AERONAUTICAL CHARTING STANDARDS

CHAPTER 1: APPLICABILITY

1.1 The standards for aeronautical charting are applicable to the design, maintenance and amendment of aeronautical charts for publication in aeronautical information products.

1.2 The standards are to be applied by an approval holder in the design, maintenance and amendment of aeronautical charts prior to their approval for publication in aeronautical information products.

1.3 The standards do not apply to aeronautical charts that are not intended for publication in aeronautical information products.

CHAPTER 2: GENERAL SPECIFICATIONS

The standards contained in this chapter are applicable to all ICAO aeronautical charts unless otherwise stated in the specifications of the chart concerned.

2.1 Operational requirements for charts

2.1.1 For the purposes of this standard, the total flight is divided into the following phases:
Phase 1 — Taxi from aircraft stand to take-off point
Phase 2 — Take-off and climb to en-route ATS route structure Phase 3 — En-route ATS route structure
Phase 4 — Descent to approach
Phase 5 — Approach to land and missed approach
Phase 6 — Landing and taxi to aircraft stand.

2.1.2 Each type of chart shall provide information relevant to the function of the chart and its design shall observe Human Factors principles which facilitate its optimum use.

2.1.3 Each type of chart shall provide information appropriate to the phase of flight to ensure the safe and expeditious operation of the aircraft.

2.1.4 The presentation of information shall be accurate, free from distortion and clutter, unambiguous, and be readable under all normal operating conditions.

2.1.5 Colours or tints and type size used shall be such that the chart can be easily read and interpreted by the pilot in varying conditions of natural and artificial light.

2.1.6 The information shall be in a form which enables the pilot to acquire it in a reasonable time consistent with workload and operating conditions.

2.1.7 The presentation of information provided on each type of chart shall permit smooth transition from chart to chart as appropriate to the phase of flight.

2.1.8 The charts should be True North orientated.

2.1.9 The basic sheet size of the charts should be 210 x 148 mm (8.27 x 5.82 in) (A5).

2.1.10 The approval holder 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.

2.1.11 The approval holder shall on request by another contracting state provide all information relating to its own territory that is necessary to enable the Standards that are contained herein to be met.

2.2 Titles

The title of a chart or chart series prepared in accordance with the specifications contained in this standard and intended to satisfy the function of the chart shall be that of the relevant chapter heading as modified by application of any Standard contained therein, except that such title shall not include “ICAO” unless the chart conforms with all Standards specified in this Chapter 2 and any specified for the particular chart.

2.3 Miscellaneous information

The marginal note layout shall be as given in Appendix 1, except as otherwise specified for a particular chart.

The following information shall be shown on the face of each chart unless otherwise stated in the specification of the chart concerned:

a) designation or title of the chart series, which may be abbreviated.

b) name and reference of the sheet;

c) on each margin an indication of the adjoining sheet (when applicable).

A legend to the symbols and abbreviations used shall be provided. The legend shall be on the face or reverse of each chart except that, where it is impracticable for reasons of space, a legend may be published separately.

2.3.1 The name and adequate address of the producing agency shall be shown in the margin of the chart except that, where the chart is published as part of an aeronautical document, this information may be placed in the front of that document.

2.4 Symbols

2.4.1 Symbols used shall conform to those shown in Appendix 2 — ICAO Chart Symbols, except that where it is desired to show on an aeronautical chart special features or items of importance to civil aviation for which no ICAO symbol is at present provided, any appropriate symbol may be chosen for this purpose, provided that it does not cause confusion with any existing ICAO chart symbol or impair the legibility of the chart.

2.4.2 The size and prominence of symbols and the thickness and spacing of lines may be varied according to the scale and functions of the chart, with due regard to the importance of the information they convey.

2.4.3 To represent ground-based navigation aids, intersections and waypoints, the same basic symbol shall be used on all charts on which they appear, regardless of chart purpose.

2.4.4 The symbol used for significant points shall be based on a hierarchy of symbols and selected in the following order: ground-based navigation aid, intersection, waypoint symbol. A waypoint symbol shall be used only when a particular significant point does not already exist as either a ground-based navigation aid or intersection.

2.4.5 Symbols are shown in the manner specified in 2.4.2, 2.4.3 and Appendix 2 — ICAO Chart Symbols, symbol number 121.

2.5 Units of measurement

2.5.1 Distances shall be derived as geodesic distances.

2.5.2 Distances shall be expressed in either kilometres or nautical miles or both, provided the units are clearly differentiated.

2.5.3 Altitudes, elevations and heights shall be expressed in either metres or feet or both, provided the units are clearly differentiated.

2.5.4 Linear dimensions on aerodromes and short distances shall be expressed in metres.

2.5.5 The order of resolution of distances, dimensions, elevations and heights shall be that as specified for a particular chart.

2.5.6 The units of measurement used to express distances, altitudes, elevations and heights shall be conspicuously stated on the face of each chart.

2.5.7 Conversion scales (kilometres/nautical miles, metres/feet) shall be provided on each chart on which distances, elevations or altitudes are shown. The conversion scales shall be placed on the face of each chart.

2.6 Scale and projection

2.6.1 For charts of large areas, the name and basic parameters and scale of the projection shall be indicated.

2.6.2 For charts of small areas, a linear scale only shall be indicated.

2.7 Date of validity of aeronautical information

The date of validity of aeronautical information shall be clearly indicated on the face of each chart.

2.8 Spelling of geographical names

2.8.1 The symbols of the Roman alphabet shall be used for all writing.

2.8.2 The names of places and of geographical features in countries which officially use varieties of the Roman alphabet shall be accepted in their official spelling, including the accents and diacritical marks used in the respective alphabets.

2.8.3 Where a geographical term such as “cape”, “point”, “gulf”, “river” is abbreviated on any particular chart, that word shall be spelt out in full in the language used by the publishing agency, in respect of the most important example of each type. Punctuation marks shall not be used in abbreviations within the body of a chart.

2.8.4 In areas where romanized names have not been officially produced or adopted, and outside the territory of the State, names should be transliterated from the non-Roman alphabet form by the system generally used by the producing agency.

2.9 Abbreviations

2.9.1 Abbreviations shall be used on aeronautical charts whenever they are appropriate.

2.9.2 Where applicable, abbreviations should be selected from Part 1.

2.10 Political boundaries

2.10.1 International boundaries shall be shown, but may be interrupted if data more important to the use of the chart would be obscured.

2.10.2 Where the territory of more than one State appears on a chart, the names identifying the countries shall be indicated.

In the case of a dependent territory, the name of the sovereign State may be added in brackets.

2.11 Colours

Colours used on charts shall conform to Appendix 3 — Colour Guide.

2.12 Relief

2.12.1 Relief, where shown, shall be portrayed in a manner that will satisfy the chart users' need for:

a) orientation and identification;

b) safe terrain clearance;

c) clarity of aeronautical information when shown;

d) planning.

Relief is portrayed by combinations of contours, hypsometric tints, spot elevations and hill shading, the choice of method being affected by the nature and scale of the chart and its intended use.

2.12.2 Where relief is shown by hypsometric tints, the tints used should be based on those shown in the Hypsometric Tint Guide in Appendix 4.

2.12.3 Where spot elevations are used, they shall be shown for selected critical points.

2.12.3.1 The value of spot elevations of doubtful accuracy shall be followed by the sign '.

2.13 Prohibited, restricted and danger areas

When prohibited, restricted or danger areas are shown, the reference or other identification shall be included, except that the nationality letters may be omitted.

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 On charts used for visual flight, those parts of the ATS Airspace Classes in Part 172 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 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.

The date and the annual change may be shown.

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

2.15.4 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

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 The approval holder 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 Part 175.03.2 The execution of such quality management shall be made demonstrable for each function stage, when required. In addition, the approval holder 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.

2.17.2 The approval holder 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 The approval holder shall ensure that integrity of aeronautical data is maintained throughout the data process from survey/origin to the next intended user. Based on the applicable integrity classification, the validation and verification procedures shall:

a) for routine data: avoid corruption throughout the processing of the data;

b) for essential data: assure corruption does not occur at any stage of the entire process and may include additional processes as needed to address potential risks in the overall system architecture to further assure data integrity at this level; and

c) for critical data: 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 thorough analysis of the overall system architecture as potential data integrity risks.

Error producing faults in the entire process may be mitigated by additional data quality assurance techniques as may be required. These could include application tests for critical data (for example, by flight check); the use of security, logic, semantic, comparison, and redundancy checks; digital error detection; and the qualification of human resources and process tools such as hardware and software.

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.

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.

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 Part 139 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.

2.18.2 Vertical reference system

2.18.2.1 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.

The geoid globally most closely approximates MSL. It is defined as the equipotential surface in the gravity field of the Earth that coincides with the undisturbed MSL extended continuously through the continents.

Gravity-related heights (elevations) are also referred to as orthometric heights while distances of points above the ellipsoid are referred to as ellipsoidal heights.

2.18.2.2 In addition to the elevations referenced to MSL, for the specific surveyed ground positions, geoid undulation (referenced to the WGS-84 ellipsoid) for those positions shall also be published as specified for a particular chart.

2.18.2.3 The order of chart resolution of elevation and geoid undulation shall be that specified for a particular chart series and in accordance with Appendix 6, Table 2.

2.18.3 Temporal reference system

2.18.3.1 The Gregorian calendar and Coordinated Universal Time (UTC) shall be used as the temporal reference system.

2.18.3.2 When a different temporal reference system is used for charting, this shall be indicated in GEN 2.1.2 of the Aeronautical Information Publication (AIP).

CHAPTER 3: AERODROME OBSTACLE CHART — ICAO TYPE A (OPERATING LIMITATIONS)

3.1 Function

This chart, in combination with the relevant information published in the AIP, shall provide the data necessary to enable an operator to comply with the operating limitations of Part 91.

3.2 Availability

3.2.1 Aerodrome Obstacle Charts — ICAO Type A (Operating Limitations) shall be made available in the manner prescribed in 1.3.2 for all aerodromes regularly used by international civil aviation, except for those aerodromes where there are no obstacles in the take-off flight path areas or where the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) is provided in accordance with Chapter 5.

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

3.3 Units of measurement

3.3.1 Elevations shall be shown to the nearest half-metre or to the nearest foot.

3.3.2 Linear dimensions shall be shown to the nearest half-metre.

3.4 Coverage and scale

3.4.1 The extent of each plan shall be sufficient to cover all obstacles.

Isolated distant obstacles that would unnecessarily increase the sheet size may be indicated by the appropriate symbol and an arrow, provided that the distance and bearing from the end of the runway farthest removed and the elevation are given.

3.4.2 The horizontal scale shall be within the range of 1:10 000 to 1:15 000.

3.4.3 The horizontal scale should be 1:10 000.

When the production of the charts would be expedited thereby, a scale of 1:20 000 may be used.

3.4.4 The vertical scale shall be ten times the horizontal scale.

3.4.5 Linear scales. Horizontal and vertical linear scales showing both metres and feet shall be included in the charts.

3.5 Format

3.5.1 The charts shall depict a plan and profile of each runway, any associated stopway or clearway, the take-off flight path area and obstacles.

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

3.5.3 A profile grid shall be ruled over the entire profile area exclusive of the runway. The zero for vertical coordinates shall be mean sea level. The zero for horizontal coordinates shall be the end of the runway furthest from the take-off flight path area concerned. Graduation marks indicating the sub-divisions of intervals shall be shown along the base of the grid and along the vertical margins.

3.5.3.1 The vertical grid should have intervals of 30 m (100 ft) and the horizontal grid should have intervals of 300 m (1 000 ft).

3.5.4 The chart shall include:

a) a box for recording the operational data specified in 3.8.3;

b) a box for recording amendments and dates thereof.

3.6 Identification

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

3.7 Magnetic variation

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

3.8 Aeronautical data

3.8.1 Obstacles

3.8.1.1 Objects in the take-off flight path area which project above a plane surface having a 1.2 per cent slope and having a common origin with the take-off flight path area shall be regarded as obstacles, except that obstacles lying wholly below the shadow of other obstacles as defined in 3.8.1.2 need not be shown. Mobile objects such as boats, trains and trucks, which may project above the 1.2 per cent plane, shall be considered obstacles but shall not be considered as being capable of creating a shadow.

3.8.1.2 The shadow of an obstacle is considered to be a plane surface originating at a horizontal line passing through the top of the obstacle at right angles to the centre line of the take-off flight path area. The plane covers the complete width of the take-off flight path area and extends to the plane defined in 3.8.1.1 or to the next higher obstacle if it occurs first. For the first

300 m (1 000 ft) of the take-off flight path area, the shadow planes are horizontal and beyond this point such planes have an upward slope of 1.2 per cent.

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

3.8.2 Take-off flight path area

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

a) it commences at the end of the area declared suitable for take-off (i.e. at the end of the runway or clearway as appropriate);

b) its width at the point of origin is 180 m (600 ft) and this width increases at the rate of 0.25D to a maximum of 1 800 m (6 000 ft), where D is the distance from the point of origin;

c) it extends to the point beyond which no obstacles exist or to a distance of 10.0 km (5.4 NM), whichever is the lesser.

3.8.2.2 For runways serving aircraft having operating limitations which do not preclude the use of a take-off flight path gradient of less than 1.2 per cent, the extent of the take-off flight path area specified in 3.8.2.1 c) shall be increased to not less than 12.0 km (6.5 NM) and the slope of the plane surface specified in 3.8.1.1 and 3.8.1.2 shall be reduced to 1.0 per cent or less.

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

3.8.3 Declared distances

3.8.3.1 The following information for each direction of each runway shall be entered in the space provided:

a) take-off run available;

b) accelerate-stop distance available;

c) take-off distance available;

d) landing distance available.

In Part 139, guidance is given on declared distances.

3.8.3.2 Where a declared distance is not provided because a runway is usable in one direction only, that runway should be identified as “not usable for take-off, landing or both”.

3.8.4 Plan and profile views

3.8.4.1 The plan view shall show:

a) the outline of the runways by a solid line, including the length and width, the magnetic bearing to the nearest degree, and the runway number;

b) the outline of the clearways by a broken line, including the length and identification as such;

c) take-off flight path areas by a dashed line and the centre line by a fine line consisting of short and long dashes;

d) alternative take-off flight path areas. When alternative take-off flight path areas not centred on the extension of the runway centre line are shown, notes shall be provided explaining the significance of such areas;

e) obstacles, including:

1) the exact location of each obstacle together with a symbol indicative of its type;

2) the elevation and identification of each obstacle;

3) the limits of penetration of obstacles of large extent in a distinctive manner identified in the legend.

This does not exclude the necessity for indicating critical spot elevations within the take-off flight path area.

3.8.4.1.1 The nature of the runway and stopway surfaces should be indicated.

3.8.4.1.2 Stopways should be identified as such and should be shown by a broken line.

3.8.4.1.3 When stopways are shown, the length of each stopway shall be indicated.

3.8.4.2 The profile view shall show:

a) the profile of the centre line of the runway by a solid line and the profile of the centre line of any associated stopways and clearways by a broken line;

b) the elevation of the runway centre line at each end of the runway, at the stopway and at the origin of each take- off flight path area, and at each significant change in slope of runway and stopway;

c) obstacles, including:

1) each obstacle by a solid vertical line extending from a convenient grid line over at least one other grid line to the elevation of the top of the obstacle;

2) identification of each obstacle;

3) the limits of penetration of obstacles of large extent in a distinctive manner identified in the legend.

An obstacle profile consisting of a line joining the tops of each obstacle and representing the shadow created by successive obstacles may be shown.

3.9 Accuracy

3.9.1 The order of accuracy attained shall be shown on the chart.

3.9.2 The horizontal dimensions and the elevations of the runway, stopway and clearway to be printed on the chart should be determined to the nearest 0.5 m (1 ft).

3.9.3 The order of accuracy of the field work and the precision of chart production should be such that measurements in the take-off flight path areas can be taken from the chart within the following maximum deviations:

a) horizontal distances: 5 m (15 ft) at a point of origin increasing at a rate of 1 per 500;

b) vertical distances: 0.5 m (1.5 ft) in the first 300 m (1 000ft) and increasing at a rate of 1 per 1 000.

3.9.4 Datum. Where no accurate datum for vertical reference is available, the elevation of the datum used shall be stated and shall be identified as assumed.

CHAPTER 4: AERODROME OBSTACLE CHART — ICAO TYPE B

4.1 Function

This chart shall provide information to satisfy the following functions:

a) the determination of minimum safe altitudes/heights including those for circling procedures;

b) the determination of procedures for use in the event of an emergency during take-off or landing;

c) the application of obstacle clearing and marking criteria; and

d) the provision of source material for aeronautical charts.

4.2 Availability

4.2.1 Aerodrome Obstacle Charts — ICAO Type B should be made available, in the manner prescribed in 1.3.2, for all aerodromes regularly used by international civil aviation except for those aerodromes where the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) is provided in accordance with Chapter 5.

4.2.2 When a chart combining the specifications of Chapters 3 and 4 is made available, it shall be called the Aerodrome Obstacle Chart — ICAO (Comprehensive).

4.3 Units of measurement

4.3.1 Elevations shall be shown to the nearest half-metre or to the nearest foot.

4.3.2 Linear dimensions shall be shown to the nearest half-metre.

4.4 Coverage and scale

4.4.1 The extent of each plan shall be sufficient to cover all obstacles.

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

4.4.2 The horizontal scale shall be within the range of 1:10 000 to 1:20 000.

4.4.3 A horizontal linear scale showing both metres and feet shall be included in the chart. When necessary, a linear scale for kilometres and a linear scale for nautical miles shall also be shown.

4.5 Format

The charts shall include:

a) any necessary explanation of the projection used;

b) any necessary identification of the grid used;

c) a notation indicating that obstacles are those which penetrate the surfaces specified in Part 139;

d) a box for recording amendments and dates thereof; and

e) outside the neat line, every minute of latitude and longitude marked in degrees and minutes.

Lines of latitude and longitude may be shown across the face of the chart.

4.6 Identification

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

4.7 Culture and topography

4.7.1 Drainage and hydrographic details shall be kept to a minimum.

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

4.7.3 All objects, either cultural or natural, that project above the take-off and approach surfaces specified in 4.9 or the clearing and marking surfaces specified in Part 139, shall be shown.

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

Geographical names of features may be shown if of significance.

4.8 Magnetic variation

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

4.9 Aeronautical data

4.9.1 The charts shall show:

a) the aerodrome reference point and its geographical coordinates in degrees, minutes and seconds;

b) the outline of the runways by a solid line;

c) the length and width of the runway;

d) the magnetic bearing to the nearest degree of the runway and the runway number;

e) the elevation of the runway centre line at each end of the runway, at the stopway, at the origin of each take-off and approach area, and at each significant change of slope of runway and stopway;

f) taxiways, aprons and parking areas identified as such, and the outlines by a solid line;

g) stopways identified as such and depicted by a broken line;

h) the length of each stopway;

i) clearways identified as such and depicted by a broken line;

j) the length of each clearway;

k) take-off and approach surfaces identified as such and depicted by a broken line;

l) take-off and approach areas;

The take-off area is described in 3.8.2.1. The approach area consists of an area on the surface of the earth lying directly below the approach surface as specified in Part 139.

m) obstacles at their exact location, including:

1) a symbol indicative of their type;

2) elevation;

3) identification;

4) limits of penetration of large extent in a distinctive manner identified in the legend;

This does not exclude the necessity for indicating critical spot elevations within the take-off and approach areas.

n) any additional obstacles, as determined by 3.8.1.1 including the obstacles in the shadow of an obstacle, which would otherwise be exempted.

The specifications in Part 139, are minimum requirements. Where the competent authority has established lower surfaces, they may be used in the determination of obstacles.

4.9.1.1 The nature of the runway and stopway surfaces should be given.

4.9.1.2 Wherever practicable, the highest object or obstacle between adjacent approach areas within a radius of 5 000 m (15 000 ft) from the aerodrome reference point should be indicated in a prominent manner.

4.9.1.3 The extent of tree areas and relief features, part of which constitute obstacles, should be shown.

4.10 Accuracy

4.10.1 The order of accuracy attained shall be shown on the chart.

4.10.2 The horizontal dimensions and the elevations of the movement area, stopways and clearways to be printed on the chart should be determined to the nearest 0.5 m (1 ft).

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

a) Take-off and approach areas:

1) horizontal distances: 5 m (15 ft) at point of origin increasing at a rate of 1 per 500;

2) vertical distances: 0.5 m (1.5 ft) in the first 300 m (1 000 ft) and increasing at a rate of 1 per 1 000.

b) Other areas:

1) horizontal distances: 5 m (15 ft) within 5 000 m (15 000 ft) of the aerodrome reference point and 12 m (40 ft) beyond that area;

2) vertical distances: 1 m (3 ft) within 1 500 m (5 000 ft) of the aerodrome reference point increasing at a rate of 1 per 1 000.

4.10.4 Datum. Where no accurate datum for vertical reference is available, the elevation of the datum used shall be stated and identified as assumed.

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 Part 91, 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 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.

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).

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 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.

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.

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 SA CATS 175.

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 Part 175.

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 CATS Part 175, the DEM for Area 2 post spacing (grid) is specified at 1 arc second (approximately 30 m).

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

5.5.2.4 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;

b) surface type;

c) contour line values, if provided; and

d) names of cities, towns and other prominent topographic features.

5.5.2.6 Other terrain attributes specified in CATS Part 175, and provided in the database(s) should be linked to the portrayed terrain feature.

5.5.3 Obstacle features

5.5.3.1 Obstacle features, and associated attributes, portrayed or database-linked to the chart shall be based on electronic obstacle data sets which satisfy the requirements of CATS Part 175.

5.5.3.2 Each obstacle shall be portrayed by an appropriate symbol and obstacle identifier.

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

a) horizontal position in geographic coordinates and associated elevation;

b) obstacle type; and

c) obstacle extent, if appropriate.

5.5.3.4 Other obstacle attributes specified in CATS Part 175, and provided in the database(s) should be linked to the portrayed obstacle feature.

5.5.4 Aerodrome features

5.5.4.1 Aerodrome features, and associated attributes, portrayed and database-linked to the chart shall be based on aerodrome data which satisfy the requirements of Part 139.

5.5.4.2 The following aerodrome features shall be portrayed by an appropriate symbol:

a) aerodrome reference point;

b) runway(s), with designation numbers, and if available, stopway(s) and clearway(s); and

c) taxiways, aprons, large buildings and other prominent aerodrome features.

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

a) geographical coordinates of the aerodrome reference point;

b) aerodrome magnetic variation, year of information and annual change;

Magnetic variation may be database-linked to the aerodrome reference point.

c) length and width of runway(s), stopway(s) and clearway(s);

d) type of surface of runway(s) and stopway(s);

e) magnetic bearings of the runway(s) to the nearest degree;

f) elevations at each end of runway(s), stopway(s) and clearway(s), and at each significant change in slope of runway(s) and stopway(s);

g) declared distances for each runway direction, or the abbreviation “NU” where a runway direction cannot be used for take-off or landing or both.

SA CATS Part 139 provides guidance on declared distances.

5.5.5 Radio navigation aid features

Each radio navigation aid feature located within the chart coverage shall be portrayed by an appropriate symbol.

Navigation aid feature attributes may be linked to the portrayed navigation aid features in the database(s).

5.6 Accuracy and resolution

5.6.1 The order of accuracy of aeronautical data shall be as specified in Part 172, and Part 139. The order of accuracy of terrain and obstacle data shall be as specified in SA CATS Part 175.

5.6.2 The aeronautical data resolution and the resolution for terrain and obstacle data shall be as specified in SA CATS Part 175.

5.7 Electronic functionality

5.7.1 It shall be possible to vary the scale at which the chart is viewed. Symbols and text size shall vary with chart scale to enhance readability.

5.7.2 Information on the chart shall be geo-referenced, and it shall be possible to determine cursor position to at least the nearest second.

5.7.3 The chart shall be compatible with widely available desktop computer hardware, software and media.

5.7.4 The chart should include its own “reader” software.

5.7.5 It shall not be possible to remove information from the chart without an authorized update.

5.7.6 When, due to congestion of information, the details necessary to support the function of the chart cannot be shown with sufficient clarity on a single comprehensive chart view, selectable information layers shall be provided to allow for the customized combination of information.

An electronic chart format with user-selectable information layers is the preferred method of presentation for most aerodrome features.

5.7.7 It shall be possible to print the chart in hard copy format according to the content specifications and scale determined by the user.

Note 1.— Printed output may consist of “tiled” sheets or specific selected areas according to user requirements.
Note 2.— Feature attribute information available through database link may be supplied separately on appropriately referenced sheets.

5.8 Chart data product specifications

5.8.1 A comprehensive statement of the data sets comprising the chart shall be provided in the form of data product specifications on which basis air navigation users will be able to evaluate the chart data product and determine whether it fulfils the requirements for its intended use (application).

5.8.2 The chart data product specifications shall include an overview, a specification scope, a data product identification, data content information, the reference systems used, the data quality requirements, and information

on data capture, data maintenance, data portrayal, data product delivery, as well as any additional information available, and metadata.

ISO Standard 19131 specifies the requirements and outline of data product specifications for geographic information.

5.8.3 The overview of the chart data product specifications shall provide an informal description of the product and shall contain general information about the data product. The specification scope of the chart data product specifications shall contain the spatial (horizontal) extent of the chart coverage. The chart data product identification shall include the title of the product, a brief narrative summary of the content and purpose, and a description of the geographic area covered by the chart.

5.8.4 The data content of the chart data product specifications shall clearly identify the type of coverage and/or imagery and shall provide a narrative description of each.

ISO Standard 19123 contains schema for coverage geometry and functions.

5.8.5 The chart data product specifications shall include information that defines the reference systems used. This shall include the spatial reference system (horizontal and vertical) and, if appropriate, temporal reference system. The chart data product specifications shall identify the data quality requirements. This shall include a statement on acceptable conformance quality levels and corresponding data quality measures. This statement shall cover all the data quality elements and data quality sub-elements, even if only to state that a specific data quality element or sub-element is not applicable.

ISO Standard 19113 contains quality principles for geographic information while ISO Standard 19114 covers quality evaluation procedures.

5.8.6 The chart data product specifications shall include a data capture statement which shall be a general description of the sources and of processes applied for the capture of chart data. The principles and criteria applied in the maintenance of the chart shall also be provided in the chart data product specifications, including the frequency with which the chart product is updated. Of particular importance shall be the maintenance information of obstacle data sets included on the chart and an indication of the principles, methods and criteria applied for obstacle data maintenance.

5.8.7 The chart data product specifications shall contain information on how data are portrayed on the chart, as detailed in 5.5.1.1. The chart data product specifications shall also contain data product delivery information which shall include delivery formats and delivery medium information.

5.8.8 The core chart metadata elements shall be included in the chart data product specifications. Any additional metadata items required to be supplied shall be stated in the product specifications together with the format and encoding of the metadata.

ISO Standard 19115 specifies requirements for geographic information metadata.
The chart data product specifications document the chart data product which is implemented as data set. Those data sets are described by metadata.

CHAPTER 6. PRECISION APPROACH TERRAIN CHART — ICAO

6.1 Function

The 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.

6.2 Availability

6.2.1 The Precision Approach Terrain Chart — ICAO shall be made available for all precision approach runways Categories II and III at aerodromes used by international civil aviation, except where the requisite information is provided in the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) in accordance with Chapter 5.

6.2.2 The Precision Approach Terrain Chart — ICAO shall be revised whenever any significant change occurs.

6.3 Scale

6.3.1 The horizontal scale should be 1:2 500, and the vertical scale 1:500.

6.3.2 When the chart includes a profile of the terrain to a distance greater than 900 m (3 000 ft) from the runway threshold, the horizontal scale should be 1:5 000.

6.4 Identification

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

6.5 Plan and profile information

6.5.1 The chart shall include:

a) a plan showing contours at 1 m (3 ft) intervals in the area 60 m (200 ft) on either side of the extended centre line of the runway, to the same distance as the profile, the contours to be related to the runway threshold;

b) an indication where the terrain or any object thereon, within the plan defined in a), differs by □3 m (10 ft) in height from the centre line profile and is likely to affect a radio altimeter;

c) a profile of the terrain to a distance of 900 m (3 000 ft) from the threshold along the extended centre line of the runway.

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

6.5.3 The ILS reference datum height should be shown to the nearest half metre or foot.

CHAPTER 7: ENROUTE CHART — ICAO

7.1 Function

This chart shall provide flight crews with information to facilitate navigation along ATS routes in compliance with air traffic services procedures.

Note.— Simplified versions of these charts are appropriate for inclusion in Aeronautical Information Publications to complement the tabulation of communication and navigation facilities.

7.2 Availability

7.2.1 The Enroute Chart — ICAO shall be made available in the manner prescribed in 1.3.2 for all areas where flight information regions have been established.

Under certain conditions, an Area Chart — ICAO may have to be provided. (See Chapter 8.)

7.2.2 Where different air traffic services routes, position reporting requirements or lateral limits of flight information regions or control areas exist in different layers of airspace and cannot be shown with sufficient clarity on one chart, separate charts shall be provided.

7.3 Coverage and scale

Note 1.— A uniform scale for charts of this type cannot be specified due to the varying degree of congestion of information in certain areas.

Note 2.— A linear scale based on the mean scale of the chart may be shown.

7.3.1 Layout of sheet lines should be determined by the density and pattern of the ATS route structure.

7.3.2 Large variations of scale between adjacent charts showing a continuous route structure shall be avoided.

7.3.3 An adequate overlap of charts shall be provided to ensure continuity of navigation.

7.4 Projection

7.4.1 A conformal projection on which a straight line approximates a great circle should be used.

7.4.2 Parallels and meridians shall be shown at suitable intervals.

7.4.3 Graduation marks shall be placed at consistent intervals along selected parallels and meridians.

7.5 Identification

Each sheet shall be identified by chart series and number.

7.6 Culture and topography

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

7.6.2 Within each quadrilateral formed by the parallels and meridians, the area minimum altitude shall be shown, except as provided for in 7.6.3.

Note 1.— Quadrilaterals formed by the parallels and meridians normally correspond to the whole degree of latitude and longitude. Regardless of the chart scale being used, the area minimum altitude relates to the consequent quadrilateral.

Note 2. — Refer to SA CATS Part 173, for method for determination of area minimum altitude.

7.6.3 In areas of high latitude where it is determined by the appropriate authority that True North orientation of the chart is impractical, the area minimum altitude should be shown within each quadrilateral formed by reference lines of the graticule (grid) used.

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

7.7 Magnetic variation

Isogonals should be indicated and the date of the isogonic information given.

7.8 Bearings, tracks and radials

7.8.1 Bearings, tracks and radials shall be magnetic, except as provided for in 7.8.2. Where bearings and tracks are additionally provided as true values for PBN segments, they shall be shown in parentheses to the nearest tenth of a degree, e.g. 290° (294.9°T).

7.8.2 In areas of high latitude where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.

7.8.3 Where bearings, tracks or radials are given with reference to True North or Grid North, this shall be clearly indicated. When Grid North is used, its reference grid meridian shall be identified.

7.9 Aeronautical data

7.9.1 Aerodromes

All aerodromes used by international civil aviation to which an instrument approach can be made shall be shown. Other aerodromes may be shown.

7.9.2 Prohibited, restricted and danger areas

Prohibited, restricted and danger areas relevant to the layer of airspace shall be depicted with their identification and vertical limits.

7.9.3 Air traffic services system

7.9.3.1 Where appropriate, the components of the established air traffic services system shall be shown.

7.9.3.1.1 The components shall include the following:

a) the radio navigation aids associated with the air traffic services system together with their names, identifications, frequencies and geographical coordinates in degrees, minutes and seconds;

b) in respect of DME, additionally the elevation of the transmitting antenna of the DME to the nearest 30 m (100 ft);

c) an indication of all designated airspace, including lateral and vertical limits and the appropriate class of airspace;

d) All ATS routes for en-route flight including route designators, the track to the nearest degree in both directions along each segment of the routes and, where established, the designation of the navigation specification(s) including any limitations and the direction of traffic flow;

Guidance material on the organization of ATS routes for en-route flight publication which may be used to facilitate charting is contained in the Aeronautical Information Services Manual (Doc 8126).

e) all significant points which define the ATS routes and are not marked by the position of a radio navigation aid, together with their name-codes and geographical coordinates in degrees, minutes and seconds;

f) in respect of waypoints defining VOR/DME area navigation routes, additionally,

1) the station identification and radio frequency of the reference VOR/DME;

2) the bearing to the nearest tenth of a degree and the distance to the nearest two-tenths of a kilometre (tenth of a nautical mile) from the reference VOR/ DME, if the waypoint is not collocated with it;

g) an indication of all compulsory and “on-request” reporting points and ATS/MET reporting points;

h) the distances to the nearest kilometre or nautical mile between significant points constituting turning points or reporting points;

Overall distances between radio navigation aids may also be shown.

i) change-over points on route segments defined by reference to very high frequency omnidirectional radio ranges, indicating the distances to the nearest kilometre or nautical mile to the navigation aids;

Change-over points established at the mid-point between two aids, or at the intersection of two radials in the case of a route which changes direction between the aids, need not be shown for each route segment if a general statement regarding their existence is made.

j) minimum en-route altitudes and minimum obstacle clearance altitudes, on ATS routes to the nearest higher 50 metres or 100 feet;

k) communication facilities listed with their channels and, if applicable, logon address and satellite voice communications (SATVOICE) number; and

l) air defence identification zone (ADIZ) properly identified.
ADIZ procedures may be described in the chart legend.

7.9.4 Supplementary information

7.9.4.1 Details of departure and arrival routes and associated holding patterns in terminal areas shall be shown unless they are shown on an Area Chart, a Standard Departure Chart — Instrument (SID) — ICAO or a Standard Arrival Chart — Instrument (STAR) — ICAO.

For specifications of these charts, see Chapters 8, 9 and 10.
Departure routes normally originate at the end of a runway; arrival routes normally terminate at the point where an instrument approach is initiated.

7.9.4.2 Where established, altimeter setting regions shall be shown and identified.

CHAPTER 8: AREA CHART — ICAO

8.1 Function

This chart shall provide the flight crew with information to facilitate the following phases of instrument flight:

a) the transition between the en-route phase and approach to an aerodrome;

b) the transition between take-off/missed approach and en-route phase of flight; and

c) flights through areas of complex ATS routes or airspace structure.

Note.— The function described in 8.1 c) may be satisfied by a separate chart or an inset on an Enroute Chart — ICAO.

8.2 Availability

8.2.1 The Area Chart — ICAO shall be made available in the manner prescribed in 1.3.2 where the air traffic services routes or position reporting requirements are complex and cannot be adequately shown on an Enroute Chart — ICAO.

8.2.2 Where air traffic services routes or position reporting requirements are different for arrivals and for departures, and these cannot be shown with sufficient clarity on one chart, separate charts shall be provided.

Note.— Under certain conditions, a Standard Departure Chart — Instrument (SID) — ICAO and a Standard Arrival Chart — Instrument (STAR) — ICAO may have to be provided (see Chapters 9 and 10).

8.3 Coverage and scale

8.3.1 The coverage of each chart shall extend to points that effectively show departure and arrival routes.

8.3.2 The chart shall be drawn to scale and a scale-bar shown.

8.4 Projection

8.4.1 A conformal projection on which a straight line approximates a great circle should be used.

8.4.2 Parallels and meridians shall be shown at suitable intervals.

8.4.3 Graduation marks shall be placed at consistent intervals along the neat lines, as appropriate.

8.5 Identification

The chart shall be identified by a name associated with the airspace portrayed.

The name may be that of the air traffic services centre, the name of the largest city or town situated in the area covered by the chart or the name of the city that the aerodrome serves. Where more than one aerodrome serves the city or town, the name of the aerodrome on which the procedures are based should be added.

8.6 Culture and topography

8.6.1 Generalized shorelines of all open water areas, large lakes and rivers shall be shown except where they conflict with data more applicable to the function of the chart.

8.6.2 To improve situational awareness in areas where significant relief exists, all relief exceeding 300 m (1 000 ft) above the elevation of the primary aerodrome should be shown by smoothed contour lines, contour values and layer tints printed in brown. Appropriate spot elevations, including the highest elevation within each top contour line, should be shown printed in black. Obstacles should also be shown.

The next higher suitable contour line appearing on base topographic maps exceeding 300 m (1 000 ft) above the elevation of the primary aerodrome may be selected to start layer tinting.

An appropriate brown colour, on which half-tone layer tinting is to be based, is specified in Appendix 3 — Colour Guide for contours and topographic features.

Appropriate spot elevations and obstacles are those provided by the procedures specialist.

8.7 Magnetic variation

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

8.8 Bearings, tracks and radials

8.8.1 Bearings, tracks and radials shall be magnetic, except as provided for in 8.8.2. Where bearings and tracks are additionally provided as true values for PBN segments, they shall be shown in parentheses to the nearest tenth of a degree, e.g. 290° (294.9°T).

8.8.2 In areas of high latitude, where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.

8.8.3 Where bearings, tracks or radials are given with reference to True North or Grid North, this shall be clearly indicated. When Grid North is used, its reference grid meridian shall be identified.

8.9 Aeronautical data

8.9.1 Aerodromes

All aerodromes which affect the terminal routings shall be shown. Where appropriate, a runway pattern symbol shall be used.

8.9.2 Prohibited, restricted and danger areas

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

8.9.3 Area minimum altitudes

Area minimum altitudes shall be shown within quadrilaterals formed by the parallels and meridians.

Quadrilaterals formed by the parallels and meridians normally correspond to the whole degree of latitude and longitude. Regardless of the chart scale being used, the area minimum altitude relates to the consequent quadrilateral.

Note 2.— Refer to SA CATS Part 173 for method for determination of area minimum altitude.

8.9.4 Air traffic services system

8.9.4.1 The components of the established relevant air traffic services system shall be shown.

8.9.4.1.1 The components shall include the following:

a) the radio navigation aids associated with the air traffic services system, together with their names, identifications, frequencies and geographical coordinates in degrees, minutes and seconds;

b) in respect of DME, additionally the elevation of the transmitting antenna of the DME to the nearest 30 m (100 ft);

c) terminal radio aids which are required for outbound and inbound traffic and for holding patterns;

d) the lateral and vertical limits of all designated airspace and the appropriate class of airspace;

e) the designation of the navigation specification(s) including any limitations, where established;

f) holding patterns and terminal routings, together with the route designators, and the track to the nearest degree along each segment of the prescribed airways and terminal routings;

g) all significant points which define the terminal routings and are not marked by the position of a radio navigation aid, together with their name-codes and geographical coordinates in degrees, minutes and seconds;

h) in respect of waypoints defining VOR/DME area navigation routes, additionally,

   1) the station identification and radio frequency of the reference VOR/DME;

   2) the bearing to the nearest tenth of a degree and the distance to the nearest two-tenths of a kilometre (tenth of a nautical mile) from the reference VOR/DME, if the waypoint is not collocated with it;

i) an indication of all compulsory and “on-request” reporting points;

j) the distances to the nearest kilometre or nautical mile between significant points constituting turning points or reporting points;

Overall distances between radio navigation aids may also be shown.

k) change-over points on route segments defined by reference to very high frequency omnidirectional radio ranges, indicating the distances to the nearest kilometre or nautical mile to the radio navigation aids;

   Change-over points established at midpoint between two aids, or at the intersection of two radials in the case of a route which changes direction between the aids, need not be shown for each route segment if a general statement regarding their existence is made.

l) minimum en-route altitudes and minimum obstacle clearance altitudes, on ATS routes to the nearest higher 50 metres or 100 feet (see Annex 11, 2.22);

m) established minimum vectoring altitudes to the nearest higher 50 m or 100 ft, clearly identified;

Where ATS surveillance systems are used to vector aircraft to or from significant points on a published standard departure or arrival route or to issue clearance for descent below the minimum sector altitude during arrival, the relevant procedures may be shown on the Area Chart — ICAO unless excessive chart clutter will result.

Where excessive chart clutter will result, an ATC Surveillance Minimum Altitude Chart — ICAO may be provided (see Chapter 21), in which case the elements indicated by 8.9.4.1.1, l), need not be duplicated on the Area Chart — ICAO.

n) area speed and level/altitude restrictions where established;

o) communication facilities listed with their channels and, if applicable, logon address and SATVOICE number; and

p) an indication of “flyover” significant points.

CHAPTER 9: STANDARD DEPARTURE CHART — INSTRUMENT (SID) — ICAO

9.1 Function

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

Provisions governing obstacle clearance criteria and details of the minimum information to be published are contained in the SA CATS Part 173.

9.2 Availability

The Standard Departure Chart — Instrument (SID) — ICAO shall be made available wherever a standard departure route — instrument has been established and cannot be shown with sufficient clarity on the Area Chart — ICAO.

9.3 Coverage and scale

9.3.1 The coverage of the chart shall be sufficient to indicate the point where the departure route begins and the specified significant point at which the en-route phase of flight along a designated air traffic services route can be commenced.

The departure route normally originates at the end of a runway.

9.3.2 The chart should be drawn to scale.

9.3.3 If the chart is drawn to scale, a scale-bar shall be shown.

9.3.4 When the chart is not drawn to scale, the annotation “NOT TO SCALE” shall be shown and the symbol for scale-break shall be used on tracks and other aspects of the chart which are too large to be drawn to scale.

9.4 Projection

9.4.1 A conformal projection on which a straight line approximates a great circle should be used.

9.4.2 When the chart is drawn to scale, parallels and meridians should be shown at suitable intervals.

9.4.3 Graduation marks shall be placed at consistent intervals along the neat lines.

9.5 Identification

The chart shall be identified by the name of the city or town or area which the aerodrome serves, the name of the aerodrome and the identification of the standard departure route(s) — instrument as established in accordance with the SA CATS Part 173.

The identification of the standard departure route(s) — instrument is provided by the procedures specialist.

9.6 Culture and topography

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

9.6.2 To improve situational awareness in areas where significant relief exists, the chart should be drawn to scale and all relief exceeding 300 m (1 000 ft) above the aerodrome elevation should be shown by smoothed contour lines, contour values and layer tints printed in brown. Appropriate spot elevations, including the highest elevation within each top contour line, should be shown printed in black. Obstacles should also be shown.

The next higher suitable contour line appearing on base topographic maps exceeding 300 m (1 000 ft) above the aerodrome elevation may be selected to start layer tinting.

An appropriate brown colour, on which half-tone layer tinting is to be based, is specified in Appendix 3 — Colour Guide for contours and topographic features.

Appropriate spot elevations and obstacles are those provided by the procedures specialist.

9.7 Magnetic variation

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

9.8 Bearings, tracks and radials

9.8.1 Bearings, tracks and radials shall be magnetic, except as provided for in 9.8.2. Where bearings and tracks are additionally provided as true values for PBN segments, they shall be shown in parentheses to the nearest tenth of a degree, e.g. 290° (294.9°T).

A note to this effect may be included on the chart.

9.8.2 In areas of high latitude, where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.

9.8.3 Where bearings, tracks or radials are given with reference to True North or Grid North, this shall be clearly indicated. When Grid North is used, its reference grid meridian shall be identified.

9.9 Aeronautical data

9.9.1 Aerodromes

9.9.1.1 The aerodrome of departure shall be shown by the runway pattern.

9.9.1.2 All aerodromes which affect the designated standard departure route — instrument shall be shown and identified. Where appropriate, the aerodrome runway patterns shall be shown.

9.9.2 Prohibited, restricted and danger areas

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

9.9.3 Minimum sector altitude

9.9.3.1 The established minimum sector altitude shall be shown with a clear indication of the sector to which it applies.

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

Quadrilaterals formed by the parallels and meridians normally correspond to the half degree of latitude and longitude. Regardless of the chart scale being used, the area minimum altitude relates to the consequent quadrilateral.

Refer to the SA CATS Part 173 for method for determination of area minimum altitude.

9.9.4 Air traffic services system

9.9.4.1 The components of the established relevant air traffic services system shall be shown.

9.9.4.1.1 The components shall comprise the following:

a) a graphic portrayal of each standard departure route — instrument, including:

1) for departure procedures designed specifically for helicopters, the term “CAT H” shall be depicted in the departure chart plan view;

2) route designator;

3) significant points defining the route;

4) track or radial to the nearest degree along each segment of the route;

5) distances to the nearest kilometre or nautical mile between significant points;

6) minimum obstacle clearance altitudes, along the route or route segments and altitudes required by the procedure to the nearest higher 50 m or 100 ft and flight level restrictions where established;

7) where the chart is drawn to scale and vectoring on departure is provided, established minimum vectoring altitudes to the nearest higher 50 m or 100 ft, clearly identified;

Where ATS surveillance systems are used to vector aircraft to or from significant points on a published standard departure route, the relevant procedures may be shown on the Standard Departure Chart — Instrument (SID) — ICAO unless excessive chart clutter will result.

Where excessive chart clutter will result, an ATC Surveillance Minimum Altitude Chart — ICAO may be provided (see Chapter 21), in which case the elements indicated by 9.9.4.1.1, a) 6), need not be duplicated on the Standard Departure Chart — Instrument (SID) — ICAO.

b) the radio navigation aid(s) associated with the route(s) including:

1) plain language name;

2) identification;

3) frequency;

4) geographical coordinates in degrees, minutes and seconds;

5) for DME, the channel and the elevation of the transmitting antenna of the DME to the nearest 30 m (100 ft);

c) the name-codes of the significant points not marked by the position of a radio navigation aid, their geographical coordinates in degrees, minutes and seconds and the bearing to the nearest tenth of a degree and distance to the nearest two-tenths of a kilometre (tenth of a nautical mile) from the reference radio navigation aid;

d) applicable holding patterns;

e) transition altitude/height to the nearest higher 300 m or 1 000 ft;

f) the position and height of close-in obstacles which penetrate the obstacle identification surface (OIS). A note shall be included whenever close-in obstacles penetrating the OIS exist but which were not considered for the published procedure design gradient;

   In accordance with PANS-OPS, Volume II, information on close-in obstacles is provided by the procedures specialist.

g) area speed restrictions, where established;

h) the designation of the navigation specification(s) including any limitations, where established;

i) all compulsory and “on-request” reporting points;

j) radio communication procedures, including:

   1) call sign(s) of ATS unit(s);

   2) frequency and, if applicable, SATVOICE number;

   3) transponder setting, where appropriate;

k) an indication of “flyover” significant points.

9.9.4.2 A textual description of standard departure route(s) — instrument (SID) and relevant communication failure procedures should be provided and should, whenever feasible, be shown on the chart or on the same page which contains the chart.

9.9.4.3 Aeronautical database requirements

Appropriate data to support navigation database coding shall be published in accordance with the SA CATS Part 173, on the verso of the chart or as a separate, properly referenced sheet.

Appropriate data are those provided by the procedures specialist.

CHAPTER 10: STANDARD ARRIVAL CHART — INSTRUMENT (STAR) — ICAO

10.1 Function

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

Note 1.— Standard arrival routes — instrument are to be interpreted as including “standard descent profiles”, “continuous descent approach”, and other non-standard descriptions. In the case of a standard descent profile, the depiction of a cross-section is not required.

10.2 Availability

The Standard Arrival Chart — Instrument (STAR) — ICAO shall be made available wherever a standard arrival route — instrument has been established and cannot be shown with sufficient clarity on the Area Chart.

10.3 Coverage and scale

10.3.1 The coverage of the chart shall be sufficient to indicate the points where the en-route phase ends and the approach phase begins.

10.3.2 The chart should be drawn to scale.

10.3.3 If the chart is drawn to scale, a scale-bar shall be shown.

10.3.4 When the chart is not drawn to scale, the annotation “NOT TO SCALE” shall be shown and the symbol for scale break shall be used on tracks and other aspects of the chart which are too large to be drawn to scale.

10.4 Projection

10.4.1 A conformal projection on which a straight line approximates a great circle should be used.

10.4.2 When the chart is drawn to scale, parallels and meridians should be shown at suitable intervals.

10.4.3 Graduation marks shall be placed at consistent intervals along the neat lines.

10.5 Identification

The chart shall be identified by the name of the city or town or area which the aerodrome serves, the name of the aerodrome, and the identification of the standard arrival route(s) — instrument as established in accordance with the SA CATS Part 173.

The identification of the standard arrival route(s) — instrument is provided by the procedures specialist.

10.6 Culture and topography

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

10.6.2 To improve situational awareness in areas where significant relief exists, the chart should be drawn to scale and all relief exceeding 300 m (1 000 ft) above the aerodrome elevation should be shown by smoothed contour lines, contour values and layer tints printed in brown. Appropriate spot elevations, including the highest elevation within each top contour line, should be shown printed in black. Obstacles should also be shown.

The next higher suitable contour line appearing on base topographic maps exceeding 300 m (1 000 ft) above the aerodrome elevation may be selected to start layer tinting.
An appropriate brown colour, on which half-tone layer tinting is to be based, is specified in Appendix 3 — Colour Guide for contours and topographic features.
Appropriate spot elevations and obstacles are those provided by the procedures specialist.

10.7 Magnetic variation

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

10.8 Bearings, tracks and radials

10.8.1 Bearings, tracks and radials shall be magnetic, except as provided for in 10.8.2. Where bearings and tracks are additionally provided as true values for PBN segments, they shall be shown in parentheses to the nearest tenth of a degree, e.g. 290° (294.9°T).

A note to this effect may be included on the chart.

10.8.2 In areas of high latitude, where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.

10.8.3 Where bearings, tracks or radials are given with reference to True North or Grid North, this shall be clearly indicated. When Grid North is used, its reference grid meridian shall be identified.

10.9 Aeronautical data

10.9.1 Aerodromes

10.9.1.1 The aerodrome of landing shall be shown by the runway pattern.

10.9.1.2 All aerodromes which affect the designated standard arrival route — instrument shall be shown and identified. Where appropriate, the aerodrome runway patterns shall be shown.

10.9.2 Prohibited, restricted and danger areas

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

10.9.3 Minimum sector altitude

10.9.3.1 The established minimum sector altitude shall be shown with a clear indication of the sector to which it applies.

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

Quadrilaterals formed by the parallels and meridians normally correspond to the half degree of latitude and longitude. Regardless of the chart scale being used, the area minimum altitude relates to the consequent quadrilateral.

Refer to the SA CATS Part 173, for method for determination of area minimum altitude.

10.9.4 Air traffic services system

10.9.4.1 The components of the established relevant air traffic services system shall be shown.

10.9.4.1.1 The components shall comprise the following:

a) a graphic portrayal of each standard arrival route — instrument, including:

   1) route designator;

   2) significant points defining the route;

   3) track or radial to the nearest degree along each segment of the route;

   4) distances to the nearest kilometre or nautical mile between significant points;

   5) minimum obstacle clearance altitudes, along the route or route segments and altitudes required by the procedure to the nearest higher 50 m or 100 ft and flight level restrictions where established;

   6) where the chart is drawn to scale and vectoring on arrival is provided, established minimum vectoring altitudes to the nearest higher 50 m or 100 ft, clearly identified;

   Where ATS surveillance systems are used to vector aircraft to or from significant points on a published standard arrival route or to issue clearance for descent below the minimum sector altitude during arrival, the relevant procedures may be shown on the Standard Arrival Chart — Instrument (STAR) — ICAO unless excessive chart clutter will result.

   Where excessive chart clutter will result, an ATC Surveillance Minimum Altitude Chart — ICAO may be provided (see Chapter 21), in which case the elements indicated by 10.9.4.1.1, a) 6), need not be duplicated on the Standard Arrival Chart — Instrument (STAR) — ICAO.

b) the radio navigation aid(s) associated with the route(s) including:

   1) plain language name;

   2) identification;

   3) frequency;

   4) geographical coordinates in degrees, minutes and seconds;

   5) for DME, the channel and the elevation of the transmitting antenna of the DME to the nearest 30 m (100 ft);

c) the name-codes of the significant points not marked by the position of a radio navigation aid, their geographical coordinates in degrees, minutes and seconds and the bearing to the nearest tenth of a degree and distance to the nearest two-tenths of a kilometre (tenth of a nautical mile) from the reference radio navigation aid;

d) applicable holding patterns;

e) transition altitude/height to the nearest higher 300 m or 1 000 ft;

f) area speed restrictions, where established;

g) the designation of the navigation specification(s) including any limitations, where established;

h) all compulsory and “on-request” reporting points;

i) radio communication procedures, including:

1) call sign(s) of ATS unit(s);

2) frequency and, if applicable, SATVOICE number;

3) transponder setting, where appropriate;

j) an indication of “flyover” significant waypoints; and

k) for arrival procedures to an instrument approach designed specifically for helicopters, the term “CAT H” shall be depicted in the arrival chart plan view.

10.9.4.2 A textual description of standard arrival route(s) — instrument (STAR) and relevant communication failure procedures should be provided and should, whenever feasible, be shown on the chart or on the same page which contains the chart.

10.9.4.3 Aeronautical database requirements

Appropriate data to support navigation database coding shall be published in accordance with the SA CATS Part 173, on the verso of the chart or as a separate, properly referenced sheet.

Appropriate data are those provided by the procedures specialist.

CHAPTER 11: INSTRUMENT APPROACH CHART — ICAO

11.1 Function

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

Detailed criteria for the establishment of instrument approach procedures and the resolutions of associated altitudes/heights are contained in SA CATS Part 173.

11.2 Availability

11.2.1 Instrument Approach Charts — ICAO shall be made available for all aerodromes used by international civil aviation where instrument approach procedures have been established by the State concerned.

11.2.2 A separate Instrument Approach Chart — ICAO shall normally be provided for each precision approach procedure established by the approval holder.

11.2.3 A separate Instrument Approach Chart — ICAO shall normally be provided for each non-precision approach procedure established by the approval holder.

A single precision or non-precision approach procedure chart may be provided to portray more than one approach procedure when the procedures for the intermediate approach, final approach and missed approach segments are identical.

11.2.4 When the values for track, time or altitude differ between categories of aircraft on other than the final approach segment of the instrument approach procedures and the listing of these differences on a single chart could cause clutter or confusion, more than one chart shall be provided.

11.2.5 Instrument Approach Charts — ICAO shall be revised whenever information essential to safe operation becomes out of date.

11.3 Coverage and scale

11.3.1 The coverage of the chart shall be sufficient to include all segments of the instrument approach procedure and such additional areas as may be necessary for the type of approach intended.

11.3.2 The scale selected shall ensure optimum legibility consistent with:

a) the procedure shown on the chart;

b) sheet size.

11.3.3 A scale indication shall be given.

11.3.3.1 Except where this is not practicable, a distance circle with a radius of 20 km (10 NM) centred on a DME located on or close to the aerodrome, or on the aerodrome reference point where no suitable DME is available, shall be shown; its radius shall be indicated on the circumference.

11.3.3.2 A distance scale should be shown directly below the profile.

11.4 Format

The sheet size should be 210 x 148 mm (8.27 x 5.82 in).

11.5 Projection

11.5.1 A conformal projection on which a straight line approximates a great circle shall be used.

11.5.2 Graduation marks should be placed at consistent intervals along the neat lines.

11.6 Identification

The chart shall be identified by the name of the city or town or area which the aerodrome serves, the name of the aerodrome and the identification of the instrument approach procedure as established in accordance with the SA CATS Part 173.

The identification of the instrument approach procedure is provided by the procedure designer.

11.7 Culture and topography

11.7.1 Culture and topographic information pertinent to the safe execution of the instrument approach procedure, including the missed approach procedure, associated holding procedures and visual manoeuvring (circling) procedure when established, shall be shown. Topographic information shall be named, only when necessary, to facilitate the understanding of such information, and the minimum shall be a delineation of land masses and significant lakes and rivers.

11.7.2 Relief shall be shown in a manner best suited to the particular elevation characteristics of the area. In areas where relief exceeds 1 200 m (4 000 ft) above the aerodrome elevation within the coverage of the chart or 600 m (2 000 ft) within 11 km (6 NM) of the aerodrome reference point or when final approach or missed approach procedure gradient is steeper than optimal due to terrain, all relief exceeding 150 m (500 ft) above the aerodrome elevation shall be shown by smoothed contour lines, contour values and layer tints printed in brown. Appropriate spot elevations, including the highest elevation within each top contour line, shall also be shown printed in black.

The next higher suitable contour line appearing on base topographic maps exceeding 150 m (500 ft) above the aerodrome elevation may be selected to start layer tinting.

An appropriate brown colour, on which half-tone layer tinting is to be based, is specified in Appendix 3 — Colour Guide for contours and topographic features.

Appropriate spot elevations are those provided by the procedure designer.

11.7.3 In areas where relief is lower than specified in 11.7.2, all relief exceeding 150 m (500 ft) above the aerodrome elevation should be shown by smoothed contour lines, contour values and layer tints printed in brown. Appropriate spot elevations, including the highest elevation within each top contour line, should also be shown printed in black.

The next higher suitable contour line appearing on base topographic maps exceeding 150 m (500 ft) above the aerodrome elevation may be selected to start layer tinting.

An appropriate brown colour, on which half-tone layer tinting is to be based, is specified in Appendix 3 — Colour Guide for contours and topographic features.

Appropriate spot elevations are those provided by the procedure designer.

11.8 Magnetic variation

11.8.1 The magnetic variation should be shown.

11.8.2 When shown, the value of the variation, indicated to the nearest degree, shall agree with that used in determining magnetic bearings, tracks and radials.

11.9 Bearings, tracks and radials

11.9.1 Bearings, tracks and radials shall be magnetic, except as provided for in

11.9.2 Where bearings and tracks are additionally provided as true values for PBN segments, they shall be shown in parentheses to the nearest tenth of a degree, e.g. 290° (294.9°T). A note to this effect may be included on the chart.

11.9.3 In areas of high latitude, where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.

11.9.4 Where bearings, tracks or radials are given with reference to True North or Grid North, this shall be clearly indicated. When Grid North is used, its reference grid meridian shall be identified.

11.10 Aeronautical data

11.10.1 Aerodromes

11.10.1.1 All aerodromes which show a distinctive pattern from the air shall be shown by the appropriate symbol. Abandoned aerodromes shall be identified as abandoned.

11.10.1.2 The runway pattern, at a scale sufficiently large to show it clearly, shall be shown for:

a) the aerodrome on which the procedure is based;

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

11.10.1.3 The aerodrome elevation shall be shown to the nearest metre or foot in a prominent position on the chart.

11.10.1.4 The threshold elevation or, where applicable, the highest elevation of the touchdown zone shall be shown to the nearest metre or foot.

11.10.2 Obstacles

11.10.2.1 Obstacles shall be shown on the plan view of the chart. Appropriate obstacles are those provided by the procedure designer.

11.10.2.2 If one or more obstacles are the determining factor of an obstacle clearance altitude/height, those obstacles should be identified.

11.10.2.3 The elevation of the top of obstacles shall be shown to the nearest (next higher) metre or foot.

11.10.2.4 The heights of obstacles above a datum other than mean sea level (see 11.10.2.3) should be shown. When shown, they should be given in parentheses on the chart.

11.10.2.5 When the heights of obstacles above a datum other than mean sea level are shown, the datum shall be the aerodrome elevation except that, at aerodromes having an instrument runway (or runways) with a threshold elevation more than 2 m (7 ft) below the aerodrome elevation, the chart datum shall be the threshold elevation of the runway to which the instrument approach is related.

11.10.2.6 Where a datum other than mean sea level is used, it shall be stated in a prominent position on the chart.

11.10.2.7 Where an obstacle free zone has not been established for a precision approach runway Category I, this shall be indicated.

11.10.2.8 Obstacles that penetrate the visual segment surface shall be identified on the chart.

11.10.3 Prohibited, restricted and danger areas

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

11.10.4 Radio communication facilities and navigation aids

11.10.4.1 Radio navigation aids required for the procedures together with their frequencies, identifications and track-defining characteristics, if any, shall be shown. In the case of a procedure in which more than one station is located on the final approach track, the facility to be used for track guidance for final approach shall be clearly identified. In addition, consideration shall be given to the elimination from the approach chart of those facilities that are not used by the procedure.

11.10.4.2 The initial approach fix (IAF), the intermediate approach fix (IF), the final approach fix (FAF) (or final approach point (FAP) for an ILS approach procedure), the missed approach point (MAPt), where established, and other essential fixes or points comprising the procedure shall be shown and identified.

11.10.4.3 The final approach fix (or final approach point for an ILS approach procedure) should be identified with its geographical coordinates in degrees, minutes and seconds.

11.10.4.4 Radio navigation aids that might be used in diversionary procedures together with their track-defining characteristics, if any, shall be shown or indicated on the chart.

11.10.4.5 Radio communication frequencies, including call signs, that are required for the execution of the procedures shall be shown.

11.10.4.6 When required by the procedures, the distance to the aerodrome from each radio navigation aid concerned with the final approach shall be shown to the nearest kilometre or nautical mile. When no track-defining aid indicates the bearing of the aerodrome, the bearing shall also be shown to the nearest degree.

11.10.5 Minimum sector altitude or terminal arrival altitude

The minimum sector altitude or terminal arrival altitude established by the competent authority shall be shown, with a clear indication of the sector to which it applies.

11.10.6 Portrayal of procedure tracks

11.10.6.1 The plan view shall show the following information in the manner indicated:

a) the approach procedure track by an arrowed continuous line indicating the direction of flight;

b) the missed approach procedure track by an arrowed broken line;

c) any additional procedure track, other than those specified in a) and b), by an arrowed dotted line;

d) bearings, tracks, radials to the nearest degree and distances to the nearest two-tenths of a kilometre or tenth of a nautical mile or times required for the procedure;

e) where no track-defining aid is available, the magnetic bearing to the nearest degree to the aerodrome from the radio navigation aids concerned with the final approach;

f) the boundaries of any sector in which visual manoeuvring (circling) is prohibited;

g) where specified, the holding pattern and minimum holding altitude/height associated with the approach and missed approach;

h) caution notes where required, prominently displayed on the face of the chart;

i) an indication of “flyover” significant points.

11.10.6.2 The plan view should show the distance to the aerodrome from each radio navigation aid concerned with the final approach.

11.10.6.3 A profile shall be provided normally below the plan view showing the following data:

a) the aerodrome by a solid block at aerodrome elevation;

b) the profile of the approach procedure segments by an arrowed continuous line indicating the direction of flight;

c) the profile of the missed approach procedure segment by an arrowed broken line and a description of the procedure;

d) the profile of any additional procedure segment, other than those specified in b) and c), by an arrowed dotted line;

e) bearings, tracks, radials to the nearest degree and distances to the nearest two-tenths of a kilometre or tenth of a nautical mile or times required for the procedure;

f) altitudes/heights required by the procedures, including transition altitude, procedure altitudes/heights and heliport crossing height (HCH), where established;

g) limiting distance to the nearest kilometre or nautical mile on procedure turn, when specified;

h) the intermediate approach fix or point, on procedures where no course reversal is authorized;

i) a line representing the aerodrome elevation or threshold elevation, as appropriate, extended across the width of the chart including a distance scale with its origin at the runway threshold.

11.10.6.4 Heights required by procedures should be shown in parentheses, using the height datum selected in accordance with 11.10.2.5.

11.10.6.5 The profile view should include a ground profile or a minimum altitude/height portrayal as follows:

a) a ground profile shown by a solid line depicting the highest elevations of the relief occurring within the primary area of the final approach segment. The highest elevations of the relief occurring in the secondary areas of the final approach segment shown by a dashed line; or

b) minimum altitudes/heights in the intermediate and final approach segments indicated within bounded shaded blocks.

For the ground profile portrayal, actual templates of the primary and secondary areas of the final approach segment are provided to the cartographer by the procedures specialist.

The minimum altitude/height portrayal is intended for use on charts depicting non-precision approaches with a final approach fix.

11.10.7 Aerodrome operating minima

11.10.7.1 Aerodrome operating minima when established by the State shall be shown.

11.10.7.2 The obstacle clearance altitudes/heights for the aircraft categories for which the procedure is designed shall be shown; for precision approach procedures, additional OCA/H for Cat D_L aircraft (wing span between 65 m and 80 m and/or vertical distance between the flight path of the wheels and the glide path antenna between 7 m and 8 m) shall be published, when necessary.

11.10.8 Supplementary information

11.10.8.1 When the missed approach point is defined by:

— a distance from the final approach fix, or

— a facility or a fix and the corresponding distance from the final approach fix,

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

11.10.8.2 When DME is required for use in the final approach segment, a table showing altitudes/heights for each 2 km or 1 NM, as appropriate, shall be shown. The table shall not include distances which would correspond to altitudes/heights below the OCA/H.

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

11.10.8.4 A rate of descent table should be shown.

11.10.8.5 For non-precision approach procedures with a final approach fix, the final approach descent gradient to the nearest one-tenth of a per cent and, in parentheses, descent angle to the nearest one-tenth of a degree shall be shown.

11.10.8.6 For precision approach procedures and approach procedures with vertical guidance, the reference datum height to the nearest half metre or foot and the glide path/elevation/vertical path angle to the nearest one-tenth of a degree shall be shown.

11.10.8.7 When a final approach fix is specified at the final approach point for ILS, a clear indication shall be given whether it applies to the ILS, the associated ILS localizer only procedure, or both. In the case of MLS, a clear indication shall be given when an FAF has been specified at the final approach point.

11.10.8.8 If the final approach descent gradient/angle for any type of instrument approach procedure exceeds the maximum value specified in the SA CATS Part 173, a cautionary note shall be included.

11.10.9 Aeronautical database requirements

Appropriate data to support navigation database coding shall be published in accordance with the SA CATS Part 173, for non-PBN procedures, on the verso of the chart or as a separate, properly referenced sheet.

Appropriate data are those provided by the procedure designer.

CHAPTER 12. VISUAL APPROACH CHART — ICAO

12.1 Function

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

12.2 Availability

The Visual Approach Chart — ICAO shall be made available in the manner prescribed in 1.3.2 for all aerodromes used by international civil aviation where:

a) only limited navigation facilities are available; or

b) radio communication facilities are not available; or

c) no adequate aeronautical charts of the aerodrome and its surroundings at 1:500 000 or greater scale are available; or

d) visual approach procedures have been established.

12.3 Scale

12.3.1 The scale shall be sufficiently large to permit depiction of significant features and indication of the aerodrome layout.

12.3.2 The scale should not be smaller than 1:500 000.

Note.— A scale of 1:250 000 or 1:200 000 is preferred.

12.3.3 When an Instrument Approach Chart is available for a given aerodrome, the Visual Approach Chart should be drawn to the same scale.

12.4 Format

The sheet size should be 210 x 148 mm (8.27 x 5.82 in).

It is advantageous to print the charts in several colours, selected to provide maximum legibility in varying degrees and kinds of light.

12.5 Projection

12.5.1 A conformal projection on which a straight line approximates a great circle shall be used.

12.5.2 Graduation marks should be placed at consistent intervals along the neat lines.

12.6 Identification

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

12.7 Culture and topography

12.7.1 Natural and cultural landmarks shall be shown (e.g. bluffs, cliffs, sand dunes, cities, towns, roads, railroads, isolated lighthouses).

12.7.1.1 Geographical place names should be included only when they are required to avoid confusion or ambiguity.

12.7.2 Shore lines, lakes, rivers and streams shall be shown.

12.7.3 Relief shall be shown in a manner best suited to the particular elevation and obstacle characteristics of the area covered by the chart.

12.7.4 When shown, spot elevations should be carefully selected.

Note.— The value of certain spot elevations/heights in relation to both mean sea level and aerodrome elevation may be given.

12.7.5 The figures relating to different reference levels shall be clearly differentiated in their presentation.

12.8 Magnetic variation

The magnetic variation shall be shown.

12.9 Bearings, tracks and radials

12.9.1 Bearings, tracks and radials shall be magnetic except as provided for in 12.9.2.

12.9.2 In areas of high latitude, where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.

12.9.3 Where bearings, tracks or radials are given with reference to True North or Grid North, this shall be clearly indicated. When Grid North is used, its reference grid meridian shall be identified.

12.10 Aeronautical data

12.10.1 Aerodromes

12.10.1.1 All aerodromes shall be shown by the runway pattern. Restrictions on the use of any landing direction shall be indicated. Where there is any risk of confusion between two neighbouring aerodromes, this shall be indicated. Abandoned aerodromes shall be identified as abandoned.

12.10.1.2 The aerodrome elevation shall be shown in a prominent position on the chart.

12.10.2 Obstacles

12.10.2.1 Obstacles shall be shown and identified.

12.10.2.2 The elevation of the top of obstacles shall be shown to the nearest (next higher) metre or foot.

12.10.2.3 The heights of obstacles above the aerodrome elevation should be shown.

12.10.2.3.1 When the heights of obstacles are shown, the height datum shall be stated in a prominent position on the chart and the heights shall be given in parentheses on the chart.

12.10.3 Prohibited, restricted and danger areas

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

12.10.4 Designated airspace

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

12.10.5 Visual approach information

12.10.5.1 Visual approach procedures shall be shown where applicable.

12.10.5.2 Visual aids for navigation shall be shown as appropriate.

12.10.5.3 Location and type of the visual approach slope indicator systems with their nominal approach slope angle(s), minimum eye height(s) over the threshold of the on-slope signal(s), and where the axis of the system is not parallel to the runway centre line, the angle and direction of displacement, i.e. left or right, shall be shown.

12.10.6 Supplementary information

12.10.6.1 Radio navigation aids together with their frequencies and identifications shall be shown as appropriate.

12.10.6.2 Radio communication facilities with their frequencies shall be shown as appropriate.

CHAPTER 13. AERODROME/HELIPORT CHART — ICAO

13.1 Function

This chart shall provide flight crews with information which will facilitate the ground movement of aircraft:

a) from the aircraft stand to the runway; and

b) from the runway to the aircraft

stand; and helicopter movement:

a) from the helicopter stand to the touchdown and lift-off area and to the final approach and take-off area;

b) from the final approach and take-off area to the touchdown and lift-off area and to the helicopter stand;

c) along helicopter ground and air taxiways; and

d) along air transit routes;

it shall also provide essential operational information at the aerodrome/heliport.

13.2 Availability

13.2.1 The Aerodrome/Heliport Chart — ICAO shall be made available in the manner prescribed in 1.3.2 for all aerodromes/heliports regularly used by international civil aviation.

13.2.2 The Aerodrome/Heliport Chart — ICAO should be made available also, in the manner prescribed in 1.3.2, for all other aerodromes/heliports available for use by international civil aviation.

Under certain conditions, an Aerodrome Ground Movement Chart — ICAO and an Aircraft Parking/Docking Chart — ICAO may have to be provided (see Chapters 14 and 15); in which case, the elements portrayed on these supplementary charts need not be duplicated on the Aerodrome/Heliport Chart — ICAO.

13.3 Coverage and scale

13.3.1 The coverage and scale shall be sufficiently large to show clearly all the elements listed in 13.6.1.

13.3.2 A linear scale shall be shown.

13.4 Identification

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

13.5 Magnetic variation

True and Magnetic North arrows and magnetic variation to the nearest degree and annual change of the magnetic variation shall be shown.

13.6 Aerodrome/heliport data

13.6.1 This chart shall show:

a) geographical coordinates in degrees, minutes and seconds for the aerodrome/heliport reference point;

b) elevations, to the nearest metre or foot, of the aerodrome/heliport and apron (altimeter checkpoint locations) where applicable; and for non-precision approaches, elevations and geoid undulations of runway thresholds and the geometric centre of the touchdown and lift-off area;

c) elevations and geoid undulations, to the nearest half-metre or foot, of the precision approach runway threshold, the geometric centre of the touchdown and lift-off area, and at the highest elevation of the touchdown zone of a precision approach runway;

d) all runways including those under construction with designation number, length and width to the nearest metre, bearing strength, displaced thresholds, stopways, clearways, runway directions to the nearest degree magnetic, type of surface and runway markings;

Bearing strengths may be shown in tabular form on the face or verso of the chart.

e) all aprons, with aircraft/helicopter stands, lighting, markings and other visual guidance and control aids, where applicable, including location and type of visual docking guidance systems, type of surface for heliports, and bearing strengths or aircraft type restrictions where the bearing strength is less than that of the associated runways;

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

f) geographical coordinates in degrees, minutes and seconds for thresholds, geometric centre of touchdown and lift-off area and/or thresholds of the final approach and take-off area (where appropriate);

g) all taxiways, helicopter air and ground taxiways with type of surface, helicopter air transit routes, with designations, width, lighting, markings (including runway-holding positions and, where established, intermediate holding positions), stop bars, other visual guidance and control aids, and bearing strength or aircraft type restrictions where the bearing strength is less than that of the associated runways;

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

h) where established, hot spot locations with additional information properly annotated;

Additional information regarding hot spots may be shown in tabular form on the face or verso of the chart.

i) geographical coordinates in degrees, minutes, seconds and hundredths of seconds for appropriate taxiway centre line points and aircraft stands;

j) where established, standard routes for taxiing aircraft with their designators;

k) the boundaries of the air traffic control service;

l) position of runway visual range (RVR) observation sites;

m) approach and runway lighting;

n) location and type of the visual approach slope indicator systems with their nominal approach slope angle(s), minimum eye height(s) over the threshold of the on-slope signal(s), and where the axis of the system is not parallel to the runway centre line, the angle and direction of the displacement, i.e. left or right;

o) relevant communication facilities listed with their channels and, if applicable, logon address and SATVOICE number;

p) obstacles to taxiing;

q) aircraft servicing areas and buildings of operational significance;

r) VOR checkpoint and radio frequency of the aid concerned;

s) any part of the depicted movement area permanently unsuitable for aircraft, clearly identified as such.

13.6.2 In addition to the items in 13.6.1 relating to heliports, the chart shall show:

a) heliport type;

Heliport types are identified in Part 139.

b) touchdown and lift-off area including dimensions to the nearest metre, slope, type of surface and bearing strength in tonnes;

c) final approach and take-off area including type, true bearing to the nearest degree, designation number (where appropriate), length and width to the nearest metre, slope and type of surface;

d) safety area including length, width and type of surface;

e) helicopter clearway including length and ground profile;

f) obstacles including type and elevation of the top of the obstacles to the nearest (next higher) metre or foot;

g) visual aids for approach procedures, marking and lighting of final approach and take-off area, and of touchdown and lift-off area;

h) declared distances to the nearest metre for heliports, where relevant, including:

1) take-off distance available;

2) rejected take-off distance available;

3) landing distance available.

CHAPTER 14. AERODROME GROUND MOVEMENT CHART — ICAO

14.1 Function

This supplementary chart shall provide flight crews with detailed information to facilitate the ground movement of aircraft to and from the aircraft stands and the parking/docking of aircraft.

14.2 Availability

The Aerodrome Ground Movement Chart — ICAO should be made available in the manner prescribed in 1.3.2 where, due to congestion of information, details necessary for the ground movement of aircraft along the taxiways to and from the aircraft stands cannot be shown with sufficient clarity on the Aerodrome/Heliport Chart — ICAO.

14.3 Coverage and scale

14.3.1 The coverage and scale shall be sufficiently large to show clearly all the elements listed in 14.6.

14.3.2 A linear scale should be shown.

14.4 Identification

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

14.5 Magnetic variation

14.5.1 A True North arrow shall be shown.

14.5.2 Magnetic variation to the nearest degree and its annual change should be shown. This chart need not be True North orientated.

14.6 Aerodrome data

This chart shall show in a similar manner all the information on the Aerodrome/Heliport Chart — ICAO relevant to the area depicted, including:

a) apron elevation to the nearest metre or foot;
b) aprons with aircraft stands, bearing strengths or aircraft type restrictions, lighting, marking and other visual guidance and control aids, where applicable, including location and type of visual docking guidance systems;

c) geographical coordinates in degrees, minutes, seconds and hundredths of seconds for aircraft stands;

d) taxiways with designations, width to the nearest metre, bearing strength or aircraft type restrictions where applicable, lighting, markings (including runway-holding positions and, where established, intermediate holding positions), stop bars, and other visual guidance and control aids;

e) where established, hot spot locations with additional information properly annotated;

Additional information regarding hot spots may be shown in tabular form on the face or verso of the chart.

f) where established, standard routes for taxiing aircraft, with their designators;

g) geographical coordinates in degrees, minutes, seconds and hundredths of seconds for appropriate taxiway centre line points;

h) the boundaries of the air traffic control service;

i) relevant communication facilities listed with their channels and, if applicable, logon address;

j) obstacles to taxiing;

k) aircraft servicing areas and buildings of operational significance;

l) VOR checkpoint and radio frequency of the aid concerned;

m) any part of the depicted movement area permanently unsuitable for aircraft, clearly identified as such.

CHAPTER 15. AIRCRAFT PARKING/DOCKING CHART — ICAO

15.1 Function

This supplementary chart shall provide flight crews with detailed information to facilitate the ground movement of aircraft between the taxiways and the aircraft stands and the parking/docking of aircraft.

15.2 Availability

The Aircraft Parking/Docking Chart — ICAO should be made available in the manner prescribed in 1.3.2 where, due to the complexity of the terminal facilities, the information cannot be shown with sufficient clarity on the Aerodrome/Heliport Chart — ICAO or on the Aerodrome Ground Movement Chart — ICAO.

15.3 Coverage and scale

15.3.1 The coverage and scale shall be sufficiently large to show clearly all the elements listed in 15.6.

15.3.2 A linear scale should be shown.

15.4 Identification

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

15.5 Magnetic variation

15.5.1 A True North arrow shall be shown.

15.5.2 Magnetic variation to the nearest degree and its annual change should be shown.

This chart need not be True North orientated.

15.6 Aerodrome data

This chart shall show in a similar manner all the information on the Aerodrome/Heliport Chart — ICAO and the Aerodrome Ground Movement Chart — ICAO relevant to the area depicted, including:

a) apron elevation to the nearest metre or foot;
b) aprons with aircraft stands, bearing strengths or aircraft type restrictions, lighting, marking and other visual guidance and control aids, where applicable, including location and type of visual docking guidance systems;

c) geographical coordinates in degrees, minutes, seconds and hundredths of seconds for aircraft stands;

d) taxiway entries with designations, including runway-holding positions and, where established, intermediate holding positions, and stop bars;

e) where established, hot spot locations with additional information properly annotated;
Additional information regarding hot spots may be shown in tabular form on the face or verso of the chart.

f) geographical coordinates in degrees, minutes, seconds and hundredths of seconds for appropriate taxiway centre line points;

g) the boundaries of the air traffic control service;

h) relevant communication facilities listed with their channels and, if applicable, logon address;

i) obstacles to taxiing;

j) aircraft servicing areas and buildings of operational significance;

k) VOR checkpoint and radio frequency of the aid concerned;

l) any part of the depicted movement area permanently unsuitable for aircraft, clearly identified as such.

CHAPTER 16. WORLD AERONAUTICAL CHART — ICAO 1:1 000 000

16.1 Function

This chart shall provide information to satisfy the requirements of visual air navigation.

This chart may also serve:

a) as a basic aeronautical chart:

1) when highly specialized charts lacking visual information do not provide essential data;

2) to provide complete world coverage at a constant scale with a uniform presentation of planimetric data;

3) in the production of other charts required by international civil aviation;

b) as a pre-flight planning chart.

16.2 Availability

16.2.1 The World Aeronautical Chart — ICAO 1:1 000 000 shall be made available in the manner prescribed in 1.3.2 for all areas delineated in Appendix 5.

When operational or chart production considerations indicate that operational requirements can be effectively satisfied by Aeronautical Charts — ICAO 1:500 000 or Aeronautical Navigation Charts — ICAO Small Scale, either of these charts may be made available instead of the basic 1:1 000 000 chart.

16.2.2 To ensure complete coverage of all land areas and adequate continuity in any one coordinated series, the selection of a scale of other than 1:1 000 000 should be determined by regional agreement.

16.3 Scales

16.3.1 Linear scales for kilometres and nautical miles arranged in the following order:

— kilometres,

— nautical miles,

with their zero points in the same vertical line shall be shown in the margin.

16.3.1.1 The length of the linear scales should represent at least 200 km (110 NM).

16.3.2 A conversion scale (metres/feet) shall be shown in the margin.

16.4 Format

16.4.1 The title and marginal notes should be in one of the working languages of ICAO. The

language of the publishing country may be used in addition to the ICAO working language.

16.4.2 The information regarding the number of the adjoining sheets and the unit of measurement to express elevations shall be so located as to be clearly visible when the sheet is folded.

16.4.3 The method of folding should be as follows:

Fold the chart on the long axis near the mid-parallel of latitude, face out, with the bottom part of the chart face upward. Fold inward near the meridian, and fold both halves backward in accordion folds.

16.4.4 Whenever practicable, the sheet lines should conform with those shown in the index in Appendix 5.

The area covered by a sheet may vary from the lines shown to satisfy particular requirements.

The value of adopting identical sheet lines for ICAO 1:1 000 000 Charts and the corresponding sheet of the International Map of the World (IMW), provided aeronautical requirements are not compromised, is recognized.

16.4.5 Overlaps should be provided by extending the chart area on the top and right side beyond the area given on the index. This overlap area should contain all aeronautical, topographical, hydrographical and cultural information. The overlap should extend up to 28 km (15 NM), if possible, but in any case from the limiting parallels and meridians of each chart to the neat line.

16.5 Projection

16.5.1 The projections shall be as follows:

a) between the Equator and 80° latitude: the Lambert conformal conic projection, in separate bands for each tier of charts. The standard parallels for each 4° band shall be 40′ south of the northern parallel and 40′ north of the southern parallel;

b) between 80° and 90° latitude: the Polar stereographic projection with scale matching that of the Lambert conformal conic projection at latitude 80°, except that in the northern hemisphere the Lambert conformal conic projection may be used between 80° and 84° latitude and the Polar stereographic projection between 84° and 90° with the scales matching at 84° North.

16.5.2 Graticules and graduations shall be shown as follows:

a) Parallels:

Latitude	*Distance between parallels*	*Graduations on parallels*
0° to 72°	30’	1’
72° to 84°	30’	5’
84° to 89°	30’	1°
89° to 90°	30’	5° (Only on degree parallels from 72° to 89°)

b) Meridians:

Latitude	*Interval between meridians*	*Graduations on meridians*
0° to 52°	30’	1’
52° to 72°	30’	1’ (Only on even numbered meridians)
72° to 84°	1°	1’
84° to 89°	5°	1’
89° to 90°	15°	1’ (Only on every fourth meridian)

16.5.3 The graduation marks at 1’ and 5’ intervals shall extend away from the Greenwich Meridian and from the Equator. Each 10’ interval shall be shown by a mark on both sides of the graticule line.

16.5.3.1 The length of the graduation marks should be approximately 1.3 mm (0.05 in) for the 1’ intervals, and 2 mm (0.08 in) for the 5’ intervals and 2 mm (0.08 in) extending on both sides of the graticule line for the 10’ intervals.

16.5.4 All meridians and parallels shown shall be numbered in the borders of the chart. In addition, each parallel shall be numbered within the body of the chart in such a manner that the parallel can be readily identified when the chart is folded.

Meridians may be numbered within the body of the chart.

16.5.5 The name and basic parameters of the projection shall be indicated in the margin.

16.6 Identification

Sheet numbering shall be in conformity with the index in Appendix 5.

The corresponding International Map of the World (IMW) sheet number may also be shown.

16.7 Culture and topography

16.7.1 Built-up areas

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

16.7.1.2 Cities and towns of sufficient size should be indicated by the outline of their built-up areas and not of their established city limits.

16.7.2 Railroads

16.7.2.1 All railroads having landmark value shall be shown.

In congested areas, some railroads may be omitted in the interest of legibility. Note

Railroads may be named where space permits.

16.7.2.2 Important tunnels should be shown. A descriptive note may be added.

16.7.3 Highways and roads

16.7.3.1 Road systems shall be shown in sufficient detail to indicate significant patterns from the air.

16.7.3.2 Roads should not be shown in built-up areas unless they can be distinguished from the air as definite landmarks. The numbers or names of important highways may be shown.

16.7.4 Landmarks

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

16.7.5 Political boundaries

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

16.7.6 Hydrography

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

16.7.6.2 The tint covering large open water areas should be kept very light.

A narrow band of darker tone may be used along the shore line to emphasize this feature.

16.7.6.3 Reefs and shoals, including rocky ledges, tidal flats, isolated rocks, sand, gravel, stone and all similar areas, should be shown by symbols when of significant landmark value.

Groups of rocks may be shown by a few representative rock symbols within the area.

16.7.7 Contours

16.7.7.1 Contours shall be shown. The selection of intervals shall be governed by the requirement to depict clearly the relief features required in air navigation.

16.7.7.2 The values of the contours used shall be shown.

16.7.8 Hypsometric tints

16.7.8.1 When hypsometric tints are used, the range of elevations for the tints shall be shown.

16.7.8.2 The scale of the hypsometric tints used on the chart shall be shown in the margin.

16.7.9 Spot elevations

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

16.7.9.2 The elevation (in metres or feet) of the highest point on the chart and its geographical position to the nearest five minutes shall be indicated in the margin.

16.7.9.3 The spot elevation of the highest point in any sheet should be cleared of hypsometric tinting.

16.7.10 Incomplete or unreliable relief

16.7.10.1 Areas that have not been surveyed for contour information shall be labelled “Relief data incomplete”.

16.7.10.2 Charts on which spot elevations are generally unreliable shall bear a warning note prominently displayed on the face of the chart in the colour used for aeronautical information, as follows:

“Warning — The reliability of relief information on this chart is doubtful and elevations should be used with caution.”

16.7.11 Escarpments

Escarpments should be shown when they are prominent landmarks or when cultural detail is very sparse.

16.7.12 Wooded areas

16.7.12.1 Wooded areas should be shown.

On high latitude charts, the approximate extreme northern or southern limits of tree growth may be shown.

16.7.12.2 Where shown, the approximate extreme northern or southern limits of tree growth shall be indicated by a dashed black line and shall be appropriately labelled.

16.7.13 Date of topographic information

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

16.8 Magnetic variation

16.8.1 Isogonic lines shall be shown.

16.8.2 The date of the isogonic information shall be indicated in the margin.

16.9 Aeronautical data

16.9.1 General

Aeronautical data shown shall be kept to a minimum consistent with the use of the chart for visual navigation and the revision cycle (see 16.9.6).

16.9.2 Aerodromes

16.9.2.1 Land and water aerodromes and heliports shall be shown with their names, to the extent that they do not produce undesirable congestion on the chart, priority being given to those of greatest aeronautical significance.

16.9.2.2 The aerodrome elevation, the lighting available, the type of runway surface and the length of the longest runway or channel, shown in abbreviated form for each aerodrome in conformity with the example given in Appendix 2, provided they do not cause undesirable clutter on the chart, shall be indicated.

16.9.2.3 Abandoned aerodromes which are still recognizable as aerodromes from the air shall be shown and identified as abandoned.

16.9.3 Obstacles

16.9.3.1 Obstacles shall be shown.

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

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

16.9.4 Prohibited, restricted and danger

areas Prohibited, restricted and danger areas shall be shown.

16.9.5 Air traffic services system

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

16.9.5.2 Where appropriate, the air defence identification zone (ADIZ) shall be shown and properly identified.

ADIZ procedures may be described in the chart legend.

16.9.6 Radio navigation aids

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

16.9.7 Supplementary information

16.9.7.1 Aeronautical ground lights together with their characteristics or their identifications or both shall be shown.

16.9.7.2 Marine lights on outer prominent coastal or isolated features of not less than 28 km (15 NM) visibility range shall be shown:

a) where they are not less distinguishable than more powerful marine lights in the vicinity;

b) where they are readily distinguishable from other marine or other types of lights in the vicinity of built-up coastal areas;

c) where they are the only lights of significance available.

CHAPTER 17. AERONAUTICAL CHART — ICAO 1:500 000

17.1 Function

This chart shall provide information to satisfy the requirements of visual air navigation for low speed, short- or medium-range operations at low and intermediate altitudes.

This chart may be used:

a) to serve as a basic aeronautical chart;

b) to provide a suitable medium for basic pilot and navigation training;

c) to supplement highly specialized charts which do not provide essential visual information;

d) in pre-flight planning.

It is intended that these charts be provided for land areas where charts of this scale are required for civil air operations employing visual air navigation independently or in support of other forms of air navigation.

Where the service provider produces charts of this series covering their national territories, the entire area being portrayed is usually treated on a regional basis.

17.2 Availability

The Aeronautical Chart — ICAO 1:500 000 should be made available in the manner prescribed in 1.3.2 for all areas delineated in Appendix 5.

The selection of this scale as an alternative to the World Aeronautical Chart — ICAO 1:1 000 000 is covered by 16.2.1 and 16.2.2.

17.3 Scales

17.3.1 Linear scales for kilometres and nautical miles arranged in the following order:

— kilometres,

— nautical miles,

with their zero points in the same vertical line shall be shown in the margin.

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

17.3.2 A conversion scale (metres/feet) shall be shown in the margin.

17.4 Format

17.4.1 The title and marginal notes shall be in one of the working languages of ICAO.

The language of the publishing country or any other language may be used in addition to the ICAO working language.

17.4.2 The information regarding the number of the adjoining sheets and the unit of measurement used to express elevation shall be so located as to be clearly visible when the sheet is folded.

17.4.3 The method of folding should be as follows:

Fold the chart on the long axis near the mid-parallel of latitude, face out, with the bottom part of the chart face upward. Fold inward near the meridian, and fold both halves backward in accordion folds.

17.4.4 Whenever practicable, sheets should be quarter sheets of the World Aeronautical Chart — ICAO 1:1 000 000. An appropriate index to adjacent sheets, showing the relationship between the two chart series, should be included on the face of the chart or on the reverse side.

Sheet lines may be varied to satisfy particular requirements.

17.4.5 Overlaps should be provided by extending the chart area on the top and right side beyond the area given on the index. This overlap area should contain all aeronautical, topographical, hydrographical and cultural information. The overlap should extend up to 15 km (8 NM), if possible, but in any case from the limiting parallels and meridians of each chart to the neat line.

17.5 Projection

17.5.1 A conformal (orthomorphic) projection shall be used.

17.5.2 The projection of the World Aeronautical Chart — ICAO 1:1 000 000 should be used.

17.5.3 Parallels shall be shown at intervals of 30’.

17.5.3.1 Meridians shall normally be shown at intervals of 30’.

At high latitudes, this interval may be increased.

17.5.4 Graduation marks shall be shown at 1’ intervals along each whole degree meridian and parallel, extending away from the Greenwich Meridian and from the Equator. Each 10’ interval shall be shown by a mark on both sides of the graticule line.

17.5.4.1 The length of the graduation marks should be approximately 1.3 mm (0.05 in) for the 1’ intervals, and 2 mm (0.08 in) for the 5’ intervals and 2 mm (0.08 in) extending on both sides of the graticule line for the 10’ intervals.

17.5.5 All meridians and parallels shown shall be numbered in the borders of the chart.

17.5.5.1 Each meridian and parallel should be numbered within the body of the chart whenever this data is required operationally.

17.5.6 The name and basic parameters of the projection shall be indicated in the margin.

17.6 Identification

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

17.6.1.1 *Where applicable, sheets should also be identified by the reference number of the corresponding World Aeronautical Chart — ICAO 1:1 000 000, with the addition of one or more of the following letter suffixes indicating the quadrant or quadrants:*

Letter	*Chart quadrant*
A	*North-West*
B	*North-East*
C	*South-East*
D	*South-West*

17.7 Culture and topography

17.7.1 Built-up areas

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

17.7.1.2 Cities and towns of sufficient size should be indicated by the outline of their built-up areas and not of their established city limits.

17.7.2 Railroads

17.7.2.1 All railroads having landmark value shall be shown.

In congested areas, some railroads may be omitted in the interest of legibility.

Railroads may be named.

Rail stations may be shown.

17.7.2.2 Tunnels shall be shown when they serve as prominent landmarks.

A descriptive note may be added, if necessary, to accentuate this feature.

17.7.3 Highways and roads

17.7.3.1 Road systems shall be shown in sufficient detail to indicate significant patterns from the air.

Roads under construction may be shown.

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

The numbers or names of important highways may be shown.

17.7.4 Landmarks

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

17.7.5 Political boundaries

International boundaries shall be shown. Un-demarcated and undefined boundaries shall be distinguished by descriptive notes. Other boundaries may be shown.

17.7.6 Hydrography

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

17.7.6.2 The tint covering large open water areas should be kept very light.

Note.— A narrow band of darker tone may be used along the shore line to emphasize this feature.

17.7.6.3 Reefs and shoals, including rocky ledges, tidal flats, isolated rocks, sand, gravel, stone and all similar areas, should be shown by symbols when of significant landmark value.

Note.— Groups of rocks may be shown by a few representative rock symbols within the area.

17.7.7 Contours

17.7.7.1 Contours shall be shown. The selection of intervals shall be governed by the requirement to depict clearly the relief features required in air navigation.

17.7.7.2 The values of the contours used shall be shown.

17.7.8 Hypsometric tints

17.7.8.1 When hypsometric tints are used, the range of elevations for the tints shall be shown.

17.7.8.2 The scale of the hypsometric tints used on the chart shall be shown in the margin.

17.7.9 Spot elevations

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

17.7.9.2 The elevation (in metres or feet) of the highest point on the chart and its geographical position to the nearest five minutes shall be indicated in the margin.

17.7.9.3 The spot elevation of the highest point on any sheet should be cleared of hypsometric tinting.

17.7.10 Incomplete or unreliable relief

17.7.10.1 Areas that have not been surveyed for contour information shall be labelled “Relief data incomplete”.

17.7.10.2 Charts on which spot elevations are generally unreliable shall bear a warning note prominently displayed on the face of the chart in the colour used for aeronautical information, as follows:

“Warning — The reliability of relief information on this chart is doubtful and elevations should be used with caution.”

17.7.11 Escarpments

Escarpments should be shown when they are prominent landmarks or when cultural detail is very sparse.

17.7.12 Wooded areas

17.7.12.1 Wooded areas should be shown.

On high latitude charts, the approximate extreme northern or southern limits of tree growth may be shown.

17.7.12.2 Where shown, the approximate northern or southern limits of tree growth shall be indicated by a dashed black line and shall be appropriately labelled.

17.7.13 Date of topographic information

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

17.8 Magnetic variation

17.8.1 Isogonic lines shall be shown.

17.8.2 The date of the isogonic information shall be indicated in the margin.

17.9 Aeronautical data

17.9.1 General

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

17.9.2 Aerodromes

17.9.2.1 Land and water aerodromes and heliports shall be shown with their names, to the extent that they do not produce undesirable congestion on the chart, priority being given to those of greatest aeronautical significance.

17.9.2.2 The aerodrome elevation, the lighting available, the type of runway surface and the length of the longest runway or channel, shown in abbreviated form for each aerodrome in conformity with the example given in Appendix 2, provided they do not cause undesirable clutter on the chart, shall be indicated.

17.9.2.3 Abandoned aerodromes which are still recognizable as aerodromes from the air shall be shown and identified as abandoned.

17.9.3 Obstacles

17.9.3.1 Obstacles shall be shown.

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

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

17.9.4 Prohibited, restricted and danger areas Prohibited, restricted and danger areas shall be shown.

17.9.5 Air traffic services system

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

17.9.5.2 Where appropriate, the air defence identification zone (ADIZ) shall be shown and properly identified.

ADIZ procedures may be described in the chart legend.

17.9.6 Radio navigation aids

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

17.9.7 Supplementary information

17.9.7.1 Aeronautical ground lights together with their characteristics or their identifications or both shall be shown.

17.9.7.2 Marine lights on outer prominent coastal or isolated features of not less than 28 km (15 NM) visibility range shall be shown:

a) where they are not less distinguishable than more powerful marine lights in the vicinity;
b) where they are readily distinguishable from other marine or other types of lights in the vicinity of built-up coastal areas;
c) where they are the only lights of significance available.

CHAPTER 18. AERONAUTICAL NAVIGATION CHART — ICAO SMALL SCALE

18.1 Function

This chart shall:

a) serve as an air navigation aid for flight crews of long-range aircraft at high altitudes;

b) provide selective checkpoints over extensive ranges for identification at high altitudes and speeds, which are required for visual confirmation of position;

c) provide for continuous visual reference to the ground during long-range flights over areas lacking radio or other electronic navigation aids, or over areas where visual navigation is preferred or becomes necessary;

d) provide a general purpose chart series for long-range flight planning and plotting.

18.2 Availability

The Aeronautical Navigation Chart — ICAO Small Scale should be made available in the manner prescribed in 1.3.2 for all areas delineated in Appendix 5.

The selection of this scale as an alternative to the World Aeronautical Chart — ICAO 1:1 000 000 is covered by 16.2.1 and 16.2.2.

18.3 Coverage and scale

18.3.1 The Aeronautical Navigation Chart — ICAO Small Scale should provide, as a minimum, complete coverage of the major land masses of the world.

A sheet layout for this series is contained in the Aeronautical Chart Manual (Doc 8697).

The sheet size may represent the maximum press size available to the producing agency.

18.3.2 The scale shall be in the range of 1:2 000 000 to 1:5 000 000.

18.3.3 The scale of the chart shall be substituted in the title for the words “Small Scale”.

18.3.4 Linear scales for kilometres and nautical miles arranged in the following order:

— kilometres,

— nautical miles,

with their zero points in the same vertical line shall be shown in the margin.

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

18.3.6 A conversion scale (metres/feet) shall be shown in the margin.

18.4 Format

18.4.1 The title and marginal notes shall be in one of the working languages of ICAO.

The languages of South Africa or any other language may be used in addition to the ICAO working language.

18.4.2 The information regarding the number of the adjoining sheets and the unit of measurement to express elevations shall be so located as to be clearly visible when the sheet is folded.

There is no internationally agreed sheet numbering.

18.5 Projection

18.5.1 A conformal (orthomorphic) projection shall be used.

18.5.1.1 The name and basic parameters of the projection shall be shown in the margin.

18.5.2 Parallels shall be shown at intervals of 1°.

18.5.2.1 Graduations on the parallels shall be shown at sufficiently close intervals compatible with the latitude and the scale of the chart.

18.5.3 Meridians shall be shown at intervals compatible with the latitude and the scale of the chart.

18.5.3.1 Graduations on the meridians shall be shown at intervals not exceeding 5’.

18.5.4 The graduation marks shall extend away from the Greenwich Meridian and from the Equator.

18.5.5 All meridians and parallels shown shall be numbered in the borders of the chart. In addition, when required, meridians and parallels shall be numbered within the body of the chart in such a manner that they can be readily identified when the chart is folded.

18.6 Culture and topography

18.6.1 Built-up areas

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

18.6.1.2 Cities and towns of sufficient size should be indicated by the outline of their built-up areas and not of their established city limits.

18.6.2 Railroads

18.6.2.1 All railroads having landmark value shall be shown.

In congested areas, some railroads may be omitted in the interest of legibility.

18.6.2.2 Important tunnels should be shown. A descriptive note may be added.

18.6.3 Highways and roads

18.6.3.1 Road systems shall be shown in sufficient detail to indicate significant patterns from the air.

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

18.6.4 Landmarks

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

18.6.5 Political boundaries

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

18.6.6 Hydrography

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

18.6.6.2 The tint covering large open water areas should be kept very light.

A narrow band of darker tone may be used along the shore line to emphasize this feature.

18.6.6.3 Reefs and shoals, including rocky ledges, tidal flats, isolated rocks, sand, gravel, stone and all similar areas, should be shown by symbols when of significant landmark value.

18.6.7 Contours

18.6.7.1 Contours shall be shown. The selection of intervals shall be governed by the requirement to depict clearly the relief features required in air navigation.

18.6.7.2 The values of the contours used shall be shown.

18.6.8 Hypsometric tints

18.6.8.1 When hypsometric tints are used, the range of elevations for the tints shall be shown.

18.6.8.2 The scale of the hypsometric tints used on the chart shall be shown in the margin.

18.6.9 Spot elevations

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

18.6.9.2 The elevation (in metres or feet) of the highest point on the chart and its geographical position to the nearest five minutes shall be indicated in the margin.

18.6.9.3 The spot elevation of the highest point in any sheet should be cleared of hypsometric tinting.

18.6.10 Incomplete or unreliable relief

18.6.10.1 Areas that have not been surveyed for contour information shall be labelled “Relief data incomplete”.

18.6.10.2 Charts on which spot elevations are generally unreliable shall bear a warning note prominently displayed on the face of the chart in the colour used for aeronautical information, as follows:

“Warning — The reliability of relief information on this chart is doubtful and elevations should be used with caution.”

18.6.11 Escarpments

Escarpments should be shown when they are prominent landmarks or when cultural detail is very sparse.

18.6.12 Wooded areas

Wooded areas of large extent should be shown.

18.6.13 Date of topographic information

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

18.6.14 Colours

18.6.14.1 Subdued colours should be used for the chart background to facilitate plotting.

18.6.14.2 Good colour contrast should be ensured to emphasize features important to visual air navigation.

18.7 Magnetic variation

18.7.1 Isogonic lines shall be shown.

18.7.2 The date of isogonic information shall be indicated in the margin.

18.8 Aeronautical data

18.8.1 Aerodromes

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

18.8.2 Obstacles

Obstacles shall be shown.

18.8.3 Prohibited, restricted and danger areas

Prohibited, restricted and danger areas should be shown when considered to be of importance to air navigation.

18.8.4 Air traffic services system

18.8.4.1 Significant elements of the air traffic services system should be shown when considered to be of importance to air navigation.

18.8.4.2 Where appropriate, the air defence identification zone (ADIZ) should be shown and properly identified. ADIZ procedures may be described in the chart legend.

18.8.5 Radio navigation aids

Radio aids to navigation may be shown by the appropriate symbol and named.

CHAPTER 19. PLOTTING CHART — ICAO

19.1 Function

This chart shall provide a means of maintaining a continuous flight record of the aircraft position by various fixing methods and dead reckoning in order to maintain an intended flight path.

19.2 Availability

This chart should be made available, in the manner prescribed in 1.3.2, to cover major air routes over oceanic areas and sparsely settled areas used by international civil aviation.

In areas where the Enroute Chart — ICAO is provided, there may be no requirement for a plotting chart.

19.3 Coverage and scale

19.3.1 Where practicable, the chart for a particular region should cover major air routes and their terminals on a single sheet.

19.3.2 The scale should be governed by the area to be covered.

Normally the scale will range from 1:3 000 000 to 1:7 500 000.

19.4 Format

The sheet should be of a size that can be adapted for use on a navigator’s plotting table.

19.5 Projection

19.5.1 A conformal projection on which a straight line approximates a great circle should be used.

19.5.2 Parallels and meridians shall be shown.

19.5.2.1 The intervals should be arranged to permit accurate plotting to be carried out with a minimum of time and effort.

19.5.2.2 Graduation marks shall be shown at consistent intervals along an appropriate number of parallels and meridians. The interval selected shall, regardless of scale, minimize the amount of interpolation required for accurate plotting.

19.5.2.3 Parallels and meridians should be numbered so that a number appears at least once every 15 cm (6 in) on the face of the chart.

19.5.2.4 If a navigational grid is shown on charts covering the higher latitudes, it shall comprise lines parallel to the Meridian or anti-Meridian of Greenwich.

19.6 Identification

Each sheet shall be identified by chart series and number.

19.7 Culture and topography

19.7.1 Generalized shore lines of all open water areas, large lakes and rivers shall be shown.

19.7.2 Spot elevations for selected features constituting a hazard to air navigation shall be shown.

19.7.3 Particularly hazardous or prominent relief features should be emphasized. Large cities and towns may be shown.

19.8 Magnetic variation

19.8.1 Isogonals or, in higher latitudes, isogrivs, or both, shall be shown at consistent intervals throughout the chart. The interval selected shall, regardless of scale, minimize the amount of interpolation required.

19.8.2 The date of the isogonic information shall be shown.

19.9 Aeronautical data

19.9.1 The following aeronautical data shall be shown:

a) aerodromes regularly used by international commercial air transport together with their names;

b) selected radio aids to navigation that will contribute to position-finding together with their names and identifications;

c) lattices of long-range electronic aids to navigation, as required;

d) boundaries of flight information regions, control areas and control zones necessary to the function of the chart;

e) designated reporting points necessary to the function of the chart;

f) ocean station vessels.

Other aeronautical data may be shown provided that they do not detract from the legibility of essential information.

19.9.2 Aeronautical ground lights and marine lights useful for air navigation should be shown where other means of navigation are non-existent.

CHAPTER 20. ELECTRONIC AERONAUTICAL CHART DISPLAY — ICAO

20.1 Function

The Electronic Aeronautical Chart Display — ICAO, with adequate back-up arrangements and in compliance with the requirements of Annex 6 for charts, shall enable flight crews to execute, in a convenient and timely manner, route planning, route monitoring and navigation by displaying required information.

20.2 Information available for display

20.2.1 The Electronic Aeronautical Chart Display — ICAO shall be capable of displaying all aeronautical, cultural and topographic information required by Chapter 5 and Chapters 7 through 19.

20.2.2 The Electronic Aeronautical Chart Display — ICAO should be capable of displaying all aeronautical, cultural and topographic information recommended by Chapter 5 and Chapters 7 through 19.

The Electronic Aeronautical Chart Display — ICAO may display supplementary information, in addition to that required for the equivalent paper chart, which may be considered useful for safe navigation.

20.3 Display requirements

20.3.1 Display categories

20.3.1.1 Information available for display shall be subdivided into the following categories:

a) basic display information, permanently retained on the display and consisting of the minimum information essential for the safe conduct of flight; and

b) other display information, which may be removed from the display or displayed individually on demand, and consisting of information not considered essential for the safe conduct of flight.

20.3.1.2 It shall be a simple function to add or remove other display information but shall not be possible to remove information contained in the basic display.

20.3.2 Display mode and generation of neighbouring area

20.3.2.1 The Electronic Aeronautical Chart Display — ICAO shall be capable of continuously plotting the aircraft's position in a true motion mode where reset and generation of the surrounding area shall take place automatically. Other modes, such as static chart displays, may be available.

20.3.2.2 It shall be possible manually to change the chart area and the position of the aircraft relative to the edge of the display.

20.3.3 Scale It shall be possible to vary the scale at which a chart is displayed.

20.3.4 Symbols

Symbols used shall conform to those specified for electronic charts in Appendix 2 — ICAO Chart Symbols except where it is desired to show items for which no ICAO chart symbol is provided. In these cases, electronic chart symbols shall be chosen which:

a) employ a minimum use of lines, arcs and area fills;

b) do not cause confusion with any existing aeronautical chart symbol;

c) do not impair the legibility of the display.

Additional details for each symbol may be added according to the resolution of the output media, but any enhancements may not change the basic recognizability of the symbol.

20.3.5 Display hardware

20.3.5.1 The effective size of the chart presentation shall be sufficient to display the information required by 20.2 without excessive scrolling.

20.3.5.2 The display shall have the capabilities required to accurately portray required elements of Appendix 2 — ICAO Chart Symbols.

20.3.5.3 The method of presentation shall ensure that the displayed information is clearly visible to the observer in the conditions of natural and artificial light experienced in the cockpit.

20.3.5.4 The display luminance shall be adjustable by the flight crew.

20.4 Provision and updating of data

20.4.1 The provision and updating of data for use by the display shall be in conformance with the aeronautical data quality system requirements.

20.4.2 The display shall be capable of automatically accepting authorized updates to existing data. A means of ensuring that authorized data and all relevant updates to that data have been correctly loaded into the display shall be provided.

20.4.3 The display shall be capable of accepting updates to authorized data entered manually with simple means for verification prior to final acceptance of the data. Updates entered manually shall be distinguishable on the display from authorized data and its authorized updates and shall not affect display legibility.

20.4.4 A record shall be kept of all updates, including date and time of application.

20.4.5 The display shall allow the flight crew to display updates so that the flight crew may review the contents of the updates and determine that they have been included in the system.

20.5 Performance tests, malfunction alarms and indications

20.5.1 A means shall be provided for carrying out on-board tests of major functions. In case of a failure, the test shall display information to indicate which part of the system is at fault.

20.5.2 A suitable alarm or indication of system malfunction shall be provided.

20.6 Back-up arrangements

To ensure safe navigation in case of a failure of the Electronic Aeronautical Chart Display — ICAO, the provision of adequate back-up arrangements shall include:

a) facilities enabling a safe takeover of display functions in order to ensure that a failure does not result in a critical situation; and

b) a back-up arrangement facilitating the means for safe navigation of the remaining part of the flight.

A suitable back-up system may include the carriage of paper charts.

CHAPTER 21. ATC SURVEILLANCE MINIMUM ALTITUDE CHART — ICAO

21.1 Function

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

21.1.2 A note indicating that the chart may only be used for cross-checking of altitudes assigned while the aircraft is identified shall be prominently displayed on the face of the chart.

21.2 Availability

The ATC Surveillance Minimum Altitude Chart — ICAO should be made available, in the manner prescribed in 1.3.2, where vectoring procedures are established and minimum vectoring altitudes cannot be shown adequately on the Area Chart — ICAO, Standard Departure Chart — Instrument (SID) — ICAO or Standard Arrival Chart — Instrument (STAR) — ICAO.

21.3 Coverage and scale

21.3.1 The coverage of the chart shall be sufficient to effectively show the information associated with vectoring procedures.

21.3.2 The chart shall be drawn to scale.

21.3.3 The chart should be drawn to the same scale as the associated Area Chart — ICAO.

21.4 Projection

21.4.1 A conformal projection on which a straight line approximates a geodesic line should be used.

21.4.2 Graduation marks should be placed at consistent intervals along the neat lines, as appropriate.

21.5 Identification

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

The name may be that of the city which the aerodrome serves or, when the procedures apply to more than one aerodrome, that of the air traffic services centre or the largest city or town situated in the area covered by the chart.

21.6 Culture and topography

21.6.1 Generalized shorelines of all open water areas, large lakes and rivers shall be shown except where they conflict with data more applicable to the function of the chart.

21.6.2 Appropriate spot elevations and obstacles shall be shown.

Appropriate spot elevations and obstacles are those provided by the procedures specialist.

21.7 Magnetic variation

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

21.8 Bearings, tracks and radials

21.8.1 Bearings, tracks and radials shall be magnetic, except as provided for in 21.8.2.

21.8.2 In areas of high latitude, where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.

21.8.3 Where bearings, tracks or radials are given with reference to True North or Grid North, this shall be clearly indicated. When Grid North is used, its reference grid meridian shall be identified.

21.9 Aeronautical data

21.9.1 Aerodromes

21.9.1.1 All aerodromes that affect the terminal routings shall be shown. Where appropriate, a runway pattern symbol shall be used.

21.9.1.2 The elevation of the primary aerodrome to the nearest metre or foot shall be shown.

21.9.2 Prohibited, restricted and danger areas

Prohibited, restricted and danger areas shall be depicted with their identification.

21.9.3 Air traffic services system

21.9.3.1 The chart shall show components of the established air traffic services system including:

a) relevant radio navigation aids together with their identifications;

b) lateral limits of relevant designated airspace;

c) relevant significant points associated with standard instrument departure and arrival procedures;

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

d) transition altitude, where established;

e) information associated with vectoring including:

1) minimum vectoring altitudes to the nearest higher 50 m or 100 ft, clearly identified;

2) lateral limits of minimum vectoring altitude sectors normally defined by bearings and radials to/from radio navigation aids to the nearest degree or, if not practicable, geographical coordinates in degrees, minutes and seconds and shown by heavy lines so as to clearly differentiate between established sectors;

In congested areas, geographical coordinates may be omitted in the interest of legibility.

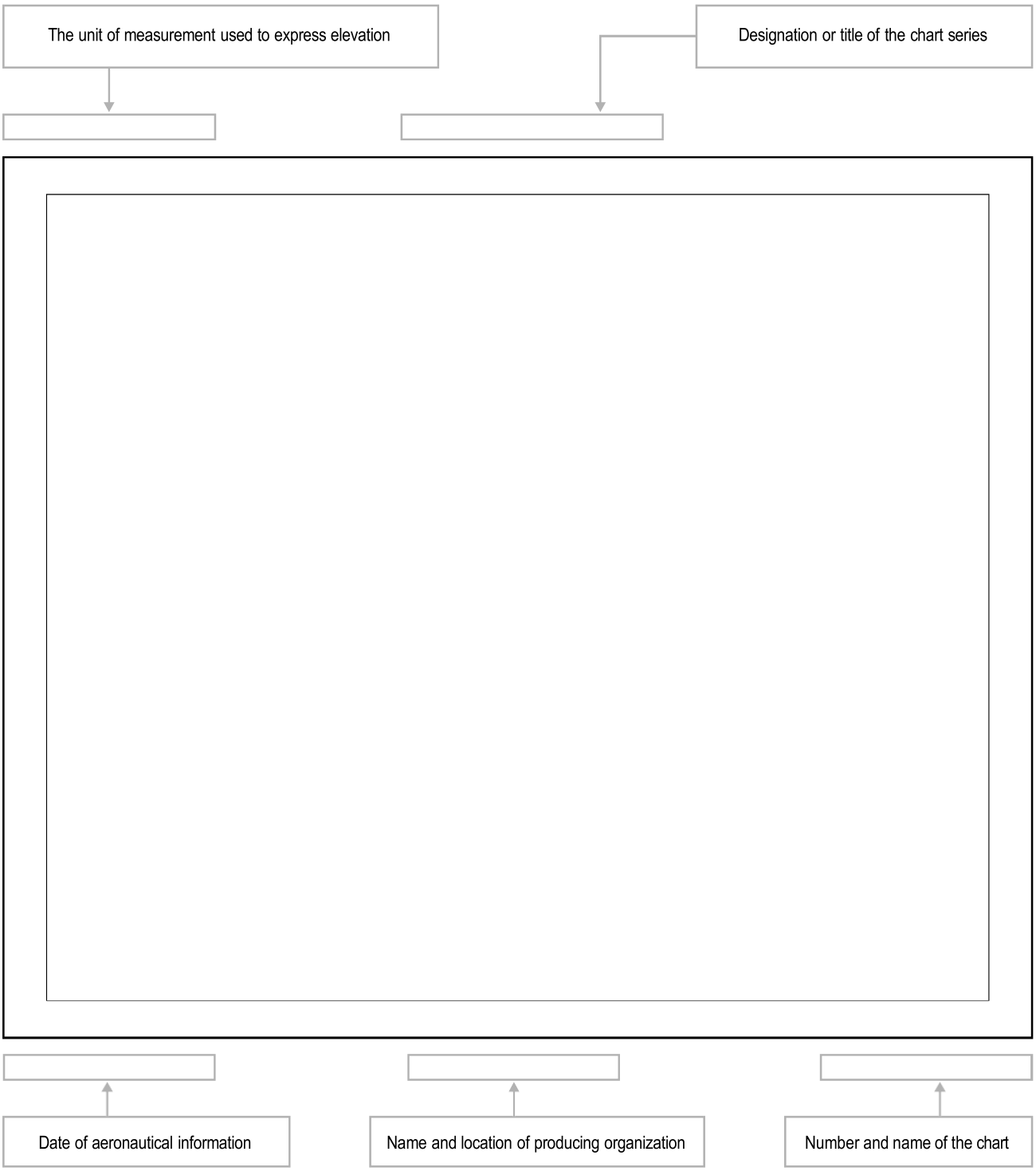
3) distance circles at 20-km or 10-NM intervals or, when practicable, 10-km or 5-NM intervals shown as fine dashed lines with the radius indicated on the circumference and centred on the identified aerodrome main VOR radio navigation aid or, if not available, on the aerodrome/heliport reference point;

4) notes concerning correction for low temperature effect, as applicable;

f) communications procedures including call sign(s) and channel(s) of the ATC unit(s) concerned.

21.9.3.2 A textual description of relevant communication failure procedures should be provided and should, whenever feasible, be shown on the chart or on the same page that contains the chart.

APPENDIX 1. MARGINAL NOTE LAYOUT



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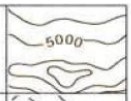
1	Contours	
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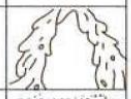
3	Relief shown by hachures	
4	Bluff, cliff or escarpment	
5	Lava flow	
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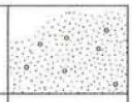
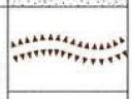
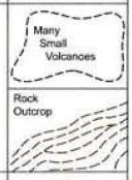
7	Sand area	

8	Gravel		
9	Levee or esker	Alternative	
10	Unusual land features appropriately labelled		
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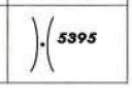
11	Mountain pass		

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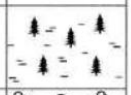
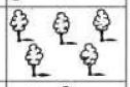
13	Spot elevation		.6397 .8975
14	Spot elevation (of doubtful accuracy)		.6370±
15	Coniferous trees		
16	Other trees		
17	Palms		

18	Areas not surveyed for contour information or relief data incomplete	Caution

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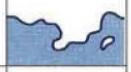
19	Shore line (reliable)		
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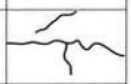
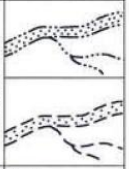
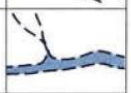
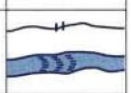
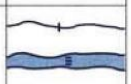
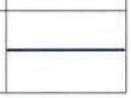
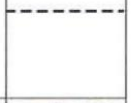
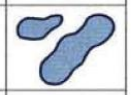
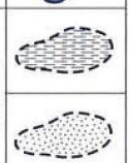
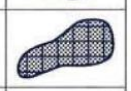
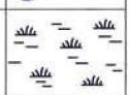
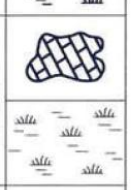
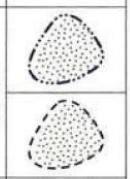
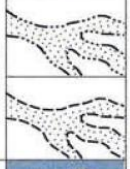
22	Coral reefs and ledges		
23	Large river (perennial)		
24	Small river (perennial)		
25	Rivers and streams (non-perennial)	Alternative	
26	Rivers and streams (unsurveyed)		
27	Rapids		
28	Falls		
29	Canal		

30	Abandoned canal *Note.— Dry canal having landmark value.*		
31	Lakes (perennial)		
32	Lakes (non-perennial)	Alternative	
33	Salt lake		
34	Salt pans (evaporator)		
35	Swamp		
36	Rice field	Alternative	
37	Spring, well or water hole	perennial	●
		intermittent	○

38	Reservoir		■ *Reservoir*
39	Dry lake bed	Alternative	
40	Wash	Alternative	
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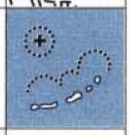
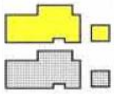
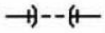
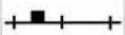
42	Glaciers and ice caps		
43	Danger line (2 m or one fathom line)		
44	Charted isolated rock		+
45	Rock awash		⁺
46	Unusual water features appropriately labelled		

CULTURE

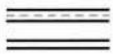
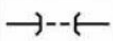
BUILT-UP AREAS

47	City or large town	
48	Town	
49	Village	
50	Buildings	

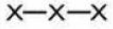
RAILROADS

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

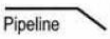
HIGHWAYS AND ROADS

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

MISCELLANEOUS

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

MISCELLANEOUS (Cont.)

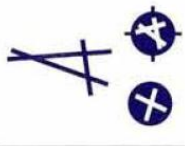
69	Pipeline	
70	Oil or gas field	
71	Tank farms	
72	Nuclear power station	
73	Coast guard station	
74	Lookout tower	
75	Mine	
76	Forest ranger station	
77	Race track or stadium	
78	Ruins	
79	Fort	
80	Church	
81	Mosque	
82	Pagoda	
83	Temple	

AERODROMES

84	Civil	Land	
85	Civil	Water	
86	Military	Land	
87	Military	Water	

88	Joint civil and military	Land	
89	Joint civil and military	Water	
90	Emergency aerodrome or aerodrome with no facilities		
91	Abandoned or closed aerodrome		

92	Sheltered anchorage	
93	Aerodrome for use on charts on which aerodrome classification is not required e.g. Enroute Charts	
94	Heliport *Note.— Aerodrome for the exclusive use of helicopters*	

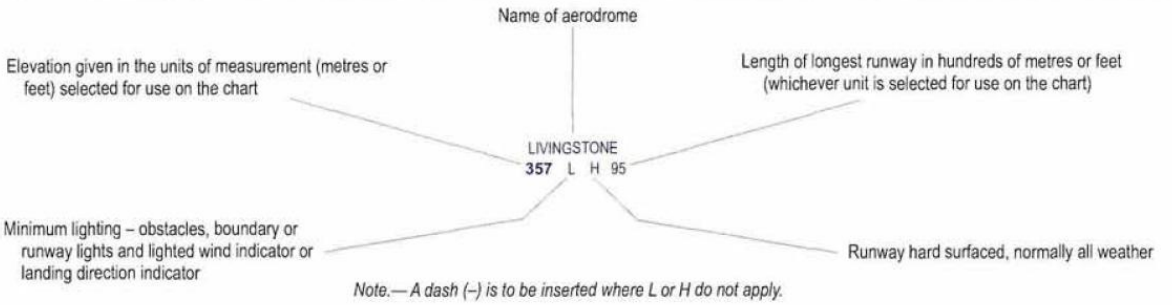
95	*Note.— Where required by the function of the chart, the runway pattern of the aerodrome may be shown in lieu of the aerodrome symbol, for example:*	

AERODROMES *(Cont.)*

AERODROME DATA IN ABBREVIATED FORM WHICH MAY BE IN ASSOCIATION WITH AERODROME SYMBOLS

(Reference: 16.9.2.2 and 17.9.2.2)

96



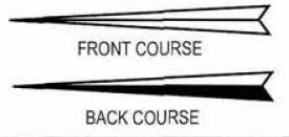
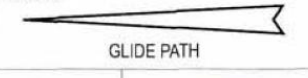
Note.— A dash (–) is to be inserted where L or H do not apply.

AERODROME SYMBOLS FOR APPROACH CHARTS

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

RADIO NAVIGATION AIDS*

99	Basic radio navigation aid symbol *Note.— This symbol may be used with or without a box to enclose the data.*		
100	Non-directional radio beacon	NDB	
101	VHF omnidirectional radio range	VOR	
102	Distance measuring equipment	DME	
103	Collocated VOR and DME radio navigation aids	VOR/DME	
104	DME distance	Distance in kilometres (nautical miles) to DME → 15 km Identification of radio navigation aid → KAV	
105	VOR radial	Radial bearing from, and identification of, VOR	R 090 KAV
106	UHF tactical air navigation aid	TACAN	

107	Collocated VOR and TACAN radio navigation aids	VORTAC	
108	Instrument landing system	ILS	PLAN VIEW Electronic  PROFILE Electronic 
109	Radio marker beacon	Elliptical	
		Bone Shape	

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

110

Compass rose
To be orientated on the chart in accordance with the alignment of the station (normally Magnetic North)

Compass rose to be used as appropriate in combination with the following symbols:

VOR	
VOR/DME	
TACAN	
VORTAC	

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

**Note.— Guidance material on the presentation of radio navigation aid data is given in the* Aeronautical Chart Manual *(Doc 8697).*

AIR TRAFFIC SERVICES

111	Flight information region	FIR	
112	Aerodrome traffic zone	ATZ	
113	Control area Airway Controlled route	CTA AWY	Alternative
114	Uncontrolled route		
115	Advisory airspace	ADA	
116	Control zone	CTR	

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

Significant Point Functionality

		Significant point depiction for conventional navigation		Significant point depiction for area navigation			
	REPORTING FLY-BY/FLY-OVER	On request (NA)	Compulsory (NA)	On request fly-by	Compulsory fly-by	On request flyover	Compulsory flyover
121 Basic Symbols with functionality	VFR reporting point	△	▲	△	▲	△	▲
	Intersection INT	△	▲	△	▲	△	▲
	VORTAC	⬡	⬢	⬡	⬢	⬡	⬢
	TACAN	⬡	⬢	⬡	⬢	⬡	⬢
	VOR	⬡	⬢	⬡	⬢	⬡	⬢
	VOR/DME	⬡	⬢	⬡	⬢	⬡	⬢
	NDB	◎	◎	◎	◎	◎	◎
	Waypoint WPT	Not used	Not used	◇	◆	◇	◆

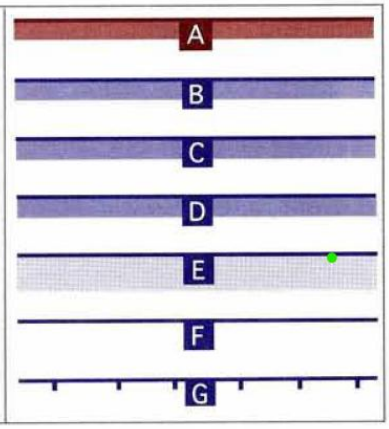
For details on use and meaning of these symbols, refer to paragraph 2.4

122	Change-over point COP To be superimposed on the appropriate route symbol at right angles to the route	26 / 36	123	ATS/MET reporting point MRP	Compulsory On request	124	Final approach fix FAF	

125	Altitudes/flight levels	Altitude/flight level "window"	17 000 10 000	FL 220 10 000
		"At or above" altitude/flight level	7 000	FL 70
		"At or below" altitude/flight level	5 000	FL 50
		"Mandatory" altitude/flight level	3 000	FL 30
		"Recommended" procedure altitude/flight level	5 000	FL 50
		"Expected" altitude	Expect 5 000	Expect FL 50
	Note.— For use only on SID and STAR charts. Not intended for depiction of minimum obstacle clearance altitude.			

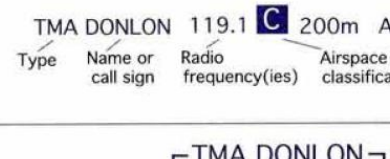
AIRSPACE CLASSIFICATIONS

126 Airspace classifications



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

127 Alternative



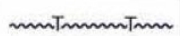
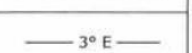
AIRSPACE RESTRICTIONS

128	Restricted airspace (prohibited, restricted or danger area)		Common boundary of two areas	
	Note:—The angle and density of rulings may be varied according to scale and the size, shape and orientation of the area.			
129	International boundary closed to passage of aircraft except through air corridor			

OBSTACLES

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

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

137	Prominent transmission line	
138	Isogonic line or isogonal	
139	Ocean station vessel (normal position)	

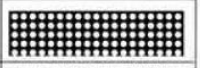
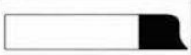
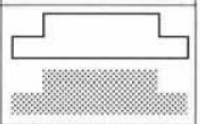
140	Wind turbine — unlighted and lighted	
141	Wind turbines — minor group and group in major area, lighted	

VISUAL AIDS

142	Marine light *Note 2.– Characteristics are to be indicated as follows:* Alt Alternating B Blue F Fixed	F	*Note 1.– Marine alternating lights are red and white unless otherwise indicated. Marine lights are white unless colours are stated.* Fl Flashing G Green Gp Group Occ Occulting R Red SEC Sector sec Second (U) Unwatched W White
143	Aeronautical ground light	☆ Electronic ★	

144	Lightship	

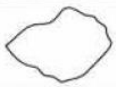
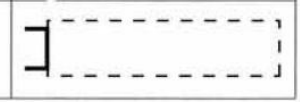
SYMBOLS FOR AERODROME/HELIPORT CHARTS

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

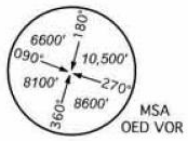
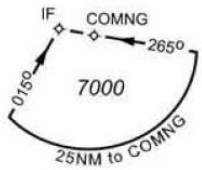
154	Point light	
155	Obstacle light	
156	Landing direction indicator (lighted)	
157	Landing direction indicator (unlighted)	
158	Stop bar	
159	Runway-holding position Pattern A Pattern B *Note.– For application, see Annex 14, Volume I, 5.2.10.*	
160	Intermediate holding position *Note.– For application, see Annex 14, Volume I, 5.2.11.*	
161	Hot spot *Note.– Hot spot location to be circled.*	

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

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

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

ADDITIONAL SYMBOLS FOR USE ON PAPER AND ELECTRONIC CHARTS

	PLAN VIEW	Electronic
171	Minimum sector altitude *Note.— This symbol may be modified to reflect particular sector shapes.* MSA	
172	Terminal arrival altitude *Note.— This symbol may be modified to reflect particular TAA shapes.* TAA	
173	Holding pattern	
174	Missed approach track	

PROFILE

175	Runway	
176	Radio navigation aid (type of aid and its use in the procedure to be annotated on top of the symbol)	
177	Radio marker beacon (type of beacon to be annotated on top of the symbol)	
178	Collocated radio navigation aid and marker beacon (type of aid to be annotated on top of the symbol)	
179	DME fix (distance from DME and the fix use in the procedure to be annotated on top of the symbol)	
180	Collocated DME fix and marker beacon (distance from DME and the type of beacon to be annotated on top of the symbol)	

APPENDIX 3. COLOUR GUIDE

CHART SYMBOLS

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

CHART SYMBOLS *(Cont.)*

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

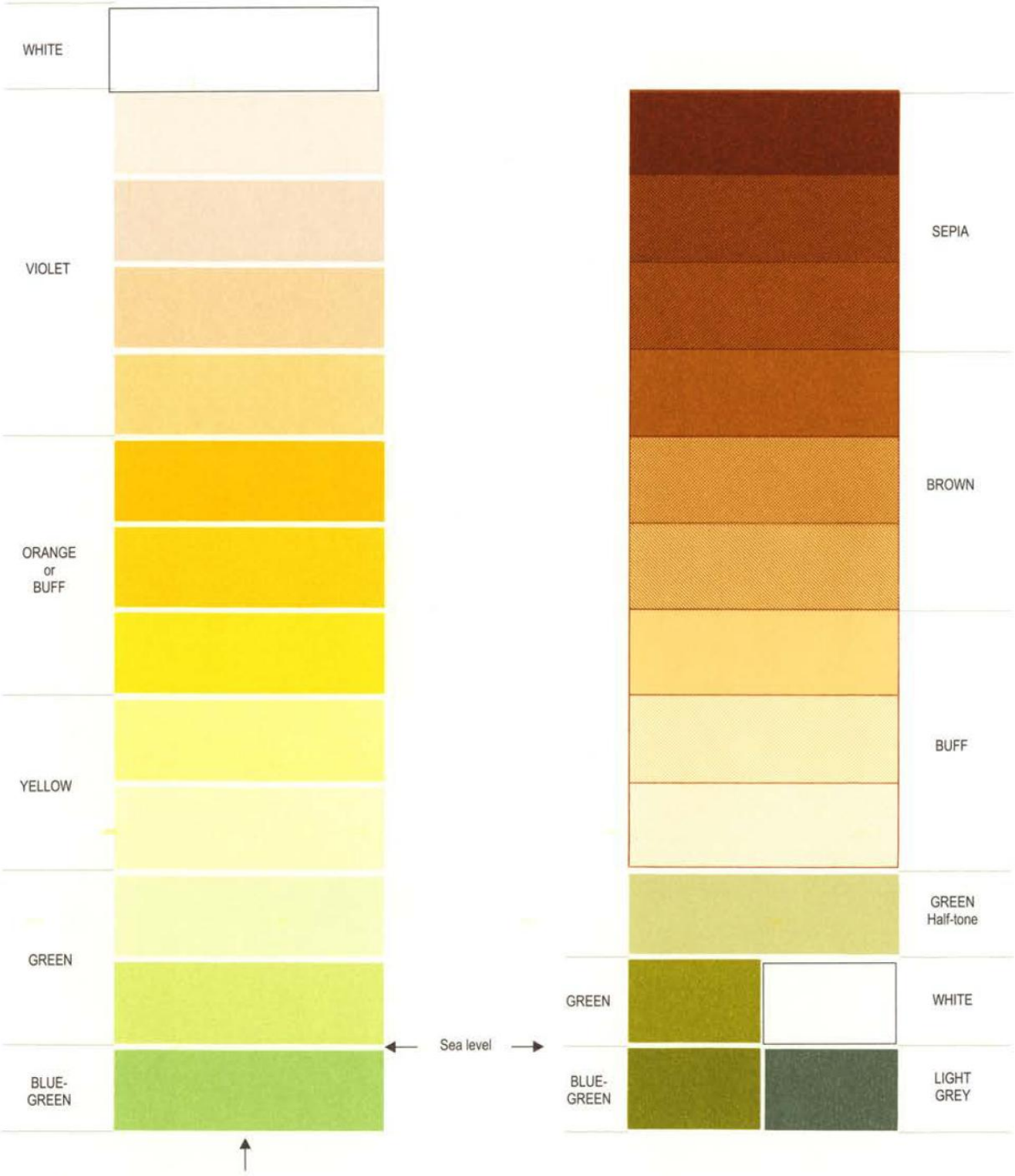
HYPSOMETRIC TINTS

WHITE VIOLET	Tint for extreme elevations		SEPIA	
ORANGE or BUFF	Tint for higher range elevations		BROWN	
YELLOW	Tint for middle range elevations		BUFF	
GREEN	Tint for lower range elevations	Optional colours	GREEN WHITE	
BLUE-GREEN	Tint for areas below sea level	Optional colours	BLUE-GREEN LIGHT GREY	

Note.— Basic tints are identical to those specified for the International Map of the World.

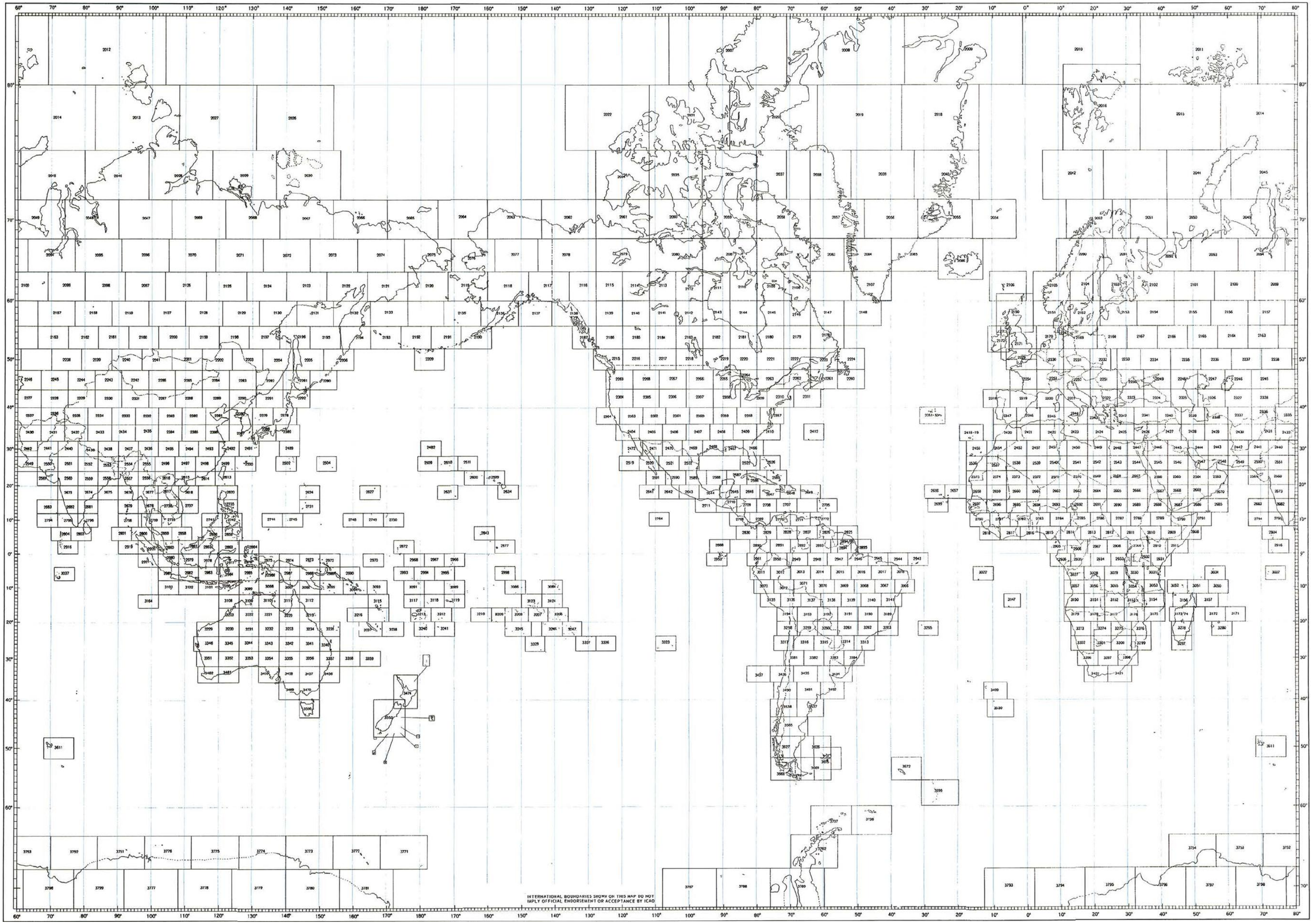
APPENDIX 4. HYPSOMETRIC TINT GUIDE

(Alternative systems, reference 2.12.2)



Note 1.— These tints are identical to those specified for the International Map of the World.

Note 2.— Elevations have not been associated with tints of either system in order to allow for flexibility in their selection.


INTERNATIONAL BOUNDARIES SHOWN ON THIS MAP DO NOT IMPLY OFFICIAL ENDORSEMENT OR ACCEPTANCE BY ICAO

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	routine
P, R, D area boundary points (outside CTA/CTR boundaries)	as plotted	routine
P, R, D area boundary points (inside CTA/CTR boundaries)	as plotted	essential
CTA/ CTR boundary points	as plotted	essential
En-route navaids, intersections and waypoints, and holding, and STAR/SID points	1 sec	essential
Obstacles in Area 1 (the entire State territory)	as plotted	routine
Aerodrome/heliport reference point	1 sec	routine
Navaids located at the aerodrome/heliport	as plotted	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 sec	essential
Runway thresholds	1 sec	critical
Taxiway centre line/parking guidance line points	1/100 sec	essential
Runway end	1 sec	critical
Runway holding position	1 sec	critical
Taxiway intersection marking line	1 sec	essential
Exit guidance line	1 sec	essential
Apron boundaries (polygon)	1 sec	routine
De-/anti-icing facility (polygon)	1 sec	routine
Aircraft standpoints/INS checkpoints	1/100 sec	routine
Geometric centre of TLOF or FATO thresholds, heliports	1 sec	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	essential
WGS-84 geoid undulation at aerodrome/heliport elevation position	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	0.5 m or 1 ft	critical
WGS-84 geoid undulation at runway or FATO threshold, TLOF geometric centre, precision approaches	0.5 m or 1 ft	critical
Threshold crossing height (Reference datum height), precision approaches	0.5 m or 1 ft	critical
Obstacle clearance altitude/height (OCA/H)	as specified in PANS-OPS (Doc 8168)	essential
Obstacles in Area 1 (the entire State territory)	3 m (10 ft)	routine
Obstacles in Area 2	1 m or 1 ft	essential
Obstacles in Area 3	1 m or 1 ft	essential
Distance measuring equipment (DME)	30 m (100 ft)	essential
Instrument approach procedures altitude	as specified in PANS-OPS (Doc 8168)	essential
Minimum altitudes	50 m or 100 ft	routine
Heliport crossing height, PinS approaches	1 m or 1 ft	essential

Table 3. Gradients and angles

Type of gradient/angle	Chart resolution	Integrity Classification
Non-precision final approach descent gradient	0.1 per cent	critical
Final approach descent angle (Non-precision approach or approach with vertical guidance)	0.1 degree	critical
Precision approach glide path/elevation angle	0.1 degree	critical

Table 4. Magnetic variation

Magnetic variation	Chart resolution	Integrity Classification
Aerodrome/heliport magnetic variation	1 degree	essential

Table 5. Bearing

Bearing	Chart resolution	Integrity Classification
Airway segments	1 degree	routine
Bearing used for the formation of an en-route and of 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	1/10 degree	essential
ILS localizer alignment	1 degree	essential
MLS zero azimuth alignment	1 degree	essential
Runway and FATO bearing	1 degree	routine

Table 6. Length/distance/dimension

Length/distance/dimension	Chart resolution	Integrity Classification
Airway segment length	1 km or 1 NM	routine
Distance used for the formation of an en-route fix	2/10 km (1/10 NM)	routine
Terminal arrival/departure route segment length	1 km or 1 NM	essential
Distance used for the formation of a terminal and instrument approach procedure fix.	2/10 km (1/10 NM)	essential
Runway and FATO length, TLOF dimensions	1 m	critical
Runway width	1 m	essential
Stopway length and width	1 m	critical
Landing distance available	1 m	critical
Take-off run available	1 m	critical
Take-off distance available	1 m	critical
Accelerate-stop distance available	1 m	critical
ILS localizer antenna-runway end, distance	as plotted	routine
ILS glide slope antenna-threshold, distance along centre line	as plotted	routine
ILS marker-threshold distance	2/10 km (1/10 NM)	essential
ILS DME antenna-threshold, distance along centre line	as plotted	essential
MLS azimuth antenna-runway end, distance	as plotted	routine
MLS elevation antenna-threshold, distance along centre line	as plotted	routine
MLS DME/P antenna-threshold, distance along centre line	as plotted	essential

— END —