

# **Civil Aviation Authority of Nepal**

**DOCUMENT TO VERIFY ACCURACY AND INTEGRITY OF DATA  
PROVIDED BY AERODROME OPERATOR**

**Third Edition  
February 2022**

**AMENDMENTS**

<b>Amendment Number</b>	<b>Date Amended</b>	<b>Amended Part/ Section</b>	<b>Amended Description</b>	<b>Signature and Entry Date</b>

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## FOREWORD

Nepal as a Contracting State to the Convention on International Civil Aviation has an obligation to the international community to ensure that civil aviation activities under its jurisdiction are carried out in strict compliance with the Standards and Recommended Practices contained in the nineteen Annexes to the Convention on International Civil Aviation in order to maintain the required aviation standards.

Users of this Advisory Circular are requested that the provisions of the Civil Aviation Authority Act - 1996 (2053 B.S.), CAAN Airport Certificate Regulations - 2004 (**First Amendment - 2016**) and Civil Aviation Regulation 2002, (Third Amendment 2017) rather than this Advisory Circular, determine the requirements of, and the obligations imposed by or under, the civil aviation legislation. Users should refer to the applicable provisions when any doubt arises.

This document provides general specifications, standards, and guidelines for collecting and maintains the integrity of aerodrome related aeronautical data. These specifications provide the requirements for capturing the data used in all phases of aerodrome development from planning to construction, and from origin to its publication in AIP and other official publication. These specifications are designed to provide information regarding the different types of data collection tasks on aerodromes.

The CAAN developed these procedures for the purpose of receiving and/or originating, collating or assembling, editing, formatting, publishing/storing and distributing aeronautical information/data concerning the entire territory of the Nepal for providing aeronautical services. Compliance with these requirements and standards without deviation is desirable for all Nepalese aerodromes.



Director General

Civil Aviation Authority of Nepal

Babarmahal, Kathmandu, Nepal

February 2022

## **GLOSSARY OF TERMS**

**Accuracy** - A degree of conformance between the estimated or measured value and the true value.

*Note. — For measured positional data, the accuracy is normally expressed in terms of a distance from a stated position within which there is a defined confidence of the true position falling.*

**Abeam Point** - An aircraft is “abeam” a fix, point, or object when that fix, point, or object is approximately 90 degrees to the right or left of the aircraft track. Abeam indicates a general position rather than a precise point.

**Accelerate-Stop Distance Available (ASDA)** - The length of the take-off run available plus the length of the stopway, if provided.

**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 beacon** - Aeronautical beacon used to indicate the location of an aerodrome from the air.

**Aerodrome certificate** - A certificate issued by the appropriate authority under applicable regulations for the operation of an aerodrome.

**Aerodrome elevation** - The elevation of the highest point of the landing area.

**Aerodrome mapping data (AMD)** - Data collected for the purpose of compiling aerodrome mapping information for aeronautical uses.

*Note. — Aerodrome mapping data are collected for purposes that include the improvement of the user’s situational awareness, surface navigation operations, trainings, charting and planning.*

**Aerodrome reference point (ARP)** - The designated geographical location of an aerodrome.

**Aeronautical beacon** - An aeronautical ground light visible at all azimuths, either continuously or intermittently, to designate a particular point on the surface of the earth.

**Aeronautical Data** - A representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing.

**Aeronautical information** - Information resulting from the assembly, analysis and formatting of aeronautical data.

**Aeronautical Information Circular (AIC)** - A notice containing information that does not qualify for the origination of a NOTAM or for inclusion in the AIP, but which relates to flight safety, air navigation, technical, administrative or legislative matters.

**Aeronautical Information Publication (AIP)** - A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.



**Aeronautical Information Service (AIS)** - A service established within the defined area of coverage responsible for the provision of aeronautical data and aeronautical information necessary for the safety, regularity and efficiency of air navigation.

**AIRAC** - An acronym (aeronautical information regulation and control) signifying a system aimed at advance notification based on common effective dates, of circumstances that necessitate significant changes in operating practices.

**Air Navigation Facility** - Any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for disseminating weather information, for signalling, for radio-directional finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and take-off of aircraft.

**Aerodrome Lighting** - Various lighting aids that may be installed on an aerodrome. Types of aerodrome lighting include Aerodrome Beacon, ALS, PAPI, REIL, threshold lights, etc.

**Aerodrome Beacon** - An aeronautical ground light visible at all azimuths, either continuously or intermittently, to designate a particular point on the surface of the earth.

**Approach Light System (ALS)** - An aerodrome lighting facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centreline of the runway on his final approach for landing. Condenser-Discharge Sequential Flashing Lights/Sequenced Flashing Lights may be installed in conjunction with the ALS at some aerodromes.

**Precision Approach Path Indicator (PAPI)** - An airport lighting facility, similar to VASI, providing vertical approach slope guidance to aircraft during approach to landing. PAPIs consist of a single row of either two or four lights, normally installed on the left side of the runway, and have an effective visual range of about 5 miles during the day and up to 20 miles at night. PAPIs radiate a directional pattern of high intensity red and white focused light beams which indicate that the pilot is “on path” if the pilot sees an equal number of white lights and red lights, with white to the left of the red; “above path” if the pilot sees more white than red lights; and “below path” if the pilot sees more red than white lights.

**Runway End Identifier Lights (REIL)** - Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

**Threshold Lights** - Fixed green lights arranged symmetrically left and right of the runway centreline identifying the runway threshold.

**Apron** - A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fuelling, parking or maintenance.

**Area Navigation (RNAV)**- A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground- or space-based navigations aids or within the limits of the capability of self-contained aids, or a combination of these.

*Note.* — Area navigation includes performance-based navigation as well as other operations

that do not meet the definition of performance-based navigation.

**Assemble** - A process of merging data from multiple sources into a database and establishing a baseline for subsequent processing.

*Note.* — The assemble phase includes checking the data and ensuring that detected errors and omissions are rectified.

**Attributes or Attribute Data** - Alphabetical and/or numeric information that describes particular characteristics of a geospatial feature, such as type, dimensions, usage, occupancy, etc.

**Astronomic Azimuth** - At the point of observation, the angle measured from the vertical plane through the celestial pole and the vertical plane through the observed object. The astronomic azimuth is established directly from observations on a celestial body and is measured in the plane of the horizon. Astronomic azimuths differ from geodetic azimuths because of the deflection of the vertical which can be greater than one minute of arc in extreme cases. Astronomic azimuths may be reckoned clockwise or counter-clockwise, from either north or south, as established by convention.

**Geodetic Azimuth** - The angle at point A between the tangent to the meridian at A and the tangent to the geodesic from A to B whose geodetic azimuth is wanted. It may be reckoned clockwise from either geodetic north or south as established by convention. Because of earth curvature, the geodetic azimuth from A to B (forward azimuth) differs from the geodetic azimuth from B to A (back azimuth) by other than 180 degrees, except where A and B have the same geodetic longitude or where the geodetic latitude of both points is zero. The “geodesic line” is the shortest surface distance between two points on the reference ellipsoid. A “geodetic meridian” is a line on the reference ellipsoid defined by the intersection of the reference ellipsoid and a plane containing the minor axis of that ellipsoid.

**Grid** - The angle in the plane of projection between a straight line and the central meridian of a plane-rectangular coordinate system. Grid azimuths may be reckoned clockwise from either geodetic north or south as established by convention.

**Magnetic** - At the point of observation, the angle between the vertical plane through the observed object and the vertical plane in which a freely suspended symmetrically magnetized needle, influenced by no transient artificial magnetic disturbance, will come to rest. Magnetic azimuths are reckoned clockwise from magnetic north.

**Bench Mark** - A relatively permanent natural or artificial material object bearing a marked point whose elevation above or below an adopted surface (datum) is known.

**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.

**Collection** - Any combination of data submitted by a provider at a given time.

**Cyclic redundancy check (CRC)** - A mathematical algorithm applied to the digital expression of data that provides a level of assurance against loss or alteration of data.

**Database** - One or more files of data so structured that appropriate applications may draw from the files and update them.

**Data Quality** - A degree or level of confidence that the data provided meets the requirements of the data user in terms of accuracy, resolution, integrity (or equivalent assurance level), traceability, timeliness, completeness and format.

**Datum** - Any quantity or set of quantities that may serve as a reference or basis for the calculation of other quantities (ISO 19104\*).

**Derived Data** - Refers to the data which is derived from other data (entity or derived) and hence, typically, not related to physical equipment - e.g. an approach procedure derived from runway, NAVAID and way-point data in association with other factors such as aircraft performance.

**Direction Finder (DF)** - A radio receiver equipped with a directional sensing antenna used to take bearings on a radio transmitter.

**Distance Measuring Equipment (DME)** - Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.

**Displaced Threshold** - A threshold not located at the extremity of a runway.

**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 Type** - Class of real-world phenomena with common properties (ISO 19110\*).

*Note.* — In a feature catalogue, the basic level of classification is the feature type.

**Flight Path** - A line, course, or track along which an aircraft is flying or intended to be flown.

**Frangible Object** - An object of low mass designed to break, distort or yield on impact so as to present the minimum hazard to aircraft.

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

**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.

*Note.* — *The geoid is irregular in shape because of local gravitational disturbances (wind tides, salinity, current, etc.) and the direction of gravity is perpendicular to the geoid at every point.*

**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 Height** - The height related to the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question.

Geospatial Data, Geospatially - Referenced Data or Geospatial Vector Data - Data that identifies the geographic location (2D or 3D coordinates) and characteristics (feature attributes)

of natural or constructed features and boundaries on the earth. This information may be derived from remote sensing and surveying technologies. The features are represented by a point, line, or polygon. The position of a point feature is described by a single coordinate pair (or triplet for three-dimensional data). The spatial extent of a line feature is described by a string of coordinates of points lying along the line, while the extent of a polygon feature is described by treating its boundary as a line feature. Vector data may be stored in a sequential, a chain node, or a topological data structure.

**Geoid Undulation** - The distance of the geoid above (positive) or below (negative) the mathematical reference ellipsoid.

*Note. — In respect to the World Geodetic System – 1984 (WGS-84) defined ellipsoid, the difference between the ellipsoidal height and orthometric height represents WGS-84 geoid undulation.*

**Global Positioning System (GPS)** - GPS refers to the worldwide positioning, navigation and timing determination capability available from the U.S. satellite constellation. The service provided by GPS for civil use is defined in the GPS Standard Positioning System Performance Standard. GPS is composed of space, control, and user elements.

**Helipad** - A small designated area, usually with a prepared surface, on a heliport, aerodrome, landing/takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters.

**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.

**Heliport Reference Point (HRP)** - The geographic centre of a heliport.

**Horizontal Survey Point** - A point that represents the horizontal position of a feature. This point may be located on the feature or located between feature components. For example, the horizontal survey point for a Precision Approach Path Indicator (PAPI) system is the centre of the light array which falls between light units.

**Instrument Landing System (ILS)** - A precision instrument approach system which normally consists of the following electronic components and visual aids: Localizer, Middle Marker, Glide Slope, Approach Lights, Outer Marker.

**Instrument Runway** - One of the following types of runways intended for the operations of aircraft using instrument approach procedures:

- a) Non-precision approach runway: A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type A and a visibility not less than 1000 m.
- b) Precision approach runway, category I: A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type B with a decision height (DH) not lower than 60 m (200 ft) and either a visibility not less than 800 m or a runway visual range not less than 550 m.
- c) Precision approach runway, category II: A runway served by visual aids and non-visual

aid(s) intended for landing operations following an instrument approach operation type B with a decision height (DH) lower than 60 m (200 ft) but not lower than 30 m (100 ft) and a runway visual range not less than 300 m.

- d) Precision approach runway, category III: A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type B to and along the surface of the runway and:

A – intended for operations with a decision height (DH) lower than 30 m (100 ft), or no decision height and a runway visual range not less than 175 m.

B – intended for operations with a decision height (DH) lower than 15 m (50 ft), or no decision height and a runway visual range less than 175 m but not less than 50 m.

C – intended for operations with no decision height (DH) and no runway visual range limitations.

*Note 1. — Visual aids need not necessarily be matched to the scale of non-visual aids provided. The criterion for the selection of visual aids is the conditions in which operations are intended to be conducted.*

*Note 2. — Refer to Annex 6 – Operations of aircraft for instrument approach operation types.*

**Integrated Aeronautical Information Package** — A package which consists of the following elements:

- a) AIP, including amendment service;
- b) Supplements to the AIP;
- c) NOTAM and pre-flight information bulletins (PIB);
- d) AIC;
- e) Checklists and lists of valid NOTAMs; and
- f) how they may be obtained.

**Integrity (aeronautical data)** - A degree of assurance that an aeronautical data and its value has not been lost nor altered since the data origination or authorized amendment.

**Landing Area** - That part of a movement area intended for the landing or take-off of aircraft.

**Levelling** - The process of determining the difference in elevation between two points. In geodetic levelling, this process results in a vertical distance from a vertical datum.

- a) **Direct** - The determination of differences in elevation by means of a series of horizontal observations on a graduated rod. The levelling instrument maintains a horizontal line of sight through spirit levelling or a compensation mechanism. The rod is observed while it is resting on a point of known elevation (back sight) and then, without disturbing the elevation of the levelling instrument, the rod is observed a second time while resting on the unknown point (foresight). The difference in rod readings is applied to the starting elevation to determine the elevation of the unknown.
- b) **Indirect** - The determination of differences in elevation by means other than differential

levelling, such as trigonometric levelling. In trigonometric levelling, the vertical angle and distance from the instrument to the point of unknown elevation are measured, and the difference in elevation between the instrument and the unknown point is computed using trigonometry.

**Localizer (ICAO)** - The component of an ILS which provides course guidance to the runway.

**Localizer Back Course** - The course line defined by the localizer signal along the extended centreline of the runway in the opposite direction from the normal localizer approach course (front course.)

**Localizer Type Directional Aid (LDA)** - A localizer with an angular offset that exceeds 3°. of the runway alignment used for non-precision instrument approaches with utility and accuracy comparable to a localizer but which are not part of a complete ILS.

**Long Range Navigation (LORAN)** - An electronic navigation system by which hyperbolic lines of position are determined by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. LORAN A operates in the 1750 - 1950 kHz frequency band. LORAN C and D operate in the 100 - 110 kHz frequency band.

**Marker Beacon** - An electronic navigational facility transmitting a 75 MHz vertical fan or bone-shaped radiation pattern to be received by aircraft flying overhead. Marker beacons are identified by their modulation frequency and keying code, and when received by compatible airborne equipment, indicate to the pilot aurally and visually that he/she is passing over the facility.

- a) **Back Course Marker (BCM)** - When installed, normally indicates the localizer back course final approach fixes where approach descent is commenced.
- b) **Inner Marker (IM)** - A marker beacon, used with an ILS Category II precision approach, located between the middle marker and the end of the ILS runway and normally located at the point of designated decision height (normally 100 feet (30.48 m) above the touchdown zone elevation) on the ILS Category II approach. It also marks progress during an ILS Category III approach.
- c) **Middle Marker (MM)** - A marker beacon that defines a point along the glideslope of an ILS, normally located at or near the point of decision height for ILS Category I approaches.
- d) **Outer Marker (OM)** - A marker beacon at or near the glideslope intercepts altitude of an ILS approach. The outer marker is normally located four to seven miles from the runway threshold on the extended centreline of the runway.

**Mean Sea Level (MSL)** - The average location of the interface between the ocean and atmosphere, over a period of time sufficiently long so that all random and periodic variations of short duration average to zero.

**Metadata** – Data about data (ISO 19115\*).

*Note.* — *A structured description of the content, quality, condition or other characteristics of data.*

**Minimum Safe Altitude Warning (MSAW)** - A function of the ARTS III computer that aids

the controller by alerting him when a tracked Mode C equipped aircraft is below or is predicted by the computer to go below a predetermined minimum safe altitude.

**Minimums** - Weather condition requirements established for a particular operation or type of operation; e.g., IFR take-off or landing, alternate aerodrome for IFR flight plans, VFR flight etc.

**Missed Approach** - A manoeuvre conducted by a pilot when an instrument approach cannot be completed to a landing.

**Movement Area** – That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area of the apron.

**Navigational Aid (NAVAID)** - Any visual or electronic device airborne or on the surface which provides point-to-point guidance information or position data to aircraft in flight.

**Nondirectional Beacon (NDB)** - An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to or from the radio beacon and "home" or track to or from the station. When the NDB is installed in conjunction with an Instrument Landing System marker, it is normally called a Compass Locator.

**Non-precision Approach Procedure** - A standard instrument approach procedure in which no electronic glide slope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDS, and SDF approaches.

**Notice to Airmen (NOTAM)** - A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

**Objective Evidence** - The observational and computational data supporting the information being provided. This evidence is used in the verification process to prove the provided aeronautical information and substantiate the change being made.

**Obstacle** - All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:

- 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.

**Obstruction** - Any object that penetrates an obstruction identification surface.

**Obstruction Identification Surface (OIS)** - Any imaginary surface authorized by the CAAN to identify obstructions. Any object that penetrates an OIS is an obstruction.

**Offset NAVAID** - A NAVAID used during the final approach segment of a straight in instrument approach and not located on the runway centreline or centreline extended.

**Orthometric Height** - Height of a point related to the geoid, generally presented as an MSL elevation.

**Orthophoto** - An aerial image that has been taken from above (either from an aircraft or a satellite) and has been spatially corrected so that features shown on the photo are displayed in their actual geographic position within a specified range of tolerance.

**Photogrammetry** - The process of creating vector data such as building outlines and elevation contours from stereo imagery (pairs of images taken of the same location but at different angles).

**Positional Accuracy** - The difference between a geospatial feature's displayed position and its actual position. Absolute positional accuracy is the difference between a geospatial feature's displayed position and its actual position on the face of the earth. Relative positional accuracy is the difference between a geospatial feature's displayed position and that of other geospatial features in the same data set.

**Precision** - The smallest difference that can be reliably distinguished by a measurement process.

*Note.* — *In reference to geodetic surveys, precision is a degree of refinement in performance of an operation or a degree of perfection in the instruments and methods used when taking measurements.*

**Precision Approach Procedure** - A standard instrument approach procedure in which an electronic glideslope/glidepath is provided; e.g., GLS, ILS, and PAR approaches.

**Published Data** - Data officially issued for distribution to the public.

**Quality**- Degree to which a set of inherent characteristics fulfils requirements (ISO 9000\*).

*Note 1.* — *The term “quality” can be used with adjectives such as poor, good or excellent.*

*Note 2.* — *“Inherent”, as opposed to “assigned”, means existing in something, especially as a permanent characteristic.*

**Quality Assurance** – Part of quality management focused on providing confidence that quality requirements will be fulfilled (ISO 9000\*).

**Quality Control** – Part of quality management focused on fulfilling quality requirements (ISO 9000\*).

**Quality level** - The extent to which the customer's needs have been met. A quality level of 100% means that there has been a complete conformance to specification every time.

**Quality Management** – Coordinated activities to direct and control an organization with regard to quality (ISO 9000\*).

**Quality Management System** - The organizational structure, procedures, processes and resources needed to implement quality management.

**Quality record** - Documented evidence of tasks carried out which demonstrates that the required results have been achieved and provides sufficient links to other quality records to



ensure traceability.

**Quality specifications** - The minimum, pre-defined specifications that must be met to fulfil the stated quality requirements. A quality system provides the management control to assure the required quality specifications are achieved.

**Radio Detection and Ranging (RADAR)** - A radio detection device which provides information on range, azimuth and/or elevation of objects.

- a) Primary Radar - Radar system which uses reflected radio signals.
- b) Secondary Radar - Radar system wherein a radio signal transmitted from a radar station initiates the transmission of a radio signal from another station.

**Secondary surveillance radar (SSR)** - A surveillance radar system which uses transmitters/receivers (interrogators) and transponders.

**Reference Ellipsoid** - A geometric figure comprising one component of a geodetic datum, usually determined by rotating an ellipse about its shorter (polar) axis, and used as a surface of reference for geodetic surveys. The reference ellipsoid closely approximates the dimensions of the Geoid. Certain ellipsoids fit the Geoid more closely for various areas of the earth. Elevations derived directly from satellite observations are relative to the ellipsoid and are called ellipsoid heights.

**Requirements for quality** - Expression of the needs or their translation into a set of quantitatively or qualitatively stated requirements for the characteristics of an entity to enable its realization and examination.

**Resolution** - The smallest spacing between two display elements expressed as dots per inch, pixels per line, or lines per millimetre or a number of units or digits to which a measured or calculated value is expressed and used.

**Runway** - A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

**Runway Centreline** - A line connecting the two opposite runway end points. The line may be physically marked on the surface of the runway.

**Runway End Point** - The point at the runway end halfway between the edges of the runway.

**Runway Length** - The straight-line distance between runway end points. This line does not account for surface undulations between points. Official runway lengths are normally computed from runway end coordinates and elevations.

**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.

**Take-off Distance Available (TODA)** - The length of the take-off run available plus the length of the clearway, if provided.

**Take-off Run Available (TORA)** - The length of the runway declared available and suitable for the ground run of an aeroplane take-off.

**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:

- a) **Aircraft stand taxilane** - A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.
- b) **Apron taxiway** - A portion of a taxiway system located on an apron and intended to provide a through taxi-route across the apron.
- c) **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.

**Threshold** - The beginning of that portion of the runway usable for landing.

**Traceability** - Ability to trace the history, application or location of that which is under consideration (ISO 9000\*).

*Note. — When considering product, traceability can relate to:*

*-the origin of materials and parts;*

*-the processing history; and*

*-the distribution and location of the product after delivery.*

**Traffic Pattern** - The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an aerodrome. The components of a typical traffic pattern are upwind leg, crosswind leg, downwind leg, base leg, and final approach.

- 1) Upwind Leg - A flight path parallel to the landing runway in the direction of landing.
- 2) Crosswind Leg - A flight path at right angles to the landing runway off its upwind end.
- 3) Downwind Leg - A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.
- 4) Base Leg - A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centreline.
- 5) Final Approach - A flight path in the direction of landing along the extended runway centreline. The final approach normally extends from the base leg to the runway. An aircraft making a straight-in approach VFR is also considered to be on final approach.

**Transmissometer (TMOM)** - An apparatus used to determine visibility by measuring the transmission of light through the atmosphere. It is the measurement source for determining runway visual range (RVR) and runway visibility value (RVV).

**Transponder Landing System (TLS)** - Transponder landing system providing azimuth and elevation guidance to aircraft on approach.

**Validation** - Confirmation through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled (ISO 9000\*).

**Verification** - Confirmation, through the provision of objective evidence, that specified requirements have been fulfilled (ISO 9000\*).

*Note: The term 'verified' is used to designate the corresponding status.*

**V<sub>1</sub>** - The take-off decision speed. If a system failure occurs before V<sub>1</sub>, the take-off is aborted. If the failure occurs at or above V<sub>1</sub>, the pilot is committed to continue the take-off.

**Vertical Survey Point** - A point that represents the elevation position of a feature. This point may be located on the top or base of the feature or located between feature components. For example, the vertical survey point for a Precision Approach Path Indicator (PAPI) system is the ground at the centre of the light array which falls between light units.

**Vertical Take-off and Landing (VTOL) Aircraft** - Aircraft capable of vertical climbs and/or descents and of using very short runways or small areas for take-off and landings. These aircraft include, but are not limited to, helicopters.

**Very High Frequency Omnidirectional Range Station (VOR)** - A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, referenced from magnetic north. Used as the basis for navigation in the National Airspace System. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature. Voice features may be used by ATC or FSS for transmitting instructions/ information to pilots.

**Visual Approach (ICAO)** - An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

## **CHAPTER 1. INTRODUCTION**

### **1.1 Introduction**

This document has been prepared in line with the CAR 15 (AIS), together with CAR 4 (Aeronautical Charts), CAR-11 (Air Traffic Services), CAR-14 (Aerodromes) as well as ICAO Documents 9674 (World Geodetic System - 1984 (WGS-84)) Manual, Manual of Standards Instrument Flight Procedure Design, Manual of Standards Aeronautical Information Service (MOS – AIS) and other supporting materials, to develop and establish a process to ensure that the aerodrome data, provided by the aerodrome operators for the publication either in the AIP, NOTAM or other official publication, is verified for its accuracy and integrity by ASSD, CAAN. It is the quality of the information that is made available to end-users (pilots, controllers and their support systems etc.) which determines the effectiveness of the data-chain in terms of safety, interoperability and as an enabler for the introduction of new concepts and technologies. There are various methods that can be used to originate, process, collate, store and distribute aeronautical information within existing and evolving environments. Thus, the first prerequisite is to ensure that quality data is correctly stipulated and originated, with originators being obliged to comply with appropriate standards and that their activities are regulated by CAAN. This is particularly important because the quality of data cannot easily be improved post origination. Secondly, the aeronautical information is increasingly vulnerable to corruption during the data processing. This is mainly due to errors introduced at each transaction point through manual intervention or automated conversion between different data standards/protocols.

Finally, reinforcing the first two points, specific requirements regarding the “quality” of Aeronautical Data/Information must be applicable on an “end-to-end” basis within the aeronautical information environment to achieve any meaningful improvement. In order to ensure the safe operation of the end-user, it is essential that the “quality” of the system as a whole be ensured. In this context, “quality” should be taken to mean the required accuracy, resolution, integrity and timeliness of each constituent part of the system. The quality system employed by CAAN shall provide users with the necessary assurance and confidence that distributed aeronautical information/data satisfy the stated requirements. In addition, it requires traceability by the use of appropriate procedures during each stage of data production or data modification processes.

## **1.2 Purpose**

- 1.2.1 It was assessed that a major reason for the loss of data integrity was the way in which aeronautical information was originated, processed, transmitted and delivered from the point of origination to application in an end-user system. The purpose of this document is to adopt a procedure for the collection of aeronautical data through field and office, processing and quality assurance of aerodrome data which will enable Aerodrome Operator to meet their safety responsibilities and provide the quality data required by the CAAN for following purpose:
- a) Listing of aerodrome data;
  - b) Certification of the aerodromes;
  - c) Data to be utilize for design and develop flight procedures;
  - d) For Preparing maps and charts;
  - e) For conducting safety evaluations; and
  - f) Data to be used for area navigation (RNAV), required navigation performance (RNP) and airborne computer-based navigation systems.
- 1.2.2 The processed data after verification will be selected for assured quality and then shall be published in the Aeronautical Information Publication (AIP) and other associated documents.

## **1.3 Publication**

The publication of aeronautical data shall be published in the following logical steps:

- a) Collecting the relevant aerodrome data (data input)
- b) Determining the areas of data to be surveyed (data source)
- c) Surveying the areas if required
- d) Listing the Aerodrome Facilities and Master Obstacle data
- e) Updating Aerodrome Manual
- f) Producing plans and filtering obstacle data as required
- g) Processing the data report for their accuracy and integrity
- h) Publishing the data and information in official documents
- i) Distributing relevant data and information in the form of published documents

## **1.4 Requirements for Aerodrome Operators**

- 1.4.1 This document will be beneficial for the aerodrome user to develop their confidence due to level of accuracy of information to reach prescribed safety standards and requirements. CAAN fully recognizes that each individual aerodrome has its own operational needs and therefore the data provided should be appropriate and economical to the type of operation intended for its purpose.
- 1.4.2 Aerodrome operator shall provide accurate information of their aerodrome and environs according to the type of operation identified by aerodrome classification issued by CAAN. Similarly, CAAN has issued this document for the purpose of understanding by aerodrome operator regarding the aeronautical data process considered as "Data Chain" with the following main stages:
- a) Data Requirement
  - b) Data Origination and Association
  - c) Data Validation/Verification
  - d) Data Storage
  - e) Data Extraction and Compilation
  - f) Data/Information Promulgation
  - g) Alternative 'Delivery' of Data
  - h) Data Use

## CHAPTER 2. DATA ORIGINATION

### 2.1 Collection of Data

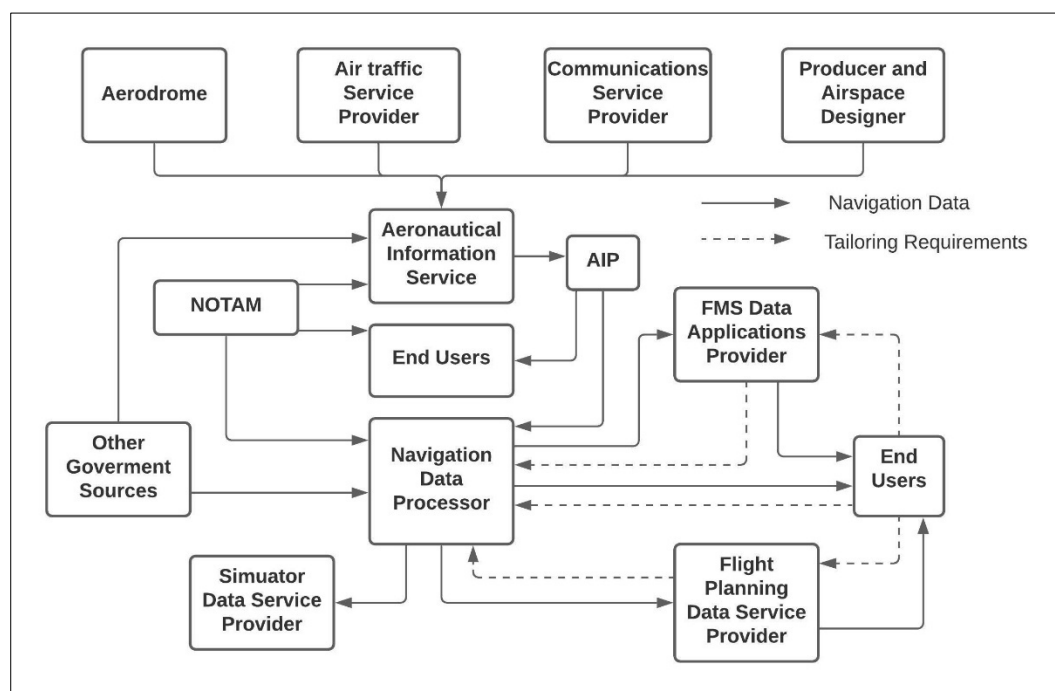
The aim of these procedures is to ensure that the aerodrome operator of Nepal should notify to ASSD, CAAN regarding any changes in the physical condition, services, procedures and facilities provided by the aerodrome due to accidents, incidents, constructions work, maintenance work, temporary or permanent facility/ service shut down, deviation from standards found during daily inspections and safety related reports from other sources and of new obstacles that may affect the safety of aircraft operations. The aerodrome operator (General Manager/ Airport Chief) has overall responsibility for ensuring that procedures be established and resources are provided to report changes to aerodrome physical characteristics, the status of obstacle limitation surface (OLS), or any other changes that may affect the safety of aircraft operations.

During the collection of data at an aerodrome if any situation arises, which may have an immediate effect on the safety of aircraft operations, then it will be reported in the first instance to ATC by radio or telephone and then confirmation by NOTAM, if applicable, will follow as soon as possible. In most cases aerodrome conditions or new obstacles that need to be reported immediately are detected during the daily serviceability inspections. The General Manager/Airport Chief shall notify the presence of obstacles to ASSD, CAAN with all data information, and shall control the erection of temporary and permanent structures in the vicinity of the aerodrome.

The following Chart shows the organization involved in forwarding different aeronautical data to the end users. It is the responsibility of concerned department of CAAN, for ensuring the determination of aeronautical raw data which is required for promulgation by the aeronautical information service (AIS) Nepal. On receipt of the raw data, the concerned department must check, record and edit the data so that they can be released to the next intended user in a standard format. Raw aeronautical data containing positional information can originate from a number of different sources as follows:

- a) **End-route.** The surveyed positions of navigational aids and communication facilities are normally provided by the owner/operator (ATC) of the equipment.
- b) **SID, STAR, Instrument approach procedures.** The calculated positions are normally determined by the air traffic service provider responsible for the procedure, in coordination with the technical branch dealing with the procedure design within state aviation authority.
- c) **Aerodrome/heliport.** The surveyed positions of thresholds, gates, obstacles and navigational aids, etc. located at the aerodrome/heliport are normally provided by the owner or operator of the aerodrome/heliport.
- d) **Airspace divisions and restrictions.** The declared positions are normally defined by CAAN in coordination with military authorities and other government bodies.

These all data will be forwarded to/ collected at ASSD, CAAN and then ASSD shall take all necessary measures to ensure that the aeronautical information/data relating to Aerodromes of Nepal is adequate, of required quality and timely for further action and processing.



*Figure 1: Chart of Organizations Involved*

### 2.1.1 Data Requirement

The requirement for individual data items may arise for very different reasons, with the majority of requirements being generated for “traditional” reasons, such as annual (periodic) check surveys of aerodromes to identify any changes since the previous survey, or the creation of a new/revised ATS route or instrument procedure. However, requirements may also arise for less prevalent or unfamiliar reasons, such as the implementation of new concepts or criteria (e.g. WGS 84, RNAV etc.) or for geo-political (legal) purposes, such as the introduction of special procedures to safeguard safety and security during regional crises, or for the protection of national interests.

Each individual requirement consists of details regarding the precise facility/location, as well as requirements for accuracy, resolution and content (e.g., position only, or position and elevation/height/altitude).

The requirement for data may have arisen, for example, because of the following factors.

- a) New Facility
- b) New Technology or Equipment
- c) New Procedure, Route or Area
- d) New Obstacle



- e) New Hazard
- f) Periodic
- g) New Concept or Criteria
- h) Legal

The word new means it also includes any revised or removed facilities, services, procedures and obstructions. Each of above factor may have a number of constituents; some of examples are as follows:

- a) New Facility:
  - New Aerodrome or New Runway
  - Runway Revision (e.g. Extension or Displaced Threshold)
  - New Terminal
  - New Taxiway
  - Revision of Movement Area
- b) New Technology or Equipment:
  - Microwave Landing System (MLS)
  - Differential GPS (DGPS)
  - New Surveillance Equipment
  - New Precision Approach Equipment
  - New Navigation Aid
- c) New Procedure, Route or Area:
  - New Standard Instrument Departure (SID)
  - New Standard Instrument Arrival (STAR)
  - New Precision Approach Procedure
  - New Missed Approach Procedure (MAP)
  - New ATS Route
  - New Airspace Configuration
- d) New Obstacle:
  - New Building
  - New Structure
  - Natural Growth of Vegetation
- e) New Hazard:
  - New High Intensity Radio Transmission Area of New Danger Area

- New Restricted Area
- New Temporary Segregated Airspace (TSA)
- New Activity
- f) Periodic:
  - Periodic requirement to check/update data
- g) New Concept of Criteria:
  - A-SGMCS
  - RNAV
  - New Geodetic Datum
  - New Accuracy/Resolution Requirements
  - Dynamic Airspace Management
- h) Legal:
  - Delegation of Airspace/ATS
  - Prohibition
  - International Treaties and Agreements

## **2.2 Survey Philosophy**

- 2.2.1 The Data may be “originated” by the Survey and Calculation methods. For Survey method, this may be achieved by “Traditional” surveying methods using theodolite and trigonometry and “Modern” surveying methods using GNSS. Similarly, for Calculation method, this may be achieved by “Manual” mathematical calculation and Calculation using computer-based applications. However, it is likely that not all Data Originators may be familiar with the ATM / Aerodromes domain requirements and, consequently, may need to be provided with specific performance requirements and/or guidelines for aeronautical data origination. The World Geodetic System of 1984 (WGS 84) Manual provides some assistance for these additional specifications and supplemented the requirements of CAR 15, specifically elaborating definitions and specifications to support the specific task of data origination.
- 2.2.2 The basic survey philosophy applied is to provide master lists of all aerodrome facilities (i.e. runways, navigation aids, meteorological equipment, etc.) and features identified as obstacles for each aerodrome. These lists form the basis for all charting, obstacle filtering (using obstacle identification surfaces) and analysis for Instrument Flight Procedures (IFP) design.

- 2.2.3 The challenge placed upon aerodrome operator is to identify appropriate features to survey in creating these “Master lists”. It will be totally impracticable and costly to survey all features. Therefore, it is important for aerodrome operator to understand the tasks and challenges faced by the end user, i.e. Aeronautical Charts and Data (ACD) producer, IFP designers, Aerodrome Inspectors (with regard to Safeguarding), in achieving their individual objectives.
- 2.2.4 The aerodrome operator is responsible for providing or arranging for the provision of the necessary surveyed aerodrome obstacle data to the aeronautical information service (AIS). The survey should be conducted prior to commissioning any of aerodrome facilities serving aircraft operation and thereafter at least every five years. The survey specifications are based on CAR 4, and are intended to provide detailed data from which obstacle charts or descriptive text can be derived. Elevations are to be to the nearest foot and linear dimensions are to be to the nearest half-metre. Co-ordinates are to be expressed in degrees, minutes, and seconds referenced to the WGS84 datum.
- 2.2.5 The surveyed data of all aerodrome facilities will be collected or assembled from entire aerodrome then the records are kept for further action to check its integrity and verification.

## **2.3 Types of Data**

The following types of data have been listed for the purpose of collecting aeronautical data by the aerodrome operator from a registered surveyor:

- a) latitude and longitude of the aerodrome reference point in degrees, minutes and seconds;
- b) runway:
  - designation, dimensions and longitudinal slopes of each runway and associated stopways, clearways, and starter extensions;
  - elevation above mean sea level (AMSL) of each runway threshold; and
  - coordinates of each runway threshold;
- c) dimensions of each runway strip and runway end safety area;
- d) depiction of each taxiway and apron area;
- e) coordinates of aircraft stand;
- f) VOR check point radial and distance from the facility, if available;
- g) detail of markings, signs and lighting;
- h) location of meteorological equipment and lighted windsocks;
- i) description of navigational aids; and
- j) location, height (AMSL and AGL) and description of any aerodrome significant obstacle i.e., any obstacle that intrudes into any of the aerodrome obstacle

limitation surfaces.

k) description of the:

- runway lighting for each runway;
- approach lighting for each runway;
- visual approach slope indicator system/PAPI including the glide path angle and
- threshold crossing height for each runway;
- circling guidance lights, lead in light system, runway end, identification lights,
- runway alignment indicator lights;
- other movement area lighting, taxiway, apron floodlighting, reflectors;
- aerodrome beacon, hazard lights;
- lighting controls and limitations of use;
- emergency lighting; and
- secondary power supply and for which facilities.

## **2.4 Data Management**

- 2.4.1 Proper data management is crucial during the entire survey and subsequently the recording process. Aerodrome operators are urged to implement rigorous data handling processes and practices to eliminate erroneous data submission. Each surveyed entity and associated attributes shall be dealt with as a single data record stream. Any change to an existing data record stream identified during a subsequent annual check survey shall necessitate a reissue of the entire data record with a new unique record number and the deletion of the old record number.
- 2.4.2 If no changes were found to all attributes in an existing record the record shall retain its original record number and survey date.
- 2.4.3 If a later full survey is submitted following an initial full survey, all previous data records shall be declared as obsolete and a new list of survey data records shall be declared with new record numbers and new survey dates.
- 2.4.4 These data will be regularly updated for any changes or correctness of its specification and keep quality assurance by cross checking with daily inspection.
- 2.4.5 Each supplied data must be checked for the following assurance:
- a) The data provided meets quality requirements specified by CAAN.
  - b) The source of any data can be traced in the proper data record.
  - c) All detected data discrepancies are addressed and reviewed from the source.
  - d) All reported errors of the data are resolved in a timely manner.

- e) Delivery of data is made at the agreed time and if the data is applicable to the specified intended period, then it should be published.
- f) Any unresolved errors or anomalies known to remain are made available to the user.

## **CHAPTER 3. DATA PROCESSING**

### **3.1 Processing of Data**

The introduction of widespread automation through electronic storage will have more accuracy and be free from errors. These systems will support improvements in the integrity of data, at least at this stage of the process. It is not known, however, how many of these tools have been validated.

One area of the process phase where it is safe to assume the data obtained “shall, if possible, be verified before distribution and if not verified shall, when distributed, be clearly identified as such”. The use of words in this requirement is clear: “if possible”. No mention is made of cost-effectiveness or practicability. It may be possible to verify the data but, in reality, AIS providers should have the resources (funding, skills and processes) to do so.

In order to ensure the end-to-end integrity of aeronautical data, it is essential that the data process is fully identified, mapped and understood. The establishment of this process is critical as it identifies the key participants, processes, inputs and outputs that must be addressed in any regularized process. Any process is made up of three key elements; Inputs, Actions and Outputs. The end-to-end data integrity process is no exception. Data originators (e.g., surveyors, ATS Personnel, service organisations, etc.) will initiate inputs to the process. The activities that are then performed in order to turn the inputs into the outputs will form actions associated with the process. The outputs of the process will be the products that meet the specific need of users for aeronautical data. These users may be human based or system based. A pilot operating in accordance with the Visual Flight Rules (VFR) using information derived from an AIP, or a flight management system (FMS) using its integrated geospatial data, are examples for each type.

The process to ensure Aeronautical Data Integrity has been given in following order:

- a) Survey data is provided by ISO 9001 accredited companies.
- b) Data is stored in electronic media, preferably through use of standard worksheets which are used throughout the process.
- c) In order to ensure that data being transferred electronically is received at the next activity without having suffered any change, it is necessary that a CRC value be calculated. This activity is referred to as CRC wrapping.
- d) Receiver of data shall conduct a CRC verification to ensure integrity of data (Check CRC).
- e) Data is verified by the ASSD for completeness and quality.
- f) Data is transferred electronically to the Publishing Authority (i.e. AIS).
- g) AIS shall process the data for storage.
- h) AIS shall store the data in database and generate documents for publication when

needed.

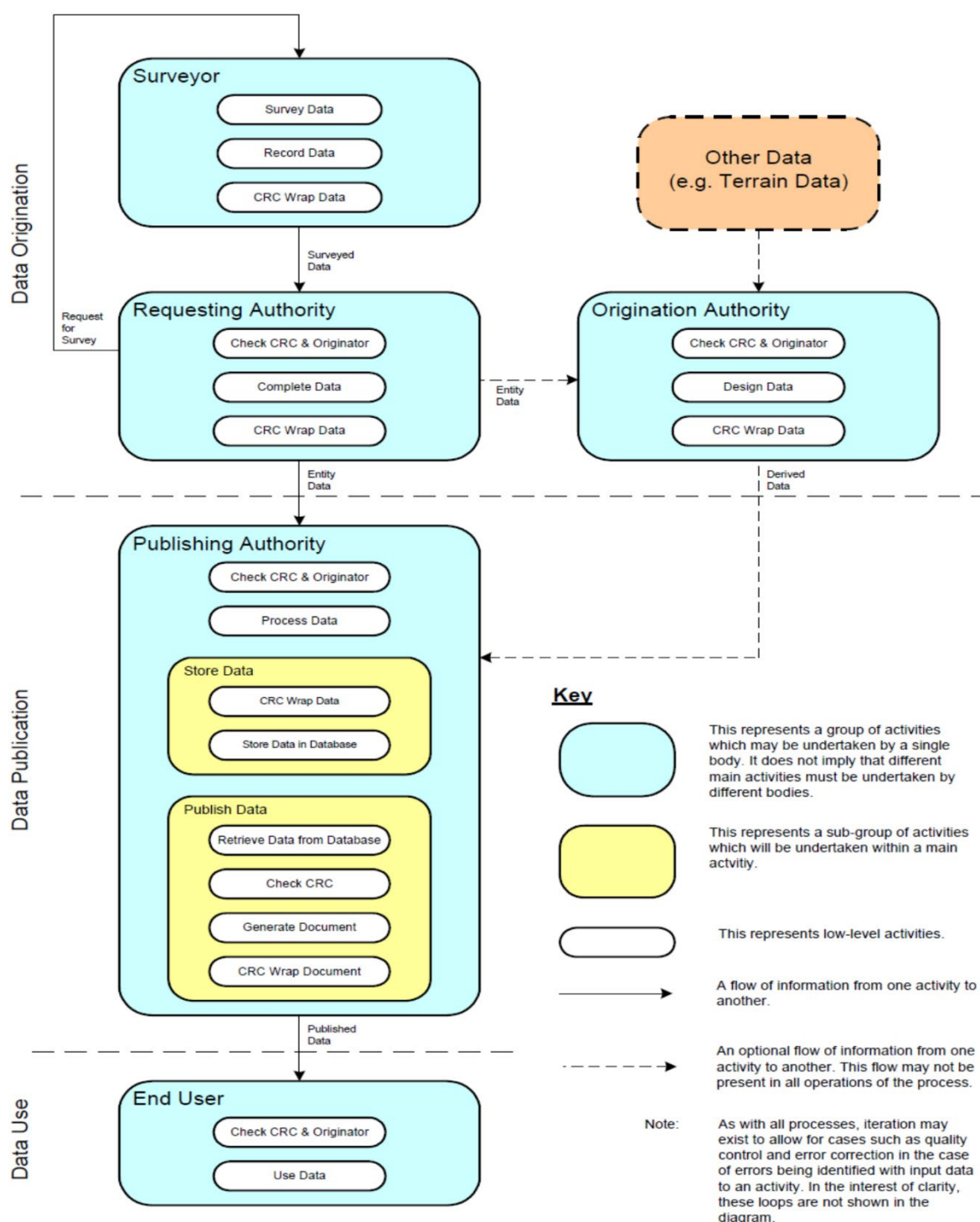


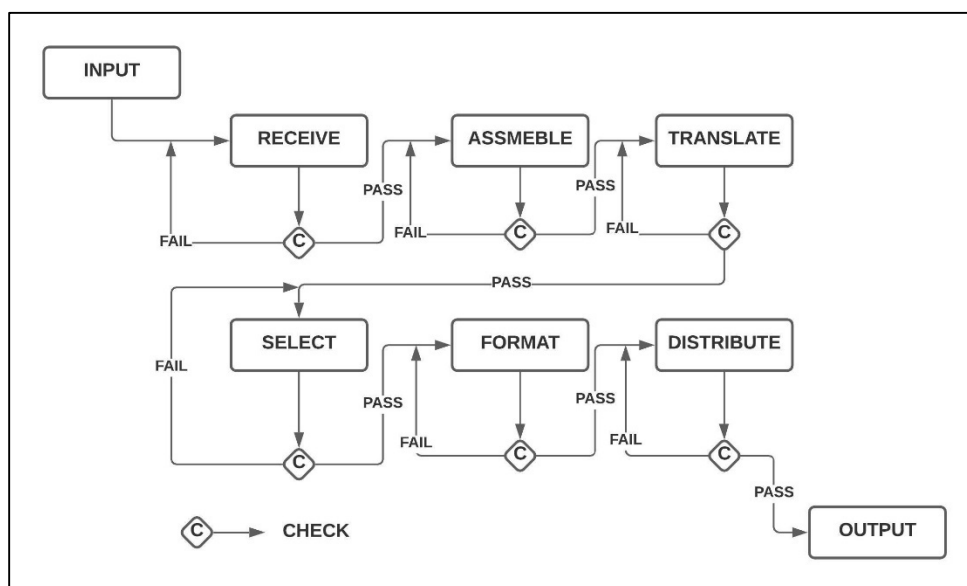
Figure 2: Aeronautical Data Process Diagram

The generic Aeronautical Information data process identifies the following main functional groupings:

- Surveyors - main organisation for surveying of data;
- Requesting Authorities - CAAN, Air Navigation Service Provider (ANSP), Air Traffic Service Provider (ATSP), aerodrome authorities and, possibly, equipment

suppliers (such as those developing terrain awareness warning systems - TAWS) that require surveys of, and survey information for, aeronautical facilities (navaids, aerodromes, obstacles, etc.);

- c) Originating Authorities - organisations responsible for creating facilities related to other ATM facilities. These organisations may perform procedure or airspace design, airspace planning etc. and create facilities such as ATS routes or instrument flight procedures;
- d) Publishing Authorities - CAAN AIS Department that issue Aeronautical Information.
- e) Users - Mostly airline operators and other associated agencies.
- f) For the purpose of Aeronautical data processing the following model is presented here to suite the organisational requirement to provide job description according to the processing system for each technical service departments. (e.g., ASSD processing personals will check for all the aeronautical data received to provide correct output to the end users.)



*Figure 3: Aeronautical Data Processing Chart*

### 3.1.1 Data Recording

Data originated by requesting authorities and originating authorities, surveyors and any other third-party organizations regarding aeronautical data shall be recorded in ASSD, CAAN.

Those aeronautical data will be collected and recorded from the outcome of following functions.

- 1) Surveyed Data:
  - a) Geodetic datum specification and use;
  - b) Establishment of Aerodrome survey control networks;



- c) Recommended procedures for achieving minimum data requirements;
  - d) Monumentation of survey control stations;
  - e) Production of survey reports;
  - f) Ongoing maintenance of data;
  - g) Data management and quality assurance.
- 2) Calculated and Derived Data (Originating Authority activities):
- a) Geodetic datum specification and use;
  - b) Airspace design;
  - c) Instrument flight procedure design;
  - d) Audit;
  - e) Data management and quality assurance.

### **3.2 Submission of Data Information**

- 3.2.1 The Processed data for submission to the CAAN shall consist of the following:
- a) Two electronic copies on CD-ROM to include the Survey Report and Survey Plans in PDF format with accompanying Digital Data.
  - b) One original signed copy of completed Survey Data.
- 3.2.2 The Aerodrome operator shall submit in hard copy the format of the survey package, comprising report, plans, data and declaration form.
- 3.2.3 The Aerodrome operator is responsible for ensuring that copies of all survey information and Survey Data are forwarded within 60 days of the survey date to ASSD, Civil Aviation Authority of Nepal.
- 3.2.4 Surveys that fail to conform to the requirements stated in this publication will be rejected and returned to the Aerodrome operator.

### **3.3 Listing of Data**

#### **3.3.1 Aerodrome geographical and administrative data**

The requirement is for aerodrome geographical and administrative data including:

- 1) aerodrome reference point (geographical coordinates in degrees, minutes and seconds) and its site location;
- 2) aerodrome elevation to the nearest metre or foot, and reference temperature;
- 3) geoid undulation at the aerodrome elevation position to the nearest metre or foot
- 4) magnetic variation to the nearest degree, date of information and annual change.

#### **3.3.2 Aprons, taxiways and check locations/positions data**

Details related to the physical characteristics of aprons, taxiways and

locations/positions of designated checkpoints, including:

- 1) Surface area and strength of aprons;
- 2) width, surface and strength of taxiways;
- 3) location and elevation to the nearest metre or foot of altimeter checkpoints;
- 4) location of VOR check points;
- 5) position of INS checkpoints in degrees, minutes, seconds and hundredths of seconds.

### 3.3.3 Surface movement guidance and control system and markings

Brief description of the surface movement guidance and control system and runway and taxiway markings, including:

- 1) use of aircraft stand identification signs, taxiway guide lines and visual docking/parking guidance system at aircraft stands;
- 2) runway and taxiway markings and lights;
- 3) stop bars (if any)

### 3.3.4 Aerodrome obstacles

Detailed description of obstacles, including:

- 1) obstacles in Area 2:
  - a) obstacle identification or designation;
  - b) type of obstacle;
  - c) obstacle position, represented by geographical coordinates in degrees, minutes, seconds and tenths of seconds;
  - d) obstacle elevation and height to the nearest metre or foot;
  - e) obstacle marking, and type and colour of obstacle lighting (if any);
  - f) NIL indication, if appropriate.
  - g) if appropriate, an indication that the list of obstacles is available in electronic form,
- 2) the absence of an Area 2 data set for the aerodrome is to be clearly stated and obstacle data are to be provided for:
  - a) obstacles that penetrate the obstacle limitation surfaces;
  - b) obstacles that penetrate the take-off flight path area obstacle identification surface; and
  - c) other obstacles assessed as being hazardous to air navigation.
- 3) indication that information on obstacles in Area 3 is not provided, or if provided:
  - a) obstacle identification or designation;

- b) type of obstacle;
- c) obstacle position, represented by geographical coordinates in degrees, minutes, seconds and tenths of seconds;
- d) obstacle elevation and height to the nearest tenth of a metre or tenth of a foot;
- e) obstacle marking, and type and colour of obstacle lighting (if any);
- f) NIL indication, if appropriate.
- g) if appropriate, an indication that the list of obstacles is available in electronic form.

***Note 1.— description of Area 2 and 3, and graphical illustrations of obstacle data collection surfaces are given in appendix.***

***Note 2. — Specifications governing the determination and reporting (accuracy of field work and data integrity) of positions (latitude and longitude) and elevations for obstacles in Area 2 and 3 are given in appendix-I of ICAO Doc 10066.***

### 3.3.5 Meteorological information provided

Detailed description of meteorological information provided at the aerodrome and an indication of which meteorological office is responsible for the service enumerated, including:

- 1) name of the associated meteorological office;
- 2) hours of service and, where applicable, the designation of the responsible meteorological office outside these hours;
- 3) office responsible for preparation of TAFs and periods of validity and interval of issuance of the forecasts;
- 4) availability of the trend forecasts for the aerodrome, and interval of issuance;
- 5) information on how briefing and/or consultation is provided;
- 6) types of flight documentation supplied and language(s) used in flight documentation;
- 7) charts and other information displayed or available for briefing or consultation;
- 8) supplementary equipment available for providing information on meteorological conditions, e.g., weather radar and receiver for satellite images;
- 9) the air traffic services unit(s) provided with meteorological information; and
- 10) additional information (e.g., concerning any limitation of service).

### 3.3.6 Runway physical Characteristics

Detailed description of runway physical characteristics, for each runway, including:

- 1) designations;

- 2) true bearings to one-hundredth of a degree;
- 3) dimensions of runways to the nearest metre or foot;
- 4) strength of pavement (PCN and associated data) and surface of each runway and associated stopways;
- 5) geographical coordinates in degrees, minutes, seconds and hundredths of seconds for each threshold and runway end and, where appropriate, geoid undulation of:
  - a) thresholds of a non-precision approach runway to the nearest metre or foot; and
  - b) thresholds of a precision approach runway to the nearest tenth of a metre or tenth of a foot;
- 6) elevations of:
  - a) thresholds of a non-precision approach runway to the nearest metre or foot;
  - b) thresholds and the highest elevation of the touchdown zone of a precision approach runway to the nearest tenth of a metre or tenth of a foot;
- 7) slope of each runway and associated stopways;
- 8) dimensions of stopway (if any) to the nearest metre or foot;
- 9) dimensions of clearway (if any) to the nearest metre or foot;
- 10) dimensions of strips;
- 11) dimensions of runway end safety areas;
- 12) location (which runway end) and description of arresting system (if any);
- 13) the existence of an obstacle-free zone; and
- 14) remarks.

#### 3.3.7 Declared distances

Detailed description of declared distances to the nearest metre or foot for each direction of each runway, including:

- 1) runway designation;
- 2) take-off run available (TORA);
- 3) take-off distance available (TODA);
- 4) accelerate-stop distance available (ASDA)
- 5) landing distance available (LDA)

If a runway direction cannot be used for take-off or landing, or both, because it is operationally forbidden, then this must be declared and the words “not usable” or the abbreviation “NU” entered (CAR 14, Part 1, Attachment A, Section 3).

3.3.8 Approach and runway lighting

Detailed description of approach and runway lighting, including:

- 1) runway designation;
- 2) type, length and intensity of approach lighting system;
- 3) runway threshold lights and threshold wing bars,
- 4) type of visual approach slope indicator system;
- 5) length of runway touchdown zone lights;
- 6) length, spacing, colour and intensity of runway centre line lights;
- 7) length, spacing, colour and intensity of runway edge lights;
- 8) colour of runway end lights and wing bars;
- 9) length and colour of stopway lights

3.3.9 Other lighting, secondary power supply

Description of other lighting and secondary power supply, including:

- 1) location, characteristics and hours of operation of aerodrome beacon;
- 2) taxiway edge and taxiway centre line lights;
- 3) secondary power supply including switch-over time.

3.3.10 Radio navigation and landing aids

Detailed description of radio navigation and landing aids associated with the instrument approach and the terminal area procedures at the aerodrome, including:

- 1) type of aids, magnetic variation to the nearest degree, as appropriate, and type of supported operation for ILS/MLS, basic GNSS, SBAS, and GBAS, and for VOR/ILS/MLS also station declination to the nearest degree used for technical line-up of the aid;
- 2) identification, if required;
- 3) frequency, channel number, service provider and Reference Path Identifier (RPI), as appropriate;
- 4) hours of operation, as appropriate;
- 5) geographical coordinates in degrees, minutes, seconds and tenths of seconds of the position of the transmitting antenna, as appropriate;
- 6) elevation of the transmitting antenna of DME to the nearest 30 m (100 ft) and of DME/P to the nearest 3 m (10 ft); elevation of GBAS reference point to the nearest metre or foot, and the ellipsoid height of the point to the nearest metre or foot. For SBAS, the ellipsoid height of the Landing Threshold Point (LTP) or the Fictitious Threshold Point (FTP) to the nearest metre or foot;

- 7) service volume radius from the GBAS reference point to the nearest kilometre or nautical mile; and

When the same aid is used for both en-route and aerodrome purposes, a description shall also be given in section ENR 4. If the GBAS serves more than one aerodrome, description of the aid shall be provided under each aerodrome. If the operating authority of the facility is other than the designated governmental agency, the name of the operating authority shall be indicated in the remarks column. Facility coverage shall be indicated in the remarks column.

### 3.3.11 Charts related to an aerodrome

The requirement is for charts related to an aerodrome to be included in the following order:

- 1) Aerodrome Chart;
- 2) Aircraft Parking/Docking Chart;
- 3) Aerodrome Ground Movement Chart;
- 4) Aerodrome Obstacle Chart - Type A (for each runway);
- 5) Precision Approach Terrain Chart (precision approach Cat II and III runways);
- 6) Area Chart (departure and transit routes);
- 7) Standard Departure Chart - Instrument;
- 8) Area Chart (arrival and transit routes);
- 9) Standard Arrival Chart - Instrument;
- 10) Instrument Approach Chart (for each runway and procedure type);
- 11) Visual Approach Chart;
- 12) Bird concentrations in the vicinity of the aerodrome;
- 13) The Enroute Chart;
- 14) World Aeronautical Chart;
- 15) Aeronautical Chart;
- 16) Aeronautical Navigation Chart;
- 17) Plotting Chart;
- 18) Electronic aeronautical chart display;
- 19) ATC surveillance minimum altitude chart.

If some of the charts are not produced, a statement to this effect must be provided.

## 3.4 CAAN Aerodrome Data System (CADS)

For promoting and enhancing aviation safety - data collection, its storage and the dissemination to the stakeholder and general public is very crucial and important. In

this regard, **CAAN Aerodrome Data System** shall be established, which collects and process all aerodrome related data. ASSD under the “aerodrome safety data” web-based program collects data from the airports. The data collected from the airports shall be validated / authenticated by the ASSD and then will be uploaded in the **Aerodrome Data System**, which is accessible to authorized ASSD officials only. Following points shall be taken into account while collecting data from the airports:

- 1) Data shall be transmitted in an electronic format
- 2) The airport authority shall make sure, as far as practicable, to maintain accuracy and authenticity of data updated.
- 3) The airports updating the data shall first be responsible for the uploaded data.
- 4) All the airports shall maintain their own electronic data base.

CAAN shall also have a CAAN Data Based System which acts as a vital part of the CAAN overall Management Information System (MIS). The Data Based System shall comprise along with the Aerodrome Data System and other data system such as ATM, AIS, CNS, etc. CAAN after scrutinizing the data within Aerodrome Data System, decides on the quality and quantity of data that may be made public and agreed data will then be published in the AIP under their respective headings.

Traditional navigation techniques have relied upon the ability to fly to or from point navigation aids. While the coordinates of the navigation aids have been provided, this information has not been used as part of the navigation process. Increasing use is being made of Area Navigation (RNAV) systems which derive the aircraft position from such sources as Inertial Navigation Systems (INS), Omega, VHF omni-directional radio range/distance measuring equipment (VOR/DME), dual or multi-DME and Global Navigation Satellite Systems (GNSS). Based on aeronautical data, RNAV systems generate appropriate instructions to the autopilots which enable the aircraft to follow the planned route during the departure, en-route and approach phases and eventually, with the implementation of GNSS, the landing phases.

### **3.5 Data Integrity**

The integrity of the data can be regarded as the degree of assurance that any data item retrieved from a storage system has not been corrupted or altered in any way since the original data entry or its latest authorized amendment. This integrity must be maintained throughout the data process from survey to data application. In respect to AIS, integrity must be maintained to the next intended user.

Integrity is expressed in terms of the probability that a data item, retrieved from a storage system with no evidence of corruption, does not hold the same value as intended. For example, an integrity of  $1 \times 10^{-8}$  means that an undetected corruption can be expected in no more than one data item in every 100,000,000 data items processed. Loss of integrity does not necessarily mean loss of accuracy. However, it does mean that it is no longer possible to prove that the data are accurate without a further verification of the data from the point at which integrity can be confirmed.

The integrity requirements for data are not absolute. The risk associated with a point being in error is dependent upon how that data point is being used. Thus, the integrity of a point at threshold, used for landing needs a higher integrity than one, used for en-route guidance. It is important to note that a lower accuracy does not necessarily imply a lower integrity requirement.

### 3.5.1 Integrity Requirements

3.5.1.1 A data item's particular use forms the basis for determining its integrity requirement. Aeronautical data integrity requirements must therefore be based upon the potential risk resulting from the corruption of data and upon the particular use of the data item. Consequently, the following classification of data must apply:

- a) **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.
- b) **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.
- c) **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.

3.5.1.2 To each of these types of data, an integrity level requirement has been assigned as follows:

- a) **Critical data (integrity level  $1 \times 10^{-8}$ ):** This level is given to the runway threshold data which define the landing point. The level of integrity has been derived from the integrity requirement for auto-land and is defined to ensure that the overall process, of which aeronautical data are only a part, has the required integrity. Procedures shall be put in place to assure corruption does not occur at any stage of the entire process and include additional integrity assurance processes to fully mitigate the effects of faults identified by thorough analysis of the overall system architecture as potential data integrity risks.
- b) **Essential data (integrity level  $1 \times 10^{-5}$ ):** This level is assigned to points which, while an error can in itself result in an aircraft being outside of the envelope required, excursion does not necessarily result in a catastrophe. Examples include en-route navigation aids and obstacles. The reason why obstacle data can be held with a relatively lower level of integrity is that, while the data need to be accurate at the time the procedures are designed, any subsequent corruption should have no impact on the safety of the aircraft on the condition that it conforms to the procedure requirements. Procedures shall be put in place to assure corruption does not occur at any stage of the entire process and include additional processes as needed to address potential risks in the overall system architecture to further assure data integrity at this level.



- c) **Routine data (integrity level  $1 \times 10^{-3}$ ):** This level is assigned to data for which errors do not affect the navigation performance. These include FIR boundary points. Procedures shall be put in place to avoid corruption throughout the processing of the data.

3.5.1.3 The protection of electronic aeronautical data while stored or in transit shall be totally monitored by the cyclic redundancy check (CRC). To achieve protection of the integrity level of all type of data as classified above in 3.5.1.2, ASSD, CAAN shall implement 32-bit CRC algorithm.

### **3.6 Verifying Accuracy**

#### **3.6.1 Accuracy Requirement**

Appropriate survey methods shall be applied to qualify the accuracy and integrity of the data provided. Survey methodology shall be clearly demonstrated in the Survey Report and the most stringent survey accuracy shall apply for all the Aerodromes. The order of resolution of aeronautical data shall be commensurate with the actual data accuracy.

The data about aerodromes is critical to the operation and safety, and the collection of this data through a combination of remotely sensed and field survey methods shall conform to the accuracy required. When determining the best method of collection, consideration to the required accuracy and efficiency of operations shall be given. Remote sensing techniques may not always meet the accuracy requirements of some aerodrome and aeronautical features, requiring their collection through field survey. Typically, linear features, some objects within the object identification surfaces, and visual navigational aids are good candidates for collection by remote sensing techniques. The geographic coordinate accuracies of this data must meet or exceed the requirements presented in the following subsections:

##### **3.6.1.1 Geodetic Control**

The survey monuments established in the aerodrome vicinity must meet all accuracy requirements and other criteria specified by CAAN and ICAO WGS-84 Manual (Doc 9674). These documents assure accurate relativity between all surveyed points on an aerodrome.

##### **3.6.1.2 Imagery**

The geo-referenced imagery of the survey area must meet the accuracy requirements obtained from set procedure approved by ASSD. Due to the critical nature of aerodrome and aeronautical data, it is important to position and attribute features accurately. Ensuring the spatial resolution and vertex spacing provides an accurate representation of features without compromising the accuracy of the data. With respect to imagery, this document defines the word “resolution” as the smallest spacing between two display elements, expressed as dots per inch, pixels per line, or lines per millimetre. Also consider the attribute accuracy. Collecting and identifying attributes from imagery requires skill and knowledge of interpreting aerodrome and

aeronautical features. The user must be familiar with the feature classes, attributes, and valid record entries used to identify spatial features contained in WGS-84 documents.

Features extracted using remote sensing technologies must have spatial accuracies reported in ground distances at the 95-percent confidence level. Use Root-Mean-Square Error (RMSE) to estimate spatial accuracies. Testing is the preferred method of reporting accuracy. Accomplish this by computing RMSE using the square root of the average of the set of squared differences between twenty or more checkpoint coordinate values and the coordinate values from an independent source of higher accuracy. However, if less than twenty checkpoints are available for testing, then report the accuracy as a deductive estimate based on knowledge of errors in each production step. Indicate in the metadata the methods used in the deductive method including complete calibration tests and describe assumptions about error propagation.

### 3.6.2 Feature Accuracy Requirements

The accuracy for geospatial vector aerodrome features (taxiway, aprons, ramps, buildings, etc.) is typically mapping grade accuracy, nominally within 3 feet (0.91 m) and 10 (3.05 m) feet vertically. Derived elevations must be within 10 feet (3.05 m) vertically. horizontally and 5 feet (1.52 m) vertically. Specific runway, stopway and navigational aid data accuracies are nominally within 1 foot (0.3 m) horizontally and 0.25 feet (0.08 m) vertically. Accuracy requirements for geospatial features used for geographic orientation (major highways and roads, lakes, rivers, coastline, and other items of landmark value) are usually 20 feet (6.1 m) horizontally.

### 3.6.3 Field Surveys

Many aerodrome features have accuracies greater than are achievable using remotely sensed methods and require field survey methods be used. These features, specifically the data for the runway(s) and some navigational aids, are nominally within 1 foot (0.3 m) horizontally and 0.25 feet (0.08 m) vertically.

## 3.7 Data Verification and Validation

As aerodromes move toward a more data centric environment, more information about the objects on and around the aerodrome is required. Each of these attributes should be completed. Realizing this will be an iterative process, there are some business rules which apply to all submissions.

Generally, the surveyor or consultant hired to collect the data will gather some of this information in the field. Other values can and should be derived from the field measurements. While other values will require information from other sources such as record drawings or interviews. Each attribute for each feature should be submitted with the data. Aerodrome operator should expect surveyors or consultants to complete these attributes based on the purpose of the survey or data collection effort. Typically, any attribute that can be measured or computed should be completed as part of the

statement of work. Base the requirement for which attributes the consultant should complete on the intent of the statement of work. If the consultant is hired to collect data for an aerodrome analysis survey, then all attributes relating to those features should be completed.

The more complete the attribution, the complete and more useful the data set will be to both the CAAN and the aerodrome operator in the future. Aerodrome operator should also plan for the updating of this information. If a previously submitted features attribution changes it should be updated as soon as possible.

Due to the critical nature of some aerodrome features, it is required that the data be verified and validated by ASSD. The validation/verification could be achieved through Flight Check, Simulation, Calculation, Photogrammetry and Satellite Imagery.

Typically, these features are those associated with the aerodrome's movement areas, navigational systems or those affecting navigable flight such as objects surrounding the aerodrome. The verification, validation and quality assurance of the safety critical data is confirmed only after verifying its accuracy of data according to requirements and standards obtained from set procedures approved by ASSD.

#### **3.7.1 Verification**

In this document, "verification" is defined as the confirmation by examination and provision of objective evidence that the specified requirements are fulfilled. Verification is necessary to ensure the data set accurately represents the specifications and is uncorrupted. The verification process proves the data was properly collected which is obtained from process approved by ASSD.

#### **3.7.2 Validation**

In this document, "validation" differs from "verification" in scale. The validation process identifies the aeronautical information submission was correctly developed as an input to the system. Validation is the confirmation by examination and provisions of objective evidence showing the data set meets the particular requirements of the intended use. The purpose of the validation process is to demonstrate the data set has sufficient overall integrity to satisfy the requirements for its intended application. Validation answers the questions "is the data reasonable when compared against known data" and "does it meet the identified need." Validation does not typically compare the data against photogrammetric analysis or review of the observational data.

### **3.8 Data Storage**

Validated data should be stored in CAAN Aerodrome Data System Bank with a unique identifier associated with them; this will allow accurate identification and retrieval of data. The data during retrieval should provide consistency and plausibility checking for data. These checks do improvement in data quality and result in the identification of some potential errors and conflict. The data storing is done as

follows:

- a) Electronic Database
- b) Paper Documents
- c) Maps, Charts and Diagrams/Plans.

## **CHAPTER 4.           QUALITY MANAGEMENT**

Quality management incorporates the overall management function that determine the quality policy, objectives and responsibilities, and implementing them by means such as quality planning, quality control, quality assurance and quality improvement within the quality system. World Geodetic System-1984 (WGS-84) is adopted to produce coordinate data referenced to a common datum in which a high degree of confidence can be placed in the accuracy and integrity of the data. To check the accuracy of the large number of unique data, which cannot be done by sample checks, quality assurance system is adopted.

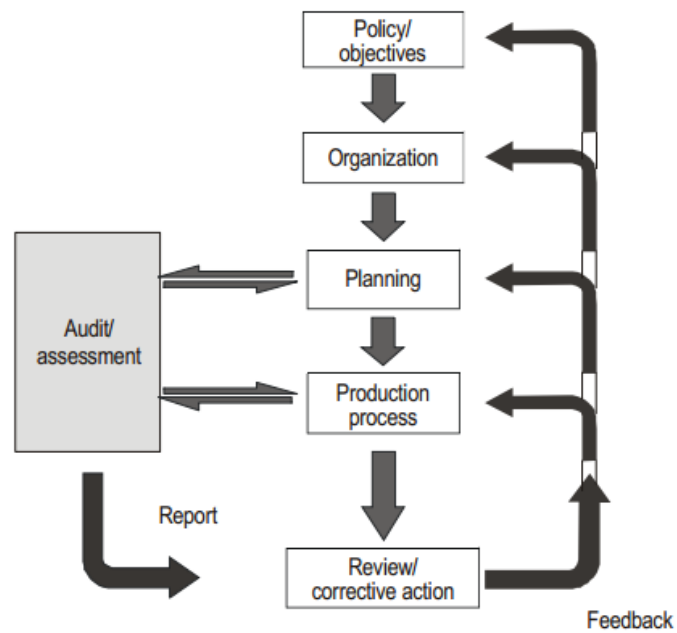
### **4.1       Quality Assurance**

Quality assurance includes all the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfil requirements for quality. The aeronautical data should be organized in such a manner that the quality system is introduced at all the functional stages of the aeronautical data process, from data origination to the distribution of data. Quality assurance is about preventing errors, rather than fixing them. The quality system should be in conformity with the International Organization for Standardization (ISO) 9000 series of quality assurance standards and be certified by Nepalese Government organization. This is done by using a quality system or quality management system (QMS). The basic elements of such a system could be:

- a) **Organization** (the management structure): It is very important that the organization be set up within CAAN with the specified responsibilities for the operation and understood by all concerned.
- b) **Planning/procedures**: ASSD, CAAN will Identify the tasks to be done and develop procedures necessary for the production process.
- c) **Documentation**: Procedures should be written down to enable consistency of application by different personnel. Documents can be updated, but under an authorized control procedure. Written quality records are needed to provide traceability if there is a problem to be located.
- d) **Assessment**: The most important part of any quality system is the method of assessment used, i.e. the audit process. It provides the checks that show whether the procedures are being used correctly and whether they are achieving the required results. It initiates the loop to make improvements where necessary. The aim of an assessment is to provide constructive recommendations for improvement where there are non-conformances and to establish confidence in the methods where there is conformance.
- e) **Review**: The process of considering the assessment result and implementing any necessary changes through a corrective action procedure.

The following figure shows the basic structure of a quality system which is required

to be developed within the organization of ASSD.



*Figure 4: Quality Assurance Loop*

- 4.1.1 ASSD shall take all necessary measures to introduce a properly organized quality system containing procedures, processes and resources necessary to implement quality management at each function stage. i.e. originate, collate or assemble, edit, format, publish/store and distribute. The execution of such quality management shall be made demonstrable for each function stage, when required.
- 4.1.2 Within the context of a quality system, the skills and knowledge required for each function shall be identified and personnel assigned to perform those functions shall be appropriately trained. CAAN shall ensure that personnel possess the knowledge and skills required to perform specific assigned functions, and appropriate records shall be maintained so that the qualifications of personnel can be confirmed. Initial and periodic assessments shall be established that require personnel to demonstrate the required skills and competencies. Periodic assessments of personnel shall be used as a means to detect and correct shortfalls.
- 4.1.3 ASSD shall ensure that established procedures exist in order that aeronautical data at each function stage is traceable to its origin so as to allow any data anomalies or errors, detected during the production/maintenance phases or in operational use, to be corrected.
- 4.1.4 The established quality system shall provide users with the necessary assurance and confidence that distributed aeronautical information/data satisfy stated requirements for data quality (accuracy, resolution and integrity) and for data traceability back to their origin along an unbroken trail by the use of appropriate procedures in every stage of data production or data modification process. The system shall also provide assurance of the applicability period of intended use of aeronautical data as well as that the agreed distribution dates will be met.
- 4.1.5 Demonstration of compliance of the quality system applied shall be by audit. If nonconformity is identified, action to correct its cause shall be determined and taken. All audit observations and remedial actions shall be evidenced and properly documented.

## **4.2 Common Reference System**

If a ground-based radar navigation aid is coordinated in two or more different geodetic reference datums, aircraft horizontal position determination will have two or more different sets of latitude and longitude values. This could lead to a situation where an aircraft close to a border between two States with different geodetic reference datums could be seen by radars in the two States as having different positions and the potential for misinterpreting aircraft separations and clearances from restricted areas. The main source of systematic errors is the non-use of a common geodetic reference datum for determining radar positions; the solution is to derive the radar positions from a common geodetic reference frame.

- 4.2.1 In order to support implementation of the CNS/ATM systems, CAAN has adopted WGS-84 coordinate system and initiated to provide all geographical coordinates referenced to this system. A detailed description/list of the WGS-84 coordinate data provided by CAAN has been published in AIP Nepal.
- 4.2.2 World Geodetic System - 1984 (WGS-84) shall be used as the horizontal (geodetic) reference system for air navigation. Reported aeronautical geographical coordinates (indicating latitude and longitude) shall be expressed in terms of the WGS- 84 geodetic reference datum. Projection is expressed in term of Universal Transverse Mercator (UTM).
- 4.2.3 Mean sea level (MSL) datum, which gives the relationship of gravity-related height (elevation) to a surface known as the geoid, shall be used as the vertical reference system for air navigation. The geoid model used is the Earth Gravitational Model 1996 - (EGM-96).
- 4.2.4 The Gregorian calendar and Coordinated Universal Time (UTC) shall be used as the temporal reference system for air navigation.

#### **4.3 Methodology**

- 4.3.1 There are many geodetic reference datums in use throughout the world providing references for the charting of particular areas. Each datum has been produced by fitting a particular mathematical earth model (ellipsoid) to the true shape of the earth (geoid) in such a way as to minimize the differences between the ellipsoid and the geoid over the area of interest.
- 4.3.2 As WGS-84 is adopted by CAAN, the local coordinate must be transformed into WGS-84 coordinate with standard methods as presented in World Geodetic System - 1984 (WGS-84) Manual.
- 4.3.3 Global Navigation Satellite System (GNSS) derived heights are referenced to the WGS-84 ellipsoid which will usually differ from the “normal” (orthometric) height at the same point. The difference will be of significance in the aerodrome environment when navigating with GNSS sensors.
- 4.3.4 The difference between orthometric height (geoid height, elevation) and WGS-84 ellipsoidal height must therefore be made available to the aviation community. The height that separates geoid and WGS-84 ellipsoid is the geoid undulation. Geoid undulation is required for airport elevations, runway thresholds and touchdown and lift-off areas (TLOFs) or thresholds of final approach and take-off areas (FATOs) at heliports.



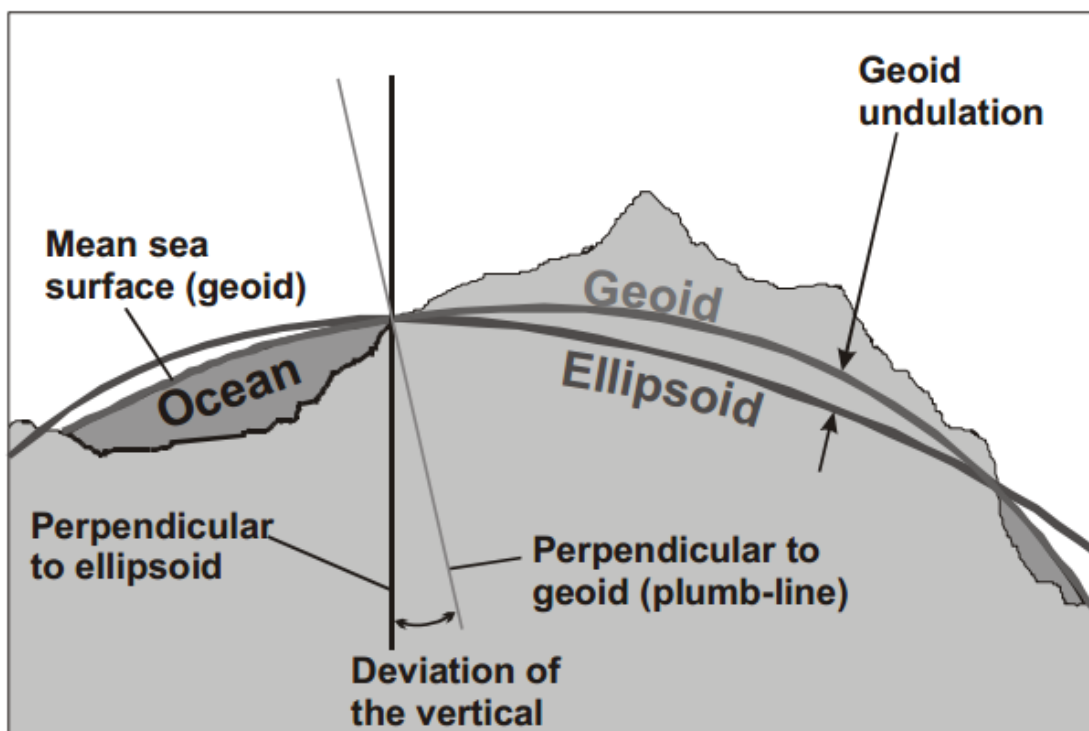


Figure 5: Earth as a Geoid

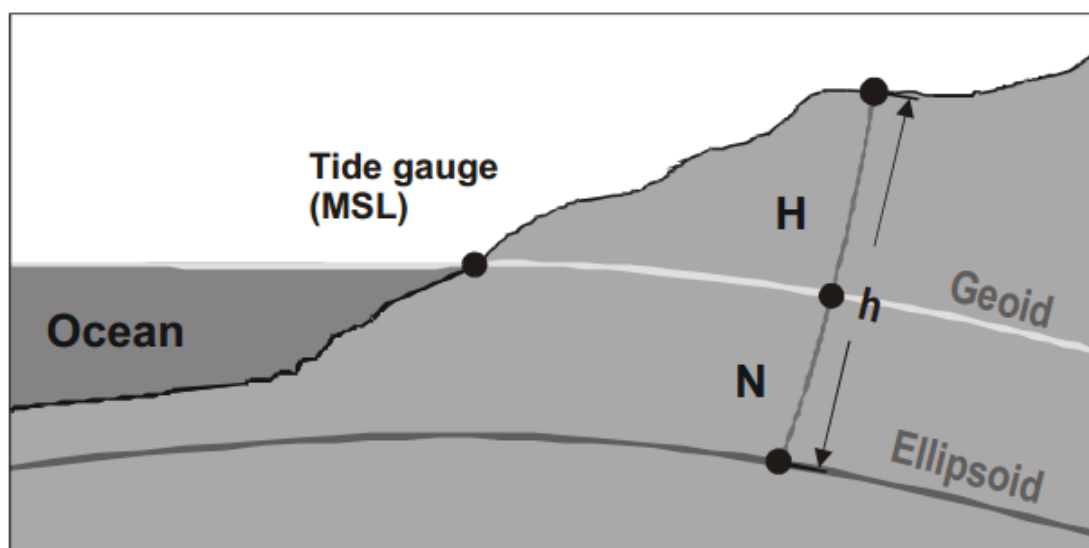


Figure 6: Geoid as Reference Surface for Heights

- 4.3.5 Thus, to fulfil the ICAO requirements for geographical coordinates referenced to the WGS-84 datum at international aerodromes, in flight information regions, enroute and in terminal areas CAAN should make the necessary arrangements to develop a national WGS-84 implementation plan and such a plan should contain a timetable for implementation. When developing a national WGS-84 plan, CAAN should establish a committee composed of personnel from the appropriate aeronautical and survey departments of Nepal. Such a committee should be tasked with the management of the WGS-84 implementation plan.
- 4.3.6 Before the geographical coordinates based on WGS-84 are published in the AIP Nepal and on charts, every effort must be made to validate and verify them. In order to ensure that quality (accuracy, resolution and integrity) and traceability requirements for the WGS-84- related geographical coordinate data are met, the guidance provided in this document should be used for introducing a quality system programme.

## **CHAPTER 5. PUBLICATION**

### **5.1 Publication / Presentation**

Aeronautical information previously had been published in only paper form. However, the use of electronic publications, either electronic representation of a paper document, such as PDF, or true electronic publications has increased for aerodrome information publication. In accordance with the CAR 15 -5.2.1.1 the aerodrome information publication (AIP), AIP Amendment, AIP Supplement and AIC can be provided on paper and/or as an electronic document. Likewise, according to the ICAO AIS Manual (Doc 8126), the use of only paper is unlikely to remain extant.

Whilst the move to electronic publication brings benefits to both the service providers and users, it introduces another area of risk regarding integrity. These risks can be addressed by the same methods utilised for data transmission. ICAO is currently considering the use of electronic media as the primary means of providing aeronautical information and it is assumed that electronic publishing will become the international standard for data dissemination to the users, facilitating accurate, timely and consistent Aeronautical Information.

The establishment of electronic publication must support the requirement for application of a standard format assuming, that the information to be published is correct.

### **5.2 Aeronautical Charts**

5.2.1 The verified and validated data should be published in aeronautical chart of AIP Nepal with at least the following types of charts:

- a) Aerodrome Obstacle Chart - ICAO Type A; B; C- These charts are intended to assist aircraft operators in making the complex take-off mass, distance and performance calculations required, including those covering emergency situations such as engine failure during take-off. Aerodrome obstacle charts show the runways in plan and profile, take-off flight path areas and the distances available for take-off run and accelerate-stop, taking obstacles into account; this data is provided for each runway which has significant obstacles in the take-off area. The detailed topographical information provided by some aerodrome obstacle charts includes coverage of areas as far as 45 km away from the aerodrome itself.
- b) Precision Approach Terrain Chart —This chart shall provide 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.
- c) En-route Chart — This chart shall provide flight crews with information to facilitate navigation along ATS routes in compliance with air traffic services procedures.
- d) Area Chart -This chart provides pilots with information to facilitate the transition

from en-route phase to final approach phase, as well as from take-off to en-route phases of the flight. The charts are designed to enable pilots to comply with departure and arrival procedures and holding pattern procedures;

- e) Standard Departure Chart -Instrument (SID) and Standard Arrival Chart - Instrument (STAR) -When air traffic services routes or position reporting requirements with sufficient clarity on the area chart cannot be shown then these separate **Charts** are produced;
- f) Aerodrome Chart -This chart provides an illustration of the aerodrome or heliport which allows the pilot to recognize significant features, rapidly clear the runway or heliport touchdown area after landing and follow taxiing instructions. The charts show aerodrome/heliport movement areas, visual indicator locations, taxiing guidance aids, aerodrome/heliport lighting, hangars, terminal buildings and aircraft/heliport stands, various reference points required for the setting and checking of navigation systems and operational information such as pavement strengths and radio communication facility frequencies.;
- g) Instrument Approach Chart - This chart provides the pilot with a graphic presentation of instrument approach procedures, and missed approach procedures to be followed should the crew be unable to carry out a landing. This chart type contains a plan and profile view of the approach with full details of associated radio navigation aids and necessary aerodrome and topographical information;
- h) Visual Approach Chart- This chart illustrates the basic aerodrome layout and surrounding features easily recognizable from the air. As well as providing orientation, these charts are designed to highlight potential dangers such as obstacles, high terrain and areas of hazardous airspace.
- i) World Aeronautical Chart — This chart shall provide information to satisfy the requirements of visual air navigation.

*Note. — In the production of Aerodrome Obstacle Charts — ICAO Type A, Aerodrome Obstacle Charts — ICAO Type C, Instrument Approach Charts — ICAO, Aerodrome Charts — ICAO and Precision Approach Charts — ICAO, CAAN shall take into account ICAO Annex 4 requirements.*

### **5.3 NOTAM**

International NOTAM offices should be adequately staffed and properly equipped for the provision of effective 24-hour service. If CAAN is going to establish another International NOTAM Office beside TIA, CAAN shall define the extent of responsibility and the area of coverage by each office.

#### **5.3.1 Use and validity of NOTAM**

CAAN should ensure that:

- a) aeronautical information to be distributed by NOTAM is originated strictly in accordance with the guidance for the completion of the NOTAM Format

contained in CAR-15;

- b) the duration of aeronautical information promulgated by NOTAM does not exceed three months and if the information is to remain valid after that period, an appropriate AIP Amendment or Supplement is issued;
- c) strict compliance with the requirement to provide at least seven days' advance notice of the activation of established danger, restricted or prohibited areas and of activities requiring temporary airspace restrictions, other than for emergency operations, is observed;
- d) a "trigger" NOTAM is originated whenever an AIRAC AIP Amendment or Supplement is published, giving a brief description of the contents, the effective date and the reference number of the AIP Amendment or Supplement. Such a NOTAM must come into force on the same effective date as the AIP Amendment or Supplement;
- e) the monthly printed plain-language summary of NOTAM in force also contains information on the latest AIP Amendments, AIP Supplements and AIC issued, and that it is distributed to the recipients with a minimum of delay by the most expeditious means.

5.3.2 AIS should exercise the proper selectivity in the origination and distribution of NOTAM by use of the flight information service or, whenever possible, automatic terminal information service (ATIS), for distribution of information that is valid for only a few hours.

5.3.3 NOTAM should be mainly used for promulgation of information of a temporary nature and of short duration. Temporary information promulgated by NOTAM should not remain in force longer than three months. In exceptional cases, if temporary information promulgated by NOTAM remains in force for longer than three months, a replacement NOTAM should be issued.

5.3.4 Use of the abbreviations WIE ("with immediate effect") and UFN ("until further notice") in the NOTAM Format under Items B and C respectively must be avoided and instead, a ten-figure group giving year, month, day, hours and minutes in UTC should be used when originating NOTAM. When information on timing is uncertain, a ten-figure date-time group should be followed by an EST to indicate the approximate duration of information.

#### **5.4 Aeronautical Information Publication (AIP)**

The aerodrome data which are relevant to the safe and efficient operation of aircraft at aerodromes of Nepal must be promulgated in the AIP of Nepal. These data will range from permanent descriptive material of the aerodrome to information of a short term and temporary nature. The responsibility for the provision of aerodrome data rests with the Aerodrome Operator. The AIP is intended primarily to satisfy international requirements for the exchange of aeronautical information of a lasting character essential to air navigation.

According to recommendation in the CAR 15 section 5.2.2, the AIP shall include:

- a) a statement of the competent authority responsible for the air navigation facilities, services or procedures covered by the AIP;
- b) the general conditions under which the services or facilities are available for international use;
- c) a list of significant differences between the national regulations and practices of the State and the related ICAO Standards, Recommended Practices and Procedures, given in a form that would enable a user to differentiate readily between the requirements of the State and the related ICAO provisions;
- d) the choice made by a State in each significant case where an alternative course of action is provided for ICAO Standards, Recommended Practices and Procedures.

5.4.1 To support the CNS/ATM systems, AIS/MAP should be directed towards the real-time provision of electronic aeronautical information/data that would ensure quality and integrity of the information provided. Information contained in the AIP should be complete and thoroughly checked for correctness before it is provided to users. To ensure consistency throughout the AIP, changes to the AIP should be made in such a way that information on the same facility, service, procedure, etc. affecting one part be changed in the other part(s), if applicable. Strict quality assurance principles should be put in place in order to ensure that aeronautical data is of the required quality (accuracy, resolution and integrity), verified and validated before it is provided to the users. This will give users the required confidence in the quality of information that is critical to flight safety. The following basic AIS/MAP requirements should be satisfied regarding:

- a) real-time provision and exchange of electronic aeronautical information/data, through a system that guarantees the quality and integrity of the information provided;
- b) provision and exchange of aeronautical information/data through modern communications means, including data link, which would allow interrogation of aeronautical data-bases on the ground from the aircraft;
- c) harmonization of AIS and MET information/data to support combined automated pre-flight and in-flight briefing facilities.

- 5.4.1.1 To enable the AIS/MAP to function efficiently and in accordance with the defined requirements, sufficient funds should be allocated so that all the administrative and operational requirements of AIS/MAP are met, including the availability of sufficient and properly qualified personnel with all the required facilities, equipment and material.
- 5.4.1.2 The requirements for printing of AIS documentation, including charts should be ascertained and given the highest priority. Personnel working for AIS/MAP services should possess the skills and competence required to perform specific assigned functions. The required skills and competencies should be demonstrated by AIS and MAP personnel through initial and periodic assessments on which basis the corresponding certificate of competence equal to an AIS license may be accorded.
- 5.4.2 Coordination between AIS and ASSD.
  - 5.4.2.1 Coordination/liaison on a permanent basis should be established between AIS/MAP and ASSD for planning and operating aerodrome, air navigation facilities and services. At least one person from those services should be assigned and be responsible for maintaining continuous liaison with AIS/MAP and providing it with “raw” information as and when required.
  - 5.4.2.2 Aerodromes responsible for origination of the raw aeronautical information should be acquainted with the requirements for promulgation and advance notification of changes that are operationally significant.
  - 5.4.2.3 If the amendment process is too slow for the publication of changes, then the Class II NOTAM should be used to promulgate information.
  - 5.4.2.4 Aerodrome operator should forward any new data, any changes which affect the accuracy of any published charts or variations of existing data to ASSD and on checking data it will be forwarded to Aeronautical Information Service department of CAAN.
  - 5.4.2.5 ASSD personnel should be included in the air navigation planning processes. This should ensure the timely preparation of appropriate AIS documentation and that the effective dates for changes to the air navigation system and procedures are satisfied.
- 5.4.3 Training of AIS and MAP personnel
  - 5.4.3.1 Within the context of the quality system implemented, the AIS and MAP training programme should ensure that AIS and MAP personnel are appropriately trained according to the skills and competencies required to perform specific assigned functions.
  - 5.4.3.2 AIS personnel should have, as an essential part of their training, sufficient knowledge of aeronautical cartography to permit them to verify information that is published on charts. In addition, AIS personnel should possess a sufficient background in automation and knowledge of the English language as are necessary for the performance of their duties.

- 5.4.3.3 The aerodrome AIS unit should provide full pre-flight Information/briefing service to flight operations personnel and flight crews for the entire coverage zone. The coverage zone for pre-flight information service at each aerodrome AIS unit should be determined taking into account the final destination of aircraft departing from the aerodrome concerned. This should be done in consultation with aircraft operators and be reviewed from time to time and/or when the air traffic pattern is expected to change.
- 5.4.3.4 Aerodrome AIS units that provide pre-flight information services should be established at locations conveniently accessible to flight operations personnel at the aerodromes, preferably on the ground floor (apron level) of aerodrome terminal buildings.
- 5.4.3.5 Arrangements should be made between the aerodrome AIS unit, airline operations personnel (including flight crews) and ATS for an effective cooperation, coordination and reporting of post-flight information on inadequacies in the status and operation of air navigation facilities. To ensure submission of post-flight reports to aerodrome AIS units without delay, arrangements should be made at aerodrome that a suitable post-flight report form, such as the one provided in Doc 8126, be made available to ATS, airline operations offices and aerodrome AIS units.
- 5.4.3.6 In view of the vital importance of the aeronautical information contained in the AIP to the safety of air navigation, information in the AIP should be kept up to date. This should be done by cooperation, coordination and reporting of information on inadequacies in the status and operation of air navigation facilities by aerodrome AIS units to CAAN for publishing in AIP Amendments on specific publication dates or in accordance with a publication schedule based on regular intervals. AIP Amendments should be issued at least once every six months.
- 5.4.3.7 Data Providers should be provided with basic AIS training so that they have some understanding of how the data they provide is subsequently used. This should include the format of data expected by the applications. The course could also allow methods of error detection to be covered, with the intention of reducing future problems. The handling of AIP data within a State could be trained and key processing issues could be raised and discussed. Data presentation and distribution for all AIP products could be trained. Every two years or so, refresher training may be beneficial, to allow the latest procedures followed by AIS to be reported to the Data Providers.

The training of AIS in surveying may also be considered so that AIS has an understanding of the process that has to be taken by the surveyor.



## **5.5 Other Publication**

### **5.5.1 AIRAC system**

- 5.5.1.1 CAAN should implement the AIRAC system in accordance with the requirements of Annex 15 with a minimum of delay and should ensure that adequate coordination between AIS and other air navigation services exists to permit effective implementation of the AIRAC system.
- 5.5.1.2 Successful implementation of the AIRAC system depends directly on the level of coordination established among the relevant technical services and the AIS. To ensure a high level of coordination, CAAN should prepare their national regulations so that they are well define the duties and responsibilities of those technical services involved in the provision of raw AIRAC information to AIS for publication. The technical services involved should be familiar with the AIRAC system and comply with it in accordance with specifications provided in CAR-11, CAR-14, Part 1 and CAR-15.
- 5.5.1.3 A schedule of AIRAC publication dates should be issued which includes a list of latest dates for the receipt of the raw information to be promulgated by AIRAC, printed on the reverse side of the Aeronautical Information Promulgation Advice Form
- 5.5.1.4 A schedule of AIRAC publication dates should be issued which includes a list of latest dates for the receipt of the raw information to be promulgated by AIRAC, printed on the reverse side of the Aeronautical Information Promulgation Advice Form.
- 5.5.1.5 To ensure that aeronautical information of operational significance reaches users at least 28 days in advance of the AIRAC effective date, measures should be taken to ensure that AIRAC information is distributed by the AIS unit at least 42 days in advance of the AIRAC effective dates.
- 5.5.1.6 Whenever major changes are planned and where advance notice is desirable and practicable, information should be made available by the AIS so as to reach recipients at least 56 days in advance of the effective date. This should be applied to the establishment of, and premeditated major changes, Guidance material on what constitutes a major change is included in the Aeronautical Information Services Manual (Doc 8126).
- 5.5.1.7 Changes to the information promulgated by the AIRAC system should be avoided by all means, especially during the period consisting of the first 28 days.
- 5.5.1.8 The AIRAC AIP Amendment shall be used to promulgate operationally significant changes to the AIP. Where applicable, aeronautical information of operational significance requiring substantive amendments to flight documentation (e.g. promulgation of new and/or revised instrument approach procedures) promulgated by an AIRAC AIP Supplement should be accompanied by charts or diagrams, as appropriate, to aid interpretation.

The AIRAC AIP Supplement shall be used to promulgate operationally significant temporary changes to the AIP.

- 5.5.1.9 Data Providers should be provided with information of AIRAC dates and the exact dates by which they should provide data to the AIS in order to meet these dates, at regular intervals. This could be at six monthly intervals. It may also be advisable to include a list of AIS contacts with this to ensure that contact between organisations is as simple as possible. If a standard form is to be used by the Data Providers for the submission of data, then this could be attached to the circular.
- 5.5.2 Aeronautical Information Circulars (AIC)
  - 5.5.2.1 AIS should establish contact with the relevant services providing AIS with raw aeronautical information to coordinate the preparation and production of Aeronautical Information Circulars (AIC) strictly in accordance with Chapter 7 of Annex 15 and Doc 8126.
  - 5.5.2.2 Checklists of current AIC must be issued at least once a year, irrespective of the number of AIC in force.

## APPENDIX-I: TERRAIN AND OBSTACLE DATA REQUIREMENTS

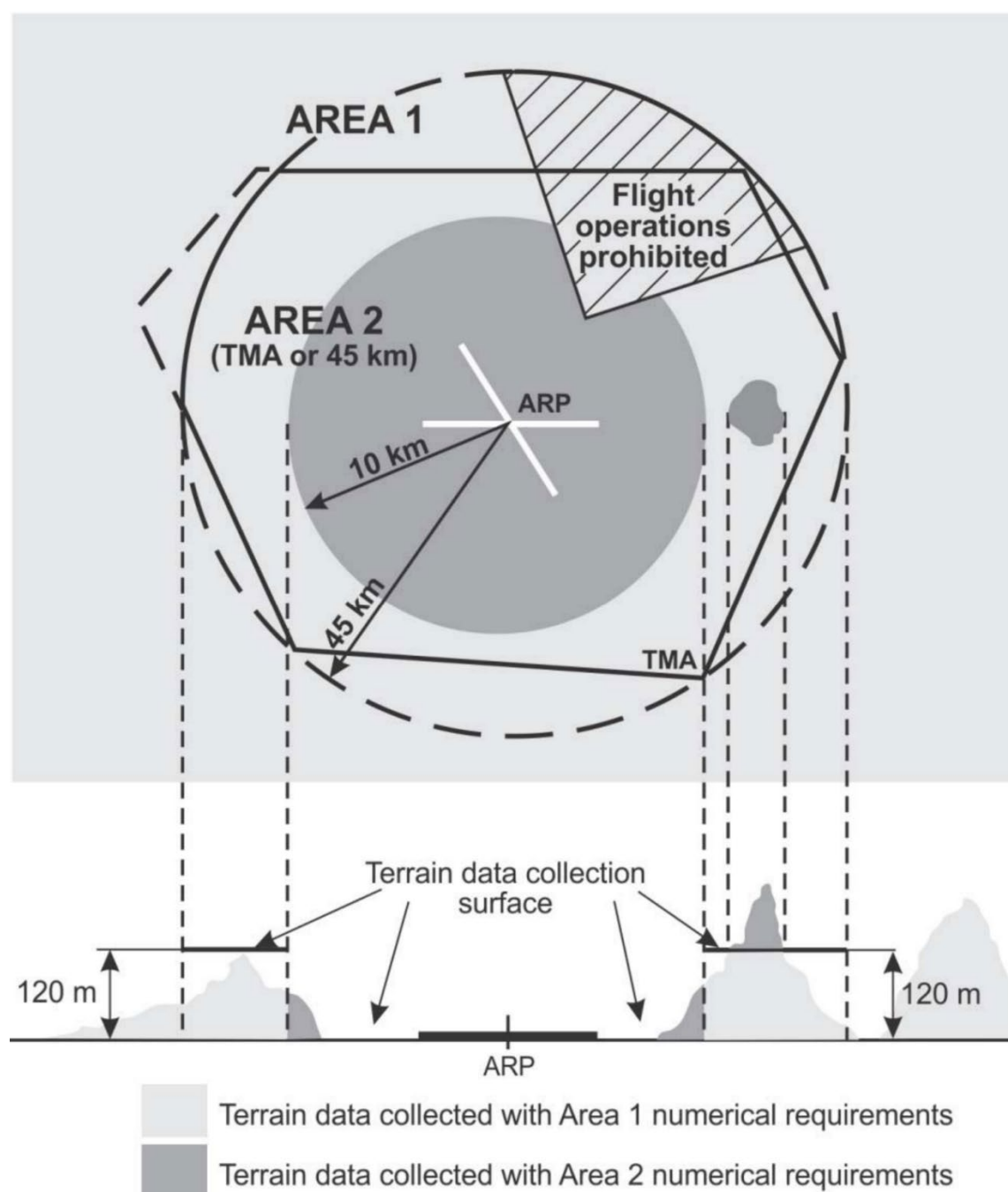


Figure 7: Terrain data collection surfaces - Area 1 and Area 2

- 1) Within the area covered by a 10-km radius from the ARP, terrain data shall be collected and recorded in accordance 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 penetrate the horizontal plane 120 m above the lowest runway elevation shall be collected and recorded in accordance 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 shall 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 shall comply with the Area 1 numerical requirements.

*Note – Terrain data numerical requirement for Area 1 and 2 are specified in the table provided in later sections.*

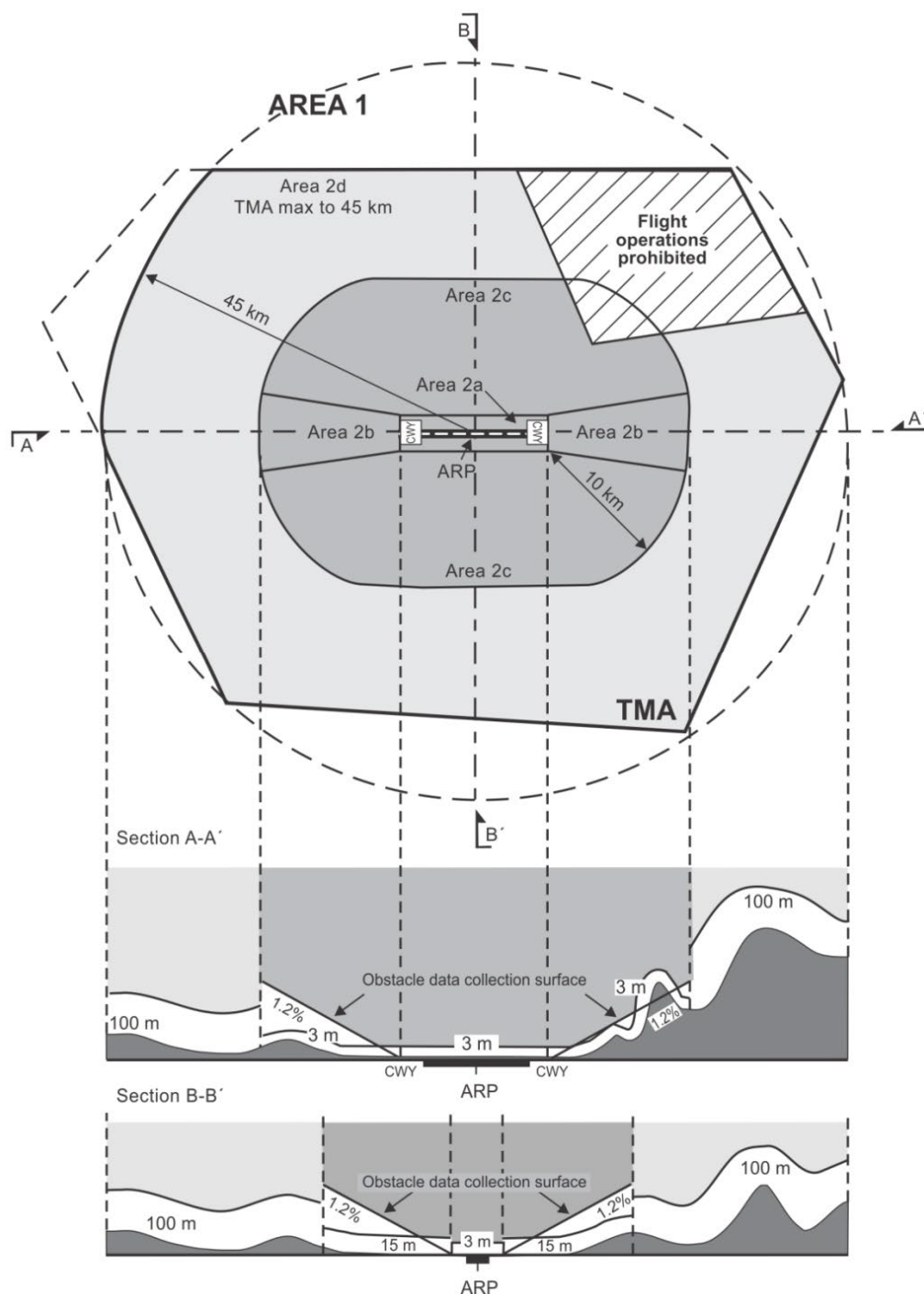


Figure 8: Obstacle data collection surfaces – Area 1 and Area 2

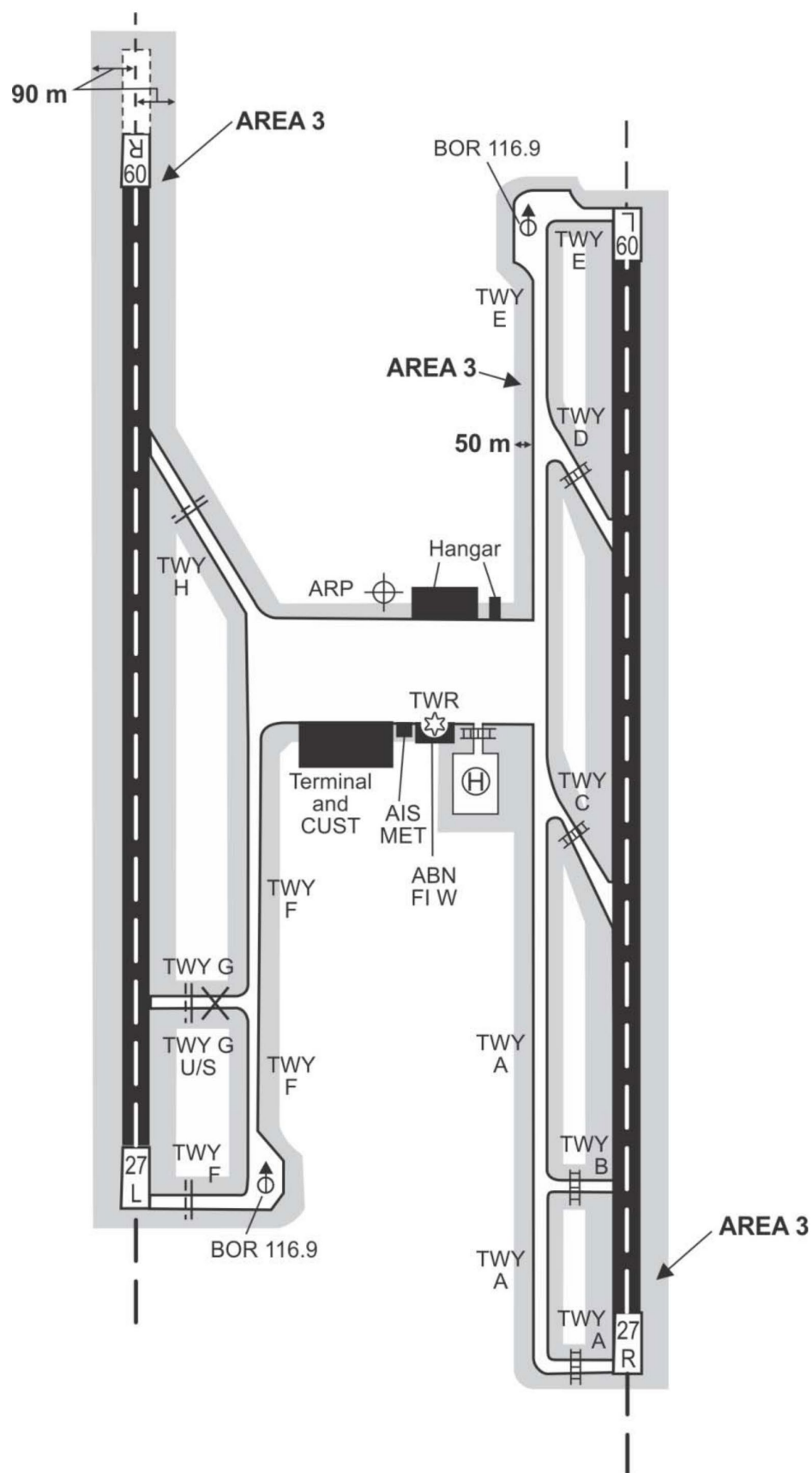


Figure 9: Terrain and obstacle data collection surface – Area 3



Figure 10: Terrain data collection surface – Area 4

*Table 1: Terrain Data Numerical Requirements*

	<b>Area 1</b>	<b>Area 2</b>	<b>Area 3</b>	<b>Area 4</b>
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 in
Horizontal accuracy	50 m	5 m	0.5 m	2.5 m
Confidence level (lo)	90%	90%	90%	90%
Data classification	routine	essential	essential	essential
Integrity' level	$1 \times 10^{-3}$	$1 \times 10^{-5}$	$1 \times 10^{-5}$	$1 \times 10^{-5}$
Maintenance period	as required	as required	as required	as required

*Table 2: Obstacle Data Numerical Requirements*

	<b>Area 1</b>	<b>Area 2</b>	<b>Area 3</b>	<b>Area 4</b>
Vertical accuracy	30 m	3m	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 3: Terrain Attributes

<b>Terrain attribute</b>	<b>Mandatory/Optional</b>
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 4: Obstacle attributes

<b>Obstacle attribute</b>	<b>Mandatory/Optional</b>
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

## APPENDIX-II: NOTAM FORMAT

<p>TO : INTERNATIONAL NOTAM OFFICE, TIA, GAUCHAR, KATHMANDU</p> <p>Phone (nn) nnn nnn nnn</p> <p>FAX (nn) nnn nnn nnn</p>	<p>FROM : .....</p> <p>Phone (nn) nnn nnn nnn</p> <p>FAX (nn) nnn nnn nnn</p>
<p>REPORTING OFFICER: ..... (NAME)</p> <p>TELEPHONE: ..... FAX : .....</p>	
<p>NOTAMN <input type="checkbox"/> NOTAMR ..... NOTAMC ..... (NUMBER) (NUMBER)</p>	
<p>LOCATION A) TRIBHUVANINTERNATIONALAIRPORT (AD)</p> <p>START TIME B) .....UTC</p> <p>FINISH TIME C).....UTC</p> <p>PERIODS OF ACTIVITY D).....UTC</p>	
<p>TEXT OF NOTAM E)</p>	
<p><i>Please fax back a copy of the NOTAM to the originator</i></p>	
<p>SIGNED: ..... DATE/TIME:..... (REPORTING OFFICER)</p>	

*Figure 11: NOTAM Format*

**APPENDIX-III: AERONAUTICAL DATA QUALITY REQUIREMENTS***Table 5: Latitude and Longitude*

<b>Latitude and Longitude</b>	<b>Publication Resolution</b>	<b>Integrity Classification</b>
Flight information region boundary points	1 min	routine
P, R, D area boundary points (outside CTA/CTZ boundaries)	1 min	routine
P, R, D area boundary points (inside CTA/CTZ boundaries)	1 sec	essential
CTA/CTZ boundary points	1 sec	essential
En-route NAVAIDS, intersections and waypoints, and holding, and STAR/SID points	1 sec	essential
Obstacles in Area 1 (the entire State territory)	1 sec	routine
Aerodrome/heliport reference point	1 sec	routine
NAVAIDS located at the aerodrome/heliport	1/10 sec	essential
Obstacles in Area 3	1/10 sec	essential
Obstacles in Area 2	1/10 sec	essential
Final approach fixes/points and other essential fixes/points comprising the instrument approach procedure	1/10 sec	essential
Runway threshold	1/100 sec	critical
Runway end (flight path alignment point)	1/100 sec	critical
Runway holding position	1/100 sec	critical
Taxiway centre line parking guidance line points	1/100 sec	essential
Taxiway intersection marking line	1/100 sec	essential
Exit guidance line	1/100 sec	essential
Aircraft stand points/TNS checkpoints	1/100 sec	routine
Geometric centre of TLOF or FATO thresholds, heliports	1/100 sec	critical
Apron boundaries (polygon)	1/10 sec	routine

<b>Latitude and Longitude</b>	<b>Publication Resolution</b>	<b>Integrity Classification</b>
De-icing anti-icing facility (polygon)	1/10 sec	routine

Table 6: Elevation/altitude/height

<b>Elevation/altitude/height</b>	<b>Publication Resolution</b>	<b>Integrity Classification</b>
Aerodrome/heliport elevation	1 m or 1 ft	essential
WGS-84 geoid undulation at aerodrome elevation position	1 m or 1 ft	essential
GBAS reference point	1 m or 1 ft	essential
Heliport crossing height, PinS approaches	1 m or 1 ft	essential
Runway or FATO threshold, non-precision approaches	1 m or 1 ft	essential
WGS-84 geoid undulation at runway or FATO threshold, TLOF geometric centre (non-precision approaches)	1 m or 1 ft	essential
Runway or FATO threshold, precision approaches	0.1 m or 0.1 ft	critical
WGS-84 geoid undulation at runway or FATO threshold, TLOF geometric centre (precision approaches)	0.1 m or 0.1 ft	critical
Threshold crossing height, precision approaches	0.1 m or 0.1 ft	critical
Obstacles in Area 2	1 m or 1 ft	essential
Obstacles in Area 3	0.1 m or 0.1 ft	essential
Obstacles in Area 1 (the entire State territory)	1 m or 1 ft	routine

<b>Elevation/altitude/height</b>	<b>Publication Resolution</b>	<b>Integrity Classification</b>
Distance measuring equipment/ precision (DME/P)	3 m (10 ft)	essential
Distance measuring equipment (DME)	30 m (100 ft)	essential
Minimum altitudes	50 m or 100 ft	routine

Table 7: Declination and magnetic variation

<b>Declination/variation</b>	<b>Publication resolution</b>	<b>Integrity Classification</b>
YHF NAVAID station declination used for technical line-up	1 degree	essential
NDB NAVAID magnetic variation	1 degree	routine
Aerodrome/heliport magnetic variation	1 degree	essential
ILS localizer antenna magnetic variation	1 degree	essential
MLS azimuth antenna magnetic variation	1 degree	essential

Table 8: Bearing

<b>Bearing</b>	<b>Publication resolution</b>	<b>Integrity Classification</b>
Airway segments	1 degree	routine
Bearing used for the formation of an en-route and a terminal fix	1/10 degree	routine
Terminal arrival /departure route segments	1 degree	routine
Bearing used for the formation of an instrument approach procedure fix	1/100 degree	essential
ILS localizer alignment (True)	1/100 degree	essential

<b>Bearing</b>	<b>Publication resolution</b>	<b>Integrity Classification</b>
MLS zero azimuth alignment (True)	1/100 degree	essential
Runway and FATO bearing (True)	1/100 degree	routine

Table 9: Length/distance/dimension

<b>Length/distance/dimension</b>	<b>Publication resolution</b>	<b>Integrity Classification</b>
Airway segment length	1/10 km or 1/10 NM	routine
Distance used for the formation of an en-route fix	1/10 km or 1/10 NM	routine
Terminal arrival/departure route segment length	1/100 km or 1/100 NM	essential
Distance used for the formation of a terminal and instrument approach procedure fix	1/100 km or 1/100 NM	essential
Runway and FATO length, TLOF dimensions	1 m or 1 ft	critical
Runway width	1 m or 1 ft	essential
Displaced threshold distance	1 m or 1 ft	routine
Clearway length and width	1 m or 1 ft	essential
Stopway length and width	1 m or 1 ft	critical
Landing distance available	1 m or 1 ft	critical
Take-off run available	1 m or 1 ft	critical
Take-off distance available	1 m or 1 ft	critical
Accelerate-stop distance available	1 m or 1 ft	critical
Runway shoulder width	1 m or 1 ft	essential
Taxiway width	1 m or 1 ft	essential

<b>Length/distance/dimension</b>	<b>Publication resolution</b>	<b>Integrity Classification</b>
Taxiway shoulder width	1 m or 1 ft	essential
ILS localizer antenna-runway end, distance	1 m or 1 ft	routine
ILS glide slope antenna-threshold, distance along centre line	1 m or 1 ft	routine
ILS marker-threshold distance	1 m or 1 ft	essential
ILS DME antenna-threshold, distance along centre line	1 m or 1 ft	essential
MLS azimuth antenna-runway end, distance	1 m or 1 ft	routine
MLS elevation antenna-threshold, distance along centre line	1 m or 1 ft	routine
MLS DME/P antenna-threshold, distance along centre line	1 m or 1 ft	essential