APPENDIX A

PROPOSED AMENDMENT TO ANNEX 10, VOLUME III

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT TO ANNEX 10, VOLUME III

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

Insert new text as follows:

CHAPTER 12. ALTERNATIVE PROVISIONS FOR AERONAUTICAL MOBILE SATELLITE (R)* SERVICE

Note 1.— This chapter contains Standards and Recommended Practices applicable to the use of next-generation satellite system (NGSS) communications technologies to support the aeronautical mobile-satellite (R) service (AMS(R)S). The Standards and Recommended Practices of this chapter are service- and performance-oriented and are not tied to a specific technology or technique. They are intended to provide alternative means of meeting AMS(R)S requirements, independent of the Standards and Recommended Practices of Annex 10, Part I, Volume III, Chapter 4.*

Note 2.— Multiple service providers may offer AMS(R)S, either according to the Standards and Recommended Practices of Annex 10, Part I, Volume III, Chapter 4 or according to those of this Chapter.

Note 3.— Additional information and guidance is provided in the Manual on Alternative Provisions for AMS(R)S.

12.1 DEFINITIONS

Next-generation satellite system (NGSS). A satellite communications system that provides AMS(R)S in conformance with the provisions of this Chapter. These services can be voice, or data, or both. An NGSS may provide non-AMS(R)S communications. An NGSS includes AESs, satellites, GESs and network control system facilities that perform administrative and operational management functions.

Satellite system service area. A portion of the Earth's surface within which a satellite-based communications system satisfies the standards of this Chapter. Depending on its design, a system may provide discontinuous service areas.

Note.— The following terms used in this chapter are defined elsewhere in Annex 10:

Aircraft earth station (AES): defined in Annex 10, Volume III, Chapter 1.
Aeronautical telecommunication network (ATN): defined in Annex 10, Volume III, Chapter 1.
Aeronautical mobile-satellite service (AMSS): defined in Annex 10, Volume II, Chapter 1.1.
Aeronautical mobile-satellite (R) service (AMS(R)S): defined in Annex 10, Volume II, Chapter 1.1.*
Data transfer delay (95 percentile): defined in Annex 10, Volume III, Chapter 4.7.2.1.
Data transit delay: defined in Annex 10, Volume III, Chapter 4.7.2.1.
Ground earth station (GES): defined in Annex 10, Volume III, Chapter 1.
Near-geostationary orbits: defined in Annex 10, Volume III, Chapter 4.1.

* route

Spot beam: defined in Annex 10, Volume III, Chapter 4.1.
Subnetwork layer: defined in Annex 10, Volume III, Chapter 6.1.
Subnetwork service data unit (SNSDU): defined in Annex 10, Volume III, Chapter 4.7.2.1

12.2 GENERAL

12.2.1 When an NGSS is operated to provide AMS(R)S, it shall conform to the requirements of this Chapter.

12.2.1.1 **Recommendation***: To ensure sufficient protection of safety-related CNS systems, NGSS aeronautical equipment not operating to provide AMS(R)S should comply with 12.3.2 and 12.3.3 of this standard.*

12.2.2 Requirements for mandatory carriage of NGSS equipment including the level of system capability shall be made on the basis of regional air navigation agreements which specify the airspace of operation and the implementation time-scales for the carriage of equipment.

12.2.3 The agreements indicated in 12.2.2 shall provide at least two years' notice of mandatory carriage of airborne systems.

12.2.4 **Recommendation.—** *Civil aviation authorities should coordinate with national authorities and service providers those implementation aspects of NGSS that will permit its worldwide interoperability and optimum use, as appropriate*.

12.3 RF CHARACTERISTICS

12.3.1 Frequency Bands

Note.—ITU Radio Regulations permit systems providing mobile-satellite service to use the same spectrum as AMS(R)S without requiring such systems to offer safety services. This situation has the potential to reduce the spectrum available for AMS(R)S. It is critical that States consider this issue in frequency planning and in the establishment of national or regional spectrum requirements.

12.3.1.1 When providing AMS(R)S communications, the NGSS shall operate only in frequency bands in which AMS(R)S is permitted and appropriately protected by ITU Radio Regulations.

12.3.2 Emissions

12.3.2.1 The total EIRP of the AES necessary to maintain system performance shall be controlled to minimize the potential for interference to other systems. This requirement shall apply to single channel AESs, and to each individual channel of AESs that are capable of providing multiple channels.

12.3.2.2 Interference to other AMS(R)S Equipment

12.3.2.2.1 Emissions from an NGSS AES shall not cause harmful interference to an AES providing AMS(R)S on a different aircraft.

Note.— One method of complying with 12.3.2.2.1 is by limiting emissions in the operating band of other AMS(R)S equipment to a level consistent with the intersystem interference requirements (single entry) of Chapter 3.2.5.3.4.2 of RTCA Document DO-215A, Change 1.

12.3.2.3 INTERFERENCE TO OTHER CNS SYSTEMS

12.3.2.3.1 Emissions from an NGSS AES shall not cause harmful interference to non-AMS(R)S CNS systems located on the same aircraft or other aircraft.

Note.— Harmful interference can result from radiated and/or conducted emissions that include harmonics, discrete spurious, intermodulation product and noise emissions, and are not necessarily limited to the "transmitter on" state.

12.3.2.3.2 **Recommendation.**— *The average output spectral density of the composite of harmonics, discrete spurious and noise emissions created by the AES when transmitting at its maximum total output power should not be greater than -115 dBW/MHz in radio-navigation satellite service band 1 559 - 1 605 MHz, when measured at the input to the AES antenna over a period of 20 milliseconds.*

Note 1.— This recommendation assumes an isolation between the input to the AMS(R)S antenna subsystem and the output of the satellite navigation antenna subsystem of 40 dB and assumes an additional margin of 6 dB relative to the satellite navigation receiver susceptibility requirements established by the GNSS Panel .

Note 2.— Additional protection of radio-navigation satellite services in the band of 1 605 - 1 609.36 MHz from the composite of harmonics, discrete spurious, noise and intermodulation products may be necessary for AES installations made prior to January 1, 2005.

12.3.3 Susceptibility

12.3.3.1 The AES equipment shall operate properly in an interference environment causing a cumulative relative change in its receiver noise temperature (*ΔT/T)* of 25%.

12.4 PRIORITY AND PREEMPTIVE ACCESS

12.4.1 The NGSS shall ensure that AMS(R)S communications are provided priority access to the radio channels over all non-AMS(R)S communications, by preemption if necessary.

12.4.2 The NGSS shall support at least 3 levels of AMS(R)S communications priority.

12.4.3 The system shall ensure that higher priority AMS(R)S communications are provided priority access to the radio channels over lower priority AMS(R)S communications, by preemption if necessary.

12.4.4 All AMS(R)S data packets and all AMS(R)S voice call attempts crossing the interface between a GES and a terrestrial network shall be identified as to their associated priority.

Note.— Some terrestrial networks, notably those implementing the 1984 version of X.25, may not offer sufficient support for the required prioritization.

12.4.5 Within the same message category, the system shall provide voice communications priority over data communications.

12.5 SIGNAL ACQUISITION AND TRACKING

12.5.1 The AES, GES and satellites shall properly acquire and track service link signals when the aircraft is moving at a ground speed of up to 1500 km/h (800 knots) along any heading.

12.5.1.1 **Recommendation.—** *The AES, GES and satellites should properly acquire and track service link signals when the aircraft is moving at a ground speed of up to 2800 km/h (1500 knots) along any heading.*

12.5.2 The AES, GES and satellites shall properly acquire and track service link signals when the component of the aircraft acceleration vector in the plane of the satellite orbit is up to 0.6 g.

12.5.2.1 **Recommendation.—** *The AES, GES, and satellites should properly acquire and track service link signals when the component of the aircraft acceleration vector in the plane of the satellite orbit is up to 1.2 g.*

12.6 PERFORMANCE REQUIREMENTS

12.6.1 Satellite system service area

12.6.1.1 **Recommendation**.— *The NGSS should provide a satellite system service area of 100% of the surface of the Earth.*

12.6.2 Failure Notification

12.6.2.1 In the event of a service failure, the NGSS shall provide timely predictions of the time, location and duration of any resultant outages until full service is restored.

Note.— Service outages may, for example, be caused by the failure of a satellite, satellite spot beam, or GES. The geographic areas affected by such outages may be a function of the satellite orbit and system design, and may vary with time.

12.6.3 AES Requirements

12.6.3.1 The AES shall support packet data service, or voice service, or both.

12.6.3.2 The AES shall meet the relevant performance requirements contained in 12.6.4 and 12.6.5 for aircraft in straight and level flight throughout the satellite system service area.

12.6.3.2.1 **Recommendation**.— *The AES should meet the relevant performance requirements contained in 12.6.4 and 12.6.5 for aircraft attitudes of +20/-5 degrees of pitch and +/- 25 degrees of roll throughout the satellite system service area*.

12.6.4 Packet data service performance

12.6.4.1 If the system provides AMS(R)S packet data service, it shall meet the standards of the following sub-paragraphs.

12.6.4.1.1 An NGSS providing a packet-data service shall be capable of operating as a constituent mobile sub-network of the ATN.

Note.— In addition, an NGSS may provide non-ATN data functions.

12.6.4.1.2 DELAY PARAMETERS

Note 1.— The terms used with respect to packet data service performance are based on the definitions in ISO 8348 (first edition). In applying these definitions to the NGSS Subnetwork layer, the word "network" and its abbreviation "N" in ISO 8348 are replaced by the word "Subnetwork" and its abbreviation "S.N.", respectively, wherever they appear.

Note 2.— Subnetwork performance may depend on a number of factors, including intensity of communication traffic. The performance values given here apply during peak busy hours.

12.6.4.1.2.1 *Connection establishment delay.* Connection establishment delay shall not be greater than 50 seconds.

Note.— Connection establishment delay, as defined in ISO 8348, includes a component, attributable to the called Subnetwork service user, which is the time between the S.N.-CONNECT indication and the S.N.-CONNECT response. This user component is due to actions outside the boundaries of the satellite Subnetwork and is therefore excluded from the AMS(R)S specifications.

12.6.4.1.2.2 *Transit delay, from-aircraft, highest priority*. From-aircraft transit delay shall not be greater than 23 seconds for the highest priority data service.

12.6.4.1.2.3 *Transit delay, from-aircraft, lowest priority*. From-aircraft transit delay shall not be greater than 28 seconds for the lowest priority data service.

Note 1.— In accordance with ISO 8348, transit delay values are based on a fixed sub-network service data unit (SNSDU) length of 128 octets. Transit delays are defined as average values.

Note 2.— In any particular AES, lower priority from-aircraft traffic may be subject to additional delay, depending on the amount and rate of from-aircraft traffic loading.

12.6.4.1.2. *Transit delay, to-aircraft, highest priority*. To-aircraft transit delay shall not be greater than 23 seconds for the highest priority data service.

12.6.4.1.2.5 *Transit delay, to-aircraft, lowest priority*. To-aircraft transit delay shall not be greater than 28 seconds for the lowest priority data service.

12.6.4.1.2.6 *Data transfer delay (95th percentile), from-aircraft, highest priority*. From-aircraft data transfer delay (95th percentile), shall not be greater than 40 seconds for the highest priority data service.

12.6.4.1.2.7 *Data transfer delay (95th percentile), from-aircraft, lowest priority*. From-aircraft data transfer delay (95th percentile), shall not be greater than 60 seconds for the lowest priority data service.

12.6.4.1.2.8 *Data transfer delay (95 percentile), to-aircraft, highest priority*. To-aircraft data transfer delay (95 percentile) shall not be greater than 25 seconds for the highest priority service.

12.6.4.1.2.9 *Data transfer delay (95th percentile), to-aircraft, lowest priority*. To-aircraft data transfer delay (95th percentile) shall not be greater than 30 seconds for the lowest priority service.

12.6.4.1.2.10 *Connection release delay (95th percentile)*. The connection release delay (95th percentile) shall not be greater than 25 seconds in either direction.

12.6.4.1.3 INTEGRITY

Note.— Residual error rate includes the probability of undetected error, the probability of undetected loss of an SNSDU, and the probability of an undetected duplicate SNSDU.

12.6.4.1.3.1 *Residual error rate, from-aircraft.* The residual error rate in the from-aircraft direction shall not be greater than 10^{-6} per SNSDU.

12.6.4.1.3.2 *Residual error rate, to-aircraft.* The residual error rate in the to-aircraft direction shall not be greater than 10^{-6} per SNSDU.

12.6.4.1.3.3 *Connection resilience*. The probability of a Subnetwork connection (SNC) provider-invoked SNC release shall not be greater than 10^{-4} over any one-hour interval.

Note. — Connection release resulting from GES-to-GES handover, AES log-off or virtual circuit preemption are excluded from this specification.

12.6.4.1.3.4 The probability of an SNC provider-invoked reset shall not be greater than 0.1 over any one-hour interval.

12.6.5 Voice service performance

12.6.5.1 If the system provides AMS(R)S voice service, it shall meet the requirements of the following sub-paragraphs.

12.6.5.1.1 CALL PROCESSING DELAY

12.6.5.1.1.1 *AES origination*. The 95th percentile of the time delay for a GES to present a call origination event to the terrestrial network interworking interface after a call origination event has arrived at the AES interface shall not be greater than 20 seconds.

12.6.5.1.1.2 *GES origination*. The 95th percentile of the time delay for an AES to present a call origination event at its aircraft interface after a call origination event has arrived at the terrestrial network interworking interface shall not be greater than 20 seconds.

12.6.5.1.2 The total allowable transfer delay within the AMS(R)S Subnetwork on a circuit-mode channel shall not be greater than 0.485 second.

Note.— Total transfer delay for the AMS(R)S Subnetwork is defined as the elapsed time commencing at the instant that speech is presented to the AES or GES and concluding at the instant that the speech enters the interconnecting network of the counterpart GES or AES. This delay includes vocoder processing time, physical layer delay, RF propagation delay and any other delays within the AMS(R)S Subnetwork.

12.6.5.1.3 VOICE QUALITY

12.6.5.1.3.1 The voice transmission shall provide overall intelligibility performance suitable for the intended operational and ambient noise environment.

12.6.5.1.3.2 **Recommendation.—** *Due account should be taken of the effects of tandem vocoders and/or other analog/digital conversions.*

12.6.5.1.4 VOICE CAPACITY

12.6.5.1.4.1 The system shall have sufficient available voice traffic channel resources such that an AES- or GES-originated AMS(R)S voice call presented to the system shall experience a probability of blockage of no more than 0.01.

Note.—Available voice traffic channel resources include all preemptable resources, including those in use by non-AMS(R)S communications.

12.6.6 Security

12.6.6.1 The system shall provide features for the protection of messages in transit from tampering.

12.6.6.2 The system shall provide features for protection against denial of service, degraded performance characteristics, or reduction of system capacity when subjected to external attacks.

Note.— Possible methods of such attack include intentional flooding with spurious messages, intentional corruption of system software or databases, or physical destruction of the support infrastructure.

12.6.6.3 The system shall provide features for protection against unauthorized entry.

Note.— These features are intended to provide protection against spoofing and "phantom controllers".

12.7 SYSTEM INTERFACES

12.7.1 The NGSS shall allow Subnetwork users to address AMS(R)S communications to specific aircraft by means of the ICAO 24-bit aircraft address.

12.7.2 The system shall annunciate a loss of communications capability within 30 seconds of the time when it detects such a loss.

Note.— Provisions on the allocation and assignment of ICAO 24-bit addresses are contained in Annex 10, Volume III, Appendix to Chapter 9.

12.7.3 Packet data service interfaces

12.7.3.1 If the system provides AMS(R)S packet data service, it shall provide an interface to the ATN.

Note.— The detailed technical specification related to provisions of ATN-compliant Subnetwork service are contained in Section 5.2.5 and Section 5.7.2 of Doc 9705 — Manual of Technical Provisions for the Aeronautical Telecommunication Network.

12.7.3.2 If the system provides AMS(R)S packet data service, it shall provide a connectivity notification (CN) function.

12.7.4 Voice service interfaces

12.7.4.1 If the system provides AMS(R)S voice services, AES and GES voice signalling and service procedures shall interwork with external telephony networks through a signalling interface consisting of a standardized set of interworking telephony events that conform to a recognized international telephony interface standard.

End of new text.

— — — — — — — —