

COVER SHEET TO AMENDMENT 56

**INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES**

AERONAUTICAL CHARTS

**ANNEX 4
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION**

ELEVENTH EDITION — JULY 2009

INTERNATIONAL CIVIL AVIATION ORGANIZATION

Checklist of Amendments to Annex 4

	<i>Effective date</i>	<i>Date of applicability</i>
Eleventh Edition (incorporates Amendments 1 to 55)	20 July 2009	19 November 2009; 18 November 2010
Amendment 56 (adopted by the Council on 24 February 2010) Replacement pages (xvii), 1-1, 1-5, 1-9, 2-6, 5-1, 5-2 and APP 6-1	12 July 2010	18 November 2010; 12 November 2015



Transmittal note

Amendment 56

to the

International Standards
and Recommended Practices

AERONAUTICAL CHARTS

(Annex 4 to the Convention on International Civil Aviation)

1. Insert the following replacement pages in Annex 4 (Eleventh Edition) to incorporate Amendment 56 which becomes applicable on 18 November 2010 and 12 November 2015:
 - a) Page (xvii) — Foreword
 - b) Pages 1-1, 1-5 and 1-9 — Chapter 1
 - c) Page 2-6 — Chapter 2
 - d) Pages 5-1 and 5-2 — Chapter 5
 - e) Page APP 6-1 — Appendix 6
 2. Record the entry of this amendment on page (iii).
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<i>Amendment</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Adopted Effective Applicable</i>
55 (11th Edition)	Secretariat with the assistance of the RNPSORSG; proposals by AP/1; and Recommendation 9/3 of IFPP/WG/WHL/1.	Definitions and new provisions relating to performance-based navigation terminology; symbols for wind turbines; a hierarchy of symbols for significant points, and publication of bearings and tracks additionally as True values.	4 March 2009 20 July 2009 19 November 2009; 18 November 2010
56	Secretariat with the assistance of the Aeronautical Information Services-Aeronautical Information Management Study Group (AIS-AIMSG)	Definitions and new provisions relating to cyclic redundancy check (CRC) and an extended applicability date for the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic).	24 February 2010 12 July 2010 18 November 2010; 12 November 2015

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

CHAPTER 1. DEFINITIONS, APPLICABILITY AND AVAILABILITY

1.1 Definitions

When the following terms are used in the Standards and Recommended Practices for aeronautical charts, they have the following meanings:

Aerodrome. A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

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

Aerodrome operating minima. The limits of usability of an aerodrome for:

- a) take-off, expressed in terms of runway visual range and/or visibility and, if necessary, cloud conditions;
- b) landing in precision approach and landing operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the category of the operation;
- c) landing in approach and landing operations with vertical guidance, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H); and
- d) landing in non-precision approach and landing operations, expressed in terms of visibility and/or runway visual range, minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions.

Aerodrome reference point. The designated geographical location of an aerodrome.

Aeronautical chart. A representation of a portion of the Earth, its culture and relief, specifically designated to meet the requirements of air navigation.

Aircraft stand. A designated area on an apron intended to be used for parking an aircraft.

Air defence identification zone. Special designated airspace of defined dimensions within which aircraft are required to comply with special identification and/or reporting procedures additional to those related to the provision of air traffic services (ATS).

Air traffic service. A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).

Air transit route. A defined route for the air transiting of helicopters.

Airway. A control area or portion thereof established in the form of a corridor.

Altitude. The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).

Application. Manipulation and processing of data in support of user requirements (ISO 19104*).

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

Area minimum altitude (AMA). The minimum altitude to be used under instrument meteorological conditions (IMC), that provides a minimum obstacle clearance within a specified area, normally formed by parallels and meridians.

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

Note.— Area navigation includes performance-based navigation as well as other operations that do not meet the definition of performance-based navigation.

Arrival routes. Routes identified in an instrument approach procedure by which aircraft may proceed from the en-route phase of flight to an initial approach fix.

ATS route. A specified route designed for channelling the flow of traffic as necessary for the provision of air traffic services.

Note 1.— The term ATS route is used to mean variously, airway, advisory route, controlled or uncontrolled route, arrival or departure route, etc.

Note 2.— An ATS route is defined by route specifications that include an ATS route designator, the track to or from significant points (waypoints), distance between significant points, reporting requirements and, as determined by the appropriate ATS authority, the lowest safe altitude.

ATS surveillance system. A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft.

Note.— A comparable ground-based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.

Bare Earth. Surface of the Earth including bodies of water and permanent ice and snow, and excluding vegetation and man-made objects.

Calendar. Discrete temporal reference system that provides the basis for defining temporal position to a resolution of one day (ISO 19108*).

Canopy. Bare Earth supplemented by vegetation height.

Change-over point. The point at which an aircraft navigating on an ATS route segment defined by reference to very high frequency omnidirectional radio ranges is expected to transfer its primary navigational reference from the facility behind the aircraft to the next facility ahead of the aircraft.

Note.— Change-over points are established to provide the optimum balance in respect of signal strength and quality between facilities at all levels to be used and to ensure a common source of azimuth guidance for all aircraft operating along the same portion of a route segment.

* All ISO Standards are listed at the end of this chapter.

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

Note.— In the Gregorian calendar, common years have 365 days and leap years 366 days divided into twelve sequential months.

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

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

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

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

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

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

Hypsometric tints. A succession of shades or colour gradations used to depict ranges of elevation.

Initial approach segment. That segment of an instrument approach procedure between the initial approach fix and the intermediate approach fix or, where applicable, the final approach fix or point.

Instrument approach procedure. A series of predetermined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en-route obstacle clearance criteria apply.

Intermediate approach segment. That segment of an instrument approach procedure between either the intermediate approach fix and the final approach fix or point, or between the end of a reversal, racetrack or dead reckoning track procedure and the final approach fix or point, as appropriate.

Intermediate holding position. A designated position intended for traffic control at which taxiing aircraft and vehicles shall stop and hold until further cleared to proceed, when so instructed by the aerodrome control tower.

Isogonal. A line on a map or chart on which all points have the same magnetic variation for a specified epoch.

Isogriv. A line on a map or chart which joins points of equal angular difference between the North of the navigation grid and Magnetic North.

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

Landing direction indicator. A device to indicate visually the direction currently designated for landing and for take-off.

Level. A generic term relating to the vertical position of an aircraft in flight and meaning variously, height, altitude or flight level.

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

Magnetic variation. The angular difference between True North and Magnetic North.

Note.— The value given indicates whether the angular difference is East or West of True North.

Manoeuvring area. That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons.

Marking. A symbol or group of symbols displayed on the surface of the movement area in order to convey aeronautical information.

Metadata. Data about data (ISO 19115*).

Note.— Data that describes and documents data.

Minimum en-route altitude (MEA). The altitude for an en-route segment that provides adequate reception of relevant navigation facilities and ATS communications, complies with the airspace structure and provides the required obstacle clearance.

Minimum obstacle clearance altitude (MOCA). The minimum altitude for a defined segment of flight that provides the required obstacle clearance.

Minimum sector altitude. The lowest altitude which may be used which will provide a minimum clearance of 300 m (1 000 ft) above all objects located in an area contained within a sector of a circle of 46 km (25 NM) radius centred on a radio aid to navigation.

Missed approach point (MAPt). That point in an instrument approach procedure at or before which the prescribed missed approach procedure must be initiated in order to ensure that the minimum obstacle clearance is not infringed.

Missed approach procedure. The procedure to be followed if the approach cannot be continued.

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

Navigation specification. A set of aircraft and flight crew requirements needed to support performance-based navigation operations within a defined airspace. There are two kinds of navigation specifications:

Required navigation performance (RNP) specification. A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH.

Area navigation (RNAV) specification. A navigation specification based on area navigation that does not include the requirement for performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1.

Note 1.— The Performance-based Navigation (PBN) Manual (Doc 9613), Volume II, contains detailed guidance on navigation specifications.

Note 2.— The term RNP, previously defined as “a statement of the navigation performance necessary for operation within a defined airspace”, has been removed from this Annex as the concept of RNP has been overtaken by the concept of PBN. The term RNP in this Annex is now solely used in the context of navigation specifications that require performance monitoring and alerting, e.g. RNP 4 refers to the aircraft and operating requirements, including a 4 NM lateral performance with on-board performance monitoring and alerting that are detailed in Doc 9613.

Stopway. A defined rectangular area on the ground at the end of take-off run available prepared as a suitable area in which an aircraft can be stopped in the case of an abandoned take-off.

Taxiing. Movement of an aircraft on the surface of an aerodrome under its own power, excluding take-off and landing.

Taxi-route. A defined path established for the movement of helicopters from one part of a heliport to another. A taxi-route includes a helicopter air or ground taxiway which is centred on the taxi-route.

Taxiway. A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including:

- 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.

Terminal arrival altitude (TAA). The lowest altitude that will provide a minimum clearance of 300 m (1 000 ft) above all objects located in an arc of a circle defined by a 46 km (25 NM) radius centred on the initial approach fix (IAF), or where there is no IAF on the intermediate approach fix (IF), delimited by straight lines joining the extremity of the arc to the IF. The combined TAAs associated with an approach procedure shall account for an area of 360 degrees around the IF.

Terrain. The surface of the Earth containing naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, and excluding obstacles.

Note.— In practical terms, depending on the method of data collection, terrain represents the continuous surface that exists at the bare Earth, the top of the canopy or something in-between, also known as “first reflective surface”.

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

Touchdown and lift-off area (TLOF). A load bearing area on which a helicopter may touch down or lift off.

Touchdown zone. The portion of a runway, beyond the threshold, where it is intended landing aeroplanes first contact the runway.

Track. The projection on the earth’s surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from North (true, magnetic or grid).

Transition altitude. The altitude at or below which the vertical position of an aircraft is controlled by reference to altitudes.

Vectoring. Provision of navigational guidance to aircraft in the form of specific headings, based on the use of an ATS surveillance system.

Visual approach procedure. A series of predetermined manoeuvres by visual reference, from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, a go-around procedure can be carried out.

Waypoint. A specified geographical location used to define an area navigation route or the flight path of an aircraft employing area navigation. Waypoints are identified as either:

Fly-by waypoint. A waypoint which requires turn anticipation to allow tangential interception of the next segment of a route or procedure; or

Flyover waypoint. A waypoint at which a turn is initiated in order to join the next segment of a route or procedure.

1.2 Applicability

1.2.1 The specifications in this Annex are applicable on and after 19 November 2009.

Note.— Chapter 2, 2.4.4, and Chapter 5 are applicable on and after 18 November 2010.

1.2.2 All charts coming within the scope of this Annex and bearing the aeronautical information date of 19 November 2009 or later shall conform to the Standards relevant to the particular chart.

1.2.2.1 **Recommendation.**— *All such charts should in addition conform to the Recommended Practices relevant to the particular chart.*

1.3 Availability

1.3.1 *Information.* A Contracting State shall on request by another Contracting State provide all information relating to its own territory that is necessary to enable the Standards of this Annex to be met.

1.3.2 *Charts.* Contracting States shall, when so specified, ensure the availability of charts in whichever of the following ways is appropriate for a particular chart or single sheet of a chart series.

Note.— *The availability of charts includes specified electronic charts.*

1.3.2.1 For any chart or single sheet of a chart series entirely contained within the territory of a Contracting State, the State having jurisdiction over the territory shall either:

- a) produce the chart or sheet itself; or
- b) arrange for its production by another Contracting State or by an agency; or
- c) provide another Contracting State prepared to accept an obligation to produce the chart or sheet with the data necessary for its production.

1.3.2.2 For any chart or single sheet of a chart series which includes the territory of two or more Contracting States, the States having jurisdiction over the territory so included shall determine the manner in which the chart or sheet will be made available. This determination shall be made with due regard being given to regional air navigation agreements and to any programme of allocation established by the Council of ICAO.

Note.— *The phrase “regional air navigation agreements” refers to the agreements approved by the Council of ICAO normally on the advice of regional air navigation meetings.*

1.3.3 A Contracting State shall take all reasonable measures to ensure that the information it provides and the aeronautical charts made available are adequate and accurate and that they are maintained up to date by an adequate revision service.

2.14 Air traffic services airspaces

2.14.1 When ATS airspace is shown on a chart, the class of airspace, the type, name or call sign, the vertical limits and the radio frequency(ies) to be used shall be indicated and the horizontal limits depicted in accordance with Appendix 2 — ICAO Chart Symbols.

2.14.2 **Recommendation.**— *On charts used for visual flight, those parts of the ATS Airspace Classes table (Appendix 4) in Annex 11 applicable to the airspace depicted on the chart should be on the face or reverse of each chart.*

2.15 Magnetic variation

2.15.1 True North and magnetic variation shall be indicated. The order of resolution of magnetic variation shall be that as specified for a particular chart.

2.15.2 **Recommendation.**— *When magnetic variation is shown on a chart, the values shown should be those for the year nearest to the date of publication that is divisible by 5, i.e. 1980, 1985, etc. In exceptional cases where the current value would be more than one degree different, after applying the calculation for annual change, an interim date and value should be quoted.*

Note.— *The date and the annual change may be shown.*

2.15.3 **Recommendation.**— *For instrument procedure charts, the publication of a magnetic variation change should be completed within a maximum of six AIRAC cycles.*

2.15.4 **Recommendation.**— *In large terminal areas with multiple aerodromes, a single rounded value of magnetic variation should be applied so that the procedures that service multiple aerodromes use a single, common variation value.*

2.16 Typography

Note.— *Samples of type suitable for use on aeronautical charts are included in the Aeronautical Chart Manual (Doc 8697).*

2.17 Aeronautical data

2.17.1 Each Contracting State 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 as outlined in Annex 15, 3.1.7. The execution of such quality management shall be made demonstrable for each function stage, when required. In addition, States shall ensure that established procedures exist in order that aeronautical data at any moment is traceable to its origin so to allow any data anomalies or errors, detected during the production/maintenance phases or in the operational use, to be corrected.

Note.— *Specifications governing the quality system are given in Annex 15, Chapter 3.*

2.17.2 States shall ensure that the order of chart resolution of aeronautical data shall be that as specified for a particular chart and as presented in a tabular form in Appendix 6.

2.17.3 Contracting States shall ensure that integrity of aeronautical data is maintained throughout the data process from survey/origin to the next intended user. Aeronautical data integrity requirements shall be based upon the potential risk resulting

from the corruption of data and upon the use to which the data item is put. Consequently, the following classification and data integrity level shall apply:

- a) critical data, integrity level 1×10^{-8} : 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, integrity level 1×10^{-5} : 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; and
- c) routine data, integrity level 1×10^{-3} : 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.

2.17.4 Aeronautical data quality requirements related to the integrity and data classification shall be as provided in Tables 1 to 6 in Appendix 6.

2.17.5 Electronic aeronautical data sets shall be protected by the inclusion in the data sets of a 32-bit cyclic redundancy check (CRC) implemented by the application dealing with the data sets. This shall apply to the protection of all integrity levels of data sets as specified in 2.17.3.

Note.— *Guidance material on the aeronautical data quality requirements (accuracy, resolution, integrity, protection and traceability) is contained in the World Geodetic System — 1984 (WGS-84) Manual (Doc 9674). Supporting material in respect of the provisions of Appendix 6 related to chart resolution and integrity of aeronautical data is contained in RTCA Document DO-201A and European Organization for Civil Aviation Equipment (EUROCAE) Document ED-77 — Industry Requirements for Aeronautical Information.*

2.18 Common reference systems

2.18.1 Horizontal reference system

2.18.1.1 World Geodetic System — 1984 (WGS-84) shall be used as the horizontal (geodetic) reference system. Published aeronautical geographical coordinates (indicating latitude and longitude) shall be expressed in terms of the WGS-84 geodetic reference datum.

Note.— *Comprehensive guidance material concerning WGS-84 is contained in the World Geodetic System — 1984 (WGS-84) Manual (Doc 9674).*

2.18.1.2 Geographical coordinates which have been transformed into WGS-84 coordinates but whose accuracy of original field work does not meet the requirements in Annex 11, Chapter 2, and Annex 14, Volumes I and II, Chapter 2, shall be identified by an asterisk.

2.18.1.3 The order of chart resolution of geographical coordinates shall be that specified for a particular chart series and in accordance with Appendix 6, Table 1.

Note.— *Specifications governing the determination and reporting (accuracy of field work and data integrity) of WGS-84-related aeronautical coordinates for geographical positions established by air traffic services are given in Annex 11, Chapter 2, and Appendix 5, Table 1; and for aerodrome/heliport-related positions, in Annex 14, Volumes I and II, Chapter 2, and in Table A5-1 of Appendix 5 and Table A1-1 of Appendix 1, respectively.*

CHAPTER 5. AERODROME TERRAIN AND OBSTACLE CHART — ICAO (ELECTRONIC)

5.1 Function

This electronic chart shall portray the terrain and obstacle data in combination with aeronautical data, as appropriate, necessary to:

- a) enable an operator to comply with the operating limitations of Annex 6, Part I, Chapter 5, and Part III, Section II, Chapter 3, by developing contingency procedures for use in the event of an emergency during a missed approach or take-off, and by performing aircraft operating limitations analysis; and
- b) support the following air navigation applications:
 - 1) instrument procedure design (including circling procedure);
 - 2) aerodrome obstacle restriction and removal; and
 - 3) provision of source data for the production of other aeronautical charts.

5.2 Availability

5.2.1 From 12 November 2015, Aerodrome Terrain and Obstacle Charts — ICAO (Electronic) shall be made available in the manner prescribed in 1.3.2 for aerodromes regularly used by international civil aviation.

Note 1.— Where the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) is made available, the Aerodrome Obstacle Chart — ICAO Type A (Operating Limitations) and the Aerodrome Obstacle Chart — ICAO Type B are not required (see 3.2.1 and 4.2.1).

Note 2.— The information required by the Precision Approach Terrain Chart — ICAO may be provided in the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic). Where this occurs, the Precision Approach Terrain Chart — ICAO is not required (see 6.2.1).

5.2.2 **Recommendation.**— *Aerodrome Terrain and Obstacle Charts — ICAO (Electronic) should be made available in the manner prescribed in 1.3.2 for all aerodromes regularly used by international civil aviation.*

5.2.3 The Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) shall also be made available in hard copy format upon request.

Note.— For specifications regarding hard copy printed output, see 5.7.7.

5.2.4 The ISO 19100 series of standards for geographic information shall be used as a general data modelling framework.

Note.— The use of the ISO 19100 series of standards for geographic information supports the interchange and use of the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) among different users.

5.3 Identification

Electronic charts shall be identified by the name of the country in which the aerodrome is located, the name of the city or town which the aerodrome serves, and the name of the aerodrome.

5.4 Chart coverage

The extent of each chart shall be sufficient to cover Area 2 as specified in Annex 15, 10.1.

5.5 Chart content

5.5.1 General

5.5.1.1 When developing computer graphic applications that are used to portray features on the chart, the relationships between features, feature attributes, and the underlying spatial geometry and associated topological relationships shall be specified by an application schema. Portrayed information shall be provided on the basis of portrayal specifications applied according to defined portrayal rules. Portrayal specifications and portrayal rules shall not be part of the data set. Portrayal rules shall be stored in a portrayal catalogue which shall make reference to separately stored portrayal specifications.

Note.— ISO Standard 19117 contains a definition of the schema describing the portrayal mechanism of feature-based geographic information, while ISO Standard 19109 contains rules for application schema. Spatial geometry and associated topological relationships are defined in ISO Standard 19107.

5.5.1.2 Symbols used to portray features shall be in accordance with 2.4 and Appendix 2 — ICAO Chart Symbols.

5.5.2 Terrain feature

5.5.2.1 The terrain feature, and associated attributes, to be portrayed and database-linked to the chart shall be based on the electronic terrain data sets which satisfy the requirements of Annex 15, Chapter 10 and Appendix 8.

5.5.2.2 The terrain feature shall be portrayed in a manner that provides an effective general impression of a terrain. This shall be a representation of terrain surface by continuous elevation values at all intersections of the defined grid, also known as the Digital Elevation Model (DEM).

Note.— In accordance with Annex 15, Chapter 10 and Appendix 8, the DEM for Area 2 post spacing (grid) is specified at 1 arc second (approximately 30 m).

5.5.2.3 **Recommendation.**— *Representation of terrain surface should be provided as a selectable layer of contour lines in addition to the DEM.*

5.5.2.4 **Recommendation.**— *An ortho-rectified image which matches the features on the DEM with features on the overlying image should be used to enhance the DEM. The image should be provided as a separate selectable layer.*

5.5.2.5 The portrayed terrain feature shall be linked to the following associated attributes in the database(s):

- a) horizontal positions of grid points in geographic coordinates and elevations of the points;

APPENDIX 6. AERONAUTICAL DATA QUALITY REQUIREMENTS

Table 1. Latitude and longitude

Latitude and longitude	Chart resolution	Integrity / Classification
Flight information region boundary points	as plotted	1×10^{-3} / routine
P, R, D area boundary points (outside CTA/CTR boundaries)	as plotted	1×10^{-3} / routine
P, R, D area boundary points (inside CTA/CTR boundaries)	as plotted	1×10^{-5} / essential
CTA/ CTR boundary points.....	as plotted	1×10^{-5} / essential
En-route nav aids, intersections and waypoints, and holding, and STAR/SID points.....	1 sec	1×10^{-5} / essential
Obstacles in Area 1 (the entire State territory).....	as plotted	1×10^{-3} / routine
Aerodrome/heliport reference point.....	1 sec	1×10^{-3} / routine
Nav aids located at the aerodrome/heliport.....	as plotted	1×10^{-5} / essential
Obstacles in Area 3.....	1/10 sec	1×10^{-5} / essential
Obstacles in Area 2.....	1/10 sec	1×10^{-5} / essential
Final approach fixes/points and other essential fixes/points comprising the instrument approach procedure	1 sec	1×10^{-5} / essential
Runway thresholds	1 sec	1×10^{-8} / critical
Taxiway centre line/parking guidance line points.....	1/100 sec	1×10^{-5} / essential
Runway end.....	1 sec	1×10^{-8} / critical
Runway holding position.....	1 sec	1×10^{-8} / critical
Taxiway intersection marking line.....	1 sec	1×10^{-5} / essential
Exit guidance line	1 sec	1×10^{-5} / essential
Apron boundaries (polygon).....	1 sec	1×10^{-3} / routine
De-/anti-icing facility (polygon).....	1 sec	1×10^{-3} / routine
Aircraft standpoints/INS checkpoints	1/100 sec	1×10^{-3} / routine
Geometric centre of TLOF or FATO thresholds, heliports.....	1 sec	1×10^{-8} / critical

Note.— See Annex 15, Appendix 8, for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.

Table 2. Elevation/altitude/height

Elevation/altitude/height	Chart resolution	Integrity / Classification
Aerodrome/heliport elevation.....	1 m or 1 ft	1×10^{-5} / essential
WGS-84 geoid undulation at aerodrome/heliport elevation position.....	1 m or 1 ft	1×10^{-5} / essential
Runway or FATO threshold, non-precision approaches.....	1 m or 1 ft	1×10^{-5} / essential
WGS-84 geoid undulation at runway or FATO threshold, TLOF geometric centre, non-precision approaches.....	1 m or 1 ft	1×10^{-5} / essential
Runway or FATO threshold, precision approaches.....	0.5 m or 1 ft	1×10^{-8} / critical
WGS-84 geoid undulation at runway or FATO threshold, TLOF geometric centre, precision approaches.....	0.5 m or 1 ft	1×10^{-8} / critical
Threshold crossing height, precision approaches.....	0.5 m or 1 ft	1×10^{-8} / critical
Obstacle clearance altitude/height (OCA/H).....	as specified in PANS-OPS (Doc 8168)	1×10^{-5} / essential
Obstacles in Area 1 (the entire State territory).....	3 m (10 ft)	1×10^{-3} / routine
Obstacles in Area 2.....	1 m or 1 ft	1×10^{-5} / essential
Obstacles in Area 3.....	1 m or 1 ft	1×10^{-5} / essential
Distance measuring equipment (DME).....	30 m (100 ft)	1×10^{-5} / essential
Instrument approach procedures altitude.....	as specified in PANS-OPS (Doc 8168)	1×10^{-5} / essential
Minimum altitudes.....	50 m or 100 ft	1×10^{-3} / routine

Note.— See Annex 15, Appendix 8, for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.