

RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #14

**An Approach for Testing of 1090 MHz ADS-B
Message Scheduling**

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Summary

DO-260A includes requirements for a 1090MHz event-driven message scheduling function (para. 2.2.3.3.1.4.6.1). The associated verification procedures of para. 2.4.3.3.1.4.6.1 will need to be developed. This working paper proposes a general approach for the verification of the scheduling function from which the specific measurement procedures could be developed.

References: Draft DO-260A, MOPS for 1090 MHz ADS-B, WP14-11

1. Introduction

The September 2002 draft of DO-260A (WG3 WP14-11) includes requirements for a 1090MHz event-driven message scheduling function (§2.2.3.3.1.4.6.1). The associated verification procedures will of §2.4.3.3.1.4.6.1 will need to be developed. This working paper proposes a general approach for the verification of the scheduling function from which the specific measurement procedures could be developed.

2. Discussion

The intent of the message scheduling function is to provide means of managing the broadcast of event-driven messages under the conditions where the message queue exists. There exists an overall rate limit at which event-driven message are allowed to be broadcast that is currently specified as 2 messages per second. Each message type has an associated message rate specified and under certain conditions the application of the message rate rules could result in a peak rate at which event-driver messages are generated that is in excess of the 2 per second limit. In this case a message queue could develop. The message scheduling function is to perform the management of any such message queue in order to ensure that the higher priority messages are delivered in a timely manner. It is anticipated that future version of the 1090 MHz ADS-B MOPS will define requirements for additional message type, such as trajectory change message, that will further stress the system.

3. Proposal

It is proposed to define measurement procedures that includes the broadcast of the baseline airborne position, airborne velocity and Aircraft ID & Type messages at their specified nominal rates (i.e, at combined nominal rate of 4.2 messages per second). The measurement procedure would then define a specific timed sequence of ‘events’ that would result in the generation of a specific sequence of ADS-B event-driven messages that is known to exceed the nominal broadcast limit of 2 messages per second that is allocated for event-driven messages. The intent of this procedure it to cause the development of a queue of pending ADS-B event-driven messages. In order to “load up” the event-driven message queue it is proposed to use the following event-driven messages:

Message	Message Type/Subtype Codes	Message Priority Level
Aircraft Operational Status	Type=31 and Subtype=0	7 (nominal) or 4 (info change)
Target State and Status	Type=29 and Subtype=0	5
Aircraft Status	Type=28 and Subtype=1	1
Test Message	Type=23	8

3.1 Proposed revisions to §2.2.3.2.7.3

It is proposed to revise §2.2.3.2.7.3 will to read:

2.2.3.2.7.3 TYPE “23” ADS-B Messages for “TEST”

TYPE “23” ADS-B Messages **shall** be used Exclusively for Test Purposes. Such messages are defined for bench/certification testing of 1090 MHz ADS-B systems and **shall** not be used in routine aircraft/vehicle operations. ADS-B systems **shall** support a test mode in which test messages are internally generated and/or include provisions to allow the injection of an Event-Driven TEST Message from an external source.

3.2 Proposed additions to §2.4.3.3.1.4.6.1

It is proposed to include the following test procedures under §2.4.3.3.1.4.6.1. Under these procedures, it is necessary to inject data that would result in the above identified event-driven messages being generated under the following test scenario.

The test procedures **shall** consist of the following steps performed as a continuous sequence of events. Commencing with Step 2 below, it is expected that a pending ADS-B Message queue will develop that must be managed by the message scheduling function.

Step 1 Place the ADS-B system in a test mode in which Test Messages (i.e., TYPE = 23) are generated at a nominal rate of 2 per second.

- Verify:** a) Test Messages are broadcast (see §2.2.3.3.1.4.4) at a nominal rate of 2 per second over a 30 second test period
- b) A nominal total broadcast rate of ≤ 6.2 messages per second over the 30 second test period as in a) above

Step 2 With the ADS-B still in a test mode, as defined in Step 1 in which Test Messages are being generated, inject Operational Status Message data and refresh at least once per 0.5 second with no change in data contents

- Verify:** a) Operational Status Messages are broadcast at nominal intervals of 0.8 seconds (see §2.2.3.3.1.4.2) over a 23 second test period
- b) Operational Status Messages are broadcast at nominal intervals of 2.5 seconds after 25 seconds with no change in the input data, verified over a 30 second test period (i.e., the test period starts 2 seconds after then end of a) above and continues for 30 seconds).
- c) Test Messages are broadcast at nominal intervals of 1.25 seconds over the same 23 second test period as a) above and at nominal intervals of 0.625 seconds over the subsequent 32 second test period (i.e., ending coincident with the end of b) above) and such that the nominal total event-driven message broadcast rate is a nominal 2 messages per second.

- d) A nominal total broadcast rate of ≤ 6.2 messages per second over a 55 second test period

Step 3

With the ADS-B still in a test mode, as defined in Step 2 in which Test Messages and Operational Status Messages are being generated, also inject Target State and Status data and refresh at least once per 0.5 second.

- Verify:**
- a) Target State and Status Messages are broadcast at nominal intervals of 1.25 seconds over a 30 second test period (see §2.2.3.3.1.4.1).
 - b) Operational Status Messages are broadcast at nominal intervals of 2.5 seconds verified over the same 30 second test period as a).
 - c) Test Messages are broadcast at nominal intervals of 1.25 seconds over the same 23 second test period as a) above and at nominal intervals of 1.25 seconds over the same test period as a) and b) above (i.e., such that the nominal total Event-Driven Message broadcast rate for Event-Driven Messages is 2 per second).
 - d) A nominal total broadcast rate of 6.2 messages per second is not exceeded over the same 30 second test period as a), b) and c) above.

Step 4

With the ADS-B system still in a test mode, as defined in Step 3 in which Test, Aircraft Operational Status, and Target State and Status Messages are being generated, inject Aircraft Status Message data, and refresh at least once per 1.0 second with no change in data contents.

- Verify:**
- a) Aircraft Status Messages (Type = 28, Subtype = 1) are broadcast at nominal intervals of 2.5 seconds (see §2.2.3.3.1.4.3) over a 30 second test period.
 - b) Target State and Status Messages are broadcast at nominal intervals of 1.25 seconds over the same 30 second test period as a).
 - b) Aircraft Operational Status Messages are broadcast at nominal intervals of 2.5 seconds verified over the same 30 second test period as a) and b).
 - c) Test Messages are broadcast at nominal intervals of 5 seconds over the same 30 second test period as a), b) and c) above.
 - d) A nominal total broadcast rate of 6.2 messages per second is not exceeded over the same 30 second test period as a), b), c) and d).