



**THE REPUBLIC OF SUDAN**  
**SUDAN CIVIL AVIATION AUTHORITY**  
**(SCAA)**

SUCAR PART 10  
AERONAUTICAL  
TELECOMMUNICATIONS

September 2011



# THE REPUBLIC OF SUDAN SUDAN CIVIL AVIATION AUTHORITY (SCAA)



## Sudan Civil Aviation Regulation SUCAR PART 10 Aeronautical Telecommunications

SUCAR Part 10 – *Aeronautical Telecommunications* has been promulgated pursuant to Article 33 of the Civil Aviation Act, 2010 and issued under my consent as is required by the Act.

The SUCAR fully complies with the requirements of Annex 10 – *Aeronautical Telecommunications* to the Convention on International Civil Aviation; and, supported by Directives, Orders and Procedures that may be published, from time-to-time, by the Board of Directors of Civil Aviation and/or the Director General of Civil Aviation, as required by law, constitute the Aeronautical Telecommunications Standards of the Republic of Sudan.

Dr. Mohamed Elmuktar Hassan  
Minister of Cabinet Affairs  
Khartoum, 20 October 2011



*Sudan Civil Aviation Authority*

*Aeronautical Telecommunications*





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**THE REPUBLIC OF SUDAN  
SUDAN CIVIL AVIATION AUTHORITY  
(SCAA)**



**Sudan Civil Aviation Regulation  
SUCAR PART 10  
Aeronautical Telecommunications**

SUCAR Part 10 – *Aeronautical Telecommunications* has been promulgated pursuant to Article 33 of the Civil Aviation Act, 2010 and issued under my consent as is required by the Act.

The SUCAR fully complies with the requirements of Annex 10 – *Aeronautical Telecommunications* to the Convention on International Civil Aviation; and, supported by Directives, Orders and Procedures that may be published, from time-to-time, by the Board of Directors of Civil Aviation and/or the Director General of Civil Aviation, as required by law, constitute the Aeronautical Telecommunications Standards of the Republic of Sudan.

Dr. Mohamed Elmuktar Hassan  
Minister of Cabinet Affairs  
Khartoum, 20 October 2011



**The Republic of Sudan**  
**Sudan Civil Aviation Regulations (SUCARs)**

**FOREWORD**

**1. Legal Background**

Pursuant to Article 33 of the Civil Aviation Act, 2010 regarding the empowerment of the Board of Directors of Civil Aviation to issue and amend Sudan Civil Aviation Regulations (SUCAR) for the approval of the Competent Minister, Sudan Civil Aviation Safety Regulations are issued to ensure compliance with the Convention on International Civil Aviation, signed in Chicago on 7 December 1944 (Chicago Convention) to which the State of Sudan is a Party. The Convention, through its Annexes, provides for the minimum standards to ensure the safety of civil aviation activities and environmental protection throughout the application and implementation of common standards and technical requirements. Sudan Civil Aviation Regulations provide an appropriate and comprehensive framework for the definition and implementation of common technical requirements and administrative procedures in the field of civil aviation. Standards and Recommended Practices (SARPs) contained in ICAO Annexes as well as the technical information in its related publications form a main source in the making of Sudan Civil Aviation Regulations and therefore represent an acceptable guidance in the areas that are not covered by Sudan Civil Aviation Regulations.

- a) An aircraft, other than an aircraft registered in the State of Sudan, shall not fly over or land in the territories of the State of Sudan except under an authorization granted by the Civil Aviation Authority (CAA) on behalf of the Government of the State of Sudan.
- b) An aircraft other than an aircraft registered in the State of Sudan shall not take on-board or discharge any passengers or cargo at any location within the territories of the State of Sudan, being passengers or cargo carried or to be carried for hire or reward, without the permission of the CAA granted for the aircraft in accordance with any conditions and limitations to which such permission may be subjected.
- c) An aircraft shall not fly over or land in the territory of the State of Sudan unless it is registered in:
  - i. The State of Sudan; or
  - ii. An ICAO Contracting State; or
  - iii. Any other State where an agreement/arrangement between the State of Sudan and that State making provisions for over-flight or landing in the territory of the State of Sudan.
- d) In accordance with the provisions of **SUCAR Part 7**, an aircraft registered in the State of Sudan shall comply with the Sudan Civil Aviation Regulations.
- e) An Aircraft, registered outside the State of Sudan shall comply with the Sudan Civil Aviation Regulations while operating to/from or within the territories of the State of Sudan wherever is applicable.
- f) An aircraft registered in the State of Sudan should comply with the regulations of other States that it is overflying wherever is applicable.
- g) Sudan CAA accepts the codes of the Type Certification Authority of the State of Manufacturer and/or Design, for the purpose of issuing or Revalidation of Airworthiness Certificates, Airworthiness Directives (ADs), Minimum Equipment List (MEL), and all other related issues in that respect. The Sudan Civil Aviation Authority may impose additional requirements.



- h) Any difference that may exist between SUCAR requirements and corresponding ICAO Annex SARPs. Significant differences shall be published in the National AIP. The procedure for amending the SUCARs and filing of differences with ICAO are contained in paragraph 4 below and detailed information is found in the CAA Rule Making Manual.
- i) An effort has been made for SUCAR requirements to be fully compliant with corresponding ICAO Annexes; however, where an aviation activity for which a SUCAR regulation has not been promulgated is undertaken in the Sudan, the relevant Annex provisions shall be applicable until it is addressed in an amendment of the SUCAR.” Applicability date for SUCARs by users is set at six months after they have been promulgated (30 September 2011).

## 2. Layout of the SUCAR Document

Sudan Civil Aviation Regulations cover all aspects of aviation activities in the State of Sudan and comprise of the following parts;

Part 0	SUCAR Index
Part 1	Personnel Licensing
Part 2	Rules of the Air
Part 3	Meteorological Service for International Air Navigation
Part 4	Aeronautical Charts
Part 5	Units of Measurement
Part 6	Operation of Aircraft <i><b>Note:</b> Designated as Volumes of SUCAR Part 6 in general; Standards contained in ANR Parts VII, Part VIII, Volumes 2, 3, 4, 5, 7 and ANR Part X, as amended, have been directly adopted as Volumes of SUCAR Part 6.</i>
Part 7	Aircraft Registration or Cancellation
Part 8	Airworthiness of Aircraft and Continuing Airworthiness <i><b>Note:</b> Designated as Volumes of SUCAR Part 8 in general; Standards contained in ANR Parts III, IV, V, VI, and VIII, as amended, have been directly adopted as Volumes of SUCAR Part 8.</i>
Part 9	RESERVED (Facilitation)
Part 10	Aeronautical Telecommunications
Part 11	Air Traffic Services
Part 12	Search and Rescue
Part 13	Aircraft Accident and Incident Investigation
Part 14	Aerodromes
Part 15	Aeronautical Information Services
Part 16	Environmental Protection
Part 17	Aviation Security
Part 18	The Safe Transportation of Dangerous Goods by Air

Each Part of SUCAR, but not necessarily all, is composed of :

- a) An introduction;
- b) Text;
- c) Definitions;
- d) Notes;
- e) Tables and figures;
- f) Appendices; and



- g) Attachments.

### 3 Rules of construction

In the Parts of these Regulations, unless the context requires otherwise:

1. Words importing the singular include the plural
2. Words importing the plural include the singular, and
3. Words importing the masculine gender include the feminine.
4. “Shall” is used in an imperative sense.
5. “May /should” is used in a permissive sense to state authority or permission to do the act prescribed, and the words “no person may....” Or “a person may not .....” means that no person is required, authorized or permitted to do the act prescribed, and
6. The word “Includes” means includes but is not limited to.
7. The word “Show” and its derivatives in these regulations have the exact intent as shown in the dictionary.

### 4 Amendment Rationale and Procedures

The existing Sudan Civil Aviation Regulations will from time to time be amended to reflect the latest updates of ICAO Standards and Recommended Practices (SARPs); it will also be amended to reflect the latest up to date aviation safety related matters detected by the Civil Aviation Authority, the aviation industry service providers or operators, and individuals and authorization holders; amendment may also be generated to ensure safety standardization and to accommodate new initiatives or technologies. The amendment procedure shall be as follows;

1. When the Civil Aviation Authority (**CAA**) receives an amendment to any of the current ICAO Annexes, the same will be routed by the Office of the Director General of Civil Aviation to the Standard and Safety Surveillance Committee (**SSSC**) which in turn will provide a copy to the concerned Directorate for their study and comments within a specified period of time and route the same back to the SSSC for final study and release.
2. When any of the different CAA Directorates requires a change to the applicable SUCAR parts, it will send a letter stating the required change along with its justified reasons for such change where it will then be studied and decided upon by the **SSSC**.
3. Any of the above mentioned change requests would then be prepared in draft form and sent to the concerned Directorate for further study and comments within a specified period of time.
4. All suggested changes will be drafted in the form of notices of proposed amendments and addressed to all concerned including industry representatives for comments prior to final release.
5. Any differences between the new regulations and ICAO standards and recommended practices will be reported and recorded as differences to ICAO and reflected in the Aeronautical Information Publications (**AIP**).
6. Entry into force time frame for any new regulations will be the responsibility of the **SSSC**. The SSSC will also be responsible for coordinating the identification of differences from corresponding ICAO Annexes in coordination with the concerned Directorates.
7. The Office of the Director General is responsible for filing differences with ICAO as soon as new regulations or amendments thereto have been promulgated.



8. All concerned parties will be given a copy of the new amendment and will be requested to update their copy of the regulations including their list of effective pages.
9. Approved amendments or corrigenda of SUCAR or part(s) thereof will be disseminated to the industry through hardcopies (news release circulars directives and other) and softcopies (online or database, Internet address, CD-ROM and other).
10. It is the responsibility of all concerned parties to keep their copy of the regulations up to date.
11. Where applicable, regulations contained in the Air Navigation Regulations (ANRs) that have not been revoked may be enforced should the need arise.
12. The State may release no regulation prior to the formal approval of the Competent Minister as determined in Civil Aviation Act 2010 or the Director General of Civil Aviation on delegation by the Competent Minister.

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## SUBPART 1 – RADIO NAVIGATIONS

### CHAPTER 1

### DEFINITIONS

*Note: Regulations contained in this Subpart to SUCAR 10, fully comply with the provisions contained in ICAO Annex 10, Volume I to the Convention on International Civil Aviation either through adapted regulations (Chapter 2, for Example) or adopted SARPs (Chapter 3, in its totality, and all Appendices and Attachments).*

1. **Altitude.** The vertical distance of a level a point or an object considered as a point , measured from mean sea level (MSL)
2. **Effective Acceptance Band Width.**The range of frequencies with respect to the assigned frequency for which reception is measured when all relevant receiver tolerance have been taken into account.
3. **Effective Adjacent Channel Rejection.**The rejection that is obtained at the appropriate adjacent channel frequency when all relevant receiver tolerance have been taken into account.
4. **Elevation.**The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.
5. **Height.**The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.
6. **Human Factors Principles.**Principles, which apply to design, certificate, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.
7. **Mean Power (of radio transmitter).**The average power supplied to the antenna transmission line by a transmitter during an interval of time sufficient long compared with the lowest frequency encountered in the modulation taken under normal operating conditions .
8. **Pressure-altitude.** An atmospheric pressure expressed in term of altitude, which corresponds to that pressure in the Standard Atmosphere.
9. **Touch down** The point where the nominal glide path intercepts the runway.
10. **Protected service volume.** A part of the facility coverage where the facility provides a particular service in accordance with relevant SARPs and within which the facility is afforded frequency protection.





## CHAPTER 2 GENERAL PROVISIONS FOR RADIO NAVIGATION AIDS

### 2.1 Standard radio navigation aids

2.1.1 The standard radio navigation aids shall be:

- a) the instrument landing system (ILS) conforming to the Standards contained in Chapter 3, 3.1;
- b) the microwave landing system (MLS) conforming to the Standards contained in Chapter 3, 3.11;
- c) the global navigation satellite system (GNSS) conforming to the Standards contained in Chapter 3, 3.7;
- d) the VHF omnidirectional radio range (VOR) conforming to the Standards contained in Chapter 3, 3.3;
- e) the non-directional radio beacon (NDB) conforming to the Standards contained in Chapter 3, 3.4;
- f) the distance measuring equipment (DME) conforming to the Standards contained in Chapter 3, 3.5; and
- g) the en-route VHF marker beacon conforming to the Standards contained in Chapter 3, 3.6.

*Note 1.*— 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.

*Note 2.*— 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.

*Note 3.*— Categories of precision approach and landing operations are classified in Annex 6, Part I, Chapter 1.

*Note 4.*— Information on operational objectives associated with ILS facility performance categories is given in Attachment C, 2.1 and 2.14.

*Note 5.*— Information on operational objectives associated with MLS facility performance is given in Attachment G, 11.

2.1.2 Differences in radio navigation aids in any respect from the Standards of Chapter 3 shall be published in an Aeronautical Information Publication (AIP).

2.1.3 Wherever there is installed a radio navigation aid that is neither an ILS nor an MLS, but which may be used in whole or in part with aircraft equipment designed for use with the ILS or MLS, full details of parts that may be so used shall be published in an Aeronautical Information Publication (AIP).

*Note.*— This provision is to establish a requirement for promulgation of relevant information rather than to authorize such installations.

2.1.4 GNSS-specific provisions

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



2.1.4.2 On approving GNSS-based operations Sudan shall ensure that GNSS data relevant to those operations are recorded.

*Note 1.— These recorded data are primarily intended for use in accident and incident investigations. They may also support periodic confirmation that accuracy, integrity, continuity and availability are maintained within the limits required for the operations approved.*

*Note 2.—Guidance material on the recording of GNSS parameters is contained in Attachment D, 11.*

2.1.4.3 Recordings shall be retained for a period of at least 14 days. When the recordings are pertinent to accident and incident investigations, they shall be retained for longer periods until it is evident that they will no longer be required.

2.1.5 Precision approach radar

2.1.5.1 A precision approach radar (PAR) system, where installed and operated as a radio navigation aid together with equipment for two-way communication with aircraft and facilities for the efficient coordination of these elements with air traffic control, shall conform to the Standards contained in Chapter 3, 3.2.

*Note 1.—The precision approach radar (PAR) element of the precision approach radar system may be installed and operated without the surveillance radar element (SRE), when it is determined that the SRE is not necessary to meet the requirements of air traffic control for the handling of aircraft.*

*Note 2.—Although SRE is not considered, in any circumstances, a satisfactory alternative to the precision approach radar system, the SRE may be installed and operated without the PAR for the assistance of air traffic control in handling aircraft intending to use a radio navigation aid, or for surveillance radar approaches and departures.*

2.1.6 When a radio navigation aid is provided to support precision approach and landing, it shall be supplemented, as necessary, by a source or sources of guidance information which, when used in conjunction with appropriate procedures, will provide effective guidance to, and efficient coupling (manual or automatic) with, the desired reference path.

*Note.— DME, GNSS, NDB, VOR and aircraft navigation systems have been used for such purposes.*

## **2.2 Ground and flight testing**

2.2.1 Radio navigation aids of the types covered by the specifications in Chapter 3 and available for use by aircraft engaged in international air navigation shall be the subject of periodic ground and flight tests.

*Note.— 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).*





## **2.3 Provision of information on the operational status of radio navigation services**

- 2.3.1 Aerodrome control towers and units providing approach control service shall be provided with information on the operational status of radio navigation services essential for approach, landing and takeoff at the aerodrome(s) with which they are concerned, on a timely basis consistent with the use of the service(s) involved.

## **2.4 Power supply for radio navigation aids and communication systems**

- 2.4.1 Radio navigation aids and ground elements of communication systems of the types specified in Annex 10 shall be provided with suitable power supplies and means to ensure continuity of service consistent with the use of the service(s) involved.

*Note.*— *Guidance material on power supply switch-over is contained in Attachment C, 8.*

- 2.5 Human Factors considerations** 2.5.1 **Recommendation.**—*Human Factors principles should be observed in the design and certification of radionavigation aids. Note.*— *Guidance material on Human Factors principles can be found in the Human Factors Training Manual(Doc 9683) and Circular 249 (Human Factors Digest No. 11 — Human Factors in CNS/ATM Systems).*



## CHAPTER 3 SPECIFICATIONS FOR RADIO NAVIGATION AIDS

*The Republic of Sudan has through the promulgation of this SUCAR adapted Standards and Recommended Practices (SARPs) contained in Chapter 3 to Annex 1, Volume 1 to the Convention on International Civil Aviation and thus are implemented, as applicable, in the Republic of Sudan as National Regulations relating to Specifications for Radio Navigation Aids. SARPs directly adapted include the full text of the following Sub-chapters, Appendices and Attachments:*

- 3.1 Specification for ILS
  - 3.2 Specification for precision approach radar system
  - 3.3 Specification for VHF omnidirectional radio range (VOR)
  - 3.4 Specification for non-directional radio beacon (NDB)
  - 3.5 Specification for UHF distance measuring equipment (DME)
  - 3.6 Specification for en-route VHF marker beacons (75 MHz)
  - 3.7 Requirements for the Global Navigation Satellite System (GNSS)
  - 3.9 System characteristics of airborne ADF receiving systems
  - 3.11 Microwave landing system (MLS) characteristics
- 
- Appendix A Microwave Landing System (MLS) characteristics
  - Appendix B Technical Specifications for the Global Satellite Navigation System (GNSS)
- 
- Attachment A Determination of integrity and continuity of service objectives using the risk tree method
  - Attachment B Strategy for introduction and application of non-visual aids to approach and landing
  - Attachment C Information and material for guidance in the application of the Standards and Recommended Practices for ILS, VOR, PAR, 75 MHz marker beacons (en-route), NDB and DME
  - Attachment D Information and material for guidance in the application of the GNSS Standards and Recommended Practices
  - Attachment E Guidance material on the pre-flight checking of VOR airborne equipment
  - Attachment F Guidance material concerning reliability and availability of radiocommunications and navigation aids
  - Attachment G Information and material for guidance in the application of the MLS Standards and Recommended Practices



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**SUBPART 2 – COMMUNICATION PROCEDURES**  
**CHAPTER 1**  
**DEFINITIONS**

***Note1:** Regulations contained in this Subpart to SUCAR 10, fully comply with the provisions contained in ICAO Annex 10, Volume II to the Convention on International Civil Aviation either through adapted/adopted regulations (Chapter 2, for Example) or adopted SARPs (Chapter 3 to Chapter 8, including relevant Appendices and Attachments, as applicable).*

***Note2:** Definitions provided in Annex 10, Volume 2 – Communication Procedures, Chapter 1 – Definitions are adapted as Chapter 1, to Volume II of this SUCAR and should be used as the appropriate reference for terms and words used in this Subpart.*



## CHAPTER 2 ADMINISTRATIVE PROVISIONS

### 2.1 Division of service

The international aeronautical telecommunication service shall be divided into four parts:

- 1) aeronautical fixed service;
- 2) aeronautical mobile service;
- 3) aeronautical radio navigation service;
- 4) aeronautical broadcasting service.

### 2.2 Telecommunication — Access

All aeronautical telecommunication stations, including end systems and intermediate systems of the aeronautical telecommunication network (ATN), shall be protected from unauthorized direct or remote access.

### 2.3 Hours of service

2.3.1 Sudan Civil Aviation Authority shall give notification of the normal hours of service of stations and offices of the international aeronautical telecommunication service under its control to the aeronautical telecommunication agencies designated to receive this information by other Administrations concerned.

2.3.2 Whenever necessary and practicable, the SCAA shall give notification of 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.

2.3.3 If a station of the international aeronautical telecommunication service, or an aircraft operating agency, requests a change in the hours of service of another station, such change shall be requested as soon as possible after the need for change is known. The station or aircraft-operating agency requesting the change shall be informed of the result of its request as soon as possible.

### 2.4 Supervision

2.4.1 The Republic of Sudan has designated the Sudan Civil Aviation Authority as responsible for ensuring that the international aeronautical telecommunication service is conducted in accordance with the Procedures in this SUCAR and corresponding ICAO Annex.

2.4.2 Occasional infringements of the Procedures contained herein, when not serious, shall be dealt with by direct communication between the SCAA and the parties immediately interested either by correspondence or by personal contact.

2.4.3 When a station commits serious or repeated infringements, representations relating to them shall be made to the authority designated in 2.4.1 of the State to which the station belongs by the authority which detects them.

2.4.4 The Air Navigation Services Directorate of the SCAA shall exchange information regarding the performance of systems of communication, radio navigation, operation and maintenance, unusual transmission phenomena, etc.

### 2.5 Superfluous transmissions

The Republic of Sudan shall ensure that there is no willful transmission of



unnecessary or anonymous signals, messages or data by any station within its territory.

## **2.6 Interference**

Before authorizing tests and experiments in any station, the ANS Directorate of the SCAA, in order to avoid harmful interference, 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. Any harmful interference resulting from tests and experiments shall be eliminated as soon as possible.



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## CHAPTERS 3 to 8

*The Republic of Sudan has through the promulgation of this SUCAR adopted Standards and Recommended Practices (SARPs) contained in Chapters 3 to 8, to Annex 10, Volume II to the Convention on International Civil Aviation and thus are implemented, as applicable, in the Republic of Sudan as National Regulations relating to the respective subjects addressed by those Chapters including associated Appendices and Attachments, as follows:*

- |              |   |
|--------------|---|
| Chapter 3    | General Procedures for the International Aeronautical Service   |
| Chapter 4    | Aeronautical Fixed Service (AFS)  |
| Chapter 5    | Aeronautical Mobile Service – Voice Communications  |
| Chapter 6    | Aeronautical Radio Navigation Service   |
| Chapter 7    | Aeronautical Broadcasting Service   |
| Chapter 8    | Aeronautical Mobile Service – Data Link Communications  |
| Attachment A | List of specialized COM terms and their definitions related to aeronautical telecommunications planning |
| Attachment B | Guidance material for transmission of long messages on the AFTN   |



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**SUBPART 3 – COMMUNICATION SYSTEMS**  
**CHAPTER 1**  
**DEFINITIONS**

***Note1:** Regulations contained in this Subpart to SUCAR 10, fully comply with the provisions contained in ICAO Annex 10, Volume III to the Convention on International Civil Aviation either through adapted regulations (Chapter 2, for Example) or adopted SARPs (Chapter 3, in its totality, and all Appendices and Attachments).*

***Note2:** Definitions provided in Annex 10, Volume 3 – Communication Systems, Chapter 1 – Definitions are adapted as Chapter 1, to Volume III of this SUCAR and should be used as the appropriate reference for terms and words used in this Subpart.*



## **CHAPTER 2 GENERAL**

**TO BE DEVELOPED**





## PARTS I and II

*The Republic of Sudan has through the promulgation of this SUCAR adopted Standards and Recommended Practices (SARPs) contained in Part I – Digital Data Communication System and Part II – Voice Communication Systems of Annex 10, Volume III to the Convention on International Civil Aviation and thus are implemented, as applicable, in the Republic of Sudan as National Regulations relating to the respective subjects addressed by respective Chapters contained in those Parts, including associated Appendices and Attachments, as follows:*

### **Part I – Digital Data Communication Systems**

Chapter 1	Definitions
Chapter 2	General (to be developed)
Chapter 3	Aeronautical Telecommunications Network
Chapter 4	Aeronautical Mobile-Satellite (Route) Service (AMS(R)S)
Chapter 5	SSR Mode S Air-Ground Data Link
Chapter 6	VHF Air-Ground Digital Link (VDL)
Chapter 7	Sub network Interconnection (to be developed)
Chapter 8	AFTN Network
Chapter 9	Aircraft addressing System
Chapter 10	Point-to-Multipoint Communication
Chapter 11	HF Data Link
Chapter 12	Universal Access Transceiver (UAT)

### **Part II – Voice Communication Systems**

Chapter 1	Definitions
Chapter 2	Aeronautical Mobile Service
Chapter 3	SELCAL System
Chapter 4	Aeronautical Speech Circuits
Chapter 5	Emergency Locator Transmitter (ELT) for Search and Rescue

Attachment to Part I – Guidance Material for the VHF Digital Link (VDL)

Attachment to Part II – Guidance material for Communication Systems



## SUBPART 4 – SURVEILLANCE AND COLLISION AVOIDANCE SYSTEMS CHAPTER 1

### DEFINITIONS

*Note 1.*— All references to “Radio Regulations” are to the Radio Regulations published by the International Telecommunication Union (ITU). Radio Regulations are amended from time to time by the decisions embodied in the Final Acts of World Radiocommunication Conferences held normally every two to three years. Further information on the ITU processes as they relate to aeronautical radio system frequency use is contained in the Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies (Doc 9718).

*Note 2.*— The Mode S extended squitter system is subject to patent rights from the Massachusetts Institute of Technology (MIT) Lincoln Laboratory. On 22 August 1996, MIT Lincoln Laboratory issued a notice in the Commerce Business Daily (CBD), a United States Government publication, of its intent not to assert its rights as patent owner against any and all persons in the commercial or non-commercial practice of the patent, in order to promote the widest possible use of the Mode S extended squitter technology. Further, by letter to ICAO dated 27 August 1998, MIT Lincoln Laboratory confirmed that the CBD notice has been provided to satisfy ICAO requirements for a statement of patent rights for techniques that are included in SARPs, and that the patent holders offer this technique free of charge for any use.

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

*Note.*— SSR transponders referred to above are those operating in Mode C or Mode S.

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

*Note.*— SSR Mode S transponders transmit extended squitters to support the broadcast of aircraft-derived position for surveillance purposes. The broadcast of this type of information is a form of automatic dependent surveillance (ADS) known as ADS-broadcast (ADS-B).

3. **Automatic dependent surveillance-broadcast (ADS-B) OUT.** A function on an aircraft or vehicle that periodically broadcasts its state vector (position and velocity) and other information derived from on-board systems in a format suitable for ADS-B IN capable receivers.
4. **Automatic dependent surveillance-broadcast (ADS-B) IN.** A function that receives surveillance data from ADS-B OUT data sources.
5. **Collision avoidance logic.** The sub-system or part of ACAS that analyses data relating to an intruder and own aircraft, decides whether or not advisories are



appropriate and, if so, generates the advisories. It includes the following functions: range and altitude tracking, threat detection and RA generation. It excludes surveillance.

6. **Human Factors principles.** Principles which apply to design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.
7. **Secondary surveillance radar (SSR).** A surveillance radar system which uses transmitters/receivers (interrogators) and transponders.

*Note.*—*The requirements for interrogators and transponders are specified in Chapter 3.*

8. **Surveillance radar.** Radar equipment used to determine the position of an aircraft in range and azimuth. **Traffic information service – broadcast (TIS-B) IN.** A surveillance function that receives and processes surveillance data from TIS-B OUT data sources.
9. **Traffic information service – broadcast (TIS-B) OUT.** A function on the ground that periodically broadcasts the surveillance information made available by ground sensors in a format suitable for TIS-B IN capable receivers.

*Note.*—*This technique can be achieved through different data links. The requirements for Mode S extended squitters are specified in Annex 10, Volume IV, Chapter 5. The requirements for VHF digital link (VDL) Mode 4 and universal access transceiver (UAT) are specified in Annex 10, Volume III, Part I.*



## CHAPTER 2 GENERAL

### 2.1 SECONDARY SURVEILLANCE RADAR (SSR)

2.1.1 When SSR is installed and maintained in operation as an aid to air traffic services, it shall conform with the provisions of 3.1 unless otherwise specified in this 2.1.

*Note.*—As referred to in this Annex, Mode A/C transponders are those which conform to the characteristics prescribed in 3.1.1. Mode S transponders are those, which conform to the characteristics prescribed in 3.1.2. The functional capabilities of Mode A/C transponders are an integral part of those of Mode S transponders.

### 2.1.2 Interrogation modes (ground-to-air)

2.1.2.1 Interrogation for air traffic services shall be performed on the modes described in 3.1.1.4.3 or 3.1.2. The uses of each mode shall be as follows:

- 1) *Mode A* — to elicit transponder replies for identity and surveillance.
- 2) *Mode C* — to elicit transponder replies for automatic pressure-altitude transmission and surveillance.
- 3) *Intermode*—
  - a) *Mode A/C/S all-call*: to elicit replies for surveillance of Mode A/C transponders and for the acquisition of Mode S transponders.
  - b) *Mode A/C-only all-call*: to elicit replies for surveillance of Mode A/C transponders. Mode S transponders do not reply.
- 4) *ModeS*—
  - a) *Mode S-only all-call*: to elicit replies for acquisition of Mode S transponders.
  - b) *Broadcast*: to transmit information to all Mode S transponders. No replies are elicited.
  - c) *Selective*: for surveillance of, and communication with, individual Mode S transponders. For each interrogation, a reply is elicited only from the transponder uniquely addressed by the interrogation.

*Note 1.*— *Mode A/C transponders are suppressed by Mode S interrogations and do not reply.*

*Note 2.*— *There are 25 possible interrogation (uplink) formats and 25 possible Mode S reply (downlink) formats.*

2.1.2.1.1 SCAA shall coordinate with appropriate national and international authorities those implementation aspects of the SSR system, which will permit its optimum use.

*Note.*—*To permit the efficient operation of ground equipment designed to eliminate interference from unwanted aircraft transponder replies to adjacent interrogators (defruiting equipment), Sudan may develop coordinated plans for the assignment of pulse recurrence frequencies (PRF) to SSR interrogators.*



2.1.2.1.2 The assignment of interrogator identifier (II) codes, where necessary in areas of overlapping coverage, across international boundaries of flight information regions, shall be the subject of regional air navigation agreements.

2.1.2.1.3 The assignment of surveillance identifier (SI) codes, where necessary in areas of overlapping coverage, shall be the subject of regional air navigation agreements.

*Note.*— *The SI lockout facility cannot be used unless all Mode S transponders within coverage range are equipped for this purpose.*

2.1.2.2 Mode A and Mode C interrogations shall be provided.

*Note.*—*This requirement may be satisfied by intermode interrogations which elicit Mode A and Mode C replies from Mode A/C transponders.*

2.1.2.3 In areas where improved aircraft identification is necessary to enhance the effectiveness of the ATC system, SSR ground facilities having Mode S features shall include aircraft identification capability.

*Note.*—*Aircraft identification reporting through the Mode S data link provides unambiguous identification of aircraft suitably equipped.*

2.1.2.4 Side-lobe suppression control interrogation:

2.1.2.4.1 Side-lobe suppression shall be provided in accordance with the provisions of 3.1.1.4 and 3.1.1.5 on all Mode A, Mode C and intermode interrogations.

2.1.2.4.2 Side-lobe suppression shall be provided in accordance with the provisions of 3.1.2.1.5.2.1 on all Mode S-only all-call interrogations.

### **2.1.3 Transponder reply modes (air-to-ground)**

2.1.3.1 Transponders shall respond to Mode A interrogations in accordance with the provisions of 3.1.1.7.12.1 and to Mode C interrogations in accordance with the provisions of 3.1.1.7.12.2.

*Note.*— *If pressure-altitude information is not available, transponders reply to Mode C interrogations with framing pulses only.*

2.1.3.1.1 The pressure-altitude reports contained in Mode S replies shall be derived as specified in 3.1.1.7.12.2.

*Note.*—*3.1.1.7.12.2 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 2.1.3.1.1 is to ensure that all transponders, not just Mode C transponders, report uncorrected pressure-altitude.*

2.1.3.2 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.

2.1.3.2.1 All transponders, used in the airspace of Sudan, shall respond to Mode C



interrogations with pressure-altitude information.

*Note.*— Operation of the airborne collision avoidance system (ACAS) depends upon intruder aircraft reporting pressure-altitude in Mode C replies.

2.1.3.2.2 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) shall be reported in 7.62 m (25 ft) increments.

*Note.*— Performance of the ACAS is significantly enhanced when an intruder aircraft is reporting pressure-altitude in 7.62 m (25 ft) increments.

2.1.3.2.3 All Mode A/C transponders shall report pressure-altitude encoded in the information pulses in Mode C replies.

2.1.3.2.4 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.

2.1.3.2.5 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)) shall be set to 0.

*Note.*— 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.

2.1.3.3 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.

2.1.3.3.1 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.

2.1.3.3.2 The agreements indicated in 2.1.3.3.1 shall provide at least five years' notice.

#### **2.1.4 Mode A reply codes (information pulses)**

2.1.4.1 All transponders shall be capable of generating 4 096 reply codes conforming to the characteristics given in 3.1.1.6.2.

2.1.4.1.1 The ANS Directorate of the SCAA shall establish the procedures for the allotment of SSR codes in conformity with Regional Air Navigation agreements, taking into account other users of the system.

*Note.*— Principles for the allocation of SSR codes are given in Doc 4444, Chapter 8.

2.1.4.2 The following Mode A codes shall be reserved for special purposes:

2.1.4.2.1 Code 7700 to provide recognition of an aircraft in an emergency.

2.1.4.2.2 Code 7600 to provide recognition of an aircraft with radiocommunication



failure.

- 2.1.4.2.3 Code 7500 to provide recognition of an aircraft, which is being subjected to unlawful interference.
- 2.1.4.3 Appropriate provisions shall be made in ground decoding equipment to ensure immediate recognition of Mode A codes 7500, 7600 and 7700.
- 2.1.4.4 Mode A code 0000 shall be reserved for allocation subject to regional agreement, as a general purpose code.
- 2.1.4.5 Mode A code 2000 shall be reserved to provide recognition of an aircraft which has not received any instructions from air traffic control units to operate the transponder.

## 2.1.5 Mode S airborne equipment capability

- 2.1.5.1 All Mode S transponders shall conform to one of the following five levels:
  - 2.1.5.1.1 Level 1 — Level 1 transponders shall have the capabilities prescribed for:
    - a) Mode A identity and Mode C pressure-altitude reporting (3.1.1);
    - b) intermode and Mode S all-call transactions (3.1.2.5);
    - c) addressed surveillance altitude and identity transaction (3.1.2.6.1, 3.1.2.6.3, 3.1.2.6.5 and 3.1.2.6.7);
    - d) lockout protocols (3.1.2.6.9);
    - e) basic data protocols except data link capability reporting (3.1.2.6.10); and
    - f) air-air service and squitter transactions (3.1.2.8).

*Note.*— Level 1 permits SSR surveillance based on pressure-altitude reporting and the Mode A identity code. In an SSR Mode S environment, technical performance relative to a Mode A/C transponder is improved due to Mode S selective aircraft interrogation.

- 2.1.5.1.2 Level 2 — Level 2 transponders shall have the capabilities of 2.1.5.1.1 and also those prescribed for:
  - a) standard length communications (Comm-A and Comm-B) (3.1.2.6.2, 3.1.2.6.4, 3.1.2.6.6, 3.1.2.6.8 and 3.1.2.6.11);
  - b) data link capability reporting (3.1.2.6.10.2.2); and
  - c) aircraft identification reporting (3.1.2.9).

*Note.*— Level 2 permits aircraft identification reporting and other standard length data link communications from ground to air and air to ground. The aircraft identification reporting capability requires an interface and appropriate input device.

- 2.1.5.1.3 Level 3 — Level 3 transponders shall have the capabilities of 2.1.5.1.2 and also those prescribed for ground-to-air extended length message (ELM) communications (3.1.2.7.1 to 3.1.2.7.5).

*Note.*— Level 3 permits extended length data link communications from ground to air and thus may provide retrieval from ground-based data banks and receipt of other air traffic services which are not available with Level 2 transponders.





2.1.5.1.4 Level 4 — Level 4 transponders shall have the capabilities of 2.1.5.1.3 and also those prescribed for air-to-ground extended length message (ELM) communications (3.1.2.7.7 and 3.1.2.7.8).

*Note.*— *Level 4 permits extended length data link communications from air to ground and thus may provide access from the ground to airborne data sources and the transmission of other data required by air traffic services which are not available with Level 2 transponders.*

2.1.5.1.5 Level 5 — Level 5 transponders shall have the capabilities of 2.1.5.1.4 and also those prescribed for enhanced Comm.-B and extended length message (ELM) communications (3.1.2.6.11.3.4, 3.1.2.7.6 and 3.1.2.7.9).

*Note.*— *Level 5 permits Comm-B and extended length data link communications with multiple interrogators without requiring the use of multisite reservations. This level of transponder has a higher minimum data link capacity than the other transponder levels.*

2.1.5.1.6 *Extended squitter* — Extended squitter transponders shall have the capabilities of 2.1.5.1.2, 2.1.5.1.3, 2.1.5.1.4 or 2.1.5.1.5, the capabilities prescribed for extended squitter operation (3.1.2.8.6) and the capabilities prescribed for ACAS cross-link operation (3.1.2.8.3 and 3.1.2.8.4). Transponders with these capabilities shall be designated with a suffix “e”.

*Note.*— *For example, a level 4 transponder with extended squitter capability would be designated “level 4e”.*

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

*Note.*— *For example, a level 4 transponder with extended squitter capability and SI capability would be designated “level 4es”.*

2.1.5.1.7.1 SI code capability shall be provided in accordance with the provisions of 2.1.5.1.7 for all Mode S transponders installed on or after 1 January 2003 and by all Mode S transponders by 1 January 2005.

*Note.*— *Mandates from certain States may require applicability in advance of these dates.*

2.1.5.1.8 *Extended squatter non-transponder devices.* Devices that are capable of broadcasting extended squitters that are not part of a Mode S transponder shall conform to all of the 1 090 MHz RF signals in space requirements specified for a Mode S transponder, except for transmit power levels for the identified equipment class as specified in 5.1.1.

2.1.5.2 All Mode S transponders used by international civil air traffic shall conform, at least, to the requirements of Level 2 prescribed in 2.1.5.1.2.

*Note 1.*— *Level 1 may be admitted for use within an individual State or*





*within the terms of a regional air navigation agreement. The Mode S Level 1 transponder comprises the minimum set of features for compatible operation of Mode S transponders with SSR Mode S interrogators. It is defined to prevent a proliferation of transponder types below Level 2 which would be incompatible with SSR Mode S interrogators.*

***Note 2.**— The intent of the requirement for a Level 2 capability is to ensure the widespread use of an ICAO standard transponder capability to allow worldwide planning of Mode S ground facilities and services. The requirement also discourages an initial installation with Level 1 transponders that would be rendered obsolete by later requirements in certain airspace for mandatory carriage of transponders having Level 2 capabilities.*

- 2.1.5.3 Mode S transponders installed on aircraft with gross mass in excess of 5 700 kg or a maximum cruising true airspeed capability in excess of 463 km/h (250 kt) shall operate with antenna diversity as prescribed in 3.1.2.10.4 if:
- a) the aircraft individual certificate of airworthiness is first issued on or after 1 January 1990; or
  - b) Mode S transponder carriage is required on the basis of regional air navigation agreement in accordance with 2.1.3.3.1 and 2.1.3.3.2.

***Note.**— Aircraft with maximum cruising true airspeed exceeding 324 km/h (175 kt) are required to operate with a peak power of not less than 21.0 dBW as specified in 3.1.2.10.2 c).*

- 2.1.5.4 Capability reporting in mode s squitters:

2.1.5.4.1 Capability reporting in Mode S acquisition squitters (unsolicited downlink transmissions) shall be provided in accordance with the provisions of 3.1.2.8.5.1 for all Mode S transponders installed on or after 1 January 1995.

2.1.5.4.2 Transponders equipped for extended squitter operation shall have a means to disable acquisition squitters when extended squitters are being emitted.

***Note.**— This will facilitate the suppression of acquisition squitters if all ACAS units have been converted to receive the extended squitter.*

- 2.1.5.5 Extended length message (ELM) transmit power:

In order to facilitate the conversion of existing Mode S transponders to include full Mode S capability, transponders originally manufactured before 1 January 1999 shall be permitted to transmit a burst of 16 ELM segments at a minimum power level of 20 dBW.

***Note.**—This represents a 1 dB relaxation from the power requirement specified in 3.1.2.10.2.*

## **2.1.6 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 and the Appendix to Chapter 9, Part I, Volume III, Annex 10.



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## 2.2 HUMAN FACTORS CONSIDERATIONS

Human Factors principles shall be observed in the design and certification of surveillance radar and collision avoidance systems.

*Note.*— *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).*



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## CHAPTERS 3 to 8

*The Republic of Sudan has through the promulgation of this SUCAR adopted Standards and Recommended Practices (SARPs) contained in Chapters 3 to 7, to Annex 10, Volume IV to the Convention on International Civil Aviation and thus are implemented, as applicable, in the Republic of Sudan as National Regulations relating to the respective subjects addressed by those Chapters including associated Appendices and Attachments, as follows:*

Chapter 3	Surveillance Systems
Chapter 4	Airborne Collision Avoidance System
Chapter 5	Mode S Extended Squatter
Chapter 6	Multilateration Systems
Chapter 7	Technical Requirements for Airborne Surveillance Applications
Chapter 8	Aeronautical Mobile Service – Data Link Communications
Attachment	Guidance Material Related to Airborne Collision Avoidance System (ACAS)



## SUBPART 5 – AERONAUTICAL RADIO FREQUENCY SPECTRUM UTILIZATION

### CHAPTER 1 DEFINITIONS

*Note.*— All references to “Radio Regulations” are to the Radio Regulations published by the International Telecommunication Union (ITU). Radio Regulations are amended from time to time by the decisions embodied in the Final Acts of World Radio communication Conferences held normally every two to three years. Further information on the ITU processes as they relate to aeronautical radio system frequency use is contained in the Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including statement of approved ICAO policies (Doc 9718).

When the following terms are used in this volume of the Annex, they have the following meanings:

1. **Alternative means of communication.** A means of communication provided with equal status, and in addition to the primary means.
2. **Double channel simplex.** Simplex using two frequency channels, one in each direction.

*Note.*—This method was sometimes referred to as cross-band.

3. **Duplex.** A method in which telecommunication between two stations can take place in both directions simultaneously.
4. **Frequency channel.** A continuous portion of the frequency spectrum appropriate for a transmission utilizing a specified class of emission.

*Note.*—The classification of emissions and information relevant to the portion of the frequency spectrum appropriate for a given type of transmission (bandwidths) are specified in the Radio Regulations, Article S2 and Appendix S1.

5. **Offset frequency simplex.** A variation of single channel simplex wherein telecommunication between two stations is effected by using in each direction frequencies that are intentionally slightly different but contained within a portion of the spectrum allotted for the operation.
6. **Operational control communications.** Communications required for the exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of a flight.

*Note.*—Such communications are normally required for the exchange of messages between aircraft and aircraft operating agencies.

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



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

*Note.*—*In application to the aeronautical mobile service, this method may be subdivided as follows:*

- a) *single channel simplex;*
  - b) *double channel simplex;*
  - c) *offset frequency simplex.*
9. **Single channel simplex.** Simplex using the same frequency channel in each direction.
10. **VHF digital link (VDL).** A constituent mobile subnetwork of the aeronautical telecommunication network (ATN), operating in the aeronautical mobile VHF frequency band. In addition, the VDL may provide non-ATN functions such as, for instance, digitized voice.



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## CHAPTERS 2 to 4

*The Republic of Sudan has through the promulgation of this SUCAR adopted Standards and Recommended Practices (SARPs) contained in Chapters 2 to 47, to Annex 10, Volume V to the Convention on International Civil Aviation and thus are implemented, as applicable, in the Republic of Sudan as National Regulations relating to the respective subjects addressed by those Chapters including associated Appendices and Attachments, as follows:*

Chapter 2	Distress Frequencies
Chapter 3	Utilization of Frequencies Below 30 MHz
Chapter 4	Utilization of Frequencies Above 30 MHz
Appendix	List of Assignable Frequencies
Attachment A	Considerations affecting the deployment of VHF communication frequencies
Attachment B	Considerations affecting the deployment of LF/MF frequencies and the avoidance of harmful interference
Attachment C	Guiding principles for long distance operational control communications

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