SC209-WP03-03
August 8-9, 2006
Washington, D.C.

RTCA Special Committee 209

Transponder MOPS

Meeting #3

Mode S Specific Services

(Proposed Appendix B to DO-181D Mode S Transponder MOPS)

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SUMMARY

This working paper presents those functions, which have been extracted from the current Mode S ADLP MOPS (DO-218B) that make up the Mode S Specific Services (MSSS). Additionally, this working paper highlights the inclusion of updated ICAO MSSS requirements and BDS registers allocation. The MSSS will be included in the updated Transponder MOPS (RTCA DO-181), in an effort to harmonize DO-181 with ED-73 in coordination with EUROCAE WG-49.

APPENDIX B

Mode S Specific Services (MSSS)

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B.1 INTRODUCTION

B.1.1 Purpose

This Appendix sets forth minimum operational performance standards for the Mode S Specific Services (MSSS). The MSSS provides a standard communication interface and service through which avionics application processors may exchange data with ground-based application processors via the Mode S transponder. Compliance with these standards is required to assure that the Mode S Specific Services characteristics will perform its intended functions satisfactorily under normal operating conditions. Incorporated within these standards are system characteristics that will facilitate the design and implementation of the Mode S Specific Services.

B.1.2 Scope

This Appendix defines the functional requirements for the Mode S Specific Services, and describes the architecture within which the Mode S Specific Services entity will operate. It does not define data link applications that will be supported by Mode S and other data links.

B.1.3 Mode S Application Entity (AE)/Transponder Interface Management

The Mode S AE controls the interface to the Mode S Transponder based on information received from the Higher-Layer Entity (HLE) via the Specific Services Entity (SSE) interface, and based on the internal processing requirements of the AE. Additionally, the Mode S AE receives information via the AE/Transponder interface, which must be processed and transferred to the HLE.

The Mode S AE must also establish and maintain the local relationship between the Mode S Aircraft AE and the various Mode S Ground AEs with which it communicates.

B.2 DESIGN REQUIREMENTS

B.2.1 Basic Operations

The Mode S Specific Services shall offer the following types of services to the user.

a. Mode S Protocol service: The Mode S Protocol (MSP) service transfers limited data between air and ground application peers, using extremely low overhead. The MSP service does not use diagnostic, flow control, or interrupt procedures as defined within ISO 8208. Such mechanisms should be defined within the application entities.

b. Broadcast Protocol service (Comm-A, Comm-B): The Mode S subnetwork is capable of supporting information delivery to all interrogators participating in data link operations for that aircraft through the use of the Broadcast Comm-B protocol. It is also able to receive messages directed to all transponders through the use of the Broadcast Comm-A protocol.

c. Ground-Initiated Comm-B service: The Mode S subnetwork allows for the access of prestored data within the Mode S transponder (256 register set) from ground application entities.

B.2.2 Mode S Specific Services Entity (SSE) Interface Requirements

B.2.2.1 General

Note: *Mode S specific services consist of the broadcast Comm-A and Comm-B, Ground-Initiated Comm-B (GICB) and MSP.*

The AE shall support the accessing of Mode S specific services through the provision of one or more separate AE interfaces.

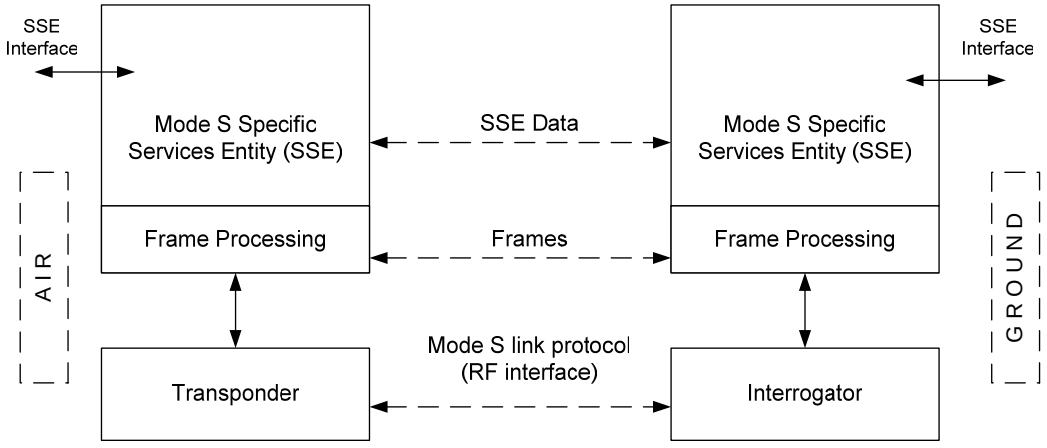
B.2.2.2 Functional Capability

Message and control coding via the MSSS interface shall support all of the capabilities specified in paragraph A2.2.6.

B.2.2.3 Mode S Specific Services Architecture

The Mode S Specific Services architecture, as shown in Figure B-2-1, providces for the top level architecture, which is inclusive of the Mode S Specific Services Entity (SSE), the SSE interface to a higher layer application process, frame processing function, Mode S transponder (aircraft component), and Mode S interrogator (ground component). Between air and ground, the peer interface entities are identified as being, SSE Data, Frames, and Mode S link protocol (RF).

Figure B-2-1: Mode S Specific Services Architecture



B.2.2.4 Transponder to Application Entity (AE) Interface

The AE shall accept an indication of protocol type from the transponder in connection with data transferred from the transponder to the AE. This shall include the following types of protocols:

a. Surveillance interrogation,

b. Comm-A interrogation,
c. Comm-A broadcast interrogation,
d. Uplink ELM.

The AE shall also accept the II code of the interrogator used to transmit the surveillance, Comm-A or uplink ELM.

Note: *Transponders will not output all-call and Traffic Alert and Collision Avoidance System (TCAS) information on this interface. Use of SI code limited to Comm-A and Comm-A broadcast intgerrogations.*

The AE shall accept control information from the transponder indicating the status of downlink transfers. This shall include:

a. Comm-B closeout,
b. Comm-B broadcast time-out,
c. Downlink ELM closeout.

The AE shall have access to current information defining the communication capability of the Mode S transponder with which it is operating. This information shall be used to generate the Data Link Capability Report (A2.2.8).

B.2.2.5 Application Entity (AE) to Transponder Interface

The AE shall provide an indication of protocol type to the transponder in connection with data transferred from the AE to the transponder. This shall include the following types of protocols:

a. Ground-initiated Comm-B,
b. Air-initiated Comm-B,
c. Multisite-directed Comm-B,
d. Comm-B broadcast,
e. Downlink ELM,
f. Multisite-directed downlink ELM.

The AE shall also provide:

1. The II code for transfer of a multisite-directed Comm-B or multisite-directed downlink ELM, and
2. The Comm-B Data Selector (BDS) code for a ground-initiated Comm-B.

Note: *Use of SI code limited to Ground-initiated Comm-B and Comm-B Broadcast.*

B.2.2.6 Mode S Specific Services Processing

Mode S specific services shall be processed by an entity in the application termed the Mode S specific services entity.

B.2.2.6.1 Processing

Notes:

1. *There are three Mode S specific services protocol types; broadcast, GICB and MSP.*

2. *Control data can consist of information permitting message length, BDS code used to access the data format for a particular register, and aircraft 24-bit address.*

B.2.2.6.1.1 Downlink Processing

Note: *This section describes the processing of control and message data received from the Mode S specific services interface (A2.2.1.2).*

B.2.2.6.1.1.1 General

The AE shall be capable of receiving control and message data from the Mode S specific services interface(s) and sending delivery notices to this interface. The control data shall be processed to determine the protocol type and the length of the message data. When a message or control data provided at this interface are erroneous (i.e. incomplete, invalid or inconsistent) the AE shall discard the message and deliver an error report at the interface.

Note: *The diagnostic content and the error reporting mechanism are a local issue.*

B.2.2.6.1.1.2 Broadcast Processing

The control and message data shall be used to format the Comm-B broadcast message as specified in A2.2.6.4 and transfer it to the transponder.

B.2.2.6.1.1.3 Ground-Initiated Comm-B (GICB) Processing

The 8-bit BDS code shall be determined from the control data. The 7-byte register content shall be extracted from the received message data. The register content shall be transferred to the transponder, along with an indication of the specified register number. A request to address one of the air-initiated Comm-B registers or the TCAS Active Resolution Advisories Register shall be discarded. The assignment of registers shall be as specified in Table B-2-1.

B.2.2.6.1.1.4 MSP Processing

The MSP message length, channel number (M/CH, A2.2.6.2.1) and optionally the interrogator II code shall be determined from the control data. The MSP message content shall be extracted from the received message data. If the message length is 26 bytes or less, the SSE shall format an air-initiated Comm-B message (A2.2.7.1.3) for transfer to the transponder using the Short Form MSP Packet (A2.2.6.2.1). If the message length is 27 to 159 bytes and the transponder has adequate downlink ELM capability, the SSE shall format an ELM message for transfer using the Short Form MSP Packet. If the message length is 27 to 159 bytes and the transponder has a limited downlink ELM capability, the SSE shall format multiple Long Form MSP Packets (A2.2.6.2.1) using ELM messages as required utilizing the L-bit and the M/SN Fields for association of the packets. If the message length is 27 to 159 bytes and the transponder does not have

downlink ELM capability, the SSE shall format multiple long form MSP packets using air initiated Comm-B messages, as required utilising the L-bit and M/SN fields for association of the packets. Different frame types shall never be used in the delivery of an MSP message. Messages longer than 159 bytes shall be discarded. The assignment of downlink MSP channel numbers shall be as specified in Table B-2-2.

For an MSP, a request to send a packet shall cause the packet to be multisite-directed to the interrogator II code as specified in control data. If no II code is specified, the packet shall be down linked using the air-initiated protocol. A message delivery notice for this packet shall be provided to the Mode S specific interface when the corresponding closeout(s) have been received from the transponder. If a closeout has not been received from the transponder in Tz seconds, as specified in Table B-2-4, the MSP packet shall be discarded. This shall include the cancellation in the transponder of any frames associated with this packet. A delivery failure notice for this message shall be provided to the Mode S specific services interface.

Table B-2-1: GICB Register Number Assignments

Transponder register No.	*Assignment*	*Minimum update rate*
00_{16}	Not valid	N/A
01_{16}	Unassigned	N/A
02_{16}	Linked Comm-B, segment 2	N/A
03_{16}	Linked Comm-B, segment 3	N/A
04_{16}	Linked Comm-B, segment 4	N/A
05_{16}	Extended squitter airborne position	0.2s
06_{16}	Extended squitter surface position	0.2s (see B.2.3.3.1 and B.2.3.3.2)
07_{16}	Extended squitter status	1.0s
08_{16}	Extended squitter identification and type	15.0s
09_{16}	Extended squitter airborne velocity	1.3s
$0A_{16}$	Extended squitter event-driven information	variable
$0B_{16}$	Air/air information 1 (aircraft state)	1.3s
$0C_{16}$	Air/air information 2 (aircraft intent)	1.3s
$0D_{16}$-$0E_{16}$	Reserved for air/air state information	To be determined
$0F_{16}$	Reserved for ACAS	To be determined
10_{16}	Data link capability report	≤4.0s (see B.2.1.2)
11_{16}-16_{16}	Reserved for extension to datalink capability reports	5.0s
17_{16}	Common usage GICB capability report	5.0s
18_{16}-$1F_{16}$	Mode S specific services capability reports	5.0s
20_{16}	Aircraft identification	5.0s
21_{16}	Aircraft and airline registration markings	15.0s
22_{16}	Antenna positions	15.0s
23_{16}	Reserved for antenna position	15.0s
24_{16}	Reserved for aircraft parameters	15.0s
25_{16}	Aircraft type	15.0s
26_{16}-$2F_{16}$	Unassigned	N/A
30_{16}	ACAS active resolution advisory	[Ref 2, 4.3.8.4.2.2.]
31_{16}-$3F_{16}$	Unassigned	N/A
40_{16}	Selected vertical intention	1.0s
41_{16}	Next waypoint identifier	1.0s
42_{16}	Next waypoint position	1.0s
43_{16}	Next waypoint information	0.5s
44_{16}	Meteorological routine air report	1.0s
45_{16}	Meteorological hazard report	1.0s
46_{16}	Reserved for flight management system Mode 1	To be determined
47_{16}	Reserved for flight management system Mode 2	To be determined
48_{16}	VHF channel report	5.0s
49_{16}-$4F_{16}$	Unassigned	N/A
50_{16}	Track and turn report	1.3s
51_{16}	Position report coarse	1.3s
52_{16}	Position report fine	1.3s
53_{16}	Air-referenced state vector	1.3s

Transponder register No.	*Assignment*	*Minimum update rate*
54_{16}	Waypoint 1	5.0s
55_{16}	Waypoint 2	5.0s
56_{16}	Waypoint 3	5.0s
57_{16}-$5E_{16}$	Unassigned	N/A
$5F_{16}$	Quasi-static parameter monitoring	0.5s
60_{16}	Heading and speed report	1.3s
61_{16}	Extended squitter emergency/priority status	1.0s
62_{16}	Reserved for target state and status information	N/A
63_{16}	Reserved for extended squitter	N/A
64_{16}	Reserved for extended squitter	N/A
65_{16}	Extended squitter aircraft operational status	1.7 s
66_{16}-$6F_{16}$	Reserved for extended squitter	N/A
70_{16}-75_{16}	Reserved for future aircraft downlink parameters	N/A
76_{16}-$E0_{16}$	Unassigned	N/A
$E1_{16}$-$E2_{16}$	Reserved for Mode S BITE	N/A
$E3_{16}$	Transponder type/part number	15 s
$E4_{16}$	Transponder software revision number	15 s
$E5_{16}$	ACAS unit part number	15 s
$E6_{16}$	ACAS unit software revision number	15 s
$E7_{16}$-$F0_{16}$	Unassigned	N/A
$F1_{16}$	Military applications	15 s
$F2_{16}$	Military applications	15 s
$F3_{16}$-FF_{16}	Unassigned	N/A

Table B-2-2: MSP Channel Number Assignments

Uplink Channel Number	Assignment
0	Not valid
1	Reserved (Specific Services Management)
2	Reserved (Traffic Information Service)
3	Reserved (Ground-to-Air Alert)
4	Reserved (Ground Derived Position)
5	TCAS Sensitivity Level Control
6	Reserved (Ground-to-Air Service Request)
7	Reserved (Air-to-Ground Service Response)
8-63	Unassigned

Downlink Channel Number	Assignment
0	Not valid
1	Reserved (Specific Services Management)
2	Unassigned
3	Reserved (Data Flash)
4	Reserved (Position Request)
5	Unassigned
6	Reserved (Ground-to-Air Service Response)
7	Reserved (Air-to-Ground Service Request)
8-63	Unassigned

Table B-2-3: Broadcast Identifier Number Assignments

Uplink Broadcast Identifier	Assignment
00_{16}	Not valid
01_{16}	Reserved (Differential GPS Correction)
30_{16}	Not valid
31_{16}	Reserved for ACAS (RA broadcast)
32_{16}	Reserved for ACAS (ACAS broadcast)
Others	Unassigned

Downlink Broadcast Identifier	Assignment
00_{16}	Not valid
02_{16}	Reserved (Traffic Information Service)
10_{16}	Data Link Capability Report
20_{16}	Aircraft Identification
FE_{16}	Update Request
FF_{16}	Search Request
Others	Unassigned

B.2.2.6.1.2 Uplink Processing

Note: *This section describes the processing of Mode S specific services messages received from the transponder.*

B.2.2.6.1.2.1 General

The AE shall be capable of receiving Mode S specific services messages from the transponder via Frame Processing. The AE shall be capable of delivering the messages and the associated control data at the specific services interface. When the resources allocated at the interface are insufficient to accommodate the output data, the AE shall discard the message and deliver an error report at this interface.

B.2.2.6.1.2.2 Broadcast Processing

If the received message is a broadcast Comm-A, as indicated by control data received over the transponder/AE interface, the broadcast ID and user data (A2.2.6.4) shall be forwarded to the Mode S specific services interface (A2.2.1.2), along with the control data that identifies this as a broadcast message. The assignment of uplink broadcast identifier numbers shall be as specified in Table B-2-3.

B.2.2.6.1.2.3 MSP Processing

If the received message is an MSP, as indicated by the packet format header (A2.2.6.2), the User Data Field of the received MSP packet shall be forwarded to the Mode S specific services interface (A2.2.1.2) together with the MSP channel number (M/CH), the IIS subfield (A2.2.5.1.1.1) together with control data that identifies this as an MSP message. L-bit processing (A2.2.6.3) shall be performed as required. The assignment of uplink MSP channel numbers shall be as specified in Table B-2-3.

B.2.2.6.2 MSP Packet Formats

B.2.2.6.2.1 Short Form MSP Packet

The format for this packet shall be as follows:

DP:1	MP:1	M/CH:6	FILL 1:0 or 6	UD:v

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 0 to indicate that this is a Short Form MSP Packet.

MSP Channel Number (M/CH) The field shall be set to the channel number derived from the SSE control data.

Fill Field. (FILL1: 0 or 6) The Fill length shall be 6 bits for a downlink SLM Frame. Otherwise the Fill length shall be 0.

User Data (UD) The User Data Field shall contain message data received from the Mode S specific services interface (A2.2.1.2).

B.2.2.6.2.2 Long Form MSP Packet

The format for this packet shall be as follows:

DP:1	MP:1	SP:2	L:1	M/SN:3	FILL 2:0 or 2	M/CH:6	UD:v

Fields shown in the packet format and not specified in the following paragraphs shall be set as specified in A2.2.3.2.1 and A2.2.6.2.1.

Data Packet Type (DP) This field shall be set to 0.

MSP Packet Type (MP) This field shall be set to 1 to indicate that this is not a Short Form MSP Packet.

Supervisory Packet (SP) This field shall be set to 0.

L Field (L) A value of one shall indicate that the packet is part of an L-bit sequence with more packets in the sequence to follow. A value of zero shall indicate that the sequence ends with this packet.

MSP Sequence Number Field (M/SN) This field shall be used to detect duplication in the delivery of L-bit sequences. The first packet in an L-bit sequence shall be assigned a sequence number of 0. Subsequent packets shall be numbered sequentially. A packet received with the same sequence number as the previously received packet shall be discarded.

B.2.2.6.3 L-Bit Processing

L-bit processing shall be performed only on the Long Form MSP Packet and shall be performed as specified for M-bit processing (A2.2.3.1.4.1) except as specified in the following paragraphs.

Upon receipt of a long form MSP Packet the AE shall construct the User Data Field by:

a. Verifying that the packet order is correct using the M/SN Field (A2.2.6.2.2).

b. Assuming that the User Data Field in the MSP Packet is the largest number of integral bytes that is contained within the frame.

c. Associating each User Data Field in an MSP Packet received with a previous User Data Field in an MSP Packet that has an L-bit value of ONE.

d. Truncating the assembled User Data Field to 151 bytes if necessary.

Note: *Truncation of the user data field is a condition that cannot be reported*

e. If an error is detected in the processing of an MSP packet, the packet shall be discarded.

In the processing of an L-bit sequence, the AE shall discard any MSP packets that have duplicate M/SN values. The AE shall discard the entire L-bit sequence if a long form MSP Packet is determined to be missing by use of the M/SN Field.

The packets associated with any L-bit sequence whose reassembly is not completed in Tm seconds (Table B-2-4) shall be discarded.

B.2.2.6.4 Broadcast Format

The first byte of the broadcast MA field shall contain the broadcast identifier as specified in Table B-2-3.

B.2.2.7 System Timers

The values for timers referenced in this specification shall conform to the values given in Table B-2-4.

Table B-2-4: AE Mode S Subnetwork Timers

Timer Name	Timer Label	Nominal Value	Reference
L bit Delivery	Tm	120 Sec	A2.2.6.3
Interrogator Link	Tz	30 Sec	A2.2.6.1.1.4

Tolerace for all timers shall be ± 1 percent.
Resolution for all timers shall be 1 second.

B.3 BDS REGISTER FORMATS

Tables are numbered B-3-X where "X" is the decimal equivalent of the BDS code Y,Z where Y is the BDS1 code and Z is the BDS2 code, used to access the data format for a particular register. The following tables are not included:

B-3-1
B-3-2 to B-3-4 (Used by the linked Comm-B protocol)
B-3-5 to B-3-12, B-3-97 & B-3-101 (Used for extended squitter)
B-3-13 to B-3-14 (Reserved for air/air state information)
B-3-15 (Reserved for ACAS)
B-3-17 to B-3-22
B-3-35 (Reserved for antenna position)
B-3-36 (Reserved for aircraft parameters)
B-3-38 to B-3-47
B-3-49 to B-3-63
B-3-68 to B-3-69 (Reserved for meteorological reports)
B-3-70 to B-3-71
B-3-73 to B-3-79
B-3-87 to B-3-94
B-3-102 to B-3-111 (Reserved for extended squitter)
B-3-112 to B-3-224
B-3-225 to B-3-226 (Reserved for Mode S BITE)
B-3-231 to B-3-240
B-3-243 to B-3-255

Table B-3-16: BDS code 1,0 — Data link capability report

MB FIELD

Reference Data Link Capability Report §2.2.17.1.12.5

1	MSB
2	
3	
4	BDS code 1,0
5	
6	
7	
8	LSB
9	Continuation flag (see 9)
10	
11	
12	RESERVED
13	
14	
15	
16	Reserved for ACAS
17	
18	
19	
20	Mode S subnetwork version number (see 12)
21	
22	
23	
24	Transponder enhanced protocol indicator (see 4)
25	Mode S specific services capability (see 2)
26	
27	Uplink ELM average throughput capability (see 13)
28	
29	Downlink ELM: throughput capability of downlink ELM
30	containing the maximum number of ELM segments that the
31	transponder can deliver in response to a single requesting
32	interrogation (UF = 24). (see 14)
33	Aircraft identification capability (see 11)
34	Squitter capability subfield (SCS) (see 5)
35	Surveillance identifier code (SIC) (see 6)
36	Common usage GlCB capability report (see 7)
37	
38	RESERVED FOR ACAS
39	
40	
41	MSB
42	
43	
44	
45	
46	
47	Bit array indicating the support status of DTE Sub addresses 0 to
48	15 (see 3 and 8)
49	
50	
51	
52	
53	
54	
55	
56	LSB

PURPOSE: To report the data link capability of the Mode S transponder/data link installation

The coding of this register shall conform to:

1) Annex 10, Volume IV, 3.1.2.6.10.2.

2) When bit 25 is set to 1**,** it shall indicate that at least one Mode S specific service (other than GICB services related to registers 02_{16}, 03_{16}, 04_{16}, 10_{16}, 17_{16} to $1C_{16}$, 20_{16} and 30_{16}) is supported and the particular capability reports shall be checked. *Note.- Registers accessed by BDS codes 0,2; 0.3; 0,4; 1,0; 1,7 to 1,C; 2,0 and 3,0 do not affect the setting of bit 25.*

3) Starting from the MSB, each subsequent bit position shall represent the DTE subaddress in the range from 0 to 15

4) The enhanced protocol indicator shall denote a Level 5 transponder when set to 1 and a Level *2* to 4 transponder when **set** to 0

5) The squitter capability subfield (SCS) shall be set to 1 if both registers 05_{16} and 06_{16} have been updated within the last ten plus or minus one seconds. Otherwise, it shall be set to 0. *Note.— Registers* 05_{16} and 06_{16} *are used for the extended squitter airborne and surface position reports, respectively.*

6) The surveillance identifier code (SIC) bit shall be interpreted as follows:
0 = no surveillance identifier code capability
1 = surveillance identifier code capability

7) Bit 36 shall be toggled each time the common usage GlCB capability report (register 17_{16}) changes. To avoid the generation of too many broadcast capability report changes, register 17_{16} shall be sampled at approximately one minute intervals to check for changes.

8) The current status of the on-board DTE shall be periodically reported to the GDLP by on-board sources. Since a change in this field results in a broadcast of the capability report, status inputs shall be sampled at approximately one minute intervals.

9) In order to determine the extent of any continuation of the data link capability report (into those registers reserved for this purpose: register 11_{16} to register 16_{16}), bit 9 shall be reserved as a 'continuation flag' to indicate if the subsequent register shall be extracted. For example: upon detection of bit 9 = 1in register 10_{16} then register 11_{16} shall be extracted. If bit 9 = 1 in register 11_{16} then register 12_{16} shall be extracted, and so on (up to register 16_{16}). Note that if bit 9 = 1 in register 16_{16} then this shall be considered as an error condition.

(Requirements are continued on the next page)

Table B-3-16: BDS code 1,0 — Data link capability report (Concluded)

10) The Mode S transponder may update bits 1-8, 16, 33, 35 and 37-40 independent of the ADLP. These bits are provided by the transponder when the data link capability report is broadcast as a result of a transponder-detected change in capability reported by the ADLP (3.1.2 of Annex 10, Volume IV).

11) Bit 33 indicates the availability of Aircraft Identification data. It shall be set by the transponder if the data comes to the transponder through a separate interface and not through the ADLP.

12) The Mode S subnetwork version number shall be coded as follows:

Version number	Year of Annex 10 amendment	Edition of This Document
0	Mode S subnetwork not available	
1	1996	---
2	1998	---
3	2002	---
4	2007	Edition 1
5-127	Unassigned	

13) Uplink ELM average throughput capability shall be coded as follows:

0 = No UELM Capability
1 = 16 UELM segments in 1 second
2 = 16 UELM segments in 500 ms
3 = 16 UELM segments in 250 ms
4 = 16 UELM segments in 125 ms
5 = 16 UELM segments in 60 ms
6 = 16 UELM segments in 30 ms
7 = Unassigned

14) Downlink ELM: throughput capability shall be coded as follows:

0 = No DELM capability
I = One 4-segment DELM every second
2 = One 8-segment DELM every second
3 = One 16-segment DELM every second
4 = One 16-segment DELM every 500 ms
5 = One 16-segment DELM every 250 rns
6 = One 16-segment DELM every 125 ms
7-15 = Unassigned

Table B-3-23: BDS code 1,7 — Common usage GICB capability report

MB FIELD

1	0,5 Extended squitter airborne position
2	0,6 Extended squitter ground position
3	0,7 Extended squitter status
4	0,8 Extended squitter type and identification
5	0,9 Extended squitter airborne velocity information
6	0,A Extended squitter event-driven information
7	2,0 Aircraft identification
8	2,l Aircraft registration number
9	4,0 Selected vertical intention
10	4,l Next waypoint identifier
11	4,2 Next waypoint position
12	4,3 Next waypoint information
13	4,4 Meteorological routine report
14	4,5 Meteorological hazard report
15	4.8 VHF channel report
16	5,0 Track and turn report
17	5,1 Position coarse
18	5,2 Position fine
19	5,3 Air-referenced state vector
20	5,4 Waypoint 1
21	5,5 Waypoint 2
22	5,6 Waypoint 3
23	5,F Quasi-static parameter monitoring
24	6,0 Heading and speed report
25	Reserved for aircraft capability
26	Reserved for aircraft capability
27	E,1 Reserved for Mode S BITE (Built In Test Equipment)
28	E,2 Reserved for Mode S BITE (Built In Test Equipment)
29	F,1 Military applications
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	RESERVED
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	

PURPOSE: To indicate common usage GlCB services currently supported.

1) Each bit position shall indicate that the associated register is available in the aircraft installation when set to 1.

2) All registers shall be constantly monitored at a rate consistent with their individual required update rate and the corresponding capability bit shall be set to 1 only when valid data is being input to that register at the required rate or above.

3) The capability bit shall be set to a 1 if at least one field in the register is receiving valid data at the required rate with the status bits for all fields not receiving valid data at the required rate set to ZERO.

4) Registers 18_{16} to $1C_{16}$ shall be independent of register 17_{16}

Table B-3-24 to B-3-28: BDS codes 1,8 to 1,C — MSSS GICB capability reports

MB FIELD

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

PURPOSE: To indicate GICB services that are installed

Each bit position shall indicate that the GICB service that it represents has been implemented in the aircraft installation when set to 1.

Starting from the LSB, each bit position shall represent the register number, in accordance with the following table:

BDS code	Capability installed for register:
BDS 1,8	01_{16} to 38_{16}
BDS 1,9	39_{16} to 70_{16}
BDS 1,A	71_{16} to $A8_{16}$
BDS 1,B	$A9_{16}$ to $E0_{16}$
BDS 1,C	$E1_{16}$ to FF_{16}

The 25 most significant bits of BDS 1,C shall not be used.

Table B-3-29 to B-3-31: BDS codes 1,D to 1,F — MSSS MSP capability reports

MB FIELD

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

PURPOSE: To indicate MSP services that are installed and require a service.

Each bit shall indicate that the MSP it represents requires service when set to 1.
Starting from the MSB, each bit position shall represent the MSP channel number for both uplink and downlink channel fields, in accordance with the following table:

BDS code	MSP channels
BDS 1,D	1 to 28 up and down
BDS 1,E	29 to 56 up and down
BDS 1,F	57 to 63 up and down

1) In register $1F_{16}$ the least significant bits of both uplink and downlink channel fields shall not be used.

2) The conditions for setting the capability bits shall be as defined in the specification of the corresponding service, see section A.3.

Table B-3-32: BDS code 2,0 — Aircraft identification

MB FIELD

1	MSB	
2		
3		
4	BDS code 2,0	
5		
6		
7		
8	LSB	
9	MSB	
10		
11		CHARACTER 1
12		
13		
14	LSB	
15	MSB	
16		
17		CHARACTER 2
18		
19		
20	LSB	
21	MSB	
22		
23		CHARACTER 3
24		
25		
26	LSB	
27	MSB	
28		
29		
30		CHARACTER 4
31		
32	LSB	
33	MSB	
34		
35		CHARACTER 5
36		
37		
38	LSB	
39	MSB	
40		
41		CHARACTER 6
42		
43		
44	LSB	
45	MSB	
46		
47		CHARACTER 7
48		
49		
50	LSB	
51	MSB	
52		
53		CHARACTER 8
54		
55		
56	LSB	

PURPOSE: To report aircraft identification to the ground

1) Annex 10, Volume IV, 3.1.2.9.
2) The character coding to be used shall be identical to that defined in Table 3-6 of Chapter 3, Annex 10, Volume IV.

3) This data may be input to the transponder from sources other than the Mode S ADLP.

4) Characters 1 – 8 of this format shall be used by the extended squitter application.

5) Capability to support this register shall be indicated by setting bit 33 in register 10_{16} and the relevant bits in registers 17_{16} and 18_{16}.

6) The aircraft identification shall be that employed in the flight plan. When no flight plan is available the registration marking of the aircraft shall be used.

Reference Aircraft Identification Reporting §2.2.17.1.13

Table B-3-33: BDS code 2,1 — Aircraft and airline registration markings

MB FIELD

1	STATUS	
2	MSB	
3		
4	CHARACTER 1	
5		
6		
7	LSB	
8	MSB	
9		
10	CHARACTER 2	
11		
12		
13	LSB	
14	MSB	
15		
16	CHARACTER 3	
17		
18		
19	LSB	
20	MSB	
21		
22	CHARACTER 4	AIRCRAFT
23		REGISTRATION
24		NUMBER
25	LSB	
26	MSB	
27		
28	CHARACTER 5	
29		
30		
31	LSB	
32	MSB	
33		
34	CHARACTER 6	
35		
36		
37	LSB	
38	MSB	
39		
40	CHARACTER 7	
41		
42		
43	LSB	
44	STATUS	
45	MSB	
46		
47	CHARACTER 1	
48		
49		
50	LSB	ICAO AIRLINE
51	MSB	REGISTRATION
52		MARKING
53	CHARACTER 2	
54		
55		
56	LSB	

PURPOSE: To permit ground systems to identify the aircraft without the necessity of compiling and maintaining continuously updated data banks.

The character coding shall be as defined in Table 3-6 of Chapter 3, Annex 10, Volume IV.

Table B-3-34: BDS code 2,2 — Antenna positions

MB FIELD

1	MSB	
2	ANTENNA TYPE	
3	LSB	
4	MSB = 32 m	
5		
6	X POSITION	
7	Range = [1, 63]	ANTENNA 1
8		
9	LSB = 1 m	
10	MSB = 16 m	
11		
12	Z POSITION	
13	Range = [1,31]	
14	LSB = 1 m	
15	MSB	
16	ANTENNA TYPE	
17	LSB	
18	MSB = 32 m	
19		
20	X POSITION	
21	Range = [1, 63]	ANTENNA 2
22		
23	LSB = 1 m	
24	MSB = 16 m	
25		
26	Z POSITION	
27	Range = [1, 31]	
28	LSB = 1 m	
29	MSB	
30	ANTENNA TYPE	
31	LSB	
32	MSB = 32 m	
33		
34	X POSITION	
35	Range = [1, 63]	ANTENNA 3
36		
37	LSB = 1 m	
38	MSB = 16 m	
39		
40	Z POSITION	
41	Range = [1, 31]	
42	LSB = 1 m	
43	MSB	
44	ANTENNA TYPE	
45	LSB	
46	MSB = 32 m	
47		
48	X POSITION	
49	Range = [1, 63]	ANTENNA 4
50		
51	LSB = 1 m	
52	MSB = 16 m	
53		
54	Z POSITION	
55	Range = [1, 31]	
56	LSB = 1 m	

PURPOSE: To provide information on the position of Mode S and GNSS antennas on the aircraft in order to make very accurate measurements of aircraft position possible.

1) The antenna type field shall be interpreted as follows:

   0 = Invalid
   1 = Mode S bottom antenna
   2 = Mode S top antenna
   3 = GNSS antenna
   4 to 7 = Reserved

2) The X position field shall be the distance in meters along the aircraft centre line measured from the nose of the aircraft. The field shall be interpreted as invalid if the value is 0 and the value of 63 shall mean that the antenna position is 63 meters or more from the nose.

3) The Z position field shall be the distance in meters of the antenna from the ground, measured with the aircraft unloaded and on the ground. The field shall be interpreted as invalid if the value is 0 and the value 31 shall mean that the antenna position is 31 meters or more from the ground.

Table B-3-37: BDS code 2,5 — Aircraft type

MB FIELD

1	MSB	
2		
3	AIRCRAFT TYPE	
4		
5		
6	LSB	
7	MSB	
8	NUMBER OF ENGINES	
9	LSB	
10	MSB	
11		
12	ENGINE TYPE	
13		
14		
15	LSB	
16	MSB	
17		
18	CHARACTER 1	
19		
20		
21	LSB	
22	MSB	
23		
24	CHARACTER 2	
25		
26		
27	LSB	
28	MSB	
29		
30	CHARACTER 3	MODEL
31		DESIGNATION
32		
33	LSB	
34	MSB	
35		
36		
37	CHARACTER 4	
38		
39	LSB	
40	MSB	
41		
42	CHARACTER 5	
43		
44		
45	LSB	
46	MSB	
47		
48	WAKE TURBULENCE	
49	CATEGORY	
50		
51	LSB	
52		
53		
54	RESERVED	
55		
56		

PURPOSE: To provide information on aircraft type.

1) Subfield coding

The coding shall be as in Doc 8643 — *Aircraft Type Designators*. All the subfields that contain characters shall be encoded using the 6-bit subset of 1A-5 as specified in Table 3-6 of Annex 10, Volume IV.

2) Model designation

Coding shall consist of four characters as specified in Doc 8643. The fifth character shall be reserved for future expansion and shall contain all zeros until it is specified. 2222 in the first four characters shall mean that the designator is not specified.

3) Number of engines

This subfield shall be encoded as a binary number where number 7 means 7 or more engines.

Table B-3-48: BDS code 3,0 — ACAS active resolution advisory

MB FIELD

Reference Comm-B Used by TCAS §2.2.20.1.2

1	MSB
2	
3	
4	BDS code 3,0
5	
6	
7	
8	LSB
9	MSB
10	
11	
12	
13	
14	
15	ACTIVE RESOLUTION ADVISORIES
16	
17	
18	
19	
20	
21	
22	LSB
23	MSB
24	RACs RECORD
25	
26	LSB
27	RA TERMINATED
28	MULTIPLE THREAT ENCOUNTER
29	MSB THREAT-TYPE INDICATOR
30	LSB
31	MSB
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	THREAT IDENTITY DATA
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	LSB

PURPOSE: To report resolution advisories (RAs) generated by ACAS equipment.

The coding of this register shall conform to:

1) Annex 10, Volume IV, 4.3.8.4.2.2.

2) Bit 27 shall mean RA terminated when set to 1.

Table B-3-64: BDS 4,0 — Selected vertical intention

MB FIELD

1	STATUS
2	MSB = 32 768 ft
3	
4	
5	MCP/FCU SELECTED ALTITUDE
6	
7	
8	
9	Range [0, 65 520] ft
10	
11	
12	
13	LSB = 16 ft Resolution
14	STATUS
15	MSB = 32 768 ft
16	
17	
18	FMS SELECTED ALTITUDE
19	
20	
21	
22	Range [0, 65 520] ft
23	
24	
25	
26	LSB = 16 ft Resolution
27	STATUS
28	MSB = 204.8 mb
29	
30	
31	
32	BAROMETRIC PRESSURE SETTING
33	MINUS 800 mb
34	
35	
36	Range [0, 410] mb
37	
38	
39	LSB = 0.1 mb Resolution
40	
41	
42	
43	
44	RESERVED
45	
46	
47	
48	STATUS OF MCP/FCU MODE BITS
49	VNAV MODE
50	ALT HOLD MODE
51	APPROACH MODE
52	RESERVED
53	
54	STATUS OF TARGET ALT SOURCE BITS
55	TARGET ALT SOURCE
56	TARGET ALT SOURCE

PURPOSE: To provide ready access to information about the pilot's current vertical intentions, in order to improve the effectiveness of conflict probes and to provide additional tactical information to controllers.

1) Target altitude shall be the short-term intent value, at which the aircraft will level off (or has leveled off) at the end of the current maneuver. The data source that the aircraft is currently using to determine the target altitude shall be indicated in the altitude source bits (54 to 56) as detailed below.

   Note.- This information which represents the real "aircraft intent", when available, represented by the altitude control panel selected altitude, the flight management system selected altitude, or the current aircraft altitude according to the aircraft's mode of flight (the intent may not be available at all when the pilot is flying the aircraft).

2) The data entered into bits 1 to 13 shall be derived from the mode control panel/flight control unit or equivalent equipment. Alerting devices may be used to provide data if it is not available from "control" equipment. The associated mode bits for this field (48 to 51) shall be as detailed below

3) The data entered into bits 14 to 26 shall be derived from the flight management system or equivalent equipment managing the vertical profile of the aircraft

4) The current barometric pressure setting shall be calculated from the value contained in the field (bits 28 to 39) plus 800 mb.

   When the barometric pressure setting is less than 800 mb or greater than 1 209.5 mb, the status bit for this field (bit 27) shall be set to indicate invalid data

5) Bits 48 to 56 shall indicate the status of the values provided in bits 1 to 26 as follows:

   Bit 48 shall indicate whether the mode bits (49, 50 and 51) are actively being populated:

   0 = No mode information provided
   1= Mode information deliberately provided

   Bits 49, 50 and 51:

   0 = Not active
   1 = Active

   Bit 54 shall indicate whether the target altitude source bits (55 and 56) are actively being populated.

   0 = No source information provided
   1 = Source information deliberately provided

   Bits 55 and 56, shall indicate target altitude source:

   00 = Unknown
   01 = Aircraft altitude
   10 = FCU/MCP selected altitude
   11 = FMS selected altitude

Table B-3-65: BDS 4,1 — Next waypoint details

MB Field

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

PURPOSE: To provide ready access to details about the next waypoint on an aircraft's route, without the need to establish a data link dialogue with the flight management system. This will assist with short and medium term tactical control.

1) Each character shall be encoded as specified in Annex 10, Volume VI, 3.1.2.9.1.2

Table B-3-66: BDS 4,2 — Next waypoint details

MB Field	
1	STATUS
2	SIGN
3	MSB = 90 degrees
4	
5	
6	
7	WAYPOINT LATITUDE
8	
9	
10	
11	
12	
13	
14	Range [-180, 180] degrees
15	
16	
17	
18	
19	
20	LSB = 90/131 072 degrees
21	STATUS
22	SIGN
23	MSB = 90 degrees
24	
25	
26	
27	WAYPOINT LONGITUDE
28	
29	
30	
31	
32	
33	
34	Range [-180, 180] degrees
35	
36	
37	
38	
39	
40	LSB = 90/131 072 degrees
41	STATUS
42	SIGN
43	MSB = 65 536 ft
44	
45	
46	WAYPOINT CROSSING
47	ALTITUDE
48	
49	
50	
51	Range [-131 072, 131 064] ft
52	
53	
54	
55	
56	LSB = 8 ft

PURPOSE: To provide ready access to details about the next waypoint on an aircraft's route, without the need to establish a data link dialogue with the flight management system. This will assist with short and medium term tactical control.

Table B-3-67: BDS 4,3 — Next waypoint details

MB field

1	STATUS
2	SIGN
3	MSB = 90 degrees
4	
5	
6	BEARING TO WAYPOINT
7	
8	
9	Range [-180, 180] degrees
10	
11	
12	LSB = 360/2 048 degrees
13	STATUS
14	MSB = 204.8 min
15	
16	
17	
18	TIME TO GO
19	
20	
21	Range [0, 410] min
22	
23	
24	
25	LSB = 0.1 min
26	STATUS
27	MSB = 3276.8 NM
28	
29	
30	
31	
32	DISTANCE TO GO
33	
34	
35	
36	
37	Range [0, 6 554] NM
38	
39	
40	
41	
42	LSB = 0.1 NM
43	
44	
45	
46	
47	
48	
49	
50	RESERVED
51	
52	
53	
54	
55	
56	

PURPOSE: To provide ready access to details about the next waypoint on an aircraft's route, without the need to establish a data link dialogue with the flight management system. This will assist with short and medium term tactical control.

1) The bearing to waypoint is the bearing from the current aircraft heading position to the waypoint position referenced to true north.

Table B-3-72: BDS code 4,8 — VHF channel report

MB FIELD

1	MSB	
2		
3		
4		
5		
6		
7		VHF 1
8		
9		
10		
11		
12		
13		
14		
15	LSB	
16	STATUS	
17	MSB	VHF 1
18	LSB	AUDIO STATUS
19	MSB	
20		
21		
22		
23		
24		
25		
26		VHF 2
27		
28		
29		
30		
31		
32		
33	LSB	
34	STATUS	
35	MSB	VHF 2
36	LSB	AUDIO STATUS
37	MSB	
38		
39		
40		
41		
42		
43		VHF 3
44		
45		
46		
47		
48		
49		
50		
51	LSB	
52	STATUS	
53	MSB	VHF 3
54	LSB	AUDIO STATUS
55	MSB	121.5 MHz
56	LSB	AUDIO STATUS

PURPOSE: To allow the ATC system to monitor the settings of the VHF communications channel and to determine the manner in which each channel is being monitored by the aircrew.

Channel report coding:
Each VHF communications channel shall be determined from the 15-bit positive binary number, N in kHz, according to the formula.
Channel (MHz) = Base + N x 0.001 (MHz)
where Base = 118.000 MHz
Notes. —
1) The use of binary to define the channel improves the coding efficiency.
2) This coding is compatible with analogue channels on 25 kHz, 8.33 kHz channel spacing and VDL as described below.
3) VDL has a full four bits allocated such that the active status of each of its four multiplex channels can be ascertained.

25 kHz VDL: Mode 3

Bit	
16	Status
15	MSB (12 800 kHz)
...	range 118.000 to 143.575 136.975 (military uses)
6	LSB (25 kHz)
5	4 × channel active flags
4	
3	
2	
1	VDL indicator = 1

25 kHz analogue

Bit	
16	Status
15	MSB (12 800 kHz)
...	range 118.000 to 143.575 136.975 (military uses)
6	LSB (25 kHz)
5	unused
4	unused
3	unused
2	8.33 indicator = 0
1	VDL indicator = 0

8.33 kHz analogue

Bit	
16	Status
15	MSB (17 066 kHz)
...	range 118.000 to 152.112 136.975 (military uses)
4	LSB (17 066/2 048 kHz)
3	unused
2	8.33 indicator = 1
1	VDL indicator = 0

Audio status coding:

Each pair of audio status bits shall be used to describe the aircrew monitoring of that audio channel according to the following table:

Bit 1	Bit 2	
0	0	UNKNOWN
0	1	NOBODY
1	0	HEADPHONES ONLY
1	1	LOUDSPEAKER

Table B-3-80: BDS code 5,0 — Track and turn report

MB FIELD

1	STATUS
2	Sign 1 = Left wing down
3	MSB = 45 degrees
4	
5	
6	ROLL ANGLE
7	
8	Range [-90, 90] degrees
9	
10	
11	LSB = 45/256 degrees
12	STATUS
13	SIGN 1 = West (e.g. 315 = -45º)
14	MSB = 90 degrees
15	
16	
17	TRUE TRACK ANGLE
18	
19	
20	Range [-180, 180] degrees
21	
22	
23	LSB = 90/512 degrees
24	STATUS
25	MSB = 1 024 kt
26	
27	
28	GROUND SPEED
29	
30	
31	Range [0, 2 046] kt
32	
33	
34	LSB = 1 024/512 kt
35	STATUS
36	SIGN 1= Minus
37	MSB = 8 degrees/second
38	
39	
40	TRACK ANGLE RATE
41	
42	Range [-16, 16] degrees/second
43	
44	
45	LSB = 8/256 degrees/second
46	STATUS
47	MSB = 1 024 kt
48	
49	
50	TRUE AIRSPEED
51	
52	
53	Range [0, 2 046] kt
54	
55	
56	LSB = 2 kt

PURPOSE: To provide track and turn data to the ground systems:

1) If the value of a parameter from any source exceeds the range allowable in the register definition, the maximum allowable value in the correct positive or negative sense shall be used instead.

Note.- This requires active intervention by the GFM.

2) The data entered into the register shall, whenever possible, be derived from the sources that are controlling the aircraft.

3) If any parameter is not available on the aircraft, all bits corresponding to that parameter shall be actively set to zero by the GFM.

4) The LSB of all fields shall be obtained by rounding.

Table B-3-81: BDS code 5,1 — Position report coarse

MB FIELD

1	STATUS (see 1)
2	SIGN
3	MSB = 90 degrees
4	
5	
6	
7	
8	
9	LATITUDE
10	
11	
12	
13	
14	Range = [-180, +180]
15	(see 2)
16	
17	
18	
19	
20	
21	LSB = 360/1 048 576 degrees
22	SIGN
23	MSB = 90 degrees
24	
25	
26	
27	
28	LONGITUDE
29	
30	
31	
32	
33	
34	Range = [-180, +180]
35	
36	
37	
38	
39	
40	
41	LSB = 360/1 048 576 degrees
42	SIGN
43	MSB = 65 536 ft
44	
45	
46	
47	PRESSURE
48	ALTITUDE
49	
50	Range = [-1 000, +126 752]
51	
52	
53	
54	
55	
56	LSB = 8 ft

PURPOSE: To provide a three-dimensional report of aircraft position

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 52_{16}.

2) The required valid range for latitude is +90 degrees to –90 degrees, but the parameter shall be coded with an MSB of 90 degrees to allow the use of the same coding algorithm as for longitude.

3) The source of the information in this register shall be the same as that indicated in the FOM/SOURCE field of register 52_{16}

Table B-3-82: 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	PRESSURE ALTITUDE
48	OR
49	GNSS HEIGHT (HAE)
50	
51	
52	Range [-1 000, 126 752] ft
53	
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_{16}.
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 20 (e.g. INS data) pressure altitude
2 = RNP 5 (e.g. VOR/DME) pressure altitude
3 = RNP 1 (e.g. DME/DME or GNSS) pressure altitude
4 = RNP 0.5 (e.g. DME/DME or GNSS) pressure altitude
5 = RNP 0.3 (e.g. DME/DME or GNSS) pressure altitude
6= RNP 0.3/125 (e.g. DME/DME or GNSS) pressure altitude
7 = RNP 0.03/50 (ILS, MLS or differential GNSS) pressure altitude
8 = RNP 0.02/40 (ILS, MLS or differential GNSS) pressure altitude
9 = RNP 0.01/15 (ILS, MLS or differential GNSS) pressure altitude
10 = RNP 0.003 (ILS, MLS or differential GNSS) pressure altitude
11 = RNP 1 (e.g. DME/DME or GNSS) GMSS height
12 = RNP 0.3/125 (e.g. DME/DME or GNSS) GNSS height
13 = RNP 0.03/50 (ILS, MLS or differential GNSS) GNSS height
14 = RNP 0.02/40 (ILS, MLS or differential GNSS) GNSS height
15 = RNP 0.01/15 (ILS, MLS or differential GNSS) GNSS height

where RNP is required navigation performance as defined by ICAO.

Note. - 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_{16}

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_{16}.

3) When GNSS height is contained in bits 42 to 56, the pressure altitude can be obtained from register 51_{16}.

Table B-3-83: BDS code 5,3 — Air-referenced state vector

MB FIELD

1	STATUS
2	SIGN
3	MSB = 90 degrees
4	
5	
6	MAGNETIC HEADING
7	
8	
9	Range [-180, 180] degrees
10	
11	
12	LSB = 90/512 degrees
13	STATUS
14	MSB = 512 kt
15	
16	
17	INDICATED AIRSPEED (IAS)
18	
19	
20	Range [0, 1 023] kt
21	
22	
23	LSB = 1 kt
24	STATUS
25	MSB = MACH 2.048
26	
27	
28	MACH NUMBER
29	
30	Range [0, 4.096] MACH
31	
32	
33	LSB = MACH 0.008
34	STATUS
35	MSB = 1 024 kt
36	
37	
38	
39	
40	TRUE AIRSPEED
41	
42	
43	Range [0, 2 048] kt
44	
45	
46	LSB = 0.5 kt
47	STATUS
48	SIGN
49	MSB = 8 192 ft/min
50	
51	ALTITUDE RATE
52	
53	Range [-16 384, +16 320] ft/min
54	
55	
56	LSB = 64ft/min

PURPOSE: To provide the ATC system with current measured values of magnetic heading, IAS/MACH, altitude rate and TAS.

Table B-3-84 to B-3-86: BDS codes 5,4 to 5,6 — Waypoints 1, 2 and 3

MB FIELD

1	STATUS (see 1)
2	MSB
3	
4	CHARACTER 1
5	
6	
7	LSB
8	MSB
9	
10	CHARACTER 2
11	
12	
13	LSB
14	MSB
15	
16	CHARACTER 3
17	
18	
19	LSB
20	MSB
21	
22	CHARACTER 4
23	
24	
25	LSB
26	MSB
27	
28	CHARACTER 5
29	
30	
31	LSB
32	MSB = 30 min
33	
34	ESTIMATED TIME OF ARRIVAL
35	(NORMAL FLIGHT)
36	
37	Range [0, 60] min
38	
39	
40	LSB = 60/512 min
41	MSB = 320 FL
42	
43	ESTIMATED FLIGHT LEVEL
44	(NORMAL FLIGHT)
45	Range [0, 630] FL
46	LSB = 10 FL
47	MSB = 30 min
48	
49	TIME TO GO
50	(DIRECT ROUTE)
51	
52	Range [0, 60] min
53	
54	
55	LSB = 60/512 min
56	RESERVED

PURPOSE: To provide information on the next three waypoints, register 54_{16} contains information on the next waypoint, register 55_{16} contains information on the next waypoint plus 1, and register 56_{16} contains information on the next waypoint plus 2.

1) The single status bit shall be set to 0 if any of the parameters are invalid.

2) The actual time or flight level shall be calculated from the trajectory scheduled in the FMS.

Note. More detail on the next waypoint is given in register 41_{16} *to* 43_{16}.

3) When the waypoint identity has only three characters two leading zero characters shall be added. (e.g. CDN becomes 00CDN).

4) Estimated time is in minutes and all ones shall be used to indicate that the waypoint referred to is one hour or more away.

Table B-3-95: BDS code 5,F — Quasi-static parameter monitoring

MB FIELD

1	MSB MCP/FCU SELECTED ALTITUDE
2	LSB
3	RESERVED
4	
5	RESERVED
6	
7	RESERVED
8	
9	RESERVED
10	
11	RESERVED
12	
13	MSB NEXT WAYPOINT
14	LSB
15	RESERVED
16	
17	MSB FMS VERTICAL MODE
18	LSB
19	MSB VHF CHANNEL REPORT
20	LSB
21	MSB METEOROLOGICAL HAZARDS
22	LSB
23	MSB FMS SELECTED ALTITUDE
24	LSB
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	RESERVED
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	

PURPOSE: To permit the monitoring of changes in parameters that do not normally change very frequently, i.e. those expected to be stable for 5 minutes or more by accessing a single register

Parameter monitor coding:

1) The changing of each parameter shall be monitored by 2 bits. The value 00 shall indicate that no valid data are available on this parameter. The decimal value for this 2-bit field shall be cycled through 1, 2 and 3, each step indicating a change in the monitored parameter.

2) The meteorological hazards subfield shall report changes to turbulence, wind shear, wake vortex, icing and microburst, as in register number 45_{16}.
3) The next waypoint subfield shall report change to data contained in registers 41_{16}, 42_{16} and 43_{16}.
4) The FMS vertical mode shall report change to bits 48 to 51 in register 40_{16}.

Table B-3-96: BDS code 6,0 — Heading and speed report

MB FIELD

1	STATUS
2	SIGN 1=West (e.g. 315 = -45°)
3	MSB = 90 degrees
4	
5	
6	MAGNETIC HEADING
7	
8	
9	Range = [-180, +180]
10	
11	
12	LSB = 90/512 degrees
13	STATUS
14	MSB = 512 kt
15	
16	
17	INDICATED AIRSPEED
18	
19	
20	Range = [0, 1023]
21	
22	
23	LSB = 1 kt
24	STATUS
25	MSB = 2.048 MACH
26	
27	
28	MACH
29	
30	
31	Range = [0,4.092] MACH
32	
33	
34	LSB = 2.048/512 MACH
35	STATUS
36	SIGN 1=Below
37	MSB = 8 192 ft/min
38	
39	
40	BAROMETRIC ALTITUDE RATE
41	
42	Range = [-16384, 16 352] ft/min
43	
44	
45	LSB = 8 192/256 = 32 ft/min
46	STATUS
47	SIGN 1= Below
48	MSB = 8 192 ft/min
49	
50	INERTIAL VERTICAL VELOCITY
51	
52	
53	Range =[-16 384, 16 352] ft/min
54	
55	
56	LSB = 8 192/256 = 32 ft/min

PURPOSE: To provide heading and speed data to ground systems

1) If the value of a parameter from any source exceeds the range allowable in the register definition, the maximum allowable value in the correct positive or negative sense shall be used instead.

   Note. — This requires active intervention by the GFM.

2) The data entered into the register shall whenever possible be derived from the sources that are controlling the aircraft.

3) The LSB of all fields shall be obtained by rounding.

Table B-3-227: BDS code E,3 — Transponder type/part number

MB Field

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

PURPOSE : To provide Mode S transponder part number or type as defined by the supplier.

FORMAT TYPE CODING:

Bit 2	Bit 3	
0	0	= Part number (P/N) coding
0	1	= Character coding
1	0	= RESERVED
1	1	= RESERVED

1) When available it is recommended to use the part number. P/N Digits are BCD encoded. Digit 1 is the first left digit of the part number.

2) If the part number is not available the first 8 characters of the commercial name can be used with format type “01”.

3) If format type “01” is used the coding of character 1 to 8 shall be as defined in Table 3-7 of Chapter 3, Annex 10, Volume IV. Character 1 is the first left character of the transponder type.

4) For operational reasons, some military installations may not implement this format.

Table B-3-228: BDS code E,4 — Transponder software revision number

MB Field

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

PURPOSE: To provide Mode S transponder software revision number as defined by the supplier.

FORMAT TYPE CODING:

Bit 2	Bit 3	
0	0	= Part number (P/N) coding
0	1	= Character coding
1	0	= RESERVED
1	1	= RESERVED

1) When a part number is allocated to the software revision it is recommended to use the format type 00. In this case P/N Digits are BCD encoded. Digit 1 is the first left digit of the part number.

2) If format type 01 is used the coding of character 1 to 8 shall be as defined in Table 3-7 of Chapter 3, Annex 10, Volume IV. Character 1 is the first left character of the software revision number

3) For operational reasons, some military installations may not implement this format.

Table B-3-229: BDS code E,5 — ACAS unit part number

MB Field

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

PURPOSE: To provide ACAS unit part number or type as defined by the supplier.

FORMAT TYPE CODING:

Bit 2	Bit 3	
0	0	= Part number (P/N) coding
0	1	= Character coding
1	0	= RESERVED
1	1	= RESERVED

1) When available it is recommended to use the part number. P/N Digits are BCD encoded. Digit 1 is the first left digit of the part number.

2) If the part number is not available the first 8 characters of the commercial name can be used with format type “01”.

3) If format type “01” is used the coding of character 1 to 8 shall be as defined in Table 3-7 of Chapter 3, Annex 10, Volume IV. Character 1 is the first left character of the ACAS unit type.

4) For operational reasons, some military installations may not implement this format.

Table B-3-230: BDS code E,6 — ACAS unit software revision

MB Field

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

PURPOSE: To provide ACAS unit sotware revision number as defined by the supplier.

FORMAT TYPE CODING:

Bit 2	Bit 3	
0	0	= Part number (P/N) coding
0	1	= Character coding
1	0	= RESERVED
1	1	= RESERVED

1) When available it is recommended to use the part number. P/N Digits are BCD encoded. Digit 1 is the first left digit of the part number.

2) If format type “01” is used the coding of character 1 to 8 shall be as defined in Table 3-7 of Chapter 3, Annex 10, Volume IV. Character 1 is the first left character of the ACAS unit software revision.

3) For operational reasons, some military installations may not implement this format.

Table B-3-241: BDS code F,1 — Military applications

MB FIELD

1	STATUS	
2	Character Field (see 1)	
3	C1	
4	A1	
5	C2	
6	A2	
7	C4	
8	A4	MODE 1 CODE
9	X	
10	B1	
11	D1	
12	B2	
13	D2	
14	B4	
15	D4	
16	STATUS	
17	C1	
18	A1	
19	C2	
20	A2	
21	C4	
22	A4	MODE 2 CODE
23	X	
24	B1	
25	D1	
26	B2	
27	D2	
28	B4	
29	D4	
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		RESERVED
43		
44		
45		
46		
47		
48		
49		
50		
51		
52		
53		
54		
55		
56		

PURPOSE: To provide data in support of military applications

1) The character field shall be used to indicate whether 2 characters or 4 characters are used in the Mode 1 code. The logic shall be as follows:

   0 = 2 octal codes
   (A1-A4 and B1-B4)

   1 = 4 octal codes
   (A1-A4, B1-B4, C1-C4 and D1-D4)

2) The status fields shall be used to indicate whether the data are available or unavailable. The logic shall be as follows:

   0 = Unavailable
   1 = Available

Table B-3-242: BDS code F,2 — Military applications

MB FIELD

1	MSB	
2		
3	AF=2, TYPE CODE = 1	
4		
5	LSB	
6	STATUS	
7	CHARACTER FIELD (see 1)	
8	C1	
9	A1	
10	C2	
11	A2	
12	C4	
13	A4	
14	X	MODE 1 CODE
15	B1	
16	D1	
17	B2	
18	D2	
19	B4	
20	D4	
21	STATUS	
22	C1	
23	A1	
24	C2	
25	A2	
26	C4	
27	A4	
28	X	MODE 2 CODE
29	B1	
30	D1	
31	B2	
32	D2	
33	B4	
34	D4	
35	STATUS	
36	C1	
37	A1	
38	C2	
39	A2	
40	C4	
41	A4	
42	X	MODE A CODE
43	B1	
44	D1	
45	B2	
46	D2	
47	B4	
48	D4	
49		
50		
51		
52		RESERVED
53		
54		
55		
56		

PURPOSE: This register is used for military applications involving DF=19. Its purpose is to provide data in support of military applications.

'**TYPE CODE' shall be encoded as follows**:

0 = Unassigned
1 = Mode code information
2-31 = Unassigned

1) The character field shall be used to indicate whether 2 characters or 4 characters are used *in* the Mode 1 code The logic shall be as follows:

0 = *2* octal codes
(Al-A4 and B1-B4)

1 = 4 octal codes
(Al-A4, B1-B4, C1-C4, and Dl-D4)

2) The status fields shall be used to indicate whether the data are available or unavailable. The logic shall be as follows:

0 = Unavailable
1 = Available

DF=19 Application Field (AF) shall be encoded as follows:

0=Reserved for civil extended squitter formats
1=Reserved for formation flight
2=Reserved for military applications
3-7 Reserved