RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #15

Proposed Accommodation of the Broadcast of Mode A Codes

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Summary

There as been some consideration of requiring ADS-B systems to broadcast Mode A codes when operated within certain U.S. airspace. This Working Paper, while not endorsing the need for the broadcast of Mode A codes, proposes a technical approach for accommodating the broadcast of Mode A codes using the 1090 MHz Extended Squitter.

Reference: DO-260A Draft 4F

1. Discussion

There as been some consideration within SC-186 of requiring ADS-B systems to broadcast Mode A codes when operated within certain U.S. airspace. This Working Paper, while not endorsing the need for the broadcast of Mode A codes, proposes a technical approach for accommodating the broadcast of Mode A codes using the 1090 MHz Extended Squitter.

The basis for the proposed approach are the following points:

1. Knowledge of the aircraft's Mode A codes are only needed by certain ground ATC automation systems and not by other aircraft

2. Future U.S. ATC automation systems eliminate the need for including Mode A codes in ADS-B

3. Based on discussions with ICAO SCRSP the desire to include Mode A codes within ADS-B appears to unique to the U.S. since most other countries planning for the use of ADS-B do not have the same limitations within their ATC automation systems. Therefore, it will not be possible to include a requirement for the broadcast of Mode A codes within ICAO standards.

4. As a consequence of 3) above, the broadcast of Mode A will need to be inhibited when aircraft operate outside of the U.S.

5. With 1090ES, when equipped aircraft are operating within SSR coverage, there is no need to broadcast the Mode A codes. This occurs since the ADS-B target reports will need to be "fused" with the corresponding SSR target report before it is processed by the ground ATC automation functions and as a result the target report provided to the controller and the ATC automation functions will include the Mode A code as received by the SSR. Therefore, within SSR coverage the broadcast of Mode A codes by ADS-B will need to be inhibited to preserve link capacity. Thus, in most of the NAS where 1090ES will be used there will be no need, nor desire to allow, for the broadcast of Mode A codes by ADS-B. Exceptions will include parts of Alaska and potentially certain other low altitude airspace below the coverage floor of SSR.

6. It is desirable to select a 1090ES message format that would not be received and used for report generation onboard airborne ADS-B systems.

As a result of the above the use of 1090ES "TEST" message is recommended as the best solution to convey the Mode A codes. In order to do this it will be necessary to define a SUBTYPE code for the "TEST" (i.e., TYPE=23) messages and to then assign a Subtype code specifically for allowing "TEST" messages to convey an aircraft's Mode A code. Also a means will need to be provided to allow the flight crew to enable or disable the transmission of this "TEST" message. In DO-260A we would need to revise the specification for the TEST message, the associated update rate and the TEST message lifetime.

2. Proposal

If it is determined that accommodation must be provided within ADS-B for the broadcast of Mode A codes, then the following revisions to DO-260A are proposed.

CHANGE #1

2.2.3.2.7.3 Type "23" ADS-B Messages for "TEST"

Type "23" ADS-B Messages shall be used for Test Purposes. "TEST" messages **shall** be used exclusively for the broadcast of information in support of bench and/or certification testing of 1090 MHz ADS-B system or for the broadcast of information of interest only to local ground ADS-B ground applications. "TEST" message broadcasts are not to result in an ADS-B report being generated onboard any other ADS-B equipped aircraft, nor is the specific information being included in the test message expected to be generally codified within internationally accepted standards. "TEST" messages containing information of interest only to local ground ADS-B ground applications are intended to be used in support of technical or operational evaluations or in support of local operational requirements.

This MOPS defines two categories of use for "TEST" messages as specified below. Provisions **shall** be made to allow the flight crew to inhibit the broadcast of "TEST" messages when operating in airspace or under operating conditions where such broadcasts are not authorized.

Subtype "0" "TEST" messages **shall** be used only for messages in support of bench and or certification testing of 1090 MHz ADS-B systems. The format for Subtype "0 "TEST" messages shall be as shown in Figure 2.2.3.2.7.3-1.

	"TEST MESSAGE (TYPE=23 and SUBTYPE=0)"					
Msg. Bit #	33	37	38	40	44	88
"ME" Bit #	1	5	6	8	12	56
Field Name	Type = 28 [5]		Subtype = 0 [3]		Unformatted Test Data [48]	
	MSB	LSB	MSB	LSB	MSB	LSB

Figure 2.2.3.2.7.3-1: TEST Message (TYPE=23 and SUBTYPE=0) Format

"TEST" messages of Subtypes 1 through 6 are reserved.

Subtype "7" "TEST" messages **shall** be used for the broadcast of the Mode A, 4096, code currently assigned to the aircraft. The format for Subtype "7" "TEST" messages shall be as shown in Figure 2.2.3.2.7.3-2. The transmission of the Subtype "7" "TEST" messages shall be inhibited if the Mode A code has not been received from an on-board source within the past 5 seconds.

	"TEST MESSAGE (TYPE=23 and SUBTYPE=7)"							
Msg. Bit #	33	37	38	40	44	55	56	88
"ME" Bit #	1	5	6	8	12	23	24	56
Field Name	Type = 28 [5]		Subtype = 0 [3]		Mode A Code [12]		Reserved [36]	
	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB

Figure 2.2.3.2.7.3-2: TEST Message (TYPE=23 and SUBTYPE=7) Format

CHANGE #2

2.2.3.3.1.4.4 "TYPE 23 (TEST)" ADS-B Event-Driven Message Broadcast Rate

The following broadcast rate requirements **shall** apply only under the condition that "TEST" messages of the Subtype indicated are authorized to be transmitted. Section 2.2.3.2.7.3 requires a means for the flight crew to inhibit the transmission of "TEST" when operating in airspace or under operating conditions where such transmissions are not authorized.

The "TEST" ADS-B Event-Driven Messages with SUBTYPE = "0" **shall** be broadcast NOT MORE THAN ONCE each time the Event Driven Test Information is updated to the transponder.

The "TEST" ADS-B Event-Driven Messages with SUBTYPE = "7" **shall** be broadcast at random intervals that are uniformly distributed over the range of 11.8 to 12.2 seconds.

CHANGE #3

Modify the entry in Table 2.2.3.3.1.4.6.1 for Message Type 23 as follows:

Message Type	**Message SUBTYPE**	**Message Lifetime (seconds)**
23	= 0	5.0 seconds (+/- 0.2 sec.)
	= 1, 2, 3, 4, 5 or 6	Reserved (see note)
	= 7	24 seconds (+/- 0.2 sec.)