CIVIL AVIATION SAFETY AUTHORITY AUSTRALIA

AIRWORTHINESS BULLETIN

Transponder Altitude Reporting Issues

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1. Applicability

Maintenance on all Mode "C" equipped aircraft using "Gillham code" as a source for altitude reporting (mode C) data.
Note Airborne Collision Avoidance System (ACAS) is also known as Traffic Collision Avoidance System (TCAS)

2. Background

Several reported incidents have occurred overseas where TCAS equipped aircraft have suffered from erroneous TCAS Resolution Advisories (RA's). Investigation by overseas National Airworthiness Authorities (NAA) revealed that the spurious RA's were due to incorrect Transponder Mode "C" data.

In each case these installations used altitude information derived from a Gillham code source (encoding altimeter or blind encoder), and the altitude error was caused by pins being pushed back in the transponder rack.

Mode C transponders have been around for a long time so why all the problem now? Recent introduction of ACAS, rely on the altitude reporting function of the transponder. The code lines from the Gillham source work in such a manner that a pushed back line could cause Mode C altitude data to jump several thousand feet, resulting in an aircraft equipped with ACAS/TCAS receiving an immediate erroneous RA.

A similar situation could occur if the aircraft is within the monitored intruder area of a ACAS/TCAS equipped aircraft and the intruders Mode C altitude suddenly drops from being a threat altitude to an altitude that is no longer classified as a threat. This could result in a mid air collision.

Similarly the proposed use of Automatic Dependant Surveillance Broadcast (ADS-B) as an air traffic control function will rely heavily on the altitude data integrity of the transponders.

3. Return to Service Requirements

- For VFR aircraft, the airframe and engine privileges allows for an airframe LAME to certify for the replacement of removable items of radio equipment.

  Note: Be aware that a functional test to establish the integrity of the code lines will be required when replacing a Mode C equipped transponder utilising the altitude data from a Gillham source. As special test equipment is required this task will require the certification of an appropriately trained and rated LAME.

- For IFR aircraft, an appropriately trained and rated LAME is required to provide certification for replacement and subsequent return to service.

Because of the possible problem associated with the Mode C Gillham code altitude data a repaired or replacement transponder may be installed without repeating the requirements of CAO 100.5 testing; however a minimum performance test must be performed before return to service.

Any time the aircraft connections to a transponder or the altitude data source have been removed and reconnected, each altitude reporting code line must be tested for integrity of connection. Integrity of connection may be verified by performing a test of

the Mode C function of the transponder system. Table 1 indicates the altitude that confirms line integrity.

TABLE 1. ABBREVIATED CORRESPONDENCE TEST

ALTITUDE INFORMATION PULSE POSITIONS

RANGE	PULSE POSITION										
(0 or 1 in a pulse position indicates absence or presence of a pulse, respectively)											
INCREMENTS (FEET)	D2	D4	A1	A2	A4	B1	B2	B4	C1	C2	C4
-1000	0	0	0	0	0	0	0	0	0	1	0
-900	0	0	0	0	0	0	0	0	1	1	0
-700	0	0	0	0	0	0	0	1	1	0	0
-400	0	0	0	0	0	0	0	1	0	1	1
-200	0	0	0	0	0	0	1	1	0	0	1
800	0	0	0	0	0	1	1	0	0	0	1
2800	0	0	0	0	1	1	0	0	0	0	1
6800	0	0	0	1	1	0	0	0	0	0	1
14800	0	0	1	1	0	0	0	0	0	0	1
30800	0	1	1	0	0	0	0	0	0	0	1

Integrity of code lines is ensured through testing at these increments.