RWANDA AIRPORTS COMPANY

AIR NAVIGATION SERVICES

AERONAUTICAL INFORMATION MANAGEMENT

CARTOGRAPHY
OPERATIONS MANUAL

First Edition

Kigali International Airport

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Cartography Operations Manual

Approval Page

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Cartography Operations Manual

Foreword

This Manual of Operations Cartography office has been developed as guidance to all Cartography personnel in performing their duties in Cartography office. This is in line with the Rwanda Civil Aviation Regulations, and the standards prescribed by the Civil Aviation Authority.

The manual incorporates general Cartography procedures, processes and resources necessary to provide efficient services in the Cartography office.

This manual will be updated when necessary to reflect current developments or new regulatory requirements that could have profound effect to the provision of Cartography services in Kigali flight information region.

The contents of this manual is reviewed as required and the Cartography office is responsible for coordinating changes to the manual.

RWANDA AIRPORTS COMPANY

CHARLES HABONIMANA
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Date and Signature: 15-02-2021

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Chapter 1: Introduction

1.1 General

The provision of aeronautical information is essential for the safety, regularity and efficiency of air navigation. The role of aeronautical information / data has become all the more significant with the implementation of area navigation (RNAV), Required Navigation Performance (RNP) and Airborne Computer based Navigation Systems such as Flight Management System (FMS). Any error in the aeronautical information/ data can affect the safety of air navigation. Aeronautical information service that deals with aeronautical charts is provided by Cartography office.

1.2 Purpose and scope of the manual

The purpose of this manual is to assist and direct serving Cartography engineer on how to effectively undertake the tasks taking cognizance of the regulatory requirements and need for harmonized procedures to be followed in the Cartography office at Kigali international airport.

It should be used as a reference tool in achieving the Objectives of Cartography office for ensuring the flow of information necessary for the safety regularity and efficiency of air navigation through the promotion of maximum efficiency in the organization and operation of the office.

The scope of the manual covers the processes associated with the reception, collation or editing, formatting, publishing/storage and of aeronautical data associated with aeronautical charts and the preparation, production, dissemination, and availability of aeronautical charts.

1.3 Compliance with applicable Civil Aviation Authority regulations and requirements

This manual is prepared in accordance with the Rwanda Civil Aviation Regulations 2018; Part 31.

1.4 Compliance with the operational instructions contained in this manual by the relevant personnel in the performance of their duties.

All Cartography personnel is adhered to the operational guidelines and instructions contained in this Manual and failure to do so is construed to be a contravention of the same.

1.4.1 Reference Materials to be used in hand with this MANOPS Cartography office

a) Aeronautical Information Publication
b) Rwanda Civil Aviation Regulations
c) QMS Procedures

1.5 Responsibility for content of the manual

The Director Air Navigational Services is responsible for the accuracy of the information contained in this manual.

1.6 Responsibility for amendment of the manual

The Cartography office initiates the changes to be made for consideration before the amendment is submitted to the Manager AIM for approval.

Chapter 2: Definitions and Abbreviations

2.1 Definitions

Aerodrome. A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft;
Aerodrome elevation. The elevation of the highest point of the landing area;
Aerodrome operating minima. The limits of usability of an aerodrome for—
(i) take-off, expressed in terms of runway visual range and/or visibility and, if necessary, cloud conditions;
(ii) landing in precision approach and landing operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the category of the operation;
(iii) landing in approach and landing operations with vertical guidance, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H); and
(iv) landing in non-precision approach and landing operations, expressed in terms of visibility and/or runway visual range, minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions;
Aerodrome reference point. The designated geographical location of an aerodrome;
Aeronautical chart. A representation of a portion of the Earth, its culture and relief, specifically designated to meet the requirements of air navigation;
Aircraft stand. A designated area on an apron intended to be used for parking an aircraft;
Air defense identification zone. Special designated airspace of defined dimensions within which aircraft are required to comply with special identification and/or reporting procedures additional to those related to the provision of air traffic services (ATS);
Air traffic service. A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service);
Air transit route. A defined route for the air transiting of helicopters;
Airway. A control area or portion thereof established in the form of a corridor;
Altitude. The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL);
Application. manipulation and processing of data in support of user requirements (ISO 19104*);
Apron. A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fueling, parking or maintenance.
Area minimum altitude (AMA). The minimum altitude to be used under instrument meteorological conditions (IMC), which provides a minimum obstacle clearance within a specified area, normally formed by parallels and meridians;
Area navigation (RNAV). A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground- or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these;
Arrival routes. Routes identified in an instrument approach procedure by which aircraft may proceed from the en-route phase of flight to an initial approach fix;

ATS route. A specified route designed for channeling the flow of traffic as necessary for the provision of air traffic services;
ATS surveillance system. A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft;
Bare Earth. surface of the Earth including bodies of water and permanent ice and snow, and excluding vegetation and man-made objects;
Calendar. discrete temporal reference system that provides the basis for defining temporal position to a resolution of one day (ISO 19108*);
Canopy. Bare Earth supplemented by vegetation height.
Change-over point. The point at which an aircraft navigating on an ATS route segment defined by reference to very high frequency omni directional radio ranges is expected to transfer its primary navigational reference from the facility behind the aircraft to the next facility ahead of the aircraft;
Clearway. A defined rectangular area on the ground or water under the control of the appropriate authority selected or prepared as a suitable area over which an aeroplane may make a portion of its initial climb to a specified height.
Contour line. A line on a map or chart connecting points of equal elevation. Specified times;
Data product specification. Detailed description of a data set or data set series together with additional information that will enable it to be created, supplied to and used by another party (ISO 19131*);
Data quality. A degree or level of confidence that the data provided meets the requirements of the data user in terms of accuracy, resolution and integrity (or equivalent assurance level), traceability, timeliness, completeness and format.
Data Resolution. A number of units or digits to which a measured or calculated value is expressed and used
Data set. Identifiable collection of data (ISO 19101*);
Data set series. Collection of data sets sharing the same product specification (ISO 19115*);
Datum. Any quantity or set of quantities that may serve as a reference or basis for the calculation of other quantities (ISO 19104*);
Digital Elevation Model (DEM). The representation of terrain surface by continuous elevation values at all intersections of a defined grid, referenced to common datum;
Displaced threshold. A threshold not located at the extremity of a runway;
Electronic aeronautical chart display. An electronic device by which flight crews are enabled to execute, in a convenient and timely manner, route planning, route monitoring and navigation by displaying required information;
Elevation. The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level;
Ellipsoid height (Geodetic height). The height related to the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question;
Feature. Abstraction of real world phenomena (ISO 19101*);
Feature attribute. Characteristic of a feature (ISO 19101*);
Final approach. That part of an instrument approach procedure which commences at the specified final approach fix or point, or where such a fix or point is not specified—

(i) at the end of the last procedure turn, base turn or inbound turn of a racetrack procedure, if specified; or at the point of interception of the last track specified in the approach procedure; and
(iii) ends at a point in the vicinity of an aerodrome from which—
(iv) a landing can be made; or
(v) a missed approach procedure is initiated;

Final approach and take-off area (FATO). A defined area over which the final phase of the approach manoeuvre to hover or landing is completed and from which the take-off manoeuvre is commenced. Where the FATO is to be used by performance Class 1 helicopters, the defined area includes the rejected take-off area available;

Final approach fix or point. That fix or point of an instrument approach procedure where the final approach segment commences;

Final approach segment. That segment of an instrument approach procedure in which alignment and descent for landing are accomplished;

Flight information region. an airspace of defined dimensions within which flight information service and alerting service are provided;

Flight level. A surface of constant atmospheric pressure which is related to a specific pressure datum, 1013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals;

Geodesic distance. The shortest distance between any two points on a mathematically defined ellipsoidal surface;

Geodetic datum. A minimum set of parameters required to define location and orientation of the local reference system with respect to the global reference system/frame;

Geoid. The equipotential surface in the gravity field of the Earth which coincides with the undisturbed mean sea level (MSL) extended continuously through the continents;

Geoid undulation. The distance of the geoid above (positive) or below (negative) the mathematical reference ellipsoid;

Glide path. A descent profile determined for vertical guidance during a final approach;

Gregorian calendar. Calendar in general use; first introduced in 1582 to define a year that more closely approximates the tropical year than the Julian calendar (ISO 19108*);

Height. The vertical distance of a level, point or an object considered as a point, measured from a specific datum;

Helicopter stand. an aircraft stand which provides for parking a helicopter and where ground taxi operations are completed or where the helicopter touches down and lifts off for air taxi operations;

Heliport. An aerodrome or a defined area on a structure intended to be used wholly or in part for the arrival, departure and surface movement of helicopters;

Holding procedure. A predetermined manoeuvre which keeps an aircraft within a specified airspace while awaiting further clearance;

Hot spot. A location on an aerodrome movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary;

Human Factors principles. Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance;

Hypsometric tints. A succession of shades or colour gradations used to depict ranges of elevation;
Initial approach segment. That segment of an instrument approach procedure between the initial approach fix and the intermediate approach fix or, where applicable, the final approach fixes or point;
Instrument approach procedure. A series of predetermined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en-route obstacle clearance criteria apply;
Integrity classification (aeronautical data). Classification based upon the potential risk resulting from the use of corrupted data. Aeronautical data is classified as—
(i) routine data: there is a very low probability when using corrupted routine data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;
(ii) essential data: there is a low probability when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;
(iii) critical data: there is a high probability when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;
Intermediate approach segment. That segment of an instrument approach procedure between either the intermediate approach fix and the final approach fix or point, or between the end of a reversal, racetrack or dead reckoning track procedure and the final approach fix or point, as appropriate;
Intermediate holding position. A designated position intended for traffic control at which taxiing aircraft and vehicles stop and hold until further cleared to proceed, when so instructed by the aerodrome control tower;
Isogonal. A line on a map or chart on which all points have the same magnetic variation for a specified epoch;
Isogriv. A line on a map or chart which joins points of equal angular difference between the North of the navigation grid and Magnetic North;
Landing area. That part of a movement area intended for the landing or take-off of aircraft;
Landing direction indicator. A device to indicate visually the direction currently designated for landing and for take-off;
Level. A generic term relating to the vertical position of an aircraft in flight and meaning variously, height, altitude or flight level;
Logon address. A specified code used for data link logon to an ATS unit;
Magnetic variation. The angular difference between True North and Magnetic North;
Manoeuvring area. That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons;
Marking. A symbol or group of symbols displayed on the surface of the movement area in order to convey aeronautical information.
Metadata. Data about data (ISO 19115*);

Minimum en-route altitude (MEA). The altitude for an en-route segment that provides adequate reception of relevant navigation facilities and ATS communications, complies with the airspace structure and provides the required obstacle clearance;
Minimum obstacle clearance altitude (MOCA). The minimum altitude for a defined segment of flight that provides the required obstacle clearance;
Minimum sector altitude (MSA). The lowest altitude which may be used which will provide a minimum clearance of 300 m (1 000 ft) above all objects located in an area contained within a sector of a circle of 46 km (25 NM) radius centred on significant point, the aerodrome reference point (ARP), or the heliport reference point (HRP);
Missed approach point (MAPt). That point in an instrument approach procedure at or before which the prescribed missed approach procedure must be initiated in order to ensure that the minimum obstacle clearance is not infringed;
Missed approach procedure. The procedure to be followed if the approach cannot be continued;
Movement area. That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and the apron(s);
specification. A set of aircraft and flight crew requirements needed to support performance based navigation operations within a defined airspace. There are two kinds of navigation specifications—
(i) Required navigation performance (RNP) specification. A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH;
(ii) Area navigation (RNAV) specification. A navigation specification based on area navigation that does not include the requirement for performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV;
Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that—
(i) are located on an area intended for the surface movement of aircraft; or
(ii) extend above a defined surface intended to protect aircraft in flight; or
(iii) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation;
Obstacle clearance altitude (OCA) or obstacle clearance height (OCH). The lowest altitude or the lowest height above the elevation of the relevant runway threshold or the aerodrome elevation as applicable, used in establishing compliance with appropriate obstacle clearance criteria;
Obstacle free zone (OFZ). The airspace above the inner approach surface, inner transitional surfaces, and balked landing surface and that portion of the strip bounded by these surfaces, which is not penetrated by any fixed obstacle other than a low-mass and frangibly mounted one required for air navigation purposes;
Orthometric height. Height of a point related to the geoid, generally presented as an MSL elevation;
Performance-based navigation (PBN). Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace;
Point light. A luminous signal appearing without perceptible length;
Portrayal. Presentation of information to humans (ISO 19116*);

Position (geographical). Set of coordinates (latitude and longitude) referenced to the mathematical reference ellipsoid which define the position of a point on the surface of the Earth;
Precision approach procedure. An instrument approach procedure utilizing azimuth and glide path information provided by ILS or PAR;
Procedure altitude/height. A published altitude/height used in defining the vertical profile of a flight procedure, at or above the minimum obstacle clearance altitude/height where established.
Procedure turn. Manoeuvre in which a turn is made away from a designated track followed by a turn in
the opposite direction to permit the aircraft to intercept and proceed along the reciprocal of the designated track;
Prohibited area. An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited;
Relief. The inequalities in elevation of the surface of the Earth represented on aeronautical charts by contours, hypsometric tints, shading or spot elevations;
Reporting point. A specified (named) geographical location in relation to which the position of an aircraft can be reported;
Resolution. A number of units or digits to which a measured or calculated value is expressed and used;
Restricted area. An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions;
Reversal procedure. A procedure designed to enable aircraft to reverse direction during the initial approach segment of an instrument approach procedure. The sequence may include procedure turns or base turns;
Runway. A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft;
Runway-holding position. A designated position intended to protect a runway, an obstacle limitation surface, or an ILS/MLS critical/sensitive area at which taxiing aircraft and vehicles stop and hold, unless otherwise authorized by the aerodrome control tower;
Runway strip. A defined area including the runway and stopway, if provided, intended—
(i) to reduce the risk of damage to aircraft running off a runway; and
(ii) to protect aircraft flying over it during take-off or landing operations;
Runway visual range (RVR). The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line;
Shoulder. An area adjacent to the edge of a pavement so prepared as to provide a transition between the pavement and the adjacent surface;
Significant point. A specified geographical location used in defining an ATS route or the flight path of an aircraft and for other navigation and ATS purposes;
Stopway. A defined rectangular area on the ground at the end of take-off run available prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off;
Taxiing. movement of an aircraft on the surface of an aerodrome under its own power, excluding take-off and landing;

Taxi-route. A defined path established for the movement of helicopters from one part of a heliport to another. A taxi-route includes a helicopter air or ground taxiway which is centred on the taxi-route;
Taxiway. A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including—
(i) Aircraft stand taxilane. A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only;
(ii) Apron taxiway. A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron;
(iii) Rapid exit taxiway. A taxiway connected to a runway at an acute angle and designed to allow landing aeroplanes to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times;
Terminal arrival altitude (TAA). The lowest altitude that will provide a minimum clearance of 300 m (1000 ft) above all objects located in an arc of a circle defined by a 46 km (25 NM) radius centred on the Initial Approach Fix (IAF), or where there is no IAF on the Intermediate approach Fix (IF), delimited by straight lines joining the extremity of the arc to the IF. The combined TAAs associated with an approach procedure shall account for an area of 360 degrees around the IF;
Terrain. The surface of the Earth containing naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, and excluding obstacles;
Threshold. The beginning of that portion of the runway usable for landing;
Touchdown and lift-off area (TLOF). A load bearing area on which a helicopter may touch down or lift off;
Touchdown zone. The portion of a runway, beyond the threshold, where it is intended landing aeroplanes first contact the runway;
Track. The projection on the earth's surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from North (true, magnetic or grid);
Transition altitude. The altitude at or below which the vertical position of an aircraft is controlled by reference to altitudes;
Vectoring. Provision of navigational guidance to aircraft in the form of specific headings, based on the use of an ATS surveillance system;
Visual approach procedure. A series of predetermined manoeuvres by visual reference, from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, a go-around procedure can be carried out;
Waypoint. A specified geographical location used to define an area navigation route or the flight path of an aircraft employing area navigation. Waypoints are identified as either—
(i) Fly-by waypoint. A waypoint which requires turn anticipation to allow tangential interception of the next segment of a route or procedure; or
(ii) Flyover waypoint. A waypoint at which a turn is initiated in order to join the next segment of a route or procedure.

2.2 Abbreviations & Acronyms

The following are acronyms or abbreviations used in this manual:
AMA = Area Minimum Altitude
APCH = Approach
ASDA=Accelerate Stop Distance Available
ATS = Air Traffic Services
CWY= Clearway
DEM = Digital Elevation Model
hPa = hectopascals ()
IAF = Initial Approach Fix
IF = Intermediate Approach Fix
ILS = Instrument Landing System
I**MC** = Instrument Meteorological Conditions
MAPt = Missed Approach Point
LDA= Landing Distance Available
MEA = Minimum En-route Altitude
MOCA = Minimum Obstacle Clearance Altitude
MSA = Minimum Sector Altitude
MSL = Mean Sea Level
OCA = Obstacle Clearance Altitude
OCH = Obstacle Clearance Height
OFZ = Obstacle Free Zone
FATO = Final Approach and Takeoff Area
PBN = Performance-Based Navigation
PAR = Precision Approach Radar
RCAR = Rwanda Civil Aviation Regulations
RCAA = Rwanda Civil Aviation Authority
RVR = Runway Visual Range
RNP = Required navigation performance
RNAV = Area Navigation
SWY= Stopway
TAA = Terminal Arrival Area
TLOF = Touchdown and Lift-off area
TODA= Takeoff Distance Available
TORA= Takeoff Run Available

Chapter 3: Maps and Charts Management

Aeronautical Maps and Charts management. This service involves the collection and processing of aeronautical data and aeronautical information/data including surveyed data required for development and maintenance for the production of aeronautical maps and charts included in the AIP and other outside the AIP. The raw data for production of aeronautical charts or maps will be received be recorded in Cartography office meta data file (Appendix 4) using raw data providers

form according to (Appendix 8). Cartography engineer will check the data and produce aeronautical charts or maps accordingly, after producing aeronautical charts or maps the produced charts or maps will be sent to the AIM quality officer for checking accuracy, integrity and classifications according to the appendix 6 **refer to quality manual** (Aeronautical data quality requirements related to integrity and data classification) through MEMOs or emails. When the quality officer is not contented with the accuracy, integrity and classifications of the charts or maps produced, AIM quality officer will use the same method to send the maps or charts to the Cartography office, when the quality officer is contented with the accuracy, integrity and classifications then the designed charts or maps will be sent to the Manager AIM for approval. When the published charts appear to have the errors, the NOTAM will be issued informing the subscribers about the error and informing the scribers that the error will be corrected and be published in the next amendment.

3.1 Availability of charts

The AIM provider publishes an Aeronautical Information Publication (AIP) containing current information, data and aeronautical charts relating to the airspace in which Rwanda has responsibility for air traffic services.

The aeronautical charts listed alphabetically below are, to form part of the AIP, or be distributed separately to recipients of the AIP:

a) Aerodrome/Heliport Chart — ICAO;
b) Aerodrome Obstacle Chart — ICAO Type A;
c) Aerodrome Obstacle Chart — ICAO Type B;
d) Aircraft Parking/Docking Chart — ICAO;
e) ATC Surveillance Minimum Altitude Chart — ICAO;
f) En-route chart-ICAO
g) Instrument Approach Chart — ICAO;
h) Standard Arrival Chart — Instrument (STAR) — ICAO;
i) Standard Departure Chart — Instrument (SID) — ICAO;
j) Visual Approach Chart — ICAO.
K) Aeronautical Chart- 1:500,000 —ICAO;
i) Precision Approach Terrain Chart—ICAO

After publication of any chart Cartography office issues stakeholders satisfaction questionnaires form (Appendix 1) to different end users of aeronautical charts for verification of comprehension and accuracy of it or them.

3.2 eTOD Management

Involves collection, analyzing, processing and maintenance of electronic terrain and obstacle data covering eTOD, Area 1, Area 2 and Area 3. Area 2 and Area 3 data will be collected by a contracted company and verified by Cartography Unit according to appendix 9 (Terrain and Obstacle Data Requirements). Area 1 data will be provided by the organization responsible for mapping and survey (Land Centre).

3.3 Correction of Errors in Published Charts, Maps and eTOD

If an error is determined to be hazardous or have the potential to be hazardous, remedial action appropriate to the operational significance of the error will be initiated by Cartography office. The operational significance of the error should be determined in consultation with the originator.
Fill in the error tracking Form (Appendix 2) and an appropriate action taken may include;

Issue of NOTAM;
If a NOTAM is issued, the error should be scheduled for correction in the next scheduled amendment.

Issue of AIP Supplement.
Errors should only be corrected by AIP Supplement when the page or chart is not scheduled for reissue at the next AIP amendment;

Issue of an AIP amendment at next available amendment; and

Correct at next scheduled issue of page or chart.

To ensure continuous quality improvement, Cartography office needs to record and analyze errors and implement both corrective action and preventive action.

For the purposes of recording and analysis, an error is defined as follows:

a) any instance where information is incorrectly or inaccurately published; and
b) Any instance where the accuracy, structure or format of published information does not conform with required standards.

3.4 Management of the cartography Technical Documents

3.4.1 Responsibility

The cartography personnel will be the sole custodians of all the technical documents, or any reference material acquired by RAC from either RCAA, ICAO or any other publishing authority.

Chapter 4: Maintenance of Documents and Records

4.1 Maintenance of documents

The Cartography office maintains both technical and non-technical documents.

4.2 Management of the cartography Documents

4.2.1 Responsibility

The cartography personnel will be the sole custodians of all the technical documents, or any reference material acquired by RAC from either ICAO or any other publishing authority.

4.2.2 Purpose

The cartography documents will be available for reference to RAC staff or any other interested persons so long as it is within the precincts of the Cartography office.

4.2.3 Loaning of Reference Materials

The following guidelines apply: -

i) Loaning of Cartography office documents will only be extended to RAC Staff.
ii) All other persons/organizations/agencies interested will only be allowed to make reference to the documents within the precincts of the office.
iii) When loaning, all details of the officer i.e. Name, Title, Section and personal Number be recorded in the Document lending book
iv) The initial loaning will be for a maximum period of two weeks after which if the loanee is still interested in retaining the document the officer will have to renew it for a further one week.
v) In case the officer fails to return the document a reminder note will be sent to the officer that the document is now overdue.
vi) If the document is not returned after a further three weeks, the officer will be sent a note copied to the managing director with the attention to the Human Resource (HR) for the immediate recovery of the equivalent value of the document from the officer's salary.
vii) In case of documents that are returned and they are deemed to have been damaged, the concerned officer will also be required to bear the replacement costs hence the managing director through HR will be requested to act as (vi) above.

4.3 Maintenance of Records

The Cartography office generates various records. Retention of these records are as described in the table below:

Record Type	Storage and Duration within Cartography office	Remarks
Metadata File	5 yrs	
Data file	5 yrs	

Error tracking form	5 yrs	
Training Records	Moved to Archive once one retires	
Stake holders satisfaction questionnaire form	1 Years	
Operations Manual and quality manual	After Amendments	

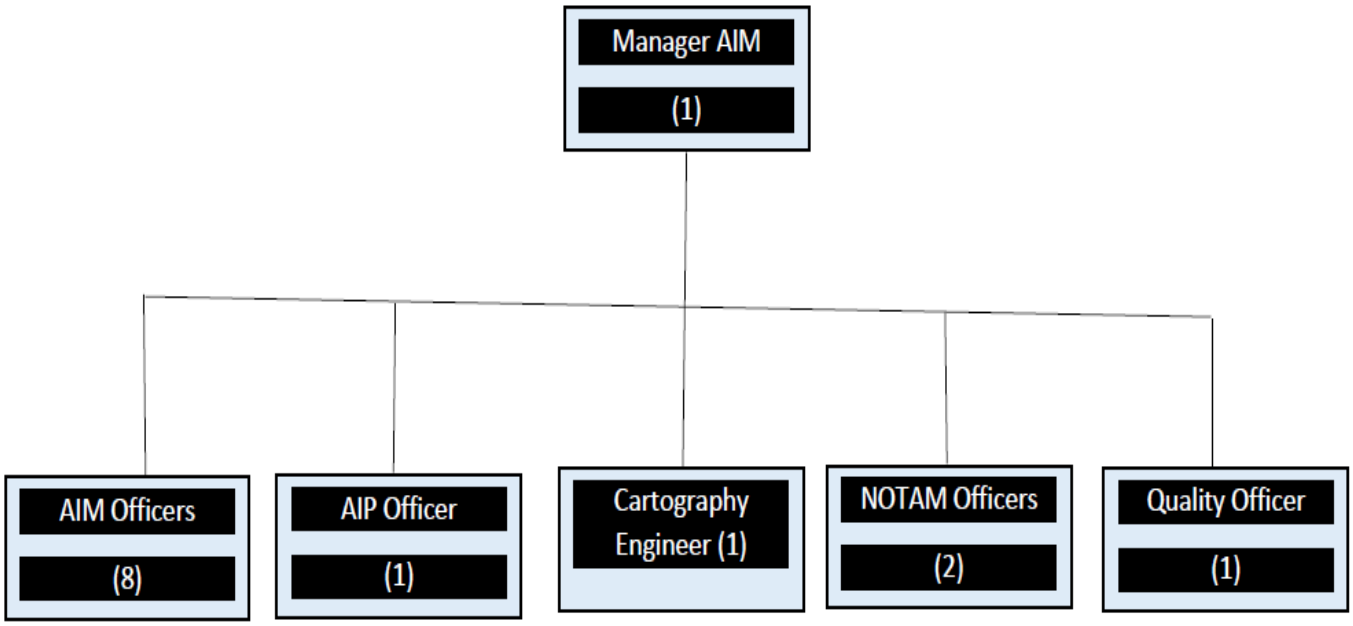
4.4 Disposal of Document and Records

After the completion of the specified storage period all Cartography documents will be classified obsolete and be disposed in appropriate place.

Chapter 5: Personnel Requirements and their Responsibilities

5.1 AIM Organizational Structure

AIM organizational structure was extracted from RAC Organizational structure refer to Appendix 10 of this manual



5.2 Staff Requirements and Responsibilities

When determining the staff requirement, current government policies on labour are used and implemented by HR., Cartography office will be manned by at least 1 Cartography engineer who has done digital cartography.

5.3 Job Title, Description, Responsibilities and Qualifications

Job Title –Cartography Engineer
Reports to: Manager AIM
Job Description: Production of aeronautical maps and charts for Rwanda airspace and Collection of aeronautical data for use to develop or amend Rwanda AIP
Responsibilities

- Collects aeronautical data for use to develop or amend charts in the Rwanda airspace
- Analyses and formats the aeronautical data into an acceptable state for entry and processing into the AIS Database.

- Collates raw data for development and updating of aeronautical maps/charts.
- Prepare, draft, print and distribute maps and charts as per the current subscription list
- Maintains the inventory of maps and charts and ensure they are up to date
- Maintain tools and equipment for cartographic drafting
- Plot and update navigation warnings in Rwanda FIR
- Avail maps and charts relevant to Rwanda FIR and ensure they are up to date
- Assist manager AIM in cartographic drafting.
- Avail summary of mandatory and recommended charts and their uses
- Perform Data quality checks on raw data before using it for cartographic drafting.
- Supervises the on-job-training of new staff.
- Coordinates with charting authorities in the neighboring FIRs for continuity of world area charts
-Prepares, draft, print and distribute AIP, AIP Amendment, AIP Supplements and AICs as per the current subscription list
- Performs any other duties assigned by Manager AIM

Qualifications

- ❑ A Bachelor degree in computer science, computer engineering, Geographical Information System or IT.
- ❑ A Certificate in Aeronautical Information Services from an ICAO recognized training institution
- ❑ Certificate in Quality Management System.
- ❑ A certificate in Aeronautical Digital Cartography

Experience

- ❑ Successfully completed on-job- training in digital cartography
- ❑ Knowledge of relevant ICAO Annexes.
- ❑ Knowledge on relevant Rwanda Civil Aviation Regulations
- ❑ Knowledge of relevant Rwanda Civil Aviation technical guidance materials
- ❑ Basic Computer skills
- ❑ Basic knowledge of drawing software program.
- ❑ Has a minimum of four years in AIM unit

Chapter 6: Training and Performance Assessment

6.1 Training

The Cartography training is divided into five phases namely:

- Basic training
- Specialised/Advanced training
- Recurrent Training
- Refresher Training
- On-Job Training

6.1.1 Basic Training

The AIS ICAO course 21 is the basic AIS training conducted before joining the service. It is meant to provide new or strengthen skills to employees who have been newly recruited promoted or transferred from another job. The course consists of the following:

- ICAO, Air Law, Facilitation and Regulations 32 hrs;
- Aviation Geography 28 hrs;
- Aerodromes and Ground Aids (AGA) 28 hrs;
- Aeronautical Information Service 42 hrs;
- Principles of Flight 32 hrs;
- Air Traffic Control (ATC) Theory 32 hrs;
- Meteorology 24 hrs;
- Flight Navigation 32 hrs;
- Radio aids to air Navigation 24 hrs;
- Flight Planning including typical crew procedures for flight preparations 30 hrs;
- Communication Procedures 6 hrs
- Introduction to Automated AIS Systems 60 hrs;
- AIS Documentation 20 hrs;
- CNS/ATM 20 hrs;
- WGS-84 10 hrs;
- Public Relations 10 hrs;
- Computer operations 60 hrs.

AIS course 21 is the entry professional qualification for Cartography engineer.
After being absorbed in the AIM unit at the entry grade the officer under goes OJT before deployment.

6.1.2 Specialized/Advanced Training

To facilitate further effective service delivery, it's imperative that the officer be given further training as soon as possible. This Training is as a result of new technologies, changes in practices, discoveries of performance deficiencies or upgrading of job responsibilities. Further it is designed to enhance the prospects for career advancement and to increase job satisfaction. It can be promotion oriented, where it will be determined by standards of promotion and the existing range of skills and knowledge of the employee or it can be of a broader level of personal development.

The following courses are geared to meet the above objectives: -

- Cartographic /GIS
- AIS Automation
- AIP/MAP Management
- AICM/AIXM Database, publication and Charting
- ICAO PANS – OPS Instrument Procedures Design
- Instructor's Development programme.
- Safety Management System
- Quality Management Systems
- Advanced Digital Cartography

6.1.3 Recurrent Training

Trainings intend to strengthen skills and knowledge that have weakened through disuse and the passage of time. This training is achieved through the following courses: -

- Charts and Maps Refresher
- Customer Care
- Human Factors
- Management Courses

6.1.4 Detailed Training Programme

As part of the effort to ensure proper aviation quality the Cartography office provides a high quality-training program for Cartography engineer in order to provide the quality of service according to Appendix 6 (Training Program).

6.1.5 Training Plan

To improve the capacity, competence and knowledge of Cartography engineer, every year Manager AIM prepares the training plan, describing the training schedule, and the staff who will attend those trainings. This training plan will be approved by director ANS.

6.1.4 On Job Training

On-Job-Training is essential in reinforcement of skills learned in formal training as a means to attain full mastery of skills. It cannot be as precise as formal training but should be planned. The following procedure applies for OJT: -

6.2 Performance Assessment

6.2.1 Performance assessment during OJT

Performance during the OJT will be based on the Cartography knowledge using the On-Job Training Program (See Appendix 3 On-Job Training Program).

6.2.2 Performance and competency assessment tests

Performance Assessment and competency assessments tests shall be completed and done at least once a year for all cartography engineers. The competency assessments tests shall be done by the Manager AIM using appropriate checklist.

Details of Performance Contracts and Performance Appraisals should be held on individual staff member's files in HR Department.

6.3 Training Records

The HR office maintains training records for Cartography Engineer reflecting all the courses done and copy of the course certificate.

Chapter 7 : Quality Management System, Hours of Operation and Reference Systems

7.1 Need for Quality in Cartography office

The objective of aeronautical information service (AIS) is to ensure the flow of aeronautical data and aeronautical information necessary for global air traffic management (ATM) system safety, regularity, economy and efficiency in an environmentally sustainable manner as provided by ICAO. Additionally, the role and importance of aeronautical data and aeronautical information has changed significantly with the implementation of area navigation (RNAV), performance-based navigation (PBN), airborne computer-based navigation systems and data link systems. Corrupt, erroneous, late, or missing aeronautical data and aeronautical information can potentially affect the safety of air navigation.

Aeronautical information distributed by means of AIPs including charts by cartography, has an inherent and essential need to fulfil specific requirements in order to serve its intended purpose and meet the needs of users. The basic characteristics of aeronautical information are those of adequacy, availability and timeliness. The degree to which these and other characteristics fulfil requirements is referred to as "quality".

7.2 Need for a QMS in the Provision of Cartography Services

RCAA provides a requirement for the implementation of a quality management system at each of the function stages of originating (or collecting), collating or assembling, editing, formatting, storing, publishing and distributing of aeronautical information. This requirement has been met through the establishment of a quality system that complies with ISO 9001:2015 within the Rwanda Airports Company.

The ISO QMS approach encourages organizations to analyze customer requirements, define the processes that contribute to the achievement of a product which is acceptable to the customer, and keep those processes controlled.

7.3 The Data Quality Process

The aeronautical information data process extends from the original data sources (e.g. surveyors,) through AIS and publication to the end-users of the data in aeronautical applications. The data process is a series of complex functions within a sequential flow, particularly from data origination through to the publication of the information i.e. AIP and other media derived from their use.
Consistency in data management is required in order to:

a) ensure compliance of the data quality that is collected, processed and reported
b) ensure that the data management processes are carried out such that the integrity of the data is not jeopardized at any point in the process;
c) design the data collection and handling processes such that due regard is paid to the risk of error;

Thus in order for the required quality of service/data to be provided by Cartography office, effective implementation of a QMS is necessary for all organizations operating within the total aeronautical data chain.

7.4 Implementation of QMS

A QMS is a management system that directs and controls an organization with regard to quality. The QMS activities generally include the following:

a) establishment of a quality policy and quality objectives;

b) quality planning:-

c) quality control:- a part of quality management focused on fulfilling quality requirements

d) quality assurance:- a part of quality management that is focused on providing confidence that quality requirements will be fulfilled. In other words, it pertains to all those planned and systematic actions necessary to provide adequate confidence that a product will satisfy the requirements for quality.

e) quality improvement:- focused on increasing the ability to fulfill quality requirements. It is not concerned with correcting errors but concerned with doing things better to improve system efficiency and effectiveness.

The intent of QMS is to provide a management framework for the organization to comply with applicable requirements, control its processes and minimize their risk, and ultimately satisfy customer needs and expectations.

All Cartography personnel should note that the AIS quality manual establishes and provides guidance on the above parameters.

More details on quality management system is found in AIM quality manual.

7.5 Aeronautical Data Quality Requirements.

Refer to Quality manual Appendix 6 for details.

7.6 Cartography Office Hours Operations

Cartography office operates normal office hours from 7.00am-5.00pm except on published or declared public holidays and weekends.

7.7 Horizontal Reference System

World Geodetic System — 1984 will be used as the horizontal reference system, all published geographical coordinates indicating latitude and longitude will be expressed in terms of the WGS-84 geodetic reference datum and will be published in degrees minutes and seconds. Geographical coordinates which have been transformed into WGS-84 coordinates but whose accuracy of original field work does not meet the requirements will be identified by an asterisk.

7.8 Vertical Reference System

Mean sea level datum will be used as vertical reference system and elevations referenced to mean sea level, for the specific surveyed ground positions, geoid undulation for the surveyed positions will be published as specified for a particular chart

Chapter 8: Cartography office Security Procedures

Security measures and procedures to ensure effective control of entry of airport will be as per Airport Security guidelines. Cartography engineer will be required to ensure measures and procedures to protect systems and facilities are strictly followed by restricting access to:

- The Cartography office,
- The Cartography records and files

The Cartography Personnel will be held accountable for the safety and security of the Cartography office documents, equipment and facilities.

All email accounts must be protected by passwords

Systems running Microsoft operating systems must have anti-virus software installed and it must be configured to automatically scan and update.

Chapter 9: Facilities and Equipment

9.1 Facilities and Equipment Provided

The following facilities and equipment are available in the Cartography office for operational purposes. Care and consideration has been made in selecting the right facilities to facilitate smooth operation in the office. The ANSP is committed to provide more as and when it is necessary.

The following are the equipment and facilities in Cartography office:

- Personal Computers (PCs), Plotter, printer, photocopying machine and connection to the internet
- Mobile Phone with associated line
- Cartographic/GIS Software to facilitate production of aeronautical maps and Charts
- Filing cabinets for keeping documents
- Reference table with seats for the Cartography engineers
- Aeronautical Charts and Maps Scanner

9.2 Requirements for installation and maintenance

Installation of any facilities and equipment in Cartography office is approved by the Manager AIM and sent to the relevant authority. Routine maintenance on the installed facilities and equipment is coordinated by the Cartography office.

Chapter 10: Fault and Defect Reporting

10.1 Fault and defect reporting Method

When an officer detects any equipment malfunction, the first action is to report to the Manager AIM and the IT engineer or any other personnel responsible for the equipment maintenance. After reporting, the officer is required to log the fault/defect on cartography Log book. Logged details should include:

- Type of Equipment
- Time of occurrence
- Description of the problem
- Action taken
- Time when the equipment resumed operation

10.2 Serviceability report

For systems, failure reports will be reported by the Cartography engineer to the Manager AIM immediately they occur. The Manager AIM will maintain a record of failure reports for compilation and analysis at the end of each quarterly report. A copy should be forwarded to CNS and any other relevant authority and another to be retained by the originating unit.

Chapter 11: Coordination, Operations and Procedures

11.1 Obligations of Aeronautical Data and Aeronautical Information Providers

The collection and distribution of aeronautical information is the responsibility of the Cartography office. However, Cartography office does not normally originate the raw information which it processes. Aeronautical data providers will ensure that the data provided is of integrity, reliable, accurate, relevant, timely, verifiable and complete.

11.2 Coordination Between Cartography office and Engineering and Maintenance Department

Continuous liaison should be maintained between the engineering and maintenance department and Cartography office. The Engineering and maintenance department should forward to the Cartography office all aeronautical data to be included in the AIP amendment. Such aeronautical data include: -

- Data on the runway
- Data on displaced threshold
- Data on taxiways
- Data on Apron
- Data on PAPIs
- Data on RESA
- Data on aerodrome charts of other airports

And any other data deemed significant to the flow movement of flights.

11.3 Coordination Procedures with ANS Units

Coordination procedures with ANS Units to be followed for coordination of raw data and aeronautical information for publication and this will be catered in the AIM letters of procedures (LOPs) with these ANS Units.

11.4 Deviations from published operational Procedures

The Cartography office is responsible for monitoring any deviations from the operational procedures detailed in this manual and take the necessary action.

Where a different way of managing the tasks described hereto changes, Cartography engineer is responsible for initiating an amendment to the procedure through Manager AIM.

Chapter 12 General Specifications

12.1 Operational requirements for charts

12.1.1 Introduction

For the purposes of this manual, the total flight is divided into the following phases; -

Phase 1 - Taxi from aircraft stand to take off
Phase 2 - Take off and climb to en-route ATS route structure
Phase 3 - En-route ATS route structure
Phase 4 - Descent to approach
Phase 5 - Approach to land and missed approach
Phase 6 - Landing and taxi to aircraft stand.

Each type of chart provides information relevant to the function of the charts and appropriate to the phase of flight.

To ensure consistency with the published aeronautical charts, charts are managed from the Cartography office database.

12.1.2 General Procedures on the Management of Aeronautical Charts

12.1.2.1 Introduction

(a) Aeronautical Charts in Rwanda are developed in accordance with the provisions contained in Rwanda Civil Aviation Regulations. The Aeronautical Chart process encompasses the acquisition of data, design and promulgation of charts.

(b) Either Manager AIM or Cartography engineer coordinates for the provision of Aeronautical data and Aeronautical information from data providers. On receiving the said data, Manager AIM forwards it to the Cartography office and the office reviews and marks it within one day. Cartography office in turn enter the same in the Meta data file (Appendix 4) and determine whether the information warrants chart development.

(c) Cartography office within one (1) day determines what type of chart fits the information from the following list:

i). Instrument Approach Chart – ICAO
ii). Aerodrome Obstacle Chart - ICAO type A
Operating Limitations)
iii). Aerodrome Obstacle Chart - ICAO type B
iv). Standard Departure Chart – Instrument (SID) – ICAO
v). Standard Arrival Chart - Instrument (STAR) – ICAO

vi). En-route Chart – ICAO
vii). Visual Approach Chart – ICAO
viii). Aerodrome/Heliport chart ICAO
ix) Aircraft Parking/Docking chart- ICAO
x) Aeronautical Chart -ICAO 1:500,000
xi) ATC Surveillance Minimum Altitude Chart — ICAO
xii) Precision Approach Terrain Chart-ICAO

12.1.3 Aeronautical Charting procedures

12.1.3.1 Aerodrome Operating Minima;

The obstacle clearance altitude/heights (OCA/H) and for GNSS LVNAV/ LNAV for the aircraft categories for which the procedure is designed be shown on the relevant instrument approach chart.

12.1.3.2 Charting Design Documentation

The documentation provided by the charting designer electronically is divided into two categories and includes:

- Documentation required for publication in the AIP in accordance with Rwanda Civil Aviation Regulations;
- Information required on the chart such as:

i) title;
ii) name and reference of the sheet;
iii) the name and producing agency
iv) symbols (conform to those shown in (appendix 6) – ICAO Chart Symbols);
v) units of measurements;
vi) scale and projection;
vii) date of validity of aeronautical information;
viii)correct colours (conform to the appendix 7)
ix) relief in the form of either contours or spot elevations;
x) airspace areas and classifications;
xi) air traffic services;
xii) magnetic variation to decimal of a degree;
xiii)typography;
xiv) aeronautical data;
xv) Aeronautical coordinates indicating latitude and longitude be expressed in terms of the WGS-84 geodetic reference datum;
xvi) controlling obstacle for each segment of the procedure;

xvii) airfield and navigation facility data;
xviii) procedural and minimum altitudes for each segment;
xix) track guidance;
xx) textual or abbreviated description, path terminators and Aeronautical data base requirements where applicable;
xxi) the latest available information displayed on the chart for the effective date, such as the magnetic variation/station declination;
xxii) associated positional data e.g. co-ordinates, bearings, distances; and for modifications or amendments to existing charts, the reasons for any changes.

Rounding of results follow the standard guidelines in Rwanda Civil Aviation Regulations.

12.1.3.3 Requirement for new or updated charts

12.1.3.3.1 New charts

Where an operational requirement exists for a new chart, Cartography office ensures that such a chart is designed in accordance with the standards outlined in Rwanda Civil Aviation Regulations.

12.1.3.3.2 Revision of existing charts

Each chart published in AIP Rwanda should be revised as follows:
when a significant change to the obstacle environment occurs, requiring an amendment of procedural minimum altitudes;

i) when a published bearing or bearing, track or radial would fall into error by 1 degree, consequent on a change to magnetic variation or station declination;
ii) to improve safety or operational efficiency, as identified;
iii) to accommodate changes to aircraft category or characteristics;
iv) to accommodate route connectivity or airspace organization change;
v) necessitated by changes to the supporting navigation facility environment;
vi) to comply with amendments to applicable ICAO provisions and other international and national standards and recommended practices;
vii) where a change in procedural attitude is required;
viii) due to errors or anomalies;
ix) when a significant change occurs to aerodrome physical characteristics such as runways; and
x) When any other significant change occurs to aeronautical, cultural or topographical data.
The revised electronic chart be published in accordance to the AIRAC sign-off date.

12.1.3.4 Competency of the Charting Personnel

In order to ensure that charts published by Cartography office meet the required standards of quality assurance the proficiency of the charting personnel should be maintained.

Aeronautical charting personnel should undergo refresher training in aeronautical charting at least every 3 years.

12.1.3.5 Aeronautical Charting Design Automation

Cartography office will ensure that an Aeronautical charting automated systems comply with the following requirements:

(1) provide for continuous and timely updating of the system database and monitoring of the validity and
(2) quality of the aeronautical information stored;
(3) integrate data from a wide variety of sources;
(4) temporally manage information and related products, to make sure that charts are always up to date;
(5) facilitate inspection of the aeronautical chart content, possibly through the synchronization of the
(6) graphical elements with the central database content via specific metadata;
(7) provide users with definable rules/templates to facilitate the assembling of the final chart product; and
(8) ensure products and services are equally available to humans and computer systems, through specific digital formats for capturing and processing the information.

12.2.2 Instrument Approach Chart-ICAO

a) Functions

The chart provides flight crews with information which will enable them perform an approved instrument approach procedure to the runway of intended landing including the missed approach procedure and where applicable associated holding patterns.

b) Availability

Instrument approach procedures are made available for the following aerodromes; -

- Kigali International Airport ;
- Kamembe Airport ; and

Any other airport where instrument approach procedures have been established

c) Coverage and Scale

The coverage of the chart is sufficient to include all segments of the instrument approach procedure, missed approach procedure and holding associated patterns.

Scale selected ensures optimum legibility consistent with the procedure and size of paper used and be indicated in the chart.

A distance circle with a radius of (25NM) cantered on DME located on or close to the aerodrome or on the aerodrome reference point where no suitable DME available is shown.

d) Format

Sheet size 210mm*297mm (A4)

e) Projection Mercator WGS-84

f) Identification

The chart is identified by the name of the city or town or area which the aerodrome serves, the name of the aerodrome, the abbreviation of the type of radio navigation aid(s) on which the instrument procedure is established and the designator of the runway where applicable.

Limitations on certain categories of aircraft is shown in parentheses at the end of the identification.

When the instrument approach procedure is designed for RNAV, the additional abbreviation "RNAV" is given. If the procedure is restricted to specific sensors, these are indicated in subscript parenthesis "RNAV $_{(GNSS)}$".

When the instrument approach procedure is designed for RNP, the abbreviation "RNP" is applied, and the RNP value be published in subscript and parenthesis, e.g. "RNP $_{(0.3)}$".

When operationally required, separate charts be published for each sensor or for a combination of navigation sensors. Separate charts are only published if the routes differ laterally or vertically.

g) Culture and Topography

Culture and topographic information pertinent to the safe execution of the approach procedure, missed approach procedure, associated holding procedures and visual maneuvering (circling) procedure when established are shown.

The background Topography used should meet the following specifications

- Be sufficient to cover the charts area of coverage.
- Topographical feature type should be separated in levels or layers
- Iso heights lines where available should be shown at an interval of 500.

h) Magnetic Variation, Bearing, Tracks and Radials

Magnetic variation, bearing, tracks and radials are indicated in the chart.

i) Aeronautical Data

- Aerodromes
  - Runway Pattern

a) Runway pattern of the aerodrome on which the procedure is based;

b) Runway pattern of aerodromes affecting the traffic pattern or so situated to be likely, under adverse weather conditions, to be mistaken for the aerodrome of intended landing.

c) Aerodrome elevation (to the nearest meter or foot)
d) Threshold elevation or where applicable the highest elevation of the touch down zone.

ii) Obstacles
Significant obstacles as specified by the procedure designers are shown. The datum used is Mean Sea Level or Orthometric Height.

iii) Prohibited, restricted and Danger areas
Prohibited, restricted and Danger areas which may affect the execution of procedures are shown with their identification and vertical limits.

iv) Radio communication facilities and navigation aids
Radio navigation aids required for the procedures together with their frequencies, identifications and track defining characteristics, if any are shown. The final approach fix (or final approach point for an ILS approach procedure) and other essential fixes or points comprising the procedure are shown and identified. The final approach fix (or final approach point for an ILS approach procedure) should be identified with its geographical coordinates in degrees, minutes and seconds.

v) Minimum sector altitude
The minimum sector altitude established by the competent authority is shown, with a clear indication of the sector to which it applies.

vi) Procedures tracks
The plan view shows the following information in the manner indicated:

- the approach procedure track by an arrowed continuous line indicating the direction of flight;
- the missed approach procedure track by an arrowed broken line;
- any additional procedure track, other than those specified in a) and b), by an arrowed dotted line;
- bearings, tracks, radials to the nearest degree and distances to the nearest two-tenths of a kilometre or tenth of a nautical mile or times required for the procedure;
- where no track-defining aid is available, the magnetic bearing to the nearest degree to the aerodrome from the radio navigation aids concerned with the final approach;
- the boundaries of any sector in which visual manoeuvring (circling) is prohibited
- where specified the holding pattern and minimum holding altitude/height associated with the approach and missed approach;
- caution notes where required, prominently displayed on the face of the chart.

The plan view should show the distance to the aerodrome from each radio navigation aid concerned with the final approach. A profile is provided normally below the plan view showing the following data:

- the aerodrome by a solid block at aerodrome elevation;
- the profile of the approach procedure segments by an arrowed continuous line indication the direction of flight;

- the profile of the missed approach procedure segment by an arrowed broken line and a description of the procedure;
- the profile of any additional procedure segment, other than those specified in b) and c), by an arrowed dotted line;
- bearings, tracks, radials to the nearest degree and distances to the nearest two-tenths of a kilometre or tenth of a nautical mile or times required for the procedure;
- altitude/heights required by the procedures, including transition altitude, where established;
- limiting distances to the nearest kilometre or nautical mile on procedure turn, when specified;
- the intermediate approach or point, on procedures where no course reversal is authorized.
- a line representing the aerodrome elevation or threshold elevation, as appropriate, extended across the width of the chart including a distance scale with its original at the runway threshold.

Heights required by procedures should be shown in parentheses; a ground profile should be shown by a solid line depicting the highest elevation of the relief occurring within the primary area of the final approach segment. The highest elevations of the relief occurring in the secondary areas of the final approach segment should be shown on the profile by a dashed line.

Actual templates of the primary and secondary areas of the final approach segment are provided to the cartographer by the procedures specialists.

ix) Supplementary information

When the missed approach point is defined by:

- a nautical mile and a table showing ground speeds and times from the final approach fix to the missed approach point is shown. a distance from the final approach fix, or
- a facility or a fix and the corresponding distance from the final approach fix, the distance to the nearest two-tenths of a kilometre or tenth of

When DME is required for use in the final approach segment, a table showing altitudes/heights for each 2 km or 1 NM, as appropriate, is shown. The table should include distances which would correspond to altitudes/heights below the OCA/H.

For procedures in which DME is not required for use in the final approach segment but where a suitably located DME is available to provide advisory descent profile information, a table showing the altitudes/heights should be included. A rate of descend table should be shown.

xiii) Final approach descend gradient

Based on descend angle to the nearest one tenth of a degree is shown for non-precision procedures, with a final approach fix.
Charts depicting ILS and LNAV/VNAV reference datum to the nearest half metre or foot and the glide path/elevation/vertical path angle is shown. Final approach descent angle is shown to the nearest one tenth of a degree for instrument procedures with vertical guidance.

12.2.3 Aerodrome Obstacle Chart –ICAO Type A (Operating Limitations)

a) Function

The purpose of this chart is to provide the data necessary to enable the operator comply with the Aeroplane Operating Performance Limitations as published in Rwanda Civil Aviation Regulations.

b) Availability

The chart is made available for the following aerodromes unless there are no significant obstacles in the take-off flight path areas;

- Kigali International Airport
- Kamembe Airport
- Any other aerodrome regularly used by international Civil Aviation.

Where a chart is not required because no significant obstacles exist in the take-off flight path area, a notification to this effect is published.

c) Units of measurement

Elevation is shown to the nearest half-metre or to the nearest foot. Linear dimensions are shown to the nearest half-metre.

d) Coverage and Scale

The extent of each plan is sufficient to cover all significant obstacles. Where isolated distant significant obstacles that may cause an increase in the sheet size exist, they may be indicated by the appropriate symbol and an arrow and distance and bearing from the end of the runway farther removed and the elevation given.

The horizontal scale is within the range of 1:10 000 to 1:15 000. The vertical scale is ten times the horizontal scale.

Linear scales. Horizontal and vertical linear scales showing both metre and feet are included in the charts.

e) Format

The chart depicts a plan and profiles of each runway, any associated stopway or clearway, the take-off flight path area, and significant obstacles.

The profile for each runway, stopway, clearway and the obstacles in the take-off flight path area is shown above its corresponding plan. The profile of an alternative take-off flight path area comprises a linear projection of the full take-off flight path and is disposed above its corresponding plan in the manner most suited to the ready interpretation of the information.

A profile grid is ruled over the entire profile area exclusive of the runway. The zero for vertical coordinates is mean sea level. The zero for horizontal coordinates is the end of the runway furthest from the take-off flight path area concerned. Graduation marks indicating the sub-divisions of intervals is shown along the base of the grid and along the vertical margins.
The vertical grid should have intervals of 30 m (100 ft) and the horizontal grid should have intervals of 300 m (1 000 ft).

The chart includes:

- a box for recording the operational data specified (Declared distances)
- a box for recording amendments and dates thereof.

f) Identification

The chart is identified as follows: -
Rwanda, followed by the name of the city or town where the Aerodrome serves; name of the Aerodrome and designator of the Runway(s)

g) Magnetic variation

The magnetic variation to the nearest degree and date of information are indicated.

h) Aeronautical data

- Obstacles

Obstacles in the take-off flight path area which project above a plane surface having a 1.2 per cent slope and having a common origin with the take-off flight path area, are regarded as significant obstacles, except that significant obstacles lying wholly below the shadow of other significant obstacles as defined here below need not be shown. Mobile obstacles such as boats, trains, trucks, etc., which may project above the 1.2 per cent plane are considered significant obstacles but are not considered as being capable of creating a shadow.

The shadow of an obstacle is considered to be a plane surface originating at a horizontal line passing through the top of the obstacle at right angles to the centre line of the take-off flight path area. The plane covers the complete width of the take-off flight path area and extends to the plane defined first. For the first 300 m (1 000 ft) of the take-off flight path area, the shadow planes are horizontal and beyond this point such planes have an upward slope of 1.2 per cent.

If the significant obstacle creating a shadow is likely to be removed, objects that would become significant obstacles by its removal are shown.

- Take-off flight path area

The take-off flight path area consists of a quadrilateral area on the surface of the earth lying directly below, and symmetrically disposed about, the take-off flight path. This area has the following characteristics:

- it commences at the end of the area declared suitable for take-off (i.e. at the end of the runway or clearway as appropriate);
- its width at the point of origin is 180 m (600 ft) and this width increases at the rate of 0.25D to a maximum of 1 800 m (6 000 ft), where D is the distance from the point of origin.
- it extends to the point beyond which no significant obstacles exist or to a distance of 10.0 km (5.4 NM), whichever is the lesser.

For runways serving aircraft having operating limitations which do not preclude the use of a take-off flight path gradient of less than 1.2 per- cent, the extend of the take-off flight path are increased to not less than 12.0 km (6.5 NM) and the slope of the plane surface is reduced to 1.0 per cent or less.

When a 1.0 per cent survey plane touches no obstacles, this plane may be lowered until it touches the first obstacle.

- Declared distances

The following information for each direction of each runway are entered in the space provided:

- take-off run available (TORA);
- accelerate-stop distance available (ASDA);
- take-off distance available TODA);
- Landing distance available (LDA).

- Plan and profile views

The plan view shows:

- the outline of the runways by a solid line, including the length and width the magnetic bearing to the nearest degree, and the runway number;
- the outline of the clearways by a broken line, including the length and identification as such;
- take-off flight path areas by a dashed line and the centre line by a fine consisting of short and long dashes;
- alternative take-off flight path areas. When alternative take-off flight path areas not centred on the extension of the runway centre line shown, notes are provided explaining the significant of such areas;
- obstacles, including;

- the exact location of each significant obstacle together with a symbol indicative of its type;
- the elevation and identification of each significant obstacle;
- the limits of penetration of significant obstacles of large extent in a distinctive manner identified in the legend.

Stopways are shown by a broken line indicating their length.

- The profile view shows:
  - ➢ the profile of the centre line of the runway by a solid line and the profile of the centre line of any associated stopways (SWY) and clearways (CWY) by a broken line;
  - ➢ the elevation of the runway centre line at each end of the runway, at the stopway and at the origin of each take-off flight path area, and at each significant change in slope of runway and stopway;
  - ➢ obstacles, including:
  - o each significant obstacle by a solid vertical line extending from a convenient grid line over at least one other grid line to the elevation of the top of the obstacle;
  - o identification of each significant obstacle;
  - o the limits of penetration of significant obstacles of large extent in a distinctive manner identified in the legend.

An obstacle profile consisting of a line joining the tops of each significant obstacle and representing the shadow created by successive significant obstacles may be shown.
Datum. Mean Sea Level or Orthometric Height

12.2.4 Aerodrome Obstacle Chart – ICAO Type B

a) Function

This chart will provide information to satisfy the following functions:

- ➢ the determination of minimum safe altitude/heights including those for circling procedures;
- ➢ the determination of procedures for use in the event of an emergency during take-off or landing;
- ➢ the application of obstacle clearing and marking criteria; and
- ➢ the provision of source material for aeronautical charts.

b) Availability

The chart will be made available for the following aerodromes unless there are no significant obstacles in the take-off flight path areas.

- ➢ Kigali international Airport
- ➢ Kamembe Airport
- ➢ Gisenyi Airport

Where a chart is not required because no significant obstacles exist in the take-off flight path area, a notification to this effect will be published.
A Chart combining the specifications of Obstacle Chart type A and Obstacle Chart Type B can be produced titled Aerodrome Obstacle Chart – ICAO (Comprehensive).

c) Units of measurement

Elevations is shown to the nearest half-metre or the nearest foot. Linear dimensions is shown to the nearest half-metre.

d) Coverage and scale

The extent of each plan will be sufficient to cover all significant obstacles.

Isolated distant obstacles that would unnecessarily increase the sheet size may be indicated by the appropriate symbol and an arrow, provided that the distance and bearing from the aerodrome reference point and elevation are given.

The horizontal scale will be within the range of 1:10 000 to 1:20 000. A horizontal linear scale showing both metre and feet will be included in the chart. When necessary, a linear scale for kilometer and a linear scale for nautical miles will also be shown.

e) Format

A4 or A3 as found necessary, depending on the location of obstacles.

f) Projection

Mercator WGS-84

A notation indicating the surfaces penetrated by the obstacles.

g) Identification

The chart is identified as follows:-

Rwanda, followed by the name of the city or town where the Aerodrome serves; name of the Aerodrome and designator of the Runway(s)

h) Culture and topography

Drainage and hydrographic details are kept to a minimum.

Buildings and other salient features associated with the aerodrome are shown. Wherever possible, they are shown to scale.

Roads and railroads within the take-off and approach area, and less than 600 m (2 000 ft) from the end of the runway or runway extensions, are shown.

Geographical names of significance features are shown if of significance.

i) Magnetic variation

The chart will show a compass rose oriented to the True North, or a North point, showing the magnetic variation to the nearest degree with the date of magnetic information and annual change.

j) Aeronautical data

The charts will show:

- the aerodrome reference point and its geographical coordinates in degrees, minutes and seconds;
- the outline of the runways by a solid line;
- the length and width of the runway
- the magnetic bearing to the nearest degree of the runway and the runway number;
- the elevation of the runway centre line at each of the runway, at the stopway (SWY), at the origin of each take-off and approach area, and at each significant change of slope of runway and stopway (SWY);
- taxiways, aprons and parking areas identified as such and the outlines by a solid line;
- Stopways (SWY) identified as such and depicted by a broken line;
- the length of each stopway;
- clearway (CWY) identified as such and depicted by a broken line;
- the length of each clearway;
- take-off and approach surfaces identified as such and depicted by a broken line;
- take-off and approach areas;
- significant obstacles at their exact location, including:

- a symbol indicative of their types;
- elevation;
- identification;
- limits of penetration of large extent in a distinctive manner identified in the legend;

- Critical spot elevations within the take-off and approach areas.
- Any additional obstacles, in the take-off area which projects above plane surface having 1.2 percent slope with a common origin within the take-off flight path.

In airports where lower surfaces have been established, they may be used to determine significance obstacles. The nature of the runway and stop way surfaces should be given.

Wherever practicable the highest object or obstacle between adjacent approach areas within a radius of 5 000 m (15,000 ft) from the aerodrome reference point should be indicated in a prominent manner. The extent of tree areas and relief features, part of which constitute significance obstacles should be shown.

k) Accuracy

The order of accuracy attained will be shown on the chart. The horizontal dimensions and the elevations of the movement area, stop ways and clearways to be printed on the charts should be determined to the nearest 0.5 m (1 ft).

The order or accuracy of the field work and the precision of chart production should be such that the resulting data will be within the maximum deviations indicated herein:

i) Take-off and approach areas:
- horizontal distances: 5 m (15 ft) at point of origin increasing at a rate of 1 per 500;
- vertical distances: 0.5 m (1.5 ft) in the first 300 m (1 000 ft) and increasing at a rate of 1 per 1 000.

ii) Other areas:
- horizontal distances: 5 m (15 ft) within 5 000 m (15 000 ft) of the aerodrome reference point and 12 m (40 ft) beyond that area;
- vertical distances: 1 m (3 ft) within 1 500 m (5 000 ft) of the aerodrome reference point increasing at a rate of 1 per 1 000

Datum. Mean Sea Level or Orthometric Height.

12.2.5 Standard Departure Chart – Instrument (SID) – ICAO

a) Function

This chart will provide the flight crew with information to enable it to comply with the designated standard departure route – instrument from take-off phase to the en-route phase.

b) Availability

be issued for all airports where standard Instrument departure procedures are developed.

c) Coverage and scale

The coverage of the chart is sufficient to indicate the point where the departure route begins and the specified significant point at which the en-route phase of flight along a designated air traffic services route can be commenced. The chart may be drawn to scale or not to scale. If the chart is drawn to scale a scale-bar is shown and when the chart is not drawn to scale the annotation “NOT TO SCALE” should be shown.

d) Projection

A conformal projection on which a straight line approximates a great circle should be used. Graduation marks are placed at consistent intervals along the lines, as appropriate.

e) Identification

The name of the aerodrome, runway designator(s) and the designator(s) of the standard departure route(s) – instrument.

When departure routes are designated for RNAV, the additional abbreviation (RNAV” are given, if routes are restricted to specific sensors, these be indicated in subscript and parenthesis, e.g. “RNAV $_{(GNSS)}$”.

For a VOR/DME RNAV procedure, the abbreviation “RNAV” or “RNAV $_{(DME/DME)}$” is followed by the identification of the reference VOR/DME.

When the departure route is designed for RNP, the abbreviation “RNP” is applied, and the RNP value is be published in subscript and parenthesis, e.g. “RNP $_{(0.3)}$”.

When operationally required, separate charts are published for each sensor or for a combination of navigation sensors. Separate charts are only published if the routes differ laterally or vertically.

f) Culture and topography

Where the chart is drawn to scale, generalized shore lines of all open water areas, large lakes and rivers are shown except where they conflict with data more applicable to the function of the chart.

g) Magnetic variation

Magnetic variation used in determining the magnetic bearings, tracks and radials are shown to the nearest degree.

h) Bearings, tracks and radials

Bearings, tracks and radials are magnetic

i) Aeronautical Data

- Aerodromes

The aerodrome of departure is shown by the runway pattern. All aerodromes which affect the designated standard departure route – instrument is shown and identified. Where appropriate the aerodromes runway patterns is shown.

- Prohibited, restricted and danger areas.

Prohibited, restricted and danger areas which may affect the execution of the procedures are shown with their identification and vertical limits.

- Minimum sector altitude

The established minimum sector altitude, based on a navigation aid associated with the procedure is shown with a clear indication of the sector to which it applies.

Where the minimum sector altitude has not been established, the chart is drawn to scale and area minimum altitudes be shown within quadrilateral formed by the parallels and meridians. Area minimum altitudes is also shown in those parts of the chart not covered by the minimum sector altitude.

- Air traffic services system

The components comprising of the following are shown;

1. a graphic portrayal of each standard departure route instrument, including:
    a. route designator;
    b. significant points defining the route;
    c. track or radial to the nearest degree along each segment of the route(s);
    d. distances to the nearest kilometer or nautical mile between significant points;
    e. minimum flight altitudes to the nearest higher 50 m or 100 ft along the route or route segments;

f. altitude to the nearest higher 50 m or 100 ft/flight level restrictions, where established;
g. Where radar procedures are used to vector aircraft to or from a significant point on a standard departure route, they may be shown.

2. The radio navigation aid(s) associated with the route(s) including:
    a. plain language name;
    b. identification;
    c. frequency;
    d. geographical coordinates in degrees, minutes and seconds;
    e. for DME, the channel and the elevation of the transmitting antenna of the DME to the nearest 30 m (100 ft);

3. the name-codes of the significant points not marked by the position of a radio navigation aid, their geographical coordinates in degrees, minutes and seconds and the bearing to the nearest tenth of a degree and distance to the nearest two-tenths of a kilometer (tenth of a nautical mile) from reference radio navigation aid;
4. applicable holding patterns;
5. transition altitude/height to the nearest higher 300 m or 1 000 ft;
6. the position and height of close-in obstacles which penetrates the obstacle identification surface (OIS). A note is included whenever close-in obstacles penetrating the OIS exist but which were not considered for the published procedure design gradient.
7. area speed restrictions, where established;
8. all compulsory and “on-request” reporting points
9. radio communication procedures, including;
    a. call sign(s) of ATS unit(s);
    b. frequency;
    c. transponder setting, where appropriate.

12.2.6 Standard Arrival Chart – Instrument (STAR) – ICAO

a) Function

This chart provides the flight crew with information to enable it to comply with the designated standard arrival route – instrument from the en-route phase to the approach phase.

b) Availability

be issued for all airports where standard Instrument departure procedures are developed.

c) Coverage and scale

The coverage of the chart is sufficient to indicate the point where the en-route phase ends and the approach phase begins.

d) Projection

A conformal projection on which a straight line approximates a great circle should be used. Graduation marks are placed at consistent intervals along the lines, as appropriate.

e) Identification

Same as for SID (See 12.2.5 (e))

f) Culture and topography

Same as for SID (See 12.2.5 (f))

g) Magnetic variation

Same as for SID (See 12.2.5 (g))

h) Bearing, tracks and radials

Same as for SID (See 12.2.5 (h))

i) Aeronautical data

Same as for SID (See 12.2.5 (i))

12.2.7 En-Route Chart – ICAO

a) Fuction

This chart provides flight crew with information to facilitate navigation along ATS routes in compliance with air traffic services procedures.

b) Availability

The chart is issued to cover the ATS Routes in Kigali FIR. A simplified version is issued and published in the AIP.

c) Coverage and scale

As deemed appropriate depending on how much data is to be included and the paper size to be used

d) Projection

A conformal projection on which a straight line approximates a great circle should be used. Parallels and meridians are shown at suitable intervals. Graduation marks are placed at consistent intervals along selected parallel meridians.

e) Identification

Each sheet is identified by chart series and number.

f) Culture and topography

Generalized shore lines of all open water areas, large lakes and rivers are shown except where they conflict with data more applicable to the function of the chart.

Where charts are not True North orientated, this fact and the selected orientation used is clearly indicated.

g) Magnetic variation
Isogonals are indicated and the date of the isogonic information given.

h) Bearings, tracks and radials
Bearings, tracks and radials are magnetic. Where bearings, tracks or radials are given with reference to True North or Grid North, this is clearly indicated. When Grid North is used its reference grid meridian is identified.

i) Aeronautical Data
- Aerodromes

For the simplified version of the chart to be published in the AIP, only aerodromes used by international civil aviation to which an instrument approach can be made is shown.

All aerodromes, including airstrips are shown in the version of Area navigation route used for briefing and flight planning.

- Prohibited, restricted and danger areas

All Prohibited, restricted and danger areas are depicted showing their identification and vertical limits.

- Air Traffic service system

Established air traffic services system is shown. The components includes the following:

- the radio navigation aids associated with the air traffic services system together with their names, identifications, frequencies and geographical coordinates in degrees, minutes and seconds;
- in respect of DME, additionally the elevation of the transmitting antenna of the DME to the nearest 30 m (100 ft);
- an indication of all designated airspace, including lateral and vertical limits and the appropriate class of airspace;
- all ATS routes for en-route flight including route designators, required navigation performance (RNP) types, the track to the nearest degree in both directions along each segment of the routes and, where applicable, the direction of traffic flow;
- all significant points which define the ATS routes and are not marked by the position of a radio navigation aid, together with their name-code and geographical coordinates in degrees, minutes and seconds;
- in respect of waypoints defining VOR/DME area navigation routes, additionally,

a. the station identification and radio frequency of the reference VOR/DME;

b. The bearing to the nearest tenth of a degree and the distance to the nearest two-tenths of a kilometer (tenth of a nautical mile) from the reference VOR/DME, if the waypoints is not collocated with it;
- an indication of all compulsory and “on-request” reporting points and ATS/MET reporting points;
- the distances to the nearest kilometer or nautical mile between significant points consisting turning points or reporting points;
- change-over points on route segments defined by reference to very high frequency omni directional radio ranges, indicating the distances to the nearest kilometer or nautical mile to the navigation aids.
- minimum flight altitudes on ATS routes to the nearest higher 50 metres or 100 feet.
- radio communication facilities listed with their frequencies;

j) Supplementary information
Where established, altimeter setting regions are shown and identified.

12.2.8 Visual Approach Chart – ICAO

a) Function

This chart provides crews with information which will enable them to transit from the en-route/descend to approach phases of flight to the runway of intended landing by means of visual reference.

b) Availability

The Visual Approach Chart – ICAO is made available for all aerodromes used by international as well as national civil aviation where:

- only limited navigation facilities are available; or
- radio communication facilities are not available; or
- no adequate aeronautical charts of the aerodrome and its surroundings at 1:500 000 or greater scale are available;
- visual approach procedures have been established.

c) Scale

The scale is sufficiently large to permit depiction of significant features and indication of the aerodrome layout. The scale should not be smaller than 1:500 000.

d) Format

A4 and A3 Acceptable.

e) Projection

A conformal projection on which a straight line approximates a great circle is used. Graduation marks should be placed at consistent intervals along the neat lines.

f) Identification

The chart is identified by the name of the city or town which the aerodrome serves and the name of the aerodrome.

g) Culture and topography

Natural and cultural landmarks are shown (e.g. bluffs, cliffs, sand dunes, cities, towns, roads, railroads, isolated lighthouses). Geographical place names should be included only when they are required to avoid confusion or ambiguity.

Shore lines, lakes, rivers and streams are shown. Relief are shown in a manner best suited to the particular elevation and obstacle characteristics of the area covered by the chart.

When shown, spot elevations should be carefully selected. The value of certain spot elevations/heights in relation to both mean sea level and aerodrome elevation may be given.

h) Magnetic variation

The magnetic variation is shown.

i) Bearings, tracks and radials

Bearings, tracks and radials are magnetic except as provided. In areas of high latitude, where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.

j) Aeronautical data

- Aerodromes

All aerodromes are shown by the runway pattern. Restrictions on the use of any landing direction are indicated. Where there is any risk of confusion between two neighboring aerodromes, this is indicated. Abandoned aerodromes are identified as abandoned. The aerodrome elevation is shown in a prominent position on the chart.

- Obstacles

Obstacles are shown and identified. The elevation of the top of obstacles is shown to the nearest (next higher) metre or foot. The heights of obstacles above the aerodrome elevation should be shown.

- Prohibited, restricted and danger areas

Prohibited areas, restricted areas, and danger areas are depicted with their identification and vertical limits.

- Designated airspace

Where applicable, control zones and aerodrome traffic zones are depicted with their vertical limits and the appropriate class of airspace.

- Visual approach information

Visual approach procedures are shown where applicable. Visual aids for navigation are shown as appropriate.

- Supplementary information

Radio navigation aids together with their frequencies and identifications are shown as appropriate. Radio communication facilities with their frequencies are shown as appropriate.

12.2.9 Aerodrome/Heliport Chart — ICAO

a) Function
This chart provides flight crews with information which will facilitate the ground movement of aircraft:

a) from the aircraft stand to the runway; and
b) from the runway to the aircraft stand;
and helicopter movement:
a) from the helicopter stand to the touchdown and lift-off area and to the final approach and take-off area;
b) from the final approach and take-off area to the touchdown and lift-off area and to the helicopter stand;
c) along helicopter ground and air taxiways; and
d) along air transit routes;

b) Availability
The Aerodrome/Heliport Chart — ICAO is made available for all aerodromes/heliports available for use by international as well as national civil aviation.

c) Coverage and scale
The coverage and scale is sufficiently large to show clearly all the elements listed in 12.2.9 (f). A linear scale is shown.

d) Identification
The chart is identified by the name of the city or town or area which the aerodrome/heliport serves and the name of the aerodrome/heliport.

e) Magnetic variation
True and Magnetic North arrows and magnetic variation to the nearest degree and annual change of the magnetic variation is shown.

f) Aerodrome/heliport data
This chart shows:

a) geographical coordinates in degrees, minutes and seconds for the aerodrome/heliport reference point;
b) elevations, to the nearest metre or foot, of the aerodrome/heliport and apron (altimeter checkpoint locations) where applicable; and for non-precision approaches, elevations and geoid undulations of runway thresholds and the geometric centre of the touchdown and lift-off area;
c) elevations and geoid undulations, to the nearest half-metre or foot, of the precision approach runway threshold, the geometric centre of the touchdown and lift-off area, and at the highest elevation of the touchdown zone of a precision approach runway;
d) all runways including those under construction with designation number, length and width to the nearest metre, bearing strength, displaced thresholds, stopways, clearways, runway directions to the nearest degree magnetic, type of surface and runway markings;
e) all aprons, with aircraft/helicopter stands, lighting, markings and other visual guidance and control aids, where applicable, including location and type of visual docking guidance systems, type of surface for heliports, and bearing strengths or aircraft type restrictions where the bearing strength is less than that of the associated runways;
f) geographical coordinates in degrees, minutes and seconds for thresholds, geometric centre of touchdown and lift-off area and/or thresholds of the final approach and take-off area (where appropriate);
g) all taxiways, helicopter air and ground taxiways with type of surface, helicopter air transit routes, with designations, width, lighting, markings (including runway-holding positions and, where established, intermediate holding positions), stop bars, other visual guidance and control aids, and bearing strength or aircraft type restrictions where the bearing strength is less than that of the associated runways;
h) geographical coordinates in degrees, minutes, seconds and hundredths of seconds for appropriate taxiway centre line points and aircraft stands;
j) where established, standard routes for taxiing aircraft with their designators;
k) approach and runway lighting;
i) aircraft servicing areas and buildings of operational significance;

Bearing strengths or aircraft type restrictions are shown in tabular form on the face or verso of the chart.

12.2.10 Aircraft Parking/Docking Chart — ICAO

a) Function
This supplementary chart provides flight crews with detailed information to facilitate the ground movement of aircraft between the taxiways and the aircraft stands and the parking/docking of aircraft.

b) Availability
The Aircraft Parking/Docking Chart — ICAO is made available and where, due to the complexity of the terminal facilities, the information cannot be shown with sufficient clarity on the Aerodrome/Heliport Chart — ICAO.

c) Coverage and scale
The coverage and scale is sufficiently large to show clearly all the elements listed in 12.2.10 (f). A linear scale is shown.

d) Identification
The chart is identified by the name of the city or town or area which the aerodrome serves and the name of the aerodrome.

e) Magnetic variation
A True North arrow is shown. Magnetic variation to the nearest degree and its annual change is shown.

f) Aerodrome data
This chart shows in a similar manner all the information on the Aerodrome/Heliport Chart — ICAO relevant to the area depicted, including:

- apron elevation to the nearest metre or foot;
- aprons with aircraft stands, bearing strengths or aircraft type restrictions, lighting, marking and other visual guidance and control aids, where applicable, including location and type of visual docking guidance systems;
- geographical coordinates in degrees, minutes, seconds and hundredths of seconds for aircraft stands;
- taxiway entries with designations, including runway-holding positions and, where established, intermediate holding positions, and stop bars;
- aircraft servicing areas and buildings of operational significance;

12.2.11 Aeronautical Chart — ICAO 1:500 000
a) Function
This chart provides information to satisfy the requirements of visual air navigation for low speed, short- or medium-range operations at low and intermediate altitudes.

This chart is used:
a) to serve as a basic aeronautical chart;
b) to provide a suitable medium for basic pilot and navigation training;
c) to supplement highly specialized charts which do not provide essential visual information;
d) in pre-flight planning.

b) Availability

The Aeronautical Chart — ICAO 1:500 000 is made available for all the flights that are satisfied by the requirements of visual air navigation for low speed, short- or medium-range operations at low and intermediate altitudes

c) Scales

Linear scales for kilometres and nautical miles arranged in the following order:
— kilometres,
— nautical miles,
with their zero points in the same vertical line is shown in the margin.

The length of the linear scale is not less than 200 mm (8 in).

d) Projection

A conformal (orthomorphic) projection is used. Parallels are shown at intervals of 30 minutes
Meridians are normally shown at intervals of 30 minutes

e) Identification

Each sheet is identified by a name which should be that of the principal town or of a main geographical feature appearing on the sheet.

f) Culture and topography

- Built-up areas

Cities, towns and villages are selected and shown according to their relative importance to visual air navigation.

- Railroads

All railroads having landmark value are shown. In congested areas, some railroads may be omitted in the interest of legibility. Railroads may be named. Rail stations may be shown.

- Highways and roads

Road systems are shown in sufficient detail to indicate significant patterns from the air.

Roads are not shown in built-up areas unless they can be distinguished from the air as definite landmarks.

The numbers or names of important highways may be shown.

Natural and cultural landmarks, such as bridges, prominent transmission lines, permanent cable car installations, wind turbines, mine structures, lookout towers, forts, ruins, levees, pipelines, rocks, bluffs, cliffs, sand dunes, isolated lighthouses and lightships, when considered to be of importance for visual air navigation, are shown.

- Political boundaries

International boundaries are shown. Un-demarcated and undefined boundaries are distinguished by descriptive notes.

- Hydrography

All water features compatible with the scale of the chart comprising shore lines, lakes, rivers and streams (including those non-perennial in nature), salt lakes, glaciers and ice caps are shown.

- Contours

Contours are shown. The selection of intervals is governed by the requirement to depict clearly the relief features required in air navigation. The values of the contours used are shown.

- Spot elevations

Spot elevations are shown at selected critical points. The elevations selected are always the highest in the immediate vicinity and generally indicate the top of a peak, ridge, etc. Elevations in valleys and at lake surface levels which are of navigational value are shown. The position of each selected elevation is indicated by a dot.

- Date of topographic information

The date of latest information shown on the topographic base is indicated in the margin.

g) Magnetic variation

Isogonic lines is shown. The date of the isogonic information is indicated in the margin.

h) Aeronautical data

- General

Aeronautical information is shown consistent with the use of the chart and the revision cycle.

- Aerodromes

Aerodromes and heliports are shown with their names, to the extent that they do not produce undesirable congestion on the chart, priority being given to those of greatest aeronautical significance.

The aerodrome elevation, the lighting available, the type of runway surface and the length of the longest runway or channel, shown in abbreviated form for each aerodrome, if do not cause undesirable clutter on the chart, is indicated.

- Obstacles

Obstacles are shown. objects of a height of 100 m (300 ft) or more above ground are normally regarded as obstacles.

When considered of importance to visual flight, prominent transmission lines, permanent cable car installations and wind turbines, which are obstacles, are shown.

- Prohibited, restricted and danger areas

Prohibited, restricted and danger areas are shown.

- Air traffic services system

Significant elements of the air traffic services system including, where practicable, control zones, aerodrome traffic zones, control areas, flight information regions and other airspaces in which VFR flights operate are shown together with the appropriate class of airspace.

- Radio navigation aids

Radio navigation aids are shown by the appropriate symbol and named, but excluding their frequencies, coded designators, times of operation and other characteristics unless any or all of this information which is shown is kept up to date by means of new editions of the chart.

12.2.12 ATC Surveillance Minimum Altitude Chart — ICAO

a) Function

This chart provides information that will enable flight crews to monitor and cross-check altitudes assigned by a controller using an ATS surveillance system.

b) Availability

The ATC Surveillance Minimum Altitude Chart — ICAO is made available where vectoring procedures are established and minimum vectoring altitudes cannot be shown adequately on the Standard Departure Chart — Instrument (SID) — ICAO or Standard Arrival Chart — Instrument (STAR) — ICAO.

c) Coverage and scale

The coverage of the chart is sufficient to effectively show the information associated with vectoring procedures. The chart is drawn to scale.

The chart should be drawn to the same scale as the associated Standard Departure Chart — Instrument (SID) — ICAO or Standard Arrival Chart — Instrument (STAR) — ICAO.

d) Projection

A conformal projection on which a straight line approximates a geodesic line is used. Graduation marks should be placed at consistent intervals along the neat lines, as appropriate.

e) Identification

The chart is identified by the name of the aerodrome for which the vectoring procedures are established or, when procedures apply to more than one aerodrome, the name associated with the airspace portrayed.

f) Culture and topography

Generalized shorelines of all open water areas, large lakes and rivers are shown except where they conflict with data more applicable to the function of the chart. Appropriate spot elevations and obstacles are shown.

g) Magnetic variation

The average magnetic variation of the area covered by the chart is shown to the nearest degree.

h) Bearings, tracks and radials

Bearings, tracks and radials are magnetic.

i) Aeronautical data

- Aerodromes

All aerodromes that affect the terminal routings are shown. Where appropriate, a runway pattern symbol is used.

The elevation of the primary aerodrome to the nearest metre or foot is shown.

- Prohibited, restricted and danger areas

Prohibited, restricted and danger areas are depicted with their identification.

- Air traffic services system

The chart shows components of the established air traffic services system including:

a) relevant radio navigation aids together with their identifications;
b) lateral limits of relevant designated airspace;
c) relevant significant points associated with standard instrument departure and arrival procedures;
d) transition altitude, where established;
e) information associated with vectoring including:
1) minimum vectoring altitudes to the nearest higher 50 m or 100 ft, clearly identified;
2) lateral limits of minimum vectoring altitude sectors normally defined by bearings and radials to/from radio navigation aids to the nearest degree or, if not practicable, geographical coordinates in degrees, minutes and seconds and shown by heavy lines so as to clearly differentiate between established sectors;

Routes used in the vectoring of aircraft to and from the significant points may be shown.

12.2.13 Precision Approach Terrain Chart — ICAO

a) Function

The chart provides detailed terrain profile information within a defined portion of the final approach so as to enable aircraft operating agencies to assess the effect of the terrain on decision height determination by the use of radio altimeters.

b) Availability

The Precision Approach Terrain Chart — ICAO is made available for all precision approach runways Categories II and III at aerodromes used by international civil aviation.

c) Scale
The horizontal scale should be 1:2 500, and the vertical scale 1:500. When the chart includes a profile of the terrain to a distance greater than 900 m (3 000 ft) from the runway threshold, the horizontal scale should be 1:5 000.

d) Identification
The chart is identified by the name of the country in which the aerodrome is located, the name of the city or town or area which the aerodrome serves, the name of the aerodrome and the designator of the runway.

e) Plan and profile information
The chart includes:
a) a plan showing contours at 1 m (3 ft) intervals in the area 60 m (200 ft) on either side of the extended centre line of the runway, to the same distance as the profile, the contours to be related to the runway threshold;
b) an indication where the terrain or any object thereon, within the plan defined in a), differs by +or -3 m (10 ft) in height from the centre line profile and is likely to affect a radio altimeter;
c) a profile of the terrain to a distance of 900 m (3 000 ft) from the threshold along the extended centre line of the runway.

Where the terrain at a distance greater than 900 m (3 000 ft) from the runway threshold is mountainous or otherwise significant to users of the chart, the profile of the terrain should be shown to a distance not exceeding 2 000 m (6 500 ft) from the runway threshold.

The ILS reference datum height is shown to the nearest half metre or foot

RAC-AIM-CART-001

Appendix 1: Stake Holders Satisfaction Questionnaire Form.

Aeronautical Charts		Degree of Satisfaction			
	Very Dissatisfied	Dissatisfied	Undecided	Satisfied	Very Satisfied
1) Degree of RAC Aeronautical Charts compliance with ICAO SARPS.					
2) Degree of accuracy of the published Aeronautical Charts eg. En-route Chart, Aerodrome charts, SIDS AND STARS, Visual Approach Charts, Packing and Docking Charts etc.					
3) Quality of the aeronautical charts					
4) Availability of reference Aeronautical Charts in the Aerodrome units.					
5) Easiness of locating Aeronautical charts in the AIP					
Comment					

Appendix 2: Error Tracking Form

Date	Description of error	Affected Documents (s)	Notified by	Cause & Analysis	Corrective Action	signature

Appendix 3: On-Job Training Program

OJT Part A. General orientation

		Self-Evaluation					1ST Supervisor Evaluation				
		1	2	3	4	5	1	2	3	4	5
OJT PART A 1: Employee Orientation on the first day of the week											
1) .	Tour of AIM unit and familiarization with staff at the office and office sections that make up AIM										
OJT PART A2: Overview of the ON-JOB training Schedule											
1)	Trainee and supervisor discuss training schedule.										
2)	Access to office, access codes/passwords (email, computer e.t.c) and Cartography manuals.										
3)	Overview of the section organization structure, duties and responsibilities.										

OJT PART B: Technical Tasks Assessment

OJT PART B1: Orientation On Operational Documents											
1)	Data providers forms	1	2	3	4	5	1	2	3	4	5
2)	Signed service level agreements										
3)	Procedures on reception of raw data										
4)	Operations Manual										
5)	QMS manual and ISO procedures										
6)	Other Technical Documents (ICAO publications, systems operations manuals etc)										
7)	Rwanda Civil Aviation Regulations										

OJT PART B2: Data and Information Management-Pre Process Data

1)	Receive and record raw data (internal and/or external)	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
2)	Evaluate whether the raw data is from an authorized source										
3)	Evaluate whether the data meets protection requirements										
4)	Identify if there is a need for translation and/or coding of the raw data										
5)	Analyse the appropriateness of the data										
6)	Verify the quality of the raw data										
7)	Analyse the data for completeness, coherence, abbreviation and ambiguity										
8)	Identify any discrepancies, duplication and misinterpretations of the data										
9)	Coordinate with data source										
10)	Execute corrective action										
OJT PART B3: Data and Information Management-Process Data											
1)	Perform storage of raw data	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
2)	Assess the impact of the data on existing publications, the significance and complexity of the data, and its temporality.										
3)	Coordinate with other relevant parties										
4)	Select the means of publication										
5)	Schedule the publication process, taking into consideration the main milestones, proposed publication/effective date and the AIRAC cycle										
6)	Perform calculations e.g., data conversions										
7)	Apply appropriate data formatting rules										
8)	Enter data into application										
9)	Assemble statistical data –metadata										
10)	Make data available										
OJT PART B4: Database Management											
1)	Apply database maintenance operations	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**

2)	Identify faults in the operation of the database and apply fault reporting procedures										
3)	Operate application(s)										
4)	Apply database maintenance operations										

OJT PART B5: Software Training (ARCGIS Software)											
1)	Loading of data in ARCGIS software	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
2)	Management of data (digitizing)										
3)	Interacting with ARGIS tools										
4)	Chart Development- map frame										
5)	Printing chart										
OJT PART B6: Technical Documentations											
1)	Maintain Technical publications through replacement of pages or entire copies as applicable (e.g. insert AIP amendments)	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
2)	Maintain data sets (static and/or dynamic)										
3)	Distribute as per subscription records										
4)	Maintain records of reception and distribution										
OJT PART B7: Developing all types of charts according to the Civil Aviation Cartography Regulations											
1)	Collect data as per Rwanda Civil Aviation Regulations	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
2)	Evaluate whether the data is from an authorized source eg. AIP										
3)	Coordinate with other relevant parties where applicable										
4)	Verify the quality and accuracy of the data										
5)	Analyze the data for completeness, coherence, abbreviation and ambiguity.										
6)	Prepare charts										
5)	Proof read the draft chart										

Part C: General Competency Evaluation by 2nd Supervisor.

1)	Ability to Learn	1	2	3	4	5
2)	Attitude					
3)	Conduct					
4)	Motivation/Initiative					
5)	Quality and Accuracy of Work					
6)	Quantity of Work					
7)	Safety Practices					
8)	Etiquette					
9)	Overall rating					

KEY

1	2	3	4	5
Poor	Below Average	Average	Good	Very Good

:

1) This form is to be filled out at the end of each training session
2) A grading of 3-5 is to be considered as satisfactory
3) A grading of 1-2 is to be considered as unsatisfactory and a remedial action plan will be implemented as per last staff performance appraisal report.

Appendix 4: Cartography office Meta Data File

Raw data SR. Number	Date Received	Data Source	Subject	Approved By	Action Taken	Sign

Appendix 5: Training Program

Section 1. 0 Indoctrination

Cartography Course Title	Indoctrination
Training Category	Basics
Sequence	Initial
Duration	20 Weeks
Objective	Fill areas of gaps with knowledge and skills, and change all negative attitudes to positive attitude. Improve performance of briefing, NOF, and Cartography Personnel to enhance productivity and profit of the Rwanda Airport Company (RAC). Fulfil Rwanda Airport Company (RAC) long-term goals i.e. vision, and quality Objectives. Adopt proactive and zero defect culture. Encourage innovative and creative ideas of briefing, NOF and Cartography personnel for optimum use of materials
Description	This course is designed for briefing, NOF, AIP and Cartography personnel to cope with applications needed and implemented.
Content	➢ Equipment handling ➢ FPL management ➢ Pre and post flight information management ➢ Documents and local procedures ➢ Workload management ➢ Customer service ➢ NOTAM promulgation ➢ Equipment handling ➢ NOTAM system management ➢ Technical library management ➢ Coordination & teamwork ➢ Workload management ➢ Airspace ➢ ATS requirements for information ➢ Aeronautical met reports Applicable phenomena

Prerequisites	None

Section 2.0 Basic Trainings

Section 2.0.1 Basic AIS

Cartography Course Title	AIS ICAO 021
Training Category	Basics
Sequence	Initial
Course Duration	12 Weeks
Course Objective	At the end of the course, the AIS, NOTAM,AIP, quality officers and cartography engineer will be able to: -Interpret basic civil aviation regulations for the safe operation of air navigation; -Organize and prepare self-briefing boards for the air crew; -Perform the requirements of the provision of pre-flight and in flight information; -Compile and produce pre-flight briefing bulletins for long range flights originating from major airports; -Disseminate such information to flight crew, airlines, ground organizations and other Civil Aviation Authorities for safe conduct of flight operations; and -Plot navigation warnings on charts and ensuring that the charts and all maps are kept up- to-date at all times.
Course Description	The course produces determined and polished officers able to handle flight plans and airline operators with confidence.
Course content	➢ Aviation geography ➢ Communication procedures ➢ Radio theory ➢ ICAO law ➢ Meteorology ➢ Chart interpretation ➢ Flight planning ➢ AIP Introduction ➢ NOTAM ➢ Introduction to ATS

	➢ ICAO Annexes
Prerequisites	Indoctrination course

Section 2.0.2 AIS Digital Cartography

Cartography Course Title	AIS Digital Cartography
Training Category	Basic Training
Sequence	Initial
Course Length	12 Weeks
Course Objective	At the end of the course, the participants will be able to: Manage changes in aeronautical maps/charts data; Maintain aeronautical data quality; Produce aeronautical charts; Install, customize and maintain the system applications; Create and set up chart templates for generation of grids.
Course Description	This course is designed to Cartography engineer in Aeronautical Information Management to prepare, digitize, develop and produce aeronautical maps and charts.
Course Content	This course provides training on AIS Digital Cartography and typically includes the following subjects: • Use of charts for air navigation; • Compilation and editing of charts; • Map and chart reproduction; • Amendment cycles; • Liaison between AIS and Cartographic agencies; • Map and chart distribution; • Introduction to Computer Assisted Cartography • Geographical Information Systems • Map Projections • Geographic Reference Systems • Micro Station, and; • Smart globe Aeronautical Utilities

Prerequisites	Indoctrination and Basic courses

Section 2.0.3 Aeronautical GIS (OJT Included)

Cartography Course Title	Aeronautical GIS (OJT Included)
Training Category	Basics
Sequence	Initial
Course Length	4 Weeks
Course Objective	By the end of the course the participant will be able to work easily with satellite images, know the type of projection of maps and how to rectify the satellite images to use with different software and how to extract the elevation data out of the images (DEM).
Course Description	GIS allows data to be created, edited, and stored in a centralized manner for further uses such as: • Charts • Aeronautical Information Publications (AIPs) • Aeronautical data creation, tasking, and Web services • Multi-dimensional visualization and analysis
Course Content	With GIS, aeronautical information management can: • Create, visualize, analyse, and disseminate critical data from Aeronautical Information Systems (AIS). • Automatically update charts through the AIS to reduce data latency, redundancy, and errors. • Produce a wide range of charting products, including International Civil Aviation Organization (ICAO)-compliant charts, from a central database. • Share data using the Aeronautical Information Exchange Model (AIXM). • Efficiently generate aeronautical charts for route planning, in-flight navigation, and take-off and landing
Prerequisites	Indoctrination, Basic AIS Course

Section 2.0.4 Quality Management System

Cartography Course Title	Quality Management System
Training Category	Basics
Sequence	Initial
Course Length	5 days

Course Objective	After the completion of this course trainee will be able to: •Be conversant about the evolution of quality and quality assurance as applied to aviation •Understand the quality requirements of key regulatory bodies and national authorities such as ICAO, ISO, EASA, and FAA •Be knowledgeable about specific quality requirements for aviation and how to merge them in an integrated Quality Management System •Apply quality management principles to your organization •Create a quality culture and know how to assure and audit for quality
Course Description	In this course trainee will gain practical knowledge on how to apply the many requirements for quality management to aviation. trainee will also learn about the latest requirements regarding quality of the International Organization for Standardization (ISO),
Course Content	•Quality definitions and applications •Link between quality and safety in aviation •ICAO Annexes and SARPs citing the need for quality and safety assurance •Quality as a management responsibility •Definition, elements and objectives of a QMS •ISO 9000 series of standards, in particular, the ISO 9001:2015 model for a QMS •Current aviation quality requirements and their implementation from an airline •Integration of other management standards and requirements to a quality management system •Quality and service relationships •Auditing for quality •Model for quality management and customer service for CAAs and ANSPs
Prerequisites	Indoctrination, Basic AIS Course

Section 3.0 Currency Trainings

Section 3.0.1 e-TOD Survey and Production (Including OJT)

Cartography Course Title	e-TOD Survey and production (Including OJT)
Training Category	Currency Training
Sequence	Currency
Course Length	3 Weeks

Course Objective	-After completing this course, students need a procedure to load their current digital data into a database optimized for eTOD functionality -Students will be able to select the Area needed to create new Coverage Area boundaries as defined by the eTOD rules.
Course Description	The surface of the Earth containing naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, and including obstacles. In the context of eTOD, obstacles are defined as: a) are located on an area intended for the surface movement of aircraft; or b) extend above a defined surface intended to protect aircraft in flight; or c) Stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.
Course Content	➢ Data survey ➢ Conceptual Design ➢ Database Development ➢ Application Development ➢ Testing ➢ Coverage Area Data Concept ➢ eTOD obstacle File Geodatabase ➢ eTOD File Geodatabase ➢ Coverage Area Feature Dataset ➢ Point Features - Coverage Area Dataset
Prerequisites	Indoctrination, Basic AIS Course

Section 3.0.2 Aeronautical Survey including OJT

Cartography Course Title	Aeronautical Survey including OJT
Training Category	Currency Training
Sequence	Currency
Course Length	4 Weeks
Course Objective	At the end: I. Students will be able to understand Specifications for ground surveys at airports. II. The requirements for reporting deviations, unusual circumstances. III. How to use all the equipment required during survey process. IV. How the recording of surveyed data is done.

Course Description	The data collected for the Aeronautical Survey is critical to the operation and safety of the National Airspace System. The data is used to develop instrument approach and departure procedures, to certify airport for certain types of operations, to determine maximum take-off weights, to update aeronautical publications, to provide geodetic control for engineering projects, to assist in airport planning and land use studies.
Course Content	This is what to be covered in aeronautical survey: ➢ Existing Survey Marks ➢ Other Survey Marks ➢ Unusable Marks & New Site Selection ➢ New Survey Points ➢ Other New Points - Additional Temporary Survey Points May Be Set, If Required. ➢ Descriptions of New Marks and Recovery of Existing Survey Marks ➢ Verification of Existing Survey Marks. ➢ Runways - Runway Lengths, Widths, And Profiles ➢ Runway End Points Are Named ➢ Displaced Thresholds Are Named ➢ Stop ways Are Named ➢ Photographs and Sketches ➢ Digital Photograph Format and File Naming ➢ Determine The Positions and Elevations of All Obstructions ➢ Photographic Control Points
Prerequisites	Indoctrination and Basic AIS course

Section 3.0.3 WGS-84 and OLS Evaluation (Including OJT)

Cartography Course Title	WGS-84 and OLS Evaluation (Including OJT)
Training Category	Currency Training
Sequence	Currency
Course Length	19 days
Course Objective	The objective of this training is to train in the provision of geographical coordinates referenced to the WGS 84 datum and obstacle limitation surfaces assessment in order to assist AIM in implementation of the standards on WGS 84.
Course Description	The aim of the training is to effectively implement accuracy, resolution and integrity of aeronautical data and assessing OLS
Course Content	- Demonstrate familiarization with Obstacle limitation surfaces. - Evaluate obstacles mentally / manually. - Use OLS. Software to evaluate obstacles.

	- Identify effects of using differing coordinate reference systems in aviation. - Demonstrate familiarization with accuracy, resolution and integrity of aeronautical data. - Identify geodesy principals. - Demonstrate familiarization with GNSS in survey. - Define and know how to obtain the global wgs-84 coordinate system. - Demonstrate familiarization with surveying guidance and requirements of survey reports. - Demonstrate familiarization with Datum transformation. - Demonstrate familiarization with Map projection. - Demonstrate familiarization with Survey inventory related to WGS-84 implementation.
Prerequisites	Indoctrination and Basic AIS course

Section 3.0.4 Electronic AIP (eAIP)

Cartography Course Title	Electronic AIP (eAIP)
Training Category	Currency Training
Sequence	Currency
Course Length	2 Weeks
Course Objective	➢ At the end of the Course the trainees will be able to: ➢ Publish the content of Aeronautical Information Publication (AIP), AIP Amendments (AMDT), AIP Supplements (SUP) and Aeronautical Information Circulars (AIC) in a structured electronic format, ➢ Visualize the content of these electronic documents on a computer screen, using Web technology.
Course Description	This course is designed for Cartography engineer to provide knowledge for developing an eAIP
Course Content	➢ How to Visualize changes, both in text and graphics; ➢ How to distribute through the Internet or equivalent private networks; ➢ consistency, integrity, usability;

	➢ How it is technological leap forward; ➢ How it is reduced risk and cost as compared to isolated development; ➢ How it is easier to create integrated/regional AIPs; ➢ How it is possible to guarantee the integrity and the authenticity of the document by digitally signatures
Prerequisites	Indoctrination and Basic AIS

Section 4.0 Advanced Trainings

Section 4.0.1 Advanced AIS

Cartography Course Title	Advanced AIS Training
Training Category	Advanced Training
Sequence	Advanced
Course Length	4 Weeks
Course Objective	➢ Understand the Objectives and practices when moving from product-centric to data-centric aeronautical information provision ➢ Understand the safety implications of quality of data, correct data storage and efficient AIS distribution in the AIM environment
Course Description	Provide the trainee with theoretical basic knowledge to understand the detailed information regarding the basic functions which have to be performed by an AIS officer in PUB, NOF offices, consulting and updating AIP and how aeronautical information are collected and distributed. Provide the trainee with theoretical knowledge to AIRAC system applications, Handling of national and foreign NOTAM and facilitate AIS briefing and self-briefing.
Course Content	➢ The safety impact of aeronautical information ➢ AIM principles ➢ System Wide Information Management (SWIM) ➢ Examination of the 'Roadmap for the Transition from AIS to AIM' (ICAO, 1st edition 2009) ➢ The work of ICAO AIS workgroup AIS AIMSG ➢ Electronic Terrain and Obstacle Data (eTOD) ➢ WGS-84 data ➢ Integrated Aeronautical Data Base ➢ Electronic AIP ➢ AICM/ AIXM

	➢ Aeronautical Information Briefing ➢ Aerodrome Mapping ➢ AIS/MET data-link ➢ Digital NOTAMs ➢ Several case studies ➢ AIM implementation examples
Prerequisites	Indoctrination and Basic courses

Section 4.0.2 Aeronautical Information Exchange Model (AIXM 5.1)

Cartography Course Title	Aeronautical Information Exchange Model (AIXM 5.1)
Training Category	Advanced Training
Sequence	Advanced
Course Length	2 Weeks
Course Objective	- Study and apply the AIXM 5.1 UML Model - Describe the basics of XML - Differentiate and explain the basics of GML -Analyze AIXM 5.1 requirements and Approach -Recognize and work with the AIXM 5.1 XML Model/Schema -Explain the Digital NOTAM Concept -Create, edit and export to CSV a basic dabase using Excel. -Map data from CSV files, Databases and Snapshot to XML (AIXM-Update) using MapForce -Edit, validate and correct AIXM-Update files using Altova Spy

	-Check, explain and repair level errors from SDO Upload Status Report
Course Content	- Computer models intended for aeronautical data storage and Exchange - Aeronautical Information Models - Introduction to AIXM 5.1 - AIXM 5.1 Model Objectives - UML Basic concepts - AIXM 5.1 UML Model - Class Diagrams vs. Entity Relation Diagrams AIXM UML Modelling Conventions - Other Aspects of the Model - Geography Markup Language (GML) - AIXM 5.1 Requirements and Approach - AIXM 5.1 and GML - Digital NOTAM and SNOWTAM
Prerequisites	Indoctrination, Basic AIS and AIS Digital Cartography courses

Section 4.0.3 Advanced Digital Cartography

Cartography Course Title	Advanced Digital Cartography Training
Training Category	Advanced Training
Sequence	Advanced
Course Length	4 Weeks
Course Objective	By the end of this course the participant will be able to read, design and produce all aeronautical ICAO charts using CAD Tools manually.
Course Description	Design and production of full-color digital maps and information graphics, map cognition and use, and principles of desktop mapping.
Course Content	Advanced Digital Cartography reflects on the theoretical principles of cartography and introduces novel geo visualization concepts. The course utilizes Adobe InDesign, Adobe Illustrator, ArcGIS and MA Publisher to create a range of digital mapping products. Students will also explore dynamic and interactive mapping platforms. Good cartographic product design guidelines, effective and efficient visual communication strategies and modern cartographic production processes will enable students to design a professional-grade cartographic atlas in a teamwork setting.
Prerequisites	Indoctrination, Basic AIS and AIS Digital Cartography courses

Section 4.0.4 Procedure Design Training

Cartography Course Title	Procedure Design Training
Training Category	Advanced Training
Sequence	Advanced
Course Length	8 Weeks
Course Objective	The purpose of the course is to apply procedure design criteria to the development of procedures for a select set of the navigation specifications in the Performance Based Navigation Manual dealing with terminal and approach operations. The general concept of PBN is presented, then the procedure design criteria associated with some specific applications such as Basic-RNP 1, RNAV 1, RNP APCH and baro-VNAV are studied and applied and the procedure design is documented.
Course Description	Design of all instrument flight procedures according to the all segments of flight procedures.
Course Content	PBN concept: • General overview, • Description of navigation specifications, • Avionics, aircraft equipment and airworthiness regulations, • Which application for which airspace? • Performance – notion of accuracy, precision, continuity, availability GNSS concept: • Aircraft based augmentation system (ABAS) • Satellite based augmentation system (SBAS) in a PBN context

	• Ground based augmentation system (GBAS) in a PBN context Quality assurance (Quality Assurance Manual for Flight Procedure Design): • Document and store procedure for traceability • Data origination • Procedure design process
Prerequisites	Indoctrination, Basic and AIS Digital Cartography courses

Cartography Course Title	Chart Management Course
Training Category	Advanced Training
Sequence	Advanced
Course Length	2 Weeks
Course Objective	By the end of this course Cartographer will be able to be familiar with all types of chart in annex 4. The instructors will help the trainee with a highly technique manually and automated ways for drawing charts.
Course Description	AIM unit will benefit from this training where the Cartography engineer will be able to produce and able to use all techniques as specialty.
Course Content	At the end the trainee will be able to understand: ➢ Customize the aeronautical charts ➢ To understand and customize instrument approach procedures ➢ To be familiar with ARCMAP and ARCCATALOG usage ➢ To be able to understand in detail instrument approach segments ➢ Will be able to be familiar with coordinate system and map projection. ➢ To be familiar with aerodrome obstacle charts type A, B and C ➢ To be familiar with precision approach terrain chart
Prerequisites	Indoctrination, Basic AIS and AIS Digital Cartography

Section 4.0.5 Chart Management Course

Section 4.0.6 Automated AIS System

Cartography Course Title	Automated AIS System
Training Category	Advanced Training
Sequence	Advanced

Course Length	3 weeks
Course Objective	At the end of the course, the participants will be able to: Apply the principles and functions of an Automated AIS System in their performance; Operate the Automated AIS Systems both the Aeronautical Information Data Processing System (AIDPS) and Aeronautical Flight Data Processing System (AFDPS).
Course Description	This course is designed for AIM personnel to produce determined and polished officers able to perform their duties using the new AIS technology systems as a tool to achieve data quality.
Course Content	This course provides training on and will typically include the following subjects: • Introduction to Automated AIS Systems, • Development of Automated Processes, • AIS Test Bed, • The concept for an Integrated Automated AIS Systems, • Fall-back procedures, • Planning for and Implementation of Integrated Systems, • System Administration • NOTAM Management • Flight Plan Management • PIB Management • Chart Management • AIP Production • Reference Database Management
Prerequisites	Indoctrination and Basic AIS

Section 4.0.7 Transition from AIS to AIM

Cartography Course Title	Transition from AIS to AIM
Training Category	Advanced
Sequence	Advanced Training
Course Length	3 Weeks
Course Objective	Provide the trainee with basic theoretical knowledge and the applications needed for the transition phases from AIS to AIM.
Course Description	This course is designed for AIM, NOF and Cartography personnel to cope with applications needed for the transition from AIS to AIM

Course Content	➢ Demonstrate ICAO Global Air Navigation Plan (GANP) and Global ATM Operational Concept. ➢ Determine the components of the ATM. ➢ Explain the System Wide Information Management (SWIM). ➢ Describe the work of ICAO AIS workgroup AIS AIMSG. ➢ Appreciate the Use of AIS in the cockpit. ➢ State the Collaborative Decision Making (CDM). ➢ Identify Common Reference Systems (CRS). ➢ List the objectives of the transition to AIM. ➢ Demonstrate the guiding principles for the transition to AIM. ➢ Identify the Phases of the transition to AIM. ➢ Demonstrate ICAO Roadmap for the Transition ➢ Determine Aeronautical Information Conceptual model (AICM). ➢ Determine Aeronautical Information Exchange model (AIXM). ➢ Characterize the Electronic AIP (eAIP). ➢ Explain Digital NOTAM. ➢ Explain Electronic Terrain and Obstacle Data (eTOD). ➢ Identify AIRAC cycle. ➢ Explain WGS-84. ➢ Consider Integrated Aeronautical Database. ➢ Conduct Aeronautical Information Briefing. ➢ Explain the Aerodrome Mapping. ➢ Demonstrate AIS/MET data-link.
Prerequisites	Indoctrination and Basic AIS

Section 4.0.8 AIP Text/Chart Editing

Cartography Course Title	AIP Text/Chart Editing
Training Category	Advanced Training
Sequence	Advanced
Course Length	2 Weeks
Course Objective	At the end of training the trainee will be able to: 1. Recognize on AIS in general. 2. Get the requirements of the exchange of the information. 3. Recognize on the contents and format of AIP. 4. Differentiate between the types of AIP AMDT.

	5. Understand the requirements of charts. 6. Issue AIRAC and TRIGGER NOTAM.
Course Description	Cartography engineer will benefit from this training because the trainee will be able: Understand the requirements of charts Exchange of aeronautical information.
Course Content	1. Introduction. 2. AIS in general. 3. Quality system. 4. Exchange of aeronautical information. 5. AIRAC. 6. AIC. Module Two 1. AIP contents and formats. 2. AIP amendments and AIP supplements. 3. Presentation of information. 4. Charts to be included in AIP. 5. Abbreviations and colures in charts.
Prerequisites	None

Section 4.0.9 Human Factors Course

Cartography Course Title	Human Factors
Training Category	Advanced Training
Sequence	Advanced
Course Length	5 days
Course Objective	Upon completion of this workshop, trainee will be able to: • Recognise the importance of human factors in the overall improvement of human performance in AIS • Identify the critical role of hazard assessment, risk management and AIS automation in the overall human factors framework • Apply the principles involved in the concept of human factors
Course Description	This training provides trainee with an understanding of the concept of human factors in aeronautical information services (AIS) and the corresponding training requirements to meet the AIS standards set by the ICAO Annex 15 and Annex 15 (Aeronautical information services and aeronautical charts). It also focuses on the disciplines of human

	factors, their applications and ways to improve human performance in AIS.
Course Content	➢ The SHEL Model (Software, Hardware, Environment, Liveware) ➢ ICAO's core human factors concepts ➢ The goal of human factors in AIS ➢ Attention and perception ➢ Situation awareness ➢ Decision-making and planning ➢ Diagnosis and problem-solving ➢ What are humans good at? ➢ Multi-tasking and mental workload ➢ Applied physiology and mental performance ➢ Stress, fatigue, distraction, ➢ Teamwork in ATM ➢ Concepts of Threat and Error Management ➢ Human Factors in Safety Management ➢ Function Allocation and System Design ➢ Automation in ATM ➢ Applying Human Factors in AIS
Prerequisites	Indoctrination, Basic AIS

Section 4.0.10 Aeronautical Data Quality Requirements (ADQ)

Cartography Course Title	Advanced
Training Category	Advanced Training
Sequence	Advanced
Course Length	2 Weeks
Course Objective	The participant will: -Name and explain the means of compliance, level of implementation and the respective assessment of aeronautical data quality
Course Description	Course will Differentiate and explain all the information of Data Quality Requirements and assurance levels for airport dataset.
Course Content	-Implementing Rules - Community Specifications (CS) - The need of Aeronautical Data Quality - From Implementing Rule to Regulation - Objective and background to the ADQ Regulation. - Structure of the ADQ Regulation - ADQ Guide, Maintenance

	- Audit and Compliance - Data Originators
Prerequisites	Basic AIS, Digital Cartography

Section 4.0.11 ARINC 424 Path and Terminator Coding

Cartography Course Title	ARINC 424 Path and Terminator Coding
Training Category	Advanced Training
Sequence	Advanced
Course Length	4 Days
Course Objective	The objective of the course is to equip the trainees with the knowledge of database coding of instrument flight procedure design.
Course Description	The ARINC 424 Path & Terminator coding course has been designed as an introduction to database coding of Instrument Flight procedures. The course is based on a presentation of the subject theory, illustrated with realistic data and files from actual AIP's that closely reflect the operating environment of the students. The theory as well as the exercises are illustrated with static database examples using the smart Globe aeronautical charting system.
Course Content	-Procedure coding methodology based on the ARINC 424 Path & Terminator concept -History and background of the Path & Terminator concept -Overview of Documentation and Discussion of individual Path Terminators -Allowed Leg Combinations, Waypoint Description codes and mandatory attributes -Application of PT concept to SID procedures, examples and commonly used PT combinations in SID procedure, Special SID coding consideration -Application of PT concept to STAR procedures, examples and commonly used PT combinations in STAR procedure(s), Special STAR coding consideration -Application of PT concept to IAP procedures, examples and commonly used PT combinations in IAP procedure, Special IAP coding consideration -Practical exercises.
Prerequisites	Digital Cartography and PANSOPS Courses

Appendix 6: Chart Symbols

SYMBOLS FOR AERODROME/HELIPORT CHARTS

145	Hard surface runway	
146	Pierced steel plank or steel mesh runway	
147	Unpaved runway	
148	Stopway SWY	
149	Taxiways and parking areas	
150	Helicopter alighting area on an aerodrome	H
151	Aerodrome reference point ARP	
152	VOR check-point	
153	Runway visual range (RVR) observation site	

154	Point light	
155	Obstacle light	
156	Landing direction indicator (lighted)	T
157	Landing direction indicator (unlighted)	T
158	Stop bar	
159	Runway-holding position Pattern A / Pattern B Note.— For application, see Annex 14, Volume I, 5.2.10.	
160	Intermediate holding position Note.— For application, see Annex 14, Volume I, 5.2.18.	
161	Hot spot Note.— Hot spot location to be circled.	

SYMBOLS FOR AERODROME OBSTACLE CHARTS - TYPE A, B AND C

		Plan	Profile
162	Tree or shrub		Identification number
163	Pole, tower, spire, antenna, etc.		
164	Building or large structure		
165	Railroad		
166	Transmission line or overhead cable		

		Plan	Profile
167	Terrain penetrating obstacle plane		
168	Escarpment		
169	Stopway SWY		
170	Clearway CWY		

OBSTACLES

130	Obstacle	
131	Lighted obstacle	
132	Group obstacles	
133	Lighted group obstacles	

134	Exceptionally high obstacle (optional symbol)	
135	Exceptionally high obstacle – lighted (optional symbol) Note.— For obstacles having a height of the order of 300 m (1 000 ft) above terrain.	
136	Elevation of top (italics) 52 (15) Height above specified datum (upright type in parentheses)	

AERODROME SYMBOLS FOR APPROACH CHARTS

97	Aerodromes affecting the traffic pattern of the aerodrome on which the procedure is based	
98	The aerodrome on which the procedure is based	

RADIO NAVIGATION AIDS*

99	Basic radio navigation aid symbol *Note.— This symbol may be used with or without a box to enclose the data.*		
100	Non-directional radio beacon	NDB	
101	VHF omnidirectional radio range	VOR	
102	Distance measuring equipment	DME	
103	Collocated VOR and DME radio navigation aids	VOR/DME	
104	DME distance	Distance in kilometres (nautical miles) to DME → 15 km Identification of radio navigation aid → KAV	
105	VOR radial	Radial bearing from, and identification of, VOR	R 090 KAV
106	UHF tactical air navigation aid	TACAN	
107	Collocated VOR and TACAN radio navigation aids	VORTAC	
108	Instrument landing system	ILS	PLAN VIEW  Electronic  FRONT COURSE  BACK COURSE PROFILE  Electronic  GLIDE PATH
109	Radio marker beacon	Elliptical Bone Shape	 

Note.— Marker beacon may be shown by outline, or stipple, or both.

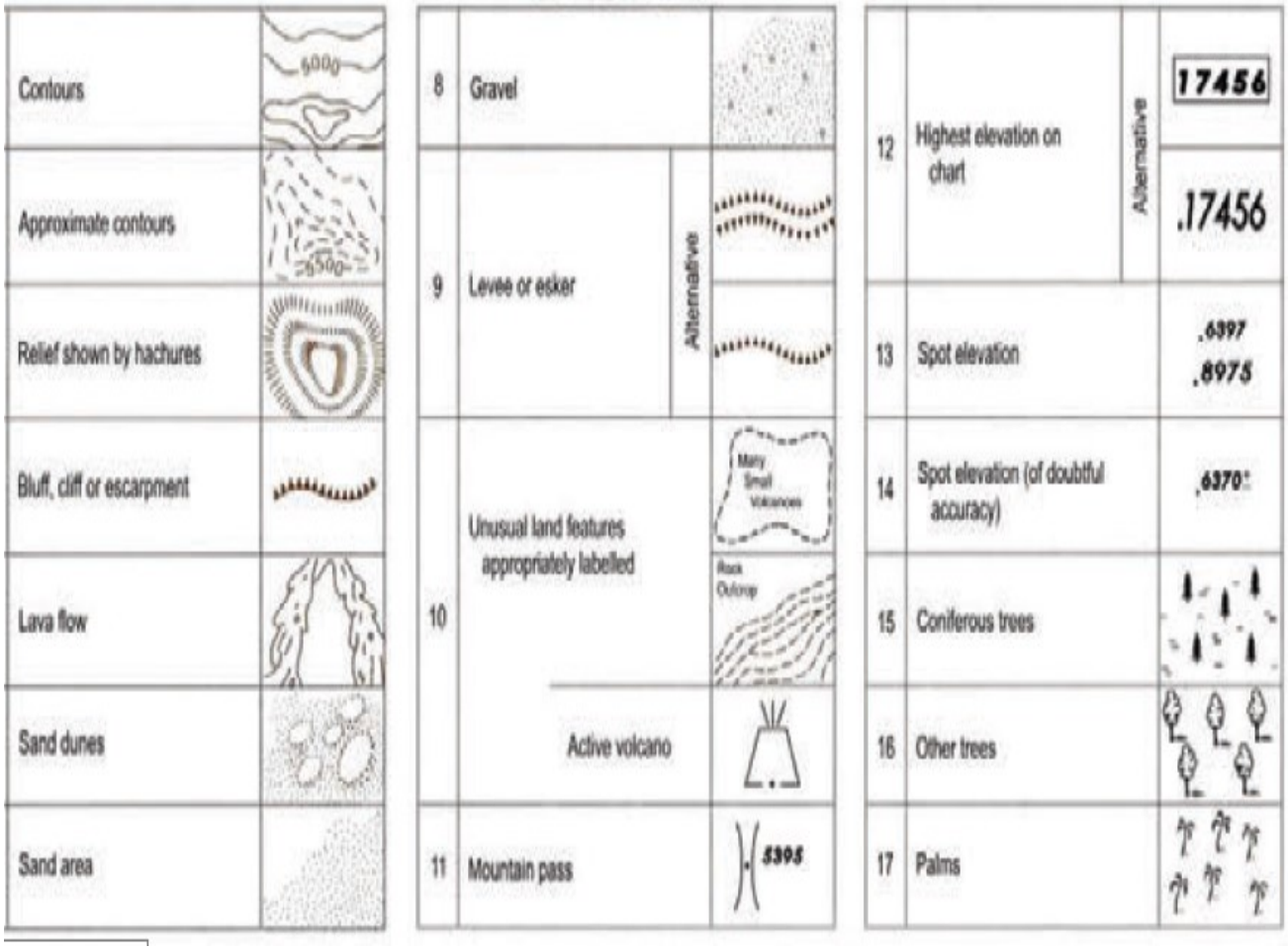
110	Compass rose To be orientated on the chart in accordance with the alignment of the station (normally Magnetic North)		Compass rose to be used as appropriate in combination with the following symbols:

Note.— Additional points of compass may be added as required.

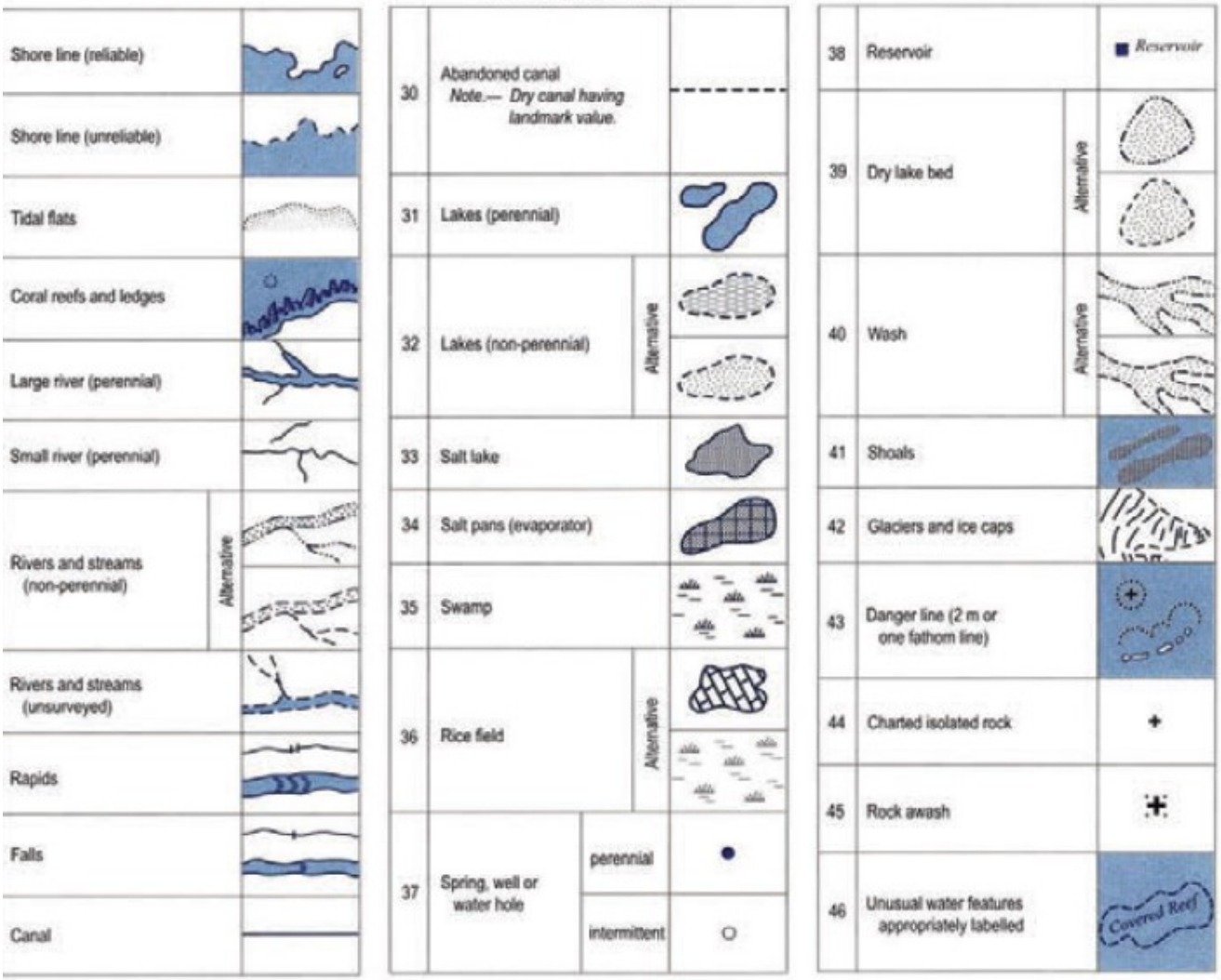
VOR	
VOR/DME	
TACAN	
VORTAC	

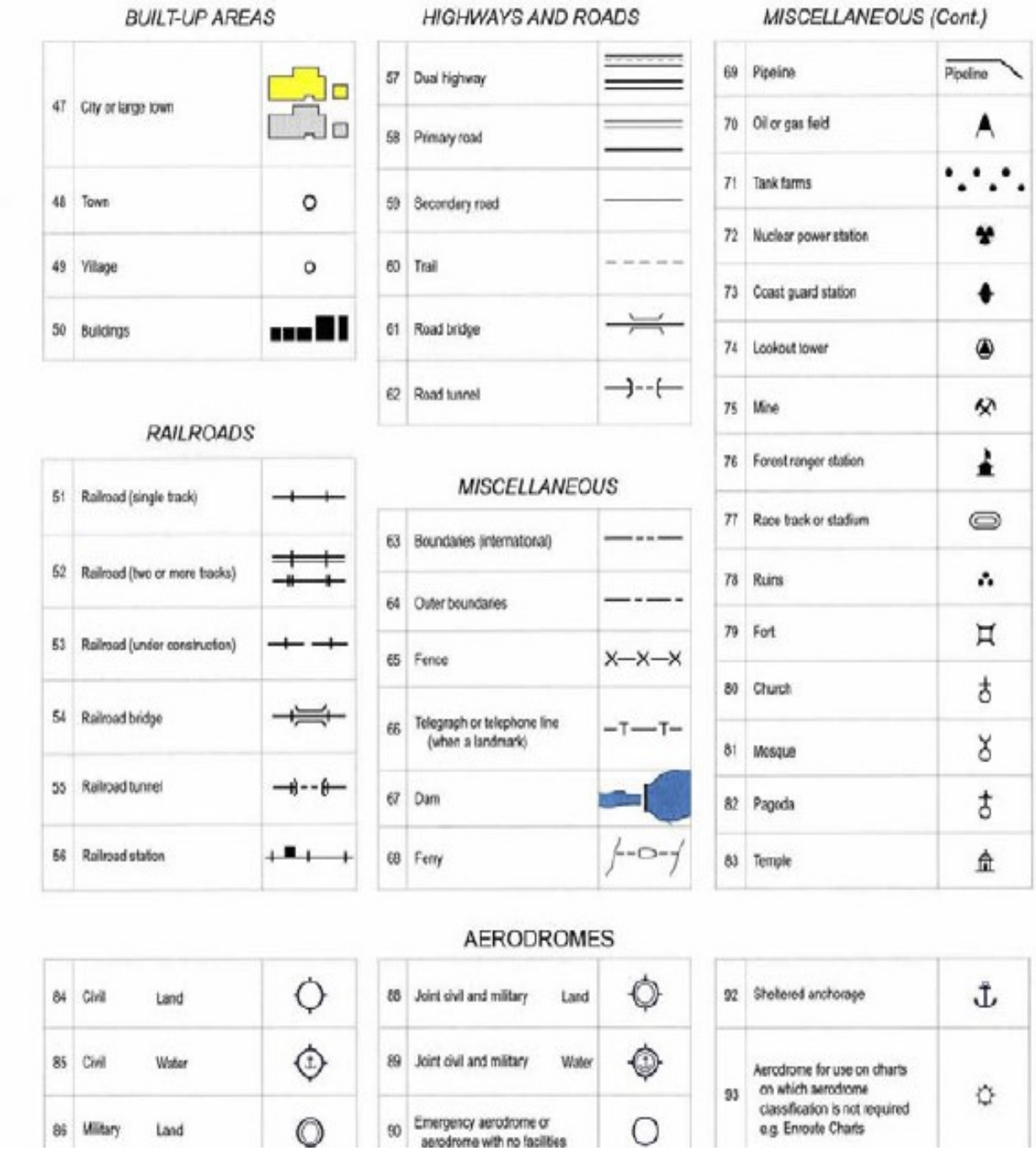
**Note.— Guidance material on the presentation of radio navigation aid data is given in the Aeronautical Chart Manual (Doc 9697).*

5. Topography



6.Hydrography





BUILT-UP AREAS

47	City or large town	
48	Town	
49	Village	
50	Buildings	

HIGHWAYS AND ROADS

57	Dual highway	
58	Primary road	
59	Secondary road	
60	Trail	
61	Road bridge	
62	Road tunnel	

MISCELLANEOUS (Cont.)

69	Pipeline	Pipeline
70	Oil or gas field	
71	Tank farms	
72	Nuclear power station	
73	Coast guard station	
74	Lookout tower	
75	Mine	
76	Forest ranger station	
77	Race track or stadium	
78	Ruins	
79	Fort	
80	Church	
81	Mosque	
82	Pagoda	
83	Temple	

RAILROADS

51	Railroad (single track)	
52	Railroad (two or more tracks)	
53	Railroad (under construction)	
54	Railroad bridge	
55	Railroad tunnel	
56	Railroad station	

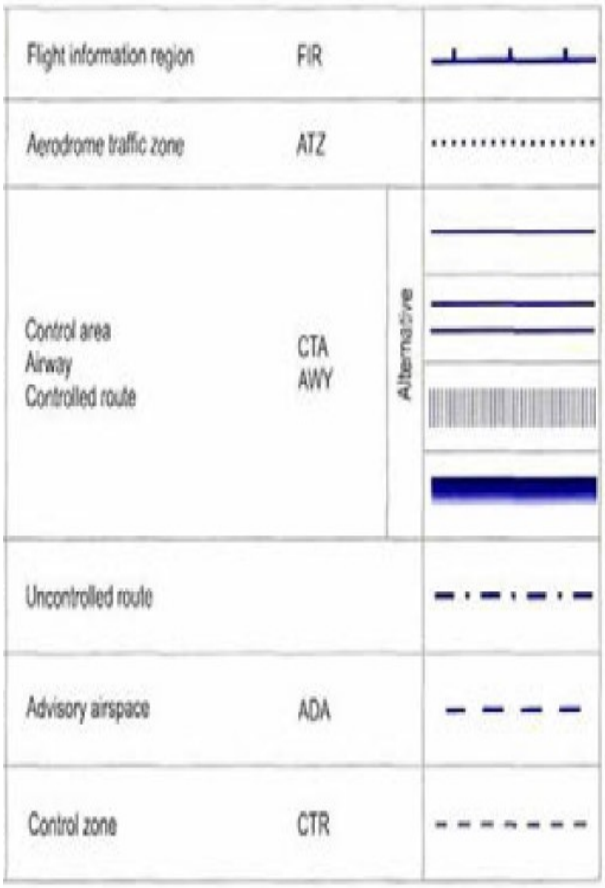
MISCELLANEOUS

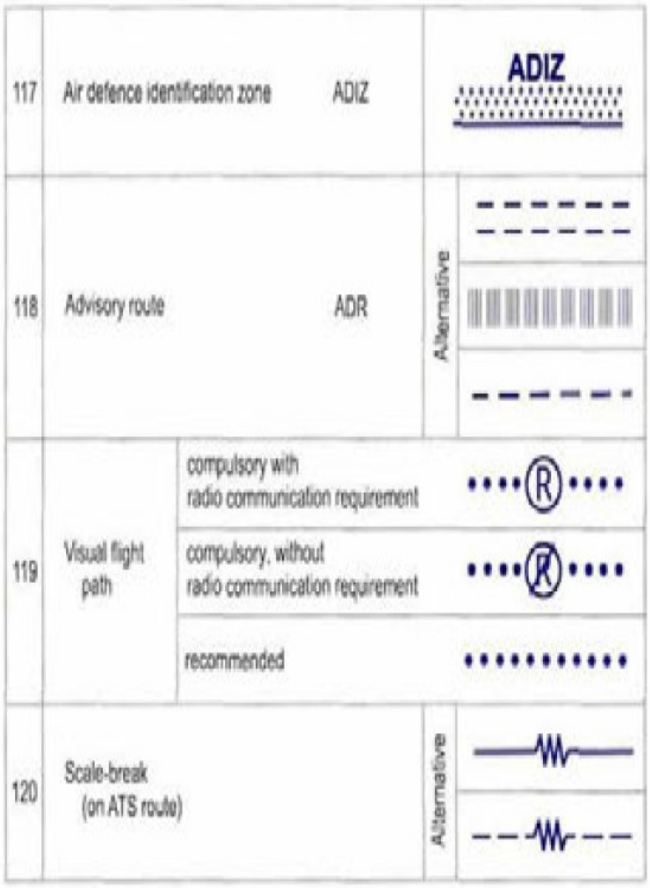
63	Boundaries (international)	
64	Outer boundaries	
65	Fence	X—X—X
66	Telegraph or telephone line (when a landmark)	—T—T—
67	Dam	
68	Ferry	

AERODROMES

84	Civil	Land	
85	Civil	Water	
86	Military	Land	
88	Joint civil and military	Land	
89	Joint civil and military	Water	
90	Emergency aerodrome or aerodrome with no facilities		

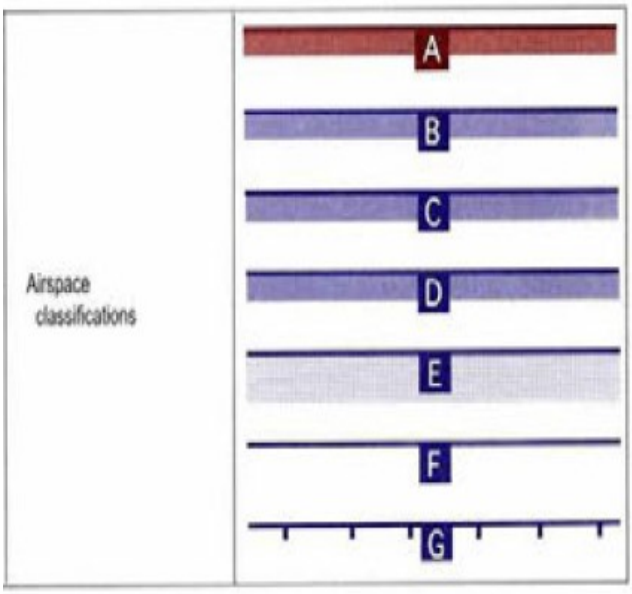
92	Sheltered anchorage	
93	Aerodrome for use on charts on which aerodrome classification is not required e.g. Enroute Charts	


Flight information region
FIR
Aerodrome traffic zone
ATZ
Control area
Airway
Controlled route
CTA
AWY
Alternative
Uncontrolled route
Advisory airspace
ADA
Control zone
CTR


117
Air defence identification zone
ADIZ
ADIZ
118
Advisory route
ADR
Alternative
119
Visual flight path
compulsory with radio communication requirement
R
compulsory, without radio communication requirement
R
recommended
120
Scale-break (on ATS route)
Alternative

		On request fly-by	Compulsory fly-by	On request flyover	Compulsory flyover
Reporting and fly-by/flyover functionality	VFR reporting point				
	Intersection INT				
	VORTAC				
	TACAN				
	VOR				
	VOR/DME				
	NDB				
	Waypoint WPT				

9.Airspace Classification



Aeronautical data in abbreviated form to be used in association with airspace classification symbols:

127 Alternative

TMA DONLON 119.1 C 200m AGL - FL 245

Type | Name or call sign | Radio frequency(ies) | Airspace classification | Vertical limits

TMA DONLON
C FL 245
200m AGL
119.1

AIRSPACE RESTRICTIONS

Restricted airspace (prohibited, restricted or danger area)		Common boundary of two areas	

Note:—The angle and density of rulings may be varied according to scale and the size, shape and orientation of the area.

International boundary closed to passage of aircraft except through air corridor	

Appendix 7: Colour Guide

Culture, except highways and roads; outlines of large cities, grids and graticules; spot elevations; danger lines and off-shore rocks; names and lettering except for aeronautical and hydrographic features		BLACK	
Built-up areas of cities		BLACK Stipple	
Highways and roads	Optional colours	BLACK Half-tone	
		RED	
Built-up areas for cities (alternative to black stipple)		YELLOW	
Contours and topographic features: Items 1 through 10 of Appendix 2 Hydrographic features: Items 39 through 41 of Appendix 2		BROWN	
Shore lines, drainage, rivers, lakes, bathymetric contours and other hydrographic features including their names or description		BLUE	
Open water areas		BLUE Half-tone	
Salt lakes and salt pans		BLUE Stipple	
Large non-perennial rivers and non-perennial lakes		BLUE Stipple	
Aeronautical data, except for Enroute and Area Charts — ICAO, where different colours may be required. Both contours may be used on the same sheet but, where only one colour is used, dark blue is preferred	Optional colours	MAGENTA	
		DARK BLUE	

Woods		GREEN	
Areas which have not been surveyed for contour information or relief data are incomplete	Optional colours	GOLDEN BUFF	
		WHITE	

Appendix 8: Raw Data Correction Advice Form

RWANDA AIRPORTS COMPANY AIR NAVIGATION SERVICES	Aeronautical Data Collection Form RAC/ANS/AIM003 Page 1 of .....

One copy of this form should be submitted for each section of the AIP involved (e.g. GEN, ENR, AD)

Section A: Raw Data Originator

Name: .....

Department: .....

Directorate: .....

Telephone: .....

Date: ..../..../..... Signature: .....

To: Rwanda Airports Company

Date: ...../...../.....

Signature: .....

ok

Section B: Raw Data provided

Originator's file reference	AIP reference (as applicable)				TEXT (to be published)	Effective date	For promulgation As **
	Page (date)*	paragraph	Line	Column			

*All AIP pages affected by each amendment should be quoted.

** Insert *A, S, N or C* when your text message is promulgated as:

A — for AIP amendment
S — for AIP supplement
N — for NOTAM
C — for AIC

The concerned Directorate has been consulted in respect to the accuracy of data and policy:

Name: ..... date: ...../...../..... Signature: .....

Section C: Declaration (done by raw data originator institution / Company representative)

I declare that the above raw data provided /or attached/ is authorized for publication as in section B above.

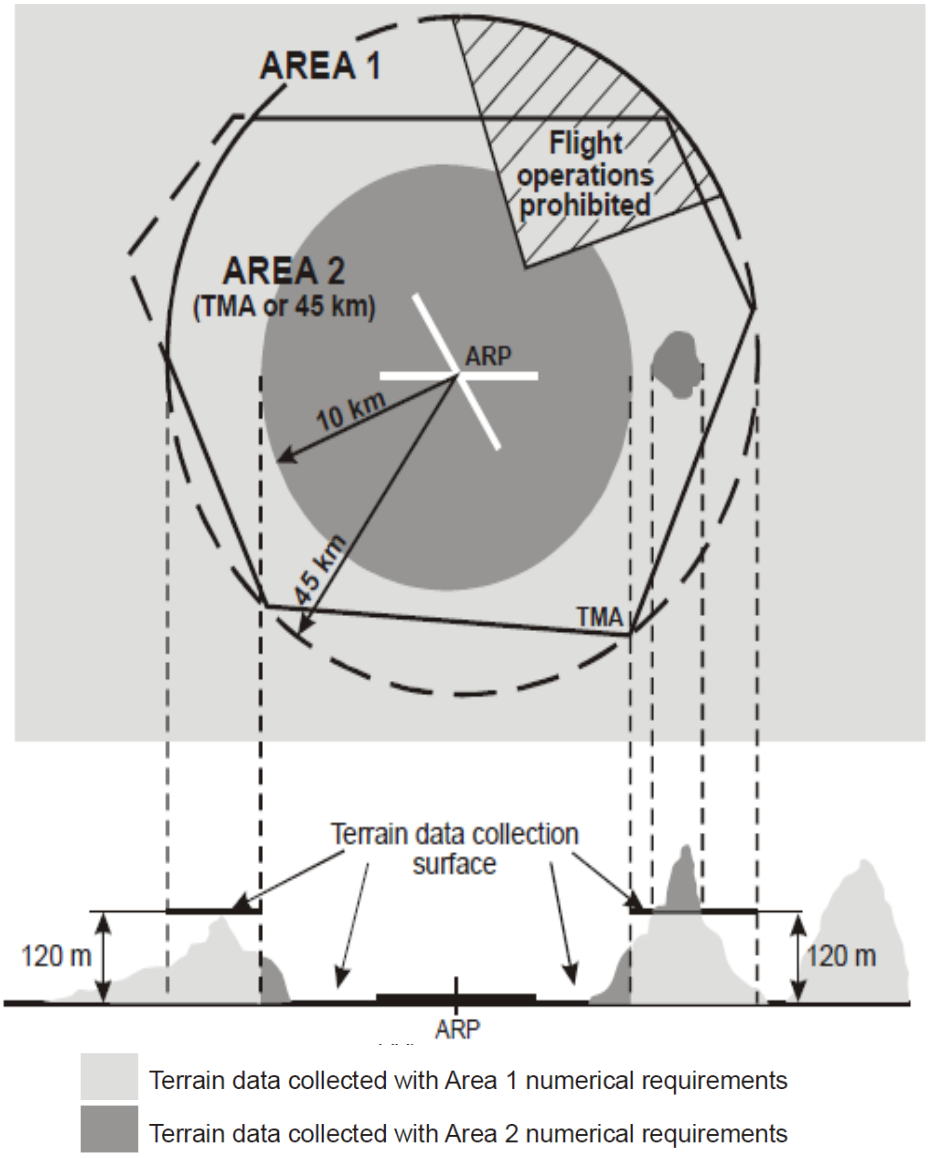
Name of Institution / Company: ..... Date: ...../...../.....

Name of representative: ..... Signature: .....

RAC-AIM-CART-009

Appendix 9: Terrain and Obstacle Data Requirements

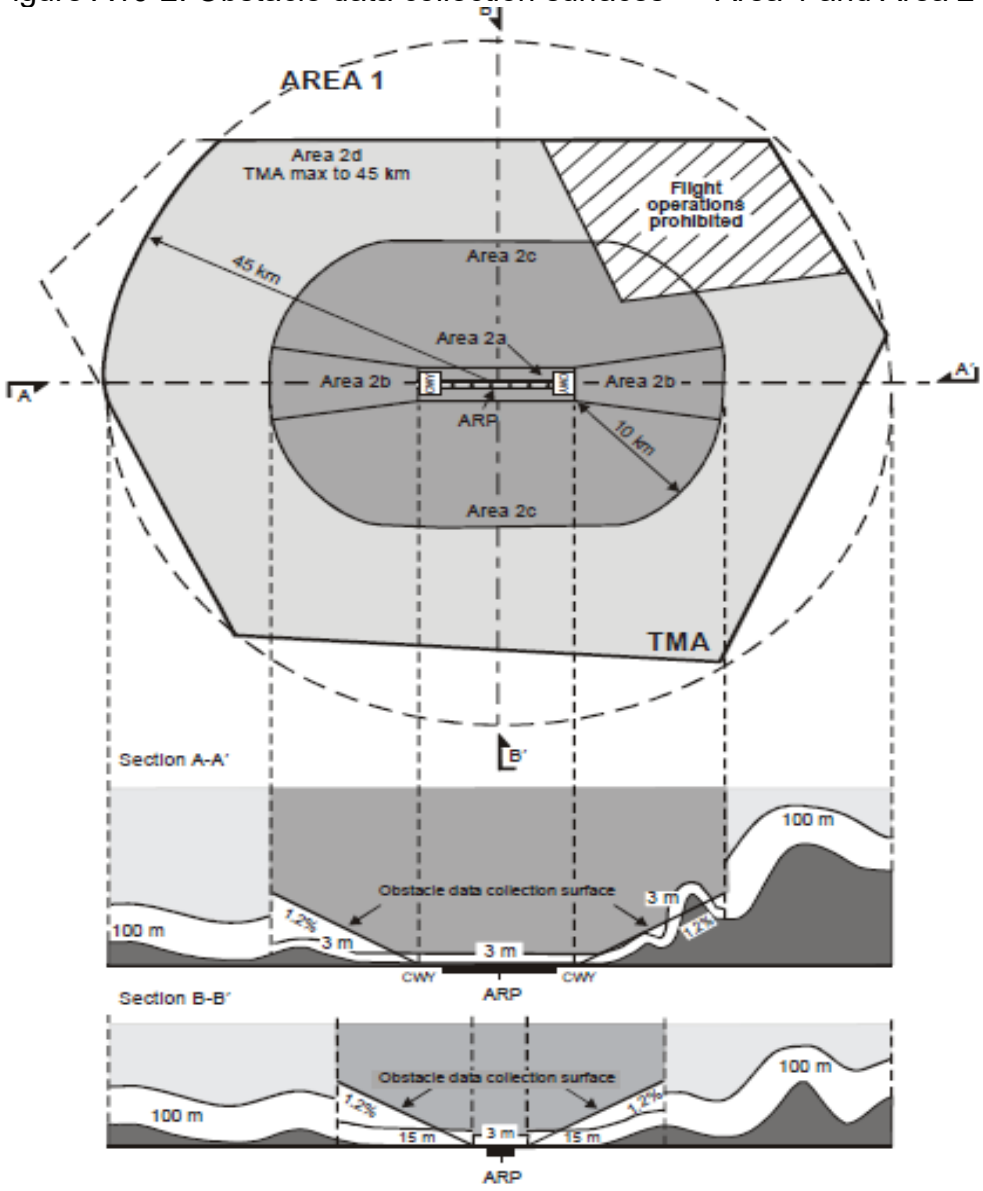
Figure A10-1: Terrain data collection surfaces — Area 1 and Area 2



Terrain data collection surfaces — Area 1 and Area 2

1. Within the area covered by a 10-km radius from the ARP, terrain data will comply with the Area 2 numerical requirements.
2. In the area between 10 km and the TMA boundary or 45-km radius (whichever is smaller), data on terrain that penetrates the horizontal plane 120 m above the lowest runway elevation comply with the Area 2 numerical requirements.
3. In the area between 10 km and the TMA boundary or 45-km radius (whichever is smaller), data on terrain that does not penetrate the horizontal plane 120 m above the lowest runway elevation comply with the Area 1 numerical requirements.
4. In those portions of Area 2 where flight operations are prohibited due to very high terrain or other local restrictions and/or regulations, terrain data comply with the Area 1 numerical requirements.

Figure A10-2: Obstacle data collection surfaces — Area 1 and Area 2



1. Obstacle data is corrected and collected and recorded in accordance with the Area 2 numerical requirements specified in table A10-1:

a. Area 2a: a rectangular area around a runway that comprises the runway strip plus any clearway that exists. The Area 2a obstacle collection surface have height of 3 m above the nearest runway elevation measured along the runway centre line, and for those portions related to a clearway, if one exists, at the elevation of the nearest runway end;

b. Area 2b: an area extending from the ends of Area 2a in the direction of departure, with a length of 10 km and a splay of 15% to each side. The Area 2b obstacle collection surface has a 1.2% slope extending from the ends of Area 2a at the elevation of the runway end in the direction of departure, with a length of 10 km and a splay of 15% to each side. Obstacles less than 3 m in height above ground need not be collected;

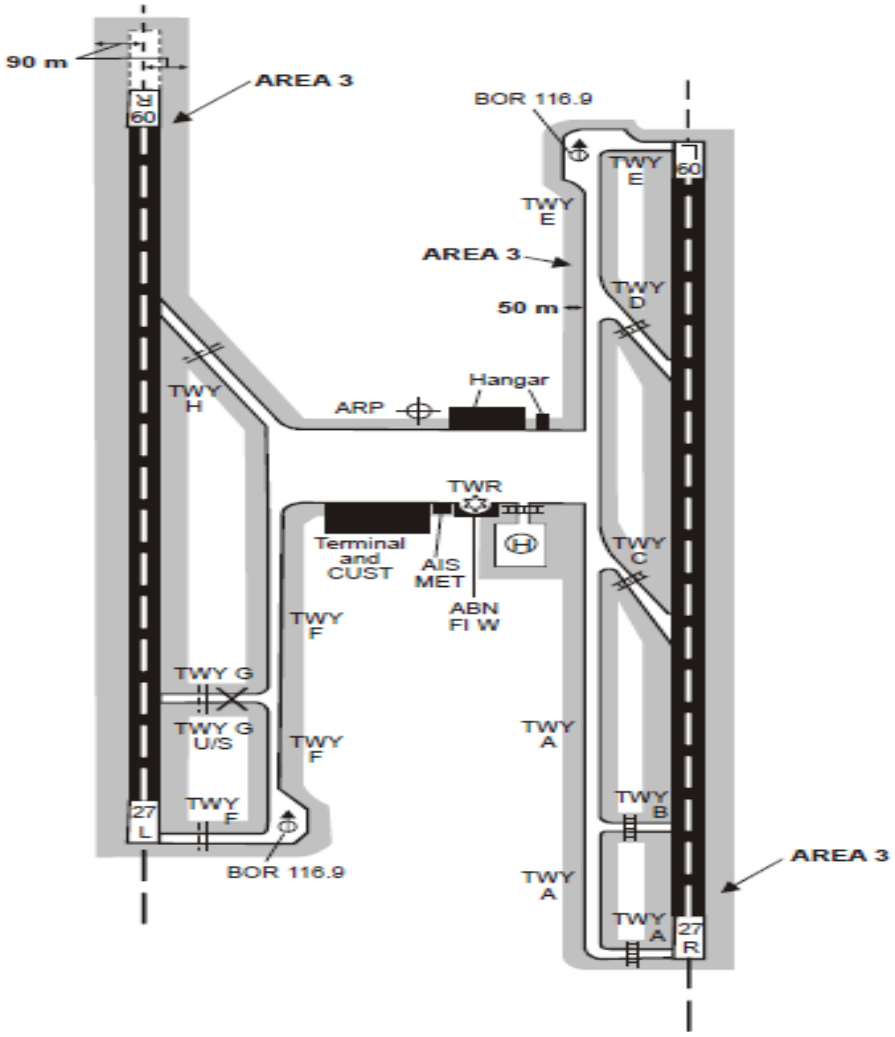
c. Area 2c: an area extending outside Area 2a and Area 2b at a distance of not more than 10 km from the boundary of Area 2a. The Area 2c obstacle collection surface has a 1.2% slope extending outside Area 2a and Area 2b at a distance of not more than 10 km from the boundary of Area 2a. The initial elevation of Area 2c is the elevation of the point of Area 2a at which it commences. Obstacles less than 15 m in height above ground need not be collected; and

d. Area 2d: an area outside the Areas 2a, 2b and 2c up to a distance of 45 km from the aerodrome reference point, or to an existing TMA boundary, whichever is nearest. The Area 2d obstacle collection surface has a height of 100 m above ground.

2. In those portions of Area 2 where flight operations are prohibited due to very high terrain or other local restrictions and/or regulations, obstacle data are collected and recorded in accordance with the Area 1 requirements.

3. Data on every obstacle within Area 1 whose height above the ground is 100 m or higher is collected and recorded in the database in accordance with the Area 1 numerical requirements.

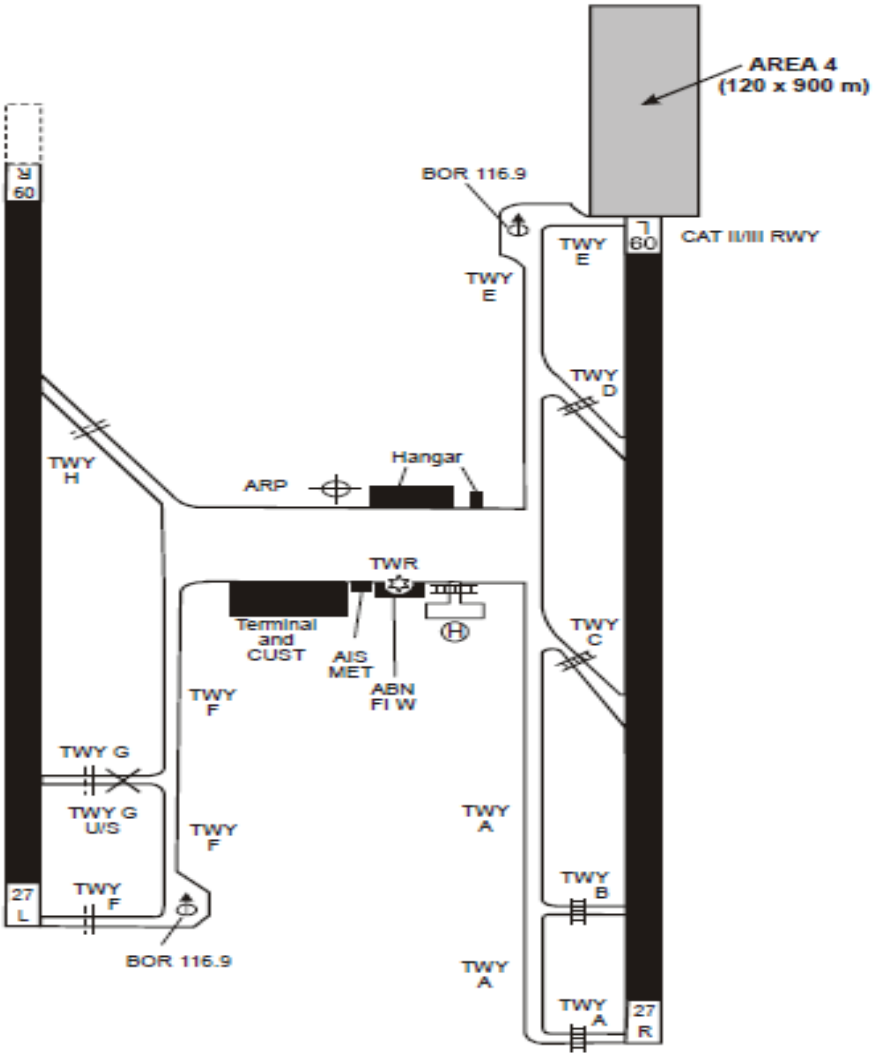
Figure A10-3: Terrain and obstacle data collection surface — Area 3



1. The data collection surface for terrain and obstacles extends a half-metre (0.5 m) above the horizontal plane passing through the nearest point on the aerodrome movement area.

2. Terrain and obstacle data in Area 3 is complying with the numerical requirements specified in Table A8-1 and Table A8-2, respectively.

Figure A10- 4: Terrain and obstacle data collection surface — Area 4



Terrain and obstacle data in Area 4 complies with the numerical requirements specified in table A10-1 and A10-2 respectively

Table A10-1: Terrain data numerical requirements

	Area 1	Area 2	Area 3	Area 4
Post spacing	3 arc seconds (approx. 90 m)	1 arc second (approx. 30 m)	0.6 arc seconds (approx. 20 m)	0.3 arc seconds (approx. 9 m)
Vertical accuracy	30 m	3 m	0.5 m	1 m
Vertical resolution	1 m	0.1 m	0.01 m	0.1 m
Horizontal accuracy	50 m	5 m	0.5 m	2.5 m
Confidence level	90%	90%	90%	90%
Integrity classification	routine	essential	essential	essential
Maintenance period	as required	as required	as required	as required

Table A10-2: Obstacle data numerical requirements

	Area 1	Area 2	Area 3	Area 4
Vertical accuracy	30 m	3 m	0.5 m	1 m
Vertical resolution	1 m	0.1 m	0.01 m	0.1 m
Horizontal accuracy	50 m	5 m	0.5 m	2.5 m
Confidence level	90%	90%	90%	90%
Integrity classification	routine	essential	essential	essential
Maintenance period	as required	as required	as required	as required

Table A10-3: Terrain attributes

Terrain attribute	Mandatory/Optional
Area of coverage	Mandatory
Data originator identifier	Mandatory
Data source identifier	Mandatory
Acquisition method	Mandatory
Post spacing	Mandatory
Horizontal reference system	Mandatory
Horizontal resolution	Mandatory
Horizontal accuracy	Mandatory
Horizontal confidence level	Mandatory
Horizontal position	Mandatory
Elevation	Mandatory
Elevation reference	Mandatory
Vertical reference system	Mandatory
Vertical resolution	Mandatory
Vertical accuracy	Mandatory
Vertical confidence level	Mandatory
Surface type	Optional
Recorded surface	Mandatory
Penetration level	Optional
Known variations	Optional
Integrity	Mandatory
Date and time stamp	Mandatory
Unit of measurement used	Mandatory

Table A10-4: Obstacle attributes

Obstacle attribute	Mandatory/Optional
Area of coverage	Mandatory
Data originator identifier	Mandatory
Data source identifier	Mandatory
Obstacle identifier	Mandatory
Horizontal accuracy	Mandatory
Horizontal confidence level	Mandatory
Horizontal position	Mandatory
Horizontal resolution	Mandatory
Horizontal extent	Mandatory
Horizontal reference system	Mandatory
Elevation	Mandatory
Height	Optional
Vertical accuracy	Mandatory
Vertical confidence level	Mandatory
Vertical resolution	Mandatory
Vertical reference system	Mandatory
Obstacle type	Mandatory
Geometry type	Mandatory
Integrity	Mandatory
Date and time stamp	Mandatory
Unit of measurement used	Mandatory
Operations	Optional
Effectivity	Optional
Lighting	Mandatory
Marking	Mandatory

Appendix 10: Rwanda Airports Company Organizational Chart (376)