

**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**

**Updated Proposal to BDS 6,2 Target State and Status Message
-to include-
MCP/FCU Selected Altitude, FMS Selected Altitude, and Barometric Correction
In Response to Action Item 24-06
[Revision 1](#)**

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Summary
Response to Action Item 24-06. This Working Paper addresses several previously proposed changes to the BDS 6,2 Target State and Status Message to provide Selected Altitude information similar to that currently provided in BDS Register 4,0. The previous working papers are reviewed and then a new definition of BDS 6,2 is proposed to provide for MCP / FCU Selected Altitude, FMS Selected Altitude, Barometric Correction, and Mode Status bits as necessary from BDS Register 4,0.

1. Introduction

With the restart of SC-186, WG-3 and EUROCAE WG-51, SG-1 for the purpose of updating the ADS-B MOPs, considerable interest has been shown in regards to providing Selected Altitude information via Extended Squitter as indicated in the following recent working papers.

- a. ASP-WGW/1-WP/19, 08/12/08, “Broadcast of Selected Altitude Via ADS-B”, was presented by Australia Air Services and CASA at the ICAO ASP Meeting held in Montreal, Canada in December, 2008.
- b. 1090-WP 24-13, “Broadcast of Selected Altitude Via ADS-B”, was prepared by Australia Air Services and presented at the SC-186 WG-3 Meeting held in Phoenix, Arizona in January, 2009.
- c. ASP-TSG-WP6-17, 02/02/09, “Extended Squitter Broadcast of Selected Altitude”, was prepared by Australia Air Services and presented at the ICAO TSG Meeting held in Ft. Lauderdale, Florida in February, 2009.
- d. ASP-TSG-WP6-26, “Proposed Changes to BDS 6,2 to include MCP / FCU Selected Altitude”, was prepared by NATS UK and presented at the ICAO TSG Meeting held in Ft. Lauderdale, Florida in February, 2009

The working paper identified in subparagraph “a” originally proposed that the contents of the Mode-S Transponder BDS Register 4,0 “Selected Vertical Intention” be broadcast as an Aircraft Status Message having Type Code = 28 and Subtype Code = 3 –to- 7. Broadcast rate was proposed as 1 per second for a period of 18 +/- 1 seconds to be executed after any change had been made in the broadcast register contents.

The working paper identified in subparagraph “b” elaborated on the proposal provided in subparagraph “a” by defining the actual “MB” field of the message. Effectively, remapping the contents of BDS Register 4,0 into an Extended Squitter Message.

At this point, it should be noted that members of the ICAO meeting in Montreal indicated that consideration should be given to reworking the Target State and Status Message to be capable of providing Selected Altitude. The members of SC186-WG-3 meeting in Phoenix concurred with the Target State and Status approach and the action item to review the possibilities was assigned to the author of this working paper.

The working paper identified in subparagraph “c” effectively continues the working paper identified in subparagraph “b” and goes on to concur that the Target State and Status Message is a viable candidate for the transmission of Selected Altitude information. The working paper goes on to point out applicability issues with the FMS Selected Altitude and various Mode bits used in BDS Register 4,0 as well as similar Mode bits used in the existing Target State and Status Message.

The working paper identified in subparagraph “d” then remaps the Target State and Status Message to provide MCP / FCU Selected Altitude, Target Altitude Source, and MCP/FCU Mode Status information while retaining and/or manipulating existing BDS 6,2 information such as Target Heading/Track Angle, Horizontal Mode, NAC_p, NIC_{baro}, SIL, Capability Mode, etc. This working paper was well received and discussed at length at the ICAO ASP TSG meeting in Ft. Lauderdale, Florida. Specifically, members indicated that there was still a desire to have MCP/FCU Selected Altitude, FMS Selected Altitude, Barometric Correction, and MCP Mode Status information in the Target State and Status message if at all possible. Likewise, the meeting members indicated the desire to retain as much as possible of the existing information in the Target State and Status Message.

Having reviewed the prior Working Papers and considering the issues surfaced in the prior meetings, the purpose of this working paper is to propose redefinition of the Target State and Status Message such that most if not all of the concerns can be met.

2. Rework of Target State and Status Message, BDS Register 6,2

2.1 Issues with the Existing Target State and Status Message

The first two columns of the following **Table_1** show the bit (e.g., field and subfield) definitions as they currently exist in RTCA DO-260A and ICAO Doc. No. 9871 for the BDS 6,2 Target State and Status Message.

The following subparagraphs list some of the issues or inconsistencies that exist with the current definition of the BDS 6,2 Target State and Status Message defined in RTCA DO-260A and ICAO Doc. No. 9871.

- a. **“Vertical Data Available / Source Indicator”** information provided in bits **8** and **9** provides little utility if information is available to indicate engagement of the Autopilot and/or VNAV capability.
- b. **“Target Altitude Type”** in bit **10**, as defined, is not needed for MCP/FCU or FMS Selected Altitude.
- c. **“Backward Compatibility Flag”** in bit **11** is no longer needed once a new baseline is established with RTCA DO-260B, e.g., ICAO Version 2.
- d. **“Target Altitude Capability”** information provided in bits **12** and **13** provides little utility if only MCP/FCU or FMS Selected Altitude are used.
- e. **“Vertical Mode Indicator”** information provided in bits **14** and **15** provides little utility since acquire, capture, hold, etc., information is not readily available on most airframes. Likewise, if such information is provided, there is little consistency as to how it is provided from one installation to the next.
- f. **“Target Altitude”** information provided in bits **16** through **25** would have more utility if it was simply either MCP/FCU or FMS Selected Altitude.
- g. **“Horizontal Data Available / Source Indicator”** information provided in bits **26** and **27** has little utility if Selected Heading or Track (preferably Selected Course).
- h. **“Target Heading / Track Angle”** information provided in bits **28** through **36** would have more utility if it was simply either Selected Heading or Selected Course #1. Note that Selected Heading is typically provided by ARINC-429 label **“101”** and Selected Course #1 is provided by label **“100”**. There is NO label assigned for Selected Track. Review of ARINC-561-11 (INS) and ARINC 579 (VLF/Omega) indicate that Track is a computed value where Track = Heading + Wind Angle.
- i. **“Horizontal Mode Indicator”** information provided in bits **38** and **39** provides little utility since acquire, capture, hold, etc., information is not readily available on most airframes. Likewise, if such information is provided, there is little consistency as to how it is provided from one installation to the next.

2.2 New Definition for BDS 6,2 Target State and Status Message

The last two (e.g., 4 and 5) columns of the following **Table-1** show the new definition for the proposed BDS 6,2 Target State and Status Message based on the inputs received during the meetings discussed above in Section 1 and the issues discussed above in section 2.1. The following subparagraphs provide a brief description of the reasoning for assigning the fields and subfields as shown in **Table-1**.

- a. **“Format Type Code”, bit 1 through 5:** No change from current RTCA DO-260A definition.
- b. **“Subtype Code”, bit 6 and 7:** No change from current RTCA DO-260A definition.
- c. **“Selected Altitude Type”, bit 8:** **Newly** assigned to declare selection between MCP/FCU or FMS Selected Altitude being provided in bits 9 through 20. “0” denotes that MCP/FCU Selected Altitude is being provided. “1” denotes that FMS Selected Altitude is being provided. It is expected that FMS Selected Altitude (e.g., bit 8 = 1) is only provided when such data is valid and VNAV (bit 23) = 1.
- d. **“Status of Selected Altitude”, bit 9:** **New** bit used to denote that data provided in bits 10 through 20 is valid. “0” = Invalid, “1” = Valid.
- e. **“MCP/FCU or FMS Selected Altitude”, bit 10-20:** Used to provide either MCP / FCU or FMS Selected Altitude data. Note that the resolution is increased to 32 feet as opposed to the 16 feet provided in BDS Register 4,0.
- f. **“Status of MCP / FCU Mode Bits”, bit 21:** Used to indicate the validity of bits 22, 23, 24, and 25. Similar to the use of BDS Register 4,0 bit 48.
- g. **“Autopilot Engaged”, bit 22:** **New** bit used to denote that the Autopilot is engaged when bit 22=1. This is a new bit assignment based on the premise that a user of the received message can establish what system is in control of the aircraft vertical profile based on Autopilot Engaged, VNAV Engaged, and Altitude Hold status.
- h. **“Status of Selected Heading / Course #1 Angle”, bit 26:** **New** bit used to indicate that either valid Selected Heading or Selected Course #1 data is being provided in bit 28 through 36. Note that Selected Course #1 is used as there is **NO** definition of Selected Track since Track is typically computed from Heading and Wind Angle.
- i. **“Selected Heading / Course #1 Indicator”, bit 27:** **New** bit used to indicate that either Selected Heading or Selected Course #1 data is being provided in bits 28 through 36.
- j. **“Navigation Accuracy Category Position (NAC_p)”, bits 37 through 40:** Same definition as current RTCA DO-260A with the exception that the bits have been moved from 40 –through- 43 –to- 37 –through- 40.
- k. **“Navigation Integrity Category Baro (NIC_{baro})”, bit 41:** Same definition as current RTCA DO-260A with the exception that the bit has been moved from 44 –to- 41.
- l. **“System Integrity Level (SIL)”, bit 42 and 43:** Same definition as current RTCA DO-260A with the exception that the bits have been moved from 45 and 46 –to- 42 and 43.

Note that there was some discussion during the SC-186 WG-3 Phoenix meeting in regards to providing additional SIL Capability annunciation that could possibly require 2 more bits in the message. Further discussions during the ICAO ASP TSG meeting in Ft. Lauderdale indicated

that such may not be the case. Consequently, the SIL subfield assignment is retained at only 2 bits in this proposal.

- m. **“Status of Baro. Pressure Setting”**, bit **44**: **New** bit used to indicate that valid Barometric Pressure Setting data is being provided in bits **45** –through- **51**.
- n. **“Barometric Pressure Setting”**, bit **45** through **51**: **New** field definition to provide Barometric Pressure Setting data that is effectively the same as that provided in BDS Register 4,0 except that the resolution has been increased from 0.1 millibars to 4.0 millibars. Likewise, the MSB has been changed from 204.8 millibars to 128 millibars.
- o. **“Capability / Mode Codes”**, bit **52** and **53**: No change from current RTCA DO-260A definition.
- p. **“Emergency / Priority Status”**, bits **54** –through- **56**: No change from current RTCA DO-260A definition.

Table 1. BDS 6,2 (NEW PROPOSED) TARGET STATE AND STATUS MESSAGE

CURRENT DEFINITION		CHANGE COMMENTARY	PROPOSED DEFINITION CHANGES	
1	MSB		1	MSB
2			2	
3	FORMAT TYPE CODE = 29		3	FORMAT TYPE CODE = 29
4			4	
5	LSB		5	LSB
6	MSB		6	MSB
7	LSB		7	LSB
8	MSB		8	
9	LSB		9	
10			10	
11			11	
12	MSB		12	
13	LSB		13	
14	MSB		14	
15	LSB		15	
16	MSB		16	
17			17	
18			18	
19			19	
20			20	
21			21	
22			22	
23			23	
24			24	
25	LSB		25	
26	MSB		26	
27	LSB		27	
28	MSB		28	
29			29	
30			30	
31			31	
32			32	
33			33	
34			34	
35			35	
36	LSB		36	
37			37	
38	MSB		38	
39	LSB		39	
40	MSB		40	
41			41	
42			42	
43	LSB		43	
44			44	
45	MSB		45	
46	LSB		46	
47			47	
48			48	
49			49	
50			50	
51			51	
52	MSB		52	
53	LSB		53	
54	MSB		54	
55			55	
56	LSB		56	

2.3 Proposed Update Rate for BDS 6,2 Target State and Status Message

It is proposed that the broadcast rate of the BDS 6,2 Target State and Status Message be retained at the currently defined rate of **1.2 -to- 1.3** seconds. (see RTCA DO-260A, 2.2.3.3.1.4.1).

Keeping the broadcast rate the same as currently defined will minimize the rearrangement of broadcast times and impact to validation.

3. Conclusion

The new proposed BDS 6,2 definition should provide more utility in the airspace as it retains the useful parameters from the previously defined message while adding the needed capabilities that are currently provided in BDS Register 4,0.

RTCA SC-186, WG-3 and EUROCAE, WG-51, SG-1 are invited to review the proposed changes and to consider approval such that formal definition and development of appropriate validation test procedures can move forward.

Should RTCA SC-186, WG-3 and EUROCAE, WG-51, SG-1 approve these changes, then similar changes will be recommended for ICAO Doc. No. 9871.