REPUBLIC OF MAURITIUS
DEPARTMENT OF CIVIL AVIATION
Sir Seewoosagur Ramgoolam International Airport, Plaine Magnien

MAURITIUS CIVIL AVIATION REQUIREMENTS

MCAR CNS

AERONAUTICAL TELECOMMUNICATIONS

ISSUE 1 | REV 1

10 July 2025

FOREWORD

Article 28 (Air navigation facilities and standard systems) of the Convention on International Civil Aviation requires each State to provide, in its territory, airports, radio services, meteorological services and other air navigation facilities in accordance with the standards and recommended practices or established from time to time, pursuant to this Convention.

This MCAR CNS "Aeronautical Telecommunications" Issue 1, Rev 0 is issued under the provisions of Regulation 135 of the Civil Aviation Regulations as amended and replaces the following requirements prescribed in:

(1) Civil Air Navigation Requirements of Mauritius (CANRM), Section 2: Air Navigation Services, Series B: Aeronautical Telecommunications, Part I Radio Navigation Aids.

(2) Civil Air Navigation Requirements of Mauritius (CANRM), Section 2: Air Navigation Services, Series B: Aeronautical Telecommunications, Part II Communication Procedures Including Those with PANS Status.

(3) Civil Air Navigation Requirements of Mauritius (CANRM), Section 2: Air Navigation Services, Series B: Aeronautical Telecommunications, Part III Communication Systems.

(4) Civil Air Navigation Requirements of Mauritius (CANRM), Section 2: Air Navigation Services, Series B: Aeronautical Telecommunications, Part IV Surveillance Radar and Collision Avoidance Systems.

(5) Civil Air Navigation Requirements of Mauritius (CANRM), Section 2: Air Navigation Services, Series B: Aeronautical Telecommunications, Part V Aeronautical Radio Frequency Spectrum Utilization. All these CANRMs dated March 2015.

This MCAR CNS Issue 1 Rev 0 was developed based on the provisions of ICAO Annex 10 "Aeronautical Telecommunications":

(1) Volume 1 "Radio Navigation Aids", 8th edition July 2023, amendment 93 dated 2 November 2023.

(2) Volume 2 "Communication Procedures including those with PANS Status", 7th edition July 2016, amendment 93 dated 28 November 2024.

(3) Volume 3 "Communication System", 2nd edition July 2007, amendment 92 dated 28 November 2024.

(4) Volume 4 "Surveillance and Collision Avoidance Systems", 5th edition July 2014, amendment 91 dated 3 November 2022.

(5) Volume 5 "Aeronautical Radio Frequency Spectrum Utilisation", 3rd edition July 2013, amendment 89 dated 14 November 2013.

(6) Volume 6 "Communication Systems and Procedures Relating to Remotely Piloted Aircraft Systems C2 Link", 1st edition July 2021.

This MCAR-CNS Issue 1 Rev 1 replaces MCAR CNS Issue 1 Rev 0 and will be effective as from 10 July 2025. Volume 6 will be effective as from 26 November 2026.

I POKHUN
Director of Civil Aviation

ISSUE AND REVISION SYSTEM

THE REVISIONS TO THIS REQUIREMENT WILL BE INDICATED BY A VERTICAL BAR ON THE LEFT SIDE, IN FRONT OF THE LINE, SECTION OR FIGURE THAT HAS BEEN AFFECTED. AN ISSUE WILL BE THE REPLACEMENT OF THE COMPLETE DOCUMENT.

THESE REVISIONS MUST BE RECORDED ON THE RECORD OF REVISIONS TABLE OF THIS DOCUMENT, INDICATING THE RESPECTIVE NUMBER, DATE IT WAS ENTERED AND SIGNED BY THE PERSON ENTERING THE REVISION.

RECORD OF REVISIONS

REV NO.	DATE	INSERTED BY
Issue 1, rev. 0	07 April 2025	ANS Inspector
Issue 1, rev. 1	10 July 2025	ANS Inspector

NOTE

The content of this document is arranged as follows:

The main requirements appear first, followed by the related Acceptable Means of Compliance (AMC), and Guidance Material (GM) paragraph(s).

All elements (i.e. Requirement, AMC and GM) are colour-coded and can be identified according to the illustration below:

Requirements

Acceptable means of compliance

Guidance Material

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GENERAL REQUIREMENTS

CNS.001 Applicability

(1) This MCAR prescribes requirements governing:

The provision of aeronautical telecommunication services, which include the provision of Communication, Navigation and Surveillance services (CNS) that supports the provision of air traffic services (ATS) and other air navigation services within the sovereign airspace of Mauritius.

(2) The service providers according to their functions and responsibilities shall comply with this requirement, and any other applicable national legislation in force at any time.

(3) Notwithstanding the standards in this requirement, the service providers in (2) above shall be able to demonstrate that its working methods and operating procedures are compliant with the following standards:

(a) ICAO Annex 10

(i) Volume 1 on radio navigation aids

(ii) Volume 2 on communication procedures

(iii) Volume 3 on communication systems

(iv) Volume 4 on surveillance and collision avoidance systems

(v) Volume 5 on aeronautical radio frequency spectrum utilisation

(vi) Volume 6 on Communication Systems and Procedures Relating to Remotely Piloted Aircraft Systems C2 Link

(4) These requirements shall also be read in conjunction with the following documents

(a) ICAO Doc 8071 Volumes I to III – Testing of Ground-based and Satellite-based Radio Navigation Systems and Surveillance Systems;

(b) ICAO Doc 9868 - PANS-Training; and

(c) ICAO Doc 10057 – ATSEP Training Manual

(5) Under these requirements the Authority has adopted the Standards of Annex 10, Volumes 1 to 6. Where there is a difference between these requirements and the Standards of Annex 10, Volumes 1 to 6, these requirements shall prevail.

(6) When the service provider is not able to comply with any requirements specified or referenced in this MCAR, an application shall be made to the Authority for an exemption or deviation from the requirement. Applications must be supported in writing with the reasons for such exemption or deviation including any safety assessment or other studies undertaken, and where appropriate, an indication of when compliance with the current requirement can be expected.

(7) Any exemption or deviation granted shall be recorded in the appropriate operations manual and shall include full details of the exemption or deviation, such as the reason that the exemption or deviation was requested, and any resultant limitations or conditions imposed.

CNS.005 Reliability and availability of communications, navigation and surveillance systems

(1) The CNS provider shall ensure that the availability and reliability of the communications, navigation and surveillance (CNS) systems is equal to or greater than 99.9%.

(2) The CNS provider shall ensure that all communication, navigation and surveillance systems are duplicated, with a main and a second standby equipment, both complying with all technical parameters established by the manufacturer and the operational requirements established for each service.

(3) The CNS provider shall ensure that all navigation and surveillance systems, in addition, have automated means of transfer to the standby equipment, to ensure the uninterrupted continuity of the service, in case of failure of the main equipment in functioning.

(4) The CNS provider shall ensure that the premises where their communication, navigation and surveillance systems are installed, have air conditioning systems that guarantee an appropriate ambient temperature during the time of operation of their equipment.

(5) The CNS provider shall ensure that their communications, navigation and surveillance systems have remote monitoring systems located in the approach units or air traffic control towers, in order to control their main parameters of work.

(6) The CNS provider shall ensure that their communications, navigation and surveillance systems have:

(a) An Annual Maintenance Plan.

(b) Records showing compliance with the annual maintenance plan.

(c) Updated records of faults with the details of them.

(d) Updated records of the corrections made, as a result of the faults presented.

(e) Copy of the reports of the flight inspections.

(7) The CNS provider shall ensure that towers and masts containing elements of communications, navigation or surveillance systems shall have a red warning light system (BEACONS) that guarantee their visibility to aircraft in flight, in the following cases:

(a) The masts or towers whose height exceeds 45 meters on the ground;

(b) those with a height greater than 10 meters that are within a radius of 5 kilometres of any end of track; and

(c) those which constitute obstacles to air navigation.

(8) The CNS provider shall ensure that all premises related to the provision of aeronautical communications, navigation and surveillance services are kept clean, with the means strictly necessary for their operation, and properly conditioned.

(9) The CNS provider shall ensure that the premises, towers and masts where systems, equipment and / or communications, navigation and surveillance antennas are installed, have a civil works maintenance status that guarantees protection against all possible external elements that can cause deterioration and damage to the equipment, or interrupt the service.

CNS.010 Functions and responsibilities

The CNS provider shall establish the functions and responsibilities for each of their technical staff, which shall be approved by the proper authority and as a minimum comply with the structure established in GM CNS.010.

GM CNS.010 Functions and responsibilities

This shall include as a minimum the following structure:

(1) Identification of the post

(2) Qualification of the post

(3) Job description of the post

(4) Duties and responsibilities of the post

CNS.015 Training programme

(1) Training programme and training plan

The CNS provider shall develop and implement a training programme and a training plan for its technical staff, which shall be approved by the Authority and as a minimum shall include initial, supplementary, OJT and refresher training when applicable. The training shall be compliant with ICAO Doc. 10057 “Manual on Air Traffic Safety Electronics Personnel Competency-based Training and Assessment”.

(2) OJT requirements

The CNS provider shall ensure that the CNS personnel is required to complete in a satisfactorily manner OJT before duties and responsibilities are assigned. This is oriented to the tasks an ATSEP will perform in a specific environment. This training addresses theoretical and practical issues from equipment-specific and/or site-specific perspectives.

(3) Supplementary training

The CNS provider shall provide supplementary training to technical staff, for the development of additional competencies required by a change to or an evolution of an ATSEP's profile.

(4) Recurrent/Refresher training

The CNS provider shall provide recurrent/refresher training to technical staff or exercises based on written procedures, to ensure that they maintain competencies and prepare for system upgrades and/or modifications of CNS systems.

(5) Training records

The CNS provider shall develop a system or methodology for maintaining and standardising training records for their technical staff.

GM CNS.015 Training programme

The CNS provider shall establish this programme through a training manual that as a minimum contains the following structure:

(1) Qualification and experience requirements

(2) Course content:

(a) Initial training

(b) Supplementary Training

(c) Recurrent training

(d) Course syllabus

(3) OJT process

(4) Familiarization process in the workplace

(5) Training Records System

CNS.020 CNS Operations manual

The CNS provider shall develop and implement an Operations Manual.

(1) The OPS Manual (OPSMA) shall be prepared and keep current for compliance by its personnel, this shall contain the procedures and policies for the use and guidance of its personnel in the provision of the services and as a minimum comply with the structure established in GM CNS.020.

(2) The CNS provider shall provide separate facility manuals to be used in conjunction with the OPSMA at each facility location. Facility manuals shall contain procedures and instructions of a local nature which are either subject to frequent change or limited in

application, but are, in all cases, supplementary to the provisions of the OPSMA, including the equipment maintenance control.

(3) The CNS provider shall control the distribution, and hold copies of, all relevant manuals and documentation ensuring amendments are made whenever necessary to ensure that all information contained is accurate and current.

(4) The CNS provider shall ensure that the OPSMA, facility manuals or any portion of a manual which has not been reviewed and found acceptable or approved by the Authority, shall not be made available for use.

GM CNS.020 CNS Operations manual

(1) The OPSMA shall describe the overall (general) unit's policies and procedures regarding the provision of the service. The contents of the OPSMA shall also include:

(a) a chart depicting units organisational structure;

(b) a description of personnel requirements and the responsibilities of personnel;

(c) minimum required staffing and qualifications at unit level;

(d) contingency plans for either a partial or total system failure for which the organization provides the services;

(e) a minimum air navigation facility equipment list specifying the minimum level of equipment required as applicable to a particular class of operation;

(f) procedures to be followed to satisfy the maintenance responsibility for facility equipment with respect to this regulation and manufacturer specifications;

(g) fault and defect reporting;

(h) maintenance of documents and records; and

(i) any other information required by the Authority.

CNS.025 Recruitment and retention

The CNS service provider shall develop and implement policies and procedures to enable recruitment and retention of appropriately qualified and experienced technical staff.

CNS.030 Safety management

The CNS provider shall establish and implement a safety management process; this shall be in line and under the umbrella of the air traffic services safety management system.

SECTION A

TECHNICAL REQUIREMENTS

Volume 1

RADIO NAVIGATION AIDS

CHAPTER 1

GENERAL PROVISIONS FOR RADIO NAVIGATION AIDS

CNS.035 Standard radio navigation aids

(1) The standard radio navigation aids shall be:

(a) the instrument landing system (ILS) conforming to the Standards contained in Chapter 3, 3.1, Volume 1 of Annex 10 of the Convention of International Civil Aviation.

(b) the global navigation satellite system (GNSS) conforming to the Standards contained in Chapter 3, 3.7; Volume 1 of Annex 10 of the Convention of the International Civil Aviation.

(c) the VHF omnidirectional radio range (VOR) conforming to the Standards contained in Chapter 3, 3.3; Volume 1 of Annex 10 of the Convention of International Civil Aviation.

(d) the non-directional radio beacon (NDB) conforming to the Standards contained in Chapter 3, 3.4, Volume 1 of Annex 10 of the Convention of International Civil Aviation.

(e) the distance measuring equipment (DME) conforming to the Standards contained in Chapter 3, 3.5; Volume 1 of Annex 10 of the Convention of International Civil Aviation.

(2) Differences in Radio Navigations AIDS

(a) Differences in Radio Navigation AIDS shall be published in the Aeronautical Information Publication (AIP) (GEN 1.7) in any respect from the Standards of Chapter 3 of ICAO Annex 10, Vol 1.

(b) Wherever there is installed a radio navigation AID that is not an ILS, but which may be used in whole or in part with aircraft equipment designed for use with the ILS, full details of parts that may be so used shall be published in the Aeronautical Information Publication (AIP).

(3) GNSS specific provisions

(a) It shall be permissible to terminate a GNSS satellite service provided by one of its elements (ICAO Annex 10, Vol 1, Chapter 3, 3.7.2), on the basis of at least a six-year advance notice by the respective service provider.

AMC CNS.035 Standard radio navigation aids

(3) GNSS specific provision

(b) GNSS data relevant to the operations should be recorded.

(c) Recordings for a period of at least 30 days should be retained. When the recordings are pertinent to accident and incident investigations, They should be retained for longer periods until it is evident that they will no longer be required.

GM CNS.035 Standard radio navigation aids

(1) The standard radio navigation aids shall be:

Since visual reference is essential for the final stages of approach and landing, the installation of a radio navigation aid does not obviate the need for visual aids to approach and landing in conditions of low visibility.

It is intended that introduction and application of radio navigation aids to support precision approach and landing operations will be in accordance with the strategy shown in Attachment B. It is intended that rationalization of conventional radio navigation aids and evolution toward supporting performance-based navigation will be in accordance with the strategy shown in Attachment H.

Categories of precision approach and landing operations are classified in Annex 6, Part I, Chapter 1.

Information on operational objectives associated with ILS facility performance categories is given in Attachment C, 2.1 and 2.14.

Information on operational objectives associated with MLS facility performance is given in Attachment G, 11.

(2) Differences in Radio Navigations AIDS

(b) This provision is to establish a requirement for promulgation of relevant information rather than to authorize such installations.

(3) GNSS specific provisions

(b) These recorded data can support accident and incident investigations. They may also support periodic analysis to verify the GNSS performance parameters detailed in the relevant Standards in this Annex.

Guidance material on the recording of GNSS parameters and on GNSS performance assessment is contained in Attachment D, 11 and 12, of Annex 10 of the Convention of International Civil Aviation.

CNS.040 Ground and flight testing

(1) Ground and Flight testing

(a) The CNS service provider shall conduct periodic ground and in-flight tests on air navigation radio aids of the types specified in MCAR CNS.035(1), and that aircraft intended for international air navigation may use it and comply with the procedures and parameters established in Document 8071 - ICAO Manual on Testing of Radio Navigations Aids.

(2) Frequency of flight inspections

(a) The CNS Provider shall conduct periodic in-flight testing of radio navigation aids in accordance with the recommendation for compliance with the inspections specified by ICAO Document 8071, as detailed:

Facility	Test Intervals (Days)
VOR	365
DME	365
ILS	180
NDB	365 where operationally required

(b) The CNS Provider shall ensure that Radio Navigational Aids are submitted to Flight Inspections, during the corresponding period indicated in MCAR CNS.040(2)(a).

(c) The CNS service provider shall ensure that when the Flight Inspection of a Radio Navigational Aid is not carried out in the period established in subsection (a) above, it is kept operating for 30 calendar days with the purpose that in that period, the technical maintenance personnel of the respective Radio Assistance, evaluate together with the entity in charge of the Flight Inspection, the feasibility of maintaining it in service by issuing a document of extension or revalidation of the certificate which details the operational status, validity of observations and restrictions applicable to the system as well as the conditions in which it is validated (mitigation measures), based on a safety risk assessment, provided that there are no conditions that may adversely affect the operational safety of air navigation, while the Inspection is carried out in Flight.

(d) If there are no favorable results to what is indicated in sub-paragraph (c) above,

proceed as established in MCAR CNS.045.

(e) The CNS service provider, in the case of a new installation of radio aids; shall ensure that it is subject to a Flight Inspection, 90 days after its Commission.

(f) If there are no favorable results to what is indicated in sub-paragraph (c) above, proceed as established in MCAR CNS.045.

(3) Operating Radio Aids condition report

(a) The CNS service provider shall ensure that the corresponding report is sent to the personnel of the entity in charge of the flight inspection, of the operational condition in which Radio AIDS will remain.

(b) The CNS service provider shall ensure that the corresponding Flight Inspection reports of the Radio Navigational AIDS are issued, with the analysis resulting from each inspection.

(4) Flight Inspection Suspension

(a) The CNS service provider shall ensure that in the case that the Flight Inspection of a commissioned Air Navigation Radio-aids have to be suspended due to force majeure or fortuitous event; the maintenance staff and the staff of the entity In charge of the Flight Inspection, jointly analyze the possibility of returning the Radio Aids to a functioning condition similar to that previously commissioned, based on the previous Flight Inspection reports, the maintenance history of the same, the current operational condition, the pending verification procedures, and whether the Radio-aids maintenance manuals allow adjustment without an aerial check.

(b) The CNS service provider shall ensure that after receiving the corresponding favorable opinion from the entity in charge of the Flight Inspection, Radio Aids are immediately put into service.

(c) The CNS service provider; in the event that the Flight Inspection has been suspended, shall ensure that all reviews and evaluations of the parameters of the Radio Aids that have been pending are carried out within fifteen days after the suspension of the Flight Inspection.

(d) The CNS service provider shall immediately after the accomplishment of what is established in subsection (c) above, shall ensure that all relevant steps are taken before the entity in charge of the Flight Inspections, so that the Flight Inspection of the Radio Aids is carried out again as soon as possible.

(5) Withdrawal of the Service of a Radio Aids

(a) The CNS service provider, in the event that a radio aid is declared unusable after its flight inspection, will be sure to remove it from the service, after notifying the users of those services through a NOTAM.

(b) The CNS service provider, in the event that a Radio Aid has been withdrawn from service, they shall ensure that it is restored to service only after its Flight Inspection has been satisfactorily completed.

GM CNS.040 Ground and flight testing

(1)(a) Guidance on the ground and flight testing of ICAO standard facilities, including the periodicity of the testing, is contained in Attachment C and in the Manual on Testing of Radio Navigation Aids (Doc 8071).

(2)(a) NDBs are not subjected to flight inspection except where operationally required.

CNS.045 Provision of information on the operational status of radio navigation services

(1) The CNS service provider in case that the results of a Flight Inspection have not been satisfactory, they shall make sure to manage immediately after the completion of the Flight Inspection, the issuance of the corresponding NOTAM, informing the operating status of the radio aid mentioned.

(2) The CNS service provider shall ensure that the Aerodrome Control Tower and the Approach Control Facility receive in a timely manner, and in accordance with the use of the service or services, Information on the operational status of the radio navigation services essential for the approach, landing, and take-off at the aerodrome in question.

GM CNS.045 Provisions of information on the operational status of radio navigation services

Guidance material on the application of this Standard in the case of PBN-based operations supported by GNSS is contained in the Performance-based Navigation (PBN) Manual (Doc 9613).

CNS.050 Power supply for radio navigation aids and communication systems

(1) Needed sources of energy for ensuring continuity of service

The CNS service provider shall ensure that radio navigation aids installed in Mauritius, will have adequate sources of energy, and means of ensuring continuity of service according to the use of the service or services of which they are for. For this, the following equipment is considered necessary:

(a) Emergency power plants

(b) Uninterruptible power systems

(c) Battery banks

(d) Voltage and current regulators

(2) Independent secondary backup

The CNS service provider shall ensure that their communications, navigation, and surveillance systems have adequate sources of electrical energy, as well as independent secondary energy backup means that can be activated automatically, so as to ensure

uninterrupted continuity of service in the event of failure of the main power line.

(3) Protection against electric shock

The CNS service provider shall ensure that their communications, navigation and surveillance systems have protection systems against electric shock and induction.

(4) Ground systems

The CNS service provider shall ensure that the ground systems of their communications, navigation and surveillance systems are verified every (1) year.

(5) Continuity of radio navigation aids service

The CNS service provider shall establish maintenance programs in order to ensure the continuity of the service in the radio navigation aids, and the terrestrial elements of the communications systems of the types specified in MCAR CNS.

(6) Sufficient spare parts

The CNS service provider shall establish a procedure to ensure that sufficient spare parts are held to ensure the continuity of the aeronautical telecommunication service.

GM CNS.050 Power supply for radio navigation aids and communications systems

Guidance material on power supply switch-over is contained in Annex 10, Volume 1, Attachment C, 8.

AMC CNS.055 Human factors considerations

The CNS service provider should ensure that in the process of provision, monitoring and certification for their operation of communications systems, radio aids for aeronautical navigation and surveillance, the principles relating to Human factors set out in document 9683 - Human Factors Training Manual "and in Circular 249 Human Factors Compendium no. 11 - Human factors in ICAO CNS / ATM systems be implemented.

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CHAPTER 2

SPECIFICATION FOR RADIO NAVIGATION AIDS

CNS.060 Specification for ILS

The CNS service provider shall ensure that ILS systems to be installed in Mauritius comply with the applicable specifications set out in section 3.1 – "Specifications for ILS", Chapter 3 of Volume 1, Annex 10 of the Convention of the International Civil Aviation.

GM CNS.060 Specification for ILS

Attachment C, 2.11 of Volume 1 of Annex 10 of the Convention on International Civil Aviation, contains the guidance text on the use of DME as an alternative to the radio beacon component.

CNS.065 Specification for VHF Omnidirectional Radio Range (VOR)

The CNS service provider shall ensure that the VOR Systems to be installed in Mauritius comply with the applicable specifications established in section 3.3 – "Specifications for the VHF Omnidirectional Radio Range (VOR)", Chapter 3 of Volume 1, Annex 10 of the Convention of the International Civil Aviation.

GM CNS.065 Specification for VHF Omnidirectional Radio Range (VOR)

It is not possible at present to state quantitatively the maximum permissible magnitude of the vertically polarized component of the radiation from the VOR. (Information is provided in the Manual on Testing of Radio Navigation Aids (Doc 8071) as to flight checks that can be carried out to determine the effects of vertical polarization on the bearing accuracy).

CNS.070 Specification for Non- Directional Radio Beacon (NDB)

The CNS service provider shall ensure that the NDB Systems to be installed in Mauritius comply with the applicable specifications established in section 3.4 – "Specifications for the Non-Directional Radio beacon (NDB)", Chapter 3 of Volume 1, Annex 10 of the Convention of the International Civil Aviation.

GM CNS.070 Specification for Non- Directional Radio Beacon (NDB)

In Attachment C of Volume 1, Annex 10 guidance is given on the meaning and application of rated coverage and effective coverage and on coverage of NDBs.

CNS.075 Specification for UHF Distance Measuring Equipment (DME)

The CNS service provider shall ensure that the DME Systems to be installed in Mauritius comply with the applicable specifications established in section 3.5 – "specifications for UHF Distance Measuring Equipment (DME)" , Chapter 3 of Volume 1, Annex 10 of the Convention of the International Civil Aviation.

GM CNS.075 Specification for UHF Distance Measuring Equipment (DME)

Attachment C, 2.11 of Volume 1 of Annex 10 of the Convention on International Civil Aviation, provides guidance on the association of the DME with the ILS.

CNS.080 Requirements for the Global Navigation Satellite System (GNSS)

The CNS service provider as well as Aeronautical operators shall ensure that GNSS systems to be implemented in Mauritius comply, as appropriate, with the requirements established in section 3.7 – "Requirements for the Global Navigation System (GNSS)" and what is applicable in Appendix B of Chapter 3 of Volume 1, Annex 10 of the Convention of the International Civil Aviation.

GM CNS.080 Requirements for the Global Navigation Satellite System (GNSS)

Attachment D of Volume 1 of Annex 10 of the Convention on International Civil Aviation, provides guidance on information and material for guidance in the application of the GNSS Standards and Recommended practices.

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Volume 2

COMMUNICATION PROCEDURES INCLUDING THOSE WITH PANS STATUS

CHAPTER 1

ADMINISTRATIVE PROVISIONS RELATING TO THE INTERNATIONAL AERONAUTICAL TELECOMMUNICATION SERVICE

CNS.085 Division of service

The CNS services shall be divided in the following parts:

(1) aeronautical fixed service;

(2) aeronautical mobile service;

(3) aeronautical radionavigation service; and

(4) aeronautical broadcasting service.

CNS.090 Telecommunication - Access

The CNS service provider shall ensure that all aeronautical telecommunications stations are protected against unauthorized physical or remote access.

CNS.095 Hours of service

(1) The CNS service provider shall notify the normal hours of service of stations and offices of the international aeronautical telecommunications service under its control to the aeronautical telecommunication agencies designated to receive this information by other Administrations concerned.

(2) The CNS service provider shall notify any change in the normal hours of service, before such a change is effected, to the aeronautical telecommunication agencies designated to receive this information by other Administrations concerned. Such changes shall also, whenever necessary, be promulgated in NOTAM.

(3) If a station of the international aeronautical telecommunication service or an aircraft operator, requests a change in the hours of service of another station, such change shall be requested as soon as possible to the CNS service providers.

(4) The CNS service provider shall notify the station or aircraft operator requesting the

change of the result of the request, as soon as possible. The CNS service providers shall ensure that the international aeronautical telecommunications service is conducted in accordance with the provisions established in this MCAR.

CNS.100 Supervision

(1) Designated Authority

The CNS service provider shall be overseen by the Department of Civil Aviation, to verify that the international aeronautical telecommunications service is provided in accordance with the provisions and procedures contained in MCAR CNS and Annex 10 of the Convention of the International Civil Aviation.

(3) Serious infringements

When a station commits serious or repeated infringements to the procedures contained in MCAR CNS. The CNS service provider shall notify the Department of Civil Aviation as soon as possible.

AMC CNS.100 Supervision

(2) Not serious infringements

Occasional infringements of the procedures contained in MCAR CNS, when not serious, should be resolved by direct communications between the parties immediately involved using the most appropriate means.

(4) Exchange of information

The exchange of information regarding the performance of systems of communication, radio navigation, operation and maintenance, unusual transmission phenomena, etc. should be done by Department of Civil Aviation.

CNS.105 Superfluous transmissions

(1) Wilful transmission of unnecessary or anonymous signals

The CNS service provider shall ensure that there is no wilful transmission of unnecessary or anonymous signals, messages or data by any station within Mauritius.

(2) Monitoring programme

The CNS service provider shall maintain a monitoring program that identifies intentional transmissions that affect aeronautical telecommunications.

CNS.110 Interference

(1) Monitoring programme to detect harmful interference

(a) The CNS service provider shall maintain a monitoring program that detects harmful interference that affects aeronautical telecommunications.

(b) Before authorizing tests and experiments in any station, in order to avoid harmful interference, the CNS provider shall prescribe the taking of all possible precautions, such as the choice of frequency and of time, and the reduction or, if possible, the suppression of radiation.

(c) In the case of detecting harmful interference resulting from tests and experiments, the CNS service provider shall make the denunciations and other formalities before the regulatory body, in order to eliminate such interference as soon as possible.

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CHAPTER 2

GENERAL PROCEDURES FOR THE INTERNATIONAL AERONAUTICAL TELECOMMUNICATION SERVICE

CNS.115 General

The procedures outlined in this chapter are general in character and shall be applied by the CNS provider where appropriate to the other chapters contained in this Volume.

GM CNS.115 General

Detailed procedures, with special application to the service concerned, are contained in Chapters 3, 4, 5, 6 and 7 of Annex 10 of the Convention of the International Civil Aviation.

CNS.120 Extensions of service and closing down stations

(1) Extension of normal operations hours

Stations of the international aeronautical telecommunication service shall extend their normal hours of service as required to provide for traffic necessary for flight operation.

(2) Closing down of stations

Stations of the international aeronautical telecommunication service before closing down, shall notify their intention to all other stations with which it is in direct communication, confirm that an extension of service is not required and advise the time of re-opening if other than its normal hours of service.

(3) Closing down of stations when working regularly in a network on a common circuit

When it is working regularly in a network on a common circuit, a station shall notify its intention of closing down either to the control station, if any, or to all stations in the network. It shall continue watch for two minutes and may then close down if it has received no call during this period.

(4) Stations engaged in special situations

Stations with other than continuous hours of operation, engaged in, or expected to become engaged in distress, urgency, unlawful interference, or interception traffic, shall extend their normal hours of service to provide the required support to those communications.

CNS.125 Acceptance, transmission and delivery of messages

(1) Messages under special categories

Only those messages falling within the categories of Distress, Urgency, Relative to Flight Safety, Meteorology, Aeronautical Information Management, Relative to Regularity of Flights, Administrative Aeronautics and Service, shall be accepted for transmission by the Aeronautical Telecommunication service.

(a) The responsibility for determining the acceptability of a message shall rest with the station where the message is filed for transmission.

(b) Once the message is deemed acceptable, it shall be transmitted, relayed and/or delivered in accordance with the priority classification and without discrimination or undue delay.

(2) Messages for stations forming part of the aeronautical telecommunication service

(a) Only messages for stations forming part of the aeronautical telecommunication service shall be accepted for transmission, except where special arrangements have been made with the telecommunication authority concerned.

(b) Acceptance as a single message of a message intended for two or more addresses, whether at the same station or at different stations, shall be permitted subject, however, to the provisions prescribed in 4.4.3.1.2.3. of Chapter 4, Volume II of Annex 10 of the Convention of the International Civil Aviation.

(3) Messages handled for aircraft operators

Messages handled for aircraft operators shall be accepted only when handed into the telecommunication station in the form prescribed herein and by an authorized representative of that agency, or when received from that agency over an authorized circuit.

(4) Messages delivered to one or more aircraft operator

Each station of the aeronautical telecommunication service from which messages are delivered to one or more aircraft operator, a single office for each aircraft operator shall be designated by agreement between the aeronautical telecommunication agency and the aircraft operator concerned.

(5) Responsibility for delivery of messages

(a) Stations of the international aeronautical telecommunication service shall be responsible for delivery of messages to addressee(s) located within the boundaries of the aerodrome(s) served by that station and beyond those boundaries only to such addressee(s) as may be agreed by special arrangements with the Administrations concerned.

(b) Messages shall be delivered in the form of a written record, or other permanent means as prescribed by the Authority.

(6) Messages requiring transmission

(a) Messages originated in the aeronautical mobile service by an aircraft in flight and which require transmission over the aeronautical fixed telecommunication network

to effect delivery, shall be reprocessed by the aeronautical telecommunication station using the International Telegraphic Alphabet No. 2 (ITA-2) prior to transmission on the AFTN.

(b) Messages originated in the aeronautical mobile service by an aircraft in flight and which require transmission over the aeronautical fixed service, other than on AFTN circuits, shall also be reprocessed by the aeronautical telecommunication station into the ITA 2 format except where, subject to the provisions of MCAR CNS.125 (5)(a), prior and other arrangements have been made between the aeronautical telecommunication agency and the aircraft operating agency concerned for predetermined distribution of messages from aircraft.

(c) Messages (including air-reports) without specific address containing meteorological information received from an aircraft in flight shall be forwarded without delay to the meteorological office associated with the point of reception.

(d) Messages (including air-reports) without specific address containing air traffic services information from aircraft in flight shall be forwarded without delay to the air traffic services unit associated with the communication station receiving the message.

(e) When recording the text of air-reports in AIREP form, the data conventions approved by ICAO for this purpose shall be used wherever possible.

AMC CNS.125 Acceptance, transmission and delivery of messages

(1) Messages under special categories

(c) The authority in control of any station through which a message is relayed, should make representations at a later date to the authority in control of the accepting station regarding any message which is considered unacceptable.

(5) Responsibility for delivery of messages

(c) In cases where telephone is used without recording facilities for the delivery of messages, a written copy should be provided, as confirmation of delivery, as soon as possible.

GM CNS.125 Acceptance, transmission and delivery of messages

(6)(e) Provisions relating to the composition, including data conventions, of air-reports and to the order and form in which the elements of such reports are transmitted by the aircraft stations and recorded and retransmitted by the aeronautical stations, are contained in the PANS-ATM (Doc 4444).

CNS.130 Time system

(1) Coordinated Universal Time (UTC)

(a) Coordinated Universal Time (UTC) shall be used by all stations in the aeronautical telecommunication service.

(b) Midnight shall be designated as 2400 for the end of the day and 0000 for the beginning of the day.

(c) A date-time group shall consist of six figures, the first two figures representing the date of the month and the last four figures the hours and minutes in UTC.

CNS.135 Record of communications

(1) General

(a) A telecommunication log, written or automatic, shall be maintained in each station of the aeronautical telecommunication service except that an aircraft station, when using radiotelephony in direct communication with an aeronautical station, need not maintain a telecommunication log.

(i) Aeronautical stations shall record messages at the time of their receipt, except that, if during an emergency the continued manual recording would result in delays in communication, the recording of messages may be temporarily interrupted and completed at the earliest opportunity.

(ii) When a record is maintained in an aircraft station, either in a radiotelephone log or elsewhere, concerning distress communications, harmful interference, or interruption to communications, such a record shall be associated with information concerning the time and the position, and altitude of the aircraft.

(b) In written logs, entries shall be made only by operators on duty except that other persons having knowledge of facts pertinent to the entries may certify in the log the accuracy of operators' entries.

(c) All entries shall be complete, clear, correct and intelligible. Superfluous marks or notations shall not be made in the log.

(d) In written logs, any necessary correction in the log shall be made only by the person making the initial entry. The correction shall be accomplished by drawing or typing a single line through the incorrect entry, initialling same, recording the time and date of correction. The correct entry shall be made on the next line after the last entry.

(e) Telecommunication logs, written or automatic, shall be retained for a period of at least 30 days. When logs are pertinent to inquiries or investigations they shall be retained for longer periods until it is evident that they will be no longer required.

(f) The following information shall be entered in written logs:

(iii) the name of the agency operating the station;

(iv) the identification of the station;

(v) the date;

(vi) the time of opening and closing the station;

(vii) the signature of each operator, with the time the operator assumes and relinquishes a watch;

(viii) the frequencies being guarded and type of watch (continuous or scheduled) being maintained on each frequency;

(ix) except at intermediate mechanical relay stations where the provisions of this paragraph need not be complied with, a record of each communication, test transmission, or attempted communication showing text of communication, time communication completed, station(s) communicated with, and frequency used. The text of the communication may be omitted from the log when copies of the messages handled are available and form part of the log;

(x) all distress communications and action thereon;

(xi) a brief description of communication conditions and difficulties, including harmful interference. Such entries shall include, whenever practicable, the time at which interference was experienced, the character, radio frequency and identification of the interfering signal;

(xii) a brief description of interruption to communications due to equipment failure or other troubles, giving the duration of the interruption and action taken;

(xiii) such additional information as may be considered by the operator to be of value as a part of the record of the station's operations.

GM CNS.135 Record of communications

(1)(a) The telecommunication log will serve as a protection, should the operator's watch activities be investigated. It may be required as legal evidence.

CNS.140 Establishment of radio communication

(1) All stations shall answer calls directed to them by other stations in the aeronautical telecommunication service and shall exchange communications on request.

(2) All stations shall radiate the minimum power necessary to ensure a satisfactory service.

CNS.145 Use of abbreviations and codes

Abbreviations and codes shall be used in the international aeronautical telecommunication service whenever they are appropriate and their use will shorten or otherwise facilitate communication.

CNS.150 Cancellation of messages

Messages shall be canceled by a telecommunication station only when cancellation is authorized by the message originator.

CNS.155 Globally Unique Flight Identifier (GUFI)

(1) The originator of a preliminary flight plan (PFP) or eFPL shall assign a single GUFI to a flight for which the flight plan is to be submitted.

(2) The originator of a PFP or eFPL shall ensure that all FF-ICE messages submitted for a flight are identified by the same GUFI.

(3) When providing a response to an FF-ICE message, an FF-ICE services unit shall identify the subject flight using the GUFI contained in the message.

(4) An FF-ICE services unit shall reject an FF-ICE message if the message includes a GUFI identical to that of another flight known to the FF-ICE services unit.

(5) The format of a GUFI shall include a unique identification of the entity that generated the GUFI.

(6) The originator of a PFP or eFPL shall ensure that the GUFI assigned to the flight does not duplicate any other GUFI submitted by that originator within the past 10 years.

GM CNS.155 Globally Unique Flight Identifier (GUFI)

Procedures and guidance concerning FF-ICE services, and the use of GUFI are contained in the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444) and the Manual on Flight and Flow — Information for a Collaborative Environment (FF-ICE) (Doc 9965).

(1) In the context of GUFI assignment, a flight refers to a single intended operation of an aircraft with specified aircraft identification that starts at a specified departure aerodrome at a specified date and time and finishes at an arrival aerodrome.

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CHAPTER 3

AERONAUTICAL FIXED SERVICE (AFS)

CNS.160 General

(1) The aeronautical fixed service shall comprise the following systems and applications that are used for ground-ground (i.e. point-to-point and/or point-to-multipoint) communications in the international aeronautical telecommunication service:

(a) ATS direct speech circuits; in accordance with the provisions of section 4.2 of Chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(b) Meteorological operational channels and meteorological operational telecommunication networks; in accordance with the provisions of section 4.3 of Chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(c) The Aeronautical Fixed Telecommunication Network (AFTN); in accordance with the provisions of section 4.4 of Chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(d) The Common ICAO Data Interchange Network (CIDIN); in accordance with the provisions of section 4.5 of Chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(e) ATS Message Handling System (ATSMHS); in accordance with the provisions of section 4.6 of Chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(f) The Inter-Centre Communications (ICC); in accordance with the provisions of section 4.7 of Chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

GM CNS.160 General

(c) The AFTN provides a store-and-forward messaging service for the conveyance of text messages in ITA-2 or IA-5 format, using character-oriented procedures. Provisions relating to the AFTN are contained in 4.4, Chapter 4, Volume II of Annex 10.

(d) The CIDIN provides a common transport service for the conveyance of binary or text application messages, in support of the AFTN and OPMET applications. Procedural provisions relating to the CIDIN are contained in 4.5, Chapter 4, Volume II of Annex 10.

(e) The ATS (air traffic services) message handling services (ATSMHS) application allows ATS messages to be exchanged between service users over the aeronautical telecommunication network (ATN) internet communication service (ICS). Procedural provisions relating to ATS message handling services are contained in 4.6, Chapter 4, Volume II of Annex 10.

(f) The inter-centre communications applications enable the exchange of information between air traffic service units over the aeronautical telecommunication network (ATN) internet communication service (ICS), in support of notification, coordination, transfer of control, flight planning, airspace management and air traffic flow management. Procedural provisions relating to inter-centre communications are contained in 4.7, Chapter 4, Volume II of Annex 10.

The aeronautical telecommunication network through its ATSMHS and ICC applications enable the transition of existing AFTN and CIDIN users and systems into the ATN architecture.

CNS.165 Material permitted in AFS messages

(1) The following characters are allowed in text messages:

Letters: ABCDEFGHIJKLMNOPQRSTUVWXYZ

Figures: 1 2 3 4 5 6 7 8 9 0

Other signs:	-	(hyphen)
	?	(question mark)
	:	(colon)
	(	(open bracket)
	)	(close bracket)
	.	(full stop, period, or decimal point)
	,	(comma)
	’	(apostrophe)
	=	(double hyphen or equal sign)
	/	(oblique)
	+	(plus sign)

Characters other than those listed above shall not be used in messages unless absolutely necessary for understanding of the text. When used, they shall be spelled out in full.

(2) Roman numerals shall not be employed. If the originator of a message wishes the addressee to be informed that roman figures are intended, the arabic figure or figures shall be written and preceded by the word ROMAN.

(3) Messages using the ITA-2 key shall conform to the specifications contained in section

4.1.2.5 of Chapter 4, Volume II of Annex 10 of the Convention on Civil Aviation International.

(4) Messages using the IA-5 key shall conform to the specifications contained in section 4.1.2.6 of Chapter 4, Volume II of annex 10 of the Convention on Civil Aviation International.

(5) Text of messages shall be drafted in plain language or in abbreviations and codes. The originator shall avoid the use of plain language when reduction in the length of the text by appropriate abbreviations and codes is practicable. Words and phrases which are not essential, such as expressions of politeness, shall not be used.

CNS.170 Meteorological operational channels and meteorological operational telecommunication network

Meteorological operational channel procedures and meteorological operational communication network procedures shall be compatible with aeronautical fixed telecommunication network (AFTN) or ATS Message Handling Services (ATSMHS) procedures.

GM CNS.170 Meteorological operational channels and meteorological operational telecommunication network

“Compatible” is to be interpreted as a mode of operation ensuring that the information exchanged over the meteorological operational channels also can be exchanged over the AFTN or AMHS without harmful effect on the operation of the AFTN or AMHS and vice versa.

CNS.175 Aeronautical Fixed Telecommunication Network (AFTN)

(1) General

(a) Categories of messages

The following categories of message shall be handled by the aeronautical fixed Telecommunication network:

(1) Distress messages;

(2) Urgency messages;

(3) Flight safety messages;

(4) Meteorological messages;

(5) Flight regularity messages;

(6) Aeronautical information services (AIS)

(7) Aeronautical administrative messages;

(8) Service messages.

(i) Distress messages (priority indicator SS)

This message category shall comprise those messages sent by mobile stations reporting that they are threatened by grave and imminent danger and all other messages relative to the immediate assistance required by the mobile station in distress.

(ii) Urgency messages (priority indicator DD)

This category shall comprise messages concerning the safety of a ship, aircraft or other vehicles, or of some person on board or within sight.

(iii) Flight safety messages (priority indicator FF) shall comprise:

(1) movement and control messages as defined in the PANS-ATM (Doc 4444), Chapter 11;

(2) messages originated by an aircraft operating agency of immediate concern to aircraft in flight or preparing to depart;

(3) meteorological messages restricted to SIGMET information, special air-reports, AIRMET messages, volcanic ash and tropical cyclone advisory information and amended forecasts.

(iv) Meteorological messages (priority indicator GG) shall comprise:

(1) messages concerning forecasts, e.g. terminal aerodrome forecasts (TAFs), area and route forecasts;

(2) messages concerning observations and reports, e.g. METAR, SPECI.

(v) Flight regularity messages (priority indicator GG) shall comprise:

(1) aircraft load messages required for weight and balance computation;

(2) messages concerning changes in aircraft operating schedules;

(3) messages concerning aircraft servicing;

(4) messages concerning changes in collective requirements for passengers, crew and cargo covered by deviation from normal operating schedules;

(5) messages concerning non-routine landings;

(6) messages concerning pre-flight arrangements for air navigation services and operational servicing for non-scheduled aircraft operations, e.g. overflight clearance requests;

(7) messages originated by aircraft operators reporting an aircraft arrival or departure;

(8) messages concerning parts and materials urgently required for the operation of aircraft.

(vi) Aeronautical information services (AIS) messages (priority indicator GG) shall comprise:

(1) messages concerning NOTAMs;

(2) messages concerning SNOWTAMs

(vii) Aeronautical administrative messages (priority indicator KK) shall comprise:

(1) messages regarding the operation or maintenance of facilities provided for the safety or regularity of aircraft operations;

(2) messages concerning the functioning of aeronautical telecommunication services;

(3) messages exchanged between civil aviation authorities relating to aeronautical services.

(viii) Messages requesting information shall take the same priority indicator as the category of message being requested except where a higher priority is warranted for flight safety.

(ix) Service messages (priority indicator as appropriate). This category shall comprise messages originated by aeronautical fixed stations to obtain information or verification concerning other messages which appear to have been transmitted incorrectly by the aeronautical fixed service, confirming channel-sequence numbers, etc. Service messages shall conform to the specifications contained in section 4.4.1.1.9 of Chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(b) Order of priority

(i) The order of priority for the transmission of messages in the aeronautical fixed telecommunication network shall be as follows:

Transmission Priority	Priority indicator
1	SS
2	DD FF
3	GG KK

(c) Routing of messages

The routing of messages shall be according to ICAO Annex 10, volume 2, 4.4.1.3.

(d) Supervision of message traffic

The supervision of messages shall be according to ICAO Annex 10, volume 2, 4.4.1.4.

(e) Failure of communications

The failure of communications shall be according to ICAO Annex 10, volume 2, 4.4.1.5.

(f) Long-term retention of AFTN traffic records

(i) Copies of all messages, in their entirety, transmitted by an AFTN origin station shall be retained for a period of at least 30 days.

(ii) AFTN destination stations shall retain, for a period of at least 30 days, a record containing the information necessary to identify all messages received and the action taken thereon.

(g) Short-term retention of AFTN traffic records

(i) AFTN communication centres shall retain, for a period of at least one hour, a copy of all messages, in their entirety, retransmitted or relayed by that communication centre.

(ii) In cases where acknowledgement is made between AFTN communication centres, a relay centre shall be considered as having no further responsibility for retransmission or repetition of a message for which it has received positive acknowledgement, and it may be deleted from its records.

(2) Message format-International Telegraph Alphabet No. 2 (ITA-2)

(a) All messages, unless otherwise specified in the current MCAR-CNS, will be presented in the International Telegraph alphabet format No. 2 (ITA-2).

(b) Messages shall be according to ICAO Annex 10, volume 2, chapter 4, 4.4.2.

(c) Heading

The heading of the AFTN messages is in the same way as specified in paragraph 4.4.2.1, chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(d) Address

AFTN messages is in the same way as specified in paragraph 4.4.3, chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(e) Origin

The origin of the AFTN messages is in the same way as specified in paragraph 4.4.4, chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(f) Text

The text of the AFTN messages is in the same way as specified in paragraph 4.4.5, chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(g) Ending

The ending of the AFTN messages is in the same way as specified in paragraph 4.4.6, chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

(h) Stripped address

The stripped address of the AFTN messages is in the same way as specified from paragraph 4.4.8 until 4.4.17.3.1, chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

AMC CNS.175 Aeronautical Fixed Telecommunication Network (AFTN)

(1) General

(b) Order of priority

(ii) Messages having the same priority indicator should be transmitted in the order in which they are received for transmission.

(f) Long-term retention of AFTN traffic records

(ii) AFTN communication centres should retain, for a period of at least 30 days, a record containing the information necessary to identify all messages relayed or retransmitted and the action taken thereon.

(h) Test procedures on AFTN Channels

Test messages transmitted on AFTN channels for the purpose of testing and repairing lines should consist of the following:

(i) the start-of-message signal;

(ii) the procedure signal QJH;

(iii) the originator indicator;

(iv) three page-copy lines of the sequence of characters RY in ITA-2 or U(5/5) *(2/10) in IA-5; and

(v) the end-of-message signal.

GM CNS.175 Aeronautical Fixed Telecommunication Network (AFTN)

(1)(f)(i) The AFTN origin station, although responsible for ensuring that AFTN traffic is recorded, is not necessarily the unit where the records are made and retained. By local agreement the State concerned may permit the originators to perform those functions.

(1)(f)(ii) The provision for identification of messages mentioned in (1)(o)(ii) may be obtained by recording the heading, address and origin parts of messages.

(1)(f)(iii) The provision for identification of messages mentioned in (1)(o)(iii) may be obtained by recording the heading, address and origin parts of messages.

(2) An illustration of the ITA-2 message format is given in Figure 4-1. Chapter 4, volume II of Annex 10 of the Convention on International Civil Aviation.

In the subsequent Standards relative to message format the following symbols have been used in making reference to the functions assigned to certain signals in the International Telegraph Alphabet No. 2 (see Volume III, Part I, 8.2.1 and Table 8-1).

Symbol	Signification
<	CARRIAGERETURN (signal no. 27)
≡	LINEFEED (signal no.28)
↓	LETTERSHIFT (signal no.29)
↑	FIGURESHIFT (signal no.30)
→	SPACE (signal no.31)

CNS.180 Common ICAO Data Interchange Network (CIDIN)

The common ICAO data interchange network shall be in the same way as specified in paragraph 4.5, chapter 4, Volume II of Annex 10 of the Convention on International Civil Aviation.

GM CNS.180 Common ICAO Data Interchange Network (CIDIN)

(a) The common ICAO data interchange network (CIDIN), which comprises application entities and communication services for ground-ground message exchange, makes use of protocols based on the International Telegraph and Telephone Consultative Committee (CCITT) X.25 Recommendation to provide code and byte-independent communication facilities.

(b) The principal goals of the CIDIN are to improve the AFTN and to support large message transmission and more demanding applications, such as operational meteorological information (OPMET), between two or multiple ground systems.

(c) Details of CIDIN communication procedures, as implemented in Europe, are shown in the EUR CIDIN Manual.

CNS.185 ATS Message Handling Services (ATSMHS)

The ATS message service of the ATS (Air Traffic Services) message handling service (ATSMHS) application shall be used to exchange ATS messages between users over the aeronautical telecommunication network (ATN) internet, as specified in paragraph 4.6, chapter 4, Volume II of annex 10 of the International Civil Aviation Convention.

GM CNS.185 ATS Message Handling Services (ATSMHS)

(a) The ATS message service comprised in the ATS message handling service application aims at providing generic message services over the ATN internet communication service (ICS). It may, in turn, be used as a communication system by user-applications communicating over the ATN. This may be achieved, for example, by means of application programme interfaces to the ATS message service.

(b) The detailed specification of the ATS message handling service application is included in the Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols (Doc 9880), Part II.

(c) The ATS message service is provided by the implementation over the ATN internet communication service of the message handling systems specified in ISO/IEC (International Organization for Standardization/International Electrotechnical Commission) 10021 and ITU-T (International Telecommunication Union — Telecommunication Standardization Sector) X.400 and complemented by the additional requirements specified in the Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols (Doc 9880), Part II. The two sets of documents, the ISO/IEC MOTIS (Message-Oriented Text Interchange System) International Standards and the ITU-T X.400 Series of Recommendations (1988 or later) are, in principle, aligned with each other. However, there are a small number of differences. In the above-mentioned document, reference is made to the relevant ISO International Standards and International Standardized Profiles (ISP), where applicable. Where necessary, e.g. for reasons of interworking or to point out differences, reference is also made to the relevant X.400 Recommendations.

(d) The following types of ATN end systems performing ATS message handling services are defined in the Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols (Doc 9880), Part II:

(i) an ATS message server;

(ii) an ATS message user agent; and

(iii) an AFTN/AMHS gateway (aeronautical fixed telecommunication network/ATS message handling system).

Connections may be established over the internet communications service between any pair constituted of these ATN end systems (see Table 4-1).

Table 4-1. Communications between ATN end systems implementing ATS message handling services

ATN End System 1	ATN End System 2
ATS Message Server	ATS Message Server
ATS Message Server	AFTN/AMHS Gateway
ATS Message Server	ATS Message User Agent
AFTN/AMHS Gateway	AFTN/AMHS Gateway

Table 4-1

CNS.190 Inter-Centre Communications (ICC)

The Inter-Centre Communications (ICC) applications set shall be used to exchange ATS messages between air traffic service users over the ATN internet.

GM CNS.190 Inter-Centre Communication (ICC)

(a) The ICC applications set enables the exchange of information in support of the following operational services:

(i) flight notification;

(ii) flight coordination;

(iii) transfer of control and communications;

(iv) flight planning;

(v) airspace management; and

(vi) air traffic flow management.

(b) The first of the applications developed for the ICC set is the ATS interfacility data communication (AIDC).

(c) The AIDC application exchanges information between ATS units (ATSUs) for support of critical air traffic control (ATC) functions, such as notification of flights approaching a

flight information region (FIR) boundary, coordination of boundary conditions and transfer of control and communications authority.

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CHAPTER 4

AERONAUTICAL MOBILE SERVICE - VOICE COMMUNICATIONS

CNS.195 General

(1) In all communications the highest standard of discipline shall be observed at all times.

(a) The ATS shall develop a phraseology and radiotelephony procedures manual based on ICAO standardized phraseology and it shall be used in all situations for which it has been specified. Only when standardized phraseology cannot serve an intended transmission, plain language shall be used.

(b) Transmission of messages, other than those specified in CNS.200, on aeronautical mobile frequencies when the aeronautical fixed services are able to serve the intended purpose, shall be avoided.

(2) Where it is necessary for an aircraft station to send signals for testing or adjustment which are liable to interfere with the working of a neighbouring aeronautical station, the consent of the station shall be obtained before such signals are sent. Such transmissions shall be kept to a minimum.

(3) When it is necessary for a station in the aeronautical mobile service to make test signals, either for the adjustment of a transmitter before making a call or for the adjustment of a receiver, such signals shall not continue for more than 10 seconds and shall be composed of spoken numerals (ONE, TWO, THREE, etc.) in radiotelephony, followed by the radio call sign of the station transmitting the test signals. Such transmissions shall be kept to a minimum.

(4) except as otherwise provided, the responsibility of establishing communication shall rest with the station having traffic to transmit.

(6) When an aeronautical station is called simultaneously by several aircraft stations, the aeronautical station shall decide the order in which aircraft shall communicate.

(7) In communications between aircraft stations, the duration of communication shall be controlled by the aircraft station which is receiving, subject to the intervention of an aeronautical station. If such communications take place on an ATS frequency, prior permission of the aeronautical station shall be obtained. Such requests for permission are not required for brief exchanges.

AMC CNS.195 General

(1) In all communications the highest standard of discipline should be observed at all times

(c) In all communications, the consequences of human performance which could affect the accurate reception and comprehension of messages should be taken into consideration.

(5) After a call has been made to the aeronautical station, a period of at least 10 seconds should elapse before a second call is made. This shall eliminate unnecessary transmissions while the aeronautical station is getting ready to reply to the initial call.

GM CNS.195 General

(1) For the purposes of these provisions, the communication procedures applicable to the aeronautical mobile service, as appropriate, also apply to the aeronautical mobile satellite service.

(a) Guidance material for the implementation of the aeronautical mobile satellite service is contained in the Manual on the Aeronautical Mobile Satellite (Route) Service (Doc. 9925). Additional guidance for satellite voice communications (SATVOICE) is contained in the Satellite Voice Operations Manual (Doc. 10038) and the Performance-based Communication and Surveillance (PBCS) Manual (Doc. 9869).

(c) Guidance material on human performance can be found in the Human Factors Training Manual (Doc 9683).

(4) In certain cases when SELCAL is used the procedures respecting the establishment of communications are contained in paragraph 5.2.4, chapter 5, volume II of Annex 10 of the International Civil Aviation Convention.

CNS.200 Categories of messages

(1) The categories of messages handled by the aeronautical mobile service and the order of priority in the establishment of communications and the transmission of messages shall be in accordance with the following table.

Message category and order of priority signal	Radiotelephony signal
(a) Distress calls, distress messages and distress traffic	MAYDAY
(b) Urgency messages, including messages preceded by the medical transports signal	PAN, PAN or PAN, PAN MEDICAL
(c) Communications relating to direction finding	–
(d) Flight safety messages	–
(e) Meteorological messages	–
(f) Flight regularity messages	–

(2) Distress messages and distress traffic shall be handled in accordance with the provisions of paragraph 5.3, chapter 5, volume II of Annex 10 of the International Civil Aviation Convention.

(3) Urgency messages and urgency traffic, including messages preceded by the medical transports signal, shall be handled in accordance with the provisions of paragraph 5.3, chapter 5, volume II of Annex 10 of the International Civil Aviation Convention.

(4) Communications relating to direction finding shall be handled in accordance with Chapter 6, volume II of Annex 10 of the International Civil Aviation Convention.

(5) Flight safety messages shall comprise the following:

(a) movement and control messages [see the PANS-ATM (Doc 4444)];

(b) messages originated by an aircraft operating agency or by an aircraft, of immediate concern to an aircraft in flight;

(c) meteorological advice of immediate concern to an aircraft in flight or about to depart (individually communicated or for broadcast);

(d) other messages concerning aircraft in flight or about to depart.

(6) Meteorological messages shall comprise meteorological information to or from aircraft, other than those in CNS.200, (5)(c).

(7) Flight regularity messages shall comprise the following:

(a) messages regarding the operation or maintenance of facilities essential for the safety or regularity of aircraft operation;

(b) messages concerning the servicing of aircraft;

(c) instructions to aircraft operating agency representatives concerning changes in requirements for passengers and crew caused by unavoidable deviations from normal operating schedules. Individual requirements of passengers or crew shall not be admissible in this type of message;

(d) messages concerning non-routine landings to be made by the aircraft;

(e) messages concerning aircraft parts and materials urgently required;

(f) messages concerning changes in aircraft operating schedules.

(8) Air traffic services units using direct pilot-controller communication channels shall only be required to handle flight regularity messages provided this can be achieved without interference with their primary role and no other channels are available for the handling of such messages.

(10) Interpilot air-to-air communication shall comprise messages related to any matter affecting safety and regularity of flight. The category and priority of these messages shall be determined on the basis of their content in accordance with paragraph 5.1.8, chapter 5, volume II of Annex 10 of the International Civil Aviation Convention.

AMC CNS.200 Categories of messages

(9) Messages having the same priority should, in general, be transmitted in the order in which they are received for transmission.

GM CNS.200 Categories of messages

(1) Messages concerning acts of unlawful interference constitute a case of exceptional circumstances which may preclude the use of recognized communication procedures used to determine message category and priority.

A NOTAM may qualify for any of the categories or priorities c) to f) inclusive. The decision as to which priority will depend on the contents of the NOTAM and its importance to the aircraft concerned.

(3) The term “medical transports” is defined in the 1949 Geneva Conventions and Additional Protocols (see also RR S33 Section III) and refers to “any means of transportation by land, water, or air, whether military or civilian, permanent or temporary, assigned exclusively to medical transportation and under the control of a competent authority of a Party to the conflict”.

CNS.205 Cancellation of messages

(1) Incomplete transmissions

If a message has not been completely transmitted when instructions to cancel are received, the station transmitting the message shall instruct the receiving station to disregard the incomplete transmission. This shall be effected in radiotelephony by use of an appropriate phrase.

(3) The station cancelling a transmission shall be responsible for any further action required.

AMC CNS.205 Cancellation of messages

(2) Complete transmissions

When a completed message transmission is being held pending correction and the receiving station is to be informed to take no forwarding action, or when delivery or onward relay cannot be accomplished, transmission should be cancelled. This should be effected in radiotelephony by the use of an appropriate phrase.

CNS.210 Radiotelephony procedures

Radiotelephony procedures shall be in accordance with paragraph 5.2 until 5.2.4.6.1, chapter 5, volume II of Annex 10 of the International Civil Aviation Convention.

CNS.215 Distress and urgency radiotelephony communication procedures

(1) General

(a) Distress and urgency traffic shall comprise all radiotelephony messages relative to the distress and urgency conditions respectively. Distress and urgency conditions are defined as:

(i) Distress: a condition of being threatened by serious and/or imminent danger and of requiring immediate assistance.

(ii) Urgency: a condition concerning the safety of an aircraft or other vehicle, or of some person on board or within sight, but which does not require immediate assistance.

(b) The radiotelephony distress signal MAYDAY and the radiotelephony urgency signal PAN PAN shall be used at the commencement of the first distress and urgency communication respectively.

(c) At the commencement of any subsequent communication in distress and urgency traffic, it shall be permissible to use the radiotelephony distress and urgency signals.

(d) The originator of messages addressed to an aircraft in distress or urgency condition shall restrict to the minimum the number and volume and content of such messages as required by the condition.

(e) If no acknowledgement of the distress or urgency message is made by the station addressed by the aircraft, other stations shall render assistance, as prescribed in paragraphs 5.3.2.2 and 5.3.3.2 respectively of chapter 5, volume II of Annex 10 of the International Civil Aviation Convention.

(f) Distress and urgency traffic shall normally be maintained on the frequency on which such traffic was initiated until it is considered that better assistance can be provided by transferring that traffic to another frequency.

(g) In cases of distress and urgency communications, in general, the transmissions by radiotelephony shall be made slowly and distinctly, each word being clearly pronounced to facilitate transcription.

GM CNS.215 Distress and urgency radiotelephony communication procedures

(1) General

The distress and urgency procedures contained in 5.3, chapter 5, volume II of Annex 10 of the International Civil Aviation Convention relate to the use of radiotelephony. The provisions of Article S30 and Appendix S13 of the ITU Radio Regulations are generally applicable, except that S30.9 permits other procedures to be employed where special arrangements between governments exist, and are also applicable to radiotelephony communications between aircraft stations and stations in the maritime mobile service.

(e) "Other stations" is intended to refer to any other station which has received the distress or urgency message and has become aware that it has not been acknowledged by the station addressed.

(f) 121.5 MHz or alternative available VHF or HF frequencies may be used as appropriate.

CNS.220 Radiotelephony distress communications

(1) Action by the aircraft in distress

(a) In addition to being preceded by the radiotelephony distress signal MAYDAY (see CNS.215(1)(b)), preferably spoken three times, the distress message to be sent by an aircraft in distress shall:

(i) be on the air-ground frequency in use at the time;

(ii) consist of as many as possible of the following elements spoken distinctly and, if possible, in the following order:

(1) name of the station addressed (time and circumstances permitting);

(2) the identification of the aircraft;

(3) the nature of the distress condition;

(4) intention of the person in command;

(5) present position, level (i.e. flight level, altitude, etc., as appropriate) and heading.

(2) Action by the station addressed or first station acknowledging the distress message

(a) The station addressed by aircraft in distress, or first station acknowledging the distress message, shall:

(i) immediately acknowledge the distress message;

(ii) take control of the communications or specifically and clearly transfer that responsibility, advising the aircraft if a transfer is made;

(iii) take immediate action to ensure that all necessary information is made available, as soon as possible, to:

(1) the ATS unit concerned;

(2) the aircraft operating agency concerned, or its representative, in accordance with pre-established arrangements;

(iv) warn other stations, as appropriate, in order to prevent the transfer of traffic to the frequency of the distress communication.

(3) Imposition of silence

(a) The station in distress, or the station in control of distress traffic, shall be permitted to impose silence, either on all stations of the mobile service in the area or on any station which interferes with the distress traffic. It shall address these instructions "to all stations", or to one station only, according to circumstances. In either case, it shall use:

(i) STOP TRANSMITTING;

(ii) the radiotelephony distress signal MAYDAY.

(b) The use of the signals specified in (3)(a) above shall be reserved for the aircraft station in distress and for the station controlling the distress traffic.

(4) Action by all other stations

(a) The distress communications have absolute priority over all other communications, and a station aware of them shall not transmit on the frequency concerned, unless:

(i) the distress is cancelled or the distress traffic is terminated;

(ii) all distress traffic has been transferred to other frequencies;

(iii) the station controlling communications gives permission;

(iv) it has itself to render assistance.

(b) Any station which has knowledge of distress traffic, and which cannot itself assist the station in distress, shall nevertheless continue listening to such traffic until it is evident that assistance is being provided.

(5) Termination of distress communications and of silence

(a) When an aircraft is no longer in distress, it shall transmit a message cancelling the distress condition.

(b) When the station which has controlled the distress communication traffic becomes aware that the distress condition is ended, it shall take immediate action to ensure that this information is made available, as soon as possible, to:

(i) the ATS unit concerned;

(ii) the aircraft operating agency concerned, or its representative, in accordance with pre-established arrangements.

(c) The distress communication and silence conditions shall be terminated by transmitting a message, including the words "DISTRESS TRAFFIC ENDED", on the frequency or frequencies being used for the distress traffic. This message shall be originated only by the station controlling the communications when, after the reception of the message prescribed in (5)(a) above, it is authorized to do so by the appropriate Authority.

GM CNS.220 Radiotelephony distress communications

(1) The foregoing provisions may be supplemented by the following measures:

(a) the distress message of an aircraft in distress being made on the emergency frequency 121.5 MHz or another aeronautical mobile frequency, if considered necessary or desirable. Not all aeronautical stations maintain a continuous guard on the emergency frequency;

(b) the distress message of an aircraft in distress being broadcast, if time and circumstances make this course preferable;

(c) the aircraft transmitting on the maritime mobile service radiotelephony calling frequencies;

(d) the aircraft using any means at its disposal to attract attention and make known its conditions (including the activation of the appropriate SSR mode and code);

(e) any station taking any means at its disposal to assist an aircraft in distress;

(f) any variation on the elements listed under 5.3.2.1.1 b) of Annex 10, Vol. II, when the transmitting station is not itself in distress, provided that such circumstance is clearly stated in the distress message.

The station addressed will normally be that station communicating with the aircraft or in whose area of responsibility the aircraft is operating.

(2) The requirement to inform the aircraft operating agency concerned does not have priority over any other action which involves the safety of the flight in distress, or of any other flight in the area, or which might affect the progress of expected flights in the area.

CNS.225 Radiotelephony urgency communications

(1) Action by the aircraft reporting an urgency condition except as indicated in paragraph 5.3.3.4, chapter 5, volume II of Annex 10 of the International Civil Aviation Convention.

(a) In addition to being preceded by the radiotelephony urgency signal PAN PAN (see CNS.215(1)(b)), preferably spoken three times and each word of the group pronounced as the French word “panne”, the urgency message to be sent by an aircraft reporting an urgency condition shall:

(i) be on the air-ground frequency in use at the time;

(ii) consist of as many as required of the following elements spoken distinctly and, if possible, in the following order:

(1) the name of the station addressed;

(2) the identification of the aircraft;

(3) the nature of the urgency condition;

(4) the intention of the person in command;

(5) present position, level (i.e. flight level, altitude, etc., as appropriate) and heading;

(6) any other useful information.

(2) Action by the station addressed or first station acknowledging the urgency message

(a) The station addressed by an aircraft reporting an urgency condition, or first station acknowledging the urgency message, shall:

(i) acknowledge the urgency message;

(ii) take immediate action to ensure that all necessary information is made available, as soon as possible, to:

(1) the ATS unit concerned;

(2) the aircraft operating agency concerned, or its representative, in accordance with pre-established arrangements;

(iii) if necessary, exercise control of communications.

(3) Action by all other stations

The urgency communications have priority over all other communications, except distress, and all stations shall take care not to interfere with the transmission of urgency traffic.

(4) Action by an aircraft used for medical transports

(a) The use of the signal described in (4)(b) below shall indicate that the message which follows concerns a protected medical transport pursuant to the 1949 Geneva Conventions and Additional Protocols.

(b) For the purpose of announcing and identifying aircraft used for medical transports, a transmission of the radiotelephony urgency signal PAN PAN, preferably spoken three times, and each word of the group pronounced as the French word “panne”, shall be followed by the radiotelephony signal for medical transports MAY-DEE-CAL, pronounced as in the French “médical”. The use of the signals described above indicates that the message which follows concerns a protected medical transport. The message shall convey the following data:

(i) the call sign or other recognized means of identification of the medical transports;

(ii) position of the medical transports;

(iii) number and type of medical transports;

(iv) intended route;

(v) estimated time en route and of departure and arrival, as appropriate; and

(vi) any other information such as flight altitude, radio frequencies guarded, languages used, and secondary surveillance radar modes and codes.

(5) Action by the station addressed or by other stations receiving a medical transports message.

The provisions of 5.3.3.2 and 5.3.3.3 of Annex 10, Vol. II shall apply as appropriate to stations receiving a medical transports messages.

GM CNS.225 Radiotelephony urgency communications

(1) The foregoing provisions of paragraph 5.3.3.1.1, chapter 5, volume II of Annex 10 of the International Civil Aviation Convention are not intended to prevent an aircraft broadcasting an urgency message, if time and circumstances make this course preferable.

The station addressed will normally be that station communicating with the aircraft or in whose area of responsibility the aircraft is operating.

(2) The requirement to inform the aircraft operating agency concerned does not have priority over any other action which involves the safety of the flight in distress, or of any other flight in the area, or which might affect the progress of expected flights in the area.

CNS.230 Communications related to acts of Unlawful Interference

The station addressed by an aircraft being subjected to an act of unlawful interference, or first station acknowledging a call from such aircraft, shall render all possible assistance, including notification of appropriate ATS units as well as any other station, agency or person in a position to facilitate the flight.

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CHAPTER 5

AERONAUTICAL RADIO NAVIGATION SERVICE

CNS.235 General

(1) The aeronautical radio navigation service shall comprise all types and systems of radio navigation aids in the international aeronautical service.

(2) The CNS service provider shall ensure that an aeronautical radio navigation aid which is not in continuous operation shall, if practicable, be put into operation on receipt of a request from an aircraft, the air traffic services, or an authorized representative of an aircraft operating agency.

(3) The CNS service provider shall ensure that arrangements shall be made for the aeronautical information service unit to receive without delay essential information about changes in the operational status of non-visual aids as required for pre-flight briefing and dissemination in accordance with the provisions of MCAR AIS.

AMC CNS.235 General

(2)(a) Requests from aircraft should be made to the aeronautical station concerned on the air-ground frequency normally in use.

CNS.240 Direction finding

In the case of use of the direction finding, the station or the set of radio direction-finding stations shall comply with the provisions of 6.2 to 6.2.13, chapter 6, Volume II of Annex 10 of the Convention of the International Civil Aviation.

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CHAPTER 6

AERONAUTICAL BROADCASTING SERVICE

CNS.245 General

(1) Broadcast material

The text of broadcast material shall be prepared by the originator in the form desired for transmission.

(2) Frequencies and schedules

(a) The broadcasts shall be made on specified frequencies and at specified times.

(b) Schedules and frequencies of all broadcasts shall be publicized in appropriate documents. Any change in frequencies or times shall be publicized by NOTAM at least two weeks in advance of the change. Additionally, any such change shall, if practicable, be announced on all regular broadcasts for 48 hours preceding the change and shall be transmitted once at the beginning and once at the end of each broadcast.

(c) Scheduled broadcasts (other than sequential collective type broadcasts), shall be started at the scheduled time by the general call. If a broadcast must be delayed, a short notice shall be transmitted at the scheduled time advising recipients to "stand by" and stating the approximate number of minutes of delay.

(i) After definite advice has been given to stand by for a certain period, the broadcast shall not be started until the end of the standby period.

(d) Where broadcasts are conducted on a time-allotment basis, transmission shall be terminated by each station promptly at the end of the allotted time period whether or not transmission of all material has been completed.

(i) In sequential collective type broadcasts each station shall be ready to commence its broadcasts at the designated time. If for any reason a station does not commence its broadcast at the designated time, the station immediately following in sequence shall wait and then commence its broadcast at its own designated time.

(3) Interruption of service

In the event of interruption of service at the station responsible for a broadcast, the broadcast shall, if possible, be made by another station until normal service is resumed. If this is not possible, and the broadcast is of the type intended for interception by fixed stations, the stations which are required to copy the broadcasts shall continue to listen on the specified frequencies until normal service is resumed.

GM CNS.245 General

(2)(b) This does not prevent an emergency change of frequency when required in circumstances which do not permit the promulgation of a NOTAM at least two weeks in advance of the change.

CNS.250 Radiotelephone Broadcast Procedures

(1) Broadcast technique

(a) Transmissions by radiotelephone shall be as natural, short and concise as practicable consistent with clarity.

(b) The rate of speech on radiotelephone broadcasts shall not exceed 100 words per minute.

(2) Preamble of the general call

The preamble of each radiotelephone broadcast shall consist of the general call, station name, and optionally the time of broadcast (UTC).

GM CNS.250 Radiotelephone Broadcast Procedures

The following example illustrates the application of this procedure:

(general call)	ALL STATIONS
(the words THIS IS)	THIS IS
(station name)	NEW YORK RADIO
(time of broadcast)	TIME, ZERO ZERO FOUR FIVE

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CHAPTER 7

AERONAUTICAL MOBILE SERVICE – DATA LINK COMMUNICATIONS

CNS.255 General

(1) In relation to the general provisions relating to Aeronautical mobile service Data link communications, the specifications given in section 8.1, Chapter 8, Volume II of annex 10 of the Convention on International Civil Aviation shall be applied.

GM CNS.255 General

While the provisions of Chapter 8 of Annex 10, vol. II are based primarily on the use of controller-pilot data link communications (CPDLC), the provisions of 8.1 would apply to other data link applications, where applicable, including surveillance — contract (ADS-C) and data link-flight information services (e.g. D-ATIS, D-VOLMET, etc.).

For the purposes of these provisions, the communication procedures applicable to the aeronautical mobile service, as appropriate, also apply to the aeronautical mobile satellite service.

Guidance material relating to CPDLC, ADS-C and related data link initiation capability (DLIC) can be found in the Global Operational Data Link (GOLD) Manual (Doc 10037).

CNS.260 CPDLC Procedures

(1) In all communications the highest standard of discipline shall be observed at all times.

(2) Ground and airborne systems shall provide controllers and pilots with the capability to review and validate any operational messages they send.

(3) Ground and airborne systems shall provide controllers and pilots with the capability to review, validate and when applicable, acknowledge any operational messages they receive.

(4) The controller shall be provided with the capability to respond to messages, including emergencies, to issue clearances, instructions and advisories, and to request and provide information, as appropriate.

(5) The pilot shall be provided with the capability to respond to messages, to request clearances and information, to report information, and to declare or cancel an emergency.

(6) The pilot and the controller shall be provided with the capability to exchange messages which include standard message elements, free text message elements or a combination of both.

(7) Unless specified by the ATS, voice read-back of CPDLC messages shall not be required.

(8) Establishment of CPDLC

The processes for the establishment of CPDLC shall comply with what is specified in section 8.2.8, chapter 8, Volume II of Annex 10 of the Convention on International Civil Aviation.

(9) Exchange of operational CPDLC messages

The exchange of operational CPDLC messages, shall be in accordance with the provisions of section 8.2.9, chapter 8, Volume II of Annex 10 to the convention on International Civil Aviation.

(11) Free text message elements

The use of free text message elements by controllers or pilots shall not be others than the elements normalized in MCAR CNS.255.

(12) Emergencies, hazards and equipment failure procedures

Emergencies, hazard and equipment failure procedures shall be, in accordance with the provisions of section 8.2.12, chapter 8, Volume II of Annex 10 to the convention on International Civil Aviation.

AMC CNS.260 CPDLC Procedures

(1) In all communications the highest standard of discipline should be observed at all times

(a) Consequences of human performance, which could affect the accurate reception and comprehension of messages, should be taken into consideration when composing a message.

(10) Display of CPDLC messages

ATC units utilizing a CPDLC message contained in the PANS-ATM should display the associated text pertaining to that message as presented in the PANS-ATM, Appendix 5.

GM CNS.260 CPDLC Procedures

(1) The CPDLC message set referred to in this section can be found in the PANS-ATM, Appendix 5.

(1)(a) Guidance material on human performance can be found in the Human Factors Training Manual (Doc 9683) and Human Factors Guidelines for Air Traffic Management (ATM) Systems (Doc 9758).

(11) Whilst it is recognized that non-routine and emergency situations may necessitate the use of free text, particularly when voice communication has failed, the avoidance of utilizing free text messages is intended to reduce the possibility of misinterpretation and ambiguity.

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Volume 3

COMMUNICATION SYSTEMS

Part I – Digital Data Communication Systems

Part II – Voice Communication Systems)

CHAPTER 1

AERONAUTICAL TELECOMMUNICATION NETWORK

CNS.265 Introduction

(1) The ATN is specifically and exclusively intended to provide digital data communications services to the air traffic service provider and aircraft operators in support of:

(a) air traffic services communications (ATSC) with aircraft;

(b) air traffic services communications between ATS units;

(c) aeronautical operational control communications (AOC); and

(d) aeronautical administrative communications (AAC).

CNS.270 General

(1) ATN communication services shall support ATN applications.

(2) Requirements for implementation of the ATN shall be made on the basis of regional air navigation agreements. These agreements shall specify the area in which the communication standards for the ATN/OSI or the ATN/IPS are applicable.

GM CNS.270 General

The Standards and Recommended Practices in sections 3.4 to 3.8 of chapter 3, Volume III of Annex 10 to the convention on International Civil Aviation, define the minimum required protocols and services that will enable the global implementation of the aeronautical telecommunication network (ATN).

CNS.275 General requirements

(1) The ATN shall either use International Organization for Standardization (ISO) communication standards for open systems interconnection (OSI) or use the Internet Society (ISOC) communications standards for the Internet Protocol Suite (IPS).

(2) The AFTN/AMHS gateway shall ensure the interoperability of AFTN and CIDIN stations and networks with the ATN.

(3) An authorized path(s) shall be defined on the basis of a predefined routing policy.

(4) The ATN shall transmit, relay and deliver messages in accordance with the priority classifications and without discrimination or undue delay.

(5) The ATN shall provide means to define data communications that can be carried only over authorized paths for the traffic type and category specified by the user.

(6) The ATN shall provide communication in accordance with the prescribed required communication performance (RCP).

(7) The ATN shall operate in accordance with the communication priorities defined in Table 3-1 and Table 3-2. Chapter 3 Volume III Annex 10 to the Convention on International Civil Aviation.

(8) The ATN shall enable exchange of application information when one or more authorized paths exist.

(9) The ATN shall notify the appropriate application processes when no authorized path exists.

(10) The ATN shall make provisions for the efficient use of limited bandwidth subnetworks.

(13) The ATN shall enable the exchange of address information between applications.

(14) Where the absolute time of day is used within the ATN, it shall be accurate to within 1 second of coordinated universal time (UTC).

AMC CNS.275 General requirements

(11) The ATN should enable an aircraft intermediate system (router) to connect to a ground intermediate system (router) via different subnetworks.

(12) The ATN should enable an aircraft intermediate system (router) to connect to different ground intermediate systems (routers).

GM CNS.275 General requirements

(1) ATN/IPS implementation is preferred for ground-ground networks. While ATN/OSI continues to be supported in air-ground networks, particularly when using VDL Mode 2, it is expected that future air-ground implementations will use the ATN/IPS.

Interoperability between interconnecting OSI/IPS networks is expected to be arranged prior to implementation.

Guidance material on interoperability between ATN/OSI and ATN/IPS is contained in Doc 9896.

(6) The Manual on Required Communication Performance (RCP) (Doc 9869) contains the necessary information on RCP.

(14) The time accuracy value results in synchronization errors of up to two seconds.

CNS.280 ATN Applications requirements

(1) System applications

(a) The ATN shall support the data link initiation capability (DLIC) applications when air-ground data links are implemented.

(b) The ATN/OSI end-system shall support the following directory services (DIR) application functions when AMHS and/or security protocols are implemented:

(i) directory information retrieval; and

(ii) directory information modification.

(2) Air - Ground applications

(a) The ATN shall be capable of supporting one or more of the following applications:

(i) ADS-C;

(ii) CPDLC; and

(iii) FIS (including ATIS and METAR).

(3) Ground - ground applications

(a) The ATN shall be capable of supporting the following applications:

(i) ATS interfacility data communication (AIDC); and

(ii) ATS message handling services applications (ATSMHS).

GM CNS.280 Applications requirements

System applications provide services that are necessary for operation of the ATN.

(1)(a) The Manual of Air Traffic Services Data Link Applications (Doc 9694, Part I) defines the data link initiation capability (DLIC) application.

(2) See the Manual of Air Traffic Services Data Link Applications (Doc 9694).

CNS.285 ATN Communications Service Requirements

(1) ATN/IPS upper layer communications service

An ATN host shall be capable of supporting the ATN/IPS upper layers including an application layer.

(2) ATN/OSI upper layer communications service

An ATN/OSI end-system (ES) shall be capable of supporting the OSI upper layer communications service (ULCS) including session, presentation and application layers.

(3) ATN/IPS communications service

(a) An ATN host shall be capable of supporting the ATN/IPS including the:

(i) transport layer in accordance with RFC 793 (TCP) and RFC 768 (UDP); and

(ii) network layer in accordance with RFC 2460 (IPv6).

(b) An IPS router shall support the ATN network layer in accordance with RFC 2460 (IPv6) and RFC 4271 (BGP), and RFC 2858 (BGP multiprotocol extensions).

(4) ATN/OSI communications service

(a) An ATN/OSI end-system shall be capable of supporting the ATN including the:

(i) transport layer in accordance with ISO/IEC 8073 (TP4) and optionally ISO/IEC 8602 (CLTP); and

(ii) network layer in accordance with ISO/IEC 8473 (CLNP).

(b) An ATN intermediate system (IS) shall support the ATN network layer in accordance with ISO/IEC 8473 (CLNP) and ISO/IEC 10747 (IDRP).

GM CNS.285 ATN Communications Service Requirements

(1) An ATN host is an ATN end-system in OSI terminology; an ATN end-system is an ATN host in IPS terminology.

CNS.290 ATN naming and addressing requirements

(1) The ATN shall provide provisions for unambiguous application identification.

(2) The ATN shall provide provisions for unambiguous addressing.

(3) The ATN shall provide means to unambiguously address all ATN end-systems (hosts) and intermediate systems (routers).

(4) The ATN addressing and naming plans shall allow the CNS provider to assign addresses and names within administrative domains.

GM CNS.290 ATN naming and addressing requirements

The ATN naming and addressing scheme supports the principles of unambiguous identification of intermediate systems (routers) and end-systems (hosts) and provides global address standardization.

CNS.295 ATN security requirements

(1) The ATN shall make provisions whereby only the controlling ATS unit may provide ATC instructions to aircraft operating in its airspace.

(2) The ATN shall enable the recipient of a message to identify the originator of that message.

(3) ATN end-systems supporting ATN security services shall be capable of authenticating the identity of peer end- systems, authenticating the source of messages and ensuring the data integrity of the messages.

(4) The ATN services shall be protected against service attacks to a level consistent with the application service requirements.

GM CNS.295 ATN security requirements

(1) This is achieved through the current and next data authority aspects of the controller-pilot data link communications (CPDLC) application.

(3) The use of security is the default; however, its implementation is based on local policy.

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CHAPTER 2

AERONAUTICAL MOBILE-SATELLITE (ROUTE) SERVICE (AMS(R)S)

CNS.300 General

(1) Any mobile-satellite system intended to provide AMS(R)S shall conform to the requirements of chapter 4, Volume III, Part I of Annex 10 to the Convention on International Civil Aviation.

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

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

(3) The agreements indicated in CNS.295 (2) shall provide at least two years' notice of mandatory carriage of airborne systems.

AMC CNS.300 General

(4) The CNS provider through the Department of Civil Aviation 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.

CNS.305 RF Characteristics

(1) Frequency bands

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

(2) Emissions

(a) The total emissions of the AES necessary to meet designed system performance shall be controlled to avoid harmful interference to other systems necessary to support safety and regularity of air navigation, installed on the same or other aircraft.

(b) Interference to other AMS(R)S equipment

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

(3) Susceptibility

(a) 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.

GM CNS.305 RF Characteristics

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

(2)(a) Harmful interference can result from radiated and/or conducted emissions that include harmonics, discrete spurious, intermodulation product and noise emissions, and are not necessarily limited to the “transmitter on” state.

Protection requirements for GNSS are contained in Annex 10, Volume I.

(2)(b) One method of complying with CNS.300 (2)(b) is by limiting emissions in the operating band of other AMS(R)S equipment to a level consistent with the intersystem interference requirements such as contained in RTCA document DO-215. RTCA and EUROCAE may establish new performance standards for future AMS(R)S which may describe methods of compliance with this requirement.

CNS.310 Priority and Pre-Emptive Access

(1) Every aircraft earth station and ground earth station shall be designed to ensure that messages transmitted in accordance with Annex 10, Volume II, 5.1.8, including 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 not defined in Annex 10, Volume II, 5.1.8 shall be terminated even without warning, to allow Annex 10, Volume II, 5.1.8 type messages to be transmitted and received.

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

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

CNS.315 Signal Acquisition and Tracking

(1) The AES, GES and satellites shall properly acquire and track service link signals when the aircraft is moving at a ground speed of up to 1 500 km/h (800 knots) along any heading.

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

AMC CNS.315 Signal Acquisition and Tracking

(1)(a) The AES, GES and satellites should properly acquire and track service link signals when the aircraft is moving at a ground speed of up to 2 800 km/h (1 500 knots) along any heading.

(2)(a) The AES, GES and satellites should properly acquire and track service link signals when the component of the aircraft acceleration vector in the plane of the satellite orbit is up to 1.2 g.

CNS.320 Performance Requirements

(1) Designated operational coverage

(a) An AMS(R)S system shall provide AMS(R)S throughout its designated operational coverage (DOC).

(2) Failure notification

(a) In the event of a service failure, an AMS(R)S system shall provide timely predictions of the time, location and duration of any resultant outages until full service is restored.

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

(3) AES requirements

(a) The AES shall meet the relevant performance requirements contained in 4.6.4 and 4.6.5 of Chapter 4, Volume III, Part I of Annex 10 to the Convention on International Civil Aviation for aircraft in straight and level flight throughout the designated operational coverage of the satellite system.

(4) Packet data service performance

(a) If the system provides AMS(R)S packet data service, the relevant performance requirements contained in 4.6.4 and 4.6.5 sections of Chapter 4, Volume III, part I of annex 10 to the Convention on International Civil Aviation shall be met.

(5) Security

(a) The system shall provide features for the protection of messages in transit from tampering.

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

(c) The system shall provide features for protection against unauthorized entry.

AMC CNS.320 Performance Requirements

(3) AES requirements

(a)(i) The AES should meet the relevant performance requirements contained in 4.6.4 and 4.6.5 of Chapter 4, Volume III, Part I of Annex 10 to the Convention on International Civil Aviation for aircraft attitudes of +20/-5 degrees of pitch and +/-25 degrees of roll throughout the DOC of the satellite system.

GM CNS.320 Performance Requirements

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

(4) System performance standards for packet data service may also be found in RTCA Document DO-270.

(5)(b) Possible methods of such attack include intentional flooding with spurious messages, intentional corruption of system software or databases, or physical destruction of the support infrastructure.

(5)(c) These features are intended to provide protection against spoofing and “phantom controllers”.

CNS.325 System Interfaces

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

(2) Packet data service interfaces

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

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

GM CNS.325 System Interfaces

(1) Provisions on the allocation and assignment of ICAO 24-bit addresses are contained in the Appendix to Chapter 9, Volume III, part I of annex 10 to the Convention on International Civil Aviation.

(2) The detailed technical specifications related to provisions of the ATN-compliant subnetwork service are contained in Section 5.2.5 and Section 5.7.2 of Doc 9880 — Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) (in preparation by ICAO).

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CHAPTER 3

VHF AIR-GROUND DIGITAL LINK (VDL)

CNS.330 System Capabilities

(1) Radio channels and functional channels

(a) Aircraft station radio frequency range. An aircraft station shall be capable of tuning to any of the channels in the range specified in Section 6.1.4.1 of Volume III, part I of annex 10 to the Convention on International Civil Aviation within 100 milliseconds after the receipt of an autotune command. In addition, for VDL Mode 3, an aircraft station shall be able to tune to any channel in the range specified in Section 6.1.4.1 within 100 milliseconds after the receipt of any tuning command.

(b) Ground station radio frequency range. A ground station shall be capable of operating on its assigned channel within the radio frequency range detailed in 6.1.4.1. Volume III, part I of annex 10 to the Convention on International Civil Aviation.

(c) Common signalling channel. Frequency 136.975MHz shall be reserved as a worldwide common signalling channel (CSC) for VDL Mode 2.

(2) System Capabilities

(a) Data transparency. The VDL system shall provide code-independent, byte-independent transfer of data.

(b) Broadcast. The VDL system shall provide link layer data broadcast services (Mode 2) and/or voice and data broadcast services (Mode 3). For VDL Mode 3, the data broadcast service shall support network multicasting capability originating from the ground.

(c) Connection management. The VDL system shall establish and maintain a reliable communications path between the aircraft and the ground system while allowing but not requiring manual intervention.

(d) Ground network transition. A VDL-equipped aircraft shall transition from one ground station to another when ircumstances dictate.

(e) Voice capability. The VDL Mode 3 system shall support a transparent, simplex voice operation based on a “Listen-Before-Push-To-Talk” channel access.

(3) Air-ground VHF digital link communications system characteristics

(a) The radio frequencies used shall be selected from the radio frequencies in the band 117.975–137 MHz. The lowest assignable frequency shall be 118.000 MHz, and the highest assignable frequency shall be 136.975 MHz. The separation between assignable frequencies (channel spacing) shall be 25 kHz.

(b) The design polarization of emissions shall be vertical.

GM CNS.330 System Capabilities

The very high frequency (VHF) digital link (VDL) Mode 2 and the VDL Mode 4 provide data service capabilities. The VDL Mode 3 provides both voice and data service capabilities. The data capability is a constituent mobile subnetwork of the aeronautical telecommunication network (ATN). In addition, the VDL may provide non-ATN functions. Standards and Recommended Practices (SARPs) for the VDL are defined and referenced below.

Additional information on VDL is contained in the Manuals on VHF VDL Mode 2, VDL Mode 3 and VDL Mode 4 Technical Specifications (Docs 9776, 9805 and 9816).

Sections 6.1.2 to 6.8.2 2 of Annex 10, Volume III of the Convention on International Civil Aviation contain Standards and Recommended Practices for VDL Modes 2 and 3. Section 6.9 contains Standards and Recommended Practices for VDL Mode 4.

(2)(c) In this context “reliable” is defined by the BER requirement specified in 6.3.5.1 of Volume III, part I of annex 10 to the Convention on International Civil Aviation.

(3)(a) Volume V specifies that the block of frequencies from 136.9 – 136.975 MHz inclusive is reserved for VHF air-ground digital communications.

CNS.335 System characteristics of the ground installation

(1) Ground station transmitting function

(a) Frequency stability. The radio frequency of VDL ground station equipment operation shall not vary more than plus or minus 0.0002 per cent (2 parts per million) from the assigned frequency.

(3) Spurious emissions

(a) Spurious emissions shall be kept at the lowest value which the state of the technique and the nature of the service permit.

(4) Adjacent channel emissions

(a) The amount of power from a VDL ground transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the first adjacent channel shall not exceed 0 dBm.

(i) The amount of power from all new installations of a VDL ground transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the first adjacent channel shall not exceed 2 dBm.

(b) The amount of power from a VDL ground transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the second

adjacent channel shall be less than minus 25 dBm and from thereon it shall monotonically decrease at the minimum rate of 5 dB per octave to a maximum value of minus 52 dBm.

(i) The amount of power from all new installations of a VDL ground transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the second adjacent channel shall be less than minus 28 dBm.

(ii) The amount of power from all new installations of a VDL ground transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the fourth adjacent channel shall be less than minus 38 dBm, and from thereon it shall monotonically decrease at the minimum rate of 5 dB per octave to a maximum value of minus 53 dBm.

(c) The amount of power from a VDL ground transmitter under all operating conditions when measured over a 16 kHz channel bandwidth centred on the first adjacent channel shall not exceed minus 20 dBm.

(i) The amount of power from all new installations of a VDL ground transmitter under all operating conditions when measured over a 16 kHz channel bandwidth centred on the first adjacent channel shall not exceed minus 18 dBm.

AMC CNS.335 System characteristics of the ground installation

(2) Power

The effective radiated power should be such as to provide a field strength of at least 75 microvolts per metre (minus 109 dBW/m^2) within the defined operational coverage of the facility, on the basis of free-space propagation.

GM CNS.335 System characteristics of the ground installation

(1)(a) The frequency stability for VDL ground stations using DSB-AM modulation is specified in Part II, Chapter 2 for 25 kHz channel spacing.

(3)(a) Appendix S3 to the Radio Regulations specifies the levels of spurious emissions to which transmitters must conform.

CNS.340 System characteristics of the aircraft installation

(1) Frequency stability

The radio frequency of VDL aircraft equipment shall not vary more than plus or minus 0.0005 per cent (5 parts per million) from the assigned frequency

(2) Power

The effective radiated power shall be such as to provide a field strength of at least 20 microvolts per metre (minus 120 dBW/m2) on the basis of free-space propagation, at ranges and altitudes appropriate to the operational conditions pertaining to the areas over which the aircraft is operated.

(3) Spurious emissions

(a) Spurious emissions shall be kept at the lowest value which the state of the technique and the nature of the service permit.

(4) Adjacent channel emissions

(a) The amount of power from a VDL aircraft transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the first adjacent channel shall not exceed 0 dBm.

(i) The amount of power from all new installations of a VDL aircraft transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the first adjacent channel shall not exceed 2 dBm.

(b) The amount of power from a VDL aircraft transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the second adjacent channel shall be less than minus 25 dBm and from thereon it shall monotonically decrease at the minimum rate of 5 dB per octave to a maximum value of minus 52 dBm.

(i) The amount of power from all new installations of a VDL aircraft transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the second adjacent channel shall be less than minus 28 dBm.

(ii) The amount of power from all new installations of a VDL aircraft transmitter under all operating conditions when measured over the 25 kHz channel bandwidth of the fourth adjacent channel shall be less than minus 38 dBm, and from thereon it shall monotonically decrease at the minimum rate of 5 dB per octave to a maximum value of minus 53 dBm.

(c) The amount of power from a VDL aircraft transmitter under all operating conditions when measured over a 16 kHz channel bandwidth centred on the first adjacent channel shall not exceed minus 20 dBm.

(i) The amount of power from all new installations of a VDL aircraft transmitter under all operating conditions when measured over a 16 kHz channel bandwidth centred on the first adjacent channel shall not exceed minus 18 dBm.

(5) Receiving function

(a) Specified error rate

The specified error rate for Mode 2 operation shall be the maximum corrected Bit Error Rate (BER) of 1 in 10^4. The specified error rate for Mode 3 operation

shall be the maximum uncorrected BER of 1 in 10^3. The specified error rate for Mode 4 operation shall be the maximum uncorrected BER of 1 in 10^4.

(b) Sensitivity

The receiving function shall satisfy the specified error rate with a desired signal strength of not more than 20 microvolts per metre (minus 120 dBW/m2).

(c) Out-of-band immunity performance. The receiving function shall satisfy the specified error rate with a desired signal field strength of not more than 40 microvolts per metre (minus 114 dBW/m2) and with an undesired DSB-AM D8PSK or GFSK signal on the adjacent or any other assignable channel being at least 40 dB higher than the desired signal.

(i) The receiving function of all new installations of VDL shall satisfy the specified error rate with a desired signal field strength of not more than 40 microvolts per metre (minus 114 dBW/m2) and with an undesired VHF DSB-AM, D8PSK or GFSK signal at least 60 dB higher than the desired signal on any assignable channel 100 kHz or more away from the assigned channel of the desired signal.

(d) Interference immunity performance

(i) The receiving function shall satisfy the specified error rate with a desired field strength of not more than 40 microvolts per metre, and with one or more out-of-band signals, except for VHF FM broadcast signals, having a total level at the receiver input of minus 33 dBm.

(ii) The receiving function shall satisfy the specified error rate with a desired field strength of not more than 40 microvolts per metre, and with one or more VHF FM broadcast signals having a total level at the receiver input of minus 5 dBm.

GM CNS.340 System characteristics of the aircraft installation

(3) Appendix S3 to the Radio Regulations specifies the levels of spurious emissions to which transmitters must conform.

(5)(a) The above physical layer BER requirements are derived from the BER requirement imposed by ATN at the subnetwork interface.

(5)(b) The required signal strength at the edge of the service volume takes into account the requirements of the system and signal losses within the system and considers environmental noise sources.

(5)(c) This level of interference immunity performance provides a receiver performance consistent with the influence of the VDL RF spectrum mask as specified in 6.3.4 of Annex 10, Volume III of the Convention on International Civil Aviation with an effective isolation transmitter/receiver isolation of 69 dB. Better transmitter and receiver performance could result in less isolation required. Guidance material on the measurement technique is included in the Handbook on Radio Frequency

Spectrum Requirements for Civil Aviation including statement of approved ICAO policies (Doc 9718).

(5)(d) In areas where adjacent higher band signal interference exceeds this specification, a higher immunity requirement will apply.

CNS.345 Physical layer protocols and services

In relation to the protocols and services of the physical layer, the standards and recommended practices in section 6.4 of Chapter 6, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation shall be applied.

CNS.350 Link layer protocols and services

In relation to the protocols and services of the link layer, the standards and recommended practices in section 6.5 of Chapter 6, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation shall be applied.

CNS.355 Subnetwork layer protocols and services

In relation to the protocols and services of the subnetwork layer, the standards and recommended practices in section 6.6 of Chapter 6, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation shall be applied.

CNS.360 The VDL mobile subnetwork dependent convergence function (SNDCF)

In relation to the protocols and services of the VDL mobile subnetwork layer, the standards and recommended practices in section 6.7 of Chapter 6, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation shall be applied.

CNS.365 Voice unit for mode 3

In relation to the protocols and services of the voice unit for mode 3, the standards and recommended practices in section 6.8 of Chapter 6, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation shall be applied.

CNS.370 VDL mode 4

In relation to the protocols and services of the VDL mode 4, the standards and recommended practices in section 6.9 of Chapter 6, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation shall be applied.

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CHAPTER 4

AERONAUTICAL MOBILE AIRPORT COMMUNICATIONS SYSTEM (AEROMACS)

CNS.375 General

In relation to the protocols and services of the aeronautical mobile airport communications system, the Standards and Recommended Practices in Chapter 7, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation shall be applied.

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CHAPTER 5

AFTN NETWORK

CNS.380 Technical provisions relating to teletypewriter apparatus and circuits used in the AFTN

In relation to the technical provisions relating to teletypewriter apparatus and circuits used in the AFTN, the standards and recommended practices in section 8.2 of Chapter 8, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation are not applicable to Mauritius.

CNS.385 Technical equipment associated with aeronautical radioteletypewriter channels operating in the band 2.5 – 30 MHz

In relation to the terminal equipment associated with aeronautical radioteletypewriter channels operating in the band 2.5 – 30 MHz, the standards and recommended practices in section 8.3 of Chapter 8, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation are not applicable to Mauritius.

AMC CNS.390 Characteristics of interregional AFS circuits

Interregional AFS circuits being implemented or upgraded should employ high quality telecommunications service. Modulation rate should take into account traffic volumes expected under both normal and alternate route conditions.

CNS.395 Technical provisions relating to ATS message transmission

(1) Interconnection by direct or omnibus channels — low modulation rates — 5-unit code shall be used.

AMC CNS.395 Technical provisions relating to ATS message transmission

(2) AFTN techniques should be used.

GM CNS.395 Identification

See CNS.395 for medium modulation rates.

CNS.400 Technical provisions relating to international Ground-Ground data interchange at medium and higher signalling rates

In relation to the technical provisions relating to international ground-ground data interchange at medium and higher signalling rates, the standards and recommended practices in section 8.6 of Chapter 8, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation shall be applied.

GM CNS.400 Technical provisions relating to international Ground-Ground data interchange at medium and higher signalling rates

Throughout this section in the context of coded character sets, the term “unit” means the unit of selective information and is essentially equivalent to the term “bit”.

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CHAPTER 6

AIRCRAFT ADDRESSING SYSTEM

CNS.405 General

(1) The aircraft address shall be one of 16 777 214 twenty-four-bit aircraft addresses allocated by ICAO to the State of Registry or common mark registering authority and assigned as prescribed in the Appendix to chapter 9, Volume III of the Convention on International Civil Aviation.

(2) Non-aircraft transponders that are installed on aerodrome surface vehicles, obstacles or fixed Mode S target detection devices for surveillance and/or radar monitoring purposes shall be assigned 24-bit aircraft addresses.

AMC CNS.405 General

(3) Mode S transponders used under specific conditions stated in CNS.405 (2) should not have any negative impact on the performance of existing ATS surveillance systems and ACAS.

GM CNS.405 General

(2) Under such specific conditions, the term “aircraft” can be understood as “aircraft (or pseudo-aircraft) or vehicle (A/V)” where a limited set of data is generally sufficient for operational purposes.

CNS.410 A worldwide scheme for the allocation, assignment and application of aircraft address

(1) General

Global communications, navigation and surveillance systems shall use an individual aircraft address composed of 24 bits. At any one time, no address shall be assigned to more than one aircraft. The assignment of aircraft addresses requires a comprehensive scheme providing for a balanced and expandable distribution of aircraft addresses applicable worldwide.

(2) Description of the Scheme

Table 9-1 of the Appendix to Chapter 9, Volume III, Part 1 of Annex 10 of the Convention on International Civil Aviation, provides for blocks of consecutive addresses available to States for assignment to aircraft. Each block is defined by a fixed pattern of the first 4, 6, 9, 11, 12 or 13 bits of the 24-bit address. Thus, blocks of different sizes (1 048 576, 262 144, 32 768, 8 192, 4 096 and 2 048 consecutive addresses, respectively) are made available.

(3) Management of the Scheme

The CNS provider shall not be responsible for the administration of the scheme, the International Civil Aviation Organization (ICAO) will administer the scheme so that appropriate international distribution of aircraft addresses can be maintained.

CNS.415 Allocation of aircraft addresses

(1) Blocks of aircraft addresses will not be allocated by the CNS provider, these will be allocated by ICAO to the State of Registry or common mark registering authority. Address allocations to States shall be as shown in Table 9-1 of the Appendix to Chapter 9, Volume III, Part 1 of Annex 10 of the Convention on International Civil Aviation.

(2) The State of registry or commom mark registering authority shall notify ICAO when allocation of additional block of addresses is required by Mauritius for assignment to aircrafts.

(3) Any future requirement for additional aircraft addresses shall be accommodated through coordination between ICAO and the DCA, for additional aircraft addresses a request shall only be made when at least 75 per cent of the number of addresses already allocated to the DCA have been assigned to aircraft.

CNS.420 Assignment of aircraft addresses

(1) During the registration process, using its allocated block of addresses, the State of registry or common mark registering authority shall assign an individual aircraft address to each suitably equipped aircraft entered on a national register.

(2) Aircraft addresses shall be assigned to aircraft in accordance with the following principles:

(a) At any one time, no address shall be assigned to more than one aircraft;

(b) Only one address shall be assigned to an aircraft, irrespective of the composition of equipment on board. In the case when a removable transponder is shared by several light aviation aircraft such as balloons or gliders, it shall be possible to assign a unique address to the removable transponder. Registers 08_{16} and 20_{16} of the removable transponder shall be correctly updated each time the removable transponder is installed in any aircraft;

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

(d) When an aircraft changes its State of Registry, the new registering State shall assign the aircraft a new address from its own allocation address block, and the old aircraft address shall be returned to the allocation address block of Mauritius;

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

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

(3) Assignment of aircraft addresses to unmanned aircraft (UA)

GM CNS.420 Assignment of aircraft addresses

(3) States may need to consider withholding aircraft addresses to unmanned aircraft (UA) unless certain criteria have been met. Proper and efficient utilization of available bandwidth and capacity at 1 090 MHz is a key element to ensure the safe operation of aeronautical surveillance systems, including secondary surveillance radar (SSR), automatic dependent surveillance — broadcast (ADS-B) and airborne collision avoidance systems (ACAS). A large number of UA equipped with ADS-B OUT transmitters operating at 1 090 MHz may adversely affect the operation of surveillance systems in the area. Reference is made to the guidance material contained in the Aeronautical Surveillance Manual (Doc 9924), intended to assist States when validating the utilization of 1 090 MHz.

CNS.425 Administration of the aircraft address assignment

(1) The State of Registry or common mark registering authority shall administer the allocated block of aircraft addresses so that appropriate assignment of aircraft addresses within its allocated block can be maintained.

(2) An administrative procedure shall be established and published for requesting and assigning aircraft addresses.

(3) The State of Registry or common mark registering authority shall put in place measures to ensure that aircraft registered under their responsibility are flying with a correct aircraft address.

(4) A temporary addresses shall be assigned to an aircraft in exceptional circumstances, such as when operators have been unable to obtain an address from their individual States of Registry or common mark registering authority in a timely manner. ICAO shall assign temporary addresses from the block “ICAO[1]” shown in Table 9-1 of Appendix 9, Annex 10 Volume III.

GM CNS.425 Administration of the aircraft address assignment

(1) The aircraft address is an essential element that needs to be correctly configured in an aircraft to support operation of systems and functions, such as SSR Mode S, ADS-B, datalink, collision avoidance and emergency location.

(2) An example of an effective administrative procedure, including the indication of the aircraft address in the certificate of registration, which can be used by the State of Registry or common mark registering authority, can be found in the Aeronautical Surveillance Manual (Doc 9924).

(3) Examples of such measures can be found in 2.1.7 of Appendix O of the Aeronautical Surveillance Manual (Doc 9924).

CNS.430 Application of aircraft addresses

(1) The aircraft addresses shall be used in applications which require the routing of information to or from individual suitably equipped aircraft.

(2) An address consisting of 24 ZEROs shall not be used for any application.

GM CNS.430 Application of aircraft addresses

Examples of such applications are the aeronautical telecommunication network (ATN), SSR Mode S, ADS-B, emergency locator transmitter (ELT) and airborne collision avoidance system (ACAS).

This Standard does not preclude assigning the aircraft addresses for special applications associated with the general applications defined therein. An example of such a special application is the fixed Mode S transponders (reporting the on-the-ground status as specified in Annex 10, Volume IV, 3.1.2.6.10.1.2) to monitor the Mode S ground station operation. Address assignments for special applications are to be carried out in conformance with the procedure established by Mauritius to manage the 24-bit address assignments to aircraft.

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CHAPTER 7

POINT TO MULTIPOINT COMMUNICATIONS

CNS.435 Service via satellite for the dissemination of aeronautical information

Point-to-multipoint telecommunication service via satellite to support the dissemination of aeronautical information shall be based on full-time, non pre-emptible, protected services as defined in the relevant CCITT Recommendations.

AMC CNS.440 Service satellite for the dissemination of WAFS products

(1) System characteristics should include the following:

(a) frequency – C-band, earth-to-satellite, 6 GHz band, satellite-to-earth, 4 GHz band;

(b) capacity with effective signalling rate of not less than 9 600 bits/s;

(c) bit error rates – better than 1 in 107;

(d) forward error correction; and

(e) availability 99.95 per cent.

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CHAPTER 8
HF DATA LINK

GM CNS.445 System capabilities

The Standards and Recommended Practices of Chapter 11, Volume III, Part 1 of Annex 10 of the Convention on International Civil Aviation are specific to the high frequency data link (HFDL) and are in addition to the requirements specified in the ITU Radio Regulations (Appendix 27). The HFDL is a constituent mobile subnetwork of the aeronautical telecommunication network (ATN), operating in the aeronautical mobile (R) high frequency bands. In addition, the HFDL may provide non-ATN functions, such as direct link service (DLS). The HFDL system must enable aircraft to exchange data with ground-based users.

CNS.450 HF data link system

(1) System architecture

The HFDL system shall consist of one or more ground and aircraft station subsystems, which implement the HFDL protocol (see CNS.445). The HFDL system shall also include a ground management subsystem (see CNS.450).

(a) Aircraft and ground station subsystems

The HFDL aircraft station subsystem and the HFDL ground station subsystem shall include the following functions:

(i) HF transmission and reception;

(ii) data modulation and demodulation; and

(iii) HFDL protocol implementation and frequency selection.

(2) Operational coverage

Frequency assignments for HFDL shall be protected throughout their designated operational coverage (DOC) area.

(3) Requirements for carriage of HFDL equipment

Requirements for mandatory carriage of HFDL equipment shall be made on the basis of regional air navigation agreements that specify the airspace of operation and the implementation timescale.

(a) Notice

The agreement above shall provide advance notice of at least two years for the mandatory carriage of airborne systems.

(5) Ground station synchronization

Synchronization of HFDL ground station subsystems shall be to within ±25 ms of UTC. For any station not operating within ±25 ms of UTC, appropriate notification shall be made to all aircraft and ground station subsystems to allow for continued system operation.

(6) Quality of service

(a) Residual packet error rate

The undetected error rate for a network user packet which contains between 1 and 128 octets of user data shall be equal to or less than 1 in 10^6.

(b) Speed of service

Transit and transfer delays for network user packets (128 octets) with priorities defined in Annex 10, Volume 3, Part I, Chapter 4, Table 4-26 for message priorities 7 through 14, shall not exceed the values of Table 11-1*.

AMC CNS.450 HF data link system

(4) Ground station networking

HFDL ground station subsystems should interconnect through a common ground management subsystem.

GM CNS.450 HF data link system

DOC areas may be different from current MWARAs or RDARAs as defined in Appendix 27 to the ITU Radio Regulations.

Additional coordination with ITU is required in cases where DOC areas are not in conformity with the allotment areas specified in the ITU Radio Regulations.

(4) This provides a distributed subnetwork, with a subnetwork point of attachment (SNPA), depending on the method of implementation, which allows for the maintenance of virtual circuit connections as aircraft stations transition between designated operational coverage areas. The distribution may be multi-regional or worldwide.

CNS.455 HF Data Link Protocol

The HFDL protocol shall consist of a physical layer, a link layer, and a subnetwork layer, as specified below.

(1) Physical layer RF characteristics

The aircraft and ground stations shall access the physical medium operating in simplex mode.

(a) Frequency bands

HFDL installations shall be capable of operating at any single sideband (SSB) carrier (reference) frequency available to the aeronautical mobile (R) service in the band 2.8 to 22 MHz, and in compliance with the relevant provisions of the Radio Regulations.

(b) Channel

Channel utilization shall be in conformity with the table of carrier (reference) frequencies of Appendix 27 to the ITU Radio Regulations.

(c) Tuning

The equipment shall be capable of operating on integral multiples of 1 kHz.

(d) Sideband

The sideband used for transmission shall be on the higher side of its carrier (reference) frequency.

(e) Modulation

HFDL shall employ M-ary phase shift keying (M-PSK) to modulate the radio frequency carrier at the assigned frequency. The symbol rate shall be 1 800 symbols per second ±10 parts per million (i.e. 0.018 symbols per second). The value of M, the information data rate and everything related to the M-PSK shall be as specified in Table 11-2 and in 11.3.1.5 respectively of Chapter 11, Volume III of Annex 10 of the Convention on International Civil Aviation.

(f) Transmitter Stability

The basic frequency stability of the transmitting function shall be better than:

(i) ±20 Hz for HFDL aircraft station subsystems; and

(ii) ±10 Hz for HFDL ground station subsystems.

(g) Receiver Stability

The basic frequency stability of the receiving function shall be such that, with the transmitting function stability specified in CNS.445 (1)(f), the overall frequency difference between ground and airborne functions achieved in service does not exceed 70 Hz.

(h) Protection

A 15 dB desired to undesired (D/U) signal ratio shall apply for the protection of co-channel assignments for HFDL as follows:

(i) data versus data;

(ii) data versus voice; and

(iii) voice versus data.

(i) Class of Emissions

The class of emission shall be 2K80J2DEN.

(j) Assigned Frequency

The HFDL assigned frequency shall be 1 400 Hz higher than the SSB carrier (reference) frequency.

(k) Emission Limits

For HFDL aircraft and ground station transmitters, the peak envelope power (Pp) of any emission on any discrete frequency shall be less than the peak envelope power (Pp) of the transmitter in accordance with the following:

(i) on any frequency between 1.5 kHz and 4.5 kHz lower than the HFDL assigned frequency, and on any frequency between 1.5 kHz and 4.5 kHz higher than the HFDL assigned frequency: at least 30 dB;

(ii) on any frequency between 4.5 kHz and 7.5 kHz lower than the HFDL assigned frequency, and on any frequency between 4.5 kHz and 7.5 kHz higher than the HFDL assigned frequency: at least 38 dB; and

(iii) on any frequency lower than 7.5 kHz below the HFDL assigned frequency and on any frequency higher than 7.5 kHz above the HFDL assigned frequency:

(1) HFDL aircraft station transmitters: 43 dB;

(2) HFDL ground station transmitters up to and including 50 W: [43 + 10 log10 Pp(W)] dB; and

(3) HFDL ground station transmitters more than 50 W: 60 dB

(l) Power

(i) Ground station installations. The peak envelope power (Pp) supplied to the antenna transmission line shall not exceed a maximum value of 6 kW as provided for in Appendix 27 of the Radio Regulations.

(ii) Aircraft station installations. The peak envelope power supplied to the antenna transmission line shall not exceed 400 W, except as provided for in Appendix 27/62 of the Radio Regulations.

(m) Undesired Signal Rejection

For HFDL aircraft and ground station receivers, undesired input signals shall be attenuated in accordance with the following:

(i) on any frequency between fc and (fc – 300 Hz), or between (fc + 2 900 Hz) and (fc + 3 300 Hz): at least 35 dB below the peak of the desired signal level; and

(ii) on any frequency below (fc – 300 Hz), or above (fc + 3 300 Hz): at least 60 dB below the peak of the desired signal level, where fc is the carrier (reference) frequency.

(2) Physical layer functions

In relation to the Functions of the physical layer, the standard and recommended practices in section 11.3.2, Chapter 11, Volume III, Part I of Annex 10 of the Convention on International Civil Aviation, shall apply.

(3) Link layer

The link layer shall provide control functions for the physical layer, link management and data service protocols.

(a) Control functions

The link layer shall pass commands for frequency tuning, transmitter keying and transmitter/receiver switching to the physical layer.

(b) Link management

The link layer shall manage TDMA slot assignments, log-on and log-off procedures, ground station and aircraft station TDMA synchronization, and other functions necessary, taking into account message priority, for the establishment and maintenance of communications.

(c) Data service protocols

The link layer shall support a reliable link service (RLS) protocol and a direct link service (DLS) protocol.

(i) RLS

The RLS protocol shall be used to exchange acknowledged user data packets between aircraft and ground peer link layers.

(ii) DLS

The DLS protocol shall be used to broadcast unsegmented uplink high frequency network protocol data units (HFNPDUs) and other HFNPDUs not requiring automatic retransmission by the link layer.

(4) Subnetwork layer

(a) Packet data

The HFDL subnetwork layer in the HFDL aircraft station subsystem and

HFDL ground station subsystem shall provide connection-oriented packet data service by establishing subnetwork connections between subnetwork service users.

(b) Connectivity notification service

The HFDL subnetwork layer in the HFDL aircraft station subsystem shall provide the additional connectivity notification service by sending connectivity notification event messages to the attached ATN router.

(i) Connectivity notification event messages

The connectivity notification service shall send connectivity notification event messages to the attached ATN router through the subnetwork access function.

(c) HFDL Subnetwork layer functions

The HFDL subnetwork layer in both the HFDL aircraft station subsystem and HFDL ground station subsystem shall include the following three functions:

(1) HFDL subnetwork dependent (HFSND) function;

(2) subnetwork access function; and

(3) interworking function.

(i) HFSND function

The HFSND function shall perform the HFSND protocol between each pair of HFDL aircraft station subsystems and HFDL ground station subsystems by exchanging HFNPDUs. It shall perform the HFSND protocol aircraft function in the HFDL aircraft station subsystem and the HFSND protocol ground function in the HFDL ground station subsystem.

(ii) Subnetwork access function

The subnetwork access function shall perform the ISO 8208 protocol between the HFDL aircraft station subsystem or HFDL ground station subsystem and the attached routers by exchanging ISO 8208 packets. It shall perform the ISO 8208 DCE function in the HFDL aircraft station subsystem and the HFDL ground station subsystem.

(iii) Interworking function

The interworking function shall provide the necessary harmonization functions between the HFSND, the subnetwork access and the connectivity notification functions.

AMC CNS.455 HF Data Link Protocol

(1) Physical layer RF characteristics

(n) Receiver Response to Transients

The receiving function should recover from an instantaneous increase in RF power at the antenna terminal of 60 dB within 10 milliseconds. The receiving function should recover from an instantaneous decrease in RF power at the antenna terminal of 60 dB within 25 milliseconds.

GM CNS.455 HF Data link protocol

The HFDL protocol is a layered protocol and is compatible with the open systems interconnection (OSI) reference model. It permits the HFDL to function as an aeronautical telecommunication network (ATN)-compatible subnetwork. The details of the protocol are described in the Manual on HF Data Link (Doc 9741).

(1)(j) By convention, the HFDL assigned frequency is offset from the SSB carrier (reference) frequency by 1 400 Hz. The HFDL M-PSK carrier of the digital modulation is offset from the SSB carrier (reference) frequency by 1 440 Hz. The digital modulation is fully contained within the same overall channel bandwidth as the voice signal and complies with the provisions of Appendix 27 to the ITU Radio Regulations.

(3) Details on link layer functions are contained in the Manual on HF Data Link (Doc 9741).

CNS.460 Ground management subsystem

The chart shall be identified by the name of the city or town or area which the aerodrome serves and the name of the aerodrome.

(1) Management functions

The ground management subsystem shall perform the functions necessary to establish and maintain communications channels between the HFDL ground and aircraft station subsystems.

(2) Management/control information exchange

The ground management subsystem shall interface with the ground station subsystem in order to exchange control information required for frequency management, system table management, log status management, channel management, and quality of service (QOS) data collection.

GM CNS.460 Ground management subsystem

Details on the ground management subsystem functions and interfaces are contained in the Manual on HF Data Link (Doc 9741).

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CHAPTER 9

UNIVERSAL ACCESS TRANSCEIVER (UAT)

CNS.465 Overall system characteristics

(1) UAT overall system characteristics of aircraft and ground stations

(a) Transmission frequency

The transmission frequency shall be 978 MHz.

(b) Frequency stability

The radio frequency of the UAT equipment shall not vary more than ±0.002 per cent (20 ppm) from the assigned frequency.

(c) Transmit power

(i) Transmit power levels

UAT equipment shall operate at one of the power levels shown in Table 12-1 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation.

(ii) Maximum power

The maximum equivalent isotropically radiated power (EIRP) for a UAT aircraft or ground station shall not exceed +58 dBm.

(iii) Transmit mask

The spectrum of a UAT ADS-B message transmission modulated with pseudorandom message data blocks (MDB) shall fall within the limits specified in Table 12-2 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation when measured in a 100 kHz bandwidth.

(d) Spurious emissions

Spurious emissions shall be kept at the lowest value which the state of the technique and the nature of the service permit.

(e) Polarization

The design polarization of emissions shall be vertical.

(f) Time/amplitude profile of UAT message transmission

In relation to the time/amplitude profile of a UAT message, the standard and recommended practices in 12.1.2.6 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation shall be applied.

(g) Mandatory carriage requirements

Requirements for mandatory carriage of UAT equipment shall be made on the basis of regional air navigation agreements which specify the airspace of operation and the implementation timescales for the carriage of equipment, including the appropriate lead time.

GM CNS.465 Overall system characteristics

(1) Details on technical requirements related to the implementation of UAT SARPs are contained in Part I of the Manual on the Universal Access Transceiver (UAT) (Doc 9861). Part II of the Manual on the Universal Access Transceiver (UAT) (Doc 9861) (in preparation) will provide additional guidance material.

(1)(c)(ii) For example, the maximum EIRP listed above could result from the maximum allowable aircraft transmitter power shown in Table 12-1 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation with a maximum antenna gain of 4 dBi.

(1)(c)(iii) Figure 12-1* is a graphical representation of Table 12-2 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation.

(1)(d) Appendix 3 of the ITU Radio Regulations requires that transmitting stations shall conform to the maximum permitted power levels for spurious emissions or for unwanted emissions in the spurious domain.

(1)(g) No changes will be required to aircraft systems or ground systems operating solely in regions not using UAT.

CNS.470 System characteristics of the ground installation

(1) Ground station transmitting function

(a) Ground station transmitter power

(b) Ground station receiving function

AMCCNS.470 System characteristics of the ground installation

(1) Ground station transmitting function

(a) Ground station transmitter power

(i) The effective radiated power should be such as to provide a field strength of at least 280 microvolts per metre (minus 97 dBW/m^2) within the service volume of the facility on the basis of free-space propagation.

GM CNS.470 System characteristics of the ground installation

(1)(a)(i) This is determined on the basis of delivering a –91 dBm (corresponds to 200 microvolts per metre) signal level at the PMP (assuming an omnidirectional antenna). The 280 μV/m recommendation corresponds to the delivery of a -88 dBm signal level at the PMP of the receiving equipment. The 3 dB difference between –88 dBm and –91 dBm provides margin for excess path loss over free-space propagation.

(b) An example ground station receiver is discussed in Section 2.5 of Part II of the Manual on the Universal Access Transceiver (UAT) (Doc 9861), with UAT air-to-ground performance estimates consistent with use of that receiver provided in Appendix B of that manual.

CNS.475 System characteristics of the aircraft installation

(1) Aircraft transmitting function

(a) Aircraft transmitter power

The effective radiated power shall be such as to provide a field strength of at least 225 microvolts per metre (minus 99 dBW/m2) on the basis of free-space propagation, at ranges and altitudes appropriate to the operational conditions pertaining to the areas over which the aircraft is operated. Transmitter power shall not exceed 54 dBm at the PMP.

(2) Receiving function

(a) Receiver sensitivity

(i) Long UAT ADS-B message as desired signal

A desired signal level of –93 dBm applied at the PMP shall produce a rate of successful message reception (SMR) of 90 per cent or better under the following conditions:

(1) When the desired signal is of nominal modulation (i.e. FM deviation is 625 kHz) and at the maximum signal frequency offsets, and subject to relative Doppler shift at ±1 200 knots;

(2) When the desired signal is of maximum modulation distortion allowed in 12.4.3, at the nominal transmission frequency ±1 parts per million (ppm), and subject to relative Doppler shift at ±1200 knots.

(ii) Basic UAT ADS-B message as desired signal

A desired signal level of –94 dBm applied at the PMP shall produce a rate of SMR of 90 per cent or better under the following conditions:

(1) When the desired signal is of nominal modulation (i.e. FM deviation is 625 kHz) and at the maximum signal frequency offsets, and subject to relative Doppler shift at ±1 200 knots;

(2) When the desired signal is of maximum modulation distortion allowed in 12.4.3, at the nominal transmission frequency ±1 ppm, and subject to relative Doppler shift at ±1 200 knots.

(iii) UAT ground uplink message as desired signal

A desired signal level of –91 dBm applied at the PMP shall produce a rate of an SMR of 90 per cent or better under the following conditions:

(1) When the desired signal is of nominal modulation (i.e. FM deviation is 625 kHz) and at the maximum signal frequency offsets, and subject to relative Doppler shift at ±850 knots;

(2) When the desired signal is of maximum modulation distortion allowed in 12.4.3, at the nominal transmission frequency ±1 ppm, and subject to relative Doppler shift at ±850 knots.

(b) Receiver selectivity

(see GM (2)(b))

(c) Receiver desired signal dynamic range

The receiver shall achieve a successful message reception rate for long ADS-B messages of 99 per cent or better when the desired signal level is between –90 dBm and –10 dBm at the PMP in the absence of any interfering signals.

(d) Receiver tolerance to pulsed interference

(i) For Standard and High-Performance receivers the following requirements shall apply:

(1) The receiver shall be capable of achieving 99 per cent SMR of long UAT ADS-B messages when the desired signal level is between –90 dBm and –10 dBm when subjected to DME interference under the following conditions: DME pulse pairs at a nominal rate of 3600 pulse pairs per second at either 12 or 30 microseconds pulse spacing at a level of –36 dBm for any 1 MHz DME channel frequency between 980 MHz and 1213 MHz inclusive.

(2) Following a 21 microsecond pulse at a level of ZERO (0) dBm and at a frequency of 1090 MHz, the receiver shall return to within 3 dB of the specified sensitivity level (see MCAR CNS.465 (2)(a)) within 12 microseconds.

(ii) For the standard UAT receiver the following additional requirements shall apply:

(1) The receiver shall be capable of achieving 90 per cent SMR of long UAT ADS-B messages when the desired signal level is between –87 dBm and –10 dBm when subjected to DME interference under the following conditions: DME pulse pairs at a nominal rate of 3 600 pulse pairs per second at a 12 microseconds pulse spacing at a level of –56 dBm and a frequency of 979 MHz.

(2) The receiver shall be capable of achieving 90 per cent SMR of long UAT ADS-B messages when the desired signal level is between –87 dBm and –10 dBm when subjected to DME interference under the following conditions: DME pulse pairs at a nominal rate of 3 600 pulse pairs per second at a 12 microseconds pulse spacing at a level of –70 dBm and a frequency of 978 MHz.

(iii) For the high-performance receiver the following additional requirements shall apply:

(1) The receiver shall be capable of achieving 90 per cent SMR of long UAT ADS-B messages when the desired signal level is between –87 dBm and –10 dBm when subjected to DME interference under the following conditions: DME pulse pairs at a nominal rate of 3 600 pulse pairs per second at a 12 microseconds pulse spacing at a level of –43 dBm and a frequency of 979 MHz.

(2) The receiver shall be capable of achieving 90 per cent SMR of long UAT ADS-B messages when the desired signal level is between –87 dBm and –10 dBm when subjected to DME interference under the following conditions: DME pulse pairs at a nominal rate of 3600 pulse pairs per second at a 12 microseconds pulse spacing at a level of –79 dBm and a frequency of 978 MHz.

GM CNS.475 System characteristics of the aircraft installation

(1)(a) The above field strength is determined on the basis of delivering a –93 dBm (corresponds to 160 microvolts per metre) signal level at the PMP (assuming an omnidirectional antenna). The 3 dB difference between 225 μV/m and 160 μV/m provides margin for excess path loss over free-space propagation when receiving a long UAT ADS-B message. A 4 dB margin is provided when receiving a basic UAT ADS-B message.

Various aircraft operations may have different air-air range requirements depending on the intended ADS-B function of the UAT equipment. Therefore different installations may operate at different power levels (see MCAR CNS 455 (1)(c)(i).

(2)(a)(i) The receiver criteria for successful message reception of UAT ADS-B messages are provided in Section 4 of Part I of the Manual on the Universal Access Transceiver (UAT) (Doc 9861).

(2)(a)(ii) The receiver criteria for successful message reception of UAT ADS-B messages are provided in Section 4 of Part I of the Manual on the Universal Access Transceiver (UAT) (Doc 9861).

(2)(a)(iii) The receiver criteria for successful message reception of UAT ground uplink messages are provided in Section 4 of Part I of the Manual on the Universal Access Transceiver (UAT) (Doc 9861) (in preparation).

(2)(b) This requirement ensures the bit rate accuracy supporting demodulation in the UAT equipment is adequate to properly receive the longer UAT ground uplink message.

The undesired signal used is an unmodulated carrier applied at the frequency offset.

This requirement establishes the receiver's rejection of the off-channel energy.

It is assumed that ratios in between the specified offsets will fall near the interpolated value.

The desired signal used is a UAT ADS-B long message at -90 dBm at the PMP, to be received with a 90 per cent successful message reception rate.

The tolerable co-channel continuous wave interference power level for aircraft UAT receivers is assumed to be -101 dBm or less at the PMP.

See Section 2.4.2 of Part II of the Manual on the Universal Access Transceiver (UAT) (Doc 9861) for a discussion of when a high-performance receiver is desirable.

Standard UAT receivers shall meet the selectivity characteristics given in Table 12-3 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation.

High-performance receivers shall meet the more stringent selectivity characteristics given in Table 12-4 on Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation.

See Section 2.4.2 of Part II of the Manual on the Universal Access Transceiver (UAT) (Doc 9861) for guidance material on the implementation of high-performance receivers.

(2)(c) The value of –10 dBm represents 120-foot separation from an aircraft transmitter transmitting at maximum allowed power.

(2)(d) All power level requirements in this section are referenced to the PMP.

CNS.480 Physical layer characteristics

(1) Modulation rate

The modulation rate shall be 1.041 667 Mbps with a tolerance for aircraft transmitters of ±20 ppm and a tolerance for ground transmitters of ±2 ppm.

(2) Modulation type

(a) Data shall be modulated onto the carrier using binary continuous phase frequency shift keying. The modulation index, h, shall be no less than 0.6;

(b) A binary ONE (1) shall be indicated by a shift up in frequency from the nominal carrier frequency and a binary ZERO (0) by a shift down from the nominal carrier frequency.

(3) Modulation distortion

(a) For aircraft transmitters, the minimum vertical opening of the eye diagram of the transmitted signal (measured at the optimum sampling points) shall be no less than 560 kHz when measured over an entire long UAT ADS-B message containing pseudorandom message data blocks.

(b) For ground transmitters, the minimum vertical opening of the eye diagram of the transmitted signal (measured at the optimum sampling points) shall be no less than 560 kHz when measured over an entire UAT ground uplink message containing pseudorandom message data blocks.

(c) For aircraft transmitters, the minimum horizontal opening of the eye diagram of the transmitted signal (measured at 978 MHz) shall be no less than 0.624 microseconds (0.65 symbol periods) when measured over an entire long UAT ADS-B message containing pseudorandom message data blocks.

(d) For ground transmitters, the minimum horizontal opening of the eye diagram of the transmitted signal (measured at 978 MHz) shall be no less than 0.624 microseconds (0.65 symbol periods) when measured over an entire UAT ground uplink message containing pseudorandom message data blocks.

(4) Broadcast message characteristics

In relation to the Characteristics of the broadcast message, the standard and recommended practices in section 12.4.4 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation, shall be applied.

GM CNS.480 Physical layer characteristics

(1) The tolerance on the modulation rate is consistent with the requirement on modulation distortion (see CNS.470 (1)(c)).

(2)(b) Filtering of the transmitted signal (at base band and/or after frequency modulation) will be required to meet the spectral containment requirement of MCAR CNS.455 (1)(c). This filtering may cause the deviation to exceed these values at points other than the optimum sampling points.

Because of the filtering of the transmitted signal, the received frequency offset varies continuously between the nominal values of ±312.5 kHz (and beyond), and the optimal sampling point may not be easily identified. This point can be defined in terms of the so-called “eye diagram” of the received signal. The ideal eye diagram is a superposition of samples of the (undistorted) post detection waveform shifted by multiples of the bit period (0.96 microseconds). The optimum sampling point is the point during the bit period at which the opening of the eye diagram (i.e. the minimum separation between positive and negative frequency offsets at very high signal-to-noise ratios) is maximized. An example “eye diagram” can be seen in Figure 12-3 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the

International Civil Aviation. The timing of the points where the lines converge defines the “optimum sampling point”. Figure 12-4 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation shows an eye pattern that has been partially closed by modulation distortion.

(3) Section 12.4.4 of Chapter 12, Volume III, Part I of Annex 10 of the Convention on the International Civil Aviation defines the UAT ADS-B message types.

The ideal eye diagram is a superposition of samples of the (undistorted) post detection waveform shifted by multiples of the bit period (0.96 microseconds).

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CHAPTER 10

PART II - VOICE COMMUNICATION SYSTEMS

The material on secondary power supply and guidance material concerning reliability and availability for communication systems is contained in Annex 10 of the Convention on the International Civil Aviation, Volume I, 2.9 and Volume I, Attachment F, shall be applied respectively.

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CHAPTER 11

AERONAUTICAL MOBILE SERVICE

CNS.485 Air ground VHF communication system characteristics

(1) The characteristics of the air-ground VHF communication system used in the International Aeronautical Mobile Service shall be in conformity with the following specifications:

(a) Radiotelephone emissions shall be double sideband (DSB) amplitude modulated (AM) carriers. The designation of emission is A3E, as specified in the ITU Radio Regulations.

(b) Spurious emissions shall be kept at the lowest value which the state of technique and the nature of the service permit.

(c) The radio frequencies used shall be selected from the radio frequencies in the band 117.975 – 137 MHz. The separation between assignable frequencies (channel spacing) and frequency tolerances applicable to elements of the system shall be as specified in Volume V.

(d) The design polarization of emissions shall be vertical.

GM CNS.485 Air ground VHF communication system characteristics

In the following text the channel spacing for 8.33 kHz channel assignments is defined as 25 kHz divided by 3 which is 8.3333 ... kHz.

(1)(a) Appendix S3 to the ITU Radio Regulations specifies the levels of spurious emissions to which transmitters must conform.

(1)(c) The band 117.975 – 132 MHz was allocated to the Aeronautical Mobile (R) Service in the ITU Radio Regulations (1947). By subsequent revisions at ITU World Administrative Radio Conferences the bands 132 – 136 MHz and 136 – 137 MHz were added under conditions which differ for ITU Regions, or for specified countries or combinations of countries (see RRs S5.203, S5.203A and S5.203B for additional allocations in the band 136 – 137 MHz, and S5.201 for the band 132 – 136 MHz).

CNS.490 System characteristics of the ground installation

(1) Transmitting function

(a) Frequency stability. The radio frequency of operation shall not vary more than plus or minus 0.005 per cent from the assigned frequency. Where 25 kHz channel spacing is introduced in accordance with Volume V, the radio frequency of operation shall not vary more than plus or minus 0.002 per cent from the assigned frequency. Where 8.33 kHz channel spacing is introduced in accordance with

Volume V, the radio frequency of operation shall not vary more than plus or minus 0.0001 per cent from the assigned frequency.

(i) Offset carrier systems in 8.33 kHz, 25 kHz, 50 kHz and 100 kHz channel spaced environments. The stability of individual carriers of an offset carrier system shall be such as to prevent first-order heterodyne frequencies of less than 4 kHz and, additionally, the maximum frequency excursion of the outer carrier frequencies from the assigned carrier frequency shall not exceed 8 kHz. Offset carrier systems for 8.33 kHz channel spacing shall be limited to two-carrier systems using a carrier offset of plus and minus 2.5 kHz.

(c) Modulation. A peak modulation factor of at least 0.85 shall be achievable.

(2) Receiving function

(a) Frequency stability. Where 8.33 kHz channel spacing is introduced in accordance with Volume V, the radio frequency of operation shall not vary more than plus or minus 0.0001 per cent from the assigned frequency.

(b) Sensitivity. After due allowance has been made for feeder loss and antenna polar diagram variation, the sensitivity of the receiving function shall be such as to provide on a high percentage of occasions an audio output signal with a wanted/unwanted ratio of 15 dB, with a 50 per cent amplitude modulated (A3E) radio signal having a field strength of 20 microvolts per metre (minus 120 dBW/m2) or more.

(c) Effective acceptance bandwidth. When tuned to a channel having a width of 25 kHz, 50 kHz or 100 kHz, the receiving system shall provide an adequate and intelligible audio output when the signal specified at 2.2.2.2 has a carrier frequency within plus or minus 0.005 per cent of the assigned frequency. When tuned to a channel having a width of 8.33 kHz, the receiving system shall provide an adequate and intelligible audio output when the signal specified at 2.2.2.2 has a carrier frequency within plus or minus 0.0005 per cent of the assigned frequency. Further information on the effective acceptance bandwidth is contained in the Attachment to Part II.

(d) Adjacent channel rejection. The receiving system shall ensure an effective rejection of 60 dB or more at the next assignable channel.

AMC CNS.490 System characteristics of the ground installation

(1) Transmitting function

(b) Power

On a high percentage of occasions, the effective radiated power should be such as to provide a field strength of a least 75 microvolts per metre (minus 109 dBW/m^2) within the defined operational coverage of the facility, on the basis of free-space propagation.

(d) Means should be provided to maintain the average modulation factor at the highest practicable value without overmodulation.

GM CNS.490 System characteristics of the ground installation

(1)(a) The above frequency stability requirements will not be sufficient for offset carrier systems using 25 kHz channel spacing or higher.

(1)(a)(i) Examples of the required stability of the individual carriers of offset carrier systems may be found at the Attachment to Part II.

(2)(c) The effective acceptance bandwidth includes Doppler shift.

(2)(d) The next assignable frequency will normally be plus or minus 50 kHz. Where this channel spacing will not suffice, the next assignable frequency will be plus or minus 25 kHz, or plus or minus 8.33 kHz, implemented in accordance with the provisions of Volume V. It is recognized that in certain areas of the world receivers designed for 25 kHz, 50 kHz or 100 kHz channel spacing may continue to be used.

CNS.495 System characteristics of the airborne installation

(1) Transmitting function

(a) Frequency stability. The radio frequency of operation shall not vary more than plus or minus 0.005 per cent from the assigned frequency. Where 25 kHz channel spacing is introduced, the radio frequency of operation shall not vary more than plus or minus 0.003 per cent from the assigned frequency. Where 8.33 kHz channel spacing is introduced, the radio frequency of operation shall not vary more than plus or minus 0.0005 per cent from the assigned frequency.

(b) Power. On a high percentage of occasions, the effective radiated power shall be such as to provide a field strength of at least 20 microvolts per metre (minus 120 dBW/m2) on the basis of free space propagation, at ranges and altitudes appropriate to the operational conditions pertaining to the areas over which the aircraft is operated.

(c) Adjacent channel power. The amount of power from a 8.33 kHz airborne transmitter under all operating conditions when measured over a 7 kHz channel bandwidth centred on the first 8.33 kHz adjacent channel shall not exceed -45 dB below the transmitter carrier power. The above adjacent channel power shall take into account the typical voice spectrum.

(d) Modulation. A peak modulation factor of at least 0.85 shall be achievable.

(2) Receiving function

(a) Frequency stability. Where 8.33 kHz channel spacing is introduced in accordance with Volume V, the radio frequency of operation shall not vary more than plus or minus 0.0005 per cent from the assigned frequency.

(c) Effective acceptance bandwidth for 100 kHz, 50 kHz and 25 kHz channel spacing receiving installations. When tuned to a channel designated in Volume V as having a width of 25 kHz, 50 kHz or 100 kHz, the receiving function shall ensure an effective acceptance bandwidth as follows:

(i) in areas where offset carrier systems are employed, the receiving function shall provide an adequate audio output when the signal specified at CNS.485 (2)(b) has a carrier frequency within 8 kHz of the assigned frequency;

(ii) in areas where offset carrier systems are not employed, the receiving function shall provide an adequate audio output when the signal specified at CNS.485 (2)(b) has a carrier frequency of plus or minus 0.005 per cent of the assigned frequency.

(d) Effective acceptance bandwidth for 8.33 kHz channel spacing receiving installations. When tuned to a channel designated in Volume V, as having a width of 8.33 kHz, the receiving function shall ensure an effective acceptance bandwidth as follows:

(i) in areas where offset carrier systems are employed, the receiving function shall provide an adequate audio output when the signal specified in CNS.485 (2)(b) has a carrier frequency of plus or minus 2.5 kHz of the assigned frequency; and

(ii) in areas where offset carrier systems are not employed, the receiving function shall provide an adequate audio output when the signal specified in CNS.485 (2)(b) has a carrier frequency within plus or minus 0.0005 per cent of the assigned frequency. Further information on the effective acceptance bandwidth is contained in Part II, Attachment A of Annex 10, Vol. III.

(e) Adjacent channel rejection. The receiving function shall ensure an effective adjacent channel rejection as follows:

(i) 8.33 kHz channels: 60 dB or more at plus or minus 8.33 kHz with respect to the assigned frequency, and 40 dB or more at plus or minus 6.5 kHz;

(ii) 25 kHz channel spacing environment: 50 dB or more at plus or minus 25 kHz with respect to the assigned frequency and 40 dB or more at plus or minus 17 kHz;

(iii) 50 kHz channel spacing environment: 50 dB or more at plus or minus 50 kHz with respect to the assigned frequency and 40 dB or more at plus or minus 35 kHz;

(iv) 100 kHz channel spacing environment: 50 dB or more at plus or minus 100 kHz with respect to the assigned frequency.

(h) VDL — Interference immunity performance

(i) For equipment intended to be used in independent operations of services applying DSB-AM and VDL technology on board the same aircraft, the receiving function shall provide an adequate and intelligible audio output with a desired signal field strength of not more than 150 microvolts per metre (minus 102 dBW/m2) and with an undesired VDL signal field strength

of at least 50 dB above the desired field strength on any assignable channel 100 kHz or more away from the assigned channel of the desired signal.

(ii) The receiving function of all new installations intended to be used in independent operations of services applying DSB-AM and VDL technology on board the same aircraft shall meet the provisions of CNS.485 (2)(h)(i).

(iii) The receiving function of all installations intended to be used in independent operations of services applying DSB-AM and VDL technology on board the same aircraft shall meet the provisions of CNS.485 (2)(h)(i), subject to the conditions of CNS.485 (2)(h)(iv).

(iv) Requirements for mandatory compliance of the provisions of CNS.485 (2)(h)(iii) shall be made on the basis of regional air navigation agreements which specify the airspace of operation and the implementation timescales.

(1) The agreement indicated in CNS.485 (2)(h)(iv) shall provide at least two years' notice of mandatory compliance of airborne systems.

(3) Interference immunity performance

(a) The VHF communications receiving system shall provide satisfactory performance in the presence of two signal, third-order intermodulation products caused by VHF FM broadcast signals having levels at the receiver input of minus 5 dBm.

(b) The VHF communications receiving system shall not be desensitized in the presence of VHF FM broadcast signals having levels at the receiver input of minus 5 dBm.

(c) All new installations of airborne VHF communications receiving systems shall meet the provisions of CNS.485 (3)(a) and CNS.485 (3)(b).

AMC CNS.495 System characteristics of the airborne installation

(1) Transmitting function

(e) Means should be provided to maintain the average modulation factor at the highest practicable value without overmodulation.

(2) Receiving function

(b) Sensitivity

(i) After due allowance has been made for aircraft feeder mismatch, attenuation loss and antenna polar diagram variation, the sensitivity of the receiving function should be such as to provide on a high percentage of occasions an audio output signal with a wanted/unwanted ratio of 15 dB, with a 50 per cent amplitude modulated (A3E) radio signal having a field strength of 75 microvolts per metre (minus 109 dBW/m^2).

(f) Whenever practicable, the receiving system should ensure an effective adjacent channel rejection characteristic of 60 dB or more at plus or minus 25 kHz, 50 kHz

and 100 kHz from the assigned frequency for receiving systems intended to operate in channel spacing environments of 25 kHz, 50 kHz and 100 kHz, respectively.

(g) In the case of receivers complying with CNS.495 (2)(c) or CNS.495 (2)(d) used in areas where offset carrier systems are in force, the characteristics of the receiver should be such that:

(i) the audio frequency response precludes harmful levels of audio heterodynes resulting from the reception of two or more offset carrier frequencies;

(ii) the receiver muting circuits, if provided, operate satisfactorily in the presence of audio heterodynes resulting from the reception of two or more offset carrier frequencies.

(3) Interference immunity performance

(d) Airborne VHF communications receiving systems meeting the immunity performance Standards of CNS.495 (3)(a) and CNS.495 (3)(b) should be placed into operation at the earliest possible date.

GM CNS.495 System characteristics of the airborne installation

(1)(c) The voice spectrum is assumed to be a constant level between 300 and 800 Hz and attenuated by 10 dB per octave above 800 Hz.

(2)(b)(i) For planning extended range VHF facilities, an airborne receiving function sensitivity of 30 microvolts per metre may be assumed.

(2)(d)(ii) The effective acceptance bandwidth includes Doppler shift.

When using offset carrier systems (CNS.485 (2)(c) and CNS.485 (2)(d)), receiver performance may become degraded when receiving two or more similar strength offset carrier signals. Caution is therefore advised with the implementation of offset carrier systems.

(2)(e)(i) The receiver local oscillator phase noise should be sufficiently low to avoid any degradation of the receiver capability to reject off carrier signals. A phase noise level better than minus 99 dBc/Hz 8.33 kHz away from the carrier is necessary to comply with 45 dB adjacent channel rejection under all operating conditions.

(2)(f) Frequency planning is normally based on an assumption of 60 dB effective adjacent channel rejection at plus or minus 25 kHz, 50 kHz or 100 kHz from the assigned frequency as appropriate to the channel spacing environment.

(2)(h)(i) This level of VDL interference immunity performance provides a receiver performance consistent with the influence of the VDL RF spectrum mask as specified in Volume III, Part I, 6.3.4 with an effective transmitter/receiver isolation of 68 dB. Better transmitter and receiver performance could result in less isolation required.

(3)(b) Guidance material on immunity criteria to be used for the performance quoted in

CNS.485 (3)(a) and CNS.485 (3)(b) is contained in the Attachment to Part II, 1.3 of ICAO Annex 10, Vol. III.

CNS.500 Single sideband (SSB) HF communication system characteristics for use in the aeronautical mobile service

(1) The characteristics of the air-ground HF SSB system, where used in the Aeronautical Mobile Service, shall be in conformity with the following specifications.

(a) Frequency range

(i) HF SSB installations shall be capable of operation at any SSB carrier (reference) frequency available to the Aeronautical Mobile (R) Service in the band 2.8 MHz to 22 MHz and necessary to meet the approved assignment plan for the region(s) in which the system is intended to operate, and in compliance with the relevant provisions of the Radio Regulations.

(ii) The equipment shall be capable of operating on integral multiples of 1 kHz.

(b) Sideband selection

(i) The sideband transmitted shall be that on the higher frequency side of its carrier (reference) frequency.

(c) Carrier (reference) frequency

(i) Channel utilization shall be in conformity with the table of carrier (reference) frequencies at 27/16 and the Allotment Plan at 27/186 to 27/207 inclusive (or frequencies established on the basis of 27/21, as may be appropriate) of Appendix S27.

(d) Classes of emission and carrier suppression

(i) The system shall utilize the suppressed carrier class of emission J3E (also J7B and J9B as applicable). When SELCAL is employed as specified in Chapter 3 of Part II, the installation shall utilize class H2B emission.

(ii) Aeronautical stations and aircraft stations shall have introduced the appropriate class(es) of emission prescribed in CNS.490 (1)(d)(i). The use of class A3E emission shall be discontinued except as provided in CNS.490 (1)(d)(iv).

(iii) Aeronautical stations and aircraft stations equipped for single sideband operations shall also be equipped to transmit class H3E emission where required to be compatible with reception by double sideband equipment. Effective this date the use of class H3E emission shall be discontinued except as provided in CNS.490 (1)(d)(iv).

(v) No new DSB equipment shall be installed.

(vi) Aircraft station transmitters shall be capable of at least 26 dB carrier suppression with respect to peak envelope power (Pp) for classes of emission J3E, J7B or J9B.

(vii) Aeronautical station transmitters shall be capable of 40 dB carrier suppression with respect to peak envelope power (Pp) for classes of emission J3E, J7B or J9B.

(e) Audio frequency bandwidth

(i) For radiotelephone emissions the audio frequencies shall be limited to between 300 and 2700 Hz and the occupied bandwidth of other authorized emissions shall not exceed the upper limit of J3E emissions. In specifying these limits, however, no restriction in their extension shall be implied in so far as emissions other than J3E are concerned, provided that the limits of unwanted emissions are met (see CNS.490 (1)(g)).

(ii) For other authorized classes of emission the modulation frequencies shall be such that the required spectrum limits of CNS.490 (1)(g) will be met.

(f) Frequency tolerance

(i) The basic frequency stability of the transmitting function for classes of emission J3E, J7B or J9B shall be such that the difference between the actual carrier of the transmission and the carrier (reference) frequency shall not exceed:

(1) 20 Hz for airborne installations;

(2) 10 Hz for ground installations.

(ii) The basic frequency stability of the receiving function shall be such that, with the transmitting function stabilities specified in CNS.490 (1)(f)(*1),* the overall frequency difference between ground and airborne functions achieved in service and including Doppler shift, does not exceed 45 Hz. However, a greater frequency difference shall be permitted in the case of supersonic aircraft.

(g) Spectrum Limits

In relation to the spectrum limits, the standard and recommended practices in section 2.4.1.7, Chapter 2, Volume III, Part II of Annex 10 of the Convention on the International Civil Aviation shall be applied.

(h) Power

(i) Aeronautical station installations. Except as permitted by the relevant provisions of Appendix S27 to the ITU Radio Regulations, the peak envelope power (Pp) supplied to the antenna transmission line for H2B, H3E, J3E, J7B or J9B classes of emissions shall not exceed a maximum value of 6 kW.

(ii) Aircraft station installations. The peak envelope power supplied to the antenna transmission line for H2B, H3E, J3E, J7B or J9B classes of emission shall not exceed 400 W except as provided for in Appendix S27 of the ITU Radio Regulations as follows:

(1) S27/68 It is recognized that the power employed by aircraft transmitters may, in practice, exceed the limits specified in No. 27/60. However, the use of such increased power (which normally shall not exceed 600 W Pp) shall not cause harmful interference to stations using frequencies in accordance with the technical principles on which the Allotment Plan is based.

(2) S27/60 Unless otherwise specified in Part II of this Appendix, the peak envelope powers supplied to the antenna transmission line shall not exceed the maximum values indicated in the table below; the corresponding peak effective radiated powers being assumed to be equal to two-thirds of these values:

Class of emission	Stations	Max peak envelope power *(Pp)*
H2B, J3E, J7B	Aeronautical stations	6 kW
J9B, A3E, H3E	Aircraft stations	400 W
Other emission such as A1A, FIB	Aeronautical stations	1.5 kW
	Aircraft stations	100 W

A3E and H3E shall be used only on 3023 kHz and 5680 kHz.

(i) Method of operation. Single channel simplex shall be employed.

AMC CNS.500 Single sideband (SSB) HF communication system characteristics for use in the aeronautical mobile service

(1)(d) Classes of emission and carrier suppression

(iv) For stations directly involved in coordinated search and rescue operations using the frequencies 3023 kHz and 5680 kHz, the class of emission J3E should be used; however, since maritime mobile and land mobile services may be involved, A3E and H3E classes of emission may be used.-

GM CNS.500 Single sideband (SSB) HF communication system characteristics for use in the aeronautical mobile service

(1)(a) See Introduction to Volume V, Chapter 3, and Figures 2-1 and 2-2*.

The ITU World Administrative Radio Conference, Aeronautical Mobile (R) Service,

Geneva, 1978, established a new Allotment Plan (Appendix 27, Aer to the Radio Regulations) based on single sideband replacing the earlier double sideband Allotment Plan. The World Radiocommunication Conference 1995 redesignated it as Appendix S.27. Minor editorial changes were made at the World Radiocommunication Conference 1997.

(1)(c) It is intended that only the carrier (reference) frequency be promulgated in Regional Plans and Aeronautical Publications.

(1)(e)(i) For aircraft and aeronautical station transmitter types first installed before 1 February 1983 the audio frequencies will be limited to 3000 Hz.

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CHAPTER 12
SELCAL SYSTEM

CNS.505 General

In relation to the SELCAL System, the standard and recommended practices in Chapter 3, Volume III, Part II of Annex 10 of the Convention on the International Civil Aviation, shall be applied.

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CHAPTER 13
AERONAUTICAL SPEECH CIRCUITS

CNS.510 Technical provisions relating to international aeronautical speech circuit switching and signalling for ground-ground application

(1) The use of circuit switching and signalling to provide speech circuits to interconnect ATS units not interconnected by dedicated circuits shall be by agreement between the Administrations concerned.

(2) The application of aeronautical speech circuit switching and signalling shall be made on the basis of regional air navigation agreements.

AMC CNS.510 Technical provisions relating to international aeronautical speech circuit switching and signalling for ground-ground application

(3) The ATC communication requirements defined in Annex 11, Section 6.2 of the Convention on the International Civil Aviation should be met by the implementation of one or more of the following basic three call types:

(a) instantaneous access;

(b) direct access; and

(c) indirect access.

(4) In addition to the ability to make basic telephone calls, the following functions should be provided in order to meet the requirements set out in Annex 11:

(a) means of indicating the calling/called party identity;

(b) means of initiating urgent/priority calls; and

(c) conference capabilities.

(5) The characteristics of the circuits used in aeronautical speech circuit switching and signalling should conform to appropriate ISO/IEC international standards and ITU-T recommendations.

(6) Digital signalling systems should be used wherever their use can be justified in terms of any of the following:

(a) improved quality of service;

(b) improved user facilities; or

(c) reduced costs where quality of service is maintained.

(7) The characteristics of supervisory tones to be used (such as ringing, busy, number unobtainable) should conform to appropriate ITU-T recommendations.

(8) To take advantage of the benefits of interconnecting regional and national aeronautical speech networks, the international aeronautical telephone network numbering scheme should be used.

GM CNS.510 Technical provisions relating to international aeronautical speech circuit switching and signalling for ground-ground application

Guidance material on the implementation of aeronautical speech circuit switching and signalling for ground- ground applications is contained in the Manual on Air Traffic Services (ATS) Ground-Ground Voice Switching and Signalling (Doc 9804). The material includes explanation of terms, performance parameters, guidance on basic call types and additional functions, references to appropriate ISO/IEC international standards and ITU-T recommendations, guidance on the use of signalling systems, details of the recommended numbering scheme and guidance on migration to future schemes.

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CHAPTER 14

EMERGENCY LOCATOR TRANSMITTER (ELT) FOR SEARCH AND RESCUE

CNS.515 General

(1) Emergency locator transmitters shall operate either on both 406 MHz and 121.5 MHz or on 121.5 MHz.

(2) All installations of emergency locator transmitters operating on 406 MHz shall meet the provisions of CNS.515.

(3) All installations of emergency locator transmitters operating on 121.5 MHz shall meet the provisions of CNS.510.

(4) Emergency locator transmitters shall operate on 406 MHz and 121.5 MHz simultaneously.

(5) All emergency locator transmitters shall operate simultaneously on 406 MHz.

(6) The technical characteristics for the 406 MHz component of an integrated ELT shall be in accordance with CNS.515.

(7) The technical characteristics for the 121.5 MHz component of an integrated ELT shall be in accordance with CNS.510.

(8) Arrangements shall be made for a 406 MHz ELT register. Register information regarding the ELT shall be immediately available to search and rescue authorities. Mauritius shall ensure that the register is updated whenever necessary.

(9) ELT register information shall include the following:

(a) transmitter identification (expressed in the form of an alphanumerical code of 15 hexadecimal characters);

(b) transmitter manufacturer, model and, when available, manufacturer's serial number;

(c) COSPAS-SARSAT type approval number;

(d) name, address (postal and e-mail) and emergency telephone number of the owner and operator;

(e) name, address (postal and e-mail) and telephone number of other emergency contacts (two, if possible) to whom the owner or the operator is known;

(f) aircraft manufacturer and type; and

(g) colour of the aircraft.

GM CNS.515 General

(1) From 1 January 2000, ELTs operating on 121.5 MHz will be required to meet the improved technical characteristics contained in CNS.510 (1)(h).

(9) Various coding protocols are available to States. Depending on the protocol adopted, States may, at their discretion, include one of the following as supplementary identification information to be registered:

(a) aircraft operating agency designator and operator's serial number; or

(b) 24-bit aircraft address; or

(c) aircraft nationality and registration marks.

The aircraft operating agency designator is allocated to the operator by ICAO through the State administration, and the operator's serial number is allocated by the operator from the block 0001 to 4096.

At their discretion, depending on arrangements in place, States may include other relevant information to be registered such as the last date of register, battery expiry date and place of ELT in the aircraft (e.g. "primary ELT" or "life- raft No. 1").

CNS.520 Specification for the 121.5 MHz component of emergency locator transmitter (ELT) for search and rescue

(1) Technical characteristics

(a) Emergency locator transmitters (ELT) shall operate on 121.5 MHz. The frequency tolerance shall not exceed plus or minus 0.005 per cent.

(b) The emission from an ELT under normal conditions and attitudes of the antenna shall be vertically polarized and essentially omnidirectional in the horizontal plane.

(c) Over a period of 48 hours of continuous operation, at an operating temperature of minus 20°C, the peak effective radiated power (PERP) shall at no time be less than 50 mW.

(d) The type of emission shall be A3X. Any other type of modulation that meets the requirements of CNS.510 (1)(e), (1)(f) and (1)(g) may be used provided that it will not prejudice precise location of the beacon by homing equipment.

(e) The carrier shall be amplitude modulated at a modulation factor of at least 0.85.

(f) The modulation applied to the carrier shall have a minimum duty cycle of 33 per cent.

(g) The emission shall have a distinctive audio characteristic achieved by amplitude modulating the carrier with an audio frequency sweeping downward over a

range of not less than 700 Hz within the range 1 600 Hz to 300 Hz and with a sweep repetition rate of between 2 Hz and 4 Hz.

(h) the emission shall include a clearly defined carrier frequency distinct from the modulation sideband components; in particular, at least 30 per cent of the power shall be contained at all times within plus or minus 30 Hz of the carrier frequency on 121.5 MHz.

GM CNS.520 Specification for the 121.5 MHz component of emergency locator transmitter (ELT) for search and rescue

Information on technical characteristics and operational performance of 121.5 MHz ELTs is contained in RTCA Document DO-183 and European Organization for Civil Aviation Equipment (EUROCAE) Document ED.62.

Technical characteristics of emergency locator transmitters operating on 121.5 MHz are contained in ITU-R Recommendation M.690-1. The ITU designation for an ELT is Emergency Position — Indicating Radio Beacon (EPIRB).

(1)(d) Some ELTs are equipped with an optional voice capability (A3E) in addition to the A3X emission.

CNS.525 Specification for the 406 MHz component of emergency locator transmitter (ELT) for search and rescue

(1) Technical characteristics

(a) Emergency locator transmitters shall operate on one of the frequency channels assigned for use in the frequency band 406.0 to 406.1 MHz.

(b) The period between transmissions shall be 50 seconds plus or minus 5 per cent.

(c) Over a period of 24 hours of continuous operation at an operating temperature of –20°C, the transmitter power output shall be within the limits of 5W plus or minus 2 dB.

(d) The 406 MHz ELT shall be capable of transmitting a digital message.

(2) Transmitter identification coding

(a) Emergency locator transmitters operating on 406 MHz shall be assigned a unique coding for identification of the transmitter or aircraft on which it is carried.

(b) The emergency locator transmitter shall be coded in accordance with either the aviation user protocol or one of the serialized user protocols described in CNS.520 to this chapter and shall be registered by the DCA.

GM CNS.525 Specification for the 406 MHz component of emergency locator transmitter (ELT) for search and rescue

(1) Transmission characteristics for 406 MHz emergency locator transmitters are contained in ITU-R M.633. Note 2.— Information on technical characteristics and operational performance of 406 MHz ELTs is contained in RTCA

Document DO-204 and European Organization for Civil Aviation Equipment (EUROCAE) Document ED-62.

(1)(a) The COSPAS-SARSAT 406 MHz channel assignment plan is contained in COSPAS-SARSAT Document C/S T.012.

CNS.530 Emergency locator transmitter coding

(1) General

(a) The emergency locator transmitter (ELT) operating on 406 MHz shall have the capacity to transmit a programmed digital message which contains information related to the ELT and/or the aircraft on which it is carried.

(b) The ELT shall be uniquely coded in accordance with (1)(c) below and be registered with the appropriate authority.

(c) The ELT digital message shall contain either the transmitter serial number or one of the following information elements:

(i) aircraft operating agency designator and a serial number;

(ii) 24-bit aircraft address;

(iii) aircraft nationality and registration marks.

(d) All ELTs shall be designed for operation with the COSPAS-SARSAT system and be type approved.

(2) ELT coding

In relation to the Codification of the ELT, standard and recommended practices in section 2 of Chapter 5, Volume III, Part II of Annex 10 of the Convention on International Civil Aviation shall be applied.

GM CNS.530 Emergency locator transmitter coding

A detailed description of beacon coding is contained in Specification for COSPAS-SARSAT 406 MHz Distress Beacons (C/S T.001). The following technical specifications are specific to emergency locator transmitters used in aviation.

(1)(d) Transmission characteristics of the ELT signal can be confirmed by making use of the COSPAS-SARSAT Type Approval Standard (C/S T.007).

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Volume 4

SURVEILLANCE AND COLLISION AVOIDANCE SYSTEMS

CHAPTER 1

General

CNS.535 Secondary Surveillance Radar (SSR)

(1) Transponder reply modes (air-to-ground)

(a) Transponders shall respond to Mode A interrogations in accordance with the provisions of 3.1.1.7.12.1, Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation and to Mode C interrogations in accordance with the provisions of 3.1.1.7.12.2, Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

(i) The pressure-altitude reports contained in Mode S replies shall be derived as specified in 3.1.1.7.12.2, Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

(b) 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, shall respond to Mode C interrogations with pressure-altitude encoding in the information pulses.

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

(ii) For aircraft equipped with 7.62 m (25 ft) or better pressure-altitude sources, the pressure-altitude information provided by Mode S transponders in response to selective interrogations (i.e. in the AC field, 3.1.2.6.5.4, Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation.) shall be reported in 7.62 m (25 ft) increments.

(iii) All Mode A/C transponders shall report pressure-altitude encoded in the information pulses in Mode C replies.

(iv) All Mode S transponders shall report pressure-altitude encoded in the information pulses in Mode C replies and in the AC field of Mode S replies.

(v) When a Mode S transponder is not receiving more pressure-altitude information from a source with a quantization of 7.62 m (25 ft) or better increments, the reported value of the altitude shall be the value obtained by expressing the measured value of the uncorrected pressure-altitude of the aircraft in 30.48 m (100 ft) increments and the Q bit (see 3.1.2.6.5.4

b, Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation.) shall be set to 0.

(c) Transponders used within airspace where the need for Mode S airborne capability has been determined shall also respond to intermode and Mode S interrogations in accordance with the applicable provisions of 3.1.2, Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

(i) Requirements for mandatory carriage of SSR Mode S transponders shall be on the basis of regional air navigation agreements which shall specify the airspace and the airborne implementation timescales.

(2) Mode A reply codes (information pulses)

(a) All transponders shall be capable of generating 4096 reply codes conforming to the characteristics given in 3.1.1.6.2 of Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

(b) The following Mode A codes shall be reserved for special purposes:

(i) Code 7700 to provide recognition of an aircraft in an emergency.

(ii) Code 7600 to provide recognition of an aircraft with radiocommunication failure.

(iii) Code 7500 to provide recognition of an aircraft which is being subjected to unlawful interference.

(3) Mode S airborne equipment capability

In relation to the capacity of the onboard Mode S equipment, the standard and recommended practices in section 2.1.5 of Chapter 2, Volume IV, of Annex 10 of the Convention on International Civil Aviation shall be applied.

(4) SSR Mode S address (aircraft address)

The SSR Mode S address shall be one of 16 777 214 twenty-four-bit aircraft addresses allocated by ICAO to the State of Registry or common mark registering authority and assigned as prescribed in 3.1.2.4.1.2.3.1.1 of Chapter 3, Volume IV, of Annex 10 of the Convention on International Civil Aviation and the Appendix to Chapter 9, Part I, Volume III, Annex 10 of the Convention on International Civil Aviation.

AMC CNS.535 Secondary Surveillance Radar (SSR)

(1) Transponder reply modes (air to ground)

(c)(ii) The agreements indicated in CNS.535(1)(c)(i) should provide at least five years' notice.

GM CNS.535 Secondary Surveillance Radar (SSR)

(1)(a) If pressure-altitude information is not available, transponders reply to Mode C interrogations with framing pulses only.

(a)(i) 3.1.1.7.12.2 of Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation is intended to relate to Mode C replies and specifies, inter alia, that Mode C pressure-altitude reports be referenced to a standard pressure setting of 1 013.25 hectopascals. The intention of CNS.525 (1)(a)(i) is to ensure that all transponders, not just Mode C transponders, report uncorrected pressure-altitude.

(b)(i) Operation of the airborne collision avoidance system (ACAS) depends upon intruder aircraft reporting pressure-altitude in Mode C replies.

(b)(ii) Performance of the ACAS is significantly enhanced when an intruder aircraft is reporting pressure-altitude in 7.62 m (25 ft) increments.

(b)(v) This requirement relates to the installation and use of the Mode S transponder. The purpose is to ensure that altitude data obtained from a 30.48 m (100 ft) increment source are not reported using the formats intended for 7.62 m (25 ft) data.

CNS.540 Human factors considerations

(2) Operation of controls

Aircraft Operators shall ensure that the transponder controls meet the following requirements:

(a) Transponder controls which are not intended to be operated in flight shall not be directly accessible to the flight crew.

AMC CNS.540 Human factors considerations

(1) Human Factors principles

Human Factors principles should be observed in the design and certification of surveillance systems, transponder and collision avoidance systems.

(2) Operation of control

(b) The operation of transponder controls, intended for use during flight, should be evaluated to ensure they are logical and tolerant to human error. In particular, where transponder functions are integrated with other system controls, operators shall ensure that the manufacturer ensures that unintentional transponder mode switching is minimized.

(c) The flight crew should have access at all times to the information of the operational state of the transponder.

GM CNS.540 Human factors considerations

(1) Guidance material on Human Factors principles can be found in Doc 9683, Human Factors Training Manual and Circular 249 (Human Factors Digest No. 11 — Human Factors in CNS/ATM Systems).

(2)(b) This may take the form of a confirmation of mode switching, required by the flight crew. Typically, 'Line Select' Keys, 'Touch Screen' or 'Cursor Controlled/Tracker-ball' methods used to change transponder modes should be carefully designed to minimize flight crew error. (i.e. an operational state to 'STANDBY' or 'OFF').

(2)(c) Information on the monitoring of the operational state of the transponder is provided in RTCA DO-181 E, Minimum Operational Performance Standards for Air Traffic Control Radar Beacon System/ Mode Select (ATCRBS/Mode S) Airborne Equipment, and in EUROCAE ED-73E, Minimum Operational Performance Specification for Secondary Surveillance Radar Mode S Transponders.

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CHAPTER 2

Surveillance systems

CNS.545 Systems having mode S capabilities

In relation to the characteristics of the System having mode S capabilities, the standard and recommended practices in Chapter 3, 3.1.2 of Volume IV of Annex 10 of the Convention on the International Civil Aviation shall be applied.

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CHAPTER 3

Airborne Collision Avoidance system

GM CNS.550 General Information

This chapter contains standards on ACAS I, ACAS II and ACAS III. The focus is especially on ACAS II, which provides vertical resolution advisories (RAs) in addition to traffic advisories (TAs). The related provisions are detailed in the following sections of Volume IV of Annex 10 of the Convention on the International Civil Aviation:

- 4.3 GENERAL PROVISIONS RELATING TO ACAS II AND ACAS III

- 4.4 PERFORMANCE OF THE ACAS II COLLISION AVOIDANCE LOGIC; and

- 4.5 ACAS USE OF EXTENDED SQUITTER

ACAS X and traffic alert and collision avoidance system (TCAS) Version 7.1 are considered as ACAS II systems. The provisions for ACAS X-compliant systems in this chapter cover ACAS Xa (a stands for “active surveillance”, which is its main surveillance source) and ACAS Xo (o stands for “operation specific”). ACAS Xa is developed for large commercial aircraft. ACAS Xo is a specific variation of ACAS X that adds special modes to ACAS Xa.

ACAS X is an alternative to, and interoperable with, TCAS Version 7.1-compliant systems. However, there are differences between ACAS X and TCAS Version 7.1, mainly in two areas: the collision avoidance logic and the sources of surveillance data. With these differences, technical requirements which are specific to either ACAS X or TCAS version 7.1 are identified within this Annex as “For ACAS X-compliant systems” or “For TCAS 7.1-compliant systems”.

Guidance material related to both ACAS X-compliant systems and TCAS 7.1-compliant systems including similarities and differences (e.g. monitoring and training) are contained in the Airborne Collision Avoidance System (ACAS) Manual (Doc 9863).

It is to be noted that hybrid and extended hybrid surveillance provisions contained in section 4.5 describe functionalities which are optional for TCAS version 7.1-compliant systems. However, their use is encouraged in order to minimize the risk of ACAS RF spectrum congestion, as proper and efficient utilization of available bandwidth and capacity at 1 030 MHz and 1 090 MHz is a key element to ensuring the safe operation of not only ACAS but also several surveillance systems such as secondary surveillance radar (SSR) and automatic dependent surveillance broadcast (ADS-B). These functionalities are included in ACAS X-compliant systems.

Non-SI alternative units are used as permitted by Annex 5, Chapter 3, 3.2.2. In limited cases, to ensure consistency at the level of the logic calculations, units such as ft/s, NM/s and kt/s are used.

For more details of TCAS Version 7.1-compliant systems, refer to the RTCA/DO-185B or EUROCAE/ED-143 specifications, i.e. equipment that incorporates the TCAS Version 7.1. For ACAS X-compliant systems, refer to the RTCA/DO-385 or EUROCAE/ED-256 specifications, i.e. equipment that incorporates the airborne collision avoidance system X

(ACAS X). Equipment meeting the ACAS X or TCAS Version 7.1 specifications listed above are compliant with the ACAS II requirements listed in Chapter 4. Equipment meeting the RTCA/DO-185A specifications (also known as TCAS Version 7.0) are not compliant with the ACAS II requirements listed in Chapter 4.

CNS.555 ACAS I General provisions and characteristics

(1) Functional requirements. ACAS I shall perform the following functions:

(a) Surveillance of nearby SSR transponder-equipped aircraft; and

(b) Provide indications to the flight crew identifying the approximate position of nearby aircraft as an aid to visual acquisition.

(2) Signal format. The RF characteristics of all ACAS I signals shall conform to the provisions of Chapter 3, 3.1.1.1 through 3.1.1.6 and 3.1.2.1 through 3.1.2.4 of Volume IV of Annex 10 of the Convention on the International Civil Aviation.

(3) Interference control

(a) Maximum radiated RF power. The effective radiated power of an ACAS I transmission at 0 degree elevation relative to the longitudinal axis of the aircraft shall not exceed 24 dBW.

(b) Unwanted radiated power. When ACAS I is not transmitting an interrogation, the effective radiated power in any direction shall not exceed –70 dBm.

(c) Interference limiting. Each ACAS I interrogator shall control its interrogation rate or power or both in all SSR modes to minimize interference effects and shall comply with 4.2.3.3.3 and 4.2.3.3.4 of chapter 4, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

(i) Determination of own transponder reply rate. ACAS I shall monitor the rate that own transponder replies to interrogations to ensure that the provisions in 4.2.3.3.3 of chapter 4, Volume IV of Annex 10 of the Convention on the International Civil Aviation are met.

(ii) Determination of the number of ACAS II and ACAS III interrogators. ACAS I shall count the number of ACAS II and ACAS III interrogators in the vicinity to ensure that the provisions in 4.2.3.3.3 or 4.2.3.3.4 of chapter 4, Volume IV of Annex 10 of the Convention on the International Civil Aviation are met. This count shall be obtained by monitoring ACAS broadcasts (UF = 16), (4.3.7.1.2.4 of chapter 4, Volume IV of Annex 10 of the Convention on the International Civil Aviation) and shall be updated as the number of distinct ACAS aircraft addresses received within the previous 20-s period at a nominal frequency of at least 1 Hz.

GM CNS.555 ACAS I General provisions and characteristics

(1)(b) ACAS I is intended to operate using Mode A/C interrogations only. Furthermore, it does not coordinate with other ACAS. Therefore, a Mode S transponder is not required as a part of an ACAS I installation.

(3)(b) This requirement is to ensure that, when not transmitting an interrogation, ACAS I does not radiate RF energy that could interfere with, or reduce the sensitivity of, the SSR transponder or radio equipment in other nearby aircraft or ground facilities.

(3)(c) These limits are a means of ensuring that all interference effects resulting from these interrogations, together with the interrogations from all other ACAS I, ACAS II and ACAS III interrogators in the vicinity are kept to a low level.

CNS.560 General provisions relating to ACAS II and ACAS III

(1) Functional requirements

(a) ACAS functions. ACAS shall perform the following functions:

(i) surveillance;

(ii) generation of TAs;

(iii) threat detection;

(iv) generation of RAs;

(v) coordination; and

(vi) communication with ground stations.

The equipment shall execute functions ii) through v) on each cycle of operation.

(vii) The duration of a cycle shall not exceed 1.2 s.

(2) Surveillance performance requirements

(a) General surveillance requirements. ACAS shall interrogate SSR Mode A/C and Mode S transponders in other aircraft and detect the transponder replies. ACAS shall measure the range and relative bearing of responding aircraft. For ACAS X-compliant systems, in addition to information from other sources described above, ACAS shall be able to receive other aircraft's ADS-B position, velocity and status information. Using these measurements and information conveyed by transponder replies and for ACAS X-compliant systems also by ADS-B messages, ACAS shall estimate the relative positions of each responding aircraft. ACAS shall include provisions for achieving such position determination in the presence of ground reflections, interference and variations in signal strength.

(3) In relation to the General Provisions relating to ACAS II and ACAS III, the standard and recommended practices in section 4.3, Chapter 4 of Volume IV of Annex 10 of the Convention on the International Civil Aviation shall be applied.

GM CNS.560 General provisions relating to ACAS II and ACAS III

The acronym ACAS is used in this section to indicate either ACAS II or ACAS III.

Carriage requirements for ACAS equipment are addressed in Annex 6.

The term “equipped threat” is used in this section to indicate a threat fitted with ACAS II or ACAS III.

(1)(a) Certain features of these functions must be standardized to ensure that ACAS units cooperate satisfactorily with other ACAS units, with Mode S ground stations and with the ATC system. Each of the features that are standardized is discussed below. Certain other features are given herein as recommendations.

CNS.565 Performance of the ACAS II collision avoidance system logic

In relation to the performance of the anti-collision logic of ACAS II, the standard and recommended practices in section 4.4, Chapter 4, Volume IV of Annex 10 of the Convention on the International Civil Aviation shall be applied.

GM CNS.565 Performance of the ACAS II collision avoidance system logic

Caution is to be observed when considering potential improvements to ACAS since changes may affect more than one aspect of the system performance. It is essential that alternative designs would not degrade the performances of other designs and that such compatibility is demonstrated with a high degree of confidence. The performance specified in Section 4.4 is based on the performance achieved by TCAS Version 7.1-compliant systems.

The performance of ACAS X-compliant systems is improved compared to the performance of TCAS Version 7.1-compliant systems. For more information, refer to the Airborne Collision Avoidance System (ACAS) Manual (Doc 9863).

CNS.570 ACAS use of extended squitter

In relation to the use of ACAS for extended squitter, the standard and recommended practices in section 4.5, Chapter 4 of Volume IV of Annex 10 of the Convention on the International Civil Aviation shall be applied.

GM CNS.570 ACAS use of extended squitter

Surveillance protocols defined in this section are for ACAS hybrid surveillance, and surveillance protocols for ACAS not equipped for hybrid surveillance are defined in 4.3.7.1, Chapter 4, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

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CHAPTER 4
Mode S Extended Squitter

GM CNS.575 General information

A functional model of Mode S extended squitter systems supporting ADS-B and/or TIS-B is depicted in Figure 5-1 in Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

Airborne systems transmit ADS-B messages (ADS-B OUT) and may also receive ADS-B and TIS-B messages (ADS-B IN and TIS-B IN). Ground systems (i.e. ground stations) transmit TIS-B (as an option) and receive ADS-B messages.

Although not explicitly depicted in the functional model presented in Figure 5-1, extended squitter systems installed on aerodrome surface vehicles or fixed obstacles may transmit ADS-B messages (ADS-B OUT).

CNS.580 Mode S extended squitter transmitting system characteristics

(1) ADS-B out requirements

(a) Aircraft, surface vehicles and fixed obstacles supporting an ADS-B capability shall incorporate the ADS-B message generation function and the ADS-B message exchange function (transmit) as depicted in Figure 5-1 in Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

(i) ADS-B transmissions from aircraft shall include position, aircraft identification and type, airborne velocity, periodic status and event driven messages including emergency/priority information.

(b) Extended squitter ADS-B transmission requirements.

Mode S extended squitter transmitting equipment shall be classified according to the unit's range capability and the set of parameters that it is capable of transmitting consistent with the following definition of general equipment classes and the specific equipment classes defined in Tables 5-1 and 5-2 in Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation:

(i) Class A extended squitter airborne systems support an interactive capability incorporating both an extended squitter transmission capability (i.e. ADS-B OUT) with a complementary extended squitter reception capability (i.e. ADS-B IN) in support of onboard ADS-B applications;

(ii) Class B extended squitter systems provide a transmission only (i.e. ADS-B OUT without an extended squitter reception capability) for use on aircraft, surface vehicles, or fixed obstructions; and

(iii) Class C extended squitter systems have only a reception capability and thus have no transmission requirements.

(c) Class A extended squitter system requirements.

Class A extended squitter airborne systems shall have transmitting and receiving subsystem characteristics of the same class (i.e. A0, A1, A2, or A3) as specified in CNS.570 (1)(a) and CNS.575 (1)(b).

(d) Control of ADS-B OUT operation

(ii) If an independent control of the ADS-B OUT function is provided, then the operational state of the ADS-B OUT function shall be indicated to the flight crew, at all times.

(2) ADS-B OUT requirements for surface vehicles

(a) All surface vehicles supporting any versions of extended squitter ADS-B capability shall transmit extended squitter messages as per CNS.570 (1)(b).

(b) Extended squitter version 2 required system performance. The position source and equipment installed in surface vehicles to transmit extended squitter version 2 messages shall support the following performance characteristics:

(i) The NACp for the navigation position data shall be greater than or equal to 9, a 95 per cent accuracy bound on horizontal position less than 30 metres.

(ii) The NACv for the navigation velocity data shall be greater than or equal to 2, a velocity error less than 3 metres per second.

(iii) The NACp and NACV minimum values shall be met at a minimum availability of 95 per cent.

(iv) The system design assurance parameter shall be equal to 1 or more, which defines the probability of a failure resulting in transmission of false or misleading information to be less than or equal to 1×10^{-3}.

AMC CNS.580 Mode S extended squitter transmitting system characteristics

(1) ADS-B out requirements

(a)(ii) Extended squitter transmitting equipment should use formats and protocols of the latest version available.

(d) Control of ADS-B out operation

(i) Protection against reception of corrupted data from the source providing the position should be satisfied by error detection on the data inputs and the appropriate maintenance of the installation.

GM CNS.580 Mode S extended squitter transmitting system characteristics

Many of the requirements associated with the transmission of Mode S extended squitter are included in Chapter 2 and Chapter 3 for Mode S transponder and non-transponder devices using the message formats defined in the Technical Provisions for Mode S Services and Extended Squitter (Doc 9871). The provisions presented within the following subsections are focused on requirements applicable to specific classes of airborne and ground transmitting systems that are supporting the applications of ADS-B and TIS-B.

(1)(a)(ii) The data formats and protocols for messages transferred via extended squitter are specified in the Technical Provisions for Mode S Services and Extended Squitter (Doc 9871).

Some States and/or regions require extended squitter version 2 to be transmitted by specific dates.

(1)(c) Class A transmitting and receiving subsystems of the same specific class (e.g. Class A2) are designed to complement each other with their functional and performance capabilities. The minimum air-to-air range that extended squitter transmitting and receiving systems of the same class are designed to support are:

(i) A0-to-A0 nominal air-to-air range is 10 NM;

(ii) A1-to-A1 nominal air-to-air range is 20 NM;

(iii) A2-to-A2 nominal air-to-air range is 40 NM; and

(iv) A3-to-A3 nominal air-to-air range is 90 NM.

The above ranges are design objectives, and the actual effective air-to-air range of the Class A extended squitter systems may be larger in some cases (e.g. in environments with low levels of 1 090 MHz fruit) and shorter in other cases (e.g. in environments with very high levels of 1 090 MHz fruit).

(1)(d)(ii) There is no requirement for an independent control for the ADS-B OUT function.

(2)(b)(i) NACP is calculated based on satellite performance.

(2)(b)(iv) These minimum performance requirements for extended squitter version 2 transmitted position data from surface vehicles are necessary to support aircraft-based alerting applications.

Guidance material for implementation of surface vehicle ADS-B systems is contained in the Technical Provisions for Mode S Services and Extended Squitter (Doc 9871).

CNS.585 Mode S extended squitter receiving system characteristics (ADS-B IN)

(1) Mode S extended squitter receiving system functional requirements

(a) Mode S extended squitter receiving systems shall perform the message exchange function (receive) and the report assembler function.

(b) Mode S extended squitter receiver classes.

The required functionality and performance characteristics for the Mode S extended squitter receiving system will vary depending on the ADS-B and TIS-B client applications to be supported and the operational use of the system. Airborne Mode S extended squitter receivers shall be consistent with the definition of receiving system classes shown in Table 5-3 in Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

(2) Message exchange function

(a) The message exchange function shall include the 1090 MHz receiving antenna and the radio equipment (receiver/demodulator/decoder/data buffer) sub-functions.

(b) Message exchange functional characteristics.

The airborne Mode S extended squitter receiving system shall support the reception and decoding of all extended squitter messages as listed in Table 5-3 in Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation. The ground ADS-B extended squitter receiving system shall, as a minimum, support the reception and decoding of all of the extended squitter message types that convey information needed to support the generation of the ADS-B reports of the types required by the client ATM ground applications.

(c) Required message reception performance.

The airborne Mode S extended squitter receiver/demodulation/ decoder shall employ the reception techniques and have a receiver minimum trigger threshold level (MTL) as listed in Table 5-3 in Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation as a function of the airborne receiver class. The reception technique and MTL for extended squitter ground receiver shall be selected to provide the reception performance (i.e. range and update rates) as required by the client ATM ground applications.

(d) Enhanced reception techniques.

Class A1, A2 and A3 airborne receiving systems shall include the following features to provide improved probability of Mode S extended squitter reception in the presence of multiple overlapping Mode A/C fruit and/or in the presence of an overlapping stronger Mode S fruit, as compared to the performance of the standard reception technique required for Class A0 airborne receiving systems:

(i) Improved Mode S extended squitter preamble detection.

(ii) Enhanced error detection and correction.

(iii) Enhanced bit and confidence declaration techniques applied to the airborne receiver classes as shown below:

(1) Class A1 — Performance equivalent to or better than the use of the "Centre Amplitude" technique.

(2) Class A2 — Performance equivalent to or better than the use of the "Multiple Amplitude Samples" baseline technique, where at least 8 samples are taken for each Mode S bit position and are used in the decision process.

(3) Class A3 — Performance equivalent to or better than the use of the "Multiple Amplitude Samples" baseline technique, where at least 10 samples are taken for each Mode S bit position and are used in the decision process.

(3) Report assembler function

(a) The report assembler function shall include the message decoding, report assembly, and output interface sub- functions.

(b) When an extended squitter message is received, the message shall be decoded, and the applicable ADS-B report(s) of the types defined in CNS.575 (3)(c) shall be generated within 0.5 seconds.

(c) ADS-B report types

(i) State vector report. The state vector report shall contain time of applicability, information about an airborne or vehicle's current kinematic state (e.g. position, velocity), as well as a measure of the integrity of the navigation data, based on information received in airborne or ground position, airborne velocity, identification and category, aircraft operational status and target state and status extended squitter messages. Since separate messages are used for position and velocity, the time of applicability shall be reported individually for the position related report parameters and the velocity related report parameters. Also, the state vector report shall include a time of applicability for the estimated position and/or estimated velocity information (i.e. not based on a message with updated position or velocity information) when such estimated position and/or velocity information is included in the state vector report.

(ii) Mode status report. The mode status report shall contain time of applicability and current operational information about the transmitting participant, including airborne/vehicle address, call sign, ADS-B version number, airborne/vehicle length and width information, state vector quality information, and other information based on information received in aircraft operational status, target state and status, aircraft identification and category, airborne velocity and aircraft status extended squitter messages. Each time that a mode status report is generated, the report assembler function shall update the report time of applicability. Parameters for which valid data is not available shall either be indicated as invalid or omitted from the mode status report.

(iii) Air referenced velocity report. Air referenced velocity reports shall be generated when air referenced velocity information is received in airborne

velocity extended squitter messages. The air referenced velocity report shall contain time of applicability, airspeed and heading information. Only certain classes of extended squitter receiving systems, as defined in CNS.575 (3)(d), are required to generate air referenced velocity reports. Each time that an individual mode status report is generated, the report assembly function shall update the report time of applicability.

(iv) Resolution advisory (RA) report. The RA report shall contain time of applicability, and the contents of an active ACAS resolution advisory (RA) as received in a Type=28 and Subtype=2 extended squitter message.

(d) Report time of applicability

The receiving system shall use a local source of reference time as the basis for reporting the time of applicability, as defined for each specific ADS-B report type (see CNS.575(3)(c)).

(i) Precision time reference.

Receiving systems intended to generate ADS-B reports based on the reception of surface position messages, airborne position messages, shall use GNSS UTC measured time for the purpose of generating the report time applicability for the following cases of received messages:

(1) version zero (0) ADS-B messages, as defined in 3.1.2.8.6.2 of Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation, when the navigation uncertainty category (NUC) is 8 or 9; or

(2) version one (1) or version two (2) ADS-B messages, as defined in 3.1.2.8.6.2 and 3.1.2.8.7 respectively of Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation, when the navigation integrity category (NIC) is 10 or 11;

UTC measured time data shall have a minimum range of 300 seconds and a resolution of 0.0078125 (1/128) seconds.

(ii) Non-precision local time reference

(1) For receiving systems not intended to generate ADS-B and/or TIS-B reports based on reception of ADS-B messages meeting the NUC or NIC criteria as indicated in 5.2.3.5.1 of Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation, a non-precision time source shall be allowed. In such cases, where there is no appropriate precision time source available, the receiving system shall establish an appropriate internal clock or counter having a maximum clock cycle or count time of 20 milliseconds. The established cycle or clock count shall have a minimum range of 300 seconds and a resolution of 0.0078125 (1/128) seconds.

(e) Reporting requirements

(i) Reporting requirements for Type I Mode S extended squitter airborne receiving systems. As a minimum, the report assembler function associated with Type I Mode S extended squitter receiving systems, as defined in 5.2.3 of Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation, shall support that subset of ADS-B reports and report parameters, that are required by the specific client applications being served by that receiving system.

(ii) Reporting requirements for Type II Mode S extended squitter airborne receiving systems. The report assembler function associated with Type II receiving systems, as defined in 5.2.3 of Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation, shall generate ADS-B reports according to the class of the receiving system as shown in Table 5-4 of Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation when the prerequisite ADS-B messages are being received.

(iii) Reporting requirements for Mode S extended squitter ground receiving systems. As a minimum, the report assembler function associated with Mode S extended squitter ground receiving systems, as defined in 5.2.3 of Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation, shall support that subset of ADS-B reports and report parameters, that are required by the specific client applications being served by that receiving system.

(4) Interoperability

The Mode S extended squitter receiving system shall provide interoperability between the different versions of extended squitter ADS-B message formats.

(a) Initial message decoding

The Mode S extended squitter receiving system shall, upon acquiring a new ADS-B target, initially apply the decoding provisions applicable to version 0 (zero) ADS B messages until or unless an aircraft operational status message is received indicating that a higher version message format is in use.

(b) Applying version number

The Mode S extended squitter receiving system shall decode the version number information conveyed in the aircraft operational status message and shall apply the corresponding decoding rules for the reported version, up to the highest version supported by the receiving system, for the decoding of the subsequent extended squitter ADS-B messages from that specific aircraft or vehicle.

(c) Handling of reserved message subfields

The Mode S extended squitter receiving system shall ignore the contents of any message subfield defined as reserved.

CNS.585 Mode S extended squitter receiving system characteristics (ADS-B IN)

The paragraphs herein describe the required capabilities for 1090 MHz receivers used for the reception of Mode S extended squitter transmissions that convey ADS-B and/or TIS-B messages. Airborne receiving systems support ADS- B reception while ground receiving systems support only ADS-B reception.

Detailed technical provisions for Mode S extended squitter receivers can be found within RTCA DO-260B/EUROCAE ED-102A, “Minimum Operational Performance Standards for 1 090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B).

(1)(a) The extended squitter receiving system receives ADS-B Mode S extended squitter messages and outputs ADS-B reports to client applications. This functional model (shown in Figure 5-1 in Chapter 5, Volume IV of Annex 10 of the Convention on the International Civil Aviation.) depicts both airborne and ground 1090 MHz ADS-B receiving systems.

(1)(b) Different equipment classes of Mode S extended squitter installations are possible. The characteristics of the receiver associated with a given equipment class are intended to be appropriate to support the required level of operational capability. Equipment classes A0 through A3 are applicable to those Mode S extended airborne installations that include a Mode S extended squitter transmission (ADS OUT) and reception (ADS-B IN) capability. Equipment classes B0 through B3 are applicable to Mode S extended installations with only a transmission (ADS-B OUT) capability and includes equipment classes applicable to airborne, surface vehicles and fixed obstructions. Equipment classes C1 through C3 are applicable to Mode S extended squitter ground receiving systems.

(2)(d)(iii)(*3)* The above enhanced reception techniques are as defined in RTCA DO-260B/EUROCAE ED-102A, Appendix I.

The performance provided for each of the above enhanced reception techniques when used in a high fruit environment (i.e. with multiple overlapping Mode A/C fruit) is expected to be at least equivalent to that provided by the use of the techniques described in RTCA DO-260B/EUROCAE ED-102A, Appendix I.

It is considered appropriate for ground extended squitter receiving systems to employ the enhanced reception techniques equivalent to those specified for airborne Class A2 or A3 receiving systems.

(3)(b) Two configurations of extended squitter airborne receiving systems, which include the reception portion of the ADS-B message exchange function and the ADS-B/TIS-B report assembly function, are allowed:

a) Type I extended squitter receiving systems receive ADS-B and TIS-B messages and produce application-specific subsets of ADS-B and TIS-B reports. Type I extended squitter receiving systems are customized to the particular client applications using ADS-B and TIS-B reports. Type I extended squitter receiving systems may additionally be controlled by an external entity to produce installation-defined subsets of the reports that those systems are capable of producing.

b) Type II extended squitter receiving systems receive ADS-B and TIS-B messages and are capable of producing complete ADS-B and TIS-B reports in accordance with the equipment class. Type II extended squitter receiving systems may be controlled by an external entity to produce installation-defined subsets of the reports that those systems are capable of producing.

Extended squitter ground receiving systems receive ADS-B messages and produce either application-specific subsets or complete ADS-B reports based on the needs of the ground service provider, including the client applications to be supported.

The extended squitter message reception function may be physically partitioned into hardware separate from those that implement the report assembly function.

(3)(c) The ADS-B report refers to the restructuring of ADS-B message data received from Mode S extended squitter broadcasts into various reports that can be used directly by a set of client applications. Five ADS-B report types are defined by the following subparagraphs for output to client applications. Additional information on the ADS-B report contents and the applicable mapping from extended squitter messages to ADS-B reports can be found in the Technical Provisions for Mode S Services and Extended Squitter (Doc 9871) and RTCA DO-260B / EUROCAE ED-102A.

The use of precision (e.g. GNSS UTC measured time) versus non-precision (e.g. internal receiving system clock) time sources as the basis for the reported time of applicability is described in CNS.575 (3)(d).

(3)(c)(i) Specific requirements for the customization of this type of report may vary according to the needs of the client applications of each participant (ground or airborne). The state vector data is the most dynamic of the four ADS-B reports; hence, the applications require frequent updates of the state vector to meet the required accuracy for the operational dynamics of the typical airborne or ground operations of airborne and surface vehicles.

(3)(c)(ii) Specific requirements for the customization of this type of report may vary according to the needs of the client applications of each participant (ground or airborne).

The age of the information being reported within the various data elements of a mode status report may vary as a result of the information having been received within different extended squitter messages at different times.

(3)(c)(iii) The air referenced velocity report contains velocity information that is received in airborne velocity messages along with additional information received in airborne identification and category extended squitter messages. Air referenced velocity reports are not generated when ground referenced velocity information is being received in the airborne velocity extended squitter messages.

Specific requirements for the customization of this type of report may vary according to the needs of the client applications of each participant (ground or airborne).

(3)(c)(iv) The RA report is only intended to be generated by ground receiving subsystems when supporting a ground ADS-B client application(s) requiring active RA information. An RA report will nominally be generated each time a Type=28, Subtype=2 extended squitter message is received.

(3)(c)(v) Target state report

The target state report will be generated when information is received in target state and status messages, along with additional information received in airborne identification and category extended squitter messages. The target state and status message is defined in the Technical Provisions for Mode S Services and Extended Squitter (Doc 9871). Specific requirements for the customization of this type of report may vary according to the needs of the client applications of each participant (ground or airborne).

(3)(d)(ii)*(1)* The use of a non-precision time reference as described above is intended to allow the report time of applicability to accurately reflect the time intervals applicable to reports within a sequence. For example the applicable time interval between state vector reports could be accurately determined by a client application, even though the absolute time (e.g. UTC measured time) would not be indicated by the report.

(4) All defined ADS-B versions and their corresponding message formats are contained in the Technical Provisions for Mode S Services and Extended Squitter (Doc 9871) and are identified by a version number.

ADS-B message formats are defined with backward compatibility with previous versions. An extended squitter receiver can recognize and decode signals of its own version, as well as the message formats from lower versions. The receiver, however, can decode the portion of messages received from a higher version transponder according to its own capability.

(4)(c) This provision supports interoperability between message versions by allowing the definition of additional parameters that will be ignored by earlier receiver versions and correctly decoded by newer receiver versions.

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CHAPTER 5

Multilateration System

CNS.590 Functional requirements

(1) Radio frequency characteristics, structure and data contents of signals used in 1090 MHz MLAT systems shall conform to the provisions of Chapter 3, Volume IV of Annex 10 of the Convention on the International Civil Aviation.

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

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

GM CNS.590 Functional requirements

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

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

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

(c) a combination of a) and b).

(1) Detailed technical guidance for MLAT and WAM can be found in the Aeronautical Surveillance Manual (Doc 9924), Appendix L. Material contained in EUROCAE ED-117A – MOPS for Mode S Multilateration Systems for Use in A-SMGCS and ED-142 – Technical Specifications for Wide Area Multilateration System (WAM) provides information for planning, implementation and satisfactory operation of MLAT systems for most applications.

(2) Depending on the application, either two- or three-dimensional position of the aircraft may be required.

Aircraft identity may be determined from:

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

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

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

CNS.595 Protection of the radio frequency environment

(1) In order to minimize system interferences, the effective radiated power of active interrogators shall be reduced to the lowest value consistent with the operationally required range of each individual interrogator site.

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

(3) An active MLAT system consisting of a set of transmitters shall be considered as a single Mode S interrogator.

(4) The set of transmitters used by all active MLAT systems in any part of the airspace shall not cause any transponder to be impacted such that its occupancy, because of the aggregate of all MLAT 1030 MHz interrogations, is greater than 2 per cent at any time.

(5) Active MLAT systems shall not use Mode S All-Call interrogations.

GM CNS.595 Protection of the radio frequency environment

This section only applies to active MLAT systems.

(1) Guidance material on power consideration is contained in the Aeronautical Surveillance Manual (Doc 9924).

(2) Transponder occupancy will be increased by the use of omnidirectional antennas. It is particularly significant for Mode S selective interrogations because of their higher transmission rate. All Mode S transponders will be occupied decoding each selective interrogation not just the addressed transponder.

(4) This represents a minimum requirement. Some regions may impose stricter requirements.

For an MLAT system using only Mode S interrogations, 2 per cent is equivalent to no more than 400 Mode S interrogations per second received by any aircraft from all systems using MLAT technology.

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

CNS.600 Performance requirements

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

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CHAPTER 6

Technical requirements for airborne surveillance applications

GM CNS.605 General information

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

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

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

CNS.610 General requirements

(1) Traffic data functions

(a) Identifying the reference aircraft

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

(b) Tracking the reference aircraft

(i) The system shall support a function to monitor the movements and behaviour of each reference aircraft relevant to the application.

(2) Displaying traffic

(a) The system shall display only one track for each distinct aircraft on a given display.

(b) Where a track generated by ADS-B IN and a track generated by ACAS have been determined to belong to the same aircraft, the track generated by ADS-B IN shall be displayed.

(c) The display of the tracks shall comply with the requirements of ACAS traffic display.

AMC CNS.610 General requirements

(1) Traffic data functions

(c) Trajectory of the reference aircraft

(i) The system should support a computational function to predict the future position of a reference aircraft beyond simple extrapolation.

GM CNS.610 General requirements

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

(1)(c)(i) It is anticipated that this function will be required for future applications.

(2) Provisions contained in this section apply to cases wherein tracks generated by ACAS and by reception of ADS-B IN messages are shown on a single display.

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

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

(2)(c) Section 4.3 of Chapter 4, Volume IV of Annex 10 of the Convention on the International Civil Aviation addresses colour coding and readability of the display.

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Volume 5

AERONAUTICAL RADIO FREQUENCY SPECTRUM UTILIZATION

CHAPTER 1

Distress frequencies

GM CNS.615 Introduction

The ITU Radio Regulations Article 30 provides general conditions for distress and safety communications for all mobile services. The aeronautical mobile service is also permitted under Article 30, Section III, No. 30.9 to conform to special arrangements between governments where these have been agreed. ICAO Annexes constitute such agreements.

The Standards and Recommended Practices relating to radio frequencies for distress communications take into account certain procedures that have been adopted by ICAO and also certain provisions made by the ITU in its Radio Regulations.

ICAO Annex 10, Volume II requires that an aircraft in distress when it is airborne should use the frequency in use for normal communications with aeronautical stations at the time. However, it is recognized that, after an aircraft has crashed or ditched, there is a need for designating a particular frequency or frequencies to be used in order that uniformity may be attained on a worldwide basis, and so that a guard may be maintained or set up by as many stations as possible including direction-finding stations, and stations of the maritime mobile service.

The frequency 2 182 kHz also offers possibilities for communication between aircraft and stations of the maritime mobile service. The ITU Radio Regulations specify in Article 30, Section III, No. 30.11 that the frequency 2 182 kHz is the international distress frequency for radiotelephony to be used for emergency communications by ship, aircraft and survival craft stations using frequencies in the authorized bands between 1 605 kHz and 4 000 kHz when requesting assistance from, or communicating with, the maritime service.

With respect to emergency locator transmitters (ELTs) designed to be detected and located by satellite, the Radio Regulations authorize the use of these devices, which are referenced in ITU as satellite emergency position indicating radio beacons (EPIRBs). ITU Radio Regulations Article 31, Section I, No. 31.1 specifies that the band 406 – 406.1 MHz is used exclusively by satellite EPIRBs in the earth-to-space direction.

The frequency 4 125 kHz is also authorized by the ITU to enable communications between stations in the maritime mobile service and aircraft stations in distress. The current ITU Radio Regulations (RR 5.130 and Articles 31 and 32) state that the carrier frequency 4 125 kHz may be used by aircraft stations to communicate with stations of the maritime mobile service for distress and safety purposes. The aeronautical mobile (R) service frequencies 3 023 kHz and 5 680 kHz may be employed for coordinated search and rescue operations with the maritime mobile service under RR 5.115.

With respect to survival craft stations, the Radio Regulations provide for the use of the frequencies 8 364 kHz, 2 182 kHz, 121.500 MHz and 243 MHz, if the survival craft is capable of operating in the bands 4 000 – 27 500 kHz, 1 605 – 2 850 kHz, 117.975 – 137.000 MHz and 235 – 328.6 MHz respectively (RR Articles 31 and 32).

CNS.620 Frequencies for Emergency Locator Transmitter (ELTs) for SAR

(1) All emergency locator transmitters carried in compliance with Standards of Annex 6, Parts I, II and III shall operate on both 406 MHz and 121.500 MHz.

GM CNS.620 Frequencies for Emergency Locator Transmitter (ELTs) for SAR

(1) ITU Radio Regulations (5.256) provide for the use of 243 MHz in addition to the above frequencies.

Specifications for ELTs are found in Annex 10, Volume III, Part II, Chapter 5 and the ITU Radio Regulations Article 34, Section I, No. 34.1.

CNS.625 Search and Rescue (SAR) frequencies

(1) Where there is a requirement for the use of high frequencies for search and rescue scene of action coordination purposes, the frequencies 3023 kHz and 5680 kHz shall be employed.

AMC CNS.625 Search and Rescue (SAR) frequencies

(2) Where specific frequencies are required for communication between rescue coordination centres and aircraft engaged in search and rescue operations, they should be selected regionally from the appropriate aeronautical mobile frequency bands in light of the nature of the provisions made for the establishment of search and rescue aircraft.

GM CNS.625 Search and Rescue (SAR) frequencies

(2) Where civil commercial aircraft take part in search and rescue operations, they will normally communicate on the appropriate en-route channels with the flight information centre associated with the rescue coordination centre concerned.

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CHAPTER 2

Utilization of frequencies below 30 MHz

GM CNS.630 Introduction

(1) High frequency bands allocated to the aeronautical mobile (R) service

The frequency bands between 2.8 MHz and 22 MHz allocated to the aeronautical mobile (R) service are given in Article 5 of the ITU Radio Regulations. The utilization of these bands must be in accordance with the relevant provisions of the Radio Regulations and in particular Appendix 27 to the Radio Regulations. In the utilization of these bands, States' attention is drawn to the possibility of harmful radio interference from non-aeronautical sources of radio frequency energy and the need to take appropriate measures to minimize its effects.

CNS.635 Method of operations

(1) In the aeronautical mobile service, single channel simplex shall be used in radiotelephone communications utilizing radio frequencies below 30 MHz in the bands allocated exclusively to the aeronautical mobile (R) service.

(2) Assignment of single sideband channels

(a) Single sideband channels shall be assigned in accordance with Annex 10, Volume III, Part II, Chapter 2, 2.4.

(b) For the operational use of the channels concerned, administrations shall take into account the provisions of 27/19 of Appendix 27 of the ITU Radio Regulations.

(e) The use of classes of emission J7B and J9B shall be subject to the following provisions of Appendix 27:

(i) 27/12 For radiotelephone emissions, the audio frequencies will be limited to between 300 and 2 700 Hz and the occupied bandwidth of other authorized emissions will not exceed the upper limit of J3E emissions. In specifying these limits, however, no restriction in their extension is implied in so far as emissions other than J3E are concerned, provided that the limits of unwanted emissions are met (see Nos. 27/73 and 27/74).

(ii) 27/14 On account of the possibility of interference, a given channel shall not be used in the same allotment area for radiotelephony and data transmissions.

(iii) 27/15 The use of channels derived from the frequencies indicated in 27/18 for the various classes of emissions other than J3E and H2B will be subject to special arrangements by the Administrations concerned and

affected in order to avoid harmful interference which may result from the simultaneous use of the same channel for several classes of emission.

(3) Assignment of frequencies for aeronautical operational control communications

For the Assignment of frequencies for aeronautical operations control communications, the provisions of section 3.1.3, Chapter 3, Volume V of Annex 10 of the Convention on International Civil Aviation shall apply.

AMC CNS.635 Method of operations

(2) Assignment of single sideband channels

(c) The use of aeronautical mobile (R) frequencies below 30 MHz for international operations should be coordinated as specified in Appendix 27 of the ITU Radio Regulations as follows:

(i) 27/19 The International Civil Aviation Organization (ICAO) co-ordinates radiocommunications of the aeronautical mobile (R) service with international aeronautical operations and this Organization should be consulted in all appropriate cases in the operational use of the frequencies in the Plan.

(d) Where international operating requirements for HF communications cannot be satisfied by the Frequency Allotment Plan at Part 2 of Appendix 27 to the Radio Regulations, an appropriate frequency may be assigned as specified in Appendix 27 by the application of the following provisions:

(i) 27/20 It is recognized that not all the sharing possibilities have been exhausted in the Allotment Plan contained in this Appendix. Therefore, in order to satisfy particular operational requirements which are not otherwise met by this Allotment Plan, Administrations may assign frequencies from the aeronautical mobile (R) bands in areas other than those to which they are allotted in this Plan. However, the use of the frequencies so assigned must not reduce the protection to the same frequencies in the areas where they are allotted by the Plan below that determined by the application of the procedure defined in Part I, Section II B of this Appendix.

(ii) 27/21 When necessary to satisfy the needs of international air operations Administrations may adapt the allotment procedure for the assignment of aeronautical mobile (R) frequencies, which assignments shall then be the subject of prior agreement between Administrations affected.

(iii) 27/22 The co-ordination described in No. 27/19 shall be effected where appropriate and desirable for the efficient utilization of the frequencies in question, and especially when the procedures of No. 27/21 are unsatisfactory.

GM CNS.635 Method of operations

(2)(d) Part I, Section II B of Appendix 27 relates to Interference Range Contours, and application of the procedure results in a protection ratio of 15 dB.

AMC CNS.640 NDB frequency management

(1) NDB frequency management should take into account the following:

(a) the interference protection required at the edge of the rated coverage;

(b) the application of the figures shown for typical ADF equipment;

(c) the geographical spacings and the respective rated coverages;

(d) the possibility of interference from spurious radiation generated by non-aeronautical sources (e.g. electric power services, power line communication systems, industrial radiation, etc.).

(2) To alleviate frequency congestion problems at locations where two separate ILS facilities serve opposite ends of a single runway, the assignment of a common frequency to both of the outer locators shall be permitted, and the assignment of a common frequency to both of the inner locators should be permitted, provided that:

(a) the operational circumstances permit;

(b) each locator is assigned a different identification signal; and

(c) arrangements are made whereby locators using the same frequency cannot radiate simultaneously.

GM CNS.640 NDB frequency management

(1) Guidance material to assist in determining the application of the foregoing is given in Attachment A.

Attention is drawn to the fact that some portions of the bands available for aeronautical beacons are shared with other services.

(2) The Standard in Annex 10, Volume I, 3.4.4.4, specifies the equipment arrangements to be made.

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CHAPTER 3

Utilization of frequencies above 30 MHz

GM CNS.645 General information

Details pertaining to the allocation of spectrum to aeronautical services, including footnoted allocations and restrictions, are contained in both the International Telecommunication Union (ITU) Radio Regulations and the ICAO Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies (Doc 9718).

CNS.650 Utilization in the frequency band 117.975 – 137.000 MHz

(1) General allotment of frequency band 117.975 – 137.000 MHz

For the allocation of frequencies of the group corresponding to the frequency band of 117.975 - 137.000 MHz, the provisions of 4.1.1, Chapter 4, Volume 5 of Annex 10 of the Convention on the International Civil Aviation shall apply.

(2) Frequency separation and limits of assignable frequencies

(a) In the frequency band 117.975 – 137.000 MHz, the lowest assignable frequency shall be 118.000 MHz and the highest 136.975 MHz.

(b) The minimum separation between assignable frequencies in the aeronautical mobile (R) service shall be 8.33 kHz.

(c) Requirements for mandatory carriage of equipment specifically designed for 8.33 kHz channel spacing shall be made on the basis of regional air navigation agreements which specify the airspace of operation and the implementation timescales for the carriage of equipment, including the appropriate lead time.

(d) Requirements for mandatory carriage of equipment specifically designed for VDL Mode 2, VDL Mode 3 and VDL Mode 4 shall be made on the basis of regional air navigation agreements which specify the airspace of operation and the implementation timescales for the carriage of equipment, including the appropriate lead time.

(e) The agreement indicated in CNS.640 (2)(d) shall provide at least two years' notice of mandatory carriage of airborne systems.

(f) If 25 kHz channel spacing (DSB-AM and VHF digital link (VDL)) and 8.33 kHz DSB-AM channel spacing are in operation, the publication of the assigned frequency or channel of operation shall conform to the channel contained in Table 4-1 (bis) of Annex 10, vol. v, chapter 4, 4.1.2.5.

(3) Frequencies used for particular functions

(a) Emergency channel

(i) The emergency channel 121.500 MHz shall be used only for genuine emergency purposes, as broadly outlined in the following:

(1) to provide a clear channel between aircraft in distress or emergency and a ground station when the normal channels are being utilized for other aircraft;

(2) to provide a VHF communication channel between aircraft and aerodromes, not normally used by international air services, in case of an emergency condition arising;

(3) to provide a common VHF communication channel between aircraft, either civil or military, and between such aircraft and surface services, involved in common search and rescue operations, prior to changing when necessary to the appropriate frequency;

(4) to provide air-ground communication with aircraft when airborne equipment failure prevents the use of the regular channels;

(5) to provide a channel for the operation of emergency locator transmitters (ELTs), and for communication between survival craft and aircraft engaged in search and rescue operations;

(6) to provide a common VHF channel for communication between civil aircraft and intercepting aircraft or intercept control units and between civil or intercepting aircraft and air traffic services units in the event of interception of the civil aircraft.

(ii) The frequency 121.500 MHz shall be provided at:

(1) all area control centres and flight information centres;

(2) aerodrome control towers and approach control offices serving international aerodromes and international alternate aerodromes; and

(3) any additional location designated by the appropriate ATS authority,

where the provision of that frequency is considered necessary to ensure immediate reception of distress calls or to serve the purposes specified in (3)(a)(i) above.

(iii) The frequency 121.500 MHz shall be available to intercept control units where considered necessary for the purpose specified in (3)(a)(i)*(6)*.

(iv) The emergency channel shall be guarded continuously during the hours of service of the units at which it is installed

(v) The emergency channel shall be guarded on a single channel simplex operation basis.

(vi) The emergency channel (121.500 MHz) shall be available only with the characteristics as contained in Annex 10, Volume III, Part II, Chapter 2 (25 kHz).

(b) Air-to-air communications channel

(i) An air-to-air VHF communications channel on the frequency of 123.450 MHz shall be designated 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.

(ii) In remote and oceanic areas out of range of VHF ground stations, the air-to-air VHF communications channel on the frequency 123.450 MHz shall be available only with the characteristics as contained in Annex 10, Volume III, Part II, Chapter 2 (25 kHz).

(c) Common signalling channels for VDL

(i) Common signalling channel VDL Mode 2. The frequency 136.975 MHz is reserved on a worldwide basis to provide a common signalling channel (CSC) to the VHF digital link Mode 2 (VDL Mode 2). This CSC uses the Mode 2 VDL modulation scheme and carrier sense multiple access (CSMA).

(ii) Common signalling channels VDL Mode 4. In areas where VDL Mode 4 is implemented, the frequencies 136.925 MHz and 113.250 MHz shall be provided as common signalling channels (CSCs) to the VHF digital link Mode 4 (VDL Mode 4). These CSCs use the VDL Mode 4 modulation scheme.

(d) Auxiliary frequencies for search and rescue operations

(i) Where a requirement is established for the use of a frequency auxiliary to 121.500 MHz, as described in (3)(a)(i)*(3)* the frequency 123.100 MHz shall be used.

(ii) The auxiliary search and rescue channel (123.100 MHz) shall be available only with the characteristics as contained in Annex 10, Volume III, Part II, Chapter 2 (25 kHz).

(4) Provisions concerning the deployment of VHF frequencies and the avoidance of harmful interference

In relation to the provisions related to the deployment of VHF frequencies and to avoid interference, the standard and recommended practices established in section 4.1.4 Chapter 4, Volume 5 of Annex 10 of the Convention of the International Civil Aviation shall be applied.

(5) Method of operation

(a) Single channel simplex operation shall be used in the frequency band 117.975 – 137.000 MHz at all stations providing service for aircraft engaged in international air navigation.

(b) In addition to the above, the ground-to-air voice channel associated with an ICAO standard radio navigation aid may be used, subject to regional agreement, for broadcast or communication purposes or both.

(6) Plan of assignable VHF radio frequencies for use in the international aeronautical mobile service

(a) The frequencies in the frequency band 117.975 – 137.000 MHz for use in the aeronautical mobile (R) service shall be selected from the lists in 4.1.6.1.1, Chapter 4, Volume 5 of Annex 10 of the Convention of the International Civil Aviation.

(b) The frequencies that may be allotted for use in the aeronautical mobile (R) service shall be limited to the number determined as being necessary for operational needs in the region.

AMC CNS.650 Utilization in the frequency band 117.975 – 137.000 MHz

(6) Plan of assignable VHF radio frequencies for use in international aeronautical mobile service

(a)(i) Frequencies for operational control communications may be required to enable aircraft operators to meet the obligations prescribed in Annex 6, Part I, in which case they should be selected from a dedicated band which is determined regionally.

GM CNS.650 Utilization in the frequency band 117.975 – 137.000 MHz

Introduction

Section 4.1 deals with Standards and Recommended Practices (SARPs) relating to the use of the frequency band 117.975 – 137.000 MHz and includes matters pertaining to the selection of particular frequencies for various aeronautical purposes. These SARPs are introduced by the following preface, which sets out the principles upon which the utilization of this frequency band on a worldwide basis with due regard to economy is being planned.

Preface

The utilization of the frequency band 117.975 – 137.000 MHz on a worldwide basis with due regard to economy and practicability requires a plan that will take into account:

(a) the need for an orderly evolution towards improved operation and the required degree of worldwide standardization;

(b) the desirability of providing for an economic transition from present utilization to optimum utilization of the frequencies available, taking into account the maximum possible utilization of existing equipment;

(c) the need to provide for coordination between international and national utilization so as to ensure mutual protection from interference;

(d) the need for providing a global framework for the coordinated development of Regional Plans;

(e) the need, in certain regions, to have more detailed plans and planning criteria in addition to the provisions in this section;

(f) the desirability of incorporating in any group of frequencies to be used those now in use for international air services;

(g) the need for keeping the total number of frequencies and their grouping in appropriate relation to the airborne equipment known to be widely used by international air services;

(h) a requirement for the provision of a single frequency that may be used for emergency purposes on a worldwide basis and, also, in certain regions, for another frequency that may be used as a common frequency for special purposes; and

(i) the need for providing sufficient flexibility to allow for the differences in application necessitated by regional conditions.

(1) General allotment of frequency band 117.975 – 137.000 MHz

The plan includes a general Allotment Table that subdivides the complete frequency band 117.975 – 137.000 MHz, the chief subdivisions being the frequency bands allocated to both national and international services, and the frequency bands allocated to national services. Observance of this general subdivision should keep to a minimum the problem of coordinating national and international application.

(2) Frequency separation and limits of assignable frequencies

In the following text, the channel spacing for 8.33 kHz channel assignments is defined as 25 kHz divided by 3 which is 8.333 ... kHz.

(2)(b) It is recognized that in some regions or areas, 25 kHz channel spacing provides an adequate number of frequencies suitably related to international and national air services and that equipment designed specifically for 25 kHz channel spacing will remain adequate for services operating within such regions or areas. It is further recognized that assignments based on 25 kHz channel spacing as well as 8.33 kHz channel spacing may continue to co-exist within one region or area.

(2)(c) No changes will be required to aircraft systems or ground systems operating solely in regions not using 8.33 kHz channel spacing.

(2)(f) Table 4-1 (bis) provides the frequency channel pairing plan which retains the numerical designator of the 25 kHz DSB-AM environment and allows unique identification of a 25 kHz VDL and 8.33 kHz channel.

(3)(a)(i) The use of the frequency 121.500 MHz for the purpose outlined in *(3)* is to be avoided if it interferes in any way with the efficient handling of distress traffic.

The ITU Radio Regulations (RR 5.200) permit the use of the aeronautical emergency frequency 121.500 MHz by mobile stations of the maritime mobile service under the conditions laid down in Article 31 of the Radio Regulations for distress and safety purposes with stations of the aeronautical mobile service.

(3)(a)(ii)*(3)* Where two or more of the above facilities are collocated, provision of 121.500 MHz at one would meet the requirement.

(3)(b)(i) Use of the air-to-air channel can cause interference to and from aircraft using the same frequency for air- ground communications.

(3)(d)(ii) The ITU Radio Regulations (RR 5.200) permit the use of the aeronautical auxiliary frequency 123.100 MHz by mobile stations of the maritime mobile service under the conditions laid down in Article 31 of the Radio Regulations for distress and safety purposes with stations of the aeronautical mobile service.

(6)(a)(i) It is recognized that the assignment of such frequencies and the licensing of the operation of the related facilities are matters for national determination. However, in regions where a problem exists with respect to the provision of frequencies for operational control purposes, it may be advantageous if States endeavour to coordinate the requirements of aircraft operators for such channels prior to regional meetings.

(6)(b) The number of frequencies required in a particular region is normally determined by the Council on the recommendations of Regional Air Navigation Meetings.

CNS.655 Utilization in the frequency band 108 – 117.975 MHz

(1) The block allotment of the frequency band 108 – 117.975 MHz shall be as follows:

(a) Band 108 ‑ 111.975 MHz:

(i) ILS in accordance with 4.2.2 and Annex 10, Volume I, 3.1.3;

(ii) VOR provided that:

(1) no harmful adjacent channel interference is caused to ILS;

(2) only frequencies ending in either even tenths or even tenths plus a twentieth of a megahertz are used.

(iii) GNSS ground-based augmentation system (GBAS) in accordance with Annex 10, Volume I, 3.7.3.5, provided that no harmful interference is caused to ILS and VOR.

(b) Band 111.975 – 117.975 MHz:

(i) VOR;

(ii) GNSS ground-based augmentation system (GBAS) in accordance with Annex 10, Volume I, 3.7.3.5, provided that no harmful interference is caused to VOR.

(2) For regional assignment planning, the frequencies for ILS facilities shall be selected in the following order:

(i) localizer channels ending in odd tenths of a megahertz and their associated glide path channels;

(ii) localizer channels ending in odd tenths plus a twentieth of a megahertz and their associated glide path channels.

(a) ILS channels identified by localizer frequencies ending in an odd tenth plus one twentieth of a megahertz in the band 108 – 111.975 MHz shall be permitted to be utilized on the basis of regional agreement when they become applicable.

(3) For regional assignment planning, the frequencies for VOR facilities shall be selected in the following order:

(i) frequencies ending in odd tenths of a megahertz in the band 111.975 – 117.975 MHz;

(ii) frequencies ending in even tenths of a megahertz in the band 111.975 – 117.975 MHz;

(iii) frequencies ending in even tenths of a megahertz in the band 108 – 111.975 MHz;

(iv) frequencies ending in 50 kHz in the band 111.975 – 117.975 MHz, except as provided in 4.2.3.1;

(v) frequencies ending in even tenths plus a twentieth of a megahertz in the band 108 – 111.975 MHz except as provided in (3)(a) below.

(a) Frequencies for VOR facilities ending in even tenths plus a twentieth of a megahertz in the band 108 – 111.975 MHz and all frequencies ending in 50 kHz in the band 111.975 – 117.975 MHz shall be permitted to be utilized on the basis of a regional agreement when they have become applicable in accordance with the following:

(i) in the band 111.975 – 117.975 MHz for restricted use;

(ii) for general use in the band 111.975 – 117.975 MHz at a date fixed by the Council but at least one year after the approval of the regional agreement concerned;

(iii) for general use in the band 108 – 111.975 MHz at a date fixed by the Council but giving a period of two years or more after the approval of the regional agreement concerned.

(4) To protect the operation of airborne equipment during the initial stages of deploying VORs utilizing 50 kHz channel spacing in an area where the existing facilities may not fully conform with the Standards in Annex 10, Volume I, Chapter 3, all existing VORs within interference range of a facility utilizing 50 kHz channel spacing shall be modified to comply with the provisions of Annex 10, Volume I, 3.3.5.7 of the Convention on the International Civil Aviation.

(5) Frequency deployment.

The geographical separation between facilities operating on the same and adjacent frequencies shall be determined regionally and shall be based on the following criteria:

(a) the required functional service radii of the facilities;

(b) the maximum flight altitude of the aircraft using the facilities;

(c) the desirability of keeping the minimum IFR altitude as low as the terrain will permit.

AMC CNS.655 Utilization in the frequency band 108 – 117.975 MHz

(6) To alleviate frequency congestion problems at locations where two separate ILS facilities serve opposite ends of the same runway or different runways at the same airport, the assignment of identical ILS localizer and glide path paired frequencies should be permitted, provided that:

(a) the operational circumstances permit;

(b) each localizer is assigned a different identification signal; and

(c) arrangements are made whereby the localizer and glide path not in operational use cannot radiate.

GM CNS.655 Utilization in the frequency band 108 – 117.975 MHz

(1)(a)(iii) ILS/GBAS geographical separation criteria and geographical separation criteria for GBAS and VHF communication services operating in the 118 – 137 MHz band are under development. Until these criteria are defined and included in the SARPs, it is intended that frequencies in the band 112.050 – 117.900 MHz will be used for GBAS assignments.

(1)(b)(ii) Guidance material relating to the distance separation required to prevent harmful interference between ILS and VOR when using the band 108 – 111.975 MHz is found in Section 3 of Attachment C to Annex 10, Volume I.

Guidance material relating to the distance separation required to prevent harmful interference between VOR and GBAS when using the band 112.050 – 117.900 MHz is found in Section 7.2.1 of Attachment D to Annex 10, Volume I.

(3)(a)(iii) "Restricted use", where mentioned in 4.2.2.1 a) and 4.2.3.1 a), is intended to refer to the limited use of the frequencies by only suitably equipped aircraft and in such a manner that:

(a) the performance of ILS or VOR equipment not capable of operating on these frequencies will be protected from harmful interference;

(b) a general requirement for the carriage of ILS or VOR airborne equipment capable of operation on these frequencies will not be imposed; and

(c) operational service provided to international operators using 100 kHz airborne equipment is not derogated.

(5)(c) Guidance material on this subject is contained in the Attachments to Annex 10, Volume V, on the Convention on the International Civil Aviation.

(6)(c) The Standards in Annex 10, Volume I, 3.1.2.7.2 and 3.1.3.9, specify the equipment arrangements to be made.

CNS.660 Utilization in the frequency band 960 – 1215 MHz for DME

With regard to the use of the frequency band 960-1.215 MHz for the DME, the Standards and Recommended Practices in section 4.3, Chapter 4, Volume V of Annex 10 to the Convention on International Civil Aviation shall be applied.

CNS.665 Utilization in the frequency band 5030.4 – 5150.0 MHz

In relation to the use of the frequency band of 5 030.4 - 5 150.0 MHz the Standards and Recommended Practices in section 4.4, Chapter 4, Volume V of Annex 10 to the Convention on International Civil Aviation shall be applied.

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Volume 6

COMMUNICATION SYSTEMS AND PROCEDURES RELATING TO REMOTELY PILOTED AIRCRAFT SYSTEMS C2 LINK

CHAPTER 1

Specifications

CNS.670 General

(1) Time reference to the C2 Link service

Any time reference to the C2 Link service and time-stamping of the information carried by the C2 Link shall be in Coordinated Universal Time (UTC).

GM CNS.670 General

GM-1. The C2 Link is the logical connection, however physically realized, used for the exchange of information between the remote pilot station (RPS) and the remotely piloted aircraft (RPA). It enables the remote pilot's manipulation of the flight controls in the RPS to be sent to the RPA and for the RPA to return its status to the remote pilot. The C2 Link also enables the remote pilot to manage the safe integration of the remotely piloted aircraft system (RPAS) into the global aviation, communications, navigation and surveillance operational environment.

GM-2. Guidance on the systems and procedures relating to the C2 Link is included in the Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019).

(1) This does not apply to the time-stamping internal to the network communication protocol. The time stamp includes the date and time.

CNS.675 Supported functions

(1) The C2 Link shall 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 shall, in a secure manner, meet the performance required for those tasks appropriate to the airspace requirements.

GM CNS.675 Supported functions

(1) Annex 6 contains requirements for safe operation of the RPAS.

(2) Airspace requirements vary depending upon air traffic density and complexity and may be reflected in equipage or separation requirements.

Alternate means of communications between the remote pilot and air traffic control may obviate the need for the C2 Link to be used for ATC communications.

CNS.680 Service provisions

(1) The C2 Link service shall 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 CNS.665 (1).

(2) The DCA is 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 shall 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 shall be commensurate with the C2 Link performance required for safe operations.

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

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

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

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

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

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

(9) The C2CSP shall 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.

(10) Before providing any C2 Link service, the C2CSP shall demonstrate to the responsible authority initial compliance with the provisions contained in CNS.670 (1) and CNS.670 (3) through CNS.670 (8).

GM CNS.680 Service provisions

(2) Details on State and C2CSP responsibilities related to the oversight of C2 Link service provision can be found in Annex 6.

(3) Efficient use of the limited frequency spectrum resource requires that a link be released and made available to other users when not in use.

(7) The World Geodetic System — 1984 (WGS-84) Manual (Doc 9674) contains requirements for data quality.

Intended recipients can be remote pilot or ATC units concerned.

CNS.685 C2 Link Service Area

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

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

AMC CNS.685 C2 Link Service Area

(3) To 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 when determining the C2 Link service area.

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CHAPTER 2

Procedures

CNS.690 General

(1) Prior to the flight, the C2CSP shall 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).

AMC CNS.690 General

(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.

GM CNS.690 General

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.

CNS.695 Establishment, assurance and termination of the C2 Link

(1) Human factors principles shall 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 shall be provided to the remote pilot to establish and maintain the C2 Link, including the interaction with the C2CSP. These means shall be documented in the operations manual.

(3) An indication shall 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 shall be provided to the remote pilot during flight planning.

(5) Means shall 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 shall be contained in the operations manual.

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

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

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

(11) A handover shall 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 shall 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 shall be in accordance with the operational management and safety requirements of the airspace.

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

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

AMC CNS.695 Establishment, assurance and termination of the C2 Link

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

GM CNS. 695 Establishment, assurance, and termination of the C2 Link

(1) Situations may occur in which the C2 Link would need to be terminated during the flight in order to increase the safety level of the flight. However, unintentional termination must be prevented.

CNS.700 Establishment and assurance of ATC communications

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

AMC CNS.700 Establishment and assurance of ATC communications

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

GM CNS.700 Establishment and assurance of ATC communications

(1) ATC communication procedures contained in Annex 10 — Aeronautical Telecommunications, Volume II — Communication Procedures including those with PANS status, and the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444).

CNS.705 Contingency and emergency procedures

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

(2) Technical and procedural means shall 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 shall 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 shall be required to return the RPAS to a nominal C2 Link state, in accordance with the procedures contained in the operations manual.

CNS.710 Security

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

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

CNS.715 Display

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

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

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

CNS.720 Monitoring

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

(a) RPA or RPS C2 Link and/or subsystem link and/or C2CSP emission has ceased;

(b) RPA or RPS C2 Link and/or subsystem link and/or C2CSP reception has ceased;

(c) 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;

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

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

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

CNS.725 Records

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

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

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

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

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

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

(6) The following information shall 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 the 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.

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

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

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

(9) The RPA shall maintain an electronic log, automatically recording any information described in CNS.715 (1) to CNS.715 (8) that is available to the RPA.

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

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

GM CNS. 725 Records

(3) Authorized on-duty persons can be remote pilots or any other person having knowledge of facts pertinent to the entries.

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CHAPTER 3
General C2 Link systems

CNS.730 System description

(1) The RPAS communication system shall comprise the following systems.

(a) A communication system supporting communications external to the RPAS dedicated to the airspace requirements functions.

(b) 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.

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

GM CNS.730 System description

(1)(b)(iv) The C2 Link communication system between the RPS and the RPA may comprise one or more different communication links and may be provided by one or more C2CSPs.

The C2 Link communication system may comprise ground and/or airborne and/or satellite links and systems.

CNS.735 Spectrum

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

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

GM CNS.735 Spectrum

(2) Provision for international frequency channel assignment planning can be found in the C2 Link System Guidance Manual (in preparation).

CNS.740 System characteristics

(1) The C2 Link system shall 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 shall 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 shall radiate no more power than is necessary to achieve the C2 Link specification.

CNS.745 Data transmission characteristics

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

(2) The C2 Link system message sequence management shall use time-stamping.

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

(a) RPA flight control and configuration messages;

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

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

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

(e) other flight safety messages;

(f) routine telemetry messages;

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

(h) other messages.

GM CNS. 745 Data transmission characteristics

The above order of priority is for the transmission of information over the C2 Link. The order of priority of messages transmitted by communication systems other than the C2 Link will remain as listed in Annex 10, Volume II, Chapter 4 and Volume III, Part I, Table 3-1.

Distress and urgency messages are defined in Annex 10, Volume II, 5.3.1.1.

CNS.750 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.

GM CNS.750 Performance requirements

These requirements include required communication performance (RCP), required surveillance performance (RSP) and required navigation performance (RNP) when appropriate.

CNS.755 C2 Link communication service provider (C2CSP)

(1) The RPAS operator shall establish a service level agreement (SLA) with one or more C2CSPs concerning the C2 Link service provision.

(2) The C2CSP shall ensure that the QoSD is at any time meeting the QoSR.

(a) The C2CSP shall conduct, with RPAS operators, real time interference monitoring, estimation and prediction of interference risks, and planning solutions for potential harmful interference scenarios under the oversight of the competent authority.

(3) The C2CSPs, RPAS operators and competent authorities shall act immediately when their attention is drawn to any harmful interference.

(4) The C2CSP shall have the qualified resources and adequate documentation that will allow competent authorities to perform their oversight.

(5) Terrestrial C2 communication service providers

(a) Terrestrial RPAS equipment shall operate in frequency spectrum with an allocation as described in Annex 10, Volume V, Chapter 5, section 5.2.

(6) Satellite C2 communication service providers

(a) Satellite RPAS equipment shall operate in frequency spectrum with an allocation as described in Annex 10, Volume V, Chapter 5, section 5.1.

(b) SLAs between satellite C2CSPs and RPAS operators shall ensure that, once a satellite network has completed successful coordination, which guarantees the level of protection necessary to ensure the overall RPAS C2 Link QoSD, the protection level is not eroded as a result of subsequent satellite coordination agreements.

(c) SLAs between satellite C2CSPs and RPAS operators shall ensure that satellite C2CSPs act immediately when their attention is drawn to any harmful interference.

(d) The satellite C2CSP shall 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.

GM CNS.755 C2 Link communication service provider (C2CSP)

(1) An SLA is required even when the operator is its own C2CSP.

The SLA defines the relationship and responsibilities of the two parties in accordance with the following Standards.

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