



IBAC Bulletin 02-02

Subject: Interface Problem with ACAS/TCAS and Mode S Transponder

The purpose of this Bulletin is to advise of problems with an interface between the Traffic Alert and Collision Avoidance System (TCAS) and a single type of Mode S transponder. Left uncorrected, this problem may generate erroneous alerts and significantly reduce altitude separation between aircraft.

A Mode S transponder has the ability to report altitude in either 100 foot or 25 foot increments depending on the source of the altitude data. When the transponder replies to Mode S surveillance interrogations, the altitude reporting field contains a bit, known as the Q bit, that indicates whether the altitude contained in the report is being provided in the format designed for 25 foot or 100 foot increments. Unfortunately, some transponders are using the 25 foot format, and setting the Q bit to indicate 25 foot data, when the altitude data is in fact derived from a 100 foot altitude source. In other words, the value of the altitude always ends in 00. It is essential that altitude data derived from a 100 foot source be reported using the format for 100 foot data, with the Q bit set to indicate 100 foot data.

TCAS uses the information provided by the Q bit to determine which altitude tracking algorithm will be used within the collision avoidance logic. When the incorrect tracking algorithm is used, the tracked aircraft's vertical profile, and tracked vertical speed will be very erratic. The sudden changes in an aircraft's tracked vertical speed can be interpreted by TCAS as the start of a climb or descent. This can result in unnecessary, erroneous traffic advisories (TAs) and resolution advisories (RAs) being issued by TCAS. In some cases, the RA could result in the TCAS aircraft maneuvering towards the other aircraft.

Data collected indicates there appears to be single transponder type and model currently in operation that is using the incorrect format in the altitude report. Certain Rockwell Collins TDR-94 (Collins part number 622-9352-004) and TDR-94D (Collins part number 622-9210-004) Mode S transponders indicate that 25 foot altitude data are being transmitted while actually transmitting 100 foot altitude data. This problem only occurs when these transponders are installed in airplanes with a Gillham encoded altitude source.

The evaluation data indicates that aircraft equipped with this type of transponder are causing TAs and RAs to be issued. Rockwell Collins is aware of this problem and they have developed a modification to the transponder to correct the problem. Service Bulletin Number 17 (TDR-94/94D-34-17, dated February 8, 1999) corrects the problem and results in the part numbers being changed to either 622-9352-005 or 622-9210-005.

In the United States, the TCAS Transition Program's (TTP) data collection activities have identified 26 aircraft that are equipped with this transponder. The TTP has been

able to determine the owner/operator of most of these aircraft and efforts are underway to contact these aircraft owners and operators. The TTP's investigation of this problem indicates that:

All aircraft equipped with this transponder are general aviation or regional airline aircraft

- With one exception, all aircraft are turbo-prop aircraft .
- With one exception, all aircraft have been manufactured since 1998

On November 5, 2001, the Federal Aviation Administration (FAA) issued a Notice of Proposed Rulemaking (NPRM) that would amend the Federal Aviation Regulations, Part 39.13 to add an Airworthiness Directive (AD) that requires the implementation of Collins' Service Bulletin Number 17 in the TDR-94/94D transponders that are installed on aircraft with Gillham encoded altitude sources. The details of this NPRM are contained in Docket No. 2000-CE-32-AD.

In summary:

- If an aircraft is equipped with either a Rockwell Collins TDR-94 or TDR-94D transponder with part number 622-9352-004 or 622-9210-004 and the aircraft uses Gillham code for its altitude source, TCAS-equipped aircraft can issue erroneous RAs against the aircraft and these RAs could result in the vertical separation with the TCAS aircraft being reduced instead of increased.
- The availability of a Service Bulletin from Collins that will correct the problem. I would like to request that you encourage your members to contact Collins and arrange for incorporation of Service Bulletin 17 into these transponders prior to the issuance of the AD cited above.