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

ADS-B 1090ES MOPS Maintenance

Meeting #26

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In Response to Action Item 25-14
Proposed ADS-B Transmit Rates
Revision 1

Dean C. Miller
Boeing Commercial Airplanes
Robert H. "Bob" Saffell
Rockwell Collins

Summary
This Working Paper addresses the rates that each 1090ES message is required to be transmitted at. It reviews the transmit limits (expressed in messages per second) for the total number of all types of 1090ES messages and the limits for Event Driven Register messages. It is presented as the response to Action Item #25-14.

Objectives:

Ensure the DO-260B transmit rate requirements are clear & self consistent:

Rates for each message add up to no more than the 6.2 messages / second limit

Rates for 6X msgs using the Event Driven register add up to the 2.0 msg/second limit.

The rates for broadcasting the new Mode 3/A code message and the new TCAS RA message via the Emergency / Priority Status Message (BDS 6,1) using the Event Driven Register must be clearly understood.

Airframe integrators have certification requirements for transmitting changes in position quality (e.g., NAC_P or SIL in BDS 6,5) in a timely manner:

1. Air Services Australia AC 21-45(0): Appendix B Table 1 - Maximum Data Age at Transmission of Horizontal Position integrity value must be 2 seconds or less.
2. EASA AMC 20-24: 8.3.3 ADS-B transmit systems need to transmit horizontal position quality indicators consistent with the associated position information at the time of transmission.

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We propose that standard scenarios become part of requirements text:

Nominal conditions with TSS broadcast

Nominal conditions with TSS not broadcast (Class A1 systems)

Change in NAC_P and/or SIL status

TCAS RA in effect

Others?

The goal is to maximize the number of scenarios that have repeatable transmit rates for the Event Driven Messages – there will be exceptions for non-normal cases but these should be minimized. <u>Delaying of messages should not be the normal procedure.</u>

The effects of 1090 interference on the new DO-260B messages cannot be analyzed accurately if their transmit rates are not standardized.

	Airborne Reporting Mode - with no change in status & TSS broadcast						
		Minimum	Equiv	Nominal	Equiv	Maximum	Equiv
Register	Description	Transmit	Transmit	Transmit	Transmit	Transmit	Transmit
Hex		Interval s	Rate Hz	Interval s	Rate Hz	Interval s	Rate Hz
05	ES Airborne Position	0.4	2.5	0.5	2	0.6	1.666666667
08	ES Identification & Type (Flight ID)	4.8	0.2083333	5	0.2	5.2	0.192307692
09	ES Airborne Velocity	0.4	2.5	0.5	2	0.6	1.666666667
61	Emergency/Priority Status	2.4	0.4166667	2.5	0.4	2.6	0.384615385
62	Target State & Status Information	1.2	0.8333333	1.25	0.8	1.3	0.769230769
65	Aircraft Operational Status	2.4	0.4166667	2.5	0.4	2.6	0.384615385
	Number msgs / second	=	6.875	=	5.8	=	5.064102564
	Number Event Driven msgs / sec	=	1.6666667	=	1.6	=	1.538461538

	Airborne Reporting Mode - w/change in NAC or SIL status & TSS not broadcast						
		Minimum	Equiv	Nominal	Equiv	Maximum	Equiv
Register	Description	Transmit	Transmit	Transmit	Transmit	Transmit	Transmit
Hex		Interval s	Rate Hz	Interval s	Rate Hz	Interval s	Rate Hz
05	ES Airborne Position	0.40	2.50	0.50	2.00	0.60	1.67
08	ES Identification & Type (Flight ID)	4.80	0.21	5.00	0.20	5.20	0.19
09	ES Airborne Velocity	0.40	2.50	0.50	2.00	0.60	1.67
61	Emergency/Priority Status	0.70	1.43	0.80	1.25	0.90	1.11
62	Target State & Status Information						
65	Aircraft Operational Status	0.70	1.43	0.80	1.25	0.90	1.11
	Total number msgs / second	=	8.07	=	6.70	=	5.75
	Number Event Driven msgs / sec		2.86		2.50		2.22

A.	A.		Broadcast Rate		
Register	**Event-Driven Msg Priority**	**1090ES ADS-B Message**	**On-Ground, not moving**	**On Ground and moving**	**Airborne**
BDS 0,5	N/A	Airborne Position	N/A	N/A	2 / 1 second (0.4 – 0.6 sec)
BDS 0,6	N/A	Surface Position	1 / 5 seconds 4.8 – 5.2 sec	2 / 1 second (0.4 – 0.6 sec)	N/A
BDS 0,8	N/A	Aircraft Identification and Category	1 / 10 secs 9.8 – 10.2 sec	1 / 5 seconds (4.8 – 5.2 sec)	1 / 5 seconds (4.8 – 5.2 sec)
BDS 0,9	N/A	Airborne Velocity	N/A	N/A	2 / 1 second (0.4 – 0.6 sec)
BDS 6,1	1	Aircraft Status (Emergency/Priority Status, Subtype=1) (TCAS RA Broadcast, Subtype=2)	0.7 – 0.9 seconds	0.7 – 0.9 seconds	TSS not broadcast 0.7 – 0.9 seconds
					TSS being broadcast 2.4 – 2.6 seconds
BDS 6,2	5	Target State and Status (TSS)	N/A	N/A	1.2 – 1.3 seconds
BDS 6,5	7 (nominal) 4 (info change)	Aircraft Operational Status	4.8 – 5.2 seconds	4.8 – 5.2 seconds	TSS being broadcast or not No change TCAS/NAC/SIL 2.4 – 2.6 seconds
					TSS being broadcast Change in TCAS/NAC/SIL 2.4 – 2.6 seconds
					TSS not broadcast Change in TCAS/NAC/SIL 0.7 – 0.9 seconds

ANALYSIS OF THE BROADCAST OF THE EVENT-DRIVEN SQUITTERS

Emergency	0.7-----0.9		Use 0.7, 1.5, and 2.3 for example
Op. Stat.	2.4-----2.6		Use 2.4 and 4.9 for example
Target St.	1.2-----1.3		Use 1.2 and 2.5 for example
Test	11.8---12.2		

File 1: Deletes message and reschedules
Updated 04/04/08_rhs