RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #4

Proposed changes to DO-260A based on acceptance of Working Papers 1090-WP-3-02 and 1090-WP-4-03

Presented by Gary Furr

SUMMARY
This Working Paper proposes changes required in Sections 2.2 and 2.4 of DO-260A based on acceptance of the proposed changes to Appendix A outlined in 1090-WP-4-03 for the 1090 MHz ADS-B TCAS RA Broadcast.

1.0 Introduction

At Meeting #2 in Melbourne, WG-3 agreed to identify a means for making the contents of the TCAS air-ground Resolution Advisory (RA) downlink message (contained in aircraft register 30 Hex) available as an extended squitter broadcast.

An approach was proposed in Meeting #3 in Phoenix with Working Paper 1090-WP-3-02 by Vince Orlando. Based on the presentation of 1090-WP-3-02, WG-3 agreed with the approach proposed. Based on this agreement, Vince Orlando submitted Working Paper 1090-WP-4-03 for specific changes in Appendix A required to implement the approach proposed during the Phoenix meeting.

Assuming that WG-3 agrees with the specific language proposed in 1090-WP-4-03, there are changes in Sections 2.2 and 2.4 of DO-260A that are also required.

2.0 Proposed Changes to Sections 2.2 and 2.4

I believe that changes are required to the following sections of DO-260A based on the acceptance of 1090-WP-4-03:

2.2.3.2.7.9 Extended Squitter Aircraft Status Messages (TYPE "28")

2.2.3.3.2.6.4 "Extended Squitter Aircraft Status" ADS-B Event – Driven Message Broadcast Rate

2.2.3.3.2.10 Maximum ADS-B Message Transmission Rates

And, therefore, changes are required in the associated Test Procedures in Sections:

2.4.3.2.7.9 Verification of Extended Squitter Aircraft Status Messages (TYPE "28") (subparagraph 2.2.3.2.7.9)

2.4.3.3.2.6.4 Verification of "Extended Squitter Aircraft Status" ADS-B Event – Driven Message Broadcast Rate (subparagraph 2.2.3.3.2.6.4)

2.4.3.3.2.10 Verification of Maximum ADS-B Message Transmission Rates (subparagraph 2.2.3.3.2.10)

Existing Sections with Proposed Changes:

2.2.3.2.7.9 Extended Squitter Aircraft Status Messages (TYPE "28")

The Extended Squitter Aircraft Status Message (TYPE "28") is used to provide additional information regarding aircraft status. Subtype "1" is used specifically to provide Emergency / Priority status. Subtype "2" is used specifically to provide transmission of the TCAS Resolution Advisory (RA) broadcast squitter when data is inserted into register 30 Hex, the aircraft register used for air-ground transfer of the TCAS RA downlink message.

Specific formatting of the TYPE "28," Subtype "1" is provided in Appendix A, Figure A-9. Specific formatting of the TYPE "28," Subtype "2" is provided in Appendix A, Figure A-9A.

********** End of proposed revision for Section 2.2.3.2.7.9 **********

2.2.3.3.2.6.4 "Extended Squitter Aircraft Status" ADS-B Event – Driven Message Broadcast Rate

The "Extended Squitter Aircraft Status" (Type 28), "Emergency/Priority Status" ADS-B Event - Driven Message Subtype =1) shall be broadcast at random intervals that are uniformly distributed over the range of 0.8 to 1.2 seconds relative to the previous Emergency/Priority Status Message for the duration of the emergency condition established in accordance with Appendix A, Figure A-9, Note 2. The delay conditions specified in 2.2.3.3.2.9 shall be observed.

The "Extended Squitter Aircraft Status" (Type 28), "TCAS RA Broadcast" ADS-B Event – Driven Message (Subtype = 2) shall be broadcast at random intervals that are uniformly distributed over the range of 0.8 to 1.2 seconds for ***TBD*** seconds after data has been inserted into register 30 Hex. Upon insertion of new data into register 30 Hex, the timer shall be reset and the contents of the TCAS RA Broadcast squitter shall be updated.

********** End of proposed revision for Section 2.2.3.3.2.6.4 **********

2.2.3.3.2.10 Maximum ADS-B Message Transmission Rates

a. The maximum ADS-B message transmission rate of non-transponder ADS-B transmitter implementations shall not exceed 6.2 transmitted messages per second.

b. If the Event-Driven message transmission rate must be reduced in order not to exceed the maximum rate specified in section 2.2.3.3.2, then transmission priority shall be assigned as follows:

(1). If the Emergency/Priority Status message (2.2.3.3.2.6.4) is active, it shall continue to be transmitted at the specified once per second rate and other Event-Driven messages shall be allocated equal priority for the remaining capacity.

(2). If the Emergency/Priority Status message is not active, transmission priority shall be allocated equally to all active Event-Driven messages.

(3). The broadcast of the TCAS RA Broadcast Squitter shall take priority over the Event-Driven protocol broadcast of all other message types, as specified in Section A.6.4.3. If an Emergency/Priority Status Message and a TCAS RA Broadcast Squitter occur at the same time, each squitter type shall be transmitted at the once-per-second specified rate and transmission of any other Event-Driven protocol message shall be suspended.

Note: *Prioritization should only be necessary when in the Airborne State since a number of messages are not needed during Surface operations. Specifically, TCP and TCP + 1 information should not be needed during Surface operations.*

********** End of proposed revision for Section 2.2.3.3.2.10 **********

2.4.3.2.7.9 Verification of Extended Squitter Aircraft Status Messages (TYPE "28") (subparagraph 2.2.3.2.7.9)

2.4.3.2.7.9.1 Verification of Extended Squitter Aircraft Status Messages (TYPE "28" Subtype 1) (subparagraph 2.2.3.2.7.9)

Purpose/Introduction:

The Extended Squitter Aircraft Status Message (TYPE "28") is used to provide additional information regarding aircraft status. Subtype "1" is used specifically to provide Emergency / Priority status.

Specific formatting of the TYPE "28," Subtype "1" is provided in Appendix A, Figure A-9.

Measurement Procedure:

Configure the ADS-B Transmitting System to transmit Airborne Position Messages. Set the ADS-B Transmitting System to Airborne status. Produce valid Airborne Position Messages at the nominal rate with valid position and altitude data with the Surveillance Status Subfield set to ONE (binary 01) to signify an emergency condition.

Verify that the ADS-B Transmitting System begins to transmit Extended Squitter Aircraft Status Messages at the nominal rate with the TYPE Subfield set to 28 (binary 1 1100) and the SUBTYPE Subfield set to ONE (binary 001).

Verify that for each integer Emergency/Priority Status input value in Table 2-110 the system generates Extended Squitter Aircraft Status Messages with the TYPE subfield set to 28, the SUBTYPE subfield set to ONE and the Emergency/Priority Status subfield in each such message set equal to the corresponding binary coding in the table.

Table 2-110: Discrete Values for Emergency/Priority Status

EMERGENCY/PRIORITY STATUS		
Coding (binary)	**Coding** (decimal)	**Meaning** (Emergency/Priority Status)
000	0	No Emergency
001	1	General Emergency
010	2	Lifeguard/medical
011	3	Minimum fuel
100	4	No Communications
101	5	Unlawful Interference
110	6	Reserved
111	7	Reserved

2.4.3.2.7.9.2 Verification of Extended Squitter Aircraft Status Messages (TYPE "28" Subtype 2) (subparagraph 2.2.3.2.7.9)

Purpose/Introduction:

The Extended Squitter Aircraft Status Message (TYPE "28") is used to provide additional information regarding aircraft status. Subtype "2" is used specifically to provide transmission of the TCAS Resolution Advisory (RA) broadcast squitter when data is inserted into register 30 Hex. Specific formatting of the TYPE "28," Subtype "2" message is provided in Appendix A, Figure A-9A.

Measurement Procedure:

Configure the ADS-B Transmitting System to transmit Airborne Position Messages. Set the ADS-B Transmitting System to Airborne status. Produce valid Airborne Position Messages at the nominal rate with valid position and

altitude data with the Surveillance Status Subfield set to ZERO (binary 00) to signify a "no-emergency" condition situation.

Insert valid data into register 30 Hex. Verify that the ADS-B Transmitting System begins to transmit Extended Squitter Aircraft Status Messages at the nominal rate with the TYPE field set to 28 (binary 1 1100) and the SUBTYPE Subfield set to TWO (binary 010) with the format as specified in Appendix A, Figure A-9A. Verify that these Extended Squitter Aircraft Status Messages are broadcast at random intervals that are uniformly distributed over the range of 0.8 to 1.2 seconds for ***TBD*** seconds after the data has been inserted into register 30 Hex.

********** End of revision for Section 2.4.3.2.7.9 **********

2.4.3.3.2.6.4 Verification of "Extended Squitter Aircraft Status" ADS-B Event – Driven Message Broadcast Rate (subparagraph 2.2.3.3.2.6.4)

2.4.3.3.2.6.4.1 Verification of Extended Squitter Aircraft Status Message Broadcast Rate for TYPE 28, Subtype 1 Messages (subparagraph 2.2.3.3.2.6.4)

Equipment Required:

Provide a method of loading valid data for ADS-B broadcast messages into the ADS-B equipment under test.

Provide a method of detecting the RF pulses of the ADS-B Broadcast Message for display on an oscilloscope.

Measurement Procedure:

Step 1: Initialization

Establish the emergency condition in accordance with Appendix A. Verify that the Emergency/Status Event Driven Message (Type-28, Subtype=1) is broadcast at intervals that are distributed over the range of 0.8 to 1.2 seconds. Clear the established emergency condition and verify that NO Emergency/Status Event Driven Messages are broadcast.

Step 2: Data Ceases to be Updated (subparagraph 2.2.3.3.2.11)

Establish the broadcast of the ADS-B Emergency/Status Event Driven Message (Type-28, Subtype=1) message as in Step 1 above. Then stop the input of data for the ADS-B Emergency/Status Event Driven Message (Type-28, Subtype=1) message.

Verify that the ADS-B Emergency/Status Event Driven Message (Type-28, Subtype=1) message is no longer broadcast 60 +/- 1 seconds after stopping the data input.

2.4.3.3.2.6.4.2 Verification of Extended Squitter Aircraft Status Message Broadcast Rate for TYPE 28, Subtype 2 Messages (subparagraph 2.2.3.3.2.6.4)

Equipment Required:

Provide a method of loading valid data for ADS-B broadcast messages into the ADS-B equipment under test.

Provide a method of detecting the RF pulses of the ADS-B Broadcast Messages for display on an oscilloscope.

Measurement Procedure:

Step 1: Initialization

Configure the ADS-B Transmitting System to transmit Airborne Position Messages. Set the ADS-B Transmitting System to Airborne status. Produce valid Airborne Position Messages at the nominal rate with valid position and altitude data with the Surveillance Status Subfield set to ZERO (binary 00) to signify a "no-emergency" condition situation.

Insert valid data into register 30 Hex. Verify that the ADS-B Transmitting System begins to transmit Extended Squitter Aircraft Status Messages at the nominal rate with the TYPE field set to 28 (binary 1 1100) and the SUBTYPE Subfield set to TWO (binary 010) with the format as specified in Appendix A, Figure A-9A. Verify that these Extended Squitter Aircraft Status Messages are broadcast at random intervals that are uniformly distributed over the range of 0.8 to 1.2 seconds for ***TBD*** seconds after the data has been inserted into register 30 Hex.

After ***TBD*** + 1 seconds, verify that Extended Squitter Aircraft Status Messages with TYPE 28, Subtype 2 are not being broadcast.

Step 2: Data Ceases to be Updated (subparagraph 2.2.3.3.2.11)

Establish the broadcast of the Extended Squitter Aircraft Status Messages with TYPE 28, Subtype 2 as in Step 1 above. Verify that bit 27 of these Messages is set to ZERO (0) as identified in Appendix A, Figure A-9A. After ***TBD*** + 1 seconds, verify that these Messages are not being broadcast.

****** End of proposed revision of Section 2.4.3.3.2.6.4 *********

2.4.3.3.2.10 Verification of Maximum ADS-B Message Transmission Rates (subparagraph 2.2.3.3.2.10)

Equipment Required:

Provide equipment capable of loading valid data for ADS-B broadcast messages into the ADS-B equipment under test through the operational interface.

Provide a method of monitoring ADS-B broadcast messages output by the equipment under test.

Provide a Wide Band Dual Channel Oscilloscope (HP l7l0B, or equivalent).

Measurement Procedure:

Step 1: Maximum Combined ADS-B Message Output rate (Subparagraph 2.2.3.3.2.10--Airborne

Set the Airborne condition and load valid data into all the ADS-B Broadcast messages that can be supported by the equipment under test at a rate ensuring maximum transmission rate. Also ensure that the data for all event driven messages changes at a rate requiring more than the permitted maximum output rate of two messages per second. Verify that each of the ADS-B Broadcast messages types are output at rates within the specified tolerance, that the Airborne Position Messages are being transmitted, and that only two event driven messages per second are transmitted. Also verify that the total combined rate is less than or equal to 6.2 messages per second.

During this test, also verify that the transmitted output power remains within the specified limits.

Step 2: Maximum Combined ADS-B Message Output rate (Subparagraph 2.2.3.3.2.10--Surface

Set the on the ground condition and load valid data into all the ADS-B Broadcast messages that can be supported by the equipment under test at a rate ensuring maximum transmission rate. Also ensure that the data for all event driven messages changes at a rate requiring more than the permitted maximum output rate of two messages per second. Verify that each of the ADS-B Broadcast messages types are output at rates within the specified tolerance and that the Surface Position Messages are being transmitted. Also that the total combined rate less than or equal to 6.2 messages per second. During this test pay particular attention to output power.

During this test, also verify that the transmitted output power remains within the specified limits.