

**RTCA Special Committee 209**

**Working Group #1**

**Mode S Transponder Development and Maintenance**

**Meeting #2**

**RTCA, Washington DC**

**30 May – 1 June 2007**

**Proposed Changes to ICAO Doc 9871 for TCP Registers  
Which need to also be considered for DO-181D**

**Don Walker  
Honeywell**

**SUMMARY**

This Working Paper presents a copy of a working paper submitted to the ICAO ASP TSG for their meeting in July 2007 in Paris for consideration of changes to ICAO Doc 9871 for Registers 43<sub>16</sub>, 54<sub>16</sub>-56<sub>16</sub>, and 52<sub>16</sub>. Corresponding changes should be considered for DO-181D.

**AERONAUTICAL SURVEILLANCE PANEL (ASP)**

**Technical Subgroup Meeting**

**Paris, France  
2 – 6 July 2007**

**DOC 9871 CP TO TCP Registers**

(Prepared by Don Walker, Honeywell)

**SUMMARY**

Some fields of registers  $43_{16}$ ,  $54_{16}$ - $56_{16}$ , and  $52_{16}$  are not available on the Trajectory Data Bus from the FMS as defined by ARINC 702A Supplement 3. This paper proposes changes that can be implemented with the data provided.

**Proposed change to: Doc 9871**

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Submit to: Rapporteur ASP Working Group

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1. Change No **TBD** Date submitted: May 2007

*Title:* Doc 9871 CP to Correct TCP Registers.

2. List of all relevant ASP WG-B Working Papers: ASP**XX-XX** (This paper)
3. Background: Some fields of registers  $43_{16}$ ,  $54_{16}$ - $56_{16}$ , and  $52_{16}$  are not available on the Trajectory Data Bus from the FMS as defined by ARINC 702A Supplement 3. This interface specification is the definitive standard that was agreed to by RTCA SC-186 and the FMS Vendors (Honeywell, Smiths, Rockwell Collins) attending the AEEC working group on the Trajectory bus.
4. Need for change:. This paper proposes changes that can be implemented with the data provided.
5. Change: Register  $43_{16}$  is recommended to be used for Estimated Time of Arrival. This information is not currently defined in the register. The data currently in this register can be derived by the ground system from data available in other registers. It is an inefficient use of the spectrum to transmit information that can be computed by the ground system. Bearing to Waypoint and Distance to Go can be derived by using the Waypoint Lat/Long in Register  $42_{16}$  and the own ship Lat/Long in register  $51_{16}$  and  $52_{16}$ . The Time to Go field may then be calculated with the Ground Speed data from register  $50_{16}$ . See changes attached below.

Register  $52_{16}$  is recommended to only encode Geometric HAE in bits 42-56. The reasoning is that this register must be used in concert with register  $51_{16}$  which already contains the pressure altitude. It would be redundant to encode Pressure Altitude in both registers. This simplifies the FOM coding such that only Geometric Altitude is reported. Also fixed the FOM coding so that it corresponds to DO-260A quantizations. See changes attached below.

Register  $54_{16}$  -  $56_{16}$  are recommended to be redefined to use the available data on the ARINC 702A Supplement 3 Trajectory Bus in lieu of the current data defined. Time to Go may then be calculated by the ground system as described above. See changes attached below.

6. Category: (confirmed by Rapporteur)
  1. Addition - new material e.g. new GICB, MSP, or Broadcast.
  - X2. Update - technical change or correction to current document.
  3. Useful - will enhance understanding of the document.

4. Cosmetic - needed to correct editorial error.

Submitted by: ASP Technical Subgroup

Organisation: ASP

Address: ICAO

**Table A-2-67. BDS code 4,3 –Next Waypoint ETA**

**MB FIELD**

1	Status	<b>PURPOSE:</b> This register reports the UTC Estimated Time of Arrival at the waypoint as computed by the FMS.  Note: The single status bit (bit 1) shall be set to 0 if any of the three parameters are invalid
2	MSB = 32 Seconds	
3		
4	ESTIMATED TIME OF ARRIVAL	
5	UTC SECONDS	
6	Range = [0,59] seconds	
7	LSB = 1 Second	
8	MSB = 32 Minutes	
9		
10	ESTIMATED TIME OF ARRIVAL	
11	UTC MINUTES	
12	Range = [0,59] minutes	
13	LSB = 1 Minute	
14	MSB = 16 hours	
15	ESTIMATED TIME OF ARRIVAL	
16	UTC HOURS	
17	Range = [0,23] hours	
18	LSB = 1 hour	
19		
20		
21		
22		
23		
24		
25		
26		
27		
28	RESERVED	
29		
30		
31		
32		
33		
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56		

**Table A-2-82. BDS code 5,2 — Position report fine**

**MB FIELD**

1	STATUS (see 1)
2	MSB
3	FOM/SOURCE
4	
5	LSB
6	MSB = 90/128 degrees
7	
8	
9	
10	
11	
12	
13	LATITUDE FINE
14	
15	
16	
17	
18	
19	Range [0, 180/128] degrees
20	
21	
22	
23	LSB = 90/16 777 216 degrees
24	MSB = 90/128 degrees
25	
26	
27	
28	
29	
30	
31	LONGITUDE FINE
32	
33	
34	
35	
36	
37	Range [0, 180/128] degrees
39	
39	
40	
41	LSB = 90/16 777 216 degrees
42	SIGN
43	MSB = 65 536 ft
44	
45	
46	
47	
48	
49	GNSS HEIGHT (HAE)
50	
51	
52	
53	Range [-1 000, 126 752] ft
54	
55	
56	LSB = 8 ft

**PURPOSE:** To provide a high-precision three-dimensional report on aircraft position when used in conjunction with register 51<sub>16</sub>. Information on the source of the data is included

**FOM/SOURCE coding:**

The decimal value of the binary-coded (figure of merit) FOM/SOURCE parameter shall be interpreted as follows:

- 0 = Loss of navigational capability
- 1 = ~~RNP-FOM~~ 10 Nm (e.g. INS data)
- 2 = ~~RNP-FOM~~ 4 Nm (e.g. VOR/DME)
- 3 = ~~RNP-FOM~~ 2 Nm (e.g. DME/DME or GNSS)
- 4 = ~~RNP-FOM~~ 1 Nm (e.g. DME/DME or GNSS)
- 5 = ~~RNP-FOM~~ 0.5 Nm (e.g. DME/DME or GNSS)
- 6 = ~~RNP-FOM~~ 0.3 Nm (e.g. DME/DME or GNSS)
- 7 = ~~RNP-FOM~~ 0.1 Nm/185.2 m (ILS, MLS or differential GNSS)
- 8 = ~~RNP-FOM~~ 0.05 Nm/92.6 m (ILS, MLS or differential GNSS)
- 9 = ~~RNP-FOM~~ 30 m (ILS, MLS or differential GNSS)
- 10 = ~~RNP-FOM~~ 10 m (ILS, MLS or differential GNSS)
- 11 = ~~RNP-FOM~~ 3 m (ILS, MLS or differential GNSS)
- 12 = ~~RNP~~ RESERVED
- 13 = ~~RNP~~ RESERVED
- 14 = ~~RNP~~ RESERVED
- 15 = ~~RNP~~ RESERVED

~~where RNP is required navigation performance as defined by ICAO.~~

*Note 1.— When GNSS is the source, then the FOM is encoded by the HFOM parameter. When RNP FMS is the source the FOM is encoded by the ANP. RNP signifies required navigation performance. Suitable RNP categories have not yet been defined for values below 1; therefore, CPE is used.*

- 1) The single status bit (bit 1) shall be set to 0 if any of the three parameters are invalid and is identical to the status bit in register 51<sub>16</sub>.
- 2) The LATITUDE (fine) and LONGITUDE (fine) parameters are in 2's complement coding so they shall be interpreted in conjunction with the corresponding parameters in register 51<sub>16</sub>.
- 3) The pressure altitude can be obtained from register 51<sub>16</sub>.

*Note 2.— Two's complement coding is used for all signed fields as specified in A.2.2.2.*

*Note 3.— The Figure of Merit selected is the smallest number that encompasses the HFOM or the ANP.*

**Table A-2-84 to A-2-86. BDS codes 5,4 to 5,6 – Waypoints 1, 2 and 3**

**MB FIELD**

1	STATUS (see 1)	<p><b>PURPOSE:</b> To provide information on the next three waypoints, register 54<sub>16</sub> contains information on the next waypoint, register 55<sub>16</sub> contains information on the next waypoint plus one, and register 56<sub>16</sub> contains information on the next waypoint plus two.</p> <p>1) The single status bit shall be set to ZERO (0) if any of the parameters are invalid.</p> <p><i>Note. – Mode detail on the next waypoint is given in register 41<sub>16</sub> to 43<sub>16</sub>.</i></p> <p>2) When the waypoint identity has only three characters, two leading ZERO characters shall be added (e.g., CDN becomes 00CDN).</p>
2	MSB	
3		
4	CHARACTER 1	
5		
6		
7	LSB	
8	MSB	
9		<p>2) When the waypoint identity has only three characters, two leading ZERO characters shall be added (e.g., CDN becomes 00CDN).</p>
10	CHARACTER 2	
11		
12		
13	LSB	
14	MSB	
15		
16	CHARACTER 3	
17		<p>2) When the waypoint identity has only three characters, two leading ZERO characters shall be added (e.g., CDN becomes 00CDN).</p>
18		
19	LSB	
20	MSB	
21		
22	CHARACTER 4	
23		
24		
25	LSB	<p>2) When the waypoint identity has only three characters, two leading ZERO characters shall be added (e.g., CDN becomes 00CDN).</p>
26	MSB	
27		
28	CHARACTER 5	
29		
30		
31	LSB	
32	MSB = 320 FL	
33		<p>2) When the waypoint identity has only three characters, two leading ZERO characters shall be added (e.g., CDN becomes 00CDN).</p>
34	WAYPOINT FLIGHT LEVEL	
35	Range = [0, 630] FL	
36		
37	LSB = 10 FL	
38	MSB = 32 Seconds	
39		
40	ESTIMATED TIME OF ARRIVAL	
41	UTC SECONDS	
42	Range = [0,59] seconds	
43	LSB = 1 Second	<p>2) When the waypoint identity has only three characters, two leading ZERO characters shall be added (e.g., CDN becomes 00CDN).</p>
44	MSB = 32 Minutes	
45		
46	ESTIMATED TIME OF ARRIVAL	
47	UTC MINUTES	
48	Range = [0,59] minutes	
49	LSB = 1 Minute	
50	MSB = 16 hours	
51	ESTIMATED TIME OF ARRIVAL	
52	UTC HOURS	
53	Range = [0,23] hours	
54	LSB = 1 hour	<p>2) When the waypoint identity has only three characters, two leading ZERO characters shall be added (e.g., CDN becomes 00CDN).</p>
55		
56	RESERVED	