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

ADS-B 1090ES MOPS Maintenance

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Proposed Revision to the Version 2 ES Message Set to Retain Backward Compatibility with Version 0 and Version 1

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Summary
This Working Paper addresses the issue of backward compatibility of the proposed Version 2 ES Messages.

ACSS PROPOSED DO-260B ES MESSAGES

ACSS has certified ADS-B In systems and is in the process of certifying new ADS-B IN systems, therefore backwards compatibility is a concern.

From the proposed changes that have been made up to this time it appears that the message set may allow for backward compatibility.

The following tables show the working groups proposed changes, and where required for backward compatibility ACSS's alternate proposal.

The tables are arranged in four main columns:

1. Version 0 – DO-260
2. Version 1 – DO-260A
3. ACSS Proposed Version 2 – DO-260B, as applicable
4. Working Group Proposed Version 2 – DO-260B

The color coding in the tables is as follows:

Red - Redefinition of field or field alignment

Yellow - Redefinition of field values or new values assigned to field

Blue – ADS-B In does not decode message for ADS-B Report

ACSS – ADS-B In Apps do not use field data but may be encoded into ADS-B Report

NOTE: This document is a first cut, it was intended to capture all the working groups proposed changes.

Airborne Position – Types 0, 9-18, 20-22

260		260A		Working Group PROPOSED 260B	
1	Format Type Code (0, 9-18, 20-22)	1	Format Type Code (0, 9-18, 20-22)	1	Format Type Code (0, 9-18, 20-22)
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6	Surveillance Status	6	Surveillance Status	6	Surveillance Status
7		7		7	
8	Single Antenna Flag	8	Single Antenna Flag	8	NIC Supplement
9	ALTITUDE (Baro for type codes 0, 9-18) (GNSS Height for type code 20-22)	9	ALTITUDE (Baro for type codes 0, 9-18) (GNSS Height for type code 20-22)	9	ALTITUDE (Baro for type codes 0, 9-18) (GNSS Height for type code 20-22)
10		10		10	
11		11		11	
12		12		12	
13		13		13	
14		14		14	
15		15		15	
16		16		16	
17		17		17	
18		18		18	
19		19		19	
20		20		20	
21	Time (T)	21	Time (T)	21	Time (T)
22	CPR Format (F)	22	CPR Format (F)	22	CPR Format (F)
23	Encoded Latitude	23	Encoded Latitude	23	Encoded Latitude
24		24		24	
25		25		25	
26		26		26	
27		27		27	
28		28		28	
29		29		29	
30		30		30	
31		31		31	
32		32		32	
33		33		33	
34		34		34	
35		35		35	
36		36		36	
37		37		37	
38		38		38	
39		39		39	
40	Encoded Longitude	40	Encoded Longitude	40	Encoded Longitude
41		41		41	
42		42		42	
43		43		43	
44		44		44	
45		45		45	
46		46		46	
47		47		47	
48		48		48	
49		49		49	
50		50		50	
51		51		51	
52		52		52	
53		53		53	
54		54		54	
55		55		55	
56		56		56	

- Format Type Code, NIC may no longer use vertical parameters for encoding and a new NIC Supplement value may be added
- Proposed that NIC Supplement be swapped with Single Antenna Flag

Surface Position – Types 5 - 8

260		260A		Working Group PROPOSED 260B	
1	Format Type Code (5-8)	1	Format Type Code (5-8)	1	Format Type Code (5-8)
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6	Movement – (Ground Speed)	6	Movement – (Ground Speed)	6	Movement – (Ground Speed)
7		7		7	
8		8		8	
9		9		9	
10		10		10	
11		11		11	
12		12		12	
13	Ground Track Status	13	Status for Heading	13	Status for Heading
14	Ground Track (True)	14	Heading/Ground Track (True or Mag per HRD in AOSM, Track or Heading per Track Angle/Heading in AOSM)	14	Heading/Ground Track (True or Mag per HRD in AOSM, Track or Heading per Track Angle/Heading in AOSM)
15		15		15	
16		16		16	
17		17		17	
18		18		18	
19		19		19	
20		20		20	
21	Time (T)	21	Time (T)	21	Time (T)
22	CPR Format (F)	22	CPR Format (F)	22	CPR Format (F)
23	Encoded Latitude	23	Encoded Latitude	23	Encoded Latitude
24		24		24	
25		25		25	
26		26		26	
27		27		27	
28		28		28	
29		29		29	
30		30		30	
31		31		31	
32		32		32	
33		33		33	
34		34		34	
35		35		35	
36		36		36	
37		37		37	
38		38		38	
39		39		39	
40	Encoded Longitude	40	Encoded Longitude	40	Encoded Longitude
41		41		41	
42		42		42	
43		43		43	
44		44		44	
45		45		45	
46		46		46	
47		47		47	
48		48		48	
49		49		49	
50		50		50	
51		51		51	
52		52		52	
53		53		53	
54		54		54	
55		55		55	
56		56		56	

- New NIC supplement values used with Format Type Code may define new NIC values for Surf Pos Msg

Aircraft Identification and Type – Types 1-4

260		260A		Working Group PROPOSED 260B	
1	Format Type Code (1-4 Airborne ID and Category)	1	Format Type Code (1-4 Airborne ID and Category)	1	Format Type Code (1-4 Airborne ID and Category)
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6	Aircraft Category (Emitter Category)	6	Aircraft Category (Emitter Category)	6	Aircraft Category (Emitter Category)
7		7		7	
8		8		8	
9	Character 1	9	Character 1	9	Character 1
…		…		…	
14		14		14	
15	Character 2	15	Character 2	15	Character 2
…		…		…	
20		20		20	
21	Character 3	21	Character 3	21	Character 3
…		…		…	
26		26		26	
27	Character 4	27	Character 4	27	Character 4
…		…		…	
32		32		32	
33	Character 5	33	Character 5	33	Character 5
…		…		…	
38		38		38	
39	Character 6	39	Character 6	39	Character 6
…		…		…	
44		44		44	
45	Character 7	45	Character 7	45	Character 7
…		…		…	
50		50		50	
51	Character 8	51	Character 8	51	Character 8
…		…		…	
56		56		56	

Airborne Velocity - Type 19, Subtype 0

260	
1	Format Type Code (19)
2	
3	
4	
5	
6	Subtype (0)
7	
8	
9	Reserved
10	E-W Velocity Direction
11	E-W Velocity
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	N-S Velocity Direction
23	N-S Velocity
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	Sign for Turn Rate
35	Turn Rate
36	
37	
38	
39	
40	
41	Sign for Vertical Rate
42	Vertical Rate
43	
44	
45	
46	
47	
48	
49	
50	
51	Reserved
52	
53	
54	
55	
56	

ADS-B Airborne Velocity - Type 19 Subtype 1 & 2

260		260A		Working Group PROPOSED 260B	
1	Format Type Code (19)	1	Format Type Code (19)	1	Format Type Code (19)
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6	Subtype (1 = Non-Supersonic, 2 = Supersonic)	6	Subtype (1 = Non-Supersonic, 2 = Supersonic)	6	Subtype (1 = Non-Supersonic, 2 = Supersonic)
7		7		7	
8		8		8	
9	Intent Change Flag	9	Intent Change Flag	9	Intent Change Flag
10	IFR Capability Flag	10	IFR Capability Flag	10	IFR Capability Flag
11	NUC_R – Navigation Uncertainty Category - Velocity	11	NACv – Navigation Accuracy Category Velocity	11	NACv – Navigation Accuracy Category Velocity
12		12		12	
13		13		13	
14	E-W Velocity Direction	14	E-W Velocity Direction	14	E-W Velocity Direction
15	E-W Velocity	15	E-W Velocity	15	E-W Velocity
16		16		16	
17		17		17	
18		18		18	
19		19		19	
20		20		20	
21		21		21	
22		22		22	
23		23		23	
24		24		24	
25	N-S Velocity Direction	25	N-S Velocity Direction	25	N-S Velocity Direction
26	N-S Velocity	26	N-S Velocity	26	N-S Velocity
27		27		27	
28		28		28	
29		29		29	
30		30		30	
31		31		31	
32		32		32	
33		33		33	
34		34		34	
35		35		35	
36	Source for Vertical Rate	36	Source for Vertical Rate	36	Source for Vertical Rate
37	Sign for Vertical Rate	37	Sign for Vertical Rate	37	Sign for Vertical Rate
38	Vertical Rate	38	Vertical Rate	38	Vertical Rate
39		39		39	
40		40		40	
41		41		41	
42		42		42	
43		43		43	
44		44		44	
45		45		45	
46		46		46	
47	Turn Indicator TBD	47	Reserved (0)	47	Reserved (0)
48		48		48	
49	Difference Sign	49	Difference Sign	49	Difference Sign
50	Geometric Height difference from Barometric Altitude	50	Geometric Height difference from Barometric Altitude	50	Geometric Height difference from Barometric Altitude
51		51		51	
52		52		52	
53		53		53	
54		54		54	
55		55		55	
56		56		56	

- Discussions of usage and applicability of Intent Change Flag and IFR Capability Flag

Airborne Velocity - Type 19 Subtype 3 & 4

260		260A		Working Group PROPOSED 260B	
1	Format Type Code (19)	1	Format Type Code (19)	1	Format Type Code (19)
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6	Subtype (3 = Non-Supersonic, 4 = Supersonic)	6	Subtype (3 = Non-Supersonic, 4 = Supersonic)	6	Subtype (3 = Non-Supersonic, 4 = Supersonic)
7		7		7	
8		8		8	
9	Intent Change Flag	9	Intent Change Flag	9	Intent Change Flag
10	IFR Capability Flag	10	IFR Capability Flag	10	IFR Capability Flag
11	NUC_R – Navigation Uncertainty Category - Velocity	11	NACv – Navigation Accuracy Category Velocity	11	NACv – Navigation Accuracy Category Velocity
12		12		12	
13		13		13	
14	Mag Heading Available	14	Heading Available	14	Heading Available
15	Magnetic Heading	15	Heading, (True or Mag per HRD in AOSM)	15	Heading, (True or Mag per HRD in AOSM)
16		16		16	
17		17		17	
18		18		18	
19		19		19	
20		20		20	
21		21		21	
22		22		22	
23		23		23	
24		24		24	
25	Airspeed IAS or TAS	25	Airspeed IAS or TAS	25	Airspeed IAS or TAS
26	Airspeed	26	Airspeed	26	Airspeed
27		27		27	
28		28		28	
29		29		29	
30		30		30	
31		31		31	
32		32		32	
33		33		33	
34		34		34	
35		35		35	
36	Source for Vertical Rate	36	Source for Vertical Rate	36	Source for Vertical Rate
37	Sign for Vertical Rate	37	Sign for Vertical Rate	37	Sign for Vertical Rate
38	Vertical Rate	38	Vertical Rate	38	Vertical Rate
39		39		39	
40		40		40	
41		41		41	
42		42		42	
43		43		43	
44		44		44	
45		45		45	
46		46		46	
47	Turn Indicator TBD	47	Reserved (0)	47	Reserved (0)
48		48		48	
49	Difference Sign	49	Difference Sign	49	Difference Sign
50	Geometric Height difference from Barometric Altitude	50	Geometric Height difference from Barometric Altitude	50	Geometric Height difference from Barometric Altitude
51		51		51	
52		52		52	
53		53		53	
54		54		54	
55		55		55	
56		56		56	

- Discussions of usage and applicability of Intent Change Flag and IFR Capability Flag

Test (Mode A 4096 Code) – Type 23

260		260A		Working Group PROPOSED 260B	
1	Format Type Code (23)	1	Format Type Code (23)	1	Format Type Code (23)
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6	Subtype (7)	6	Subtype (7)	6	Subtype (7)
7		7		7	
8		8		8	
9	Mode A 4096 Code	9	Mode A 4096 Code	9	Mode A 4096 Code
…		10		10	
21		11		11	
22	Reserved (0)	12	Reserved (0)	12	Reserved (0)
…		…		…	
56		56		56	

Aircraft Emergency/Priority – Type 28, Subtype 1

260		260A		Working Group PROPOSED 260B	
1	Format Type Code (28)	1	Format Type Code (28)	1	Format Type Code (28)
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6	Subtype (1)	6	Subtype (1)	6	Subtype (1)
7		7		7	
8		8		8	
9	Emergency/Priority Status	9	Emergency/Priority Status	9	Emergency/Priority Status
10		10		10	
11		11		11	
12	Reserved (0)	12	Reserved (0)	12	STATUS
13		13		13	MODE A CODE
14		14		14	
15		15		15	
16		16		16	
17		17		17	
18		18		18	
19		19		19	
20		20		20	
21		21		21	
22		22		22	
23		23		23	
24		24		24	
25		25		25	
26		26		26	Reserved (0)
…		…		…	
56		56		56	

Aircraft Emergency/Priority – Type 28, Subtype 2 – TCAS RA MESSAGE

PROPOSED RTCA/DO260B	
ME Bit	Description
1	Format Type Code (28)
2	
3	
4	
5	
6	Subtype (2)
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
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- New Subtype 2 message.

TCP / Target State and Status - Type 29

260		260A		ACSS PROPOSED 260B		Working Group PROPOSED 260B	
1	Format Type Code (29)	1	Format Type Code (29)	1	Format Type Code (29)	1	Format Type Code (29)
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6	TCP Type	6	Subtype (0)	6	Subtype (0)	6	Subtype (0)
7	Trajectory Point/Leg Type	7		7		7	
8		8	Vertical Data Available / Source Indicator	8	Status of Selected Altitude	8	Reserved (0)
9		9		9	Selected Heading Validity Bit	9	Status of Selected Altitude
10		10	Target Altitude Type (0)	10	Status of Baro. Press Setting	10	MSB = 32,768 feet
11	TCP Data Valid	11	Back Capability Flag (0)	11	Back Capability Flag (0) / (1)	11	
12	TCP Format	12	Target Altitude Capability	12	MSB = 32,768 feet	12	MCP / FCU Selected Altitude
13	TCP, TCP+1 Altitude	13		13		13	
14		14	Vertical Mode Indicator	14	MCP / FCU Selected Altitude	14	
15		15		15		15	
16		16	Target Altitude	16		16	
17		17		17		17	
18		18		18		18	
19		19		19		19	
20		20		20		20	LSB = 32 feet
21		21		21		21	Status of MCP/FCU Mode Bits
22		22		22	LSB = 32 feet	22	AUTOPILOT ENGAGED
23	TCP, TCP+1 Latitude	23		23	MSB = 180 degress	23	VNAV MODE
`24		24		24		24	ALT HOLD MODE
25		25		25		25	APPROACH MODE
26		26	Horizontal Data Available / Source Indicator	26		26	Reserved (0)
27		27		27	Selected Heading	27	Selected Heading Validity Bit
28		28	Target Heading / Track Angle	28		28	MSB = 180 degress
29		29		29		29	
30		30		30		30	
31		31		31	LSB = 0.35 degrees	31	Selected Heading
32		32		32		32	
33		33		33	MSB = 128 millibars	33	
34		34		34		34	
35		35		35		35	
36		36		36	Baro Press Setting 0 to 255	36	LSB = 0.3515625 degrees
37	TCP, TCP+1 Longitude	37	Target Heading/Track Ind	37		37	
38		38	Horizontal Mode Indicator	38		38	NACp – Navigation Accuracy Category – Position
39		39		39	LSB = 2 millibars	39	
40		40		40		40	
41		41	NACp – Navigation Accuracy Category – Position	41	NACp – Navigation Accuracy Category – Position	41	NIC baro (0)
42		42		42		42	SIL – System Integrity Level
43		43		43		43	
44		44	NIC baro (0)	44	NIC baro (0)	44	Status of Baro. Press Setting
45		45	SIL – System Integrity Level	45	SIL – System Integrity Level	45	MSB = 128 millibars
46		46		46		46	
47		47	Reserved (0)	47	Status of MCP/FCU Mode	47	
48		**48**		**48**	AUTOPILOT ENGAGED	**48**	Baro Press Setting 0 to 255
49		49		49	VNAV MODE	49	
50		50		50	ALT HOLD MODE	50	
51	TCP, TCP+1 Time-To-Go	51		51	APPROACH MODE	51	LSB = 4 millibars
52		52	TCAS Operational	52	TCAS Operational	52	TCAS Operational
53		53	TCAS RA Active	53	TCAS RA Active	53	TCAS RA Active
54		54	Emergency/Priority Status	54	Emergency/Priority Status	54	Emergency/Priority Status
55		55		55		55	
56		56		56		56	

-Alternately to ACSS Proposed message, the Backwards Compatibility Flag may be set to 1 and Version 1 ADS-B systems will discard the message, (are there Version 0 systems that will be affected by setting this bit)

- Selected Heading should have 10 bits, not 9. (2^{10} - 1 = 1023 * 0.3515625 = 359.6484375)
- Baro Pressure should have 6 bits, not 7 (2^6 – 1 = 63 * 4 = 252), (it was suggested LSB value be decreased, with 7 bits LSB can be 2 millibars, 2^7 – 1 = 127 * 2 = 254)

Aircraft Operational Coordination - Type 30

RTCA/DO260 ADS-B DF17 Figure A-11	
1	Format Type Code (30)
2	
3	
4	
5	
6	Subtype (0)
7	
8	
9	Paired Address
10	
11	
12	
13	
14	
15	
16	
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18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	Runway Threshold Speed
34	
35	
36	
37	
38	Roll Angle Sign
39	Roll Angle
40	
41	
42	
43	
44	Go Around
45	
46	Engine Out
47	
48	Reserved (0)
49	
50	
51	
52	
53	
54	
55	
56	

Aircraft Operational Status, Airborne - Type 31, Subtype 0

260		260A		Working Group PROPOSED 260B	
1	Format Type Code (31)	1	Format Type Code (31)	1	Format Type Code (31)
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6	Subtype (0)	6	Subtype (0)	6	Subtype (0)
7		7		7	
8		8		8	
9	Enroute Operational Capabilities (CC-4)	9	Service Level (0)	9	Service Level (0)
10		10		10	
11	Not TCAS	11	Not TCAS	11	Not TCAS
12	CDTI Display Capability	12	CDTI Display Capability	12	CDTI Display Capability
13	Terminal Area Operational Capabilities (CC-3)	13	Service Level (0)	13	Service Level (0)
14		14		14	
15		15	Air Velocity Report Cap.	15	Air Velocity Report Cap.
16		16	Target State Report Cap.	16	Target State Report Cap.
17	Approach/Landing Operational Capabilities (CC-2)	17	Target Change Report Capability	17	Target Change Report Capability
18		18		18	
19		19	Reserved (0)	19	Reserved (0)
20		20		20	
21	Surface Operational Capabilities (CC-1)	21		21	
22		22		22	
23		23		23	
24		24		24	
25	Enroute Operational Capability Status (OM-4)	25	OM Subfield Code (0)	25	OM Subfield Code (0)
26		26		26	
27		27	TCAS RA Active	27	TCAS RA Active
28		28	IDENT Switch Active	28	IDENT Switch Active
29	Terminal Area Operational Capability Status (OM-3)	29	Receiving ATC Services	29	Receiving ATC Services
30		30	Reserved (0)	30	Single Antenna Flag
31		31		31	Reserved (0)
32		32		32	
33	Approach/Landing Operational Capability (OM-2)	33		33	
34		34		34	
35		35		35	
36		36		36	
37	Surface Operational Capability (OM-1)	37		37	
38		38		38	
39		39		39	
40		40		40	
41	Reserved (0)	41	MOPS Version Number (1)	41	MOPS Version Number (2)
42		42		42	
43		43		43	
44		44	NIC Supplement	44	NIC Supplement
45		45	NACp – Navigation Accuracy Category – Position	45	NACp – Navigation Accuracy Category – Position
46		46		46	
47		47		47	
48		48		48	
49		49	BAQ (0)	49	BAQ (0)
50		50		50	
51		51	SIL – System Integrity Level	51	SIL – System Integrity Level
52		52		52	
53		53	NIC baro (0)	53	NIC baro (0)
54		54	Horizontal Ref Direction	54	Horizontal Ref Direction
55		55	Reserved (0)	55	Reserved (0)
56		56		56	

- MOPS Version Number incremented from 1 to 2
- NAC_P may no longer use vertical parameters for encoding
- SIL may no longer use vertical parameters for encoding
- Discussions of usage and applicability of CDTI Capability and Receiving ATC Services

Aircraft Operational Status, Ground - Type 31, Subtype 1

260A		Working Group PROPOSED 260B	
1	Format Type Code (31)	1	Format Type Code (31)
2		2	
3		3	
4		4	
5		5	
6	Subtype (1)	6	Subtype (1)
7		7	
8		8	
9	Service Level (0)	9	Service Level (0)
10		10	
11	POA – Position Offset Applied	11	POA – Position Offset Applied
12	CDTI Display Capability	12	CDTI Display Capability
13	Service Level (0)	13	Service Level (0)
14		14	
15	B2 Low (0)	15	B2 Low (0)
16	Reserved (0)	16	Reserved (0)
17		17	
18		18	
19		19	
20		20	
21	Aircraft Length and Width Code	21	Aircraft Length and Width Code
22		22	
23		23	
24		24	
25	OM Subfield Code (0)	25	OM Subfield Code (0)
26		26	
27	TCAS RA Active	27	TCAS RA Active
28	IDENT Switch Active	28	IDENT Switch Active
29	Receiving ATC Services	29	Receiving ATC Services
30	Reserved (0)	30	Reserved (0)
31		31	
32		32	
33		33	
34		34	
35		35	
36		36	
37		37	
38		38	
39		39	
40		40	
41	MOPS Version Number (1)	41	MOPS Version Number (2)
42		42	
43		43	
44	NIC Supplement Code	44	NIC Supplement Code
45	NACp – Navigation Accuracy Category – Position	45	NACp – Navigation Accuracy Category – Position
46		46	
47		47	
48		48	
49	Reserved (0)	49	Reserved (0)
50		50	
51	SIL – System Integrity Level	51	SIL – System Integrity Level
52		52	
53	Track Angle/Heading	53	Track Angle/Heading
54	Horizontal Ref Direction	54	Horizontal Ref Direction
55	Reserved (0)	55	Reserved (0)
56		56	

- MOPS Version Number incremented from 1 to 2
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