and

- result in some operators of aircraft that fly above FL 245 leaving their equipage planning until after 2018. This could increase the likelihood of a bottleneck during the transition and in particular in the period immediately prior to the 2021 mandate.

Option 5 (Preferred option): A rule mandating ADS-B above FL 245 from 31 December 2018, supported by a forward fit requirement and rule to prohibit bad or misleading data (Options 2 and 3 and 4(a)).

71. This option would comprise the following components:
- the establishment of standards for ADS-B transmission;
 - the establishment of ADS-B OUT mandatory airspace in a phased way: first in controlled airspace above FL 245 from 31 December 2018 (and providing a framework for ADS-B OUT in all controlled airspace from 31 December 2021);
 - a requirement for new transponders and new aircraft that will be subject to the ADS-B mandate to meet the current ADS-B standard ahead of the mandate; and
 - making it an offence for operators to knowingly transmit bad or misleading ADS-B data.
72. This option is consistent with the Cabinet's 2014 decision on the NAANP.
73. Under this option the CAA will be able to smooth the transition by requiring that the larger, more complex aircraft are equipped well before the proposed decommissioning of the radar is completed. Between 2018 and 2021, avionics engineers will be able to concentrate their efforts on installing and testing equipment on general aviation aircraft as proposed in the NAANP (estimated at around 2,000 aircraft).
74. The operators who have already equipped are unlikely to be affected by the proposed rule amendment, given the education that the CAA has provided so far in regard to possible minimum safety standards. The CAA and Airways have been proactively checking to ensure that the ADS-B OUT equipment aircraft installed on aircraft aligns with other countries' ADS-B OUT rules. However, a rule will ensure that the CAA can enforce the minimum safety requirements through certification.
75. This option would also minimise the safety and financial risks described in the previous options, and would maximise the benefits from ADS-B OUT implementation.

Table 1 provides a summary of the options against each of the objectives.

	Option 1: Status Quo – no rule change	Option 2: Regulation to set the standards for ADS-B transmission	Option 3) Rules to require a forward fit	Option 4: Mandate ADS-B in designated airspace and require ADS-D equipment in aircraft operating in that airspace		Preferred option: combination of 2 and 3 and 4(a)
				Option 4(a) Mandating ADS-B above FL 245 from 2018	Option 4(b) A rule requiring ADS-B in all controlled airspace from 31 December 2021	
Ensure the integrity of the surveillance system through the transition to ADS-B-OUT.	No. Under the status quo, operators are not required to install the necessary equipment on their aircraft to be able to communicate with the Airways system, which will be the ADS-B system.	No. Operators that choose to equip, will provide airways with accurate data. However, aircraft that are not equipped could pose either a safety issue for the aviation system or a resourcing issue for Airways.	No. Operators that choose to equip, will provide airways with accurate data. However, aircraft that are not equipped could pose either a safety issue for the aviation system or a resourcing issue for airways.	Yes , a mandate will ensure that all operators that fly above FL 245 in New Zealand have the necessary equipment. This will ensure the integrity of a safety critical surveillance system and enable airways to carry out testing prior to the decommissioning the existing radar system.	No. Only new aircraft would be equipped. This would significantly increase the complexity of air traffic management through the transition period. System testing would not be as comprehensive as with a fully equipped fleet above FL 245.	Yes. This will set the standards for ADS-B, require forward fit for new aircraft and new ADS-B installations, and mandate ADS-B above FL 245. The integrity of the surveillance system will be maintained throughout the transition period.
Set the required performance level for aircraft equipage	Partially. Most operators above FL 245 are already equipping their aircraft, given the advantages they	Yes. This option will provide performance criteria for the type of equipment that will be	Partially. This option will require that new transponder installations and new aircraft meet the required performance	Yes. This option will provide performance criteria for the type of equipment that will be compatible with the ATM system.	Yes. This option will provide performance criteria for the type of equipment that will be compatible with the ATM system.	Yes. This option will provide performance criteria for the type of equipment that will be compatible

	Option 1: Status Quo – no rule change	Option 2: Regulation to set the standards for ADS-B transmission	Option 3) Rules to require a forward fit	Option 4: Mandate ADS-B in designated airspace and require ADS-D equipment in aircraft operating in that airspace		Preferred option: combination of 2 and 3 and 4(a)
				Option 4(a) Mandating ADS-B above FL 245 from 2018	Option 4(b) A rule requiring ADS-B in all controlled airspace from 31 December 2021	
compatible with the ADS-B OUT surveillance system.	receive, and therefore know the required standards. There is, however, a risk that the wrong equipment may be installed.	compatible with the Air Traffic Management system.	standard, but it would not require aircraft operators to retrofit their aircraft.			with the ATM system. The data provided to Airways will be accurate.
Minimises costs to industry.	No , operators may not be aware of the required standards, and so may install incorrect equipment that does not enable Airways to efficiently manage their flight, which may have significant operational and safety consequences.	Yes , this option will ensure everyone knows what the standards are, and if they comply will minimise costs for the industry.	Partially , this option will minimise costs to industry, given that operators will only need to meet the higher standard when and if they chose to equip. However, air traffic management will be more complex as not all operators will be equipped with ADS-B OUT. This will have resourcing implications for Airways.	Yes , this option will ensure that operators fit the most up-to-date equipment in their aircraft, minimising resourcing costs for Airways and reducing the likelihood that operators will need to replace new equipment if the wrong equipment is installed in the aircraft.	Partially , this option would minimise the cost to industry as operators would only need to replace their existing transponders if their existing transponder was due for replacement or the operator sees the benefit of upgrading. However, operators that have already equipped may lose on investment made in anticipation of the mandate signalled in the approved policy and in information provided by the CAA about the likely minimum standard and timing requirements.	Yes , this option will ensure that operators fit the most up-to-date equipment in their aircraft, minimising resourcing costs for Airways and reducing the likelihood that operators will need to replace new equipment. Early adopters of ADS-B will not be disadvantaged.

Consultation

76. Between 18 February 2016 and 18 March 2016, the CAA provided a discussion document regarding the proposed rule to all operators known to fly above FL 245, and aircraft maintenance engineer license holders. The document was also published on the CAA and NSS websites.
77. Submissions were received from Air New Zealand, the New Zealand Defence Force (NZDF), Mount Cook Airline Ltd, and one general aviation operator.
78. Respondents were supportive of the general direction signalled in the document. All respondents that fly above FL 245 have at least some of their fleet already equipped with ADS-B OUT.
79. The NZDF will make specific arrangements with Airways and the CAA due to their specific military requirements (for example, long lead-in times for ADS-B OUT equipment that meets military performance requirements). The NZDF has undertaken to work with Airways and the CAA to ensure safe operation of its aircraft when those operations occur in airspace that includes non-military operations.
80. Airways can identify operators that are not currently equipped with ADS-B OUT. The CAA will follow up with operators who are not yet equipped, to determine what their plans are for their aircraft, as part of the rule making process. Airways is already following up with any operators that are providing bad or misleading data and will continue to engage with industry through the transition period.

Conclusion

81. The preferred solution is a combination of option 2, 3 and 4a. This will provide for a performance-based rule with a forward fit requirement and associated service package to facilitate a safe transition to an ADS-B OUT environment. This will require changes to Civil Aviation Rule Parts 91 and Part 71 Subpart E.
82. The rule would provide a legal framework consistent with the current practice and the proposal that was signalled in the NAANP. The effect on operators would be minimal given that operators are already expecting the change, as it was described in the NAANP.

Recommendations

83. The CAA recommends that a new performance-based rule be developed with an associated service package to mandate ADS-B OUT above FL 245 from 31 December 2018. This rule will enable the CAA to have a mechanism to enforce reliable data and set the stage for the transition to ADS-B OUT as proposed in the New Southern Sky Programme. The rule will also ensure that all equipment is installed by an appropriate person or organisation.

84. The performance criteria of the rule will be based on requiring ADS-B OUT equipage that meets the appropriate international standards that are compatible with the 1090 MHz ES ADS-B ground infrastructure that will be implemented in New Zealand.
85. It is also recommended that a forward fit requirement is part of the rules. This requirement will help smooth the transition, maintain system integrity through the change from radar to ADS-B, facilitate the adoption of the current technical standard of ADS-B equipment, and minimise the likelihood of a bottleneck of work for New Zealand's avionics engineers prior to the 31 December 2018.

Implementation plan

86. Following Cabinet approval, a Notice of Proposed Rulemaking (NPRM) will be developed providing specific details on the proposed rule amendments in Rule Part 91 and 71. This will be published on the CAA website, and affected parties will have an opportunity to submit their views.
87. A draft Advisory Circular (AC) will be developed concurrently with the NPRM for industry feedback. The AC will be finalised at the same time as the rule changes and the service package will be timed to ensure that operators are aware of their requirements at the time of the mandate.
88. Once the rule changes are completed, the relevant CAA operational group (Air Transport and Airworthiness) and Airways will monitor uptake of ADS-B by operators, and any transmission of bad or misleading data.
89. Once signed by the Minister, the new rule parts will be published on the CAA website, and affected parties will be informed on how to comply with the rule changes through an updated AC.
90. The CAA and Airways will work together to enforce the mandate. The CAA and Airways will work with operators that have exceptional circumstances to operate above FL 245 without ADS-B OUT after the mandate, provided they have the necessary approvals. Operators without an approved exemption will not be allowed to proceed above FL 245 without an appropriate and operational ADS-B OUT system in their aircraft after the mandate comes into force.

Monitoring, evaluation and review

91. Airways is currently carrying out monthly monitoring of the uptake of ADS-B OUT in the New Zealand aviation system and will advise the CAA of any issues. Any lessons learnt as part of this phase of the ADS-B OUT transition will be incorporated into Phase 2 of the ADS-B transition (controlled airspace below FL 245).
92. The CAA Air Transport and Airworthiness group will also proactively engage with operators during certifications and inspections to clarify the requirements. Where necessary, enforcement action will be taken to ensure ongoing compliance with the rules.