CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

Advisory Circular
AC 91-2

Revision 2

Assignment of Mode S Address

26 October 2022

General

Civil Aviation Authority advisory circulars (ACs) contain information about standards, practices, and procedures that the Director has found to be an **Acceptable Means of Compliance (AMC)** with the associated rule.

Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate AC.

Purpose

This AC describes an acceptable means of compliance with standards for the operation of an aircraft equipped with Mode S transponder equipment. It also documents the management of Mode S codes for non-aircraft use.

Related Rules

This AC relates specifically to Civil Aviation Rule Part 91.247(b).

Change Notice

Revision 2 updates address information for the Aircraft Register and reflects changes to how Mode S addresses are assigned.

We have also added a Version History.

Version History

History Log

Revision No.	Effective Date	Summary of Changes
AC91-2, Rev 0	1 Apr 1997	Initial issue of this AC
AC91-2, Rev 1	17 Jul 2008	Added information on: • the hex code as an easier means for expressing

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		Mode S addresses • the management of Mode S addresses for military aircraft, and • the management of Mode S addresses for ground vehicles in a multi-lateration surface surveillance environment. Amended the FAA TSO reference.
AC91-2, Rev 2	26 Oct 2022	Updates address information for the Aircraft Register. Updates sections to reflect changes to how Mode S addresses are assigned. Adds a Version History.

Table of Contents

Introduction

Aircraft are required to be equipped with, and operate, Mode S transponder equipment in certain segments of airspace within the USA. This is also a requirement within the European Airspace. Automatic Dependent Surveillance – Broadcast (ADS-B) also uses the Mode S transponder in aircraft. As ADS-B is implemented in airspace, the requirement for aircraft to be fitted with Mode S transponders will increase. Prior to operating in such airspace, the Mode S transponder equipment must be assigned a unique address code by the aircraft's State of Registry, which, for New Zealand, is done by the Director of CAA (the Director).

Requirement for Mode S address code

ICAO Annex 10 requires that selective surveillance and data link communications with a Secondary Surveillance Radar (SSR) Mode S equipped aircraft is established through the use of an SSR Mode S aircraft address composed of a unique combination of 24 bits, known as a unique SSR Mode S address code.

In New Zealand, this is reflected in rule 91.247(b) which states that aircraft with Mode S transponder equipment installed must have a unique SSR Mode S address code.

Allocation of Address Code

In accordance with ICAO Annexe 10 and rule 91.247, each aircraft needs to be ~~is~~ assigned a unique 24-bit SSR Mode S address code by the State of Registry. In practice, New Zealand-registered aircraft are assigned SSR Mode S address codes by the Director, based on the principles that:

- at any one time, no address will be assigned to more than one aircraft
- only one address shall be assigned to an aircraft, irrespective of the number of transponders on board
- the address shall not be changed, except under an exceptional circumstance, and shall not be changed in flight
- when an aircraft changes State of Registry, the previously assigned address shall be relinquished and a new address shall be assigned by the new registering authority, and
- the address serves only a technical role and is not to be used to convey other information such as aircraft performance or other operating characteristics.

Under Annex 10 Volume 1, ICAO allocates blocks of SSR Mode S addresses to each State of Registry. The first bits of the address comprise the national identification code followed by the individual address code. The length of the national identification code varies from State to State but the complete address is always 24 bits.

For New Zealand the national code is **1100 1000 0**. The remaining 15 bits provide the individual aircraft address codes, which, for New Zealand-registered aircraft, comprise the binary form of the aircraft identification number in the CAA database. An example of a complete address is

1100 1000 0000 1110 0110 0101

To make the Mode S code easier to read and interpret, it is often expressed as a six-character hexadecimal (hex) format word.

In hex format, New Zealand Mode S addresses will always be in the range C80000 to C87FFF. For the code example above, in hex format the code is C80E65.

Mode S Transponder Equipment

Mode S transponder equipment must meet the requirements of FAA TSO-C112 and be capable of replying to:

- Mode 3/A interrogations with the code specified by ATC
- Intermode, and
- Mode S interrogations.

Military Aircraft Mode S Codes

New Zealand military aircraft that operate in Mode S airspace are also required to carry a New Zealand Mode S code. Issue of the Mode S code are managed by the New Zealand Defence Aviation Authority. CAA has allocated a block of codes for military use.

Mode S Codes for Ground Vehicles

With the introduction of Multi-Lateration (MLAT) surface surveillance to support low visibility operations at major airports, some vehicles at these airports require Mode S transponders to be fitted to enter the manoeuvring area. These vehicles are assigned Mode S codes to ensure compatibility with the system. CAA has allocated a block of codes for ground vehicle use, and these are individually assigned and managed by the operator of the vehicles. Blocks of codes have currently been allocated to Airways Corporation and Auckland Airport Authority.

Uncrewed Aerial Vehicles (UAVs)[1]

For UAVs to operate within controlled airspace or shared airspace, strict controls need to be put in place to manage any risks arising from the operation proposed. The operator's approach to managing any risk of operating within controlled or shared airspace will be assessed through the operator's Part 102 certification process. This assessment will also consider whether it is appropriate to permit the UAV's nature of operation within controlled or shared airspace. CAA will determine if the risk can be appropriately managed by the operator and whether it is appropriate to issue a Mode S code, or whether some other form of electronic conspicuity, as part of a wider suite of risk management mitigations, is a better option.

Should CAA believe there is a specific safety case that warrants the use of a transponder and allocation of a Mode S code for a UAV, this will also be considered on a case-by-case basis and managed through the Part 102 certification process.

Application for Allocation of Mode S Code

A Mode S code is automatically generated when an aircraft is registered. They can be found on the CAA website by looking on the Aircraft register search.

If you need a formal letter specifying the Mode S code, or you need the code to programme a transponder before the aircraft is able to be registered (provided an application for registration has been made), this can be requested from the Aircraft Registrar.

A request for a Mode S transponder code should be emailed to: AircraftRegistrar@caa.govt.nz

[1] The term "Uncrewed Aerial Vehicles" should be interpreted as meaning the same as the ICAO definition "Unmanned Aerial Vehicles".

The requestor must supply their contact details and sufficient information to identify the aircraft, including the:

- make
- model
- serial number, and
- aircraft registration mark.

Aircraft that are not, or not intended to be, New Zealand-registered, cannot be allocated a Mode S code by the Director.

Applicants must forward their request for a Mode S code to the appropriate authority in the State of Registry for that aircraft.