

RTCA Special Committee 186, Working Group 3
EUROCAE WG-51, SG-1

ADS-B 1090ES MOPS Maintenance

Meeting #25

Eurocontrol Headquarters, Brussels Belgium
17 – 20 February 2009

Report on Action Item 24-20 regarding
Change Item #29 - Clarify start/end of squittering

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Summary
This Working Paper addresses action item 24-20 related to Change Item #29, “Clarify start/end of squittering”.

1 Introduction

This Working Paper addresses action item 24-20 related to Change Item #29, “Clarify start/end of squittering”.

Example of questions to which MOPS should provide clear answers:

- After how long Airborne Position Message will be no more transmitted when 2d position is no more available but altitude ~~is~~ remains available? Does it stop after 60s or will the Airborne position message continue to be transmitted after 60s
- When airborne position message is transmitted with no horizontal position but only with altitude, what is the duration during which the altitude might be not refreshed before the transmission is completely stopped?
- When the transmission is stopped due to lack of altitude, is the insertion of altitude sufficient to restart the transmission of the ES?

2 Comparison of 1090 MOPS with Mode S transponder Mops

1090 MOPS++	
<p>2.2.3.3.2.11 ADS-B Message Timeout</p> <p>a. The ADS-B Transmitting Subsystem shall clear all 56-bits of the Airborne Position Message, Surface Position Message and Airborne Velocity Message if no new data is received within two (2) seconds of the previous input data update. This timeout requirement shall be applied individually for each of the three (3) message types identified.</p> <p>Notes:</p> <ol style="list-style-type: none"> 1. <i>These messages are cleared to prevent the reporting of outdated position and velocity information.</i> 2. <i>During a register timeout event, the “ME” field of the ADS-B Broadcast Message may contain ALL ZEROs, except for those fields that may be updated due to the receipt of new data.</i> <p>b. The ADS-B Transmitting Subsystem shall not clear the Aircraft Identification Message (see §2.2.3.2.5) if no new data (neither aircraft type, emitter category, nor identification data) is received within up to 60 seconds of the previous input data update.</p> <p>Note: <i>The Aircraft Identification Message, is not cleared since it contains data that rarely changes in flight and is not frequently updated.</i></p> <p>c. The ADS-B Transmitting Subsystem shall not clear the Target State and Status, Operational Status, or Event-Driven Messages (see §2.2.3.2.7) if no new data is received within up to 60 seconds of the previous input data update.</p> <p>Note: <i>The Event-Driven Messages do not need to be cleared since contents of such messages are only broadcast once each time that new data is received.</i></p>	<p>Clear content after 2 seconds</p>
<p>2.2.3.3.2.12 ADS-B Message Termination</p> <p>a. The ADS-B Transmitting Subsystem shall terminate broadcast transmissions of the Airborne Position, Surface Position, Aircraft Identification and Category, Velocity, Target State and Status, and/or Aircraft Operational Status Messages if input data necessary to update the particular ADS-B Message TYPE is not available for a period of 60 seconds, except that transmission termination of Surface Position Messages does not apply to Non-Transponder Devices on aircraft that are on the surface, or on surface vehicles.</p> <p>Notes:</p> <ol style="list-style-type: none"> 1. <i>For the Airborne Position Message, specifically, Altitude Data alone is sufficient to maintain broadcast of the message once the message has been initiated.</i> 2. <i>For the Surface Position Message, the receipt of new Position (i.e., Latitude and Longitude, combined), Movement, or Ground Track data is sufficient to maintain broadcast of the message once the message has been initiated.</i> 3. <i>For all other ADS-B Messages, the receipt of new data necessary to update any single parameter of the message is sufficient to maintain broadcast of the message once the message has been initiated.</i> <p>b. Each ADS-B Message type shall be terminated individually and independently of all other ADS-B Messages.</p> <p>c. Class B2 Non-Transponder-Based Transmitting Subsystems on Ground Vehicles shall provide an interface capable of putting the unit into a standby condition in which the unit suspends all message transmissions.</p> <p>Notes:</p>	<p>Stop if data not available for 60s except for ↗ airborne position ES</p>

<p>1090 MOPS++</p>	
<p>1. This interface is intended to be used by a mapping function that will automatically trigger the interface if the Transmitting Subsystem is outside a user adaptable two-dimensional geographic area.</p> <p>2. If required because of spectrum considerations, the two-dimensional geographic area will be defined as the movement area (i.e., runways and taxiways) plus a reasonable buffer area (i.e., 50 foot buffer). Implementations of this feature should be designed such that a particular ground authority can specify a region that conserves spectrum without introducing risk of accidental termination within the movement area. Consideration should be given to precision and accuracy of the geographic region definition.</p> <p>3. As a vendor option, this mapping function may be implemented integral to the Class B2 equipment. In this case, the interface is internal to the unit.</p>	
<p>A.1.5.3 Termination of Extended Squitter Broadcast</p> <p>If input to Register 05₁₆, 06₁₆, 07₁₆, or 09₁₆ stops for 60 seconds, broadcast of the associated Extended Squitter type will be discontinued until data insertion is resumed. The insertion of altitude by the transponder will satisfy the minimum requirement for continuing to broadcast the airborne position squitter.</p> <p>Notes:</p> <p>1. Until timeout, an Extended Squitter type may contain an ME field of ALL ZEROS.</p> <p>2. Continued transmission for 60 seconds is required so that receiving aircraft will know that the data source for the message has been lost.</p>	

3 Discussion & Proposal

Summary of current ES timeout and termination

	Content	End of transmission	Question/remark
Airborne position	Cleared after 2s 2.2.3.3.2.11 a	after 60s Continue to be transmitted if altitude is present (A.1.5.3)	Continue or do not continue to be transmitted after 60s when altitude is present? If yes what happens if altitude is not available for a certain time?
Surface position	Cleared after 2s 2.2.3.3.2.11 a	after 60s Continue if movement information is received	Conflict with typecode 0?
Airborne Velocity	cleared after 2s 2.2.3.3.2.11 a	after 60s	Update rate now 1.3s – 2.6s >2s
Aircraft Identification	Not cleared before 60s May be Cleared after 60s 2.2.3.3.2.11 b	after 60s (tested in 2.4.3.3.2.4 step 4)	Update rate = 15s general rule twice the update period or 2s whichever is the greater
Target State and Status, Operational Status, or Event-Driven Messages	Never 2.2.3.3.2.11 c	event driven specific	

Proposal:

To clarify the requirement. Depending on the option retained the tests will need to be subsequently updated.

Clearing of content:

It is proposed to use the same approach than in ICAO Doc 9871, i.e., the content is cleared when the registers are not updated for a time no greater than twice the specified maximum update interval, or 2 seconds (whichever is the greater). It results in a time of 2.6s for the Airborne Velocity Message.

Transmission of Airborne position message when altitude remains available:

There are 2 possibilities for the continuation of Airborne Position Message transmission in presence of altitude:

- Option 1: to stop the transmission at the end of the 60s period whatever the presence of the altitude information
- Option 2: to continue the transmission until the altitude is no more available. In this case we must specify what happened if altitude is no more available for a certain time

Option 2 has been retained for the proposal.

The surface position message transmission stops at register timeout i.e. 2s to avoid to have ambiguous type code 0 messages.

Proposed new text:

2.2.3.3.2.11 ADS-B Message Timeout

a. The ADS-B Transmitting Subsystem **shall** clear all 56-bits of the Airborne Position Message, Surface Position Message and Airborne Velocity Message if no new data is received within twice the update rate or two (2) seconds of the previous input data update (whichever the greater). This timeout requirement **shall** be applied individually for each of the three (3) message types identified.

Notes:

1. These messages are cleared to prevent the reporting of outdated position and velocity information.
2. During a register timeout event, the “ME” field of the ADS-B Broadcast Message may contain ALL ZEROs, except for those fields that may be updated due to the receipt of new data.

b. The ADS-B Transmitting Subsystem **shall** not clear the Aircraft Identification Message (see §2.2.3.2.5) if no new data (neither aircraft type, emitter category, nor identification data) is received within up to 60 seconds of the previous input data update.

Note: The Aircraft Identification Message, is not cleared since it contains data that rarely changes in flight and is not frequently updated.

c. The ADS-B Transmitting Subsystem **shall** not clear the Target State and Status, Operational Status, or Event-Driven Messages (see §2.2.3.2.7) if no new data is received within up to 60 seconds of the previous input data update.

Note: The Event-Driven Messages do not need to be cleared since contents of such messages are only broadcast once each time that new data is received.

2.2.3.3.2.12 ADS-B Message Termination

a. The ADS-B Transmitting Subsystem **shall** terminate broadcast transmissions of the Airborne Position, ~~Surface Position~~, Aircraft Identification and Category, Velocity, Target State and Status, and/or Aircraft Operational Status Messages if input data necessary to update the particular ADS-B Message TYPE is not available for a period of 60 seconds.

Notes:

1. For the Airborne Position Message, specifically, Altitude Data alone is sufficient to maintain broadcast of the message once the message has been initiated. When altitude is available, the airborne position message continues to be transmitted after 60s however if after that period of 60s the altitude becomes not available for twice the update rate of the register (i.e.,0.4s) the airborne position message transmission is stopped and the conditions for start-up defined in 2.2.3.3.2.1.2 are necessary to resume the transmission of Airborne Position Message.

2. For all other ADS-B Messages, the receipt of new data necessary to update any single parameter of the message is sufficient to maintain broadcast of the message once the message has been initiated

~~b~~c. The ADS-B transmitting Subsystem shall terminate the transmission of Surface Position Messages if input data necessary to update the message is not available for a period of 2 seconds for position information or 2.6s for movement information, except that transmission termination of Surface Position Messages does not apply to Non-Transponder Devices on aircraft that are on the surface, or on surface vehicles.

Notes:

~~2~~—For the Surface Position Message, the receipt of new Position (i.e., Latitude and Longitude, combined), Movement, or Ground Track data is sufficient to maintain broadcast of the message once the message has been initiated.

~~d~~. Each ADS-B Message type **shall** be terminated individually and independently of all other ADS-B Messages.

c. Class B2 Non-Transponder-Based Transmitting Subsystems on Ground Vehicles **shall** provide an interface capable of putting the unit into a standby condition in which the unit suspends all message transmissions.

Notes:

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A.1.5.3 Termination of Extended Squitter Broadcast

If input to Register 05₁₆, ~~06₁₆~~, 07₁₆, or 09₁₆ stops for 60 seconds, or 2s for register 06₁₆ broadcast of the associated Extended Squitter type will be discontinued until data insertion is resumed.

The insertion of altitude by the transponder will satisfy the minimum requirement for continuing to broadcast the airborne position squitter.

Notes:

1. *Until timeout, an Extended Squitter type may contain an ME field of ALL ZEROs.*
2. *Continued transmission for 60 seconds is required so that receiving aircraft will know that the data source for the message has been lost.*