Civil Aviation Rules

Notice of Proposed Rule Making
NPRM 25/16/171-43
19 November 2025

Part 171
Aeronautical Telecommunication Service Organisation – Certification and Operation

Consequential Amendments
Nil

Docket 25/16/CAR171-43
2025 Rules Review

Proposed Applicable Date 19 November 2025

Background to the Civil Aviation Rules

The Papua New Guinea (PNG) Civil Aviation Rules (CARs) establish the *minimum* regulatory safety standards and boundary for participants to gain entry into, operate within, and exit the PNG civil aviation system. The PNG Rules are divided into Parts and each Part contains a series of individual rules which relate to a particular aviation activity.

Advisory Circulars accompany many rule Parts and contain information about standards, practices and procedures that the Director has been established to be an '*Acceptable Means of Compliance*' (AMC) for the associated rule. An Advisory Circular may also contain Guidance Material (GMs) and Explanatory Material (EMs) to facilitate compliance with the rule requirements.

The objective of the Civil Aviation Rules system is to obtain a balance of responsibility between, on the one hand, the State and regulatory authority, the Civil Aviation Safety Authority of PNG (CASA PNG) and, on the other hand, those who provide services and exercise privileges in the civil aviation system. This balance must enable the State and regulatory authority to set standards for, and monitor performance of aviation participants whilst providing the maximum flexibility for the participants to develop compliance within the safety boundary.

Section 45 of the *Civil Aviation Act 2000* prescribes general requirements for participants in the civil aviation system and requires, amongst other things, participants to carry out their activities safely and in accordance with the relevant prescribed safety standards and practices. Section 69 of the Act allows the Minister to make ordinary rules for any of the following purposes:

(a) The implementation of Papua New Guinea's obligations under the Convention

(b) To provide for a safe, sustainable, effective and efficient aviation services

(c) The provision of aviation meteorological services, search and rescue services and civil aviation security programmers and services

(d) Assisting aviation safety and security, including but not limited to personal security

(e) Assisting economic development

(f) Improving access and mobility

(g) Protecting and promoting public health

(h) Ensuring environmental sustainability

(i) Any matter related or reasonably incidental to any of the following:

  (1) The Minister's functions and role under section 8 of the Act;

  (2) The Authority's general objects and functions under section 11 of the Act;

  (3) The Authority's functions in relation to safety under section 12 of the Act; and

  (4) The Director's functions and powers under section of 17 the Act

  (5) The Director's powers under section 52A, 53 and 54 of the Act

(j) Any other matter contemplated by any provision of the Act.

Table of Contents

1. Purpose of this NPRM

The purpose of this Notice of Proposed Rulemaking is to put forward for consideration the proposed amendments to Civil Aviation Rule Part 171.

2. Background to the Proposal

2.1 General Summary

The last major amendment to Part 171 was the Amendment 5 with adoption and transposition of ICAO Annex 10 Volume V.

This NPRM proposes the adoption of:

- Amendment 94 to Annex 10 Volume I,
- Amendment 93 to Annex 10 Volume III,
- Amendment 91 to Annex 10 Volume V,
- First edition of Annex 10 Volume VI, and
- Annex 10 Volume I, II, III, IV, V, VI definitions and abbreviations.

Amendment 94 to Annex 10, Volume I addresses advanced receiver autonomous integrity monitoring (ARAIM), the global positioning system (GPS), the Galileo system, the satellite-based augmentation system (SBAS), the ground-based augmentation system (GBAS), distance-measuring equipment (DME) and frequency assignment planning for instrument landing system (ILS), VHF omnidirectional radio range (VOR), DME and GBAS.

Amendment 93 to Annex 10, Volume III is intended to enhance the security of aeronautical communications in the global air traffic management (ATM) system. The amendment introduces measures to safeguard these communication networks, ensuring their reliability, integrity and resilience against unlawful disruptions.

Amendment 91 to Annex 10, Volume V is intended to: introduce new definitions related to WAIC and update references to guidance material and in relation to frequency utilization for ILS, VHF VOR, DME and GBAS, as required.

The first edition of Volume VI to Annex 10 is intended to introduce a regulatory structure for C2 Link procedures and systems characteristics, which are addressed separately under Part I (C2 Link Procedures) and Part II (C2 Link Systems).

The proposed change is due to ICAO State letter reference AN 7/62.2.4-25/31, AN 7/64.2.4-25/25, AN 7/66.2.2-25/21 and AN 7/67.2.21/18. The Adoption are on Appendix A, C, E and F.

2.2 NPRM Development

As a signatory to the convention on international civil aviation, Papua New Guinea is committed to aligning its regulations to ICAO SARPS, where practicable. NPRM development are therefore triggered by the amendments of various Annexes to the Convention on international aviation and in PNG's effort to ensure compliance rules are developed and proposed to ensure that international operations are consistent with the international requirements of ICAO Annexes.

2.3 Key Stakeholders

The Civil Aviation Safety Authority identifies the following as key stakeholders for the proposed rule amendments contained in this NPRM:

(1) The Civil Aviation Safety Authority;
(2) The Ministry for Transport;
(3) The Minister for Civil Aviation;
(4) Aviation Document Holders and
(5) Other interested stakeholders

3. Consequential Amendments

No consequential amendments

4. Exemptions

There are no current Exemptions against this Rule Part.

5. Impact Assessment

5.1 Safety

This amendment has a positive impact on improving overall safety of airport and aerodrome operations.

5.2 Compliance Cost

Additional compliance costs to the proposed amendments have not been assessed.

5.3 Security

This amendment has a positive impact on improving overall security of airport and aerodrome operations in compliance with ICAO Annex 17 requirements.

5.4 Environment

Negligible environmental impact.

5.5 Efficiency and capacity

Implementation will result in efficiency gains and overall positive impact.

5.6 Expected implementation time

Date of publication of final rule.

6. Summary of changes

Amendment 6 of Part 171 aligns with the following:

- Amendment 94 of ICAO Annex 10 Vol I;
- Amendment 93 of ICAO Annex 10 Vol III;
- Amendment 91 to Annex 10 Vol Part V; and
- 1st Edition of Annex 10 Vol VI

The following are the summary of proposed changes to Part 171:

(a) New Inclusions

1. 171.3 (7) – new inclusion referencing definitions, abbreviation and unit of measure.

2. Appendix A (A.2) (4) – new inclusion on the VOR operating frequency band and the frequency used for channel separation, spacing and tolerance.
3. Appendix A (A.3) (k) – new inclusion on the pairing of the runway localizer and glide path transmitter frequencies of an ILS system.
4. Appendix A (A.5) – new inclusion on the Distance Measuring Equipment (DME) that are associated with VOR or ILS systems.
5. Appendix B (B.4) (c) – new inclusion on the Secondary Surveillance Radar (SSR) transponder Mode C on the need for automatic pressure altitude transmission capability.
6. Appendix B (B.4) (d) – new inclusion on all transponders, regardless of the airspace in which they will be used, shall respond to Mode C interrogations with pressure-altitude information.
7. Appendix C (C.1.1) – new inclusion on the use of Aeronautical Mobile-satellite (Route) Service. The requirements, frequency bands to operate, the provision of services and the coverage.
8. Appendix C (C.1.5) – new inclusion on the AFTN network. The characteristic of interregional AFS circuits and data signaling rate for transmission, modulation and signaling.
9. Appendix C (C.2.3) – new inclusion on the Satellite Voice Communication (SATVOICE) Characteristics.
10. Appendix C (C.2.4) (c) – new inclusion on the Selective calling system (SELCAL) tones designated by color, letter or number.
11. Appendix C (C.2.4) (d) – new inclusion on the Aeronautical stations to communicate with SELCAL equipped aircraft that have SELCAL encoders to support all tones.
12. Appendix C (C.2.4) (e) – new inclusion on SELCAL tones using Red T through Red 9.
13. Appendix E – new inclusion on the adoption and transposition of the first edition of Volume VI to Annex 10 on Communication Systems and Procedure relating to Remotely Piloted Aircraft Systems (RPAS) C2 Link.
14. Appendix F – new inclusion on all ICAO Annex 10 Volume I, II, III, IV, V, VI definitions.
15. Appendix G – new inclusion on all ICAO Annex 10 Volume I, II, III, IV, V, VI abbreviations.
16. Appendix H – new inclusion on all ICAO Annex 10 Volume I, II, III, IV, V, VI units of measure.

(b) Minor Amendments.

1. Appendix C (C.1) (a) (1) – word “digital” deleted and word “voice and” inserted. Word “operating agencies” delete and word “operators” inserted.
2. Appendix C (C.1.1 SSR Mode S Air-Ground Data Link) – word “C.1.1” number 1 after decimal deleted and inserted number 2 and reads “C.1.2 SSR Mode S Air-Ground Data Link”.
3. Appendix C (C.1.2 VHF Air-Ground Digital Link (VLD)) – word “C.1.2” number 2 after decimal deleted and inserted number 3 and reads “C.1.3 VHF Air-Ground Digital Link (VLD)”.

4. Appendix C (C.1.3 Air-ground VHF digital link communications system characteristics) – word "C.1.3" number 3 after decimal deleted and inserted number 4 and reads "C.1.4 Air-ground VHF digital link communications system characteristics".
5. Appendix C (C.1.4 Aircraft Addressing System) – word "C.1.4" number 4 after decimal deleted and inserted number 6 and reads "C.1.6 Aircraft Addressing System"
6. Appendix C (C.1.4) (5) – word "3.5.1.1" deleted and word "9.1.1" inserted.
7. Appendix C (C.2.3 Selective calling system (SELCAL)) – word "C.2.3" number 3 after decimal deleted and inserted number 4 and reads "C.2.4 Selective calling system (SELCAL)".
8. Appendix C (C.2.4 Aeronautical Speech Circuits) – word "C.2.4" number 4 after decimal deleted and inserted number 5 and reads "C.2.5 Aeronautical Speech Circuits".
9. Appendix C (C.2.5 Emergency Locator Transmitter (ELT) For Search and Rescue) – word "C.2.5" number 5 after decimal deleted and inserted number 6 and reads "C.2.6 Emergency Locator Transmitter (ELT) for Search and Rescue".
10. Appendix E – word "shall" replace with "must"

7. Legislative Analysis

7.1 Power to make rules

The Minister may make ordinary rules under sections 69, 70, 71 and 72 of the *Civil Aviation Act 2000*, for various purposes including implementing Papua New Guinea's obligations under the Convention, assisting aviation safety and security, and any matter contemplated under the Act.

These proposed rules are made pursuant to:

(a) Section 69(1)(a) which provides for the Minister to make rules for the implementation of Papua New Guinea's obligations under the Convention;

(b) Section 72(a) which provides for the Minister to make rule for the designation, classification and certification of-

(1) Air services;

(2) Aerodrome operators;

(3) Aviation security providers;

(4) Aviation training organizations;

(5) Aircraft design, manufacture, maintenance and supply organizations;

(6) Air traffic services;

(7) Aviation meteorological services;

(8) Aeronautical communication services; and

(9) Aeronautical procedures.

The proposed amendment of Part 171 complies with the requirements of the *Civil Aviation Act and does not contravene the Constitution, the Aerodrome (Business Concession) Act, Civil Aviation (Air Craft Operator Liability) Act, Aircraft Charges Act, Airport Departure Tax Act, the Explosive Act, Firearms Act, Customs Act, Plant and Disease Control Act* and the *Environmental Act.*

The proposed Rule has been checked for language and compliance with the legal conventions of Papua New Guinea.

7.2 Matters to be taken into account

This NPRM is developed in accordance with the primary statutory requirements, including but not limited to those set out in s.2 and s. 75 of the Act and key government policy priorities. The matters taken into consideration include:

7.2.1 Enhancing safety, security, efficiency, and service quality in the civil aviation system in a sustainable manner.

7.2.2 Facilitating access to the air transport network, contributing to the economic and social development of Papua New Guinea.

7.2.3 Establishing rules of operation and responsibilities within the civil aviation system to promote safety and security at a reasonable cost.

7.2.4 Implementing Papua New Guinea's obligations under international aviation and meteorological agreements.

7.2.5 Modernizing and harmonizing regulations with international practice is important.

7.2.6 Ensuring provision of civil aviation and meteorological services and facilities as efficiently and economically as practicable.

7.2.7 Driving sustainability and inclusive national development and

7.2.8 Engaging all stakeholders through transparent policy and rulemaking processes.

8. Submissions on the NPRM

8.1 Submissions are invited

Interested persons are invited to participate in the making of the proposed rule amendment by submitting written data, views, or comments. All submissions will be considered before final action on the proposed rule amendment is taken. If there is a need to make any significant change to the rule requirements in the proposal as a result of the submissions received, then interested persons may be invited to make further submissions.

8.2 Examination of submissions

All submissions will be available in the rules docket for examination by interested persons both before and after the closing date for submissions. A consultation summary will be published with final rule.

Submissions may be examined by application to the Docket Clerk at the CASA PNG Head office between 8:30 am and 3:30 pm, on weekdays, except statutory holidays.

8.3 Disclosure

Submitters should note that any information attached to submissions will become part of the docket file and will be available to the public for examination at the Civil Aviation Safety Authority Headquarter.

Submitters should state clearly if there is any information in their submission that is commercially sensitive or for some other reason the submitter does not want the information to be released to other interested parties.

9. How to make submission

Submissions may be sent by the following methods:

By Mail: Docket Clerk (NPRM 25/16/171-43)
Civil Aviation Safety Authority of Papua New Guinea
PO Box 1941
Boroko
National Capital District

Delivered: Docket Clerk (NPRM 25/16/171-43)
Civil Aviation Safety Authority of Papua New Guinea
Morea-Tobo Road
Six Mile, Jacksons Airport
Port Moresby NCD

By Fax: Docket Clerk (NPRM 25/16/171-43)
3251789 / 325 1919

By Email: Docket Clerk (NPRM 25/16/171-43)
rules@casapng.gov.pg

9.1 Final date for submissions

Comments must be received before ***COB, 26th September 2025*.**

9.2 Availability of the NPRM

Any person may obtain a copy of this NPRM from-

CASA PNG web site: www.casapng.gov.pg

or at a cost from

Docket Clerk
Civil Aviation Safety Authority of PNG Headquarter
Building 1, Level 1
Morea-Tobo Road
Six Mile, Jacksons Airport
Port Moresby NCD.

9.3 Further information

For further information, contact:

Gloria Sikre (Ms)
Acting Manager – Legal Services
CASA PNG
gsikre@casapng.gov.pg

Ph.: 325 7571 Mob: 74127191

Part 171

Aeronautical Telecommunication Service Organization – Certification and Operation

171.3 Definitions, Abbreviations and Units of Measure

…

(7) Definitions, Abbreviations and Units of Measure are in Appendix F, G and H.

Appendix A - Radio Navigation Aids

…

A.2. VHF Omnidirectional Radio Range (VOR)

…

(4) The VOR must operate in the band 111.975 MHz to 117.975 MHz except that frequencies in the band 108 MHz to 111.975 MHz. The highest assignable frequency must be 117.950 MHz. The channel separation must be in increments of 50 kHz referred to the highest assignable frequency. In areas where 100 kHz channel spacing is in general use, the frequency tolerance of the radio frequency carrier must be plus or minus 0.005 per cent.

A.3. Instrument Landing System (ILS)

…

(l) The pairing of the runway localizer and glide path transmitter frequencies of an instrument landing system used must be acceptable to the Director.

…

A.5 UHF Distance Measuring Equipment (DME)

(a) General

(1) When a DME is associated with an ILS, MLS or VOR for the purpose of constituting a single facility, must;

(i) be operated on a standard frequency pairing.

(ii) be collocated within the limits prescribed for associated facilities; and

(iii) comply with the identification provisions.

(2) Technical characteristics of interrogator must be define to ensure the interrogator;

(i) does not jeopardize the effective operation of the DME system, e.g. by increasing transponder loading abnormally; and

(ii) is capable of giving accurate distance readings.

Appendix B – Surveillance

…

B.4 Transponder reply modes (air-to-ground)

(j) Where the need for Mode C automatic pressure-altitude transmission capability within a specified airspace has been determined, transponders, when used within the airspace concerned, must respond to Mode C interrogations with pressure-altitude encoding in the information pulses.

(k) All transponders, regardless of the airspace in which they will be used, must respond to Mode C interrogations with pressure-altitude information.

Appendix C – Communications

C.1 Digital Data Communication Systems

(a) Aeronautical Telecommunication Network (ATN)

(1) Introduction.

The ATN is specifically and exclusively intended to provide ~~digital~~ voice and data communications services to air traffic service provider organizations and aircraft ~~operating agencies~~ operators in support of:

…

C.1.1 AERONAUTICAL MOBILE-SATELLITE (ROUTE) SERVICE (AMS(R)S)

(a) **GENERAL**

(1) Any mobile-satellite system intended to provide AMS(R)S must conform to the requirements of this chapter.

(2) An AMS(R)S system must support packet data service, or voice service, or both.

(3) Requirements for mandatory carriage of AMS(R)S system equipment including the level of system capability must be made on the basis of regional air navigation agreements which specify the airspace of operation and the timescales for the carriage of equipment. A level of system capability must include the performance of the AES, the satellite and the GES.

(4) The agreements indicated in paragraph (3) must provide at least two years' notice of mandatory carriage of airborne systems.

(5) Civil aviation authorities should coordinate with national authorities and service providers those implementation aspects of an AMS(R)S system that will permit its worldwide interoperability and optimum use, as appropriate.

(b) RF CHARACTERISTICS

(1) When providing AMS(R)S communications, an AMS(R)S system must operate only in frequency bands which are appropriately allocated to AMS(R)S and protected by the ITU Radio Regulations.

(2) The total emissions of the AES necessary to meet designed system performance must

be controlled to avoid harmful interference to other systems necessary to support safety and regularity of air navigation.

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

(4) Every aircraft earth station and ground earth station must be designed to ensure that messages transmitted in their order of priority, are not delayed by the transmission and/or reception of other types of messages. If necessary, as a means to comply with the above requirement, message types must be terminated even without warning, to allow messages to be transmitted and received.

(5) All AMS(R)S data packets and all AMS(R)S voice calls must be identified as to their associated priority.

(6) Within the same message category, the system must provide voice communications priority over data communications.

(7) An AMS(R)S system providing a packet data service must be capable of operating as a constituent mobile subnetwork of the ATN.

(8) An AMS(R)S system must allow subnetwork users to address AMS(R)S communications to specific aircraft by means of the ICAO 24-bit aircraft address.

C.1.~~1~~ 2 SSR Mode S Air-Ground Data Link

…

C.1.~~2~~ 3 VHF Air-Ground Digital Link (VDL)

…

C.1.~~3~~ 4 Air-ground VHF digital link communications system characteristics

…

C.1.5 AFTN NETWORK

(a) Interregional AFS circuits being implemented or upgraded must employ high quality telecommunications service. Modulation rate must take into account traffic volume expected under both normal and alternate route conditions.

(b) In international data interchange of characters, a 7-unit coded character set providing a repertoire of 128 characters and designated as International Alphabet No. 5 (IA-5) must be used.

(c) The data signaling rate should be chosen from among the following:

600 bits/s	4 800 bits/s
1200 bits/s	9 600 bits/s
2400 bits/s	

(d) The type of transmission for each data signalling rate should be chosen as follows:

1 600 bits/s	Synchronous or asynchronous serial transmission
1 200 bits/s	Synchronous or asynchronous serial transmission
2 400 bits/s	Synchronous serial transmission
4 800 bits/s	Synchronous serial transmission
9 600 bits/s	Synchronous serial transmission

(e) The type of modulation for each data signalling rate should be chosen as follows:

600 bits/s	Frequency
1 200 bits/s	Frequency

2 400 bits/s	Phase
4 800 bits/s	Phase
9 600 bits/s	Phase-amplitude

C.1.4 ~~6~~ Aircraft Addressing system

…

(5) Mode S transponders used under specific conditions stated in ~~3.5.1.1~~ 9.1.1 must any negative impact on the performance of existing ATS surveillance systems and ACAS.

C.2 Voice Communication Systems

…

C.2.3 Satellite Voice Communication (SATVOICE) Characteristics

(a) For ground-to-air calls, the SATVOICE system must be capable of contacting the aircraft and enabling the ground party/system to provide, as a minimum, the following:

1. secure calling;
2. priority level as defined in Table 2-1; and
3. aircraft SATVOICE number, which is the aircraft address expressed as an 8-digit octal number.

(b) For ground-to-air calls, the SATVOICE system must be capable of locating the aircraft in the appropriate airspace regardless of the satellite and ground earth station (GES) to which the aircraft is logged on.

(c) For air-to-ground calls, the SATVOICE system must be capable of:

1. contacting the aeronautical station via an assigned SATVOICE number, which is a unique 6-digit number or public switched telephone network (PSTN) number; and
2. allowing the flight crew and/or aircraft system to specify the priority level for the call as defined in Table 2-1

Table 2-1. Priority levels for SATVOICE calls (air-to-ground/ground-to-air)

Priority level	Application category
1 / EMG / Q15 Emergency (highest) Safety of flight	Distress and urgency. For use by flight crew, when appropriate.
2 / HGH / Q12 Operational high (second highest) Safety of flight	Flight safety. Typically assigned to calls between aircraft and ANSPs.
3 / LOW / Q10 Operational low (third highest) Safety of flight	Regularity of flight, meteorological, administrative. Typically assigned to calls between aircraft operators and their aircraft.
4 / PUB / Q9 Non-operational (lowest) Non safety	Public correspondence.

C.2.~~3~~ 4 Selective calling system (SELCAL)

…

(c) All transmitted codes must be made up of various combinations of the tones that are designated by color and letter or number.

(d) Aeronautical stations which are required to communicate with SELCAL-equipped aircraft must have SELCAL encoders that support all tones as required in (c). SELCAL codes using the tones Red T through Red 9 must only be assigned to SELCAL-equipped aircraft with the capability of receiving these tones.

(e) All SELCAL codes used must be acceptable to the Director.

C.2.4 ~~5~~ Aeronautical Speech Circuits

…

C.2.~~5~~ 6 Emergency Locator Transmitter (ELT) For Search and Rescue

…

Appendix E – Communication Systems and Procedure relating to Remotely Piloted Aircraft Systems C2 Link

E.1 SPECIFICATIONS

(a) GENERAL

(1) Any time reference to the C2 Link service and timestamping of the information carried by the C2 Link must be in Coordinated Universal Time (UTC).

(b) SUPPORTED FUNCTIONS

(1) The C2 Link must only support the remote pilot tasks required for the safe and efficient operation of the RPAS.

(2) When the C2 Link includes support for the remote pilot tasks required for air traffic control (ATC) purposes, such as relay of ATC communications, the C2 Link performance must, in a secure manner, meet the performance required for those tasks appropriate to the airspace requirements.

(c) SERVICE PROVISION

(1) The C2 Link service must only be used for the transmission of information relating to the safe and efficient operation of the RPAS and be limited to the information described in (b) (1).

(2) Each State must designate the authority responsible for documenting and implementing a C2CSP oversight process, in accordance with Annex 6.

(3) The duration between C2 Link initiation and C2 Link termination must not exceed the time of flight and ground operations, plus the time necessary to perform safety and security checking before and after each flight.

(4) The C2 Link specification must be commensurate with the C2 Link performance required for safe operations.

(5) The C2 Link's QoSR must be commensurate with the C2 Link specification required for safe operations.

(6) The C2 Link's QoSD must be commensurate with the C2 Link QoSR.

(7) The C2 Link service area geographical coordinates and time of provision, intended for RPAS operational use, must be validated and verified to ensure that C2 link service area is safe for use by its intended recipients.

(8) A pro-active process for anticipating and mitigating interrupted or lost C2 Link states must be implemented and described by the C2CSP to the RPAS operator.

(9) The C2CSP must notify the RPAS operator of any scheduled outages of the C2 Link service provision.

(10) Arrangements must be in place to ensure that the scheduled outage does not affect any RPA during any phase of flight.

(11) The C2CSP must notify the RPAS operator of any unscheduled degradation in their service provision, the kind of degradation being experienced and an estimated duration for that degradation.

(12) Before providing any C2 Link service, the C2CSP must demonstrate initial compliance with the provisions contained in (1) and (3) through (8) to the responsible authority.

(d) C2 LINK SERVICE AREA

(1) The C2 Link service area must be compatible with the planned (including contingency) areas of operation of the RPA and the location of all of the RPSs involved in the operation.

(2) The RPA and RPS must always remain within the C2 Link service area.

(3) Ensure the QoSR is always met, a margin to account for the expected worst-case propagation fluctuations in the received signal level should be included while determining the C2 Link service area.

E.1.1 PROCEDURES

Provisions contained in Annex 6 require an operator to provide, for the use and guidance of personnel concerned, an operations manual containing all the instructions and information necessary for operations personnel to perform their duties.

(a) GENERAL

(1) Prior to the flight, the C2CSP must provide the RPAS operator with appropriate means to establish that the C2 Link QoSD, security, and service area meet the requirements for safe operation of the planned flight (including contingency operations).

(2) In the case where the C2 Link service can be provided by more than one link, the RPAS should use the link with the highest QoSD.

(b) ESTABLISHMENT, ASSURANCE AND TERMINATION OF THE C2 LINK

(1) Human factors principles must be considered in the design of the RPS, in order for the remote pilot to manage the C2 Link during the flight and prevent its unintentional termination.

(2) Appropriate technical and procedural means must be provided to the remote pilot to establish and maintain the C2 Link, including the interaction with the C2CSP. These means must be documented in the operations manual.

(3) An indication must be provided to the remote pilot when the C2 Link has been successfully established between the RPS and the RPA and when it is interrupted, lost or terminated.

(4) Information about any C2 Link-related outages that are planned to occur during the expected duration of the flight must be provided to the remote pilot during flight planning.

(5) Means must be provided to the remote pilot to verify that the C2 Link meets the QoSR as part of the pre-flight check of the RPAS.

(6) The procedure supporting the switchover between links or networks that comprise the entire C2 Link must be contained in the operations manual.

(7) Before performing a switchover to another link or network, the remote pilot must be provided with sufficient information on the QoSD of the accepting link or network to confirm that it will meet the QoSR.

(8) The Switchovers between the links or networks that constitute the C2 Link during flight should be minimized.

(9) The procedure and the phraseology supporting handover of the C2 Link provision between RPS must be contained in the operations manual.

(10) The procedure supporting the handover must include a report on the status of the QoSE of the C2 Link prior to initiating the handover.

(11) A handover must only be initiated if the accepting RPS is able to confirm that its C2 Link with the RPA achieves the QoSR needed to ensure that the handover will be successful.

(12) The condition of a lost C2 Link state must be initiated by the RPAS or through an action by the remote pilot when the performance of the C2 Link has been insufficient to enable active management of the RPA for longer than the lost C2 Link decision time.

(13) The duration of the lost C2 Link decision time must be in accordance with the operational management and safety requirements of the airspace.

(14) Only the remote pilot must terminate or authorize the termination of the C2 Link.

(15) The C2CSP must not intentionally terminate a C2 Link without the explicit consent of the remote pilot.

(c) ESTABLISHMENT AND ASSURANCE OF ATC COMMUNICATIONS

(1) ATC communications relayed through the RPA and the C2 Link must be consistent with those defined for manned aircraft.

(2) Switchovers between links and networks that make up the C2 Link should be avoided during transfer of ATC communications.

(d) CONTINGENCY AND EMERGENCY PROCEDURES

(1) The remote pilot must be provided with all the available RPAS status information pertinent to expedite the recovery of the C2 Link.

(2) Technical and procedural means must be provided to indicate to the remote pilot/RPS and the RPA when the C2 Link has been successfully restored after a lost C2 Link state has occurred.

(3) From the lost C2 Link decision state, the RPAS must either return to the nominal C2 Link state or enter the lost C2 Link state once the lost C2 Link decision time has been exceeded.

(4) After being in a lost C2 Link state, a remote pilot action must be required to return the RPAS to a nominal C2 Link state, in accordance with the procedures contained in the operations manual.

(e) SECURITY

(1) Information exchange between the RPS and RPA carried on the C2 Link must be sufficiently secure to prevent unauthorized interference with the RPAS.

(2) The RPAS C2 Link design, monitoring system and operating procedures must be such as to minimize the potential for any unauthorized control of the RPA or the RPS during any operating phases.

(f) DISPLAY

(1) RPS controls and displays must present data in a manner minimizing the potential for errors, misinterpretation or misunderstandings.

(2) The C2 Link state information must be presented to the remote pilot.

(3) An indication of the C2 Link QoSD, in real-time, must be provided to the remote pilot.

(f) MONITORING

(1) An automatic monitoring system must be implemented in the RPA and RPS, to provide an alert to the remote pilot if any of the following occur within the period of operation:

(2) RPA or RPS C2 Link and/or sub-system link and/or C2CSP emission has ceased;

(3) RPA or RPS C2 Link and/or sub-system link and/or C2CSP reception has ceased;

(4) transmission of the amount of information required for the safe control of the aircraft has fallen below a level specified by the type certificate holder;

(5) interruption of the C2 Link has occurred; or

(6) the C2 Link QoSD has degraded below the stated QoSR.

(7) The monitoring system must provide an alert to the remote pilot in the event of the failure of the monitoring system itself.

(g) RECORDS

(1) A C2 Link log, written or electronic, must be maintained in each RPS.

(2) The record must commence as soon as the C2 Link is established and end only after the C2 Link is terminated.

(3) Written log entries must be made only by authorized and on-duty persons in the RPS.

(4) All entries must be complete, clear, correct and intelligible. Unnecessary marks or notations must not be made in the log.

(5) In written logs, any correction in the log must be made by the authorized on-duty person.

(6) Corrections must be initialled, dated and a rationale given for traceability.

(7) The following information must be entered in logs by the authorized on-duty person:

(i) the name of the authorized on-duty person in charge of the log;

(ii) the identification of the RPS;

(iii) the date;

(iv) the time of opening and closing of the RPS;

(v) the time of establishment and termination of the C2CSP service;

(vi) the time of establishment and termination of the C2 Link;

(vii) the QoSE of the links and networks used;

(viii) the reason for the switchover of links and networks that make up the C2 Link;

(ix) the signature of the authorized on-duty person;

(x) all lost C2 Link and lost C2 Link decision state events, location of the RPA with time of occurrence, and probable assessed cause when practicable;

(xi) any detected harmful or notable radio frequency interference, with as much detail as possible; and

(xii) any information relevant to C2 Link provision considered by the remote pilot as valuable.

(8) In the log, all time related information shall use a UTC reference and all geographical related information shall use a WGS-84 reference.

(9) The C2 Link messages related to the C2 Link management must be electronically recorded in the RPA and in any RPS which is in control of the RPA.

(10) The C2 Link management message record must be retained for at least 30 days after completion of the flight. When the record is pertinent to accident and incident investigations, it must be retained for longer periods until it is evident that the record will no longer be required.

(11) The RPA must maintain an electronic log, automatically recording any information described in (1) to (8) that is available to it.

(12) The RPA must maintain an automatically recorded electronic log of any received or transmitted ATC/remote pilot communication either voice or data, if relayed through the RPA.

(13) The RPS must maintain an automatically recorded electronic log of any received and transmitted ATC/remote pilot communication either voice or data.

E.2 C2 LINK SYSTEMS

E.2.1 GENERAL

(a) SYSTEM DESCRIPTION

(1) The RPAS communication system must comprise the following systems:

(2) A communication system supporting communications external to the RPAS dedicated to the airspace requirements functions;

(3) A C2 Link communication system supporting communications internal to the RPAS, which comprises at a minimum:

(i) an interface with the RPS;

(ii) an interface with the RPA;

(iii) a transmitter located in the RPS communicating with a receiver located in the RPA; and

(iv) a transmitter located in the RPA communicating with a receiver located in the RPS.

(4) The RPAS be equipped with a lost C2 Link state detection system designed with a level of assurance that is in accordance with the intended operation.

(b) SPECTRUM

(1) The RPAS C2 Link system be operated only in frequency bands which are appropriately allocated and protected by the ITU Radio Regulations.

(2) C2 Link system frequency assignment planning be designed to provide immunity from harmful interference and not create harmful interference.

(c) SYSTEM CHARACTERISTICS

(1) The C2 Link system enable the RPA to unambiguously and at any time ensure that it is controlled by an authorized RPS.

(2) The total period of radiation of the C2 Link system transmitters be as short as practicable, consistent with the need for avoiding saturation of the spectrum while limiting interruption of the C2 Link.

(3) The C2 Link system radio frequency transmitters radiate no more power than is necessary to achieve the C2 Link specification.

(d) DATA TRANSMISSION CHARACTERISTICS

(1) The C2 Link system message sequencing must be based on priority criteria.

(2) The C2 Link system messages sequence management must use timestamping.

(3) The order of priority of the transmission of information between the RPS and the RPA must be:

(i) RPA flight control and configuration messages;

(ii) high priority detect and avoid (DAA) messages;

(iii) air traffic control communications including distress calls and urgency messages;

(iv) flight safety telemetry messages including low priority DAA messages;

(v) other flight safety messages;

(vi) routine telemetry messages;

(vii) air traffic services other than ATC communications; and

(viii) other messages.

(e) PERFORMANCE REQUIREMENTS

(1) The QoSD of the C2 Link system shall be sufficient to support the operational and performance requirements for ATC service in the planned and contingency areas of operation of the RPA.

(f) C2 LINK COMMUNICATION SERVICE PROVIDERS (C2CSP)

(1) The C2CSP must;

(i) establish service level agreement (SLA) with RPAS operator concerning the C2 Link service provision

(ii) ensure QoSD is at any time meeting the QoSR

(iii) conduct real-time interference monitoring, estimation, prediction of interference risks and planning solutions for potential harmful interference scenarios with RPAS operators under the oversight of a competent authority

(iv) act immediately with RPAS operators and competent authority when attentions are drawn to any harmful interference

(v) have qualified resources and adequate documentation that will allow competent authorities to perform their oversight and;

(vi) be terrestrial and satellite C2 communication service providers.

(2) For RPAS operators to access terrestrial and satellite C2CSP, they must have equipment that operate in frequency spectrum allocation as described in Annex 10, Volume V, Chapter 5, section 5.1.

(3) Satellite C2CSPs must establish SLAs with RPAS operators to;

(i) ensure satellite network coordination to guarantee the level of protection necessary for overall RPAS C2 Link QoSD and to protect satellite coordination agreements.

(ii) ensure that satellite C2CSPs act immediately when their attention is drawn to any harmful interference.

(iii) be responsible for ensuring that once a satellite network has completed successful coordination, the C2 Link specifications continue to be met as a result of subsequent agreements between satellite operators.

Appendix F – Definitions

ACAS broadcast means a long Mode S air-air surveillance interrogation (UF = 16) with the broadcast address.

ACAS I means an ACAS which provides information as an aid to "see and avoid" action but does not include the capability for generating resolution advisories.

ACAS II means an ACAS which provides vertical resolution advisories in addition to traffic advisories.

ACAS III means an ACAS which provides vertical and horizontal resolution advisories in addition to traffic advisories.

Active RAC means an RAC is active if it currently constrains the selection of the RA. RACs that have been received within the last six seconds and have not been explicitly cancelled are active.

Adaptive modulation means a system's ability to communicate with another system using multiple burst profiles and a system's ability to subsequently communicate with multiple systems using different burst profiles.

Advanced receiver autonomous integrity monitoring means an ABAS function making use of ISD.

Aerodrome control radio station means a station providing radio communication between an aerodrome control tower and aircraft or mobile aeronautical stations.

AeroMACS downlink means the transmission direction from the base station to the mobile station.

AeroMACS handover means the process in which a mobile station migrates from the air-interface provided by one base station to the air-interface provided by another BS. A break-before-make AeroMACS handover is where service with the target BS starts after a disconnection of service with the previous serving BS.

AeroMACS uplink means the transmission direction from the mobile station (MS) to the base station.

Aeronautical administrative communications means communications necessary for the exchange of aeronautical administrative messages.

Aeronautical broadcasting service means a broadcasting service intended for the transmission of information relating to air navigation.

Aeronautical fixed circuit means a circuit forming part of the aeronautical fixed service.

Aeronautical fixed service means a telecommunication service between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient and economical operation of air services.

Aeronautical fixed station means a station in the aeronautical fixed service.

Aeronautical fixed telecommunication network means a worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics.

Aeronautical fixed telecommunication network circuit means a circuit forming part of the aeronautical fixed telecommunication network.

Aeronautical mobile service means an aeronautical mobile service reserved for communications relating to safety and regularity of flight, primarily along national or international civil air routes.

Aeronautical Mobile Airport Communications System means a high-capacity data link supporting mobile and fixed communications on the aerodrome surface.

Aeronautical mobile-satellite service means an aeronautical mobile-satellite service reserved for communications relating to safety and regularity of flights, primarily along national or international civil air routes.

Aeronautical mobile-satellite service means a mobile-satellite service in which mobile earth stations are located on board aircraft; survival craft stations and emergency position-indicating radio beacon stations may also participate in this service.

Aeronautical operational control means communication required for the exercise of authority over the initiation, continuation, diversion or termination of flight for safety, regularity and efficiency reasons.

Aeronautical radio navigation service means a radio navigation service intended for the benefit and for the safe operation of aircraft.

Aeronautical station means a land station in the aeronautical mobile service. In certain instances, an aeronautical station may be located, for example, on board ship or on a platform at sea.

Aeronautical telecommunication agency means an agency responsible for operating a station or stations in the aeronautical telecommunication service.

Aeronautical telecommunication log means a record of the activities of an aeronautical telecommunication station.

Aeronautical telecommunication network means a global internetwork architecture that allows ground, air-ground and avionic data subnetworks to exchange digital data for the safety of air navigation and for the regular, efficient and economic operation of air traffic services.

Aeronautical telecommunication service means a telecommunication service provided for any aeronautical purpose.

Aeronautical telecommunication station means a station in the aeronautical telecommunication service.

AFTN communication centre means an AFTN station whose primary function is the relay or retransmission of AFTN traffic from (or to) a number of other AFTN stations connected to it.

AFTN destination station means an AFTN station to which messages and/or digital data are addressed for processing for delivery to the addressee.

AFTN origin station means an AFTN station where messages and/or digital data are accepted for transmission over the AFTN.

AFTN station means a station forming part of the aeronautical fixed telecommunication network and operating as such under the authority or control of a State.

Airborne collision avoidance system means an aircraft system based on secondary surveillance radar (SSR) transponder signals which operates independently of ground-based equipment to provide advice to the pilot on potential conflicting aircraft that are equipped with SSR transponders.

Aircraft address means a unique combination of 24 bits available for assignment to an aircraft for the purpose of air-ground communications, navigation and surveillance.

Aircraft address means a unique combination of twenty-four bits available for assignment to an aircraft for the purpose of air ground communications, navigation and surveillance.

Aircraft address means a unique combination of twenty-four bits available for assignment to an aircraft for the purpose of air ground communications, navigation and surveillance.

Aircraft data circuit-terminating equipment means an aircraft specific data circuit-terminating equipment that is associated with an airborne data link processor. It operates a protocol unique to Mode S data link for data transfer between air and ground.

Aircraft data link processor means an aircraft-resident processor that is specific to a particular air-ground data link (e.g. Mode S) and which provides channel management, and segments and/or reassembles messages for transfer. It is connected to one side of aircraft elements common to all data link systems and on the other side to the air-ground link itself.

Aircraft earth station means a mobile earth station in the aeronautical mobile-satellite service located on board an aircraft.

Aircraft operating agency means a person, organization or enterprise engaged in, or offering to engage in, an aircraft operation.

Aircraft station means a mobile station in the aeronautical mobile service, other than a survival craft station, located on board an aircraft.

Aircraft-based augmentation system means an augmentation system that augments and/or integrates the information obtained from the other GNSS elements with information available on board the aircraft.

Air-ground communication means two-way communication between aircraft and stations or locations on the surface of the earth.

Air-ground control radio station means an aeronautical telecommunication station having primary responsibility for handling communications pertaining to the operation and control of aircraft in a given area.

Air-initiated protocol means a procedure initiated by a Mode S aircraft installation for delivering a standard length or extended length downlink message to the ground.

Air-report means a report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting.

Air-to-ground communication means one-way communication from aircraft to stations or locations on the surface of the earth.

Alert limit means for a given parameter measurement, the error tolerance not to be exceeded without issuing an alert.

Alert means an indication provided to other aircraft systems or annunciation to the pilot to identify that an operating parameter of a navigation system is out of tolerance.

Alternative means of communication means a means of communication provided with equal status, and in addition to the primary means.

Altitude crossing RA means a resolution advisory is altitude crossing if own ACAS aircraft is currently at least 30 m (100 ft) below or above the threat aircraft for upward or downward sense advisories, respectively.

Angular displacement sensitivity means the ratio of measured DDM to the corresponding angular displacement from the appropriate reference line.

Antenna port means a point where the received signal power is specified. For an active antenna, the antenna port is a fictitious point between the antenna elements and the antenna pre-amplifier. For a passive antenna, the antenna port is the output of the antenna itself.

Application entity means an AE represents a set of ISO/OSI communication capabilities of a particular application process (see ISO/IEC 9545 for further details).

Approach angle means the difference in the ground headings of the two aircraft at closest approach, with 180 degrees defined as head on and 0 degrees defined as parallel.

ATN security services means a set of information security provisions allowing the receiving end system or intermediate system to unambiguously identify (i.e. authenticate) the source of the received information and to verify the integrity of that information.

ATS direct speech circuit means an aeronautical fixed service telephone circuit, for direct exchange of information between air traffic services units.

ATS interfacility data communication means automated data exchange between air traffic services units in support of flight notification, flight coordination, transfer of control and transfer of communication.

ATS message handling service means an ATN application consisting of procedures used to exchange ATS messages in store-and-forward mode over the ATN such that the conveyance of an

ATS message is in general not correlated with the conveyance of another ATS message by the service provider.

ATS message handling system means the set of computing and communication resources implemented by ATS organizations to provide the ATS message handling service.

Authorized path means a communication path suitable for a given message category.

Automatic dependent surveillance — contract means a means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports.

Automatic dependent surveillance-broadcast IN means a function that receives surveillance data from ADS-B OUT data sources.

Automatic dependent surveillance-broadcast OUT means a function on an aircraft or vehicle that periodically broadcasts its state vector (position and velocity) and other information derived from on-board systems in a format suitable for ADS-B IN capable receivers.

Automatic telecommunication log means a record of the activities of an aeronautical telecommunication station recorded by electrical or mechanical means.

Automatic terminal information service means the automatic provision of current, routine information to arriving and departing aircraft throughout 24 hours or a specified portion thereof.

Axial ratio means the ratio, expressed in decibels, between the maximum output power and the minimum output power of an antenna to an incident linearly polarized wave as the polarization orientation is varied over all directions perpendicular to the direction of propagation.

Back course sector means the course sector which is situated on the opposite side of the localizer from the runway.

Base station means a generalized equipment set providing connectivity, management and control of the mobile station.

BDS Comm-B Data Selector means the 8-bit BDS code determines the register whose contents are to be transferred in the MB field of a Comm-B reply. It is expressed in two groups of 4 bits each, BDS1 (most significant 4 bits) and BDS2 (least significant 4 bits).

BDS Open Service means the specified level of positioning, velocity and timing accuracy that is available to any BDS user on a continuous, worldwide basis.

BeiDou Navigation Satellite System means the satellite navigation system operated by China.

Bit error rate means the number of bit errors in a sample divided by the total number of bits in the sample, generally averaged over many such samples.

Blind transmission means a transmission from one station to another station in circumstances where two-way communication cannot be established but where it is believed that the called station is able to receive the transmission.

Broadcast means a transmission of information relating to air navigation that is not addressed to a specific station or stations.

Burst profile means set of parameters that describe the uplink or downlink transmission properties associated with an interval usage code. Each profile contains parameters such as modulation type, forward error correction type, preamble length, guard times, etc.

Burst means a time-defined, contiguous set of one or more related signal units which may convey user information and protocols, signalling, and any necessary preamble.

C2 Link communication service provider means an entity which provides a portion of, or all of, the C2 Link service for the operation of an RPAS.

C2 Link coverage area means the area in which the C2 Link service can be received including the area where the QoSD does not meet the QoSR.

C2 Link interruption means any temporary situation where the C2 Link is unavailable, discontinuous, introduces too much delay, or has inadequate integrity; but where the lost C2 Link decision time has not been exceeded.

C2 Link log means a record of the activities related to the C2 Link.

C2 Link service area means the area within the C2 Link coverage area where the C2 Link QoSD meets the QoSR.

C2 Link service means a communication service providing the C2 Link.

C2 Link specification means the minimum performance to be achieved by the C2 Link equipment in conformity with the applicable airworthiness system design requirements.

C2 Link means the data link between the remotely piloted aircraft and the remote pilot station for the purposes of managing the flight.

Capability report means information identifying whether the transponder has a data link capability as reported in the capability (CA) field of an all-call reply or squitter transmission.

Carrier-to-multipath ratio means the ratio of the carrier power received directly, i.e. without reflection, to the multipath power, i.e. carrier power received via reflection.

Carrier-to-noise density ratio means the ratio of the total carrier power to the average noise power in a 1 Hz bandwidth, usually expressed in dBHz.

Channel of standard accuracy means the specified level of positioning, velocity and timing accuracy that is available to any GLONASS user on a continuous, worldwide basis.

Channel rate accuracy means this is relative accuracy of the clock to which the transmitted channel bits are synchronized. For example, at a channel rate of 1.2 kbits/s, maximum error of one part in 106 implies the maximum allowed error in the clock is ±1.2 × 10-3 Hz.

Channel rate means the rate at which bits are transmitted over the RF channel. These bits include those bits used for framing and error correction, as well as the information bits. For burst transmission, the channel rate refers to the instantaneous burst rate over the period of the burst.

Circuit mode means a configuration of the communications network which gives the appearance to the application of a dedicated transmission path.

Climb RA means a positive RA recommending a climb but not an increased climb.
Close-out means a command from a Mode S interrogator that terminates a Mode S link layer communication transaction.

Closest approach means the occurrence of minimum range between own ACAS aircraft and the intruder. Thus range at closest approach is the smallest range between the two aircraft and time of closest approach is the time at which this occurs.

Cluster of interrogators means two or more interrogators with the same interrogator identifier (II) code, operating cooperatively to ensure that there is no interference to the required surveillance and data link performance of each of the interrogators, in areas of common coverage.

Collision avoidance logic means the sub-system or part of ACAS that analyses data relating to an intruder and own aircraft, decides whether or not advisories are appropriate and, if so, generates the advisories. It includes the following functions: range and altitude tracking, threat detection and RA generation. It excludes surveillance.

Comm-A means a 112-bit interrogation containing the 56-bit MA message field. This field is used by the uplink standard length message and broadcast protocols.

Comm-B means a 112-bit reply containing the 56-bit MB message field. This field is used by the downlink SLM, ground-initiated and broadcast protocols.

Comm-C means a 112-bit interrogation containing the 80-bit MC message field. This field is used by the uplink extended length message protocol.

Comm-D means a 112-bit reply containing the 80-bit MD message field. This field is used by the downlink ELM protocol.

Communication centre means an aeronautical fixed station which relays or retransmits telecommunication traffic from (or to) a number of other aeronautical fixed stations directly connected to it.

Connection establishment delay means connection establishment delay, as defined in ISO 8348, includes a component, attributable to the called subnetwork (SN) service user, which is the time between the SN-CONNECT indication and the SN-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.

Connection means a logical association between peer-level entities in a communication system.

Control motion noise means that portion of the guidance signal error which causes control surface, wheel and column motion and could affect aircraft attitude angle during coupled flight, but does not cause aircraft displacement from the desired course and/or glide path.

Convolutional turbo codes means type of forward error correction code.

Coordination interrogation means a Mode S interrogation (uplink transmission) radiated by ACAS II or III and containing a resolution message.

Coordination reply means a Mode S reply (downlink transmission) acknowledging the receipt of a coordination interrogation by the Mode S transponder that is part of an ACAS II or III installation.

Coordination means the process by which two ACAS-equipped aircraft select compatible resolution advisories (RAs) by the exchange of resolution advisory complements (RACs).

Core satellite constellation(s) means the core satellite constellations are GPS, GLONASS, Galileo and BDS.

Corrective RA means a resolution advisory that advises the pilot to deviate from the current flight path.

Course line means the locus of points nearest to the runway centre line in any horizontal plane at which the DDM is zero. Course sector. A sector in a horizontal plane containing the course line and limited by the loci of points nearest to the course line at which the DDM is 0.155.

CPDLC message set means a list of standard message elements and free text message elements.

CPDLC message means Information exchanged between an airborne system and its ground counterpart. A CPDLC message consists of a single message element or a combination of message elements conveyed in a single transmission by the initiator.

Crossing encounter means an encounter in which the altitude separation of the two aircraft exceeds 100 ft at the beginning and at the end of the encounter window, and the relative vertical position of two aircraft at the end of the encounter window is reversed from that at the beginning of the encounter window.

Current data authority means the designated ground system through which a CPDLC dialogue between a pilot and a controller currently responsible for the flight is permitted to take place.

Current slot means the slot in which a received transmission begins.

Cycle means the term "cycle" used in this chapter refers to one complete pass through the sequence of functions executed by ACAS II or ACAS III, nominally once a second.

Data circuit-terminating equipment means a DCE is a network provider equipment used to facilitate communications between DTEs.

Data link capability report means Information in a Comm-B reply identifying the complete Mode S communications capabilities of the aircraft installation.

Data link entity means a protocol state machine capable of setting up and managing a single data link connection.

Data link flight information services means the provision of FIS via data link.

Data link initiation capability means a data link application that provides the ability to exchange addresses, names and version numbers necessary to initiate data link applications.

Data link service sublayer means the sublayer that resides above the MAC sublayer. For VDL Mode 4, the DLS sublayer resides above the VSS sublayer. The DLS manages the transmit queue, creates and destroys DLEs for connection oriented communications, provides facilities for the LME to manage the DLS, and provides facilities for connectionless communications.
Data link-automatic terminal information service (D-ATIS) means the provision of ATIS via data link.

Data terminal equipment means a DTE is an endpoint of a subnetwork connection.

Data transit delay means the average value of the statistical distribution of data delays. This delay represents the subnetwork delay and does not include the connection establishment delay.

Data transit delay means the average value of the statistical distribution of data delays. This delay represents the subnetwork delay and does not include the connection establishment delay.

Difference in depth of modulation means the percentage modulation depth of the larger signal minus the percentage modulation depth of the smaller signal, divided by 100.

Descend RA means a positive RA recommending a descent but not an increased descent.

Directory service means a service, based on the ITU-T X.500 series of recommendations, providing access to and management of structured information relevant to the operation of the ATN and its users.

Displacement sensitivity (localizer) means the ratio of measured DDM to the corresponding lateral displacement from the appropriate reference line.

DME dead time means a period immediately following the decoding of a valid interrogation during which a received interrogation will not cause a reply to be generated.

DME/N means Distance measuring equipment, primarily serving operational needs of en-route or TMA navigation, where the "N stands for narrow spectrum characteristics.

DME/P means the distance measuring element of the MLS, where the "P" stands for precise distance measurement. The spectrum characteristics are those of DME/N.

Domain means a set of end systems and intermediate systems that operate according to the same routing procedures and that is wholly contained within a single administrative domain.

Doppler shift means the frequency shift observed at a receiver due to any relative motion between transmitter and receiver.

Double channel simplex means simplex using two frequency channels, one in each direction.

Downlink ELM means a term referring to extended length downlink communication by means of 112-bit Mode S Comm-D replies, each containing the 80-bit Comm-D message field (MD).

Downlink means a term referring to the transmission of data from an aircraft to the ground. Mode S air-to-ground signals are transmitted on the 1 090 MHz reply frequency channel.

Duplex means a method in which telecommunication between two stations can take place in both directions simultaneously.

Effective acceptance bandwidth means the range of frequencies with respect to the assigned frequency for which reception is assured when all receiver tolerances have been taken into account.

Effective adjacent channel rejection means the rejection that is obtained at the appropriate adjacent channel frequency when all relevant receiver tolerances have been taken into account.

Encounter class means encounters are classified according to whether or not the aircraft are transitioning at the beginning and end of the encounter window, and whether or not the encounter is crossing.

Encounter window means the time interval [tca – 40 s, tca + 10 s].

Encounter means for the purposes of defining the performance of the collision avoidance logic, an encounter consists of two simulated aircraft trajectories. The horizontal coordinates of the aircraft represent the actual position of the aircraft butthe vertical coordinate represents an altimeter measurement of altitude.

End-to-end means pertaining or relating to an entire communication path, typically from:

(1) the interface between the information source and the communication system at the transmitting end to

(2) the interface between the communication system and the information user or processor or application at the receiving end.

End-user means an ultimate source and/or consumer of information.

Energy per symbol to noise density ratio means the ratio of the average energy transmitted per channel symbol to the average noise power in a 1 Hz bandwidth, usually expressed in dB. For A-BPSK and A-QPSK, one channel symbol refers to one channel bit.

Equivalent isotropically radiated power means the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain).

Essential radio navigation service means a radio navigation service whose disruption has a significant impact on operations in the affected airspace or aerodrome.

Established track means a track generated by ACAS air-air surveillance that is treated as the track of an actual aircraft.

Extended Golay Code means an error correction code capable of correcting multiple bit errors.

Extended length message means a series of Comm-C interrogations (uplink ELM) transmitted without the requirement for intervening replies, or a series of Comm-D replies (downlink ELM) transmitted without intervening interrogations.

Facility Performance Category I — ILS means an ILS which provides guidance information from the coverage limit of the ILS to the point at which the localizer course line intersects the ILS glide path at a height of 30 m (100 ft) or less above the horizontal plane containing the threshold.
Fan marker beacon means a type of radio beacon, the emissions of which radiate in a vertical fan-shaped pattern.

Final approach mode means the condition of DME/P operation which supports flight operations in the final approach and runway regions.

Forward error correction means the process of adding redundant information to the transmitted signal in a manner which allows correction, at the receiver, of errors incurred in the transmission.

Forward error correction means the process of adding redundant information to the transmitted signal in a manner which allows correction, at the receiver, of errors incurred in the transmission.
Frame means the basic unit of transfer at the link level. In the context of Mode S subnetwork, a frame can include from one to four Comm-A or Comm-B segments, from two to sixteen Comm-C segments, or from one to sixteen Comm-D segments.

Frame means the link layer frame is composed of a sequence of address, control, FCS and information fields. For VDL Mode 2, these fields are bracketed by opening and closing flag sequences, and a frame may or may not include a variable-length information field.

Frequency assignment means a logical assignment of centre frequency and channel bandwidth programmed to the base station.

Frequency channel means a continuous portion of the frequency spectrum appropriate for a transmission utilizing a specified class of emission.

Front course sector means the course sector which is situated on the same side of the localizer as the runway.

Gain-to-noise temperature ratio means the ratio, usually expressed in dB/K, of the antenna gain to the noise at the receiver output of the antenna subsystem. The noise is expressed as the temperature that a 1-ohm resistor must be raised to produce the same noise power density.

Galileo Open Service means the specified level of positioning, velocity and timing accuracy that is available to any Galileo user on a continuous, worldwide basis.

Galileo means the satellite navigation system operated by the European Union.

Gaussian filtered frequency shift keying means a continuous-phase, frequency shift keying technique using two tones and a Gaussian pulse shape filter.

GBAS/E means a ground-based augmentation system transmitting an elliptically-polarized VHF data broadcast.

GBAS/H means a ground-based augmentation system transmitting a horizontally-polarized VHF data broadcast.

General formatter/manager means the aircraft function responsible for formatting messages to be inserted in the transponder registers. It is also responsible for detecting and handling error conditions such as the loss of input data.

Global navigation satellite system means the satellite navigation system operated by the Russian Federation.

Global navigation satellite system means a worldwide position and time determination system that includes one or more satellite constellations, aircraft receivers and system integrity monitoring, augmented as necessary to support the required navigation performance for the intended operation.

Global positioning system means the satellite navigation system operated by the United States.

Global signalling channel means a channel available on a worldwide basis which provides for communication control.

GNSS position error means the difference between the true position and the position determined by the GNSS receiver.

Ground data circuit-terminating equipment means a ground specific data circuit-terminating equipment associated with a ground data link processor. It operates a protocol unique to Mode S data link for data transfer between air and ground.

Ground data link processor means a ground-resident processor that is specific to a particular air-ground data link (e.g. Mode S), and which provides channel management, and segments and/or reassembles messages for transfer. It is connected on one side (by means of its DCE) to ground elements common to all data link systems, and on the other side to the air-ground link itself.

Ground earth station means an earth station in the fixed satellite service, or, in some cases, in the aeronautical mobile-satellite service, located at a specified fixed point on land to provide a feeder link for the aeronautical mobile-satellite service.

Ground-based augmentation system means an augmentation system in which the user receives augmentation information directly from a ground-based transmitter.

Ground-based regional augmentation system means an augmentation system in which the user receives augmentation information directly from one of a group of ground-based transmitters covering a region.

Ground-initiated Comm-B means the ground-initiated Comm-B protocol allows the interrogator to extract Comm-B replies containing data from a defined source in the MB field.

Ground-initiated protocol means a procedure initiated by a Mode S interrogator for delivering standard length or extended length messages to a Mode S aircraft installation.

Ground-to-air communication means one-way communication from stations or locations on the surface of the earth to aircraft.

Half course sector means the sector, in a horizontal plane containing the course line and limited by the loci of points nearest to the course line at which the DDM is 0.0775. Half ILS glide path sector. The sector in the vertical plane containing the ILS glide path and limited by the loci of points nearest to the glide path at which the DDM is 0.0875.

Homing means the procedure of using the direction-finding equipment of one radio station with the emission of another radio station, where at least one of the stations is mobile, and whereby the mobile station proceeds continuously towards the other station.

Horizontal miss distance means the minimum horizontal separation observed in an encounter.

ILS continuity of service means that quality which relates to the rarity of radiated signal interruptions. The level of continuity of service of the localizer or the glide path is expressed in terms of the probability of not losing the radiated guidance signals.

ILS glide path angle means the angle between a straight line which represents the mean of the ILS glide path and the horizontal.

ILS glide path sector means the sector in the vertical plane containing the ILS glide path and limited by the loci of points nearest to the glide path at which the DDM is 0.175.
ILS glide path means that locus of points in the vertical plane containing the runway centre line at which the DDM is zero, which, of all such loci, is the closest to the horizontal plane.

ILS integrity means that quality which relates to the trust which can be placed in the correctness of the information supplied by the facility. The level of integrity of the localizer or the glide path is expressed in terms of the probability of not radiating false guidance signals.

ILS Point "A" means a point on the ILS glide path measured along the extended runway centre line in the approach direction a distance of 7.5 km (4 NM) from the threshold.

ILS Point "B" means a point on the ILS glide path measured along the extended runway centre line in the approach direction a distance of 1 050 m (3 500 ft) from the threshold.

ILS Point "C" means a point through which the downward extended straight portion of the nominal ILS glide path passes at a height of 30 m (100 ft) above the horizontal plane containing the threshold.

ILS Point "D" means a point 4 m (12 ft) above the runway centre line and 900 m (3 000 ft) from the threshold in the direction of the localizer.

ILS Point "E" means a point 4 m (12 ft) above the runway centre line and 600 m (2 000 ft) from the stop end of the runway in the direction of the threshold.

ILS reference datum Point "T" means a point at a specified height located above the intersection of the runway centre line and the threshold and through which the downward extended straight portion of the ILS glide path passes.

Increased rate RA means a resolution advisory with a strength that recommends increasing the altitude rate to a value exceeding that recommended by a previous climb or descend RA.

Initial approach mode means the condition of DME/P operation which supports those flight operations outside the final approach region and which is interoperable with DME/N.

Integrity support data means a set of parameters that characterize the signal-in-space (SIS) integrity performance for each specific core satellite constellation and ARAIM service type.

Integrity support message means a dedicated core satellite constellation broadcast navigation message that contains ISD parameters which may improve ARAIM performance compared to the default ISD values.

Integrity means a measure of the trust that can be placed in the correctness of the information supplied by the total system. Integrity includes the ability of a system to provide timely and valid warnings to the user (alerts).

Intermediate system means a system which performs relaying and routing functions and comprises the lowest three layers of the OSI reference model.

International telecommunication service means a telecommunication service between offices or stations of different States, or between mobile stations which are not in the same State, or are subject to different States.

Interpilot air-to-air communication means two-way communication on the designated air-to-air channel to enable aircraft engaged in flights over remote and oceanic areas out of range of VHF ground stations to exchange necessary operational information and to facilitate the resolution of operational problems.

Intruder means an aircraft for which ACAS has an established track.

Ionosphere-free pseudo-range means a pseudo-range in which the first order ionosphere effect on signal propagation has been removed by a linear combination of pseudo-range measurements from signals on two distinct frequencies from the same satellite.

ISM generator means entity which determines the values of the ISD parameters transmitted in the ISM for ARAIM for a given core satellite constellation.

Key down time means the time during which a dot or dash of a Morse character is being transmitted.
Level aircraft means an aircraft that is not transitioning.

Link layer means the layer that lies immediately above the physical layer in the Open Systems Interconnection protocol model. The link layer provides for the reliable transfer of information across the physical media. It is subdivided into the data link sublayer and the media access control sublayer.

Link management entity means a protocol state machine capable of acquiring, establishing and maintaining a connection to a single peer system. An LME establishes data link and subnetwork connections, "hands-off" those connections, and manages the media access control sublayer and physical layer. An aircraft LME tracks how well it can communicate with the ground stations of a single ground system. An aircraft VME instantiates an LME for each ground station that it monitors. Similarly, the ground VME instantiates an LME for each aircraft that it monitors. An LME is deleted when communication with the peer system is no longer viable.

Link means a link connects an aircraft DLE and a ground DLE and is uniquely specified by the combination of aircraft DLS address and the ground DLS address. A different subnetwork entity resides above every link endpoint.

Location indicator means a four-letter code group formulated in accordance with rules prescribed by ICAO and assigned to the location of an aeronautical fixed station.

Logon address means a specified code used for data link logon to an ATS unit.

Lost C2 Link decision state means the state of the RPAS in which a C2 Link interruption has occurred, but the duration of which does not exceed the lost C2 Link decision time.

Lost C2 Link decision time means the maximum length of time permitted before declaring a lost C2 Link state during which the C2 Link performance is not sufficient to allow the remote pilot to actively manage the flight in a safe and timely manner appropriate to the airspace and operational conditions.

Lost C2 Link state means the state of the RPAS in which the C2 Link performance has degraded, as a result of a C2 Link interruption that is longer than the lost C2 Link decision time, to a point where it is not sufficient to allow the remote pilot to actively manage the flight in a safe and timely manner.

M burst means a management channel data block of bits used in VDL Mode 3. This burst contains signalling information needed for media access and link status monitoring.

Mean power of a radio transmitter means the average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions.

Media access control means the sublayer that acquires the data path and controls the movement of bits over the data path.

Meteorological operational channel means a channel of the aeronautical fixed service, for the exchange of aeronautical meteorological information.

Meteorological operational telecommunication network means an integrated system of meteorological operational channels, as part of the aeronautical fixed service, for the exchange of aeronautical meteorological information between the aeronautical fixed stations within the network.

MLS approach reference datum means a point on the minimum glide path at a specified height above the threshold.

MLS datum point means the point on the runway centre line closest to the phase centre of the approach elevation antenna.

Mobile station means a station in the mobile service intended to be used while in motion or during halts at unspecified points. An MS is always a subscriber station.

Mobile surface station means a station in the aeronautical telecommunication service, other than an aircraft station, intended to be used while in motion or during halts at unspecified points.

Mode 2 means a data-only VDL mode that uses D8PSK modulation and a carrier sense multiple access control scheme.

Mode 3 means a voice and data VDL mode that uses D8PSK modulation and a TDMA media access control scheme.

Mode 4 means a data-only VDL mode using a GFSK modulation scheme and self-organizing time division multiple access.

Mode S air-initiated Comm-B protocol means a procedure initiated by a Mode S transponder for transmitting a single Comm-B segment from the aircraft installation.

Mode S broadcast protocols means procedures allowing standard length uplink or downlink messages to be received by more than one transponder or ground interrogator respectively.

Mode S ground-initiated Comm-B protocol means a procedure initiated by a Mode S interrogator for eliciting a single Comm-B segment from a Mode S aircraft installation, incorporating the contents of one of 255 Comm-B registers within the Mode S transponder.

Mode S multisite-directed protocol means a procedure to ensure that extraction and close-out of a downlink standard length or extended length message is affected only by the particular Mode S interrogator selected by the aircraft.

Mode S packet means a packet conforming to the Mode S subnetwork standard, designed to minimize the bandwidth required from the air-ground link. ISO 8208 packets may be transformed into Mode S packets and vice-versa.

Mode S specific protocol means a protocol that provides restricted datagram service within the Mode S subnetwork.

Mode S specific services entity means an entity resident within an XDLP to provide access to the Mode S specific services.

Mode S specific services means a set of communication services provided by the Mode S system which are not available from other air-ground subnetworks, and therefore not interoperable.

Mode S subnetwork means a means of performing an interchange of digital data through the use of secondary surveillance radar Mode S interrogators and transponders in accordance with defined protocols.

Mode W, X, Y, Z means a method of coding the DME transmissions by time spacing pulses of a pulse pair, so that each frequency can be used more than once.

Multilink means the ability to use more than one available air-ground subnetworks in order to provide the required performance.

Network station means an aeronautical station forming part of a radiotelephony network.

Next data authority means the ground system so designated by the current data authority through which an onward transfer of communications and control can take place.

Nominal C2 Link state means the state of the RPAS when the C2 Link performance is sufficient to allow the remote pilot to actively manage the flight of the RPA in a safe and timely manner appropriate to the airspace and operational conditions.

Non-network communications means Radiotelephony communications conducted by a station of the aeronautical mobile service, other than those conducted as part of a radiotelephony network.

Offset frequency simplex means a variation of single channel simplex wherein telecommunication between two stations is effected by using in each direction frequencies that are intentionally slightly different but contained within a portion of the spectrum allotted for the operation.

Operational control communications means communications required for the exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of a flight.

Operational control communications means communications required for the exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of a flight.

Original rate means the original rate of an ACAS-equipped aircraft at any time is its altitude rate at the same time when it followed the original trajectory.

Original trajectory means the original trajectory of an ACAS-equipped aircraft is that followed by the aircraft in the same encounter when it was not ACAS equipped.

Own aircraft means the aircraft fitted with the ACAS that is the subject of the discourse, which ACAS is to protect against possible collisions, and which may enter a manoeuvre in response to an ACAS indication.

Packet means the basic unit of data transfer among communication devices within the network layer (e.g. an ISO 8208 packet or a Mode S packet).

Partial rise time means the time as measured between the 5 and 30 per cent amplitude points on the leading edge of the pulse envelope.

Partial usage sub-channelization means a technique in which the orthogonal frequency division multiplexing symbol subcarriers are divided and permuted among a subset of sub-channels for transmission, providing partial frequency diversity.

Path following error means that portion of the guidance signal error which could cause aircraft displacement from the desired course and/or glide path.

Physical layer means the lowest level layer in the Open Systems Interconnection protocol model. The physical layer is concerned with the transmission of binary information over the physical medium (e.g. VHF radio).

Point-to-point means pertaining or relating to the interconnection of two devices, particularly end-user instruments. A communication path of service intended to connect two discrete end-users; as distinguished from broadcast or multipoint service.

Positive RA means a resolution advisory that advises the pilot either to climb or to descend (applies to ACAS II).

Potential threat means an intruder deserving special attention either because of its close proximity to own aircraft or because successive range and altitude measurements indicate that it could be on a collision or near-collision course with own aircraft. The warning time provided against a potential threat is sufficiently small that a traffic advisory is justified but not so small that a resolution advisory would be justified.

Preventive RA means a resolution advisory that advises the pilot to avoid certain deviations from the current flight path but does not require any change in the current flight path.

Primary frequency means the radiotelephony frequency assigned to an aircraft as a first choice for air-ground communication in a radiotelephony network.

Primary means of communication means the means of communication to be adopted normally by aircraft and ground stations as a first choice where alternative means of communication exist.

Protected service volume means a part of the facility coverage where the facility provides a particular service in accordance with relevant SARPs and within which the facility is afforded frequency protection.

Pseudo-range means the difference between the time of transmission by a satellite and reception by a GNSS receiver multiplied by the speed of light in a vacuum, including bias due to the difference between a GNSS receiver and satellite time reference.

Pulse amplitude means the maximum voltage of the pulse envelope.

Pulse code means the method of differentiating between W, X, Y and Z modes and between FA and IA modes.

Pulse decay time means the time as measured between the 90 and 10 per cent amplitude points on the trailing edge of the pulse envelope.

Pulse duration means the time interval between the 50 per cent amplitude point on leading and trailing edges of the pulse envelope.

Pulse rise time means the time as measured between the 10 and 90 per cent amplitude points on the leading edge of the pulse envelope.

Quality of service means the totality of the characteristics of an entity that bear on its ability to satisfy stated and implied needs.

Quality of service delivered means a statement of the QoS achieved or delivered to the RPAS operator by the C2CSP.

Quality of service experienced means a statement expressing the QoS that the remote pilot believes they have experienced.

Quality of service required means a statement of the QoS requirements of the RPAS operator to the C2CSP.

Quality of service means the information relating to data transfer characteristics used by various communication protocols to achieve various levels of performance for network users.

RA sense means the sense of an ACAS II RA is “upward” if it requires climb or limitation of descent rate and “downward” if it requires descent or limitation of climb rate. It can be both upward and downward simultaneously if it requires limitation of the vertical rate to a specified range.

Radio bearing means the angle between the apparent direction of a definite source of emission of electro-magnetic waves and a reference direction, as determined at a radio direction-finding station. A true radio bearing is one for which the reference direction is that of true North. A magnetic radio bearing is one for which the reference direction is that of magnetic North.

Radio direction finding means Radio determination using the reception of radio waves for the purpose of determining the direction of a station or object.

Radio direction-finding station means a radio determination station using radio direction finding.

Radiotelephony network means a group of radiotelephony aeronautical stations which operate on and guard frequencies from the same family and which support each other in a defined manner to ensure maximum dependability of air-ground communications and dissemination of air-ground traffic.

Readback means a procedure whereby the receiving station repeats a received message or an appropriate part thereof back to the transmitting station so as to obtain confirmation of correct reception.

Receiver means a subsystem that receives GNSS signals and includes one or more sensors.

Reed-Solomon code means an error correction code capable of correcting symbol errors. Since symbol errors are collections of bits, these codes provide good burst error correction capabilities.

Regular station means a station selected from those forming an en-route air-ground radiotelephony network to communicate with or to intercept communications from aircraft in normal conditions.

Remote pilot station means the component of the remotely piloted aircraft system containing the equipment used to pilot the remotely piloted aircraft.

Remotely piloted aircraft means an unmanned aircraft which is piloted from a remote pilot station.

Remotely piloted aircraft system means a remotely piloted aircraft, its associated remote pilot station(s), the required C2 Link(s) and any other component as specified in the type design.

Reply efficiency means the ratio of replies transmitted by the transponder to the total of received valid interrogations.

Required communication performance means a statement of the performance requirements for operational communication in support of specific ATM functions (see Manual on Required Communication Performance (RCP) (Doc 9869)).

Required rate means for the standard pilot model, the required rate is that closest to the original rate consistent with the RA.

Reserved (bits/words/fields) means Bits/words/fields that are not allocated, but which are reserved for a particular GNSS application.

Residual error rate means the ratio of incorrect, lost and duplicate subnetwork service data units (SNSDUs) to the total number of SNSDUs that were sent.

Resolution advisory means an indication given to the flight crew recommending: a) a manoeuvre intended to provide separation from all threats; or b) a manoeuvre restriction intended to maintain existing separation.

Resolution advisory complement means information provided by one ACAS to another via a Mode S interrogation in order to ensure complementary manoeuvres by restricting the choice of manoeuvres available to the ACAS receiving the RAC.

Resolution advisory complements record means a composite of all currently active vertical RACs (VRCs) and horizontal RACs (HRCs) that have been received by ACAS. This information is provided by one ACAS to another ACAS or to a Mode S ground station via a Mode S reply.

Resolution advisory strength means the magnitude of the manoeuvre indicated by the RA. An RA may take on several successive strengths before being cancelled. Once a new RA strength is issued, the previous one automatically becomes void.

Resolution message means the message containing the resolution advisory complement (RAC).

Reversed sense RA means a resolution advisory that has had its sense reversed.

Route segment means a route or portion of route usually flown without an intermediate stop.

Router means a router is a node that forwards Internet protocol (IP) packets not explicitly addressed to itself. A router manages the relaying and routing of data while in transit from an originating end system to a destination end system.

Routing Directory means a list in a communication centre indicating for each addressee the outgoing circuit to be used.

Satellite-based augmentation system means a wide coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter.

Search means the condition which exists when the DME interrogator is attempting to acquire and lock onto the response to its own interrogations from the selected transponder.

Secondary frequency means the radiotelephony frequency assigned to an aircraft as a second choice for air-ground communication in a radiotelephony network.

Secondary surveillance radar means a surveillance radar system which uses transmitters/receivers (interrogators) and transponders.

Segment means a portion of a message that can be accommodated within a single MA/MB field in the case of a standard length message, or MC/MD field in the case of an extended length message. This term is also applied to the Mode S transmissions containing these fields.

Self-organizing time division multiple access means a multiple access scheme based on time-shared use of a radio frequency (RF) channel employing:
(1) discrete contiguous time slots as the fundamental shared resource; and
(2) a set of operating protocols that allows users to mediate access to these time slots without reliance on a master control station.

Sensitivity level means an integer defining a set of parameters used by the traffic advisory (TA) and collision avoidance algorithms to control the warning time provided by the potential threat and threat detection logic, as well as the values of parameters relevant to the RA selection logic.

Service data unit means a unit of data transferred between adjacent layer entities, which is encapsulated within a protocol data unit (PDU) for transfer to a peer layer.

Service flow means a unidirectional flow of media access control layer (MAC) service data units (SDUs) on a connection that is providing a particular quality of service (QoS).

Service level agreement means the agreement between the C2CSP and the RPAS operator covering the safety, performance, service area and security of the C2 Link provision as required for the RPAS operator's intended operations.

Simplex means a method in which telecommunication between two stations takes place in one direction at a time.

Single channel simplex means Simplex using the same frequency channel in each direction.
Slot means one of a series of consecutive time intervals of equal duration. Each burst transmission starts at the beginning of a slot.

Slotted aloha means a random access strategy whereby multiple users access the same communications channel independently, but each communication must be confined to a fixed time

slot. The same timing slot structure is known to all users, but there is no other coordination between the users.

Spare (bits/words/fields) means Bits/words/fields that are not allocated or reserved, and which are available for future allocation.

Spot beam means Satellite antenna directivity whose main lobe encompasses significantly less than the earth's surface that is within line-of-sight view of the satellite. May be designed so as to improve system resource efficiency with respect to geographical distribution of user earth stations.

Standard length message means an exchange of digital data using selectively addressed Comm-A interrogations and/or Comm-B replies

Standard positioning service means the specified level of positioning, velocity and timing accuracy that is available to any global positioning system user on a continuous, worldwide basis.

Subnetwork connection means a long-term association between an aircraft DTE and a ground DTE using successive virtual calls to maintain context across link handoff.

Subnetwork dependent convergence function means a function that matches the characteristics and services of a particular subnetwork to those characteristics and services required by the internetwork facility.

Subnetwork entity means in this document, the phrase "ground DCE" will be used for the subnetwork entity in a ground station communicating with an aircraft; the phrase "ground DTE" will be used for the subnetwork entity in a ground router communicating with an aircraft station; and, the phrase "aircraft DTE" will be used for the subnetwork entity in an aircraft communicating with the station. A subnetwork entity is a packet layer entity as defined in ISO 8208.

Subnetwork entry time means the time from when the mobile station starts the scanning for BS transmission, until the network link establishes the connection, and the first network user "protocol data unit" can be sent.

Subnetwork layer means the layer that establishes, manages and terminates connections across a subnetwork.

Subnetwork management entity means an entity resident within a GDLP that performs subnetwork management and communicates with peer entities in intermediate or end-systems.

Subnetwork service data unit means an amount of subnetwork user data, the identity of which is preserved from one end of a subnetwork connection to the other.

Subnetwork means an actual implementation of a data network that employs a homogeneous protocol and addressing plan, and is under the control of a single authority.

Subscriber station means a generalized equipment set providing connectivity between subscriber equipment and a base station.

Surveillance radar means radar equipment used to determine the position of an aircraft in range and azimuth.

Switchover means the act of transferring the active datalink path between the RPS and the RPA from one of the links or networks that constitutes the C2 Link to another link or network that constitutes the C2 Link.

System efficiency means the ratio of valid replies processed by the interrogator to the total of its own interrogations.

System A VDL-capable entity means a system comprises one or more stations and the associated VDL management entity. A system may either be an aircraft system or a ground system.

Telecommunication means any transmission, emission, or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.

Threat means an intruder deserving special attention either because of its close proximity to own aircraft or because successive range and altitude measurements indicate that it could be on a collision or near-collision course with own aircraft. The warning time provided against a threat is sufficiently small that an RA is justified.

Time division duplex means a duplex scheme where uplink and downlink transmissions occur at different times but may share the same frequency.

Time division multiple access means a multiple access scheme based on time-shared use of an RF channel employing:

(1) discrete contiguous time slots as the fundamental shared resource; and

(2) a set of operating protocols that allows users to interact with a master control station to mediate access to the channel.

Time division multiplex means a channel sharing strategy in which packets of information from the same source but with different destinations are sequenced in time on the same channel.

Timeout means the cancellation of a transaction after one of the participating entities has failed to provide a required response within a pre-defined period of time.

Time-to-alert means the maximum allowable time elapsed from the onset of the navigation system being out of tolerance until the equipment enunciates the alert.

Total voice transfer delay means 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 an AMS(R)S subnetwork.

Touchdown means the point where the nominal glide path intercepts the runway.

Track means a sequence of measurements representing positions that could reasonably have been occupied by an aircraft.

Track means the condition which exists when the DME interrogator has locked onto replies in response to its own interrogations, and is continuously providing a distance measurement.

Traffic advisory means an indication given to the flight crew that a certain intruder is a potential threat.

Traffic information service – broadcast IN means a surveillance function that receives and processes surveillance data from TIS-B OUT data sources.

Traffic information service – broadcast OUT means a function on the ground that periodically broadcasts the surveillance information made available by ground sensors in a format suitable for TIS-B IN capable receivers.

Transit delay means in packet data systems, the elapsed time between a request to transmit an assembled data packet and an indication at the receiving end that the corresponding packet has been received and is ready to be used or forwarded.

Transitioning aircraft means an aircraft having an average vertical rate with a magnitude exceeding 400 feet per minute (ft/min), measured over some period of interest.

Transmission rate means the average number of pulse pairs transmitted from the transponder per second.

Transponder occupancy means a state of unavailability of the transponder from the time it detects an incoming signal that appears to cause some action or from the time of a self-initiated transmission, to the time that it is capable of replying to another interrogation.

Tributary station means an aeronautical fixed station that may receive or transmit messages and/or digital data but which does not relay except for the purpose of serving similar stations connected through it to a communication centre.

Turn extent means a heading difference defined as an aircraft's ground heading at the end of a turn minus its ground heading at the beginning of the turn.

Two-frequency glide path system means an ILS glide path in which coverage is achieved by the use of two independent radiation field patterns spaced on separate carrier frequencies within the particular glide path channel.

Two-frequency localizer system means a localizer system in which coverage is achieved by the use of two independent radiation field patterns spaced on separate carrier frequencies within the particular localizer VHF channel.

Uplink ELM means a term referring to extended length uplink communication by means of 112-bit Mode S Comm-C interrogations, each containing the 80-bit Comm-C message field (MC).

Uplink means a term referring to the transmission of data from the ground to an aircraft. Mode S ground-to-air signals are transmitted on the 1 030 MHz interrogation frequency channel.

User group means a group of ground and/or aircraft stations which share voice and/or data connectivity. For voice communications, all members of a user group can access all communications. For data, communications include point-to-point connectivity for air-to-ground messages, and point-to-point and broadcast connectivity for ground-to-air messages.

VDL management entity means a VDL-specific entity that provides the quality of service requested by the ATN-defined SN_SME. A VME uses the LMEs (that it creates and destroys) to enquire the quality of service available from peer systems.

VDL Mode 4 burst means a VHF digital link (VDL) Mode 4 burst is composed of a sequence of source address, burst ID, information, slot reservation and frame check sequence (FCS) fields, bracketed by opening and closing flag sequences.

VDL Mode 4 DLS system means a VDL system that implements the VDL Mode 4 DLS and subnetwork protocols to carry ATN packets or other packets.

VDL Mode 4 specific services sublayer means the sublayer that resides above the MAC sublayer and provides VDL Mode 4 specific access protocols including reserved, random and fixed protocols.

VDL station means an aircraft-based or ground-based physical entity, capable of VDL Mode 2, 3 or 4.

Vertical miss distance means notionally, the vertical separation at closest approach. For encounters in the standard encounter model, by construction the vertical separation at the time tca.

Vertical speed limit RA means a resolution advisory advising the pilot to avoid a given range of altitude rates. A VSL RA can be either corrective or preventive.

VHF digital link means a constituent mobile subnetwork of the aeronautical telecommunication network, operating in the aeronautical mobile VHF frequency band. In addition, the VDL may provide non-ATN functions such as, for instance, digitized voice.

Virtual origin means the point at which the straight line through the 30 per cent and 5 per cent amplitude points on the pulse leading edge intersects the 0 per cent amplitude axis.

Vocoder means a low bit rate voice encoder/decoder.

Voice unit means a device that provides a simplex audio and signalling interface between the user and VDL.

Voice-automatic terminal information service means the provision of ATIS by means of continuous and repetitive voice broadcasts.

VDL Mode 4 specific services means the VSS user could be higher layers in the VDL Mode 4 SARPs or an external application using VDL Mode 4.

WAIC component means any tangible entity of a WAIC network on board an aircraft.

WAIC network means a network comprised of interrelated WAIC components, such as components used for wireless communications, security or network management.

WAIC system means a system which provides wireless communications between points on board a single aircraft. A WAIC system may be comprised of one or more WAIC networks necessary for establishing, maintaining and securing wireless communications. A WAIC system consists of interrelated sets of WAIC components on board the same aircraft, so that a single aircraft contains only a single WAIC system.

Warning time means the time interval between potential threat or threat detection and closest approach when neither aircraft accelerates.

Wireless avionic intra-communication means Radiocommunication between two or more aircraft stations located on board a single aircraft for aircraft applications supporting the safe operation of the aircraft.

XDCE means a general term referring to both the ADCE and the GDCE.

XDLP means a general term referring to both the ADLP and the GDLP.

Z marker beacon means a type of radio beacon, the emissions of which radiate in a vertical cone-shaped pattern.

Appendix G – Abbreviations

AAC	means aeronautical administrative communications
ABAS	means aircraft-based augmentation system
ACAS	means airborne collision avoidance system
ADCE	means aircraft data circuit-terminating equipment
ADS	means automatic dependent surveillance
ADS-B	means automatic dependent surveillance-broadcast
ADLP	means aircraft data link processor
AE	means application entity
AES	means aircraft earth station
AFS	means aeronautical fixed service
AFTN	means aeronautical fixed telecommunication network
AIDC	means interfacility data communication
AMHS	means ATS message handling system
AOC	means aeronautical operational control
ARAIM	means advanced receiver autonomous integrity monitoring
ATIS	means automatic terminal information service
ATN	means aeronautical telecommunication network
ATSMHS	means ATS message handling service
BDS	means BeiDou Navigation Satellite System
BER	means bit error rate
CMN	means control motion noise
CSA	means channel of standard accuracy
CTC	means convolutional turbo codes
C2CSP	means C2 Link communication service provider
DCE	means data circuit-terminating equipment
DDM	means difference in depth of modulation
DIR	means directory service
DLE	means data link entity
DLIC	means data link initiation capability
DLS	means data link service
DME	means distance Measuring Equipment
DTE	means data terminal equipment
ELM	means extended length message
EIRP	means equivalent isotropically radiated power
FA	means final approach
FEC	means forward error correction
GBAS	means ground-based augmentation system
GDCE	means ground data circuit-terminating equipment
GDLP	means ground data link processor
GES	means ground earth station
GFM	means general formatter/manager
GFSK	means gaussian filtered frequency shift keying
GLONASS	means global navigation satellite system
GNSS	means global navigation satellite system

GPS	means global positioning system
GRAS	means ground-based regional augmentation system
GSC	means global signalling channel
IA	means initial approach
IS	means intermediate system
ISD	means integrity support data
ISM	means integrity support message
ITU	means international telecommunication union
LME	means link management entity
MAC	means media access control
MS	means mobile station
PFE	means path following error
PUSC	means partial usage sub-channelization
QoS	means quality of service
QoSD	means quality of service delivered
QoSE	means quality of service experienced
QoSR	means quality of service required
RA	means resolution advisory
RAC	means resolution advisory complement
RCP	means required communication performance
RPA	means remotely piloted aircraft
RPAS	means remotely piloted aircraft system
RPS	means remote pilot station
SBAS	means satellite-based augmentation system
SDU	means service data unit
SLA	means service level agreement
SNDCF	means subnetwork dependent convergence function
SNSDU	means subnetwork service data unit
SPS	means standard positioning service
SS	means subscriber station
SSR	means secondary surveillance radar
STDMA	means self-organizing time division multiple access
TA	means traffic advisory
TDD	means time division duplex
TDM	means time division multiplex
TDMA	means time division multiple access
VDL	means VHF digital link
VSL	means vertical speed limit
WAIC	means wireless avionic intra-communications

Appendix H – Units of Measure

Electric Field Strength	Volts per meter (V/m)
Output Power	Watts (W)

Pulse Width/Duration	unit of time, seconds
Radio Frequency	Hertz (Hz) Radio frequency are measured in KHz, MHz and GHz depending on the specific frequency range.
Radio Signal Strength	Decibels (dB)
Rate of Modulation	Baud (Bd)
Signal Level	Decibel-milliwatt (dBm)
Signal to noise ratio (SNR)	Decibels (dB)
Transmission of Data	bits per second (bps)