International Civil Aviation Organization | Organisation de l'aviation civile internationale | Organización de Aviación Civil Internacional | Международная организация гражданской авиации | منظمة الطيران المدني الدولي | 国际民用航空组织

Tel.: +1 (514) 954-8219 ext. 6712

Ref.: AN 7/1.3.95-09/58 30 June 2009

Subject: Proposals for the amendment of Annex 10, Volumes III and IV, concerning changes to existing provisions for 24-bit aircraft address, SSR and extended squitter as well as introducing new provisions for multilateration systems and airborne surveillance applications

Action required: Comments to reach Montreal by 13 October 2009

Sir/Madam,

1. I have the honour to inform you that the Air Navigation Commission, at the fifth meeting of its 181st Session held on 9 June 2009, considered proposals developed by the Aeronautical Surveillance Panel (ASP) to amend the Standards and Recommended Practices (SARPs) in Annex 10 — *Aeronautical Telecommunications*, Volume III — *Communication Systems*, Part I — *Digital Data Communication Systems* and Volume IV — *Surveillance and Collision Avoidance Systems*, concerning existing provisions for 24-bit aircraft address, secondary surveillance radar (SSR) and extended squitter as well as introducing new provisions for multilateration systems and airborne surveillance applications, as shown in Attachments A and B, and authorized their transmission to Contracting States and appropriate international organizations for comments.

2. The purpose of the proposed amendment is to:

a) improve the procedure for the allocation of 24-bit addresses to States and update the table of allocations;

b) update provisions relating to SSR (Modes A/C and S) and automatic dependent surveillance — broadcast (ADS-B) using 1 090 MHz extended squitter resulting from operational experience;

c) introduce system-level and functional requirements for multilateration systems used for air traffic surveillance; and

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d) introduce an initial set of technical requirements for airborne surveillance applications that are enabled by the use of ADS-B IN messages in the flight deck.

3. In examining the proposed amendments, you should not feel obliged to comment on editorial aspects as such matters will be addressed by the Air Navigation Commission during its final review of the draft amendment.

4. May I request that any comments you may wish to make on the amendment proposals be dispatched to reach me not later than 13 October 2009. The Air Navigation Commission has asked me to specifically indicate that comments received after the due date may not be considered by the Commission and the Council. In this connection, should you anticipate a delay in the receipt of your reply, please let me know in advance of the due date.

5. For your information, the proposed amendment to Annex 10, Volumes III, Part I, and IV, is envisaged for applicability on 18 November 2010. Any comments you may have thereon would be appreciated.

6. The subsequent work of the Air Navigation Commission and the Council would be greatly facilitated by specific statements on the acceptability or otherwise of the proposals. Please note that, for the review of your comments by the Air Navigation Commission and the Council, replies are normally classified as "agreement with or without comments", "disagreement with or without comments" or "no indication of position". If in your reply the expressions "no objections" or "no comments" are used, they will be taken to mean "agreement without comment" and "no indication of position", respectively. In order to facilitate proper classification of your response, a form has been included in Attachment C which may be completed and returned together with your comments, if any, on the proposals in Attachments A and B.

Accept, Sir/Madam, the assurances of my highest consideration.

Taïeb Chérif
Secretary General

Enclosures:

A — Proposed amendment to Annex 10, Volume III, Part I
B — Proposed amendment to Annex 10, Volume IV
C — Response form

ATTACHMENT A to State letter AN 7/1.3.95-09/58

PROPOSED AMENDMENT TO ANNEX 10, VOLUME III, PART I

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

1.	~~Text to be deleted is shown with a line through it~~.	text to be deleted
2.	New text to be inserted is highlighted with grey shading.	new text to be inserted
3.	~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES

AERONAUTICAL TELECOMMUNICATIONS

ANNEX 10

TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

VOLUME III
(COMMUNICATION SYSTEMS)

PART I — DIGITAL DATA COMMUNICATION SYSTEMS

. . .

APPENDIX TO CHAPTER 9 A WORLDWIDE SCHEME FOR THE ALLOCATION, ASSIGNMENT AND APPLICATION OF AIRCRAFT ADDRESSES

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5. ASSIGNMENT OF AIRCRAFT ADDRESSES

5.1 ~~When required for use by suitably equipped aircraft entered on a national or international register,~~ An individual aircraft address ~~addresses within each block~~ shall be assigned to all suitably equipped aircraft entered on a national or international register by the State of Registry or common mark registering authority using its allocated block of addresses (Table 9-1).

Note.— For an aircraft delivery, the aircraft operator is expected to inform the airframe manufacturer of an address assignment. The airframe manufacturer or other organization responsible for a delivery flight is expected to ensure installation of a correctly assigned address supplied by the State of Registry or common mark registering authority. Exceptionally, a temporary address may be supplied under the arrangements detailed in paragraph 7.

5.2 Aircraft addresses shall be assigned to aircraft in accordance with the following principles:

a) at any one time, no address shall be assigned to more than one aircraft ~~with the exception of aerodrome surface vehicles on surface movement areas. If such exceptions are applied by the State of Registry, the vehicles which have been allocated the same address shall not operate on aerodromes separated by less than 1 000 km~~;

b) only one address shall be assigned to an aircraft, irrespective of the composition of equipment on board. ~~In the case when a removable transponder is shared by several light aviation aircraft such as balloons or gliders, it shall be possible to assign a unique address to the removable transponder. The registers 08_{16}, 20_{16},~~

~~21_{16}, 22_{16} and 25_{16} of the removable transponder shall be correctly updated each time the removable transponder is installed in any aircraft;~~

c) the address shall not be changed except under exceptional circumstances and shall not be changed during flight;

d) when an aircraft changes its State of Registry, the new registering State shall allocate the aircraft a new address from its own allocation address block and the old aircraft address shall be returned to the allocation address block of the State that previously registered the aircraft. ~~the previously assigned address shall be relinquished and a new address shall be assigned by the new registering authority~~;

e) the address shall serve only a technical role for addressing and identification of aircraft and shall not be used to convey any specific information; and

f) the addresses composed of 24 ZEROS or 24 ONES shall not be assigned to aircraft.

5.2.1 **Recommendation.**— *Any method used to allocate aircraft addresses should ensure efficient use of the entire address block that is allocated to that State.*

. . .

Table 9-1. Allocation of aircraft addresses to States

After the row for Mongolia, *insert* the following new row:

Montenegro	*					0101	00	0 10	110	00	_ _ _ _ _ _ _ _ _ _

Delete the row labelled Yugoslavia

~~Yugoslavia~~			~~*~~			~~0 1 0 0~~	~~1 1~~	~~0 0 0~~	~~— — —~~	~~— —~~	~~— — — — — — — — — —~~

After the row for Senegal, *insert* the following new row:

Serbia			*			0 1 0 0	1 1	0 0 0	_ _ _	_ _	_ _ _ _ _ _ _ _ _ _

— — — — — — — — —

ATTACHMENT B to State letter AN 7/1.3.95-09/58

PROPOSED AMENDMENT TO ANNEX 10, VOLUME IV

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

1. ~~Text to be deleted is shown with a line through it.~~	text to be deleted
2. New text to be inserted is highlighted with grey shading.	new text to be inserted
3. ~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

PROPOSED AMENDMENT TO

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

AERONAUTICAL TELECOMMUNICATIONS

ANNEX 10
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

VOLUME IV
SURVEILLANCE AND COLLISION AVOIDANCE SYSTEMS

. . .

CHAPTER 2. GENERAL

2.1 SECONDARY SURVEILLANCE RADAR (SSR)

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2.1.5.1.7 *SI capability* — Transponders with the ability to process SI codes shall have the capabilities of 2.1.5.1.1, 2.1.5.1.2, 2.1.5.1.3, 2.1.5.1.4 or 2.1.5.1.5 and also those prescribed for SI code operation (3.1.2.3.2.1.4, 3.1.2.5.2.1, 3.1.2.6.1.3, 3.1.2.6.1.4.1, 3.1.2.6.9.1.1 and 3.1.2.6.9.2). Transponders with this capability shall be designated with a suffix "s".

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CHAPTER 3. SURVEILLANCE SYSTEMS

3.1 SECONDARY SURVEILLANCE RADAR (SSR) SYSTEM CHARACTERISTICS

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3.1.1.6 REPLY TRANSMISSION CHARACTERISTICS (SIGNAL-IN-SPACE)

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3.1.1.6.2 Information pulses. Information pulses shall be spaced in increments of 1.45 microseconds from the first framing pulse. The designation and position of these information pulses shall be as follows:

Pulses	*Position (microseconds)*
C_1	1.45
A_1	2.90
C_2	4.35
A_2	5.80
C_4	7.25
A_4	8.70
X	10.15
B_1	11.60
D_1	13.05
B_2	14.50
D_2	15.95
B_4	17.40
D_4	18.85

Note.— The Standard relating to the use of these pulses is given in 2.1.4.1. However, the position of the "X" pulse is not used in replies to Mode A or Mode C interrogations and is specified only as a technical standard to safeguard possible future ~~use~~ expansion of the system. It has nevertheless been decided that such expansion should be achieved using Mode S. The presence of a pulse in the X pulse position is used in some States to invalidate replies.

. . .

3.1.1.7.4.1 The transponder shall be suppressed when the received amplitude of P_2 is equal to, or in excess of, the received amplitude of P_1 and spaced 2.0 plus or minus 0.15 microseconds. The detection of P_3 is not required as a prerequisite for initiation of suppression action.

. . .

3.1.1.7.4.3 Suppression in presence of S_1 pulse

When an S_1 pulse is detected 2.0 plus or minus 0.15 microseconds before the P_1 of a Mode A or Mode C interrogation.

a) with S_1 and P_1 above MTL the transponder shall be suppressed as specified in 3.1.1.7.4.1;

b) with P_1 at MTL and S_1 at MTL, the transponder shall be suppressed and shall reply to no more than 10 per cent of Mode A/C interrogations;

c) with P_1 at MTL and S_1 at MTL -3 dB, the transponder shall reply to Mode A/C interrogations at least 70 per cent of the time; and

d) with P_1 at MTL and S_1 at MTL -6 dB, the transponder shall reply to Mode A/C interrogations at least 90 per cent of the time.

Note 1.— The suppression action is because of the detection of S_1 and P_1, and does not require detection of a P_2 or P_3 pulse.

Note 2.— S_1 has a lower amplitude than P_1. Certain ACAS use this mechanism to improve target detection (4.3.7.1).

Note 3.— These requirements also apply to a Mode A/C only capable transponder when an S_1 precedes an intermode interrogation (2.1.2.1).

. . .

3.1.1.7.9 *REPLY RATE*

3.1.1.7.9.1 ~~The transponder shall be capable of at least 1 200 replies per second for a 15-pulse coded reply, except that, for transponder installations used solely below 4 500 m (15 000 ft), or below a lesser altitude established by the appropriate authority or by regional air navigation agreement, transponders capable of at least 1 000 replies per second for a 15-pulse coded reply shall be permitted.~~ All transponders shall be capable of continuously generating at least 500 replies per second for a 15-pulse coded reply. Transponder installations used solely below 4 500 m (15 000 ft), or below a lesser altitude established by the appropriate authority or by regional air navigation agreement, and in aircraft with a maximum cruising true airspeed not exceeding 175 kt (324 km/h) shall be capable of generating at least 1 000 15-pulse coded replies per second for a duration of 100 milliseconds. Transponder installations operated above 4 500 m (15 000 ft) or in aircraft with a maximum cruising true airspeed in excess of 175 kt (324 km/h), shall be capable of generating at least 1 200 15-pulse coded replies per second for a duration of 100 milliseconds.

Note.— A 15-pulse reply includes 2 framing pulses, 12 information pulses, and the SPI pulse.

3.1.1.7.9.2 *Reply rate limit control.* To protect the system from the effects of transponder over-interrogation by preventing response to weaker signals when a predetermined reply rate has been reached, a sensitivity reduction type reply limit control shall be incorporated in the equipment. The range of this control shall permit adjustment, as a minimum, to any value between 500 and 2 000 replies per second, or to the maximum reply rate capability if less than 2 000 replies per second, without regard to the number of pulses in each reply. Sensitivity reduction in excess of 3 dB shall not take effect until 90 per cent of the selected value is exceeded. Sensitivity reduction shall be at least 30 dB for rates in excess of 150 per cent of the selected value.

~~3.1.1.7.9.3 **Recommendation.** *The reply rate limit should be set at 1 200 replies per second, or the maximum value below 1 200 replies per second of which the transponder is capable.*~~

. . .

3.1.2.1.5.1 *Intermode interrogation*

. . .

3.1.2.1.5.1.2 *Mode A/C-only all-call interrogation.* This interrogation shall be identical to that of the Mode A/C/S all-call interrogation except that the short P_4 pulse shall be used.

Note 1.— The Mode A/C-only all-call interrogation elicits a Mode A or Mode C reply from a Mode A/C transponder. A Mode S transponder recognizes the short P_4 pulse and does not reply to this interrogation.

Note 2.— ACAS uses Mode C-only all-call interrogations with a preceding S_1 (4.3.7.1.2, 3.1.1.7.4.3).

. . .

3.1.2.4.2 *SUPPRESSION*

. . .

3.1.2.4.2.2 *Suppression pairs.* The two-pulse Mode A/C suppression pair defined in 3.1.1.7.4.1 shall initiate suppression in a Mode S transponder regardless of the position of the pulse pair in a group of pulses, provided the transponder is not already suppressed or in a transaction cycle.

. . .

3.1.2.4.2.3 Suppression in presence of S_1 pulse shall be as defined in 3.1.1.7.4.3.

. . .

3.1.2.5.2 *MODE S-ONLY ALL-CALL TRANSACTIONS*

. . .

3.1.2.5.2.1.2.2 *The use of multiple interrogator codes by one interrogator.* An interrogator shall not interleave Mode S-only all-call interrogations using different interrogator codes.

Note.— An explanation of RF interference issues, sector size and impact on data link transactions is presented in the ~~Manual of the Secondary Surveillance Radar (SSR) Systems *(Doc 9684)*~~ Aeronautical Surveillance Manual *(Doc xxxx).*

. . .

3.1.2.6.10 *BASIC DATA PROTOCOLS*

. . .

3.1.2.6.10.1.1.2 *Temporary alert condition.* The alert condition shall be temporary and shall cancel itself after T_C seconds if the Mode A identity code is changed to a value other than those listed in 3.1.2.6.10.1.1.1. The T_C shall be retriggered and continued for T_C seconds after any change has been accepted by the transponder function.

Note 1.— This retriggering is performed to ensure that the ground interrogator obtains the desired Mode A identity code before the alert condition is cleared.

Note 2.— The value of T_C is given in 3.1.2.10.3.9.

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3.1.2.6.10.2.2.2 *Updating of the data link capability report.* The transponder shall, at intervals not exceeding four seconds, compare the current data link capability status (bits 41-88 in the data link capability report) with that last reported and shall, if a difference is noted, initiate a revised data link capability report by Comm-B broadcast (3.1.2.6.11.4) for BDS1 = 1 (33-36) and BDS 2 = 0 (37-40). The transponder shall initiate, generate and ~~transmit~~ announce the revised capability report even if the aircraft data link capability is degraded or lost. The transponder shall ensure that ~~set~~ the BDS code is set for the data link capability report in all cases, including a loss of the interface.

Note.— The setting of the BDS code by the transponder ensures that a broadcast change of capability report will contain the BDS code for all cases of data link failure (e.g. the loss of the transponder data link interface).

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3.1.2.6.10.3.1 *Aircraft* with an automatic means for determining the on-the-ground condition ~~that are equipped to format extended squitter messages~~ on which transponders have access to at least one of the parameters, ground speed, radio altitude or airspeed, shall perform the following validation check:

If the automatically determined air/ground status is not available or is "airborne", no validation shall be performed. If the automatically determined air/ground status is available and "on-the-ground" condition is being reported, the air/ground status shall be overridden and changed to "airborne" if: ~~the conditions given for the vehicle category in Table 3-7 are satisfied.~~

Ground Speed > 100 knots OR Airspeed > 100 knots OR Radio Altitude > 50 feet

~~*Note.— While this test is only required for aircraft that are equipped to format extended squitter messages, this feature is desirable for all aircraft.*~~

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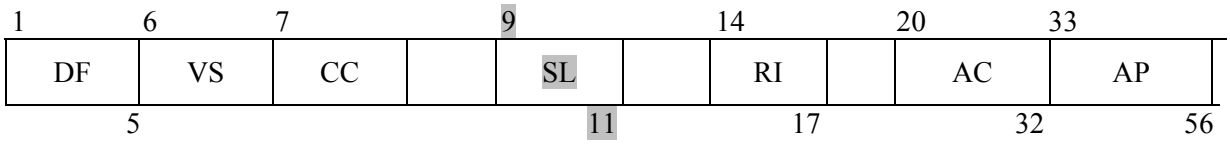
3.1.2.8.2 *SHORT AIR-AIR SURVEILLANCE, DOWNLINK FORMAT 0*

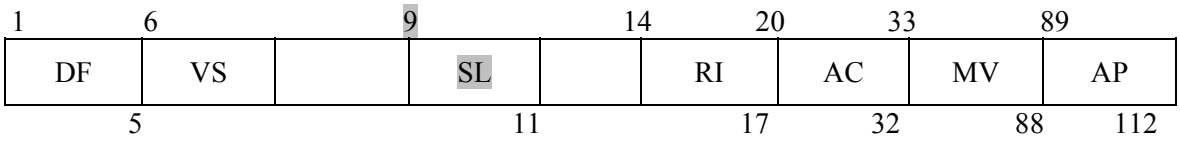


This reply shall be sent in response to an interrogation with UF equals 0 and RL equals 0. The format of this reply shall consist of these fields:

Field	*Reference*
DF downlink format	3.1.2.3.2.1.2
VS vertical status	3.1.2.8.2.1
CC cross-link capability	3.1.2.8.2.3
spare — 1 bits ~~6 bits~~	
SL sensitivity level, ACAS	~~4.3.8.4.2.5~~
spare — 2 bits	
RI reply information	3.1.2.8.2.2
spare — 2 bits	
AC altitude code	3.1.2.6.5.4
AP address/parity	3.1.2.3.2.1.3

. . .

3.1.2.8.3 *LONG AIR-AIR SURVEILLANCE, DOWNLINK FORMAT 16*



This reply shall be sent in response to an interrogation with UF equals 0 and RL equals 1. The format of this reply shall consist of these fields:

Field	*Reference*
DF downlink format	3.1.2.3.2.1.2
VS vertical status	3.1.2.8.2.1
spare — 2 bits ~~7 bits~~	
SL sensitivity level, ACAS	4.3.8.4.2.5
spare — 2 bits	
RI reply information	3.1.2.8.2.2
spare — 2 bits	
AC altitude code	3.1.2.6.5.4
MV message, ACAS	3.1.2.8.3.1
AP address/parity	3.1.2.3.2.1.3

. . .

3.1.2.8.4 *AIR-AIR TRANSACTION PROTOCOL*

Note.— Interrogation-reply coordination for the air-air formats follows the protocol outlined in Table 3-5 (3.1.2.4.1.3.2.2).

The most significant bit (bit 14) of the RI field of an air-air reply shall replicate the value of the AQ field (bit 14) received in an interrogation with UF equals 0.

If AQ equals 0 in the interrogation, the RI field of the reply shall contain the value 0 (no operating ACAS) or ACAS information as indicated in 3.1.2.8.2.2 and 4.3.8.4.1.2.

If AQ equals 1 in the interrogation, the RI field of the reply shall contain the maximum cruising true airspeed capability of the aircraft as defined in 3.1.2.8.2.2.

In response to a UF = 0 with RL = 1 and DS ≠ 0, the transponder shall reply with a DF = 16 reply in which the MV field shall contain the contents of the GICB register designated by the DS value. In response to a UF = 0 with RL = 1 and DS = 0, the transponder shall reply with a DF = 16 with an MV field of all zeros. Receipt of a UF = 0 with DS ≠ 0 but RL = 0 shall have no associated ACAS cross-link action, and the transponder shall reply as specified in 3.1.2.8.2.2.

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3.1.2.8.6 *EXTENDED SQUITTER, DOWNLINK FORMAT 17*

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3.1.2.8.6.2 *ME: Message, extended squitter.* This 56-bit (33-88) downlink field in DF = 17 shall be used to transmit broadcast messages. Extended squitter shall be supported by registers 05, 06, 07, 08, 09, 0A {HEX} and 61-6F {HEX} and shall conform to either version 0 or version 1 message formats as described below:

a) Version 0 ES message formats and related requirements are suitable for early implementation of extended squitter applications. Surveillance quality is reported by navigation uncertainty category (NUC), which can be an indication of either the accuracy or integrity of the navigation data used by ADS-B. However, there is no indication as to which of these, integrity or accuracy, the NUC value is providing an indication of.

b) Version 1 ES message formats and related requirements apply to more advanced ADS-B applications. Surveillance accuracy and integrity are reported separately as navigation accuracy category (NAC), navigation integrity category (NIC) and surveillance integrity level (SIL). Version 1 ES formats also include provisions for enhanced reporting of status information.

Note 1.— The formats and update rates of each register are specified in the Technical Provisions for Mode S Services and Extended Squitter *(Doc 9871).*

Note 2.— The formats for the two versions are interoperable. An extended squitter receiver can recognize and decode both version 0 and version 1 message formats.

Note 3.— Guidance material on transponder register formats and data sources is included in the ~~Manual on Mode S Specific Services *(Doc 9688)*~~ Technical Provisions for Mode S Services and Extended Squitter *(Doc 9871)*.

. . .

3.1.2.8.6.4.6 *Event-driven squitter rate.* The event-driven squitter shall be transmitted once, each time that GICB register 0A {HEX} is loaded, while observing the delay conditions specified in 3.1.2.8.6.4.7. The maximum transmission rate for the event-driven squitter shall be limited by the transponder to twice per second. If a message is inserted in the event-driven register and cannot be transmitted due to rate limiting, it shall be held and transmitted when the rate limiting condition has cleared. If a new message is received before transmission is permitted, it shall overwrite the earlier message.

Note.— The squitter transmission rate and the duration of squitter transmissions is application-dependent. Choices made for each application must take into account interference considerations ~~*(*Manual of the Secondary Surveillance Radar (SSR) Systems *(Doc 9684), Chapter 8 refer)*~~ *as shown in the* Aeronautical Surveillance Manual *(Doc xxxx)*.

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3.1.2.8.9 *EXTENDED SQUITTER MAXIMUM TRANSMISSION RATE*

3.1.2.8.9.1 The maximum total number of extended squitters (DF = 17, 18 ~~or~~ and 19) emitted by any extended squitter installation shall not exceed 6.2 per second, except as specified in 3.1.2.8.9.2.

3.1.2.8.9.2 For installations capable of emitting DF = 19 squitters and in accordance with 3.1.2.8.8, transmission rates for lower power DF = 19 squitters shall be limited to a peak of forty DF = 19 squitters per second, and thirty DF = 19 squitters per second averaged over 10 seconds, provided that the maximum total squitter power-rate product for the sum of full power DF = 17 squitters, full power DF = 18 squitters, full power DF = 19 squitters, and lower power DF = 19 squitters, is maintained at or below a level equivalent to the power sum of 6.2 full power squitters per second averaged over 10 seconds.

3.1.2.8.9.3 States shall ensure that the use of low power and higher rate DF = 19 operation (as per 3.1.2.8.9.2) is compliant with the following requirements:

a) it is limited to formation or element lead aircraft engaged in formation flight, directing the messages toward wing and other lead aircraft through a directional antenna with a beamwidth of no more than 90 degrees; and

b) the type of information contained in the DF = 19 message is limited to the same type of information in the DF = 17 message, that is, information for the sole purpose of safety-of-flight.

Note.— This low-power, higher squitter rate capability is intended for limited use by State aircraft in coordination with appropriate regulatory bodies.

3.1.2.8.9.4 All UF = 19 airborne interrogations shall be included in the interference control provisions of 4.3.2.2.2.2.

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3.1.2.9 AIRCRAFT IDENTIFICATION PROTOCOL

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3.1.2.9.1.4 *Change of aircraft identification.* If the aircraft identification reported in the AIS subfield is changed in flight, the transponder shall report the new identification to the ground by use of the Comm-B broadcast message protocol of 3.1.2.6.11.4 for BDS1 = 2 (33 - 36) and BDS2 = 0 (37 - 40). The transponder shall initiate, generate and announce the revised aircraft identification even if the interface providing Flight Identification is lost. The transponder shall ensure that the BDS code is set for the aircraft identification report in all cases, including a loss of the interface. In this latter case, bits 41 - 88 shall contain all ZEROs.

Note.— The setting of the BDS code by the transponder ensures that a broadcast change of aircraft identification will contain the BDS code for all cases of Flight Identification failure (e.g. the loss of the interface providing Flight Identification).

3.1.2.10 ESSENTIAL SYSTEM CHARACTERISTICS OF THE SSR MODE S TRANSPONDER

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3.1.2.10.1.1.5 *Spurious response*

3.1.2.10.1.1.5.1 **Recommendation.—** *The response to signals not within the receiver pass band should be at least 60 dB below normal sensitivity.*

3.1.2.10.1.1.5.2 For equipment certified after 1 January 2011, the spurious Mode A/C reply ratio generated by low level Mode S interrogations shall be no more than:

a) an average of 1 per cent in the input interrogation signal range between -81 dBm and the Mode S MTL; and

b) a maximum of 3 per cent at any given level in the input interrogation signal range between -81 dBm and the Mode S MTL.

Note.— Failure to detect a low level Mode S interrogation can also result in the transponder decoding a three- pulse Mode A/C/S all-call interrogation. This would result in the transponder responding with a Mode S all-call (DF = 11) reply. The above requirement will also control these DF = 11 replies since it places a limit on the probability of failing to correctly detect the Mode S interrogation.

. . .

3.1.2.10.3.10.3 *Inhibition of squitter transmissions.* It shall not be possible to inhibit extended squitter transmissions except as specified in 3.1.2.8.6 or acquisition squitter transmissions except as specified in 3.1.2.8.5 regardless of whether the aircraft is airborne or on the ground.

Note.— For additional information on squitter inhibition see the ~~Manual of the Secondary Surveillance Radar (SSR) Systems *(Doc 9684)*~~ Aeronautical Surveillance Manual (*Doc xxxx*).

. . .

Insert new text as follows:

CHAPTER 6. MULTILATERATION SYSTEMS

Note 1.— Multilateration (MLAT) systems use the time difference of arrival (TDOA) of the transmissions of a SSR transponder (or the extended squitter transmissions of a non-transponder device) between several ground receivers to determine the position of the aircraft (or ground vehicle). A multilateration system can be:

a) passive, using transponder replies to other interrogations or spontaneous squitter transmissions;

b) active, in which case the system itself interrogates aircraft in the coverage area; or

c) a combination of the two above.

Note 2.— Material contained in EUROCAE ED-117 – MOPS for Mode S Multilateration Systems for Use in A-SMGCS and ED-142 – Technical Specifications for Wide Area Multilateration System (WAM) provides a good basis for planning, implementation and satisfactory operation of MLAT systems for most applications.

6.1 Definitions

Multilateration (MLAT) System. A group of equipment configured to provide position derived from the secondary surveillance radar (SSR) transponder signals (replies or squitters) primarily using time difference of arrival (TDOA) techniques. Additional information, including identification, can be extracted from the received signals.

Time Difference of Arrival (TDOA). The difference in relative time that a transponder signal from the same aircraft (or ground vehicle) is received at different receivers.

6.2 Functional requirements

6.2.1 Radio frequency characteristics, structure and data contents of signals used in 1 090 MHz MLAT systems shall conform to the provisions of Chapter 3.

6.2.2 An MLAT system used for air traffic surveillance shall be capable of determining aircraft position and identity.

Note 1.— Depending on the application, either two or three dimensional position of the aircraft may be required.

Note 2.— Aircraft identity may be determined from

a) *Mode A code contained in Mode A or Mode S replies; or*

b) *Aircraft Identification contained in Mode S replies or extended squitter identity and category message.*

Note 3.— Other aircraft information can be obtained by analysing transmissions of opportunity (i.e. squitters or replies to other ground interrogations) or by direct interrogation by the MLAT system.

6.2.3 Where an MLAT system is equipped to decode additional position information contained in transmissions, it shall report such information separately from the aircraft position calculated based on TDOA.

6.3 Protection of the Radio Frequency Environment.

Note.— This section only applies to Active MLAT Systems.

6.3.1 In order to minimize system interference the effective radiated power of active interrogators shall be reduced to the lowest value consistent with the operationally required range of each individual interrogator site.

Note.— Guidance material on power consideration is contained in the Aeronautical Surveillance Manual *(Doc xxxx)*.

6.3.2 An active MLAT system shall not use active interrogations to obtain information that can be obtained by passive reception within each required update period.

Note. — Transponder occupancy will be increased by the use of omni-directional antennas. It is particularly significant for Mode S selective interrogations because of their higher transmission rate. All Mode S transponders will be occupied decoding each selective interrogation not just the addressed transponder.

6.3.3 The set of transmitters used by all active MLAT systems in any part of the airspace shall not occupy any transponder more than 2% of the time.

Note. — The use of active MLAT systems may be even more restrictive in some regions.

6.3.4 Active MLAT systems shall not use Mode S All-Call interrogations.

Note. — Mode S aircraft can be acquired by the reception of acquisition squitter or extended squitter even in airspace where there are no active interrogators.

6.4 Performance requirements

6.4.1 The performance characteristics of the MLAT system used for air traffic surveillance shall be such that the intended operational service(s) can be satisfactorily supported.

CHAPTER 7 — TECHNICAL REQUIREMENTS FOR AIRBORNE SURVEILLANCE APPLICATIONS

Note 1.— Airborne surveillance applications are based on aircraft receiving and using ADS-B message information transmitted by other aircraft/vehicles or ground stations. The capability of an aircraft to receive and use ADS-B/TIS-B message information is referred to as ADS-B/TIS-B IN.

Note 2.— Initial airborne surveillance applications use ADS-B messages on 1090 MHz extended squitter to provide airborne traffic situational awareness (ATSA) and are expected to include "In-trail procedures" and "Enhanced visual separation on approach".

Note 3.— Detailed description of aforementioned applications can be found in RTCA/DO-289 and DO-312.

7.1 GENERAL REQUIREMENTS

7.1.1 TRAFFIC DATA FUNCTIONS

Note 4.— The traffic transmitting ADS-B messages used by other aircraft for airborne surveillance applications is referred to as the reference aircraft.

7.1.1.1 IDENTIFYING THE REFERENCE AIRCRAFT

7.1.1.1.1 The system shall support a function to unambiguously identify each reference aircraft relevant to the application.

7.1.1.2 TRACKING THE REFERENCE AIRCRAFT

7.1.1.2.1 The system shall support a function to monitor the movements and behavior of each reference aircraft relevant to the application.

7.1.1.3 TRAJECTORY OF THE REFERENCE AIRCRAFT

7..1.1.3.1 **Recommendation.—** *The system should support a computational function to predict the future position of a reference aircraft beyond simple extrapolation.*

Note. — It is anticipated that this function will be required for future applications.

7.1.2 Displaying Traffic

Note. — Provisions contained in this section apply to the cases wherein tracks generated by ACAS and by reception of ADS-B/TIS-B IN messages are shown on a single display.

7.1.2.1 The system shall display only one track for each distinct aircraft, on a given display.

Note. — This is to ensure that tracks established by ACAS and ADS-B /TIS-B IN are properly correlated and mutually validated before being displayed.

7.1.2.2 Where there is a track generated by ADS-B/TIS-B IN and a track generated by ACAS that have been determined to belong to the same aircraft, the track generated by ADS-B /TIS-B IN shall be displayed.

Note. — At close distances, it is possible that the track generated by ACAS provides a better accuracy than the track generated by ADS-B/TIS-B IN. The requirement above ensures the continuity of the display.

7.1.2.3 The display of the tracks shall comply with the requirements of ACAS traffic display.

Note. — Section 4.3 addresses color coding and readability of the display.

End of new text.

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Table 3-1. Pulse shapes — Mode S and intermode interrogations

			(Rise time)		*(Decay time)*	
Pulse	*Duration*	*Duration Tolerance*	*Min.*	*Max.*	*Min.*	*Max*
P_1, P_2, P_3, P_5	0.8	±0.1	0.05	0.1	0.05	0.2
P_4 (short)	0.8	±0.1	0.05	0.1	0.05	0.2
P_4 (long)	1.6	±0.1	0.05	0.1	0.05	0.2
P_6 (short)	16.25	±0.25	0.05	0.1	0.05	0.2
P_6 (long)	30.25	±0.25	0.05	0.1	0.05	0.2
S_1	0.8	±0.1	0.05	0.1	0.05	0.2

. . .

Table 3-3. Field definitions

Field		*Format*		*Reference*
Designator	*Function*	*UF*	*DF*	
…				
SD	…	…	…	…
SL	Sensitivity Level (ACAS)		0, 16	4.3.8.4.2.5
UF				
…				

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Delete Table 3.7 in its entirety

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Figure 3-7. Summary of Mode S interrogation or uplink formats

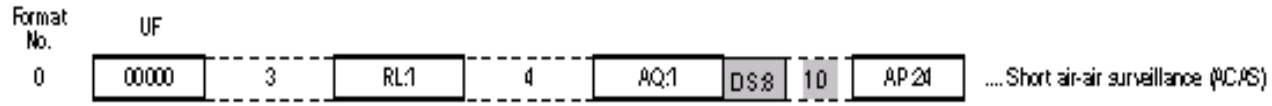

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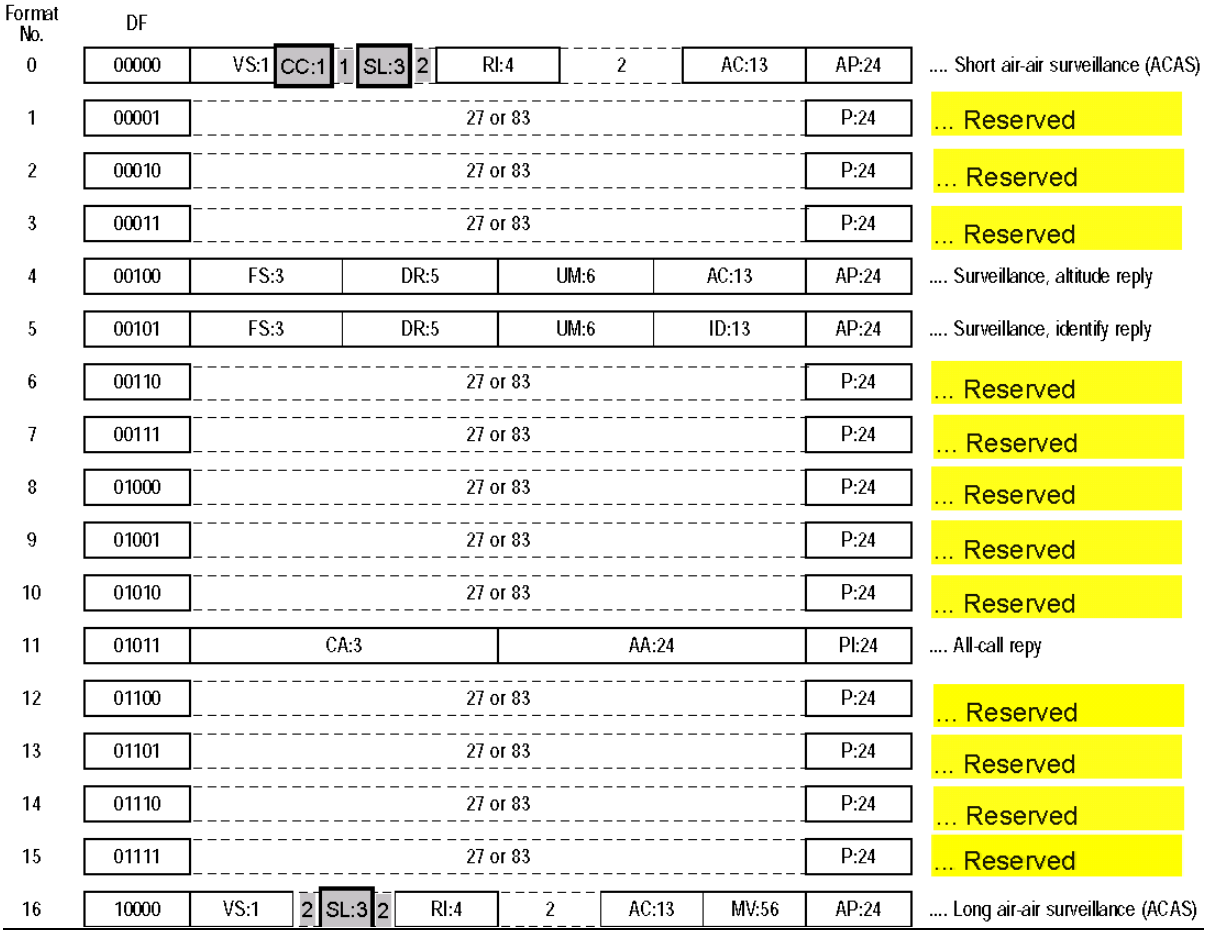
Figure 3-8. Summary of Mode S reply or downlink formats



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ATTACHMENT C to State letter AN 7/1.3.95-09/58

RESPONSE FORM TO BE COMPLETED AND RETURNED TO ICAO TOGETHER WITH ANY COMMENTS YOU MAY HAVE ON THE PROPOSED AMENDMENTS

To: The Secretary General
International Civil Aviation Organization
999 University Street
Montreal, Quebec
Canada, H3C 5H7

(**State)** ———————————————

Please make a checkmark (✓) against one option for each amendment. If you choose options "agreement with comments" or "disagreement with comments", **please provide your comments on separate sheets.**

	Agreement without comments	*Agreement with comments**	*Disagreement without comments*	*Disagreement with comments*	*No position*
Amendment Annex 10 — *Aeronautical Telecommunications*, Volume III — Communication *Sy*stems, Part I — Digital Data Communicatio*n* Systems (Attachment A refers)					
Amendment Annex 10 — *Aeronautical Telecommunications*, Volume IV — Surveillance and Collision Avoidance Systems (Attachment B refers)					

***** "Agreement with comments" indicates that your State or organization agrees with the intent and overall thrust of the amendment proposal; the comments themselves may include, as necessary, your reservations concerning certain parts of the proposal and/or offer an alternative proposal in this regard.

Signature ——————————————— Date ———————————————

— END —