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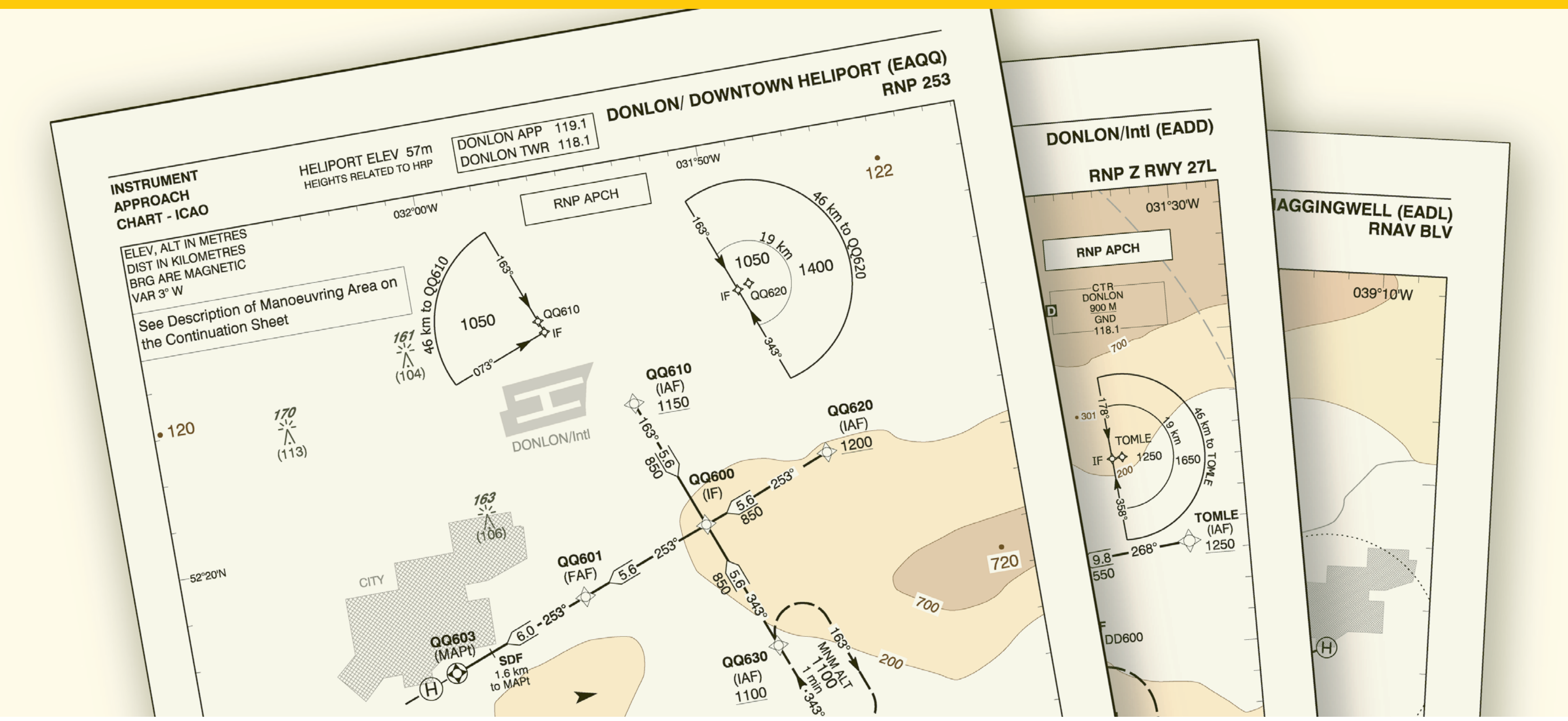
Aeronautical Chart Manual

Third Edition, 2016



Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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AMENDMENTS

Amendments are announced in the supplements to the *Products and Services Catalogue;* the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS		
No.	Date	Entered by
1	11.12.20	ICAO

CORRIGENDA		
No.	Date	Entered by
1	10.6.16	ICAO

FOREWORD

The Standards and Recommended Practices (SARPs) and explanatory notes contained in Annex 4 — *Aeronautical Charts* define the obligations of States to make available certain ICAO aeronautical chart types, and specify chart coverage, format, identification and content including standardized symbology and colour use. The goal is to satisfy the need for uniformity and consistency in the provision of a broad range of aeronautical charts that contain appropriate information of a defined quality. The aeronautical charts required by all segments of the aviation community can thus be provided in the form, quality and variety in which they best serve their function.

The purpose of this manual is to explain the obligations of States for providing aeronautical charts and to describe methods for their production, distribution and maintenance. It is also intended that the manual:

a) assist both governmental and non-governmental charting agencies in the uniform application of the SARPs contained in Annex 4;

b) promote maximum efficiency in the organization and operation of services providing aeronautical charts; and

c) assist States in the training of personnel responsible for the production of aeronautical charts.

In developing the manual it was necessary to limit some of the content. The manual does not generally cover how information/data to be charted is derived before it reaches the cartographer. The manual does, however, often indicate who or which authority should be supplying the information and provides references to associated documents. It has been assumed that each State has some cartographic capacity and that it would be unnecessary to give significant consideration to basic cartographic practices and techniques. Also, techniques specific to particular cartographic software and hardware are not covered as those elements would be included in the training and documentation provided by the producers and vendors of those products. The scope of the manual is therefore generally limited to those aspects which concern the application of Annex 4 SARPs to aeronautical chart production and chart distribution.

The manual is published further to Recommendation 11/1 of the Aeronautical Information Services and Aeronautical Charts Divisional Meeting (Montréal, 13 April to 7 May 1966), and is published under the authority of the Secretary General of ICAO. It should be read in conjunction with the latest editions of the following related ICAO documents:

Annex 4 — *Aeronautical Charts*
Annex 15 — *Aeronautical Information Services*
Doc 8126 — *Aeronautical Information Services Manual*
Doc 8400 — *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC)
Doc 9674 — *World Geodetic System — 1984 (WGS-84) Manual*

Users of this manual may also wish to consult the online Aviation Training Directory of ICAO at http://www.icao.int/td/ for institutions that provide training in aeronautical cartography.

With the exception of Chapter 7, references within square brackets [ ] at the right margin are to the governing SARPs of Annex 4, and relate to the subsequent sub-paragraphs of the manual. Chapter 7 is divided into sub-sections which relate to the chapters of Annex 4. In Chapter 7, the references reflecting the Annex 4 provisions concerned are listed in a separate column and are shown opposite the text. The second digit of the page numbers in Chapter 7 correspond to chapters in Annex 4.

With this new edition, the manual is brought up to date with Annex 4, Amendment 58, and is distributed electronically. In order to support the performance-based navigation (PBN) criteria, as well as other technologies such as ground-based augmentation systems (GBAS) and satellite-based augmentation system (SBAS) landing systems, new charting recommendations have been developed and introduced in the manual. Charting and navigation data requirements have been taken into account to promote harmonization of charts, databases and avionics systems. New charting criteria for point-in-space (PinS) operations for helicopters and for departures for helicopters have been introduced. The document also presents a new chapter aimed at providing instructions and guidelines to support States` implementation of fully automated charting systems.

Users are invited to forward to ICAO suggestions for improvements or additions based on their experience when using the manual. Any contribution for inclusion in the manual, or any errors or discrepancies noticed therein, should be brought to the attention of:

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International Civil Aviation Organization
999 Robert-Bourassa Boulevard
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CANADA
H3C 5H7

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Specimen charts

The Specimen charts are available electronically in Adobe PDF format and will be provided separately in conjunction with the Aeronautical Chart Manual.

DEFINITIONS

Accelerate-stop distance available. The length of the take-off run available plus the length of the stopway, if provided.

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

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

Advisory airspace. An airspace of defined dimensions, or designated route, within which air traffic advisory service is available.

Advisory route. A designated route along which air traffic advisory service is available.

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

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

Aerodrome control service. Air traffic control service for aerodrome traffic.

Aerodrome control tower. A unit established to provide air traffic control service to aerodrome traffic.

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

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

a) take-off, expressed in terms of runway visual range and/or visibility and, if necessary, cloud conditions;

b) landing in 2D instrument approach operations, expressed in terms of visibility and/or runway visual range, minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions; and

c) landing in 3D instrument approach operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the type and/or category of the operation.

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

Aerodrome traffic. All traffic on the manoeuvring area of an aerodrome and all aircraft flying in the vicinity of an aerodrome.

Note.— An aircraft is in the vicinity of an aerodrome when it is in, entering or leaving an aerodrome traffic circuit.

Aerodrome traffic circuit. The specified path to be flown by aircraft operating in the vicinity of an aerodrome.

Aerodrome traffic zone. An airspace of defined dimensions established around an aerodrome for the protection of aerodrome traffic.

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

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

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

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

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

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

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

Aeronautical station. A land station in the aeronautical mobile service. In certain instances, an aeronautical station may be located, for example, on board ship or on a platform at sea.

Aeronautical telecommunication service. A telecommunication service provided for any aeronautical purpose.

Aeronautical telecommunication station. A station in the aeronautical telecommunication service.

Aeroplane. A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.

AIP Amendment. Permanent changes to the information contained in the AIP.

AIP Supplement. Temporary changes to the information contained in the AIP which are published by means of special pages.

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

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

Air-ground control radio station. An aeronautical telecommunication station having primary responsibility for handling communications pertaining to the operation and control of aircraft in a given area.

Air side. The movement area of an airport, adjacent terrain and buildings or portions thereof, access to which is controlled.

Air taxiway. A defined path on the surface established for the air taxiing of helicopters.

Air-to-ground communication. One-way communication from aircraft to stations or locations on the surface of the Earth.

Air traffic. All aircraft in flight or operating on the manoeuvring area of an aerodrome.

Air traffic advisory service. A service provided within advisory airspace to ensure separation, in so far as practical, between aircraft which are operating on IFR flight plans.

Air traffic control service. A service provided for the purpose of:

a) preventing collisions:

   i) between aircraft, and

   ii) on the manoeuvring area between aircraft and obstructions; and

b) expediting and maintaining an orderly flow of air traffic.

Air traffic control unit. A generic term meaning variously, area control centre, approach control unit or aerodrome control tower.

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

Air traffic services airspaces. Airspaces of defined dimensions, alphabetically designated, within which specific types of flights may operate and for which air traffic services and rules of operation are specified.

Note.— ATS airspaces are classified as Class A to G as shown in Annex 11, Appendix 4.

Air traffic services reporting office. A unit established for the purpose of receiving reports concerning air traffic services and flight plans submitted before departure.

Note.— An air traffic services reporting office may be established as a separate unit or combined with an existing unit, such as another air traffic services unit, or a unit of the aeronautical information service.

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

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

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

AIS product. Aeronautical data and aeronautical information provided in the form of the elements of the Integrated Aeronautical Information Package (except NOTAM and PIB), including aeronautical charts, or in the form of suitable electronic media.

Alternate aerodrome. An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing where the necessary services and facilities are available, where aircraft performance requirements can be met and which is operational at the expected time of use. Alternate aerodromes include the following:

Take-off alternate. An alternate aerodrome at which an aircraft would be able to land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure.

En-route alternate. An alternate aerodrome at which an aircraft would be able to land in the event that a diversion becomes necessary while en route.

Destination alternate. An alternate aerodrome at which an aircraft would be able to land should it become either impossible or inadvisable to land at the aerodrome of intended landing.

Note.— The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for that flight.

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

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

Approach control service. Air traffic control service for arriving or departing controlled flights.

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

Area control centre. A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

Area control service. Air traffic control service for controlled flights in control areas.

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

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

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

Area navigation route. An ATS route established for the use of aircraft capable of employing area navigation.

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

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

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

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

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

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

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

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

Automatic terminal information service (ATIS). The automatic provision of current, routine information to arriving and departing aircraft throughout 24 hours or a specified portion thereof:

Data link-automatic terminal information service (*D-ATIS*). The provision of ATIS via data link.

Voice-automatic terminal information service (Voice-ATIS). The provision of ATIS by means of continuous and repetitive voice broadcasts.

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

Barrette. Three or more aeronautical ground lights closely spaced in a transverse line so that from a distance they appear as a short bar of light.

Base turn. A turn executed by the aircraft during the initial approach between the end of the outbound track and the beginning of the intermediate or final approach track. The tracks are not reciprocal.

Note.— Base turns may be designated as being made either in level flight or while descending, according to the circumstances of each individual procedure.

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

Canopy. Bare Earth supplemented by vegetation height.

Ceiling. The height above the ground or water of the base of the lowest layer of cloud below 6 000 metres (20 000 ft) covering more than half the sky.

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

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

Circling approach. An extension of an instrument approach procedure which provides for visual circling of the aerodrome prior to landing.

Clearway. A defined rectangular area on the ground or water under the control of the appropriate authority, selected or prepared as a suitable area over which an aeroplane may make a portion of its initial climb to a specified height.

Communication centre. An aeronautical fixed station which relays or retransmits telecommunication traffic from (or to) a number of other aeronautical fixed stations directly connected to it.

Contour line. A line on a map or chart connecting points of equal elevation.

Control area. A controlled airspace extending upwards from a specified limit above the Earth.

Control zone. A controlled airspace extending upwards from the surface of the Earth to a specified upper limit.

Controlled aerodrome. An aerodrome at which air traffic control service is provided to aerodrome traffic.

Note.— The term "controlled aerodrome" indicates that air traffic control service is provided to aerodrome traffic but does not necessarily imply that a control zone exists.

Controlled airspace. An airspace of defined dimensions within which air traffic control service is provided in accordance with the airspace classification.

Note.— Controlled airspace is a generic term which covers ATS airspace Classes A, B, C, D and E as described in 2.6 of Annex 11.

Controlled flight. Any flight which is subject to an air traffic control clearance.

Culture. All man-made features constructed on the surface of the Earth, such as cities, railways and canals.

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

Danger area. An airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times.

Data product. Data set or data set series that conforms to a data product specification (ISO 19131).

Data product specification. Detailed description of a data set or data set series together with additional information that will enable it to be created, supplied to and used by another party (ISO 19131).

Note.— A data product specification provides a description of the universe of discourse and a specification for mapping the universe of discourse to a data set. It may be used for production, sales, end-use or other purpose.

Data quality. A degree or level of confidence that the data provided meet the requirements of the data user in terms of accuracy, resolution and integrity.

Data set. Identifiable collection of data (ISO 19101).

Data set series. Collection of data sets sharing the same product specification (ISO 19115).

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

Note.— This primarily refers to data stored electronically and accessed by computer rather than in files of physical records.

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

Declared distances.

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

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

Accelerate-stop distance available (ASDA). The length of the take-off run available plus the length of the stopway, if provided.

Landing distance available (LDA). The length of runway which is declared available and suitable for the ground run of an aeroplane landing.

Note.— The calculation of declared distances is described in Annex 14, Volume I, Attachment A.

Declared distances — heliports.

Take-off distance available (TODAH). The length of the final approach and take-off area plus the length of helicopter clearway (if provided) declared available and suitable for helicopters to complete the take-off.

Rejected take-off distance available (RTODAH). The length of the final approach and take-off area declared available and suitable for helicopters operated in performance class 1 to complete a rejected take-off.

Landing distance available (LDAH). The length of the final approach and take-off area plus any additional area declared available and suitable for helicopters to complete the landing manoeuvre from a defined height.

Descent fix. A fix established in a precision approach at the FAP to eliminate certain obstacles before the FAP, which would otherwise have to be considered for obstacle clearance purposes.

Digital Elevation Model (DEM). The representation of terrain surface by continuous elevation values at all intersections of a defined grid, referenced to common datum.

Note.— Digital Terrain Model (DTM) is sometimes referred to as DEM.

Direct transit area. A special area established in an international airport, approved by the public authorities concerned and under their direct supervision or control, where passengers can stay during transit or transfer without applying for entry to that State.

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

DME distance. The line of sight distance (slant range) from the source of a DME signal to the receiving antenna.

Electronic aeronautical chart display. An electronic device by which flight crews are enabled to execute, in a convenient and timely manner, route planning, route monitoring and navigation by displaying required information.

Elevation. The vertical distance of a point or a level, on or affixed to the surface of the Earth, measured from mean sea level.

Ellipsoid height (Geodetic height). The height related to the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question.

Facility performance Category I – ILS. An ILS which provides guidance information from the coverage limit of the ILS to the point at which the localizer course line intersects the ILS glide path at a height of 60 m (200 ft) or less above the horizontal plane containing the threshold.

Note.— This definition is not intended to preclude the use of Facility Performance Category I — ILS below the height of 60 m (200 ft), with visual reference where the quality of the guidance provided permits, and where satisfactory operational procedures have been established.

Facility performance Category II – ILS. An ILS which provides guidance information from the coverage limit of the ILS to the point at which the localizer course line intersects the ILS glide path at a height of 15 m (50 ft) or less above the horizontal plane containing the threshold.

Facility performance Category III – ILS. An ILS which, with the aid of ancillary equipment where necessary, provides guidance information from the coverage limit of the facility to, and along, the surface of the runway.

Fan marker beacon. A type of radio beacon, the emissions of which radiate in a vertical fan-shaped pattern.

Feature. Abstraction of real world phenomena (ISO 19101).

Feature attribute. Characteristic of a feature (ISO 19101).

Note.— A feature attribute has a name, a data type and a value domain associated with it.

Feature operation. Operation that every instance of a feature type may perform (ISO 19110).

Note.— An operation upon the feature type dam is to raise the dam. The result of this operation is to raise the level of water in the reservoir.

Feature relationship. Relationship that links instances of one feature type with instances of the same or a different feature type (ISO 19101).

Feature type. Class of real world phenomena with common properties (ISO 19110).

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

Final approach. That part of an instrument approach procedure which commences at the specified final approach fix or point, or where such a fix or point is not specified,

a) at the end of the last procedure turn, base turn or inbound turn of a racetrack procedure, if specified; or

b) at the point of interception of the last track specified in the approach procedure; and

ends at a point in the vicinity of an aerodrome from which:

1) a landing can be made; or

2) a missed approach procedure is initiated.

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

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

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

Fixed light. A light having constant luminous intensity when observed from a fixed point.

Flight information centre. A unit established to provide flight information service and alerting service.

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

Flight information service. A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.

Flight level. A surface of constant atmospheric pressure which is related to a specific pressure datum, 1 013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals.

Note 1.— A pressure type altimeter calibrated in accordance with the Standard Atmosphere:

a) when set to a QNH altimeter setting, will indicate altitude;

b) when set to a QFE altimeter setting, will indicate height above the QFE reference datum;

c) when set to a pressure of 1 013.2 hPa, may be used to indicate flight levels.

Note 2.— The terms "height" and "altitude", used in Note 1 above, indicate altimetric rather than geometric heights and altitudes.

Flight plan. Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft.

Note.— Specifications for flight plans are contained in Annex 2. When the expression "flight plan form" is used it denotes the model flight plan form at Appendix 2 to the PANS-ATM.

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

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

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

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

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

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

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

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

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

Hazard beacon. An aeronautical beacon used to designate a danger to air navigation.

Heading. The direction in which the longitudinal axis of an aircraft is pointed, usually expressed in degrees from North (true, magnetic, compass or grid).

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

Helicopter clearway. A defined area on the ground or water, selected and/or prepared as a suitable area over which a helicopter operated in performance class 1 may accelerate and achieve a specific height.

Helicopter ground taxiway. A ground taxiway intended for the ground movement of wheeled undercarriage helicopters.

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

Helideck. A heliport located on a fixed or floating offshore facility such as an exploration and/or production unit used for the exploitation of oil or gas.

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

Holding bay. A defined area where aircraft can be held, or bypassed, to facilitate efficient surface movement of aircraft.

Holding point. A specified location, identified by visual or other means, in the vicinity of which the position of an aircraft in flight is maintained in accordance with air traffic control clearances.

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

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

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

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

Identification beacon. An aeronautical beacon emitting a coded signal by means of which a particular point of reference can be identified.

IFR. The symbol used to designate the instrument flight rules.

IFR flight. A flight conducted in accordance with the instrument flight rules.

ILS glide path. That locus of points in the vertical plane containing the runway centre line at which the difference in depth of modulation (DDM) is zero, which, of all such loci, is the closest to the horizontal plane.

ILS glide path angle. The angle between a straight line which represents the mean of the ILS glide path and the horizontal.

IMC. The symbol used to designate instrument meteorological conditions.

Initial approach fix. A fix that marks the beginning of the initial segment and the end of the arrival segment, if applicable. In RNAV applications this fix is normally defined by a fly-by waypoint.

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

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

Instrument meteorological conditions. Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, less than the minima specified for visual meteorological conditions.

Note.— The specified minima for visual meteorological conditions are contained in Annex 2.

Instrument runway. One of the following types of runways intended for the operation of aircraft using instrument approach procedures:

a) *Non-precision approach runway*. A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type A and a visibility not less than 1 000 m.

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

c) *Precision approach runway, category II*. A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type B with a decision height (DH) lower than 60 m (200 ft) but not lower than 30 m (100 ft) and a runway visual range not less than 300 m.

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

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

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

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

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

Note 2.— Refer to Annex 6 for instrument approach operation types.

Integrated Aeronautical Information Package. A package in paper or electronic media which consists of the following elements:

— AIP, including amendment service;
— Supplements to the AIP;
— NOTAM and PIB;
— AIC; and
— checklists and lists of valid NOTAM.

Integrity (aeronautical data). A degree of assurance that an aeronautical data and its value has not been lost or altered since the data origination or authorized amendment.

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

Intermediate fix. A fix that marks the end of an initial segment and the beginning of the intermediate segment. In RNAV applications this fix is normally defined by a fly-by waypoint.

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

International airport. Any airport designated by the Contracting State in whose territory it is situated as an airport of entry and departure for international air traffic, where the formalities incident to customs, immigration, public health, animal and plant quarantine and similar procedures are carried out.

International NOTAM office (NOF). An office designated by a State for the exchange of NOTAM internationally.

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

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

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

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

Landing distance available. The length of runway which is declared available and suitable for the ground run of an aeroplane landing.

Landing surface. That part of the surface of an aerodrome which the aerodrome authority has declared available for the normal ground or water run of aircraft landing in a particular direction.

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

Location indicator. A four-letter code group formulated in accordance with rules prescribed by ICAO and assigned to the location of an aeronautical fixed station.

Locator. An LF/MF NDB used as an aid to final approach.

Note.— A locator usually has an average radius of rated coverage of between 18.5 and 46.3 km (10 and 25 NM).

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

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

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

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

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

Metadata. Data about data (ISO 19115).

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

Minimum descent altitude/height. A specified altitude or height in a 2D instrument approach operation or circling approach operation below which descent must not be made without the required visual reference.

Note 1.— Minimum descent altitude (MDA) is referenced to mean sea level and minimum descent height (MDH) is referenced to the aerodrome elevation or to the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. A minimum descent height for a circling approach is referenced to the aerodrome elevation.

Note 2.— The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In the case of a circling approach the required visual reference is the runway environment.

Note 3.— For convenience when both expressions are used they may be written in the form "minimum descent altitude/height" and abbreviated "MDA/H".

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

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

Minimum sector altitude. The lowest altitude which may be used which will provide a minimum clearance of 300 m (1 000 ft) above all objects located in an area contained within a sector of a circle of 46 km (25 NM) radius centred on a significant point, the aerodrome reference point (ARP) or the heliport reference point (HRP).

Missed approach holding fix. A fix used in RNAV applications that marks the end of the missed approach segment and the centre point for the missed approach holding.

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

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

Mountainous area. An area of changing terrain profile where the changes of terrain elevation exceed 900 m (3 000 ft) within a distance of 18.5 km (10.0 NM).

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

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

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

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

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

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

Non-instrument runway. A runway intended for the operation of aircraft using visual approach procedures or an instrument approach procedure to a point beyond which the approach may continue in visual meteorological conditions.

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

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

a) are located on an area intended for the surface movement of aircraft; or

b) extend above a defined surface intended to protect aircraft in flight; or

c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.

Note.— The term obstacle is used in Annex 4 solely for the purpose of specifying the charting of objects that are considered a potential hazard to the safe passage of aircraft in the type of operation for which the individual chart series is designed.

Obstacle assessment surface. A defined surface intended for the purpose of determining those obstacles to be considered in the calculation of obstacle clearance altitude/height for a specific ILS facility and procedure.

Obstacle clearance altitude (OCA) or obstacle clearance height (OCH). The lowest altitude or the lowest height above the elevation of the relevant runway threshold or the aerodrome elevation as applicable, used in establishing compliance with appropriate obstacle clearance criteria.

Note 1.— Obstacle clearance altitude is referenced to mean sea level and obstacle clearance height is referenced to the threshold elevation or in the case of non-precision approaches to the aerodrome elevation or the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. An obstacle clearance height for a circling approach is referenced to the aerodrome elevation.

Note 2.— For convenience when both expressions are used they may be written in the form "obstacle clearance altitude/height" and abbreviated "OCA/H".

Note 3.— See Procedures for Air Navigation Services — Aircraft Operations *(Doc 8168), Volume I, Part III, 1.5, and Volume II, Part I, Section 4, Chapter 5, 5.4 for specific applications of this definition.*

Obstacle free zone (OFZ). The airspace above the inner approach surface, inner transitional surfaces, and balked landing surface and that portion of the strip bounded by these surfaces, which is not penetrated by any fixed obstacle other than a low-mass and frangibly mounted one required for air navigation purposes.

Obstacle/terrain data collection surface. A defined surface intended for the purpose of collecting obstacle/terrain data.

Operational planning. The planning of flight operations by an operator.

Operator. A person, organization or enterprise engaged in or offering to engage in the operation of an aircraft, aerodrome or associated aviation activity.

Orthometric height. Height of a point related to the geoid, generally presented as a mean sea level (MSL) elevation.

Pavement classification number. A number expressing the bearing strength of a pavement for unrestricted operations.

Performance-based navigation (PBN). Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

Note.— Performance requirements are expressed in navigation specifications (RNAV specification, RNP specification) in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept.

Point light. A luminous signal appearing without perceptible length.

Portrayal. Presentation of information to humans (ISO 19117).

Position (geographical). Set of coordinates (latitude and longitude) referenced to the mathematical reference ellipsoid which define the position of a point on the surface of the Earth.

Precision approach procedure. An instrument approach procedure utilizing azimuth and glide path information provided by ILS or PAR.

Precision approach radar. Primary radar equipment used to determine the position of an aircraft during final approach, in terms of lateral and vertical deviations relative to a nominal approach path, and in range relative to touchdown.

Note.— Precision approach radars are designated to enable pilots of aircraft to be given guidance by radiocommunication during the final stages of the approach to land.

Pre-flight information bulletin (PIB). A presentation of current NOTAM information of operational significance, prepared prior to flight.

Primary runway. Runway(s) used in preference to others whenever conditions permit.

Procedure altitude/height. A specified altitude/height flown operationally at or above the minimum altitude/height and established to accommodate a stabilized descent at a prescribed descent gradient/angle in the intermediate/final approach segment.

Procedure turn. A manoeuvre in which a turn is made away from a designated track followed by a turn in the opposite direction to permit the aircraft to intercept and proceed along the reciprocal of the designated track.

Note 1.— Procedure turns are designated "left" or "right" according to the direction of the initial turn.

Note 2.— Procedure turns may be designated as being made either in level flight or while descending, according to the circumstances of each individual procedure.

Prohibited area. An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited.

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

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

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

Quality assurance. All the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfil requirements for quality (ISO 8402).

Quality control. The operational techniques and activities that are used to fulfil requirements for quality (ISO 8402).

Quality management. All activities of the overall management function that determine the quality policy, objectives and responsibilities, and implementing them by means such as quality planning, quality control, quality assurance and quality improvement within the quality system (ISO 8402).

Quality system. The organizational structure, procedures, processes and resources needed to implement quality management (ISO 8402).

Racetrack procedure. A procedure designed to enable the aircraft to reduce altitude during the initial approach segment and/or establish the aircraft inbound when the entry into a reversal procedure is not practical.

Radar. A radio detection device which provides information on range, azimuth and/or elevation of objects.

Radar approach. An approach in which the final approach phase is executed under the direction of a controller using radar.

Radio bearing. The angle between the apparent direction of a definite source of emission of electro-magnetic waves and a reference direction, as determined at a radio direction-finding station. A true radio bearing is one for which the reference direction is that of true North. A magnetic radio bearing is one for which the reference direction is that of magnetic North.

Radio direction-finding station. A radio determination station using radio direction finding.

Note.— The aeronautical application of radio direction finding is in the aeronautical radio navigation service.

Reference datum height. The height of the extended glide path or a nominal vertical path at the runway threshold.

Relief. The inequalities in elevation of the surface of the Earth represented on aeronautical charts by contours, hypsometric tints, shading or spot elevations.

Reporting point. A specified named geographical location in relation to which the position of an aircraft can be reported.

Note.— There are three categories of reporting points: ground-based navigation aid, intersection and waypoint. In the context of this definition, intersection is a significant point expressed as radials, bearings and/or distances from ground-based navigation aids. A reporting point can be indicated as "on request" or as "compulsory".

Requirements for quality. Expression of the needs or their translation into a set of quantitatively or qualitatively stated requirements for the characteristics of an entity to enable its realization and examination (ISO 8402).

Resolution. A number of units or digits to which a measured or calculated value is expressed and used.

Restricted area. An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.

Reversal procedure. A procedure designed to enable aircraft to reverse direction during the initial approach segment of an instrument approach procedure. The sequence may include procedure turns or base turns.

Route segment. A route or portion of route usually flown without an intermediate stop.

Route stage. A route or portion of a route flown without an intermediate landing.

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

Runway end safety area. An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.

Runway-holding position. A designated position intended to protect a runway, an obstacle limitation surface, or an ILS/MLS critical/sensitive area at which taxiing aircraft and vehicles shall stop and hold, unless otherwise authorized by the aerodrome control tower.

Note.— In radiotelephony phraseologies, the expression "holding point" is used to designate the runway-holding position.

Runway strip. A defined area including the runway and stopway, if provided, intended:

a) to reduce the risk of damage to aircraft running off a runway; and

b) to protect aircraft flying over it during take-off or landing operations.

Runway visual range (RVR). The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

Safety area. A defined area on a heliport surrounding the final approach and take-off area (FATO) which is free of obstacles, other than those required for air navigation purposes, and intended to reduce the risk of damage to helicopters accidentally diverging from the FATO.

Search and rescue region. An area of defined dimensions, associated with a rescue coordination centre, within which search and rescue services are provided.

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

Shoulder. An area adjacent to the edge of a pavement so prepared as to provide a transition between the pavement and the adjacent surface.

Signal area. An area on an aerodrome used for the display of ground signals.

Significant point. A specified geographical location used in defining an ATS route or the flight path of an aircraft and for other navigation and ATS purposes.

Note.— There are three categories of significant points: ground-based navigation aid, intersection and waypoint. In the context of this definition, intersection is a significant point expressed as radials, bearings and/or distances from ground-based navigation aids.

Standard instrument arrival. A designated instrument flight rule (IFR) arrival route linking a significant point, normally on an ATS route, with a point from which a published instrument approach procedure can be commenced.

Standard instrument departure. A designated instrument flight rule (IFR) departure route linking the aerodrome or a specified runway of the aerodrome with a specified significant point, normally on a designated ATS route, at which the en-route phase of a flight commences.

Station declination. An alignment variation between the zero degree radial of a VOR and true north, determined at the time the VOR station is calibrated.

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

Surveillance radar. Radar equipment used to determine the position of an aircraft in range and azimuth.

Take-off runway. A runway intended for take-off only.

Take-off surface. That part of the surface of an aerodrome which the aerodrome authority has declared available for the normal ground or water run of aircraft taking off in a particular direction.

TAS (True airspeed). The speed of the aeroplane relative to undisturbed air.

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

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

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

a) *Aircraft stand taxilane.* A portion of an apron designated as a taxiway and intended to provide access to aircraft stands only.

b) *Apron taxiway.* A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron.

c) *Rapid exit taxiway.* A taxiway connected to a runway at an acute angle and designed to allow landing aeroplanes to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times.

Taxiway intersection. A junction of two or more taxiways.

Taxiway strip. An area including a taxiway intended to protect an aircraft operating on the taxiway and to reduce the risk of damage to an aircraft accidentally running off the taxiway.

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

Terminal control area. A control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes.

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

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

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

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

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

Traceability. Ability to trace the history, application or location of an entity by means of recorded identifications (ISO 8402).

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

Transfer of control point. A defined point located along the flight path of an aircraft, at which the responsibility for providing air traffic control service to the aircraft is transferred from one control unit or control position to the next.

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

Transition layer. The airspace between the transition altitude and the transition level.

Transition level. The lowest flight level available for use above the transition altitude.

Validation. Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled (ISO 8402).

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

Verification. Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled (ISO 8402).

Note.— Objective evidence is information which can be proved true, based on facts obtained through observation, measurement, test or other means (ISO 8402).

VFR. The symbol used to designate the visual flight rules.

VFR flight. A flight conducted in accordance with the visual flight rules.

Visibility. Visibility for aeronautical purposes is the greater of:

a) the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;

b) the greatest distance at which lights in the vicinity of 1 000 candelas can be seen and identified against an unlit background.

Note 1.— The two distances have different values in air of a given extinction coefficient, and the latter b) varies with the background illumination. The former a) is represented by the meteorological optical range (MOR).

Note 2.— The definition applies to the observations of visibility in local routine and special reports, to the observations of prevailing and minimum visibility reported in METAR and SPECI and to the observations of ground visibility.

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

Visual manoeuvring (circling) area. The area in which obstacle clearance should be taken into consideration for aircraft carrying out a circling approach.

Visual meteorological conditions. Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, equal to or better than specified minima.

Note.— The specified minima are contained in Annex 2, Chapter 4.

VOLMET broadcast. Provision, as appropriate, of current METAR, SPECI, TAF and SIGMET by means of continuous and repetitive voice broadcasts.

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

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

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

Chapter 1

GENERAL

1.1 EVOLUTION OF ANNEX 4

1.1.1 The International Standards and Recommended Practices (SARPs) of Annex 4 had their inception in "Annex J — Aeronautical Maps and Charts" of the Draft Technical Annexes adopted by the International Civil Aviation Conference in Chicago in 1944. This draft material formed the basis for the work of the first Meeting of the MAP Sub-committee of the PICAO Air Navigation Committee in 1945. Further development and refinement was continued by four meetings of the Aeronautical Charts Division (1945, 1947, 1948 and 1951), by combined meetings of the Aeronautical Information Services and Aeronautical Charts Division held in 1959 and 1966 and, in a limited way, by other divisional components of the Organization. A MAP Panel was organized in 1958 to do preparatory work for the first of these two combined meetings.

1.1.2 Standards and Recommended Practices for aeronautical charts were first adopted by the Council in 1948 and were designated as Annex 4 to the Convention on International Civil Aviation at that time. The original SARPs were written so as to be generally applicable to all types of charts but with emphasis on the World Aeronautical Chart 1:1 000 000. As successive meetings were held, SARPs for other specific types were prepared so that by the time the first combined divisional meeting was held, some eleven types had been designated. However, there was still no obligation to produce any of these charts.

1.1.3 On the establishment of the MAP Panel the entire situation was reviewed on the basis of developing in turn the operational requirements for charts, the functions to be satisfied, the specifications of general application, the specifications for individual types of charts with due regard to their functional interrelationship and the obligations of States to produce charts. The Division accepted these concepts, and they are reflected in the present SARPs. A more detailed account of the historical background of Annex 4, including the major elements of the various amendments to the Annex, is contained in the Foreword to the Annex.

1.1.4 On 27 February 1984 and 18 March 1985, the Council of ICAO adopted amendments (No. 46 and No. 47) to Annex 4 which constituted major changes to the specifications of that Annex. These amendments, developed with the assistance of a Study Group, affected largely the specifications for charts to be used in the cockpit. They also introduced specifications for five new charts, i.e. Aerodrome Ground Movement Chart — ICAO; Aircraft Parking/Docking Chart — ICAO; Standard Departure Chart Instrument (SID) — ICAO; Standard Arrival Chart — Instrument (STAR) — ICAO; and Aerodrome Obstacle Chart — ICAO Type C, and deleted the specifications for the Landing Chart — ICAO.

1.1.5 On 24 February 1989, the Council of ICAO adopted Amendment No. 48 to Annex 4 which was subsequent to Amendment 18 to Annex 6 and Amendment 33 to Annex 14. This amendment was developed with the assistance of the Visual Aids Panel (VAP/11) and the Secretariat. The amendment affected the following charts: Aerodrome Obstacle Chart — ICAO Types A, B and C; Precision Approach Terrain Chart — ICAO; Standard Departure Chart — Instrument (SID) — ICAO; Standard Arrival Chart — Instrument (STAR) — ICAO; Instrument Approach Chart — ICAO; Visual Approach Chart — ICAO; Aerodrome Chart — ICAO; Aerodrome Ground Movement Chart — ICAO; Aircraft Parking/Docking Chart — ICAO; World Aeronautical Chart — ICAO 1:1 000 000; Aeronautical Chart — ICAO 1:500 000; Aeronautical Navigation Chart — ICAO Small Scale; Plotting Chart — ICAO. Specifications for ICAO chart symbols were provided.

1.1.6 On 28 February 1992, the Council of ICAO adopted Amendment No. 49 to Annex 4 which was subsequent to Amendment No. 33 to Annex 11, Amendment No. 39 to Annex 14, the Adoption of Annex 14, Vol. II and Amendments Nos. 5 and 6 to the *Procedures for Air Navigation Services — Aircraft Operations*, Volume I — *Flight Procedures* and Volume II — *Construction of Visual and Instrument Flight Procedures* (PANS-OPS, Doc 8168). The amendment introduced new definitions and general specifications for the following charts: Enroute Chart — ICAO; Area Chart — ICAO; Instrument Approach Chart — ICAO; Visual Approach Chart — ICAO; Aerodrome Chart — ICAO; World Aeronautical Chart — ICAO 1:1 000 000; Aeronautical Chart — ICAO 1:500 000. Further specifications for the ICAO chart symbols were provided.

1.1.7 On 1 March 1995, the Council of ICAO adopted Amendment No. 50 to Annex 4, which included the adoption of the World Geodetic System — 1984 (WGS-84) as the standard geodetic reference system for international aviation, World Area Forecast System (WAFS) planning and implementation, PANS-OPS implementation problems, the revision of the *Manual of All-Weather Operations* (Doc 9365), the integration of helicopter traffic with conventional aeroplane traffic and the proposal by the Eighth Meeting of the Review of the General Concept of Separation Panel (RGCSP/8). New definitions were introduced and new provisions concerning the promulgation, as of 1 January 1998, of WGS-84-related geographical coordinates, the deletion of the requirement for presentation of level acceleration altitude/height, the introduction of RNP type, the inclusion of the note on close-in obstacles on SID charts and introduction of a new chart symbol for an active volcano.

1.1.8 On 20 March 1998, the Council of ICAO adopted Amendment No. 51 to Annex 4, which included the recommendations coming from the Tenth and Eleventh Meetings of the Obstacle Clearance Panel (OCP) and Air Navigation Commission (ANC). New definitions were introduced. The vertical component of the WGS-84 was adopted. Furthermore the following topics were introduced: aeronautical databases; human factors; identification of RNAV procedures; provision of final approach gradient; steep glide path angle approaches and chart symbols for flyover and fly-by waypoints.

1.1.9 On 7 March 2001, the Council of ICAO adopted Amendment No. 52 to Annex 4 which included the recommendations of the Visual Aids Panel (VAP), the OCP, the joint ICAO and industry Controlled Flight into Terrain (CFIT) Task Force, the Aeronautical Information Services/Aeronautical Charts (AIS/MAP) Divisional Meeting (1998) and the Secretariat. New definitions were introduced including runway-holding position and air defence identification zone (ADIZ). The following topics were introduced: portrayal of terrain and minimum flight altitudes; runway visual range (RVR) observation sites; airspace classifications, flight procedures and obstacle clearance criteria based on area navigation (RNAV) systems; and chart symbols for runway-holding position, ADIZ, electronic aeronautical charts, airspace classifications, nuclear power station and waypoint and the introduction of new provisions, as of 28 November 2002, concerning the Electronic Aeronautical Chart Display — ICAO.

1.1.10 On 23 February 2004, the Council of ICAO adopted Amendment No. 53 to Annex 4. This amendment was developed with the assistance of OCP/12, OCP/13, the ANC and the Secretariat. New provisions concerning definitions; vertical and temporal reference systems; terminal arrival altitude; Radar Minimum Altitude Chart — ICAO and chart symbols for altitudes/flight levels and final approach fix were introduced. Updating of existing provisions related to the World Geodetic System — 1984 (WGS-84); obstacles identification; aerodrome operating minima and supplementary information on the Instrument Approach Chart — ICAO, and aeronautical data quality requirements were adopted.

1.1.11 On 12 March 2007, the Council of ICAO adopted Amendment No. 54 to Annex 4. Various sources contributed to this Amendment including the AIS/MAP Divisional Meeting (1998-Recommendation 2.3/2), recommendations of the OCP/14 and OPLINKP/1 meetings, and the Runway Safety Education and Awareness Programme. The Amendment covered definitions and introduction of new provisions, as of 18 November 2010, concerning the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic); minimum enroute altitudes; minimum obstacle clearance altitudes; logon address; ATS surveillance system terminology; aeronautical database requirements; approach fixes and points; aeronautical data quality requirements for gradients and angles; steep angle approach cautionary note; hot spot and intermediate holding position including new symbols.

1.1.12 On 4 March 2009, the Council of ICAO adopted Amendment No. 55 to Annex 4. This amendment was developed by the Secretariat with the assistance of the Required Navigation Performance Special Operational Requirements Study Group (RNPSORSG) and from proposals of the first meeting of the Aerodromes Panel (AP/1) and recommendations (Recommendation 9/3) of the Working Group of the Whole of the Instrument Flight Procedure Panel (IFPP/WG/WHL/1). Definitions and new provisions were introduced relating to performance-based navigation terminology; symbols for wind turbines; a hierarchy of symbols for significant points; and publication of bearings and tracks additionally as True values.

1.1.13 On 24 February 2010, the Council of ICAO adopted Amendment No. 56 to Annex 4. This amendment was developed by the Secretariat with the assistance of the Aeronautical Information Services-Aeronautical Information Management Study Group (AIS-AIMSG). Definitions and new provisions were introduced relating to cyclic redundancy check (CRC) and an extended applicability date for the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic).

1.1.14 On 27 February 2013, the Council of ICAO adopted Amendment No. 57 to Annex 4. The amendment was developed by the Secretariat with the assistance of the Aeronautical Information Services — Aeronautical Information Management Study Group (AIS-AIMSG). A new definition was added for integrity classification to define the high, low or very low probability for critical, essential or routine data, that when corrupted, would have a potential risk for catastrophe.

1.1.15 On 3 March 2014, the Council of ICAO adopted Amendment No. 58 to Annex 4. The amendment was developed by the Secretariat with the assistance of the Instrument Flight Procedure Panel and introduced procedure design criteria and charting requirements to support point-in-space (PinS) approach and departure operations.

1.2 FUNCTIONAL RELATIONSHIP OF AERONAUTICAL CHARTS

[2.1]

1.2.1 As indicated in 1.1.3, care was taken to ensure that the specifications for each type of chart took account of the interrelationship of charts and the need for easy transition from one chart to another in the various phases of flight operations. For example, the Enroute Chart and the Area Chart are complementary and cover similar requirements for navigation in the enroute and terminal area phases, respectively, and in the compilation of any such pair of charts, the functional interrelationship embodied in the specifications should be fully exploited. Similarly, there is an interrelationship between the Area Chart and the Instrument Approach Chart, the Approach Chart and the Aerodrome Chart, etc.

1.2.2 The main functions to be taken into account are:

a) use of a common projection;

b) selection of scales, the relative values of which should be easily comprehensible, e.g. 10 to 1;

c) rational coverage where one chart is a larger scale portion of another;

d) selection of spot elevations/heights and other terrain information, culture and aeronautical data which will facilitate transition from one chart to another; and

e) simultaneous issue of related charts, both new charts and revisions.

These various factors have been treated in more detail in Chapter 7 — Preparation of Specific Charts.

1.3 OBLIGATION OF STATES TO PROVIDE CHARTS

1.3.1 Under the terms of Article 28 of the Convention on International Civil Aviation, each Contracting State has undertaken, so far as practicable, to adopt and put into operation the Standards and other operational practices and rules which might be recommended or established from time to time pursuant to the Convention. One such set of Standards and Recommended Practices is contained in Annex 4 to the Convention, which lays down specifications for the production and dissemination (including their availability) of certain types of aeronautical charts. Their purpose is to contribute to the safety, regularity and efficiency of international air navigation by specifying the types of charts to be made available, and by ensuring adequate uniformity for all charts within its scope. Another set of Standards and Recommended Practices is contained in Annex 15 to the Convention, which deals with the collection and dissemination (including its availability) of aeronautical information for use by all types of international aircraft operations, and which is the responsibility of the aeronautical information service (AIS) established by each State (cf. 3.1 of Annex 15). The interrelationship between these two Annexes is treated in some detail in subsequent paragraphs.

[1.3.1, 1.3.2, 1.3.3]

1.3.2 Annex 4 requires each Contracting State to ensure the availability of the required charts either by producing the charts itself, or by arranging for production by another Contracting State or by an agency, which should be provided with the necessary data. For any chart or single sheet of a chart series which includes the territory of two or more Contracting States, the States with jurisdiction over the territory so included are required to determine the manner in which the chart or sheet will be made available. In reaching a decision, due regard should be given to regional air navigation agreements approved by the Council of ICAO, normally on the advice of Regional Air Navigation Meetings and to any programme of allocation established by the Council of ICAO. Such agreements and allocations are normally reflected in the Air Navigation Plan publication for each ICAO Region. Annex 4 also requires each Contracting State to provide all information relating to its territory that is necessary to enable any other Contracting State to implement its chart programme.

[1.3.4]

1.3.3 The increased speed of aircraft, together with greater range in operating altitudes and route stages, and the increasing congestion of air traffic impose requirements for rapid chart interpretation and some latitude for improvements in chart design to meet changing operational needs. There is a continuing need for experimentation in these directions but a balance has to be struck among uniformity in chart presentation, operational requirements, and the need to use the most efficient and economical techniques. To promote worldwide adoption of new techniques and production methods of proven value, Annex 4 recommends the exchange without charge between Contracting States of appropriate charts, since cartographic methods and techniques are major factors governing ability to meet aeronautical cartographic requirements. Also, information on new charting techniques and production methods as such should receive the widest possible dissemination.

1.3.4 The effective function of AIS pre-flight information units is partly dependent upon the availability of aeronautical charts for flight planning. Aeronautical charts could be printed or displayed on a graphical user interface and in all cases they are in turn dependent upon the cooperative efforts of those responsible for compiling and drafting them as well as of those responsible for originating the raw information for the prescribed aeronautical overlays. All branches of endeavour involved in the production of a State's aeronautical charts need to be aware of the functional interrelationships involved, as well as of specifications and related requirements. Safe air navigation requires timely, up-to-date and accurate aeronautical charts that meet current aviation needs; but the availability of such chart depends on an adequate cartographic establishment, experience in aeronautical cartography, adequate basic surveys, the availability of the data required for the topographic base and aeronautical overlays, awareness of the circumstances under which the charts require to be revised and the related amendment cycles, appreciation of the nature of the demand, and familiarity with the division of responsibility for compilation and production of the charts and the machinery established for coordination of this activity. Each Contracting State is therefore to ensure the liaison and arrangements necessary for the efficient discharge of the cooperative effort involved in the production and dissemination of aeronautical charts. This is particularly significant where the aeronautical chart programme is administered by an agency outside of the aviation administration.

1.4 NATIONAL CARTOGRAPHIC SERVICES

1.4.1 Local circumstances generally determine the administrative arrangements of States with regard to their national cartographic services. While these arrangements vary as between States depending on the existing infrastructure and the availability of suitable staff, accommodation and facilities, they commonly take, with minor variations, one of the following forms:

a) a department of surveys or national equivalent responsible for the entire governmental charting programme including aeronautical charts, in some cases with assistance from military cartographic units;

b) a department of surveys or equivalent body responsible for ministering to governmental needs for topographic maps and charts as well as small-scale aeronautical charts, other aeronautical charts being the responsibility of a unit in the national civil aviation administration responsible for the aeronautical information services; or

c) a department of surveys or national equivalent responsible for the governmental charting programme with the exception of aeronautical charts, which are the responsibility of the unit within the national civil aviation administration in charge of the aeronautical information service (AIS), the AIS in some cases having the assistance of the national cartographic service in the compilation and drafting of the topographic base for small-scale visual air navigation charts, and perhaps drawing on the services of military cartographic units, or on a commercial chart-producing agency for similar charts.

1.4.2 While it is not the purpose of this manual to concern itself with charts other than aeronautical charts, it will be evident from the foregoing analysis of the general pattern of cartographic responsibility that the production of aeronautical charts is controlled, in all cases where this is not the responsibility of a government Department distinct from the national civil aviation authority, by the unit responsible for administering the aeronautical information service which 3.1 of Annex 15 requires each Contracting State to provide. It is important that there should be a proper appreciation of this, so that the necessary machinery could be set in motion for organizing and coordinating the production of aeronautical charts in such a manner as to ensure their availability as required, their conformity with the stipulated specifications and amendment cycles, and proper liaison between the civil aviation administration and the chart-producing agency in all cases where these are not identical.

[1.3.1, 1.3.2]

1.4.3 While the chart-producing agency, governmental or commercial, is responsible for making available accurate charts and data on request and for timely implementation of specifications and revision cycles, the aeronautical information service of each State is responsible for ensuring their availability to flight operations personnel including air crews, particularly at the aerodrome AIS units established at aerodromes normally used for international air operations (cf. 2.2.5, 2.2.6, 7.1.1, 7.1.2, Annex 15). The aeronautical information services are also required to publish in their Aeronautical Information Publications a description and list of aeronautical chart series available and an indication of their intended use (cf. GEN 3.2.4, Annex 15).

[1.3.3]

1.4.4 So much depends upon a State's departmental arrangements, which are largely dictated by the availability of funds and/or competent staff, that it is not practicable to suggest an ideal arrangement which could be uniformly applied. It would be advantageous, however, for a State's cartographic services to be as self-contained in the matter of aeronautical charts as local circumstances permit since this would facilitate control of the chart-producing operation in all its phases by a single unit, besides saving time, effort and money by reducing the number of units separately administered and the records and reference documents to be maintained. Such an arrangement would also simplify coordination and liaison. In situations where the cartographic services within a State are entirely the responsibility of a department other than that which controls civil aviation, there is a special need for coordination and liaison between the two departments in the matter of availability, specifications and amendment cycles, the requirement for these charts springing from civil aviation needs. The charts themselves must portray valid aeronautical information concerning facilities and procedures available to international air navigation on which only the agency responsible for them is in a position to provide bona fide information. Where the responsibility for aeronautical charts is entirely within the purview of the department controlling civil aviation, coordination and liaison, as well as interpretation of specifications and requirements, are limited to the technical branches within that department which are involved in chart production. Departments responsible for civil aviation may however find it more economical to delegate the production of small-scale charts to either the department responsible for topographic charts or to a commercial chart-producing agency, or even, through bilateral agreement, to the cartographic services of another State; this is especially so where the demand for them is slight. It is important to note that, whatever arrangements for production of aeronautical charts are in force in a State, the responsibility for their availability, adequacy, accuracy and revision is placed on that State, and that this responsibility encompasses coordination and liaison, as well as necessary priority for aeronautical charts in the national chart-production programme.

1.4.5 Within each of the designated departments and agencies an appropriate official, e.g., the Chief of the section responsible for the production of aeronautical charts in the chart-producing department or agency, and the Chief of the AIS section in the department responsible for civil aviation, should be charged with the responsibility of maintaining day-to-day liaison, for solving purely local problems or developing local procedures, and for satisfying the requirements to the best possible extent with facilities and staff already available. Where the territory under the control of a State for civil aviation purposes is administered through regional units it may be necessary to appoint appropriate officials in each regional unit who would operate under delegated authority of, and in accordance with instructions from, these Chiefs. These designated officials would also be responsible, within their departments, for initiating action, through the machinery established by the State, on all matters affecting current policy, as well as recruitment and training not already provided for by the State. In some circumstances it may be found advantageous to form a “board” consisting of the more important providers of facilities, services and funds for the sole purpose of solving problems which require their intervention, or for identification and drafting of requests affecting cartographic policy and recruitment.

1.4.6 Every possible attention should be given to the development of simplified chart distribution arrangements within each State:

a) by establishing a common centre for the sale and distribution of all aeronautical charts and associated AIS publications; a number of distributing agencies and lack of association with Aeronautical Information Publications (AIP) would complicate the distribution of charts;

b) by including as many charts as practicable in Aeronautical Information Publications (see Chapter 6, 6.2 of this manual);

c) by providing subscription service for any charts not associated with the AIP; and

d) by placing the production of frequently amended charts (e.g. enroute charts) on a regular production schedule in keeping with the dates established by the State’s aeronautical information service for advance distribution with a common effective date. (ref. 5.9.5, AIS Manual).

States could also derive additional benefits by ascertaining the existence and availing themselves of data, processes and techniques which would help them to provide the required charts. Valuable information could be obtained, for instance, from large-scale topographical maps which might be published by national, public or private organizations, particularly for areas around international aerodromes, which would be helpful to those States that have not yet produced aerodrome obstacle charts. In some States considerable assistance could be derived from military services and aircraft operating agencies which operate advanced cartographic units, and this should not be overlooked.

1.4.7 Once the various agencies which can usefully participate in aeronautical chart-producing actions have been determined, agreements providing for maximum practicable cooperation should be concluded between the department responsible for civil aviation and those departments or agencies not under its control which are involved in the overall plan for production of aeronautical charts. These agreements must, of course, be sufficiently detailed and delegate sufficient authority to assure immediate action, appropriate levels of liaison, and prompt exchange of information. Since the efficiency of the cartographic services will depend upon the degree of cooperation existing between participating departmental units or cartographic agencies, designated officials in these units or agencies should review at regular intervals the agreements, the operational specifications, and the means available for the exchange of information necessary to enable the Standards of Annex 4 to be met. The agreements should ensure that the following points are covered, as appropriate:

a) description of the facilities to be made available by the agency concerned, and their capabilities;

b) scope of the assistance to be provided, including an indication of any additional assistance which may be made available for stated periods if required;

c) the charts for which each agency is responsible including area of coverage and quantity;

d) the priorities to be assigned to the production of aeronautical charts ;

e) the levels of liaison, including designation of the official:

   1) to whom approach should be made, to ensure prompt initiation of action concerning reference documents, chart specifications and availability requirements;

   2) who would normally make a request for initiation of action to produce an assigned chart;

   3) whose unit would be responsible for production of the chart;

   4) who would be responsible for coordination, in cases where there is a pooling of resources;

   5) who would be responsible for recording, verifying and entering new or revised information on the chart;

f) the common centre established for sale and distribution of the charts and associated AIS publications;

g) method of publication of charts, e.g., by inclusion in the AIP or in a separate subscription service;

h) due note of the Regional Plan in so far as it affects responsibility for chart production;

i) deadlines for production and revision;

j) any special arrangements concerning the sharing of charting actions, including procedure for reimbursement of costs.

1.5 RELATIONS WITH OTHER STATES

[1.3.2.1]

1.5.1 The provision of aviation cartographic services jointly by two or more States or by delegation of authority to a non-governmental agency is provided for in Annex 4. If arrangements are made on a joint basis then the principles previously enunciated for achieving coordination and liaison can equally apply to the State undertaking the responsibility of providing the charts, care being taken to ensure that any division of responsibilities between States is clearly defined. Each State, of course, remains responsible for the adequacy and accuracy of information promulgated regarding its own territory, and adequate liaison must be provided between the relevant technical departments of each State to ensure quick transmission of information to the publishing State. Also, information published by one State for another must clearly indicate that it is published under the authority of that State.

1.5.2 If responsibility is delegated to an agency, it is very desirable that such agency should at least have an adequate technical background and preferably be one engaged in or allied to civil aviation. Where such background is lacking, the need for close coordination and liaison increases. An agency may be appointed to cover the whole or any part of the aeronautical charting programme and here again the responsibilities delegated should be clearly defined.

[1.3.2.2]

1.5.3 In determining the manner in which a chart or single sheet of a chart series which includes the territory of two or more Contracting States will be made available, the objectives should be the maintenance of adequate continuity in the production of any one coordinated series of charts, particularly in the matter of ensuring complete coverage of all land areas at one scale or another. An example would be the adoption of either 1:500 000 charts or small-scale charts as an alternative to the World Aeronautical Chart — ICAO 1:1 000 000. This does not preclude agreements resulting from discussions between two or more States either as a prelude to or flowing from such regional agreements, or from informal meetings sponsored by ICAO between groups of States in any of the ICAO Regions.

1.5.4 Neighbouring States may find it advantageous to explore possibilities for a pooling of resources for the production of charts. Small-scale charts lend themselves particularly to this solution because of the savings possible in staff, accommodation and equipment, the greater ease with which sheets covering the territory of two or more States can be produced, and the potential for greater facility of coordination and for less risk of misinterpretation of the specifications. Such a solution would also facilitate the special and unique type of survey of the take-off flight path areas (cf. 3.8.2 of Annex 4) required in the preparation of Aerodrome Obstacle Charts, inasmuch as the recruitment and training of such a survey crew severally by each State would be uneconomic. A group of States might also find it particularly useful to organize a special team for surveys required within their territories in connection with the preparation of aeronautical charts, or alternatively several States might collectively arrange for one of the available aerial survey companies to do this work on a single contract at more economical rates. Where a State is unable to produce the required charts and a pooling of chart production facilities by two or more States is not feasible, the solution may lie in contracting the work out to a commercial chart-producing agency or in agreement with a State with the capability to produce the charts, on a mutually acceptable, e.g. cost-repayment, basis. States in need of such assistance could also avail themselves of types of assistance available under the ICAO Technical Cooperation Programme or bilateral aid, to suit their particular needs for on-the-job training or expert assistance.

1.6 RELATIONS WITH OTHER INTERNATIONAL ORGANIZATIONS

1.6.1 In the aeronautical chart field, there is some interplay with other international organizations at both international and State levels. In order to clarify these relationships, a brief summary of the role played by each of the relevant international organizations, with particular reference to aeronautical charting, is provided in the following paragraphs.

1.6.2 United Nations (UN)

1.6.2.1 The cartographic activity of the Department of Technical Cooperation for Development has the following primary functions:

1) to coordinate the plans and programmes of the UN and the specialized agencies in the fields of cartography, taking into account the work of the various governmental and non-governmental organizations;

2) to promote the exchange of technical information, including the preparation of a study on modern cartographic methods and development of uniform international standards;

3) in cooperation with international scientific organizations, to give such assistance as might be requested by the specialized agencies;

4) to publish periodical summaries on cartography, including reports on activities, progress and plans in this field — with a view to facilitating the coordination of national programmes;

5) to coordinate efforts in international standardization of the writing of geographical names;

6) to arrange for and administer regional cartographic conferences, (further elaborated below in 1.6.3); and

7) to provide technical assistance in cartography.

1.6.2.2 In 1959, the Economic and Social Council (ECOSOC) paved the way for a small group of experts to meet and provide technical recommendations on standardizing geographical names at the national and international levels. This meeting gave rise to the United Nations Conferences on the Standardization of Geographical Names (UNCSGN) and to the United Nations Group of Experts on Geographical Names (UNGEGN). The UNCSGN is held every five years, and UNGEGN meets between the Conferences to follow up on the implementation of resolutions adopted by the Conferences and to ensure continuity of activities between Conferences. Today, UNGEGN is one of the seven standing expert bodies of ECOSOC, with over 400 members from over 100 countries.

1.6.2.3 Due to the need for global standardization of geographical names, UNGEGN promotes the recording of locally-used names reflecting the languages and traditions of a country. UNGEGN's goal is for every country to decide on its own nationally standardized names through the creation of national names authorities or recognized administrative processes. With the wide dissemination of the nationally standardized forms through gazetteers, atlases, web-based databases, toponymic guidelines, etc., UNGEGN can promote the use of these names internationally. For each non-Roman alphabet or script this will be through the adoption and use of a single scientifically-based romanization system.

1.6.2.4 As to technical assistance activities, governments have received technical assistance in analysing existing and future needs in cartography, in establishing national cartographic centres, in techniques of geodetic, topographic and photogrammetric surveying and photo-interpretation. Considerable emphasis is placed on training of technical personnel through provision of fellowships and by arranging regional and interregional seminars.

1.6.3 UN Regional Cartographic Conferences

1.6.3.1 In February 1948, the Economic and Social Council recommended that member governments of the United Nations stimulate surveying and mapping of their national territories and that the Secretary-General of the United Nations take appropriate action to further such efforts. A Committee of Experts on Cartography was appointed to study the problem and advise on the means of its implementation. The Committee recommended the convening of regional cartographic conferences as an effective means of achieving the Council's goal and named six regions for this purpose.

1.6.3.2 The Committee considered that the primary object of regional cartographic conferences, which would be advisory and consultative in nature, should be the stimulation and execution of practical topographic surveys (including geodetic control) to meet the needs of the region in question. This was conceived to involve a review of the mapping programmes of States, a review of the regional needs for maps, consideration of a programme for regional mapping, the coordination of national programmes to meet regional needs, exchange of technical information on data and methods and on executive organizations, and the provision of mutual assistance in the fields of finance, equipment, personnel and training. There was a wide measure of support of the Committee's proposals, and Conferences have been held for Asia and the Far East, Africa, and the Americas.

1.6.3.3 Following the rapid development and progress of geographical information systems in all countries and recognizing the need for regional and global geographical information system cooperation and the necessity for experience exchange and technology transfer on geographical information systems, the Thirteenth United Nations Regional Cartographic Conference for Asia and the Pacific (UNRCC-AP, 9 to 18 May 1994, Beijing) and the Sixth United Nations Regional Cartographic Conference for the Americas (UNRCC-A) (New York, 2 to 6 June 1997) recommended that directorates of national survey and mapping organizations in the regions form a permanent committee to discuss and agree on, inter alia, geographical information system standards, geographical information system infrastructure and institutional development, and linkage of the prospective committee with related bodies in the world. Pursuant to these resolutions, permanent committees on GIS Infrastructure for both Asia and the Pacific and the Americas were formed (PCGIAP, PC-IDEA).

1.6.3.4 Global spatial data initiatives involving mapping agencies, non-governmental organizations, international agencies, industry, and academia were taken. PCGIAP made progress in building a regional spatial data infrastructure. A new UN Geographic Information Working Group, established for coordinating the efforts and relevant initiatives of the UNRCC for Asia and the Pacific for mutual and complementary benefit, made huge efforts towards creating a UN system-wide/multi-scaled UN Geographic Database.

1.6.3.5 The Seventh United Nations Regional Cartographic Conference expressed its support in relation to the formulation of a system-wide geographic information strategic plan and the proposed development of the United Nations Geographic Database, recognizing the importance of a multi-scale, seamless global database that addresses the different needs of the United Nations. The participation of national mapping agencies, other governmental and non-governmental organizations, international and regional organizations, industry and academia in advancing the objectives of the Working Group was considered fundamental, and it was recommended that national mapping and other responsible agencies provide maps showing framework data layers, in analogue and digital formats when available, to the United Nations.

1.6.3.6 The Eighth United Nations Regional Cartographic Conference for the Americas (New York, June 2005 — Resolution XI), recognized that the availability of fundamental framework data sets, such as national administrative divisions, is crucial for the analysis and management of socio-economic phenomena and consequently welcomed the efforts of the Global Mapping project and those of the UN Geographic Information Working Group (UNGIWG) Second Administrative Level Boundaries project (SALB) in the generation of global seamless data sets of importance for the Americas. It also recommended that Member States, particularly through their National Mapping Agencies (NMAs) and notably with the help of the Permanent Committee on Spatial Data Infrastructure for the Americas (PC-IDEA) and the Pan American Institute of Geography and History (PAIGH), support and participate actively in the SALB and Global Mapping projects by providing the necessary data and information they require. It was further recommended that member States in the Americas take full advantage of participating in the Global Mapping project for capacity building to help establish National and Regional Spatial Data Infrastructures in the region.

1.6.3.7 The Eighteenth United Nations Regional Cartographic Conference for Asia and the Pacific (Bangkok, 26 to 29 October 2009), recalling the recommendations made in the Economic and Social Council Resolution of 19 February 1948 entitled “Coordination of cartographic services of specialized agencies and international organizations”, and taking note of the rapid development of and increased demand for geographic information infrastructure in all countries, promoted the possible creation of a United Nations global forum for the exchange of information between countries and other interested parties, and in particular for sharing best practices in legal and policy instruments, institutional management models, technical solutions and standards, interoperability of systems and data, and sharing mechanisms that guarantee easy and timely accessibility of geographic information and services.

1.6.3.8 The Eighteenth United Nations Regional Cartographic Conference for Asia and the Pacific recognized the importance of the integration of fundamental data with other spatial data, including hazard and exposure data sets in support of disaster mitigation and reduction. It also recognized the power of spatial tools in integrating various data from many sources and multiple formats, noting that the discovery, access, integration and delivery of spatial data can become much easier with enhanced interoperability. It was consequently recommended that the Permanent Committee on Geographical Information System Infrastructure for Asia and the Pacific assist member States in understanding and pursuing the principles of data integration within the context of spatially enabled society and cooperate with the International Steering Committee for Global Mapping, the United Nations Statistics Division and other international organizations to integrate spatial and statistical data.

1.6.3.9 Through its 41st Session (New York, 23 to 26 February 2010), the United Nations Statistical Commission recognized the importance of the integration of geographic and statistical information and the opportunities offered in this context by the fast development of information technologies and noted that national statistical offices are playing an increasing role in this integration, especially in the area of census management. The Commission further called upon all national statistical offices to actively participate, in partnership with relevant national authorities, to further develop national geographic information capacity, in the context of spatial data infrastructures, taking full advantage of information technology and focusing special attention on the area of improving statistical and geographic metadata compatibility.

1.6.3.10 ICAO participated in these Conferences since they are largely directed towards improvement of cartography, and this inevitably has had a favourable impact on aeronautical charting. National aeronautical chart authorities should be aware of the activities of the Conferences and should encourage participation which will ensure that the above-mentioned goals are achieved.

1.6.4 Pan American Institute of Geography and History (PAIGH)

1.6.4.1 The Pan American Institute of Geography and History was created in 1928 at the Sixth International Conference of American States (Havana). In 1930, the government of Mexico provided the PAIGH with a building in Mexico City, in which its offices are currently located. In January 1949 it became the first Inter-American Specialized Agency of the Organization of American States.

1.6.4.2 The PAIGH's main objectives, which are set down in its founding Statutes, are:

a) to encourage, coordinate and publicize cartographical, geographical, historical and geophysical studies, as well as other related scientific studies of interest to the Americas;

b) to promote and coordinate scientific and technical development, research, relations among institutions and specialists, studies and training in cartography, geography, geophysics and history;

c) to promote and stimulate cooperation among the specialized institutions of the Americas and international organizations in its four fields of activity.

1.6.4.3 PAIGH is the oldest specialized agency of the Organization of American States (OAS) and a unique multidisciplinary organization in the Americas, combining spatial information, geography, geophysics, anthropology and history (space and time). The PAIGH Assembly consists of Member States delegations. Each Member State has a PAIGH Nation Section. It is composed of four Commissions: Cartography (1941), Geography (1946), History (1946) and Geophysics (1969). Commissions are responsible for developing and executing the scientific programmes of PAIGH. The General Secretariat is the central unit of PAIGH and is responsible for developing and executing the scientific programmes of PAIGH and for the successful operation of the Institute.

1.6.4.4 Since its inception, the PAIGH has made major contributions to understanding, analysing and investigating the geography and history of the hemisphere as the common heritage of the peoples of the Americas, by means of a series of initiatives, technical assistance projects, training programmes, and the applications of training results/ accomplishments that reaffirm the direct link between knowledge of the territory, environmental and geophysical conditions, and opportunities for economic and social growth.

1.6.4.5 Innovations in information technologies, the mounting volume of data describing territory, and information systems have given to geography the role of a science used to improve the quality of life of people and their biophysical environment, and new and significant roles to play in project design, decision-making, science and technology. This has increased the importance of an organization like the PAIGH. Considering the relevance of guiding and promoting the scientific activities for the benefit of its Member States and the specialized community, the role of the PAIGH as identifier and assembler of regional and institutional competencies is being encouraged and consolidated.

1.6.4.6 The PAIGH is currently tasked with endorsing the following actions:

a) to champion modernization programmes of Geographic Institutes responsible for national cartography in the Member States in order to facilitate incorporation of new technologies and to adapt their composition to the requirements of each nation and its users;

b) to agree on a PAIGH policy on Fundamental Spatial Data including: geodesic control networks, base geography, spatial administration, infrastructure, land use and environment;

c) to promote the execution of decennial plans to produce, update and maintain the fundamental databases of the Member States;

d) to establish a programme of activities to assist geographic institutes responsible for national cartography with human resource training and functional and technological modernization;

e) to support national initiatives based on international standards and spatial data infrastructure (SDI) concepts, especially projects that develop a culture of documentation and the creation of geospatial metadata catalogues; and

f) to assist national entities responsible for cartography with the process of certification of international standards and norms promoted by the International Organization for Standardization – ISO.

1.6.4.7 In many respects the work of the Commission on Cartography is similar to that of the UN Regional Cartographic Conferences. ICAO lends support to this Organization and participates in its work whenever possible, and States in the area are encouraged to do likewise.

1.6.5 International Cartographic Association (ICA)

1.6.5.1 The International Cartographic Association is an organization formed of national member organizations, to provide a forum for issues and techniques in cartography. The ICA is the world authoritative body for cartography. It was created at Berne in 1959 at a conference organized by the Swiss Federal Topographic Service following several informal conferences sponsored by both national and commercial mapping organizations. The first General Assembly was held in Paris in 1961, and a second in London in 1964 in conjunction with the 11th General Assembly of the International Geographical Union (IGU). Concurrently, steps were taken towards affiliation of the ICA with the IGU, and this was consummated at the above-mentioned joint Assembly. Later conferences have been held around the world in, among others, Russia (Moscow, 2007), Chile (Santiago de Chile, 2009), France (Paris, 2011) and Germany (Dresden, 2013). The international nature of ICA activity has also been reflected by the work of its Commissions and Working Groups over many decades, under the leadership of many different people and in many different places. These organizations have addressed the full range of scientific, technical and social research which is the mark of ICA activity. Throughout its 50-year history, ICA has brought together researchers, government mapping agencies, commercial cartographic publishers, software developers, educators, earth and environmental scientists, and those with a passion for maps.

1.6.5.2 The ICA is a non-governmental organization open to any nation which pursues cartographic activity and agrees to collaborate actively in the work of the Organization. It does not represent either government or commercial cartographic interests but is rather a scientific association interested in the promotion of all aspects of cartography.

1.6.5.3 The ICA has the following aims:

1) advancing the study of cartographic or geographic information (GI) science issues. In particular it is concerned with the processing, storage and analysis of source material and the design, construction, reproduction and display techniques of maps and associated forms of graphic communications. To this end, cooperation with different branches of geodetic, geographic and other scientific research disciplines is desirable;

2) initiating, fostering and coordinating research in cartography and GI science, involving the cooperation between different nations, the exchange of ideas and documents, the furtherance of education and training in cartography and GI science, and encouraging the dissemination of cartographic and GI science knowledge;

3) organizing international and regional conferences, meetings, exhibitions and outreach programmes, and participation in similar meetings facilitated by other organizations;

4) establishing commissions and working groups to work on issues of particular interest to cartography and GI science; and

5) promoting and ensuring equity in all matters and at all levels of responsibility within the Association and amongst its members.

1.6.5.4 The International Cartographic Association is led by its Executive Committee, which undertakes the plans and activities that are endorsed by the General Assembly of member nations for implementation in the four years following each General Assembly. The Executive Committee is supported by the Chairs and vice-Chairs of Commissions and Working Groups, the Editor of ICA News, the Chairs of the Publications Committee, the Awards Committee, and the Statutes Committee.

1.6.5.5 The Executive consists of a President, up to seven vice-Presidents, and a Secretary General and Treasurer. All of these positions are voluntary. The Executive is elected by popular vote at the General Assembly, which takes place every four years. To achieve its aims the ICA operates through a number of Commissions and Working Groups. It works with national and international governmental and commercial bodies, and with other international scientific societies. It works closely with sister organizations through its membership of the Joint Board of Geospatial Information Societies (JBGIS). Commissions and Working Groups carry out the detailed work of the ICA. These organizations have addressed the full range of scientific, technical and social research, which is the mark of ICA activity.

1.6.5.6 The ICA promotes the generation of extensive publications, generally through its Commissions and Working Groups. This activity provides a focus for Commissions and Working Groups and allows for the dissemination of knowledge about advances in contemporary thinking and research. The publications include books, ICA-recognized journals and ICA News. At present, Commissions and Working Groups are constituted with terms of reference as follows:

1) Commission on Atlases
2) Commission on Cartography and Children
3) Commission on Cartography in Early Warning and Crisis Management
4) Commission on Cognitive Visualization
5) Commission on Data Quality
6) Commission on Digital Technologies in Cartographic Heritage
7) Commission on Education and Training
8) Commission on Generalisation and Multiple Representation
9) Commission on Geoinformation Infrastructures and Standards
10) Commission on Geospatial Analysis and Modeling
11) Commission on Geovisualization
12) Commission on GI for Sustainability

13) Commission on the History of Cartography
14) Commission on Map Design
15) Commission on Map Production and Geo-Business
16) Commission on Map Projections
17) Commission on Mapping from Remote Sensor Imagery
18) Commission on Maps and Graphics for Blind and Partially Sighted People
19) Commission on Maps and Society
20) Commission on Maps and the Internet
21) Commission on Mountain Cartography
22) Commission on Neocartography
23) Commission on Open Source Geospatial Technologies
24) Commission on Planetary Cartography
25) Commission on Theoretical Cartography
26) Commission on Ubiquitous Mapping
27) Commission on Use and User Issues

1) Joint ICA Working Group and IGU Commission on Toponymy
2) Working Group on International Map Year
3) Working Group on Technology Outreach.

1.6.5.7 It would be useful for each State to participate in the work of this Organization, and the association or component of the administration chosen for this purpose should adequately reflect the aeronautical interest in cartography. As of the date of publication, the President of the Organization is Georg Gartner, Institute of Geoinformation and Cartography, Vienna University of Technology, Erzherzog Johann Platz 1, 1040 Vienna, Austria; the Secretary General is László Zentai, Department of Cartography and Geoinformatics Eötvös University H-1117 Budapest, Pázmány Péter sétány 1/A Hungary.

1.6.6 International Hydrographic Organization (IHO)

1.6.6.1 The International Hydrographic Organization is an intergovernmental consultative and technical organization that was established in 1921 to support safety of navigation and the protection of the marine environment.

1.6.6.2 The object of the Organization is to bring about:

a) the coordination of the activities of national hydrographic offices;

b) the greatest possible uniformity in nautical charts and documents;

c) the adoption of reliable and efficient methods of carrying out and exploiting hydrographic surveys; and

d) the development of the sciences in the field of hydrography and the techniques employed in descriptive oceanography.

1.6.6.3 The official representative of each Member Government within the IHO is normally the national Hydrographer, or Director of Hydrography, who, together with their technical staff, meet at five-year intervals in Monaco for an International Hydrographic Conference. The Conference reviews the progress achieved by the Organization through its committees, subcommittees and working groups, and adopts the programmes to be pursued during the ensuing five-year period. A Directing Committee of three senior hydrographers is elected to administer the work of the Organization during that time.

1.6.6.4 The Directing Committee, together with a small international staff of technical experts in hydrography and nautical cartography, makes up the International Hydrographic Bureau in Monaco. The IHB is the secretariat of the IHO, coordinating and promoting the IHO's programmes and providing advice and assistance to Member States and others.

1.6.6.5 In many ways the work of the IHO and that of ICAO are similar where nautical and aeronautical charts, respectively, are concerned. There are several areas of common concern, such as the design of symbols for navigational aids, and the use and abbreviation of geographical terms. Some collaboration with the IHO has been experienced in the past, and there will likely be a need for coordination in the future.

1.6.7 International Society for Photogrammetry and Remote Sensing (ISPRS)

1.6.7.1 The International Society for Photogrammetry and Remote Sensing, which began as the International Society for Photogrammetry in Austria in 1910, is a non-governmental international organization devoted to the development of international cooperation for the advancement of photogrammetry and remote sensing and its applications.

1.6.7.2 The direction and management of the ISPRS, including the conduct of its technical and scientific programme, is undertaken through the following components: the Congress, the General Assembly, the Council, the Financial Commission, the Technical Commissions and the Sustaining Members Committee. The scientific activities of the Society are entrusted to and conducted by eight Technical Commissions and their Working Groups. The General Assembly, at every quadrennial Congress, elects eight Ordinary Members which will host the eight Commissions, and approves Resolutions which provide direction for the scientific activities to be undertaken.

1) The General Assembly is the supreme authority of the ISPRS for all decisions and it determines the general policy of the Society. The General Assembly consists of Delegates and Representatives of the Ordinary, Associate, Regional Member organizations plus Council, Financial Commission and Honorary Members of the Society;

2) The Council includes the President, the Congress Director, the First Vice-President, the Second Vice-President, the Secretary General and the Treasurer. The Council conducts the affairs of the Society in the interval between meetings of the General Assembly in accordance with the statutes and bylaws and with the decisions and directives of the General Assembly and of Congress. A meeting of the Council is convened at least once each year;

3) The Congress consists of all the photogrammetrists and remote sensing specialists present who are affiliated with a Member organization and others who have been invited. The Congress convenes every four years. The Congress site is selected by the General Assembly from proposals made by Members. Arrangements for all activities at the Congress are the responsibility of the Congress Director who is nominated by the Member which hosts the Congress; and

4) The eight Technical Commissions are responsible for scientific work of the ISPRS. Each of the Commissions is entrusted for a four-year term to an Ordinary Member through election by the General Assembly. The scientific activities of each Commission are defined by Terms of Reference in the Society Bylaws and by quadrennial Resolutions which are approved by the General Assembly. Commissions form Working Groups to address various aspects of its scientific activity. Each Commission is responsible to organize an International Symposium in the second year between Congresses. Each Working Group is to be composed of international scientists and experts and is expected to convene at least once each year between Congresses.

1.6.7.3 The ISPRS scientific interests include photogrammetry, remote sensing, spatial information systems and related disciplines, as well as applications in cartography, geodesy, surveying, natural, Earth and engineering sciences, and environmental monitoring and protection. Further applications include industrial design and manufacturing, architecture and monument preservation, medicine and others.

1.6.7.4 The principal activities of the ISPRS are:

a) stimulating the formation of national or regional Societies of Photogrammetry and Remote Sensing;

b) initiating and coordinating research in photogrammetry and remote sensing;

c) holding international Symposia and Congresses at regular intervals;

d) ensuring worldwide circulation of the records of discussion and the results of research by publication of the International Archives of Photogrammetry and Remote Sensing;

e) encouraging the publication and exchange of scientific papers and journals dealing with photogrammetry and remote sensing; and

f) promoting cooperation and coordination with related international scientific organizations.

1.6.7.5 Aeronautical charts are used during aerial photographic operations. In some applications, sophisticated navigational methods and instruments are applied in order to fly a photographic aircraft accurately along prescribed flight lines. Aeronautical charts are frequently compiled and updated through the application of aerial photographs and photogrammetric mapping techniques.

1.6.7.6 The work of ISPRS is influenced by ICAO directly through the Commission Presidents and indirectly through the Member Organizations.

Chapter 2

REQUIREMENTS FOR AERONAUTICAL CHARTS

2.1 ESTABLISHING THE NEED FOR AERONAUTICAL CHARTS

For the safe performance of air operations it is essential that a current, comprehensive and authoritative source of navigation data be made available at all times, and aeronautical charts provide a convenient medium for supplying this information in a manageable, condensed and coordinated manner. All segments of aviation make reference to them for air traffic control, planning and navigation purposes, and it is of prime importance to place current and accurate charts in the hands of these users quickly. The differing scales and functions of the charts in Annex 4 reflect this varied interest, as also do the chart design and the type of information shown on them. Annex 4 contains the specifications for seventeen types of aeronautical charts for which an international need for uniformity has been established. Of these charts the production/availability of six types of charts is mandatory, six non-mandatory and for four types of charts the production is "conditional".

2.2 MANDATORY CHARTS

[3.2.1, 3.2.2, 6.2.1, 7.2.1, 11.2.1, 13.2.1, 16.2.1]

2.2.1 The six mandatory charts are the Aerodrome Obstacle Chart — ICAO Type A; Precision Approach Terrain Chart — ICAO; Enroute Chart — ICAO; Instrument Approach Chart — ICAO; Aerodrome/Heliport Chart — ICAO; and the World Aeronautical Chart — ICAO, 1:1 000 000.

2.2.2 For all aerodromes used by international civil aviation, the Precision Approach Terrain Chart must be produced for all precision approach runways Categories II and III, and the Instrument Approach Chart where instrument approach procedures have been established by the State. 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.

2.2.3 For all aerodromes regularly used by international civil aviation, the Aerodrome/Heliport Chart is required, as well as the Aerodrome Obstacle Chart, Type A where significant obstacles exist in the take-off flight-path areas. Where the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) is made available, the Aerodrome Obstacle Chart — ICAO Type A (Operating Limitations) is not required.

2.2.4 Furthermore, the Enroute Chart must be made available for all areas where Flight Information Regions (FIR) have been established and the World Aeronautical Chart — ICAO 1:1 000 000 must be produced for all areas delineated in Appendix 5 of Annex 4.

2.3 NON-MANDATORY CHARTS

[4.2, 14.2, 15.2, 17.2, 18.2, 19.2]

2.3.1 Six other charts, which are touched upon below, are considered "non-mandatory" charts, which means that these should be produced only if, in the opinion of the State authority, the availability of these charts would contribute to the safety, regularity and efficiency of aircraft operations.

2.3.2 The Aerodrome Obstacle Chart — ICAO Type B should be produced only where a need exists for a chart to assist in the determination of critical heights, e.g., for circling procedures, or of procedures for use in the event of an emergency during take-off or landing, and of obstacle clearing and marking criteria. Where the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) is made available, Aerodrome Obstacle Chart — ICAO Type B is not required.

2.3.3 The Aerodrome Ground Movement Chart — ICAO is a supplementary chart which should be produced only where the detailed information needed for the ground movement of aircraft along taxiways to and from the aircraft stands and the parking and docking of aircraft, cannot be shown with sufficient clarity on the Aerodrome/Heliport Chart — ICAO.

2.3.4 The Aircraft Parking/Docking Chart — ICAO is also a supplementary chart which should be made available only where, due to the complexity of terminal facilities, the information on the ground movement of aircraft between the taxiways and the aircraft stands and the parking/docking of aircraft cannot be shown with sufficient clarity on the Aerodrome/Heliport Chart — ICAO or on the Aerodrome Ground Movement Chart — ICAO.

2.3.5 The Aeronautical Chart — ICAO 1:500 000 and the Aeronautical Navigation Chart — Small Scale should be provided only when operational requirements for visual navigation or chart production considerations indicate a need for these charts either as a substitute for or to supplement the World Aeronautical Chart — ICAO 1:1 000 000.

2.3.6 Plotting Chart — ICAO. These charts are a useful adjunct where a need exists for a chart which will provide a means of maintaining a continuous flight record of the aircraft position by various fixing methods and dead-reckoning, and maintain an intended flight path. These charts would be appropriate to major air routes over oceanic areas and sparsely settled areas flown by international commercial air transport.

2.4 CONDITIONALLY REQUIRED CHARTS

[8.2, 1, 9.2, 10,2, 12.2]

2.4.1 The requirement for production of the four charts listed below is "conditional", which means that the availability of these charts is required only if certain conditions/circumstances prevail.

2.4.2 The Area Chart — ICAO is to be made available only where the air traffic services routes or position reporting requirements are complex and cannot be adequately shown on the Enroute Chart — ICAO.

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

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

2.4.5 The Visual Approach Chart — ICAO has to be made available for all aerodromes used by international civil aviation where only limited navigation facilities are available or radio communication facilities are not available or no adequate aeronautical charts of the aerodrome and its surroundings at 1:500 000 or greater scale are available, or where visual approach procedures have been established.

2.5 CHART GROUPS

2.5.1 The seventeen types of charts now contained in Annex 4 have been arranged in four groups. They are:

a) Group 1: Charts, exclusively for planning use

1) Aerodrome Obstacle Chart — ICAO Type A
2) Aerodrome Obstacle Chart — ICAO Type B
3) Aerodrome Terrain and Obstacle Chart — ICAO (Electronic)
4) Precision Approach Terrain Chart — ICAO

b) Group 2: Charts for use in flight between take-off and landing

5) Enroute Chart — ICAO
6) Area Chart — ICAO
7) Standard Departure Chart — Instrument (SID) — ICAO
8) Standard Arrival Chart — Instrument (STAR) — ICAO
9) Instrument Approach Chart — ICAO
10) Visual Approach Chart — ICAO

c) Group 3: Charts for use during ground movement of aircraft on the aerodrome

11) Aerodrome Chart/Heliport — ICAO
12) Aerodrome Ground Movement Chart — ICAO
13) Aircraft Parking/Docking Chart — ICAO

d) Group 4: Charts for visual air navigation, plotting and planning purposes

14) World Aeronautical Chart — ICAO 1:1 000 000
15) Aeronautical Chart — ICAO 1:500 000
16) Aeronautical Navigation Chart — ICAO Small Scale
17) Plotting Chart — ICAO

2.5.2 Furthermore, within Group 2 a direct relationship exists between the Enroute, Area, SID and STAR charts. The Area Chart can be considered as an enlargement or “blow up” of a portion of the Enroute Chart. This usually occurs around a busy airport or in a terminal area, but could also occur at a busy intersection of major ATS routes. It is not always necessary to produce a separate Area Chart, since it might be possible to include an enlargement on the Enroute Chart as an “inset”. For the Area Chart, the same relationship exists with the Standard Departure Chart — Instrument (SID) and the Standard Arrival Chart — Instrument (STAR). The latter two charts are produced only when an instrument departure or arrival route cannot be shown with sufficient clarity on the Area Chart. The SID and STAR Charts can be considered “blow-ups” of parts of the Area Chart.

2.5.3 A similar relationship exists in Group 3 between the Aerodrome/Heliport, the Aerodrome Ground Movement and the Aircraft Parking/Docking Charts. The two supplementary charts are required only if the information cannot be shown with sufficient clarity on the Aerodrome/Heliport Chart. The Aerodrome Ground Movement Chart is an enlargement of part of the Aerodrome/Heliport Chart and the Aircraft Parking/Docking Chart is an enlargement of part of the Ground Movement Chart.

2.5.4 For details on the preparation of the specific charts, please refer to Chapter 7 of this manual.

2.6 JOINT CIVIL/MILITARY CHARTS

The specifications for ICAO aeronautical charts stem from Article 37 of the Convention on International Civil Aviation (Chicago, 7 December 1944) which is applicable only to international civil aviation, to the exclusion of the operation of State aircraft (military, customs, police, etc.). However, a State may find it expedient either to issue aeronautical charts e.g. plotting and enroute charts for use by all of its air services, including the military, or to utilize the services of a military cartographic unit for the production of such charts. Article 3d) of the Convention requires Contracting States to have due regard for the safety of navigation of civil aircraft when issuing regulations for military, customs and police aircraft, and Article 28 requires their collaboration to secure the publication of aeronautical maps and charts in accordance with standards which may be recommended or established from time to time pursuant to the Convention, so far as it may be practicable. It is therefore highly necessary that uniformity with the internationally agreed specifications be preserved through close coordination and liaison. In areas of difference which cannot be resolved through negotiation between the parties concerned, adjudication by the authority in the State which has control over all the parties may be found to be necessary.

2.7 PRIORITIES

2.7.1 In the production of aeronautical charts, it is desirable to assign priorities both to the several chart series and to the individual charts within each series, particularly where they are not produced within the department responsible for civil aviation. It is not, however, feasible to expect that each State could follow a uniform system in this respect, since most administrations attempt to produce first those charts which are within their capabilities to produce and any firm allocation of priorities as between chart series could have the effect of retarding rather than of advancing implementation. Even between charts in a particular series it is difficult to propose a system of priority which could be uniformly applied; much depends on the type and volume of air traffic, and the functions for the time being to be satisfied. It may be possible in such cases that priority of function will dictate priority of production, and States will be well advised to be so guided, to the extent that it is practicable, in assigning priorities to the production of chart series or of individual charts within a series.

2.7.2 Certain difficulties in assigning priorities may arise where a government department, other than that responsible for civil aviation, is charged with the production and publication of aeronautical charts. This is particularly so when the same department is responsible for supplying the entire national requirements for maps and charts, in addition to aeronautical charts. Under such an organization, this department is normally limited by a cadre of personnel who would be allocated to the more routine and foreseeable mapping programmes. It is imperative therefore that the requirements for aeronautical charts be adequately anticipated and assigned an appropriate priority, within the national charting programme. There may be a tendency in some administrations, particularly in States with developing economies, to place a greater emphasis on maps and charts more directly related to plans for economic development, to the detriment of the production of aeronautical charts. It is important therefore that the many benefits which accrue to a State from its participation within the international civil aviation community be recognized and that aeronautical charts be given the requisite priority. When these charts are produced within, or are directly under the control of the department of civil aviation, the aviation needs are better known and appreciated, and it is much easier to make rapid assessments and adjustments to programmes to meet emergency situations, a factor which is common only in the field of aeronautical charts.

2.8 RELATIONS WITH CHART USERS

2.8.1 In the matter of aeronautical charts, design and development have their origin in the needs of the users, which also provide the impetus for the initiation of the charting programme. These users are primarily aircrew, and general aviation pilots, airline flight operations personnel, air traffic control personnel, and briefing officers in aerodrome AIS units, although other departmental and airline units indirectly involved in flight operations planning and chart production, as well as technical libraries, may have a secondary interest in the charts. Not only must the needs of these users be taken into consideration in determining priorities, design criteria and the cartographic requirement, arrangements must also be made to ensure distribution of the finished product to all those whose needs initially established the requirement for it. This cycle requires a total integration of the special operational skills and experience of those engaged in air navigation and flight planning, with the technological skills of cartographic or of AIS specialists responsible for publication of the charts. Inasmuch as it is the operational data collected from users that, after internal analysis and coordination, and subject to technological limitations, ultimately makes up the finished product, the cycle is not complete until the product is in the hands of those who stimulated its creation.

2.8.2 The speed, volume and complexity of modern air navigation demand, for reasons of safety of human life and property, that accurate and up-to-date aeronautical charts be available promptly to all users. The most elaborate system of aids and procedures for air navigation would be of little value unless aircrew and those in the various aviation ground services who would assist them have the means to do so through the medium of the prescribed aeronautical charts, which are specialized tools expressly designed to facilitate this purpose. Complete reliance on charts produced by non-State agencies is not in keeping with the obligation imposed on States by the Chicago Convention and Annex 4, which is to assume responsibility for the production of the prescribed charts in the internationally agreed form.

Chapter 3

MAINTENANCE OF CHARTS

3.1 NATURE OF THE PROBLEM

3.1.1 Pilot fatigue is often indicated as the probable cause of navigation errors and as a contributing factor in many crashes. An accurate, well-designed chart that is easy to read under varying conditions of natural and artificial light will assist in alleviating the tension of flying in adverse weather conditions and, if kept up to date, the chart can contribute greatly to reducing the risk of error. At present there is no practical method for keeping charts completely up to date. There is an implication in every NOTAM that an amendment to a map or chart may be required. However, several steps can be taken which will contain the problem within manageable dimensions. A compromise has to be found between the interest of the map producers in attempting to spread their work evenly throughout the year, which results in staggered publication dates, and the interest of the users who would prefer that aeronautical data have the same validity on all associated charts, and that the charts reach their hands simultaneously.

3.1.2 The problem of presenting up-to-date base information to users of aeronautical charts has plagued chart producers for many years. Consideration of the problem requires separate treatment of aeronautical information, cultural information and terrain information, the former being more important because aeronautical information shown on a chart is highly susceptible to change. It is essential to safety that the information be kept up to date. It is in fact true that changes in some data on the chart will demand early revision, while changes in less important facilities and procedures can be held for a longer period.

3.1.3 The degree of urgency of chart revision varies according to:

a) the nature and function of the chart, this depending on the accuracy of the navigation required; and

b) the density of data on the chart which is subject to change and the rate of change.

3.1.4 For example, the Area Chart — ICAO is designed to provide data for navigation of high accuracy; it must therefore be kept up to date more strictly than a World Aeronautical Chart (WAC) — ICAO 1:1 000 000, which has much less aeronautical data and in general serves a less critical purpose. This is true regardless of the particular type of chart, but there is a distinction to be made between a complex chart for an area where the degree of separation and navigation accuracy requirements are low as compared with a similar chart where they are high. In summary, there are three factors involved, i.e. the complexity of the chart, the accuracy of the navigation required, and the intensity of use.

3.1.5 Chart users are generally unwilling to accept hand amendments, which should be avoided as far as practicable or at least kept to a minimum as they are conducive to error. Pilots and briefing officers, particularly those handling large numbers of charts, have little time for manuscript corrections.

3.2 PREVENTIVE MEASURES

3.2.1 The best method of reducing the rate of obsolescence is to ensure that changes affecting the charts are kept to a minimum. Measures which may be taken to accomplish this are as follows, it being recognized that some of these matters are somewhat out of the hands of the chart producer:

a) changeable data should be kept to the minimum required to fulfil the function of the chart. This requires, of course, that the function of the chart is clearly defined. Since data on a chart starts to change from the moment of publication, if not before, every unnecessary item on the chart increases the chance of obsolescence;

b) a system should be established for coordinating changes in facilities and procedures, and other matters over which one has control, with the schedule for new chart editions. This is particularly important around the period that the chart normally would be revised, to avoid delays and changes immediately following publication;

c) the effective date of changes in facilities, procedures, etc., should be given advance notice. The chart producer's job becomes impossible unless notice is received in time to permit appropriate action. It is also essential that such advance notification can be relied upon to take place at the specific time;

d) a facility should not be commissioned until it is reasonably certain stability has been reached and that under normal conditions there would be no change in its status or characteristics;

e) the chart specifications should be kept simple and uncomplicated (not only those relating to aeronautical data) so that the production process can be kept to a minimum when a revision is necessary;

f) simultaneous production of associated chart series should be arranged. When each of an associated group of charts carries a different aeronautical date the verification of amendments (which may be found in NOTAM, for example) becomes particularly confusing; and

g) where practicable, bases for future aeronautical overprints should be printed in quantity in advance to permit rapid and economical issue of new editions.

3.3 METHODS

3.3.1 There are three basic methods available to the chart producer for keeping charts up to date, namely hand amendments, overprints or new editions.

3.3.2 Hand amendments at first glance appear to offer the most effective solution, but are normally not acceptable to the user because:

a) the complexity of modern charts prevents insertion of legible amendments;

b) many corrections entail expert draughtsmanship and/or interpretation of the material;

c) there is uncertainty as to whether all relevant material has been received; and

d) it places a burden on the user whereas it is more economical collectively to action the amendments at the source.

Furthermore, hand amendments are unacceptable to chart producers and distributors because of the problem of amending stock before issue and because of the possibility of making errors.

3.3.3 Overprinting of charts must coincide with the withdrawal of charts from stock. This system can only be applied, therefore, to undistributed stock which would then need to be issued as replacement for existing stock. Also, the complexity of some charts precludes the possibility of overprinting without impairing the legibility of the chart.

3.3.4 The issue of new editions of charts appears to offer the only effective solution, particularly in the case of the more complex charts (densely covered with aeronautical data), and this is the only method that seems to satisfy the users. Indeed, if any information as to the frequency, identification, times of operation and other characteristics of radio aids to navigation are shown on World Aeronautical Chart — ICAO 1:1 000 000 or on Aeronautical Chart — ICAO 1:500 000, this information is required to be kept up to date by means of new editions of the chart (c.f. 16.9.6 and 17.9.6, Annex 4). However, there are some disadvantages, namely:

a) greater production facilities are required;

b) there are economic drawbacks to both producer and distributing agencies; and

c) it is difficult to gain cooperation of sales agencies when chart stocks are frequently rendered obsolete, unless the old stock are recalled at no loss to the agencies.

3.3.5 One method which is suitable for certain types of charts is multiple printing and issue in bound volumes. An essential part of such a system is the arrangement for purchase on a subscription basis, this having the advantage to the producer of stabilizing the demand, i.e. the quantity to be produced. Additionally, charts which are revised frequently on a pre-determined schedule can also be issued on a subscription basis.

3.4 FREQUENCY OF REVISIONS

A chart should be revised as frequently as is necessary to keep it up to date. It is difficult, however, to assess the requirements for scheduling the issue of new editions of charts on an international basis because of the different conditions existing in each State. Also the criteria must rest on an analysis of the various charts or chart series available and their interrelationship; for example, if a full complement of charts is available, the maintenance of one series such as the Enroute Chart in a completely up-to-date condition may lessen the necessity for adherence to a schedule for other less critical charts to the extent permissible under the specifications. With these reservations, Table 3-1 may be taken to indicate a close approximation of what is required:

Table 3-1.

Type of Chart	*Approximate period between revisions*	*Remarks*
1. Aerodrome Obstacle Chart (Types A, B)	When accumulation of hand amendments justifies	
2. Precision Approach Terrain Chart	When any significant change in terrain profile occurs	
3. Enroute Chart	28 days (AIRAC cycle) Multiples of 12 weeks (AIRAC cycle)	Congested areas Uncongested areas
4. Standard Departure Chart — Instrument (SID) Standard Arrival Chart — Instrument (STAR)	When a significant change occurs but not more often than 4 weeks	

Type of Chart	*Approximate period between revisions*	*Remarks*
5. Instrument Approach Chart	When a significant change in procedure occurs	
6. Visual Approach Chart	When accumulation of hand amendments justifies	
7. Aerodrome/Heliport Chart Aerodrome Ground Movement Chart Aerodrome Parking/Docking Chart	When accumulation of hand amendments justifies	
8. World Aeronautical Chart 1:1 000 000 Aeronautical Chart 1:500 000 Aeronautical Navigation Small Scale	Base — 4 years Aeronautical Information — 1 – 2 years	In congested areas the aeronautical information may be revised more frequently. Note also 16.9.1 and 17.9.1 of Annex 4
9. Plotting Chart	Significant change in aeronautical information	

Note.— Significant changes are those which need to be taken into account in aircraft operations.

3.5 ISSUE OF "ADVANCE" INFORMATION

3.5.1 To operate high performance aircraft in the ever-increasing volume of air traffic, the pilot must devote a minimum amount of time to reference data. Information must be presented to the pilot in a clear, positive and orderly fashion preferably through self-briefing media. In the absence of reasonable assurance that facilities and services directly required on a flight are available and are operating satisfactorily, operators are expressly forbidden from commencing that flight (c.f. 4.1.1, Part I of Annex 6). Changes in the availability status of aerodromes and navigation aids, in air traffic procedures and in the realignment of the air traffic services system are not matters which yield to guesswork. Yet there is frequently a considerable time lag before permanent changes appear on aeronautical charts.

3.5.2 There is no place on the airways for pilots who are not up to date on their route information. The responsibility for the pilot-in-command of any international flight to be acquainted with all appropriate information is stated in Chapter 2 of Annex 2. The conventional practice of expecting the pilot-in-command to absorb this information in a pre-flight information unit immediately prior to take-off is no longer adequate. It is necessary to go to the root of the problem and to control the amendments at their origin by ensuring that editions of charts carrying new or amended aeronautical information are issued in advance of the date on which the changes become effective, whenever the changes are foreseeable. When such charts are received by users haphazardly, or after the effective date, it becomes virtually impossible to ensure that flight crews are adequately forewarned.

3.5.3 Changes to radio communication and navigation aids, services and procedures normally shown on aeronautical charts can be anticipated and made effective in accordance with a predetermined schedule of "effective dates". Most of the above-mentioned changes are already subject to the "regulated system (AIRAC)" applied by States' Aeronautical Information Services under the provisions of 5.2 of Annex 15. Under the AIRAC system, the changes, unless operational considerations make it impracticable:

a) must reach users at least 28 days in advance of an indicated effective date;

b) have effective dates in keeping with a pre-determined, internationally agreed schedule of effective dates based on an interval of 28 days; and

c) must not be changed further for at least another 28 days after the indicated effective date, unless the circumstance notified is of a temporary nature and would not persist for the full period.

It is essential that coordination take place between AIS and MAP activities to ensure that related aeronautical information is given advance distribution simultaneously on the documents issued by both activities, and timed to be available 28 days before the same effective date. It must be ensured that for four weeks after the effective date of such information, amendment will only be required in respect of urgent unforeseeable temporary changes.

3.5.4 The procedure described above should be brought to the attention of all parties responsible for originating information for aeronautical charts, to ensure that the raw information will be protected while in transfer and received in time for publication on the schedule date. These parties should be advised of the dates established, including not only the publication and effective dates, but also the number of days in advance of publication that all such information should be available to those processing the charts. Ideally there should be an interval of 42 days between the publication date and the effective date. This allows for a period of up to 14 days' postage time in order for recipients to receive the information at least 28 days in advance of the effective date.

3.5.5 In cases where additional notice is desirable and practicable, a publication date of 56 days (or even longer) in advance of the effective date is used. Effective dates established for the 10-year period commencing January 2010 appear below.

3.5.6 In order to ensure that charts published under AIRAC procedures include the correct effective date, it is essential that an effective date should not be notified until a high degree of certainty exists that it will be met.

Schedule of AIRAC effective dates, 2010-2014

2010	2011	2012	2013	2014
14 January	13 January	12 January	10 January	9 January
11 February	10 February	9 February	7 February	6 February
11 March	10 March	8 March	7 March	6 March
8 April	7 April	05 April	4 April	3 April
6 May	5 May	03 May	2 May	1 May
3 June	2 June	31 May	30 May	29 May
1 July	30 June	28 June	27 June	26 June
29 July	28 July	26 July	25 July	24 July
26 August	25 August	23 August	22 August	21 August
23 September	22 September	20 September	19 September	18 September
21 October	20 October	18 October	17 October	16 October
18 November	17 November	15 November	14 November	13 November
16 December	15 December	13 December	12 December	11 December

Schedule of AIRAC effective dates, 2015-2019				
2015	2016	2017	2018	2019
8 January	7 January	5 January	4 January	3 January
5 February	4 February	2 February	1 February	31 January
5 March	3 March	2 March	1 March	28 February
2 April	31 March	30 March	29 March	28 March
30 April	28 April	27 April	26 April	25 April
28 May	26 May	25 May	24 May	23 May
25 June	23 June	22 June	21 June	20 June
23 July	21 July	20 July	19 July	18 July
20 August	18 August	17 August	16 August	15 August
17 September	15 September	14 September	13 September	12 September
15 October	13 October	12 October	11 October	10 October
12 November	10 November	9 November	8 November	7 November
10 December	8 December	7 December	6 December	5 December

Chapter 4

AUTOMATED AERONAUTICAL CHARTING

4.1 GENERAL

4.1.1 The purpose of this chapter is to provide instruction and guidelines to support States' implementation toward a fully automated charting system.

4.1.2 Four levels of automation, which describe both the current and future systems, have been identified, and the process to achieve a fully automated charting system is provided. Database content, charting products, specific technologies currently in use, and their advantages, are detailed in this chapter.

4.1.3 Each State is requested to assess and identify its current level of automation. It should be the goal of each State to gradually reduce human intervention in order to achieve fully automated systems. States which have already implemented automated procedures may use the guidelines below to further progress.

4.1.4 The transition from paper products to electronic/digital ones is strongly encouraged. The electronic charts must continue to adhere to the ICAO Annex 4 Standards and Recommended Practices (SARPs). Lessons learned through the development and usage of paper charts can be utilized while creating improvements through the capabilities of modern applications and display.

4.2 BASIC PRINCIPLES

4.2.1 The principal objective of developing an automated charting system is to improve, through automation, the overall speed, quality, efficiency, accuracy and cost-effectiveness of the aeronautical charting system.

4.2.2 Automation introduces control systems and information technologies which reduce the need for human work in the production phase.

4.2.3 The basic principles of an automated environment are:

a) reduces user workload;

b) facilitates allocation of charting development tasks;

c) avoids duplication of activities;

d) reduces errors in the charting design process;

e) performs tasks that are beyond human capabilities; and

f) ensures compliance with ICAO Annex 4 Standard requirements.

4.2.4 Automation should be tailored according to the specific situation in order to ensure the establishment of simple, flexible and efficient systems. For reasons of cost-effectiveness, the introduction of automated systems must strike a balance between the degree of sophistication of the system required and the impact that a new automated system may have on the overall performance of the organization.

4.2.5 Situational and human factors should be taken into account during the implementation of automated procedures, as they may influence the functioning of technological systems as well as human-environment equilibrium. An integration process aimed at incorporating human factors into the systems engineering should be adopted. This ensures that the users will be an integral part of the future automated system and that their needs and requirements are considered at all levels for the system to perform effectively.

4.2.6 New communication technology for the retrieval, exchange and distribution of aeronautical information is considered optimal for strengthening the transition towards automated systems. Common conceptual and exchange data models are encouraged to facilitate an easier transmission and exchange of aeronautical information.

4.2.7 The development of an automated environment must take into account a proper quality system and procedures which will ensure that the available aeronautical information is of appropriate quality (accuracy, resolution, integrity) and timeliness.

4.3 USERS' OPERATIONAL REQUIREMENTS IN AN AUTOMATED ENVIRONMENT

4.3.1 The aeronautical charting automated system should be capable of satisfying the users' operational requirements, which include:

a) provision of a high-quality aeronautical charting service;

b) supplying of information which is accurate and consistent;

c) notification of changes to make sure that obsolete charts are discarded and replaced by current editions; and

d) timely distribution of aeronautical charting products.

4.3.2 Aeronautical charting automated systems should comply with the following requirements:

a) provide for continuous and timely updating of the system database and monitoring of the validity and quality of the aeronautical information stored;

b) integrate data from a wide variety of sources;

c) temporally manage information and related products, to make sure that charts are always up to date;

d) facilitate inspection of the aeronautical chart content, possibly through the synchronization of the graphical elements with the central database content via specific metadata;

e) provide users with definable rules/templates to facilitate the assembling of the final chart product; and

f) ensure products and services are equally available to humans and computer systems, through specific digital formats for capturing and processing the information.

4.3.3 Moving towards aeronautical information management (AIM) environments, the future system should further:

a) permit access to the system by authorized users through suitable applications/services;

b) provide for rapid responses to user requests for information;

c) be untied from the products, focusing on storing the aeronautical information as individual data sets, accessible at any time within the various stages of production and distribution;

d) ensure interoperability between tools and applications, in order to be able to manage a large amount of information of various types;

e) consider both graphics and text, not as separate techniques, but complementary for the display of aeronautical information; and

f) improve the processes, which currently involve lengthy timescales and are not comparable to other fully automated procedures.

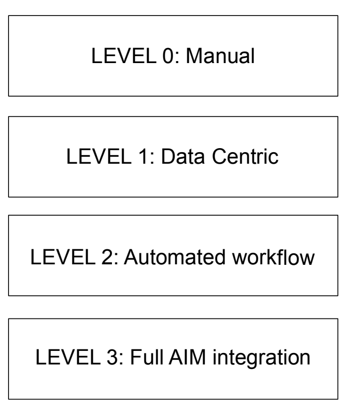
4.4 DIFFERENT LEVELS OF AUTOMATION

4.4.1 Overview of different levels of automation

4.4.1.1 The entire chain, from data origination to aeronautical charts production and distribution, is supported by systems that are characterized by various degrees of automation.

4.4.1.2 The scenario may range from manual aeronautical information service (AIS) production systems, where human intervention still plays a crucial role, to semi-automated AIS production systems, where the production is less dependent on human intervention, to fully automated AIM production systems where human intervention is minimal. All of these AIS/AIM production systems could produce both paper and electronic/digital products.

4.4.1.3 Four main levels of automation have been identified, the last being the most sophisticated. It is an evolving scenario, where each level introduces a step forward in automation and decreases the need for human involvement.



4.4.1.4 The differentiation between one level and the subsequent has been done taking into account the following elements: characterization of data sources; practices for generating and maintaining aeronautical charts; mechanisms for validating the chart content; and various methodologies for transmitting the aeronautical information to the consumers.

a) *Aeronautical chart generation, maintenance*. Aeronautical chart generation and maintenance may occur differently, switching from manual processes (hand-operated assembling, manual finishing operations, etc.) to automated procedures driven by central data storage. The maintenance process may be critical if not sufficiently supported by automation; charts are submitted to continuous changes, due to diverse reasons, such as route connectivity or airspace organization changes, obstacle environment variation, a new amendment to Annex 4 — *Aeronautical Charts* provisions, eventual errors or anomalies, significant modifications to the layout of an aerodrome, or any other significant change to the aeronautical, cultural or terrain data. All these changes have a temporal applicability that varies from case to case; they may be critical, as to require immediate action, or schedulable. The ability to maintain an aeronautical chart up to date relies on the high efficiency of procedures and processes established within the single organization and on the expertise of properly trained staff; or, in the most advanced situations, it relies on automated mechanisms that auto-detect changes, according to a temporal-based approach.

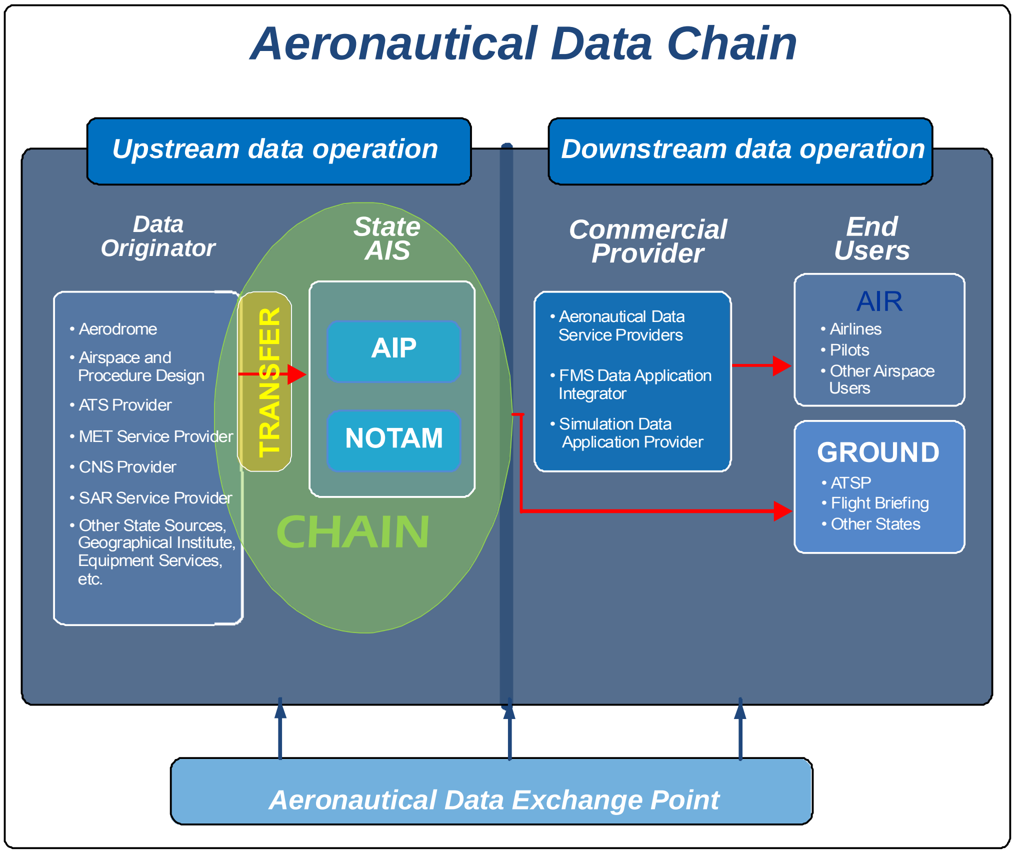
   Future AIM systems will further revolutionize this concept by introducing a different method of providing and managing information.

b) *Aeronautical chart validation*. This process involves the verification of all the elements that compose the content of an aeronautical chart. It may occur through an eye-screening process of a person(s) properly trained in charting design and with the right expertise and knowledge; or may happen automatically. Automatic validation is easily performed when the charting product is constantly aligned with the database content. The chart, being generated out of the data, is in fact auto-consistent. Further checks and verification procedures may be embedded in the applications, usually designed to alarm the user in case of errors, mistakes or non-conformities.

c) *Aeronautical information transmission and associated product distribution*. The aeronautical information transmission is a functional link, where data are moved from one location to another (RTCA DO 200A). Within the aeronautical data chain the aeronautical information flows from the originators to the end users; moving from upstream to downstream, specific data exchange points are established. These aeronautical exchange points may be automated or not, and the aeronautical information may be transmitted on paper or electronically: the methodology chosen generates a different level of efficiency in the whole process.

4.4.1.5 The primary issues associated with transmitting data are detecting errors and ensuring that the data configuration management requirements are satisfied. The security of the transmission is also to be considered, such as protecting the data from modification by an external entity, or minimizing the potential for accepting invalid data.

4.4.1.6 The following sections describe in detail the characteristics of each level of automation in relation to aeronautical chart generation, maintenance and distribution. States should read this guidance and determine, according to the single specificity, the best order in which automation may be introduced to improve safety, increase efficiency and create greater cost-effectiveness.



4.4.2 LEVEL 0 — Manual

1) Distributed sources

2) Manual generation and maintenance

3) Paper/electronic/digital products

4) Manual validation

5) Human intervention during transfer

6) Time-consuming process; potential errors

4.4.2.1 At LEVEL 0, the information coming from distributed sources is assembled and managed by hand by the State AIS or by the reference agency delegated to provide aeronautical charts services.

4.4.2.2 Different actors play a crucial role in handling heterogeneous information; airport authorities, terrain data agencies, procedure and airspace designers, etc., are differently involved in the origination of various types of information which is then issued in the public domain. The State service providers access the information, process, compile and use the result to generate a consistent output.

4.4.2.3 LEVEL 0 involves a high human intervention and only the expertise of properly trained staff ensures an accurate integration of diverse and distributed information sources. The dynamic nature of information makes the scenario more complicated: aeronautical information changes rapidly, and it is vitally important to be aware of the modifications and to put in place methodologies which support the detection of updates and eventual inconsistency and/or incompleteness. At this level no automation is in place, and all methodologies rely purely on manual handling tasks, personnel competency, good work organization, optimal quantitative and qualitative workloads, clarified work roles, supportive interaction and adequate strategies.

4.4.2.4 The chart content validation is an eye-screening process, which may lead to inconsistencies and to low efficiency in detecting missing information, duplications or mistakes. The process is time-consuming and potential errors may easily occur.

4.4.2.5 The outcome might be a traditional paper-based product or an electronic/digital product which needs to be submitted to finishing processes before being distributed.

4.4.2.6 Electronic/digital products bring a few benefits: the generation, maintenance and validation of charts are facilitated as they rely on functions embedded in the applications used.

4.4.2.7 Most aeronautical charts have a 28-day revision (AIRAC) cycle and are re-issued on tight schedules to avoid obsolete products which are highly dangerous to navigation. Some charts may require a less frequent revision so they need to be printed at a specific point in time and others may be provided on demand, according to user requests/orders. A distribution department is then dedicated to supply sales agencies, aeronautical data service providers, application providers, airlines, flight crews, flight briefing offices and other States with the new chart products. This department determines the quantity requirements, initiates orders and maintains customer mailing lists. The challenge for this team is the timely distribution of the date-sensitive charts.

4.4.2.8 At LEVEL 0, each single procedure is manually intensive and involves considerable well-trained personnel. Complex workflows are in place, and the whole process may be generally error-prone, inefficient and expensive.

4.4.2.9 The introduction of Quality Management systems may significantly increase the efficiency of the aeronautical chart generation, maintenance and distribution processes, lower their error ratios and decrease the overall expense of the operation.

4.4.3 LEVEL 1 — Data-centric

1) Data-centric architecture

2) Automated generation, automated changes detection

3) Electronic and digital products

4) Human intervention during transfer

5) Improved safety, increased efficiency, greater cost-effectiveness

4.4.3.1 At LEVEL 1 a data-centric architecture is set forth as a system design where databases play a crucial role. The continuous evolution of database management systems has caused an increasing development of applications which rely on them. This configuration is clearly in contrast to file-based (whether paper or digital) data structures and access methods.

4.4.3.2 Major advantages consist of:

a) the possibility of using a dynamic table-driven logic allows programmes and procedures to be simpler and more flexible;

b) the possibility of using a shared database as the basis for communicating between parallel processes in distributed applications simplifies the design; and

c) the possibility of using provided transaction processing and indexing results in a high degree of reliability, performance and capacity.

4.4.3.3 A data-driven aeronautical charting process adheres to these advantages. The core is precisely a reference database, containing all the data sets necessary to generate the desired output. The centralized storage is made of different types of features, rich in attributes, geographically referenced allowing the system and all chart products real-time access to updated information. These data come from different sources under the control of the State AIS and are validated to properly feed the central storage.

4.4.3.4 Data coming from a database are meaningless if not properly manipulated to become a real cartographic product. Data need a context, and context elevates the original data into information. In an automated environment, data are extracted, temporally referred, collocated in a specific framework, related to each other and transformed into information. The aeronautical chart product becomes an information-layered product where each graphical element is synchronized and strictly linked to the central data stored through a unique set of attributes, called metadata.

4.4.3.5 Aeronautical chart generation is the result of an automated and single process in which data are retrieved, manipulated, contextualized and displayed in a geographical environment: the outcome can be inspected, as every single graphical element is synchronized with the database features and attributes. This ensures to the user a direct interaction due to direct access to the associated metadata.

4.4.3.6 The constant link to the central database and the temporal approach make the aeronautical charts intelligent products, permanently updated on the status of their information. Changes which occur at a database level are automatically detected by every single chart that contains the changed information.

4.4.3.7 In an automated system it is also easily recognizable how many aeronautical charts are going to be affected by each single data change.

4.4.3.8 This approach generally minimizes the potential for handling errors, provides facilities for a much faster status update and enables automated access to the data.

4.4.3.9 Also at this level, even though the aeronautical chart is generated and maintained electronically/digitally, the final output to be distributed might be either an electronic/digital or a paper printout product.

4.4.4 LEVEL 2 — Automated workflow (from data originators to end users)

1) Data-centric architecture

2) Automated generation, automated changes detection

3) Digital products

4) Automated workflow

5) Improved safety; increased efficiency; greater cost-effectiveness

4.4.4.1 LEVEL 2 automates the exchange points in the upstream phase of the aeronautical data chain. Moving to the downstream data operation, human intervention is still present.

4.4.4.2 The automated transmission of data involves compliance to ISO Standards (ISO 9001, ISO TC2112). Data are held in electronic media, preferably using standard formats which can be used throughout the whole process. During the transmission, data must not suffer of any change, be it accidental or intentional: they are protected, usually through the use of a Cyclic Redundancy Check (CRC) algorithm. Furthermore they are encrypted to ensure integrity and constantly verified by the responsible organizations (aerodrome authority, ANSP, CAA, etc.) or by the delegated agency.

4.4.4.3 AIS receives the electronic data, verifies their completeness and integrity, and processes them to publication using electronic media.

4.4.4.4 Electronic publications are then transferred to commercial providers (aeronautical data service providers, FMS data application integrator, simulation data application provider) and through them to the end users (airlines, flight crews, other airspace users, flight briefing offices, other States), or directly to the end users, e.g., an instrument approach chart is published and issued in the public domain. Organizations may access the electronic information and process it, encode the data (ARINC 424 standards) and translate it into a proprietary format that allows the target application to access the data.

4.4.5 LEVEL 3 — Full AIM integration

1) Single authoritative source

2) Data-centric architecture

3) Web services and applications

4) User-defined outputs

4.4.5.1 At LEVEL 3 full automation is ensured and an AIM system is completely established.

4.4.5.2 Experience has shown that one of the quickest ways to corrupt data is to allow multiple authoritative sources. Aggregating information from accredited sources and then integrating them into a single authoritative source ensures a minimization of multi-path data sources, facilitates information characteristics verification (information consistency and its compliance to the quality standards) and supports the instantaneous identification of eventual changes, immediate notification and response. Only authorized users may access the authoritative source, use information and provide feedback as to whether it is complete and adequate for its intended use. Potential data duplication and fragmentation are consequently reduced.

4.4.5.3 In the full AIM environment, there will be AIM actors who require operational access to AIM information and AIM users, that is, the whole ATM community. Everyone with the same objective will be accessing the information in real time. This occurs through services and applications.

4.4.5.4 Future AIM systems will rely on a service-oriented architecture (SOA), where services are supposed to be mechanisms that enable access to one or more capabilities, using prescribed interfaces; access is exercised in compliance with specific standards and policies as specified by the service description. Consumers of services may take advantage of dedicated applications (e.g. web-based applications) to determine the available SOA-based services and access the information with constraints and in conformance to adequate standards and practices. Information becomes accessible through various messaging mechanisms, discoverable according to temporal and spatial filters and seamless thanks to the use of common interfaces.

4.4.5.5 The need for aeronautical charts does not change: the skill that goes into portraying data (be it geographic or tabular) is the capability to transform data and raw information into a decision-support tool. Aeronautical charts become a fully user-defined product, generated on demand: each individual, through common interfaces may access specific data sets and choose diverse styling options for these data sets. This approach does not require the user to have any knowledge of the attributes or feature types of the underlying data. Users access various information and ask for an on-demand display, compose layers and introduce proper filters to ensure a readable result. User-defined symbolization of feature and coverage data is carried out through two main parameters, layers and style. The layer defines a stream of features, and the style defines how these features are symbolized. Within this context the user is never allowed to change the information, which remains consistent and accurate.

4.5 CONCEPT FOR AN AUTOMATED AERONAUTICAL CHARTING SYSTEM

The following provides the concept for automated aeronautical charting along with its major characteristics such as system configuration and set up, management of the configured environment, database contents and expected outputs.

The transition from AIS to AIM is an evolutionary process that entails a continuous development of systems and applications. The automated environment, as described in this context, is in line with the current maturity of AIS systems but opens the way to future developments.

4.5.1 System configuration

4.5.1.1 *Central storage*

4.5.1.1.1 Automated aeronautical charting systems rely on a central warehouse properly designed to provide all the necessary information to generate the desired output.

4.5.1.1.2 Central storage is intended to be:

a) a dynamic table-driven database, preferably based on standard conceptual models, consisting of interrelated features and attributes;

b) a geo-database, namely a spatial database designed to store, query and manipulate geographic information and spatial data which are actually managed as points, lines or polygon data types;

c) a repository, catalogue and file-based system aimed at supplying reference maps, images and information layers for the completeness of the aeronautical chart outputs.

4.5.1.2 *Chart templates*

4.5.1.2.1 In an automated environment, aeronautical charts are generated based on aeronautical chart templates specific for each chart type.

4.5.1.2.2 An aeronautical chart template is a reference model that facilitates the generation process. It may be:

a) a standardized file used by the system as a pre-formatted example on which to base the generation of aeronautical charts (e.g. a master graphic file, or a series of graphic files, containing dynamic graphical elements and labels);

b) a system that combines a template with data to produce an output;

c) a set of business rules, stored in the central database, designed to transform aeronautical, terrain and cultural information into cartographic information. Each aeronautical chart type addresses specific criteria, e.g., Aerodrome Obstacle Chart — ICAO Type A represents only obstacles in the take-off flight path area; a lower enroute chart includes only airspaces and routes below specific flight levels; in the enroute chart, prohibited, restricted and danger areas relevant to the layer of airspace must be depicted with their identification and vertical limits, etc. Consequently each data feature may be used differently according to its destination, may have a different representation according to the target chart type and may be associated with different metadata according to the kind of map, its scale and characteristics. Cartographic information is exactly that which complies with the specific requirements associated to the single chart type; and

d) a reference chart structure which identifies features, symbols and reference business rules per each chart type.

4.5.1.3 *Configuration tools*

4.5.1.3.1 System configurability is another important feature that automated systems should include.

4.5.1.3.2 Systems do not have to be customizable, but mostly configurable, meaning it is possible to choose how information is presented to a specific group of users and which information they have access to.

4.5.1.3.3 The immediate benefit is the tremendous flexibility to tailor the system to internal processes. This allows for the possibility to establish common settings (date/time formats, units of measurements, access to the database, etc.) which are centralized and shared by all applications, to construct different application flows by selecting sections of the application process and arranging them into a desired order and to share a common list of authorized users, with specific roles and consequently different allowed actions along the workflow activities.

4.5.1.3.4 When the system is configurable, the quality assurance remains focused on one version of applications and tools, which means that the system is more stable and reliable.

4.5.1.4 *Backup management*

4.5.1.4.1 A complete, high-availability and disaster recovery strategy requires dependable data backup, restoration, and recovery procedures.

4.5.1.4.2 There are various reasons for data loss such as human error, operating system failure and application problems, among others. Backup plays a vital role for businesses or organizations. Therefore, not taking appropriate steps to preserve the data is a major mistake.

4.5.2 Database Contents

Central warehouses contain various data which support the generation of aeronautical charts. Usually three categories of information are identified:

a) *terrain data*, used to develop the background of an aeronautical chart and aimed at providing an accurate picture of the terrain as it would be observed from the air. Usually the terrain data are composed of entities such as relief, contour lines, spot heights, vegetation, rivers, water spots, etc.;

b) *cultural features*, that assist flight crews in identifying the safest location for a forced, emergency landing. Examples of cultural data are the road network, built-up areas, man-made obstacles, and other features visible from the air and useful for navigation, such as prominent power transmission lines; and

c) *aeronautical data*, that comprehend the whole aeronautical reality, basically divided into five families: enroute framework and significant points; airports; navigational aids; terminal procedure; and airspace structure.

4.5.2.1 *Terrain data*

4.5.2.1.1 When stored in electronic formats, terrain data is traditionally managed through GRID and TIN formats, composed of 3D points, lines and contours. GRID and TIN are made of points representing the high and low extremes of the terrain. Each point is associated with x, y coordinates and related z-values. This kind of storage is usually not really practical with large collections of mass points from data sources.

4.5.2.1.2 A viable alternative to this kind of storage is terrain data sets. Terrain data are described as features, attributes and geometries characterized by points, multi-points, lines, poly-lines and polygon-based features. This is a more database-oriented solution which brings numerous advantages as the information becomes more easily accessible, seamless and consistent. Terrain data are stored in geo-databases, where they can be handled in different formats: each format is associated with a different capacity. It is possible to have geo-databases files, able to store a huge number of points, which do not allow multi-user editing; or full geo-databases with their unequivocal advantages associated with a centralized database architecture. A geo-database not only can handle big amounts of data, but ensures a multi-user editing, versioning and tracking of every action which occurs to the data.

4.5.2.2 *Cultural data*

4.5.2.2.1 High-resolution digital images or topographic maps (raster and vector files) are stored in central repositories to be available at any time during the aeronautical charts' production.

4.5.2.2.2 It is considered an optimal enhancement to transform these high-resolution images into digital data sets. All visible features such as man-made morphological formations that include transportation systems (roads and trails; railroads and pipelines; runways; transmission lines), and other man-made structures, (buildings, houses, schools, churches, hospitals) should be captured, stored in proper geo-databases as points, lines, poly-lines, polygons, etc. Attributes should be added to better qualify the stored information and the whole data sets then validated to ensure their integrity.

4.5.2.3 *Aeronautical data*

4.5.2.3.1 Standard conceptual models exist providing a formal description of the aeronautical information items; the best known is the aeronautical information conceptual model (AICM) which has been developed based on the ICAO requirements for the provision of "data necessary for the safety, regularity and efficiency of international air navigation". This standard model is increasingly used as the basis for the design of an AIS database.

4.5.2.3.2 Aerodrome mapping databases, describing the aerodrome reality through geographic and geometric information and organized as a structured data set are another significant example of electronic storage of aeronautical information which provide important support for aeronautical chart production. Aerodrome mapping data go deeply into the aerodrome reality and consist of features and attributes which are described as points, lines or polygons. Examples include runway thresholds, taxiways, taxiway guidance lines, parking stand areas, etc.

4.5.3 Charting Products

The outcome of an automated aeronautical charting system may range from the traditional paper products to the more advanced aeronautical chart display which supports real-time access to the information. Descriptions of various products are provided below.

4.5.3.1 *Traditional products*

Aeronautical charts have historically been produced as paper products, either the charts issued in the public domain through the AIP, or the charts carried by the flight crew members from aircraft to aircraft, providing standardization from one aircraft type to another. These charts may be large-format paper charts, folded charts, booklets, printed on side or on both sides, etc.

4.5.3.2 *Electronic products*

4.5.3.2.1 Early versions of electronic charts have essentially been electronic representations of the paper products, basically represented by raster files.

4.5.3.2.2 A raster chart is an electronic snapshot, either a copy or a scan of existing paper charts. All the information which composes the content of a raster chart is printed on it. The introduction of raster charts has advantages: the chart can be more easily inspected by zooming in and out, and rotation, panning, etc., functions.

4.5.3.3 *Digital products*

4.5.3.3.1 Digital products are basically represented by vector charts. Vector charts have the same information as their raster equivalents. The difference is that the content of a vector chart is not printed, but computer generated. It is made of points and lines that make up the features belonging to the chart. Details on the vector charts can be turned on and off, and it is possible to click on each graphical element to learn more details about the feature itself. Rotation and zooming may occur with discrimination in respect to the feature type. The vector chart is a digital product, made of layers of information which the user may switch on and off to reduce clutter or add detail to the chart.

4.5.3.3.2 A sophisticated example of digital products is represented by the data-driven charts, which are described in the following paragraph.

4.5.3.4 *Data-driven charts*

4.5.3.4.1 Data-driven charts have changed significantly the approach to chart production. Data-driven charts are constantly linked to central storage and they are consequently auto-consistent.

4.5.3.4.2 Data-driven charts are digital products which result from the overlaying of different layers of information, terrain, cultural and aeronautical, and they are usually generated thanks to the use of business-related information, such as business rules and aeronautical chart templates.

4.5.3.5 *Chart display*

4.5.3.5.1 In this context, the aeronautical chart becomes a set of display elements, organized in more than one view. Each displayed element is associated with attributes meant to qualify it and is associated with a different level of criticality based on the functional importance of this element on the display.

4.5.3.5.2 Access to the information may vary, so critical information should be quickly accessible while less significant information may be deselected. Information which has been deselected is reselectable for display at any time.

4.5.3.5.3 The chart display usually varies according to situational constraints. An electronic chart display may be generated for briefing purposes or to execute flight procedures and consequently the content and structure of the display are different.

4.5.3.5.4 Information in the chart display has to be readable and presented in a legible and useable mode. For this purpose this type of electronic chart display offers facilities for zooming, panning, selecting and deselecting layers. More sophisticated systems provide chart declutter capabilities and reduction algorithms to support users in their inspection.

4.6 PLANNING FOR AND IMPLEMENTATION OF AN AUTOMATED CHARTING SYSTEM

4.6.1 Understanding the improvements

Planning for and implementation of an automated system means understanding where the improvements need to be introduced. The enhancements can be of a different nature, that is reducing incompatibilities and divergences, diminishing data duplication thereby ensuring standardization of procedures, products and services to end-users. Improvements are introduced at different levels, hereby described.

1) *Process improvement*: the core is the functional processes established to originate, maintain and treat data and finalized to generate consistent outputs. Functional process changes may encourage the introduction of centralized databases, managed workflow, task management, change control, etc.

2) *System improvement*: introduction of new technology, new hardware/software and applications which automate tasks, consequently overridden by the user, ensure the quality of information and facilitate the compliance with criteria, e.g., procedure design automated tools supporting the application of the *Procedures for Air Navigation Services — Aircraft Operations* (Doc 8168) prescriptions or applications providing aeronautical chart templates to facilitate compliance with Annex 4 Standards. Security software which minimizes damage done by unintentional and malicious updates to databases by unauthorized users. Telecommunications improvement to provide easier access to the data and improve both accuracy and timeliness of the data.

3) *Data design improvement*: introduction of standard conceptual/exchange models which facilitate data storage and exchange, database design improvements, stored functions, stored privileges management, triggers, etc.

4) *Policy and procedure improvement*: setting the rules for ensuring quality processes, development of appropriate guidance and training for the usage of automated tools, identification of proper personnel to manage the automated systems, etc.

4.6.2 System Analysis

4.6.2.1 *Determining functional requirements (System design)*

4.6.2.1.1 To initiate a new automated system or to establish a new level of automation within an existing system, a deep analysis must be done of its actual and future design. This study is oriented to identify all the functional requirements in terms of inputs, behaviour and outputs and to depict its application architecture.

4.6.2.1.2 The hierarchy for determining functional requirements is:

user/stakeholder request → feature → use case

Use cases, once listed, are then transformed into business rules.

4.6.2.1.3 Within an AIS system, use cases need to be developed in relation to the following processes and behavioural scenarios:

1) Data flow diagram: understanding the complex data flows supported by the system and all the mechanisms put in place to manage them;

2) Data management tools: understanding the aeronautical data storage and management methodology, from the collection of change requests to the update of the official production data stores;

3) Design environment (Procedure and airspace design): understanding the system configuration, the technological platforms used, the procedures in place to keep control of the design criteria, the outputs generated and their format;

4) Production environment and data output: AIP generation, aeronautical charts, etc.; recognition of all the interface tools used to support the production phase, the technological platforms used and related outputs;

5) Connections between the AIS and the external world: data change, consequential correction requests, dissemination of data reports and aeronautical publications;

6) End-to-end services: auditing, tasks management, change control, system security and access functionalities, centralization, etc.; and

7) External connections: external connections, separated from the core system.

4.6.2.2 *Determining non-functional requirements (System architecture)*

4.6.2.2.1 The analysis of non-functional requirements means outlining the general behaviour of the system as a whole, without identifying specific behaviours. The aim is specifying overall characteristics which drive the technical architecture of the system.

4.6.2.2.2 Non-functional requirements are more difficult to determine and a holistic approach needs to be applied. The analysis of non-functional requirements within an AIS system should provide the following information: how to improve the whole productivity of the system and its performances, how to expand the system to handle an increased throughput and how predictable and reliable the system is.

4.6.2.2.3 When the analysis of functional and non-functional requirements is completed, the picture of the system is drawn. Actual performances, scalability and capability of the system to be expanded, its reliability and the related costs to maintain the whole system operational are known. It is consequently possible to delineate the roadmap towards a better automated environment.

4.6.2.2.4 The migration process defines the steps to reach a higher level of automation. It has to be properly planned and organized in order to ensure a successful progression.

4.6.3 Data Migration

4.6.3.1 When the level of automation is low and most of the processes for handling aeronautical information are managed manually, the initial step consists of setting up a reference central storage; this means introducing standard data models to facilitate the storage and the exchange of aeronautical information, creating central repositories to collect all digital topographical and cultural material (roads, rail, hydro line, city), etc.

4.6.3.1.1 Whether or not a data-centric architecture is already established, the focus is to ensure the accuracy, consistency and integrity of the data through the application of business rules and consistency checks or through the introduction of data-protection algorithms, e.g., geographical coordinates. All critical data may be tagged and monitored (CRC wrap) while stored and moved around in the system.

4.6.3.1.2 Improving the workflow from data origination to data transmission is considered a positive step forward. This may occur by introducing web-based forms for data originator or, for more advanced systems, direct input into the system from survey equipment, from instrument procedure design interfaces, etc.

4.6.3.2 *Production environment*

Increasing the level of automation within a production environment means replacing routine manual activities with specific computerized functions, such as:

a) introducing tools and facilities that automate activities usually performed by the cartographer, e.g., chart generation, chart changes detection;

b) initiating tools and facilities that support compliance with Annex 4 prescriptions for aeronautical chart production;

c) preparing dynamic aeronautical chart templates and reference chart models to speed up the assembling of the chart product;

d) establishing business rules and de-cluttering rules in support of automatic symbolization and chart finishing;

e) introducing applications which prevent unauthorized users from drawing in the basic map, avoiding an alteration of the content, and only allowing them to move shapes, change fonts, set map borders and assemble chart layers of information overlaying updated digital data;

f) replacing the traditional means of distribution for aeronautical information and related products. The alternative consists of web services (catalogue services, web feature services, web map services, web coverage services), which are of a certain relevance when digital data products are concerned. Through these services common interfaces are set up to query geographical data and metadata, the available digital products, specific services and potential resources, to serve geo-reference map images and to request geographical coverage.

4.6.3.3 *Testing environment*

4.6.3.3.1 Testing the environment means running a series of checks on the complete system, to ensure that all the newly established functional processes operate correctly and that their introduction does not downgrade the system performance. Each individual test, or use case, should exercise a particular operating condition of the user's environment, recreate a real condition and stress the system to make evidence of eventual criticality.

4.6.3.3.2 The test environment is usually designed to be identical, or as close as possible, to the anticipated user's environment.

4.6.3.3.3 These tests are based on identified data sets and are usually accompanied by a formal description of the operational activities to be performed and of the expected results.

4.6.3.3.4 Within an AIS system the following main areas need to be verified: system configuration management, system security and access, users and associated tasks management, auditing processes, etc. Further details of the production processes include all tools related to data management and control, design environment, charting and AIP production, digital libraries and repositories, etc.

4.6.3.4 *Going in parallel*

When the system to be automated is characterized by a certain complexity, it could be necessary to consider a period of parallel operations between the old system and the new one. The switch to the new system may occur fully at a certain point in time, or single processes may be progressively migrated to the new operational environment.

4.6.3.5 *Training*

4.6.3.5.1 Automation introduces new skill requirements and abilities; consequently training is a fundamental part of the migration process.

4.6.3.5.2 The evolution to an automated system occurs over an extended period, through several stages and with different styles of operation proceeding in parallel. It takes time for personnel to achieve a thorough understanding of the new applications and methodologies. Recurrent training should be provided to ensure that the users in charge of specific activities are fully aware of the consequences of their actions and are able check the accuracy of their output.

Chapter 5

REPRODUCTION

5.1 ESTIMATING DEMAND

5.1.1 The interrelated factors which normally should be taken into account, in estimating the potential demand for a new chart or chart series, as well as enabling the assessment of priorities and ensuring economies in production, are:

a) the past sales experience with other charts of a similar type;

b) if the chart is associated with a particular aerodrome, the relative traffic at that aerodrome;

c) the experience of neighbouring States in publishing similar charts;

d) the number of aircraft registered in the country;

e) the number of pilots licensed in the country; and

f) the chart procurement practices of airlines operating in the country (the operators may depend on the chart services of the country concerned, contract with a service agency or produce the charts themselves).

5.1.2 Obviously the question of demand should be analysed in the early planning stages to ensure that there is sufficient demand to warrant initiation of the project. This does not mean that the demand need be high since mandatory charts called for in Annex 4 will need to be produced in any event. For example, the requirement for Aerodrome Obstacle Chart — Type A may be limited to a few copies, and the primary decision then becomes one of “method of reproduction”.

5.1.3 The question of price is not raised in the above since it is considered that the price would not be a significant factor in the demand. This is based on the assumption that the price would be a nominal one and would not reflect the total cost of surveys, compilation and drafting, printing, storage, selling, etc.

5.1.4 In the case of revisions, some of the factors included in 5.1.1 would not be applicable and past experience would be the major criterion.

5.1.5 In the case of relatively expensive charts, such as multi-colour visual navigation charts, it might be useful to conduct a survey of anticipated demand among the potential chart users, bearing in mind, however, that such surveys can be expensive and possibly their cost might better be invested in the chart programme itself. As a compromise, a sample survey could be undertaken with a limited number of participants. If such a survey is undertaken it should be comprehensive and on a long-term basis, listing all potential charting plans and obtaining, among other things, an indication of priorities rather than concentrating on the “need” for a specific chart or chart series.

5.2 ESTIMATING PRODUCTION RUNS

5.2.1 Having estimated the demand, the actual production run will need to take into account:

a) whether the chart is to be included in the Aeronautical Information Publication (AIP) and if so, whether it would also be made available separately;

b) whether there is an annual subscription system to cover all new and revised charts;

c) the probable period of validity of the chart;

d) the cost of producing various quantities beyond the minimum run necessary to serve initial requirements, bearing in mind the economy of high press runs for multi-colour charts and the relative change in the aeronautical information and in the base information; and

e) the extra cost involved in re-runs of a multi-colour chart.

5.2.2 For a mono-colour chart, the press run should be sufficient to take care of the estimated initial demand and any supplementary demand for the chart during its estimated period of validity. In the case of multi-colour charts, it is likely that the aeronautical information will become obsolete before the base information, and it might therefore be feasible to print sufficient impressions of the base material to take care of two or three runs of the aeronautical plate.

5.3 REPRODUCTION

5.3.1 When the preparation of a chart is complete, it is imperative that printing instructions be clearly presented to the activity responsible for reproduction. The various items provided should be clearly identified in a reasonably permanent manner, and this is particularly essential where more than one plate is involved. The following instructions should be provided:

a) number of copies required;

b) method of reproduction to be employed;

c) material on which the finished product is to be provided, together with weight, thickness, tear and fold strengths, brightness and opacity of paper where relevant;

d) colour or colours for photo colour prints or press printing;

e) where one colour is used for depiction of various items and differentiation is accomplished by screening, complete details of the combination of negatives at the plate-making stage;

f) when reproduction is to be multi-coloured printing, the method for effecting registration and details of tolerances;

g) where a screen is used, as noted above, the specifications of the screen, i.e. line dots (number of lines of dots) per centimetre (inch), and the percentage of solid colour appearing on the printed product;

h) where more than one screen is used, the angles at which they are to be used (patterning or moiré effect will result in areas of overlap if screens are not properly aligned). The usual screen angles are:

2 screens — 45° and 90°
3 screens — 30°, 60° and 90°
6 screens — 15°, 30°, 45°, 60°, 75°, and 90°
with 0° at 12 o'clock;

i) detailed proofing requirements;

j) if the requirement is such, and if capability exists with the reproduction agency, special instructions for drilling holes (for pages to be contained in loose-leaf binders), folding or binding, supported by samples;

k) the date on which the finished product is required;

l) complete delivery instructions; and

m) instructions for the return or disposal of all originals.

5.3.2 Many of the items listed above will require preliminary discussion between the requisitioner and the reproduction agency. There is also a critical point in production of very small quantities in one colour. For one or two prints of a large original, vandyke or ozalid copies are economical but, depending on local conditions, at some point between 20 and 50 prints it becomes more economical to make a printing plate and print the required impressions on a printing press.

5.3.3 The use of screens will be limited to the capability provided by the reproduction agency. Both size and type of screens available will affect capability, and this knowledge should be a part of production planning.

5.3.4 If a job is not of a standard pattern it will be necessary to determine what capabilities (camera, press, etc.) actually exist. Where it is found that requirements are extending capabilities to their limits, it is good practice to obtain samples before commencing a project to specifications which may not be attainable.

5.3.5 The required production date should be discussed with the reproduction agency to ensure satisfactory scheduling. The meeting of the required production date will be contingent upon the requisitioner supplying originals on or before a mutually satisfactory date.

5.3.6 Preliminary discussion will always be necessary to determine the form in which material is to be presented for printing. This is particularly true where circumstances are such that small press capability is being used to capacity while large press capability may be available. If such a situation exists it may be determined that multiple printing (more than one chart on a plate) is a more economical answer to the reproduction problem.

5.4 COLOURS AND MULTICOLOUR PRINTING

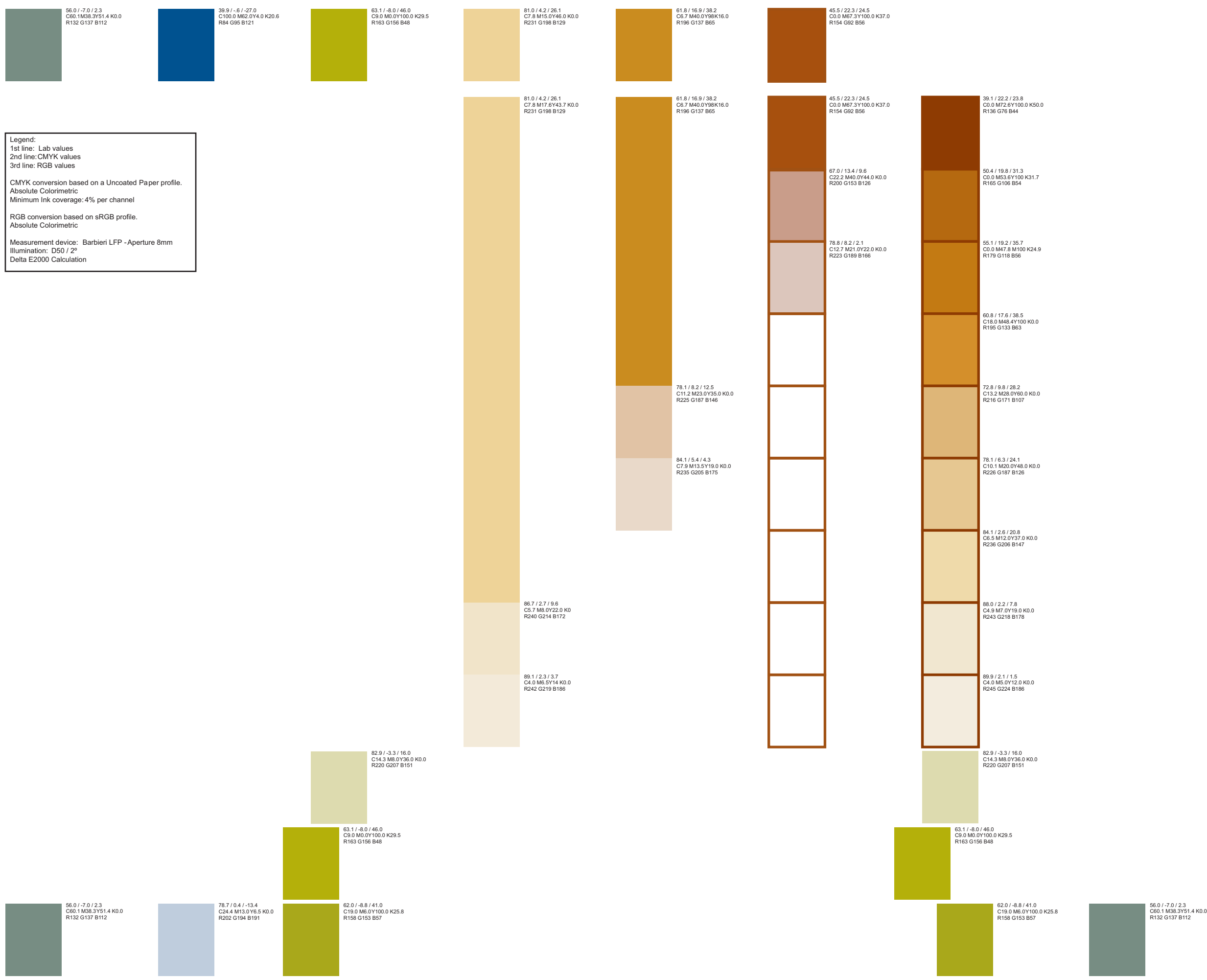
[Appendices 3 and 4]

5.4.1 Colours specified for use on aeronautical charts are contained in the Colour Guide of Annex 4, Appendix 3 together with the elements associated with each colour. Optional colours are permitted for certain culture data, areas where relief data is incomplete and aeronautical overprint information; these are clearly defined in the Colour Guide. Alternative systems for hypsometric tints are specified in Appendix 4, one system being the tint system for the International Map of the World on the Millionth Scale (IMW), (Appendix 4). Single colour charts should be printed in black on white or off-white paper.

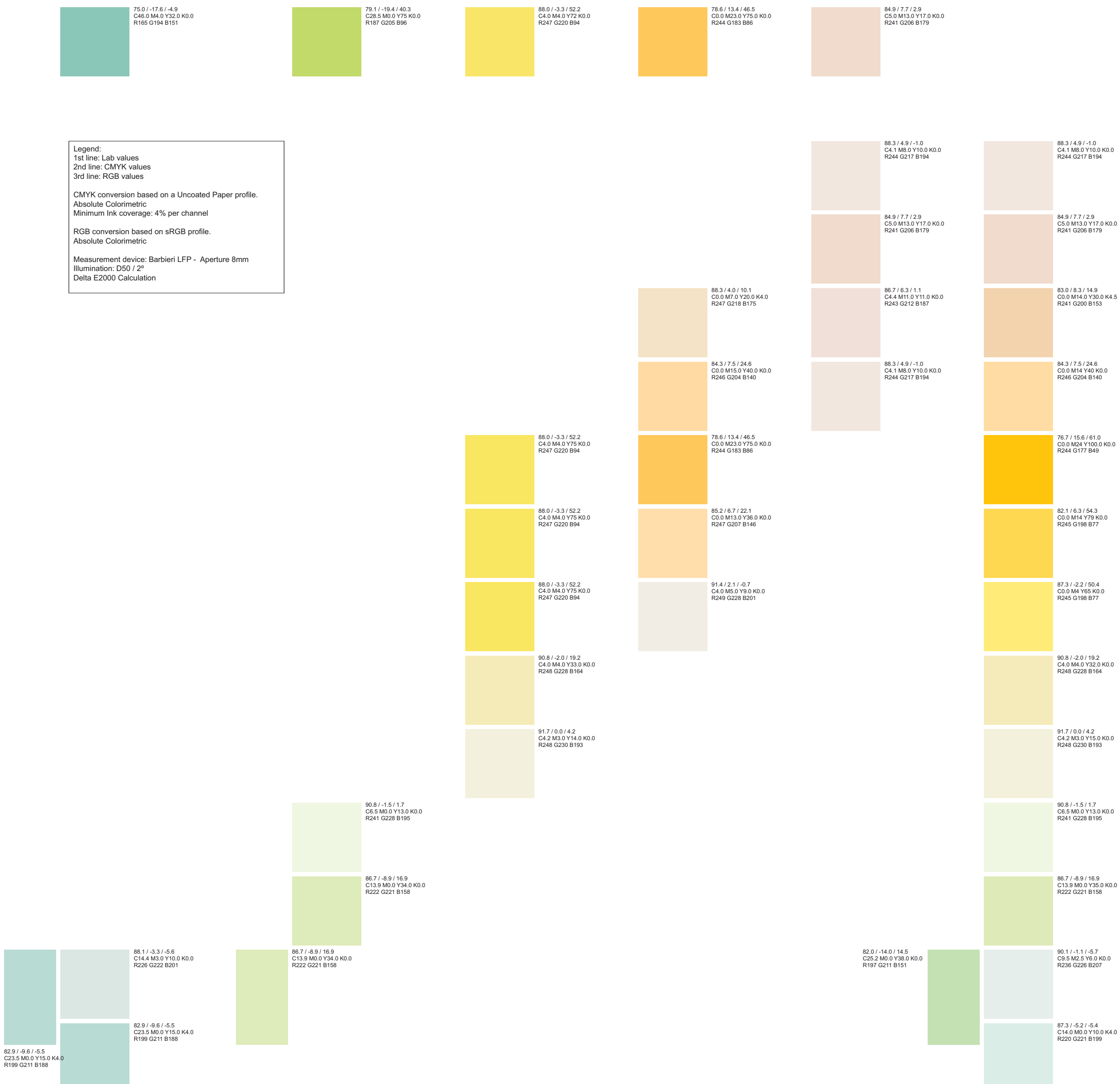
5.4.2 Detailed specifications for the exact proportion of colour pigments required to obtain a selected colour are omitted because of the lack of an international printing ink colour standard. Matching the colours to be used on a chart will depend on the technical colour-matching capacity available to the cartographic agency or on the advice available from private printing consultants. Colours should be carefully compared and matched within an area utilizing artificial light (which provides a more consistent and even light than natural daylight). Colour proofing from press proofs should be made only when the inks are dry. Chemical reactions of certain colour pigments on paper, particularly when the colours are overprinted on each other, provide different tones or values when wet or dry.

5.4.3 Detailed guides to the proportion of colours (angles, densities, dot areas, line weights, diameter of dots, etc.) for the screens required to produce the tints for both the World Aeronautical Chart — ICAO 1:1 000 000 and the International Map of the World on the Millionth Scale (IMW) are provided in Appendices 1 and 2 to this chapter. These guides provide the essential information required to produce the colour effects at the plate-making and printing steps in the production of a chart. To obtain the correct reproduction impressions, the lighter colours must be printed first, followed by overprinting the darker colours to ensure the final colour and screen effect desired. Exact replicas of the type of screens illustrated on these samples are generally available.

WORLD AERONAUTICAL CHART — ICAO 1: 1 000 000
SCALE OF HYPSOMETRIC AND BATHYMETRIC TINTS



INTERNATIONAL MAP OF THE WORLD 1: 1 000 000
SCALE OF HYPSOMETRIC AND BATHYMETRIC TINTS



Chapter 6

CHART DISTRIBUTION

6.1 INTRODUCTION

Chart distribution is second only in importance to the production of the charts themselves. There is a requirement for a distribution system which will be simple in arrangement, but will ensure prompt availability of the charts to States, organizations or individuals requiring them. To this end every possible attention should be given to:

a) establishing a common centre for the distribution of all aeronautical charts and associated AIS publications;

b) including as many charts as practicable in the AIP;

c) providing a subscription service for any chart not included in the AIP; and

d) placing the production of frequently amended charts (e.g. Enroute Charts) on a regular production schedule in keeping with the procedure established by the State's aeronautical information service for advance distribution with a universal effective date.

6.2 DISTRIBUTION WITH AERONAUTICAL INFORMATION PUBLICATION (AIP)

6.2.1 The MAP part of an AIP is intended as a catalogue of information on the availability of aeronautical charts and is not to be a repository for the charts themselves. The MAP part of the specimen AIP (cf. 5.7 - Charts to be included in the AIP) of the *Aeronautical Information Services Manual* (Doc 8126) indicates the range and type of information required to be so published.

6.2.2 The following charts, especially for aerodromes listed in the AGA part of the relevant regional plan, should, when available, form part of the AIP unless distributed through a separate subscription service to recipients of the AIP:

Aerodrome Chart — ICAO
Aerodrome Ground Movement Chart — ICAO
Aircraft Parking/Docking Chart — ICAO
Aerodrome Obstacle Chart — ICAO Type A (Obstacle Limitations)
Precision Approach Terrain Chart — ICAO
Enroute Chart — ICAO
Instrument Approach Chart — ICAO
Area Chart — ICAO
Standard Departure Chart — Instrument (SID) — ICAO
Standard Arrival Chart — Instrument (STAR) — ICAO
Visual Approach Chart — ICAO

6.2.3 The location of these charts should be as follows:

Aerodrome Charts (and when required, the Aerodrome Ground Movement and the Aircraft Parking/Docking Charts): in the AGA part, each chart to immediately follow the detailed description of the aerodrome to which it is related;

Aerodrome Obstacle Chart — Type A and Precision Approach Terrain Chart: to follow the relevant Aerodrome Chart;

Area Charts (and when required, the Standard Departure Chart — Instrument (SIR) and the Standard Arrival Chart — Instrument (STAR)): in the RAC 4 part of the AIP in association with the description of holding, arrival, approach and departure procedures;

Instrument Approach and Visual Approach Charts: in an Appendix following the MAP part of the AIP, and in that order with the charts in each series in alphabetical order by name of the city and given an appropriate page number for checklist purposes.

In addition to the above, other charts in so far as possible should be included in the AIP to become a part of the regular distribution system of AIP.

6.2.4 When the sheet size of a chart is larger than AIP sheet size and the sheet cannot be folded to this size, the chart (e.g. Enroute Chart) may be placed in a pocket or open end plastic wallet. If this would create difficulties in use or amendment, a separate volume of the AIP may be a solution.

6.2.5 Distribution of charts with the AIP has the following basic advantages:

a) each AIS unit or service responsible for the provision of pre-flight information to air navigation will receive the essential charts necessary for this function through a single subscription; and

b) potential users of charts will be better able to obtain the latest editions of the charts.

6.3 DISTRIBUTION BY SUBSCRIPTION

6.3.1 When it is not feasible to distribute charts with an AIP, a segregate subscription service should be established especially for those charts which are reissued frequently, e.g. Enroute Charts. This will ensure that all users of the charts would, for the period of the subscription, receive without delay all the charts produced without having to make arrangements for purchase of the charts each time a new edition is issued.

6.3.2 In computing charges to be made, only a reasonable proportion of production costs should be recovered; excessive charges tend to discourage sales. The desirability of recovery by an annual charge is stressed, as charging out individual issues not only gives rise to considerable petty accounting but can delay quick distribution. Distribution by subscription also would enable the chart-producing agency to establish the demand for each type of chart, a basic factor in the subsequent printing, distributing and other necessary arrangements.

6.4 DISTRIBUTION AGENCIES

6.4.1 Each State should arrange to establish at least one chart distribution centre or agency within its territory where all aeronautical charts and associated AIS publications produced by that State can be purchased from stock by any State, organization or individual. Also sale of all such charts and publications may be delegated to additional local or foreign centres or agencies at points where operators and other interested users generate an appreciable demand which can be better met by this method. To ensure notification of the availability of charts and other AIS publications, these centres or agencies and their functions should be listed in the AIP with full address, prices and how purchases may be made.

6.4.2 The latest editions of charts produced by each State should be available for sale also at each Aerodrome AIS Unit, particularly those established at international airports. This will enable crew members to obtain the charts they need conveniently and without delay. An ICAO *Aeronautical Chart Catalogue* (Doc 7101) should also be available at each of these aerodromes, to provide information on the worldwide availability of charts.

6.5 AVAILABILITY OF FOREIGN CHARTS

6.5.1 All chart distribution centres or agencies should have available stocks of charts produced by foreign States and chart-producing agencies, relative to their needs and to meet the requirements of Annex 4, 1.3. These charts could be provided on a "sale or return basis" so as to encourage the holding of sufficient stocks to satisfy all potential needs without the risk of financial loss.

6.5.2 Arrangements should also be made for adequate advertisement, within a State, of the foreign charts available together with details of the procedure to be followed if purchase is contemplated. Such notification may be effected by means of an Aeronautical Information Circular (AIC) or any other appropriate method. If these charts are on sale at each international airport it would enable those likely to require them to examine them with a minimum of inconvenience before deciding on purchase.

6.6 RECIPROCAL EXCHANGE

6.6.1 Annex 4, 1.3.4, recommends that appropriate charts produced by Contracting States be made available without charge to other Contracting States on request on a reciprocal basis. In addition to providing essential aeronautical information, such an exchange serves to improve worldwide dissemination of information on new charting techniques and production methods.

6.6.2 Arrangements should be made for at least one copy of each chart (if a series, a copy of one sheet in the series) to be furnished free of charge to each State receiving AIS publications. To this list may be added any other interested chart-producing State or agency willing to furnish similar charts on a reciprocal basis. The charts should be addressed to the designated aeronautical authority of the State or State-authorized chart-producing agency, as appropriate.

6.7 OUT-OF-DATE CHARTS

Chapter 2, 2.8.2, emphasizes the importance of the availability of up-to-date aeronautical charts. While State-controlled distribution agencies are in a good position to withdraw from sale charts that are obsolete, a problem arises with chart distribution centres or agencies designated by a State and engaged in the sale of charts for profit. The problem is magnified when foreign commercial and private users of aeronautical charts seek to obtain their requirements from advertised distribution agencies outside the control of the State in which these agencies operate. The difficulty arises mainly from the reluctance of sales agents to have unsold obsolete charts on their hands when new editions are issued. Unawareness of the charts being out-of-date could also be a factor. It is important that a State should take every practicable measure to prevent the sale of out-of-date charts. These measures should include prompt restocking of up-to-date editions of the charts concerned and advice to sales agents of the obsolescence of charts for which the State has production responsibility and of the need to withdraw immediately the obsolete charts from sale.

Chapter 7

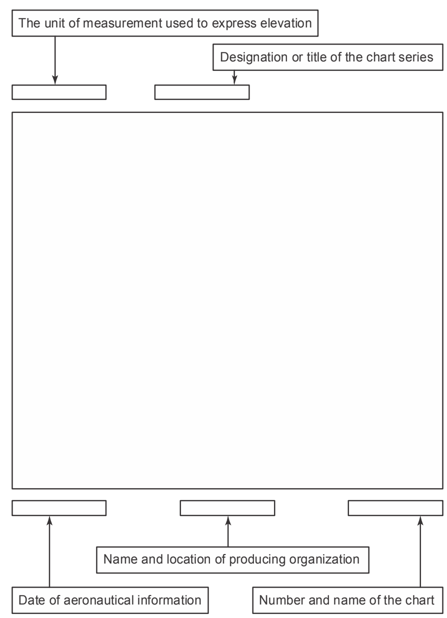
PREPARATION OF SPECIFIC CHARTS

7.1 INTRODUCTION

Annex 4 reference	*General*
2.1	In developing specifications for charts, the requirements of flight crews and the environmental factors affecting the use of aeronautical charts in the cockpit have been taken into account. Flight crews require information from the time the aircraft moves from the loading point until it stops at the unloading point at its destination. For the purpose of determining the operational requirements, the total flight has been 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. Ideally, the information required for total flight should be available on one chart, but as this is not possible, a compromise is necessary, which has to take into account the requirements for: a) minimum number of charts to cover the flight; b) optimum size of the charts and their handling in the cockpit; c) clarity of information, use of colours and type face; and d) continuity of information from one chart to the next.

7.2 GENERAL SPECIFICATIONS

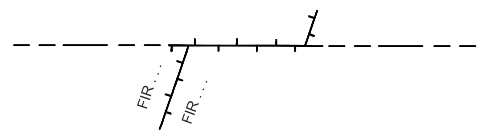
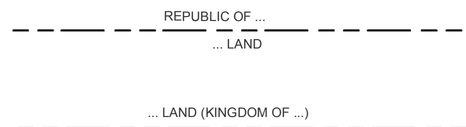
Annex 4 reference	*General*
	The following operational requirements governing the presentation of essential information on each type of chart have been formulated.
2.1.1	Each type of chart must provide information relevant to the function of the chart.
2.1.2	Each type of chart must provide information appropriate to the phase of flight, to ensure the safe and expeditious operation of the aircraft.
2.1.3	The presentation of information must be accurate, free from distortion and clutter, unambiguous, and be readable under all normal operating conditions.
2.1.4	Colours or tints and type size must be such that the chart can be easily read and interpreted by the pilot in varying conditions of natural and artificial light.
2.1.5	The information must be in a form which enables the pilot to acquire it in a reasonable time consistent with workload and operating conditions.
2.1.6	The presentation of information provided on each type of chart must permit smooth transition from chart to chart as appropriate to the phase of flight.
2.1.7	The charts should be True North orientated.
2.1.8	The basic sheet size of the charts should be 210 × 148 mm (8.27 × 5.82 in) which is the A5 size developed by the International Standards Organization.
	A number of general specifications have been formulated which are applicable to all ICAO aeronautical charts, unless otherwise stated in the detailed specifications of the chart concerned. These general specifications are:

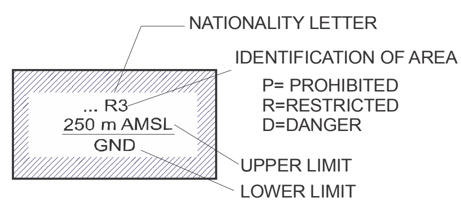
Annex 4 reference	*Details*	*Drafting illustration*
2.6	**Scale and projection**	
2.6.1	For charts of large areas, the name and basic parameters and scale of the projection must be indicated.	
2.6.2	For charts of small areas, a linear scale only must be indicated.	
	Marginal note layout	**MARGINAL NOTE LAYOUT** 
2.3.1	The marginal note layout must be as given in Annex 4, Appendix 1, except as otherwise specified for a particular chart.	
2.3.2	The following information must be shown on the face of each chart unless otherwise stated in the specifications of the chart concerned: a) designation or title of the chart series; the title may be abbreviated; b) name and reference of the sheet; and c) on each margin an indication of the adjoining sheet (when applicable).	
2.3.3	A legend to the symbols and abbreviations used must be provided. The legend must 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.	*See specimen charts*
2.3.4	The name and adequate address of the producing agency must be shown in the margin of the chart except that, where the chart is published as part of an aeronautical document, this information must be placed in the front of that document.	

Annex 4 reference	*Details*	*Drafting illustration*
2.2	**Titles**	
	The title of a chart or chart series prepared in accordance with the specifications contained in Annex 4 and intended to satisfy the function of the chart must be that of the relevant chapter heading as modified by application of any Standard contained therein, except that such title must not include "ICAO" unless the chart conforms with all Standards specified in Annex 4, Chapter 2, and any specified for the particular chart.	*See specimen charts*
2.4	**Symbols**	
2.4.1	Symbols used must conform to those shown in Annex 4, 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. 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. Further guidance on symbols appears later in this Section.	
2.4.2	To represent ground-based navigation aids, intersections and waypoints, the same basic symbol must be used on all charts on which they appear, regardless of chart purpose.	
2.4.3	The symbol used for significant points must be based on a hierarchy of symbols and selected in the following order: ground-based navigation aid, intersection, waypoint symbol. A waypoint symbol must be used only when a particular significant point does not already exist as either a ground-based navigation aid or intersection	
2.4.4	States must ensure that as of 18 November 2010, symbols are shown in the manner specified in 2.4.2, 2.4.3 and Appendix 2 — ICAO Chart Symbols, symbol number 121.	

Annex 4 reference	*Details*	*Drafting illustration*
2.4.5	States should ensure that 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**	
2.5.2	Distances must be expressed in either kilometres and tenths thereof or nautical miles and tenths thereof or both, provided the units are clearly differentiated.	*Note for chart:* "DISTANCES IN KILOMETRES" *or* "DISTANCES IN NAUTICAL MILES" *or* "DISTANCES IN KILOMETRES (AND NAUTICAL MILES)" *e.g.* 188.1 km (101.4 NM)
2.5.3	Altitudes, elevations and heights must be expressed in either metres or feet or both, provided the units are clearly differentiated.	*Note for chart:* "ALTITUDES, ELEVATIONS AND HEIGHTS IN METRES" *or* "ALTITUDES, ELEVATIONS AND HEIGHTS IN FEET" *or* "ALTITUDES, ELEVATIONS AND HEIGHTS IN METRES (AND FEET)" *e.g.* 8 m (27 FT)
2.5.4	Linear dimensions on aerodromes and short distances must be expressed in metres.	*Note for chart:* "DIMENSION IN METRES"
2.5.6	The units of measurement used to express distances, altitudes, elevations and heights must be conspicuously stated on the face of each chart.	*See specimen charts*
2.5.7	Conversion scales (kilometres/nautical miles, metres/feet) must be provided on each chart on which distances, elevations or altitudes are shown. The conversion scales must be placed on the face of each chart.	*See specimen charts*
2.7	**Date of aeronautical information** The date of validity of aeronautical information must be clearly indicated on the face of each chart.	DATE OF AERONAUTICAL INFORMATION

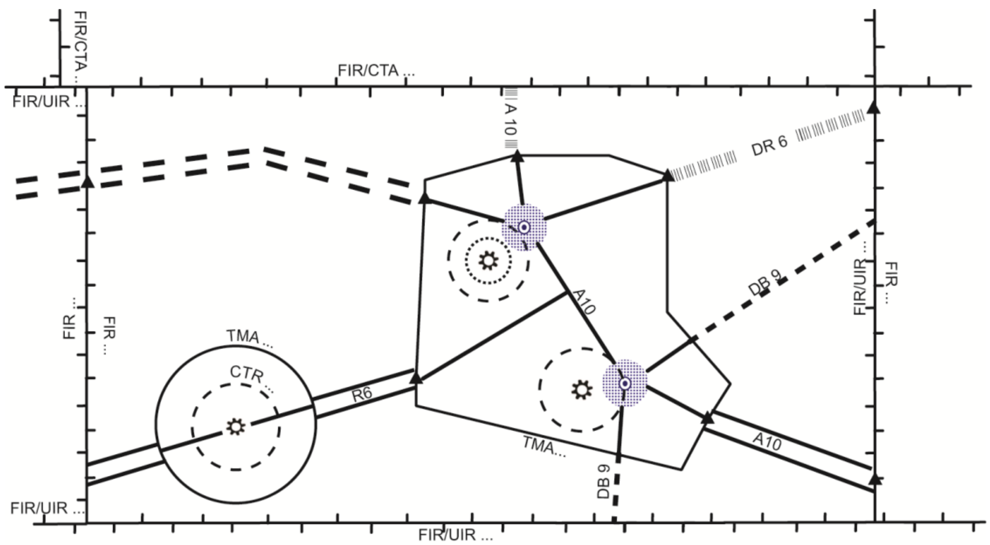
Annex 4 reference	*Details*	*Drafting illustration*
2.8	**Spelling of geographical names**	
2.8.1	The symbols of the Roman alphabet must be used for all writing.	
2.8.2	The names of places and of geographical features in countries which officially use varieties of the Roman alphabet must be accepted 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” or “river” is abbreviated on any particular chart, that word must 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 must 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 Contracting States, 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 2.9.2 2.8.3	In order to avoid problems of translation and legibility, the practice of using abbreviations on aeronautical charts is to be followed, this necessitating of course the provision of a suitable legend. For the most part, abbreviations for aeronautical information are contained in the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (Doc 8400), and no abbreviation should be used which is in conflict or inconsistent with those in that document. Where geographical terms are abbreviated on any particular chart, they should be spelled out in full in the language used by the publishing agency in respect of the most important example of each type. Punctuation marks are not to be used for abbreviations within the body of the chart.	

Annex 4 reference	*Details*	*Drafting illustration*
2.10	**Political boundaries**	
2.10.1	International boundaries must 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 must 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 should conform to Annex 4, Appendix 3 — Colour Guide. See also Chapter 5 of this manual, Appendices 1 and 2.	
	Selection of type	
2.16	The type and style of lettering to be used on aeronautical charts should be selected primarily for legibility. The Roman and Gothic styles, which are generally available in a great number of variations and sizes, are recommended in preference to other more elaborate or fancy styles. The Gothic style is sometimes referred to as “sans serif”, block or single style letter. The Roman type face should be used for the identification of countries, cities, towns and hydrographic features, etc. The latter in oblique style. Gothic type faces are recommended for smaller towns, islands, capes, mountains, railroads, highways, selected landmarks, etc. The selection of size will depend on the scale of the chart and the importance of the element identified. In positioning names on a chart, they should be placed, wherever practical, to the right and slightly above the relevant symbol. It may be necessary to use lead lines in congested areas but these should be kept to a minimum since they also add to the congestion. Samples of type suitable for use on aeronautical charts are provided later in this chapter.	

Annex 4 reference	*Details*	*Drafting illustration*
	Culture and Topography	
2.12.1	Relief, where shown, must 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; and d) planning.	
	Relief is usually 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.	*See specimen charts*
	See also the explanation of the concept of minimum obstacle/terrain altitude, defined by area portrayal in Section 7.11. This is a method of combining relief and terrain clearance in a way which is most useful for pilots conducting flights in instrument meteorological conditions.	*See specimen chart 8*
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 Annex 4, Appendix 4.	
2.12.3	Where spot elevations are used they must be shown for selected critical points.	
2.12.3.1	The value of spot elevations of doubtful accuracy must be followed by the sign ±.	• 187 ±
2.13	**Prohibited, Restricted and Danger Areas**	
	When prohibited, restricted or danger areas are shown, the reference or other identification must be included, except that the nationality letters may be omitted.	
	Nationality letters are those contained in *Location Indicators* (Doc 7910).	
	It is specified that prohibited, restricted and danger areas must be shown on World Aeronautical Charts — ICAO 1:1 000000; Aeronautical Charts — ICAO 1:500 000; Enroute Charts — ICAO; Instrument Approach Charts — ICAO; Area Charts	

Annex 4 reference	*Details*	*Drafting illustration*
	— ICAO; Standard Departure Chart — Instrument (SID) — ICAO; Standard Arrival Chart — Instrument (STAR) — ICAO; Visual Approach Charts — ICAO and Aeronautical Navigation Charts — ICAO Small Scale. The same symbol is to be used in the depiction of all such areas, the type of area (or restriction) being evident from the designator P, R or D meaning prohibited, restricted or danger area, respectively.	
2.14	**Air Traffic Service Airspaces**	
2.14.1	When ATS airspace is shown on a chart, the class of airspace must be indicated. For application, see subsequent paragraph AIR TRAFFIC SERVICES SYMBOLS.	*To be developed*
2.14.2	On charts used for visual flight, those parts of the ATS Airspace Classification table in Annex 11 applicable to the airspace depicted on the chart should be on the face or reverse of each chart. The ATS Airspace Classification table appears later in this chapter.	
2.15	**Magnetic Variation**	
2.15.1 2.15.2	True North and magnetic variation must be indicated. 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. 2010, 2015, 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.	

Annex 4 reference	*Details*	*Drafting illustration*
	Air Traffic Services Symbols The illustration is intended as a guide to application of the air traffic services symbols included in the ICAO chart symbols. Alternative symbols are provided for certain elements in the system, i.e. advisory route, control area, etc., and a separate example for each is portrayed. In the actual production of a chart, only one of the alternative symbols should be used.	



	Radio Navigation Aids Symbols General principles The indication of radio navigation aids and radio communication facilities on various types of charts is specified in very general terms in the relevant chapters of Annex 4 and is elaborated in Chapter 7 of this manual. With the exception of the three types of Aerodrome Obstacle charts, some radio facility data is required or is recommended for all charts but obviously this need will vary according to the function and scale of the chart and to its frequency of revision. The radio navigation aids shown can therefore be limited to en-route aids, with only sufficient identification to enable reference to an Enroute Chart or to a	

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting illustration</th></tr>
<tr><td></td><td>
publication giving the desired details. In view of the relatively rapid change in the location and characteristics of radio navigation aids, particularly in frequency assignments, and due to the impracticability of continually revising the charts, it is imperative that the radio data be kept to a minimum to avoid obsolescence.

Application of symbols

For most radio navigation aids a discrete symbol is available and this, together with the name of the aid (shown in a box), is sufficient where only minimum data is required. For radio navigation aids for which no discrete symbol is available, it is necessary to use the common symbol together with an abbreviated indication of the service provided. The size of the symbol and associated data will need to be varied to suit the scale and congestion of the chart, The size shown in Appendix 2 of Annex 4 is considered to be a minimum. Lead lines should be avoided wherever possible.

Where a radio navigation aid is located at an aerodrome it may be feasible to combine the two symbols, for example NDB and civil land aerodrome.

Similarly, two or more radio navigation aids at the same location may be shown in a combined form, for example, VOR and DME symbols, or locator and radio marker beacon symbols.

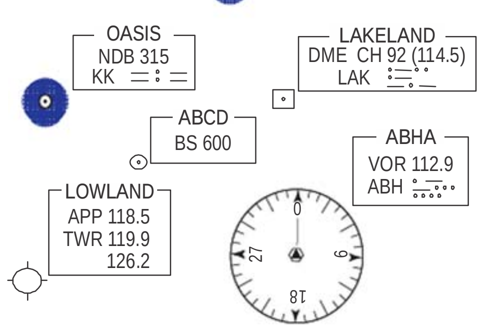
Where it is appropriate to give details of radio navigations aids, i.e., identification and frequency, they should be shown as in the examples.

Where it is appropriate to give details of radio communication facilities, they should be shown as in the example opposite.

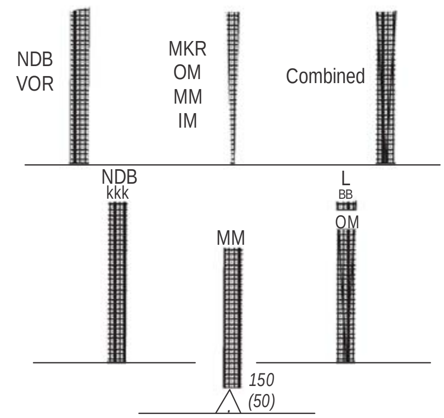
However it is not desirable to show such detail on most charts, and if this is deemed to be required, consideration should be given to the alternative of placing such data in a table to be shown in the margin or on the back of the chart.
</td><td>







</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting illustration*
	Profile views The symbols opposite are appropriate for navigational aids when depicted in profile form, for example, on instrument approach charts. The type of aid and its identification should be indicated at the top of the symbol as in the examples opposite. If the antennae are considered to constitute an obstacle, then the radio aid symbol should rest on the obstacle symbol, as shown.	

Samples of Type

USE	*TYPE STYLE*	*EXAMPLE*
Names of countries and states.	Roman capitals — outline.	CUBA THAILAND
Cities and towns of 1st, 2nd, and 3rd importance to air navigation. Towns of 4th importance to air navigation.	Gothic (block) capitals — Gothic condensed 12 pt. to 8 pt. Gothic (block) capitals — News Gothic condensed, 8 pt.	BALTIMORE **KINGSTON** PHILLIPSBURG
Towns of 5th and 6th importance to air navigation.	Gothic (block) letters: capitals and lower case News Gothic 6 pt. and News Gothic condensed 6 pt.	Trujillo Albinson
Islands and island groups, points, capes, mountains passes and national parks.	Gothic (block) letters: capitals and lower case (News Gothic and News Gothic condensed).	GALAPAGOS ISLANDS BRENNER PASS Cape Moreton PUNTA JAVANA INERIDGE NATIONAL PARK
Mountain ranges and prominent peaks. Peaks of secondary importance.	Gothic (block) letters: Light Copperplate Gothic condensed capitals. Lightline Gothic capitals and lower case.	Mt. Vernon Pikes Peak **CORDILLERAS**
All hydrographic features.	Roman Italics (capitals or lower case).	*Rio Tejo* *INDUS RIVER* *Calais Canal*
Names of railroads and prominent highways.	Gothic Italics (capitals).	*CANADIAN NATIONAL* *ALASKA HIGHWAY*
Descriptive notes and landmarks.	Gothic lightline.	Ranger station Tower
General information (for charts used in the cockpit and for pre-flight planning charts)	Gothic letters: capitals and lower case — block, italics; light, medium, bold; regular and condensed; sizes as appropriate*; Univers or similar style**.	**INFORMATION** INFORMATION INFORMATION *INFORMATION* **Information** Information *Information* **123456789** 123456789
Notes.— * Final printed size to be no smaller than 6 pt, capital height 1.4 mm (.055 ins) e.g. A B C D E F G H I. ** Type style chosen should avoid numerals which could be ambiguous, e.g. avoid “3,5,6,9” which could be confused with “8” under certain circumstances.		*(etc.)*

ATS AIRSPACE CLASSES — SERVICES PROVIDED AND FLIGHT REQUIREMENTS

(Annex 11, Chapter 2, 2.6 refers)

Class	*Type of flight*	*Separation provided*	*Service provided*	*Speed limitation**	*Radio communication requirement*	*Subject to an ATC clearance*
A	IFR only	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
B	IFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
C	IFR	IFR from IFR IFR from VFR	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	VFR from IFR	1) Air traffic control service for separation from IFR; 2) VFR/IFR traffic information (and traffic avoidance advice on request)	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	Yes
D	IFR	IFR from IFR	Air traffic control service, traffic information about VFR flights (and traffic avoidance advice on request)	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	Yes
	VFR	Nil	IFR/VFR and VFR/VFR traffic information (and traffic avoidance advice on request)	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	Yes
E	IFR	IFR from IFR	Air traffic control service and, as far as practical, traffic information about VFR flights	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	Yes
	VFR	Nil	Traffic information as far as practical	250 kt IAS below 3 050 m (10 000 ft) AMSL	No	No
F	IFR	IFR from IFR as far as practical	Air traffic advisory service; flight information service	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	No
	VFR	Nil	Flight information service	250 kt IAS below 3 050 m (10 000 ft) AMSL	No	No
G	IFR	Nil	Flight information service	250 kt IAS below 3 050 m (10 000 ft) AMSL	Continuous two-way	No
	VFR	Nil	Flight information service	250 kt IAS below 3 050 m (10 000 ft) AMSL	No	No

* When the height of the transition altitude is lower than 3 050 m (10 000 ft) AMSL, FL 100 should be used in lieu of 10 000 ft.

PORTRAYAL OF RELIEF
ON THE INSTRUMENT APPROACH CHART — ICAO AND OTHER REVEVANT CHARTS

1. INTRODUCTION

1.1 This section is aimed at providing guidance on the portrayal of relief, obstacles and minimum altitudes on the Instrument Approach Chart — ICAO; Area Chart — ICAO; Standard Departure Chart — Instrument (SID) — ICAO; and Standard Arrival Chart — Instrument (STAR) — ICAO.

1.2 The function of the instrument approach chart is to provide the pilot with information which will enable the performance of an approved instrument approach procedure to the runway of intended landing, or an established missed approach procedure. The clear portrayal of the procedure and the minimum flight altitudes applicable to the procedure flight track are the primary and essential information elements required by the pilot. Relief and obstacle information is useful for orientation, a general visualization of terrain features and especially awareness of potentially dangerous terrain. This information may be used by the pilot in deciding whether to accept clearance to altitudes below the minimum sector altitude shown on the chart. On instrument flight rules (IFR)-based charts, including the area, SID, STAR, and instrument approach charts, relief and obstacle portrayal is not intended as a navigational substitute for the minimum flight altitudes applicable to airways, routes and procedural flight track. In contrast, on the visual flight rules (VFR)-based visual approach chart, relief and obstacles are important elements for navigation and are shown in greater detail related to their value as visual landmarks.

2. RELIEF PORTRAYAL METHODS

2.1 Relief portrayal must be designed to suit the function of the chart and the significance of relief in the charted area. A primary criterion for the design of relief portrayal on IFR-based charts is that relief must not clutter the chart so as to interfere with the pilot's understanding of the primary and essential aeronautical data. Care should be taken to ensure that aeronautical data is emphasized; however, at the same time, relief should be able to be interpreted quickly, particularly where it is significant. A discussion of common relief portrayal methods follows.

2.2 Spot elevations

2.2.1 A spot elevation indicates the location of a point and its elevation above mean sea level and is to be marked in accordance with Annex 4, Appendix 2, symbol number 13 and exceptionally, in cases of doubtful accuracy, with symbol number 14. Portrayal of relief by the spot elevation method alone may be an acceptable method of portraying relief where the terrain around the aerodrome does not rise significantly and is not complex. It offers the advantages of relatively simple and economic cartographic preparation and printing. However, spot elevations have the following disadvantages:

a) they take time to interpret correctly;

b) they give no indication of the lateral extent of high ground, slope or low ground, therefore, they can be misleading if used as a basis for determining the minimum altitude at which it is safe to fly in a given area;

c) they cannot provide an instantaneous appreciation of relief because they give no indication of the shape of the terrain;

d) they do not emphasize either higher or more extensive areas of high ground;

e) they may increase "clutter" on the chart, to the detriment of other information displayed, without providing the pilot with enough useful information on the configuration of the terrain; and

f) their absence may be misinterpreted as indicating low ground.

2.3 Contour lines and layer tinting

2.3.1 Contour lines are lines connecting points of equal elevation and are to be portrayed in accordance with Annex 4, Appendix 2, symbol number 1 and exceptionally, in cases of doubtful accuracy, with symbol number 2. Portrayal of relief by contour lines without layer tinting has fewer of the disadvantages indicated in 2.2.1, except that contour lines may also create chart “clutter” and may be difficult to interpret easily unless presented by layer tinting and “smoothed” shapes. On an instrument approach chart, contour lines are normally spaced every 150 m (500 ft) or 300 m (1 000 ft) and, to be of significant benefit, must have elevation values either specified through a legend or printed with the contour line and be accompanied by selected spot elevations. A high density of contour lines, each with its printed elevation, is typical for mountainous or complex terrain areas and is likely to generate considerable chart clutter. In such circumstances, the use of colour is important to improve the readability of both the contour and the over-lying aeronautical information.

2.3.2 Even if the terrain surrounding the aerodrome is suitable for a monochrome presentation, care should be taken (e.g. prudent selection of light half-tone screens and careful supervision of the photo lithographic/image setting and printing process) to ensure that the printed chart is not cluttered and that aeronautical information is emphasized and clear. Selected spot elevations should be included and printed in solid italic type. Also, on monochrome charts, the interaction of contour lines and layer tint screens with screens used to portray other topographic features, and aeronautical information such as airspace classification boundaries, must be evaluated to make certain a clear presentation, free of patterning or moiré effect, is possible. See Chapter 5 — Reproduction, for guidance on the alignment of overlapping screens.

2.4 Smoothed contour lines, contour values and layer tints printed in brown

2.4.1 Annex 4 specifies that relief portrayal be provided by the following method:

- smoothed contour lines, contour values and layer tints printed in brown;
- layer tinting to start at the next higher suitable contour line appearing on base topographic maps, exceeding 150 m (500 ft) above the aerodrome elevation for application on instrument approach charts. This figure is raised to 300 m (1 000 ft) for application on Area, SID, and STAR charts; and
- appropriate spot elevations, including the highest elevation within each top contour line shown, printed in black.

2.4.2 This relief portrayal method offers the following advantages:

a) it provides an instantaneous general visualization of relief and emphasizes high ground;

b) selected spot elevations provide detail of high points;

c) smoothed contour lines help to decrease chart clutter;

d) the use of brown colour for contour lines, contour values and layer tints provides a visual structure and organization that allows a clear yet subdued presentation of relief while emphasizing over-lying aeronautical data;

e) the area immediately surrounding the aerodrome of intended landing is not obscured by contour lines or layer tinting; and

f) the method reflects actual relief elevations.

2.4.3 In comparison with relief portrayal by the spot elevation method, production time and cost will increase due to the preparation of a suitable terrain contour base, increased pre-press or photo lithographic work, and increased complexity in the printing process and possibly in collation for distribution. In that respect, it should be noted that the basic topographic information needed to produce the terrain contour base would have already been made available when designing the instrument procedures. From there, cartographers will have to produce the base chart, and once this is done, the overlay produced and elements of pre-press or photo lithographic work would be relatively permanent and require little further amendment. The ICAO experience in chart production indicates that a colour chart costs approximately 20 per cent more for the printing process than a monochrome chart.

2.4.4 Relief portrayal by the method of smoothed contour lines, contour values and layer tints printed in brown is required (Annex 4, 11.7.2) for all relief on the Instrument Approach Chart — ICAO under the following circumstances:

a) 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; and

b) when the final approach or missed approach procedure gradient is steeper than optimal due to terrain.

2.4.5 The above method is also recommended where relief is lower on the Instrument Approach Chart — ICAO and in areas where significant relief exists on the Area Chart — ICAO, Standard Departure Chart — Instrument (SID) — ICAO and Standard Arrival Chart — Instrument (STAR) — ICAO (Annex 4, 11.7.3, 8.6.2, 9.6.2 and 10.6.2, respectively). In all these cases of relief portrayal, obstacles must also be shown.

2.4.6 In planning relief portrayal, the interrelationship of all related charts within the terminal area should be considered. This is not only to facilitate the preparation of relief base material, but also to provide a coordinated relief presentation between charts. Where significant relief exists in the terminal area and is shown on area or SID, STAR and instrument approach charts, contours should be derived from an electronic terrain and obstacle database developed in accordance with Annex 15 — *Aeronautical Information Services*, Chapter 10, or digitized at a scale of about 1:500 000. Appropriate spot elevations, including the highest spot elevations within each top contour, should also be compiled at this stage. This scale is likely an average between approach and area chart scales and is intended to give the generalized depictions useable for all charts involved. When relief for all charts is prepared from the same base, the result (disregarding differences in chart scale, criteria for starting contours and contour intervals) is that each contour line is consistent for all charts.

2.4.7 On all instrument approach charts for a particular aerodrome, relief should be portrayed in a highly consistent manner from chart to chart (including consistent starting contours and contour intervals). In a similar manner, consistency of relief portrayal should be planned between SID and STAR charts. However, in areas of significant relief, it will likely not be possible to maintain the same contour interval between the instrument approach chart and the associated SID, STAR or area charts and provide an uncluttered relief presentation on the smaller scale charts. Where this occurs, it is desirable to have a relationship between the contour intervals used (e.g. SID, STAR or area charts to use double the contour interval of the instrument approach chart). A contour interval legend may be provided on the face of the chart.

2.4.8 On the Standard Departure Chart — Instrument (SID) — ICAO and Standard Arrival Chart — Instrument (STAR) — ICAO, the area covered by the procedures and the paper size for the chart may cause difficulties in presenting significant relief and obstacle information to scale. In these cases an inset, which portrays areas of significant relief drawn to scale, may be included in the chart.

2.4.9 The following table summarizes Annex 4 provisions for relief, obstacle, and minimum altitude portrayal on relevant aeronautical charts. Paragraph numbers associated with Annex 4 Standards are indicated in bold (e.g. **11.7.2**) and Recommended Practices in italics (e g. *8.6.2*).

	ENROUTE CHART	*AREA CHART*	*SID*	*STAR*	*IAC*	*VAC*
RELIEF	**IFR-Nil**	**IFR-relief for terrain and situational awareness** *8.6.2* Significant relief should be shown by the smoothed contour-brown layer tint method starting at **300 m** above ELEV of the primary AD.	**IFR-relief for terrain and situational awareness** *9.6.2* Significant relief should be shown by the smoothed contour-brown layer tint method starting at **300 m** above AD ELEV.	**IFR-relief for terrain and situational awareness** *10.6.2* Significant relief should be shown by the smoothed contour-brown layer tint method starting at **300 m** above AD ELEV.	**IFR-relief for terrain and situational awareness** **11.7.2** 1) Relief must be shown. 2) Where relief meets 11.7.2 criteria, all relief must be shown by the smoothed contour-brown layer tint method starting at **150 m** above AD ELEV. *11.7.3* 3) Where relief is lower than 11.7.2 criteria, all relief should be shown by the smoothed contour-brown layer tint method starting at **150 m** above AD ELEV.	**VFR-relief for visual navigation** **12.7.2** Relief must be shown. More detailed relief portrayal than the instrument approach chart. Generalization of relief by smoothed contours may not be appropriate.
OBSTACLES	Nil	*8.6.2* In areas of significant relief obstacles should be shown in association with relief.	*9.6.2* In areas of significant relief obstacles should be shown in association with relief.	*10.6.2* In areas of significant relief obstacles should be shown in association with relief.	**11.10.2** Required	**12.10.2** Required
AREA MINIMUM ALTITUDE (within parallels and meridians)	**7.6.2** Required	**8.9.3** Required	**9.9.3.2** Alternative to MSA and in parts of the chart not covered by MSA.	**10.9.3.2** Alternative to MSA and in parts of the chart not covered by MSA.	Nil	Nil
MINIMUM SECTOR ALTITUDE	Nil	Nil	**9.9.3.2** Required	**10.9.3.2** Required	**11.10.5** Required or terminal arrival altitude	Nil
CHART DRAWN TO SCALE	Yes	**8.3.2** Yes	*9.6.2* In areas where significant relief exists, the chart should be drawn to scale.	*10.6.2* In areas where significant relief exists, the chart should be drawn to scale.	**11.3.2** Yes	**12.3.1** Yes *12.3.3* Should be drawn to the same scale as the instrument approach chart.

2.5 Depiction of smoothed contour lines, intervals, values and tints

2.5.1 For application on instrument approach charts, contour lines may be selected to start at the first even 300 m (1 000 ft) contour line appearing on base topographic maps which is at least 150 m (500 ft) above aerodrome elevation. This ensures that the area immediately surrounding the aerodrome of intended landing is not obscured by the lowest layer tinting. Subsequent contour intervals may be selected at 150 m (500 ft), or 300 m (1 000 ft) or exceptionally 500 m (or 2 000 ft), in order to give a satisfactory presentation of terrain. The larger intervals may be selected to take account of the increasing steepness usually associated with higher ground, thus avoiding close spacing of the contour lines and providing a clean appearance. The interval selection may also be affected by limitations on the availability and use of colour tints. For most instrument Approach, Area, SID and STAR charts, to give a suitable generalized depiction of terrain, four or fewer contour intervals should be sufficient.

2.5.2 For application on Area, SID and STAR charts, contour lines may be selected to start at the first even 300 m (1 000 ft) contour line appearing on base topographic maps which is at least 300 m (1 000 ft) above aerodrome elevation. Subsequent contour intervals may be selected at 300 m (1 000 ft), or 500 m (or 2 000 ft), or exceptionally 1 000 m (or 3 000 ft). When an inset is used on a SID chart to depict relief in the vicinity of the initial climb, it may be appropriate, depending on the relief, to start at the first even 300 m (1 000 ft) contour line which is at least 150 m (500 ft) above aerodrome elevation and use a 150 m (500 ft) contour interval.

2.5.3 Contour data associated with topographic charts at a scale of 1:500 000 is recommended as a source. From there a smoothed contour line is to be created (traced, digitized or computed) just outside, i.e., on the lower side of the actual contour. The smoothed contour should eliminate minor indentations in the topography such as valleys not more than 3.7 km (2 NM) in width. Similarly, where two groups of contours at the same elevation come within 3.7 km (2 NM) of each other (e.g. a pass between hills), they should be combined within one contour. In the smoothing process, a closed "smoothed" contour should be considered not as a line enclosing ground above a certain elevation, but as a line outside which the ground is lower. If the smoothing of contour data is computed by a mapping system algorithm, the result should be examined to ensure that topographic features such as ridges are not truncated. The following figures illustrate the contour smoothing process:

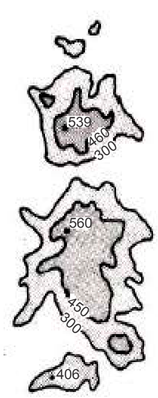


Figure 1

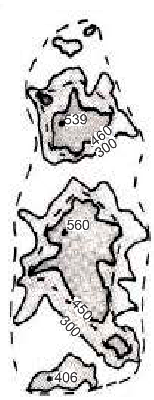


Figure 2

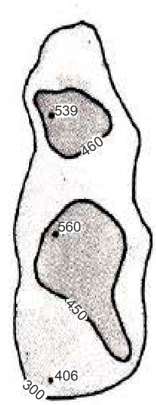


Figure 3

2.5.4 Relief is to be portrayed by graduated half-tone screen tints between contour lines with all contour lines, contour values and tints printed in brown. Half-tone screen tints are to be based on the brown colour provided in Annex 4, Appendix 3, Colour Guide, for contours and topographic features. The following specifications are recommended to achieve the desired subdued relief presentation:

- contour lines: brown, 50 per cent half-tone screen
- contour values: solid brown (position contour values to avoid conflict with aeronautical data)
- area below first contour line in the vicinity of the aerodrome: clear — no tint
- first contour tint (i.e. lowest): brown, 10 per cent half-tone screen
- second contour tint: brown, 20 per cent half-tone screen
- third contour tint: brown, 30 per cent half-tone screen
- fourth contour tint: brown, 40 per cent half-tone screen.

2.5.5 For most applications, to give the generalized depiction of terrain suitable for instrument charts, four or fewer contour intervals should be sufficient. If more are required they may be chosen from the intermediate half-tone screens (i.e. 5 per cent, 15 per cent, 25 per cent, and 35 per cent). However, to achieve differentiation between screens when using more than four tinted contour intervals, an appropriate quality reproduction process is necessary. For the best results when printing half-tone screen tints, a high quality offset paper number one, vellum or smooth finish is recommended.

2.6 Portrayal of spot elevations and obstacles

2.6.1 Appropriate spot elevations and obstacles are to be provided by the procedure specialist.

2.6.2 Spot elevations must be marked in accordance with Annex 4, Appendix 2, symbol number 13 and exceptionally, in cases of doubtful accuracy, with symbol number 14. If a spot elevation is the highest elevation on the chart, it should be emphasized in accordance with the alternatives presented in symbol number 12. The “boxed” presentation, e.g. $\boxed{17456}$ should not be used if it could cause confusion with other “boxed” altitudes on the chart. Spot elevations must be printed in black.

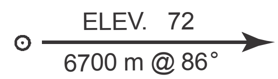
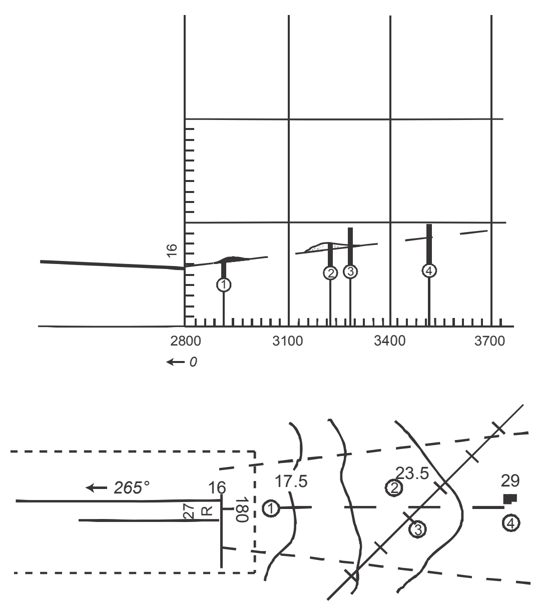
2.6.3 Obstacles are to be marked in accordance with Annex 4, Appendix 2, symbol numbers 130 to 136. Obstacles which are lighted and can be identified during night operations should be marked with the appropriate symbol. Obstacle symbols are to be positioned at their exact positions, however, should several appear within a small area, only the highest in the group needs to be shown. If an obstacle is the highest elevation on the chart, it should be emphasized by a larger symbol and larger type. Obstacles and associated elevations/heights must be printed in the colour used on the chart for aeronautical data (normally black or dark blue).

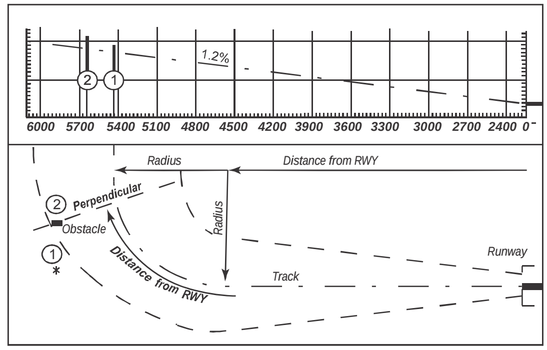
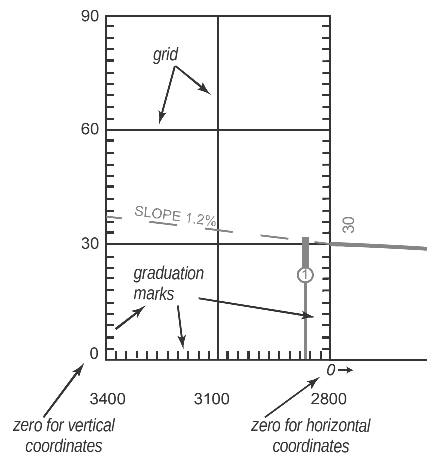
2.7 Placement of notes and text boxes

The placement of notes and text boxes must be carefully selected in order to ensure that note and text box information is easily read and has a minimum impact on aeronautical data and relief portrayal. The optimum placement is in an open non-tinted area, with the next choices being areas of the lightest screen or the least significant relief information. Relief information behind the note or text box should be cleared only when considered necessary to ensure legibility of the note or text. Obstacle or aeronautical data must not be cleared or obscured.

7.3 AERODROME OBSTACLE CHART — ICAO TYPE A (OPERATING LIMITATIONS)

Annex 4 reference	*General*
3.1	**Function** Aerodrome Obstacle Charts — ICAO Type A (Operating Limitations), in combination with relevant information published in the AIP, are required for providing the data necessary to enable the operator to comply with the operating limitations of Annex 6, Part I, Chapter 5, and Part III, Section II, Chapter 3. Such limitations are intended to ensure that for each flight an aircraft will be so loaded as to be capable of an agreed minimum performance. This minimum performance is intended to ensure that in the event of an engine failure during take-off, the aeroplane will be capable of either discontinuing the take-off and stopping within the area provided for such emergencies or of becoming airborne before reaching the end of the runway and thereafter of climbing to a specified height; and clearing all obstacles in the flight path area by a specified height; and clearing all obstacles in the flight path area by a specified height which increases as the distance from the aerodrome increases.
3.2.1 and 3.2.2	**Applicability** The production of this chart is mandatory for all aerodromes regularly used by international civil aviation, where there are significant obstacles in the take-off flight path areas. Where a chart is not required because there are not significant obstacles within the take-off flight path areas or because the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) is provided in accordance with Chapter 5, it is imperative that notification be given to this effect by publication in the AGA Section of the Aeronautical Information Publication (AIP). A separate chart is required for each runway. In some situations it may be necessary to prepare a separate chart for each "take-off" to meet printing limitations because of sheet size and to permit the finished chart to be included in the AIP. **Planning** In the planning stage, due cognizance should be taken of the interrelationship between this chart and the Aerodrome/Heliport Chart, for the same aerodrome. Duplication or repetition of surveys may be prevented by recognizing that much of the basic data will be the same for all these charts and perhaps they can be obtained with one survey. Certain limited topographical data are required to be shown on the Aerodrome Obstacle Chart — Type A primarily where the terrain penetrates the plane surface defining significant obstacles. The authority responsible for the development and production of the chart will be guided in the methods of conducting a survey (required to determine the location and heights of various natural and man-made objects) in refined areas around the aerodrome by reference to the ICAO *Airport Services Manual*, Part 6 — *Control of Obstacles* (Doc 9137).

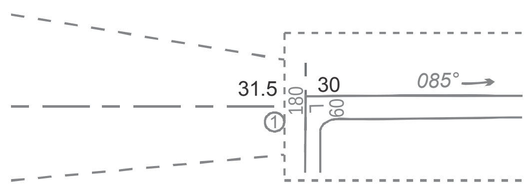
Annex 4 reference	*Details*	*Drafting illustration*
3.4	**Coverage and scale**	
3.4.1	The extent of each chart must be sufficient to cover all significant obstacles. Isolated distant significant obstacles that would unnecessarily increase the sheet size may be indicated by the appropriate symbol and 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 must 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 must be ten times the horizontal scale.	
3.4.5	Horizontal and vertical linear scales showing both metres and feet must be included in the charts.	*See specimen chart 1*
3.5	**Format**	
3.5.1	The charts must depict a plan and profile of each runway, any associated stopway or clearway, the take-off flight path area, and significant obstacles.	*See specimen chart 1*
3.5.2	The profile for each runway, stopway, clearway and the obstacles in the take-off flight path area must be shown above its corresponding plan.	

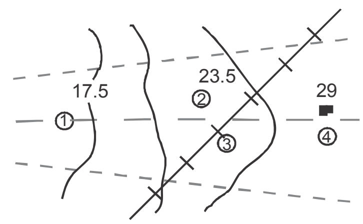
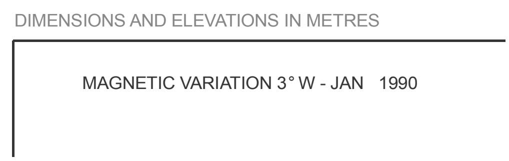
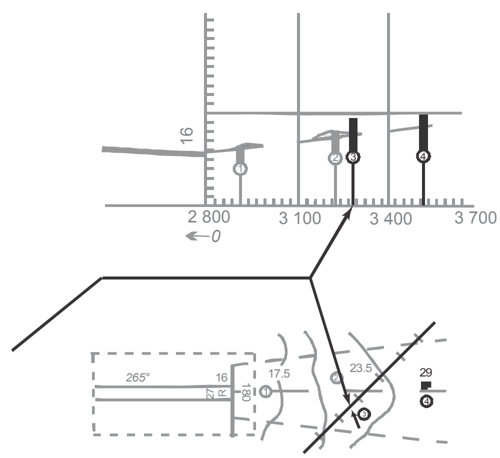
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting illustration</th></tr>
<tr><td></td><td>The profile of an alternative take-off flight path area must comprise a linear projection of the full take-off flight path and must be disposed above its corresponding plan in the manner most suited to the ready interpretation of the information.</td><td>
</td></tr>
<tr><td>3.5.3</td><td>A profile grid must be ruled over the entire profile area exclusive of the runway. The zero for vertical coordinates must be mean sea level. The zero for horizontal coordinates must be the end of the runway furthest from the take-off flight path area concerned. Graduation marks indicating the subdivisions of intervals must be shown along the base of the grid and along the vertical margins.</td><td rowspan="2">
</td></tr>
<tr><td>3.5.3.1</td><td>The vertical grid should have intervals of 30 m (100 ft) and the horizontal grid should have intervals of 300 m (1 000 ft).</td></tr>
<tr><td>3.5.4</td><td>The chart must include:

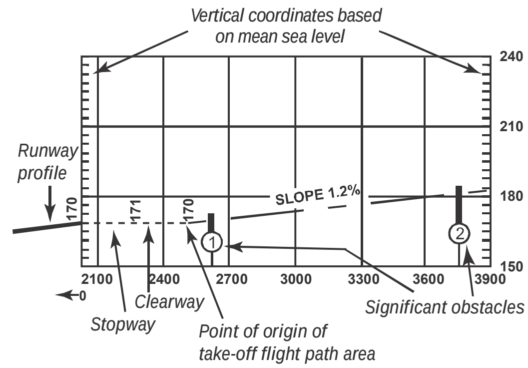
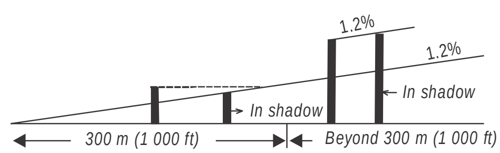
a) a box for recording the operational data specified in 3.8.3 of Annex 4; and

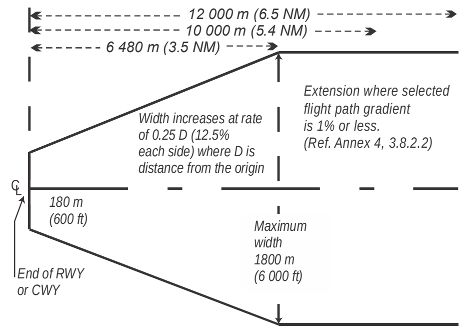
b) a box for recording amendments and dates thereof.</td><td>
<table>
<tr><th colspan="3">DECLARED DISTANCES</th></tr>
<tr><td>RWY 09 L</td><td></td><td>RWY27 RT</td></tr>
<tr><td>2800</td><td>TAKE OFF RUN AVAILABLE</td><td>2800</td></tr>
<tr><td>2800</td><td>TAKE OFF DISTANCE AVAILABLE</td><td>2800</td></tr>
<tr><td>2800</td><td>ACCELERATE STOP DISTANCE AVAILABLE</td><td>2800</td></tr>
<tr><td>2800</td><td>LANDING DISTANCE AVAILABLE</td><td>2800</td></tr>
</table>
<table>
<tr><th colspan="3">AMENDMENT RECORD</th></tr>
<tr><th>No.</th><th>DATE</th><th>ENTERED BY</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>2.2</td><td>Title

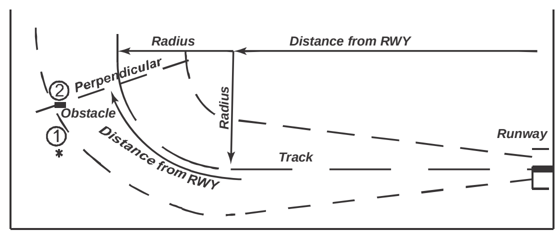
The title must be “Aerodrome Obstacle Chart – ICAO Type A (Operating Limitations)”. This title must not include “ICAO” unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 3.</td><td>See specimen chart 1</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting illustration*
3.6	**Identification** The chart must 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).	DONLON / International, ... RWY 27 R/ 09 L
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on specimen chart 1. See also Chapter 7 — General Specifications, Section 7.2, Annex 4, reference 2.3.1 to 2.3.4, as applicable.	*See specimen chart 1*
2.4	**Symbols** See Chapter 7 — General Specifications, Section 7.2, Annex 4, reference 2.4.1.	
3.3	**Units of measurement** Elevations must be shown to the nearest half-metre or the nearest foot and linear dimensions must be shown to the nearest half-metre. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	
2.7	**Date of aeronautical information** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	DATE OF AERONAUTICAL INFORMATION
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, as applicable.	

Annex 4 reference	*Details*	*Drafting illustration*
2.9	**Abbreviations** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2. **Colours** The chart should be prepared for single colour reproduction.	
2.16	**Typography** Samples of type suitable for use on charts are provided in Section 7.2. **Culture and topography** As required to satisfy the function of the chart.	
3.7	**Magnetic variation** The magnetic variation to the nearest degree and date of information must be indicated. See also in Chapter 7 — General Specifications, Section 7.2, the reference to Annex 4, 2.15.2.	
3.8	**Aeronautical data**	
3.8.1	Obstacles	
3.8.1.1	Obstacles in the take-off flight path area which project above a plane surface having a 1.2 per cent slope and having a common origin with the take-off flight path area, must be regarded as significant obstacles, except that significant obstacles lying wholly below the shadow of other significant obstacles as defined in 3.8.1.2 of Annex 4 need not be shown. Mobile obstacles such as boats, trains, trucks, etc., which may project above the 1.2 per cent plane shall be considered significant obstacles but must not be considered as being capable of creating a shadow.	

Annex 4 reference	*Details*	*Drafting illustration*
	The most critical element to be portrayed is the elevation of significant obstacles(s). It is imperative that these obstacles be plotted and be positioned on the chart to great accuracy and be clearly labelled or identified. Incidentally, the authority concerned with publishing the charts should make every possible attempt to have removable obstacles eliminated before the chart is finalized for production and distribution. In the illustration, the 1.2 per cent slope shown on the profile is a plane having a common origin with the take-off flight path area. Obstacles which penetrate this slope and which lie within the take-off flight path area are considered to be significant obstacles and must be drawn on the profile by a vertical line extending from the elevation of the top of the obstacle through the grid line immediately below to the next lower grid line. This vertical line is intersected by a circle containing the identification number of the obstacle.	
3.8.1.2	The shadow of an obstacle is considered to be a plane surface originating at the 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 at 3.8.1.1 of Annex 4 or to the next higher significant 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. The illustration shows how to determine whether an obstacle lies within the shadow of another and therefore need not be shown on the chart.	
3.8.1.3	If the significant obstacle creating a shadow is likely to be removed, then objects which should become significant obstacles by its removal must be shown. In view of the possibility of unforeseen changes in the situation, all obstacle data should be retained so that a re-survey would not necessarily be required if certain obstacles were removed or if the configuration of the aerodrome were changed.	

Annex 4 reference	*Details*	*Drafting illustration*
3.8.2	Take-off flight path areas	
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 (each side diverges at 12.5%) to a maximum of 1 800 m (6 000 ft), where D is the distance from the point of origin; and c) it extends to the point beyond which no significant obstacles exist or to a distance of 10.0 km (5.4 NM), whichever is the lesser. The take-off flight path area is the area within which obstacles are to be selected and identified. The take-off flight path area commences at the end of the runway or clearway (if there is a clearway). If the runway lies within a strip which extends beyond the runway and which has not been designated as a clearway but conforms to the minimum specifications for a clearway (Annex 14, Volume I, Chapter 3, 3.6, refers), then the take-off flight path area should commence at the end of the strip. The area should have the dimensions indicated in the illustration.	*DIMENSIONS OF TAKE-OFF FLIGHT PATH AREA* *(Not to scale)* 
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) of Annex 4 must 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 3.1.8.2 must 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.	

Annex 4 reference	Details	Drafting illustration
	A slope of less than 1.0 per cent need be considered only when there are no obstacles penetrating the 1.0 per cent slope. It should be noted that the width of the take-off flight path area remains at a constant 1 800 m (6 000 ft) if extended beyond 10.0 km (5.4 NM). In the event a chart has been published on the basis of the former more conservative specifications, the only change would be to indicate obstacles which have become significant by a lowering of the survey plane and/or by extending the area beyond the 10.0 km (5.4 NM) length. The survey may reveal that no change is necessary except to indicate the overall distance that has been taken into consideration. Curved flight path When obstacles, including high terrain, exist in the take-off flight path area it may be necessary to prescribe a turn in the take-off procedure. In such a situation the take-off flight path area has to be adjusted so that it is centred on the curved flight path rather than the extended centre line of the runway. It is appropriate to indicate the radius of turn and the distance from the beginning of the runway to the centre of curvature. The distance from the beginning of the runway to an obstacle, situated within the curved portion of the area, must be measured along the track to its intersection with a perpendicular from the actual obstacle. Obstacles situated outside and near the curved portion of the same area should be indicated (see drafting illustration).	

Annex 4 reference	*Details*	*Drafting illustration*

3.8.3 Declared distances

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

a) take-off run available;

b) accelerate-stop distance available;

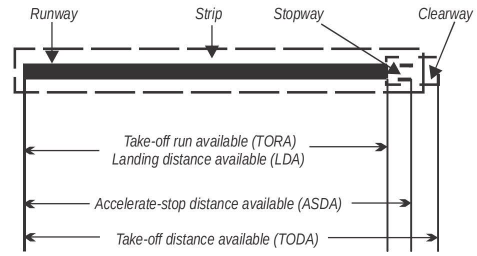
c) take-off distance available; and

d) landing distance available.

Annex 14, Volume I, Attachment A, Section 3, provides guidance on declared distances.

RWY 27R / 09L

DECLARED DISTANCES		
RWY 09 L		RWY27 RT
2800	TAKE-OFF RUN AVAILABLE	2800
2800	TAKE-OFF DISTANCE AVAILABLE	2800
2800	ACCELERATE-STOP DISTANCE AVAILABLE	2800
2800	LANDING DISTANCE AVAILABLE	2800



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

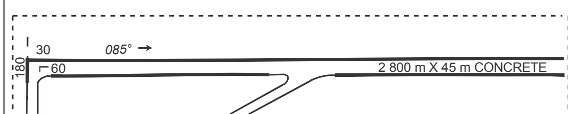
RWY 27R / 09L

DECLARED DISTANCES		
RWY 09 L		RWY27 RT
NU	TAKE-OFF RUN AVAILABLE	2800
NU	TAKE-OFF DISTANCE AVAILABLE	2800
NU	ACCELERATE-STOP DISTANCE AVAILABLE	2800
2800	LANDING DISTANCE AVAILABLE	2800

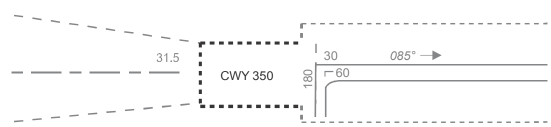
3.8.4 Plan and profile view

3.8.4.1 The plan view must show:

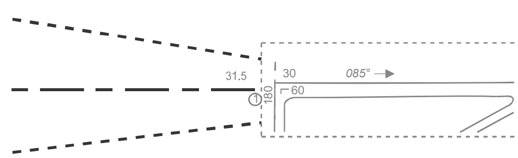
a) the outline of the runways by a solid line, including the length and width, the magnetic bearing to the nearest degree, and the runway number;

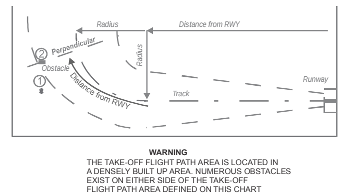
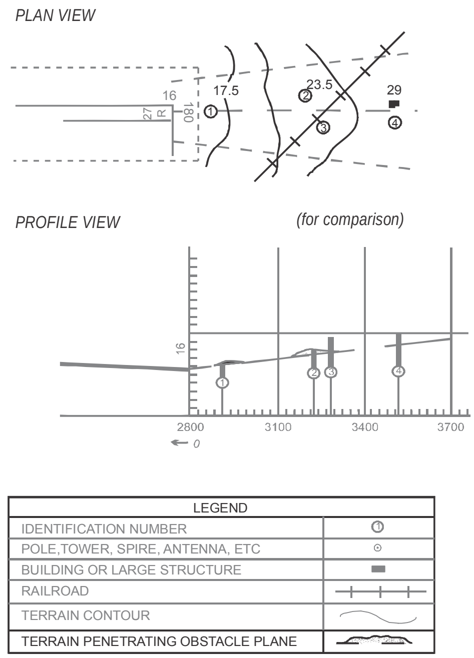
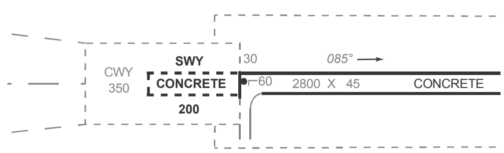


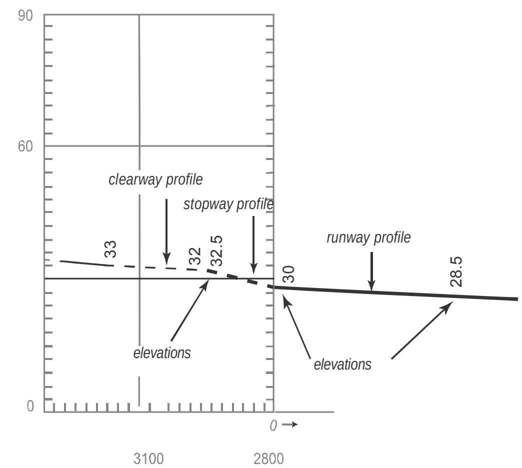
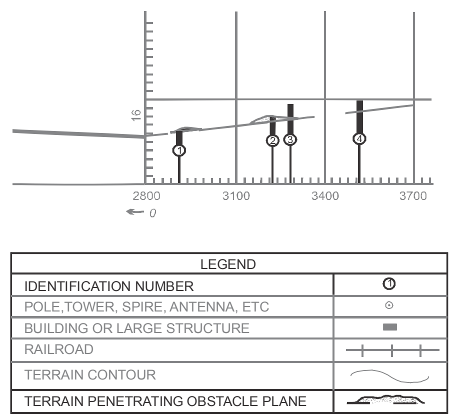
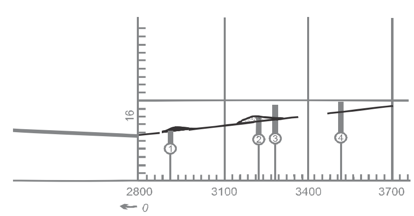
b) the outline of the clearways by a broken line, including the length and identification as such;



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



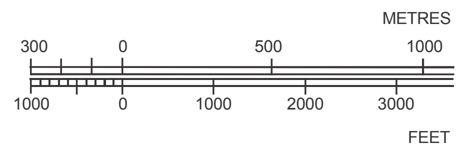
Annex 4 reference	*Details*	*Drafting illustration*
	d) alternative take-off flight path areas. When alternative take-off flight path areas not centred on the extension of the runway centre line are shown, notes must be provided explaining the significance of such areas; and	
	e) obstacles, including: 1) the exact location of each significant obstacle together with a symbol indicative of its type; 2) the elevation and identification of each significant obstacle; 3) the limits of penetration of significant 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 3.8.4.1.2 3.8.4.1.3	The nature of the runway and stopway surfaces should be indicated. Stopways should be identified as such and should be shown by a broken line. When stopways are shown, the length of each stopway must be indicated.	

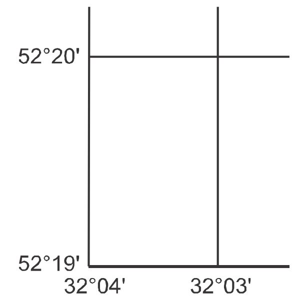
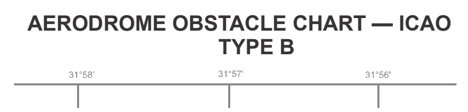
Annex 4 reference	*Details*	*Drafting illustration*
3.8.4.2	The profile view must show: a) the profile of the centre line of the runway by a solid line and the profile of the centre line of any associated stopways and clearways by a broken line; b) the elevation of the runway centre line at each end 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; and	
	c) obstacles, including: 1) each significant obstacle by a solid vertical line extending from a convenient grid line over at least one other grid line to the elevation of the top of the obstacle; 2) identification of each significant obstacle; 3) the limits of penetration of significant obstacles of large extent in a distinctive manner identified in the legend.	
	An obstacle profile consisting of a line joining the tops of each significant obstacle and representing the shadow created by successive significant obstacles may be shown.	
3.9	**Accuracy**	
3.9.1	The order of accuracy attained must be shown on the chart.	ORDER OF ACCURACY HORIZONTAL 00 M VERTICAL 00 M
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).	

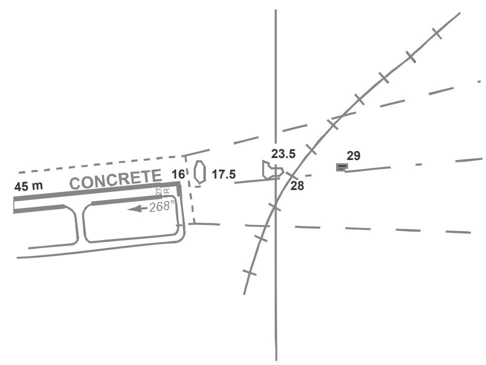
Annex 4 reference	*Details*	*Drafting illustration*
3.9.3	The order of accuracy of field-work and the precision of chart production should be such that measurements in take-off flight path areas can be taken from the chart within the following maximum deviations: a) for horizontal distances: 5 m (15 ft) at the point of origin (i.e. the commencement of the take-off flight path area) increasing at a rate of 1 m (3 ft) per 500 m (1 500 ft) of distance from the point of origin; e.g. up to 5 m (15 ft) deviation for the first 500 m (1 500 ft), up to 6 m (18 ft) deviation between 501 m (1 501 ft) and 1 000 m (3 000 ft), etc. b) for vertical distances: 0.5 m (1.5 ft) for the first 300 m (1 000 ft) increasing at a rate of 1 m (3 ft) per 1 000 m (3 000 ft) of additional height; e.g. up to 1.5 m (4.5 ft) deviation between 301 m (1 001 ft) and 1 300 m (4 000 ft), up to 2.5 m (7.5 ft) between 1 301 m (4 001 ft) and 2 300 m (7 000 ft), etc.	
3.9.4	Datum. Where no accurate datum for vertical reference is available, the elevation of the datum used must be stated and identified as “assumed”.	DATUM USED - AERODROME REFERENCE POINT ELEVATION *00* (ASSUMED)

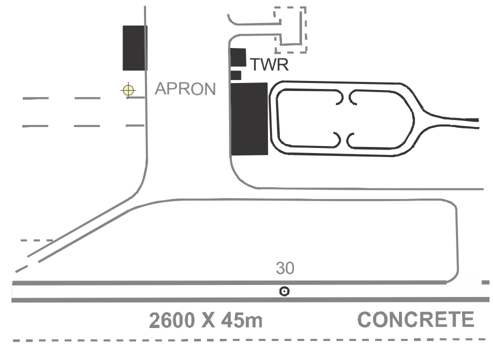
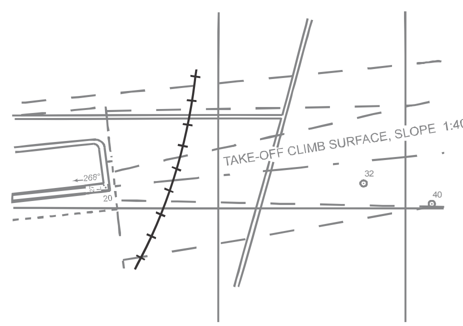
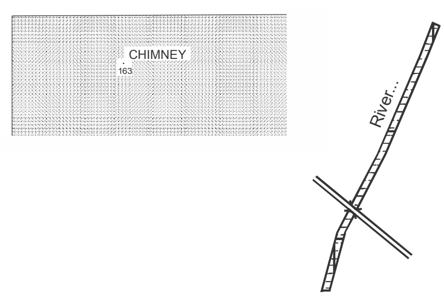
7.4 AERODROME OBSTACLE CHART — ICAO TYPE B

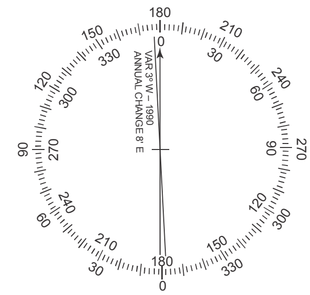
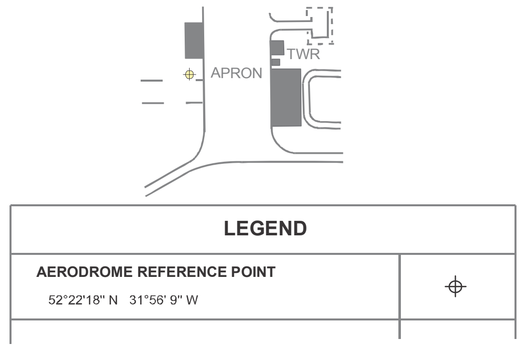
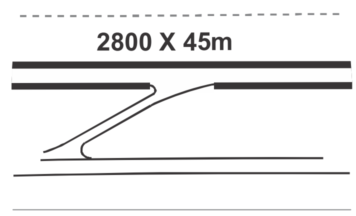
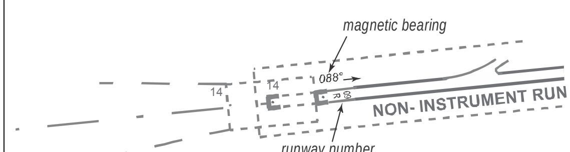
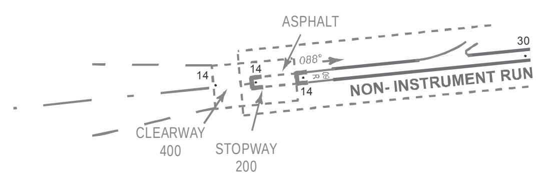
Annex 4 reference	*General*
4.1	**Function** Aerodrome Obstacle Charts — ICAO Type B are intended to satisfy the following functions: a) the determination of minimum safe altitudes/heights including those for circling procedures; b) the determination of procedures for use in the event of an emergency during take-off or landing; c) the application of obstacle clearing and marking criteria; and d) the provision of source material for aeronautical charts. In addition to the information specified for Aerodrome Obstacle Charts Type A (Operating Limitations), Type B charts include a plan of the entire aerodrome, the obstacle limitation surfaces specified in Chapter 4 of Annex 14, Volume I and the obstacles penetrating such surfaces. These surfaces vary in dimensions according to the use of the runway and runway length; reference should be made to Chapter 4 and Attachment B of Annex 14, Volume I and the *Airport Services Manual* (Doc 9137) Part 6.
4.2	**Applicability**
4.2.1	There is no obligation to publish an Aerodrome Obstacle Chart — ICAO Type B as such. However, in keeping with the functions noted above, the data required to be presented thereon are essential to many of the activities associated with ensuring that the aerodrome is safe for aircraft operations. For a State having carried out the necessary surveys for such purposes as obstacle clearance and marking and having prepared this material in graphic form for any practical use, it is a fairly simple step to publish the material in accordance with ICAO specifications. This permits operating agencies and other interested parties to have ready access to this type of information. The Aerodrome Obstacle Chart — ICAO Type B is not required when the Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) is provided in accordance with Chapter 5.
4.2.2	It is permissible to combine Type A and Type B aerodrome obstacle charts, in which case the title of the chart must be “Aerodrome Obstacle Chart — ICAO (Comprehensive)”. **Planning** In the planning stage, cognizance should be taken of the close interrelationship between this type of chart, the Aerodrome Obstacle Chart — ICAO Type A (Operating Limitations) and the Aerodrome/Heliport Chart — ICAO. Surveys and detailed drawings prepared by the authority charged with the planning, construction and maintenance of the aerodrome should be available to cover the basic data required for inclusion on the chart.

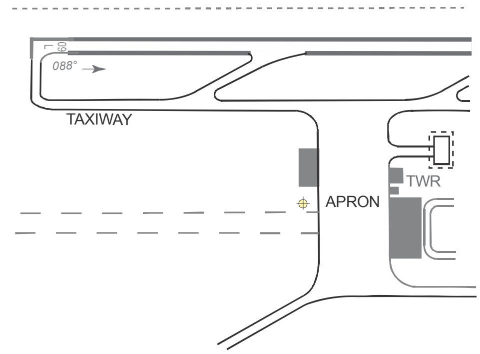
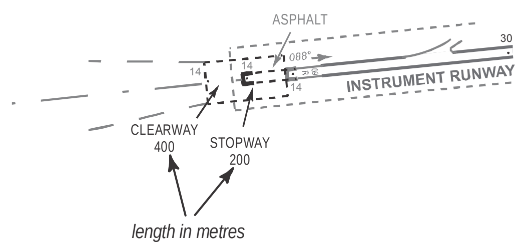
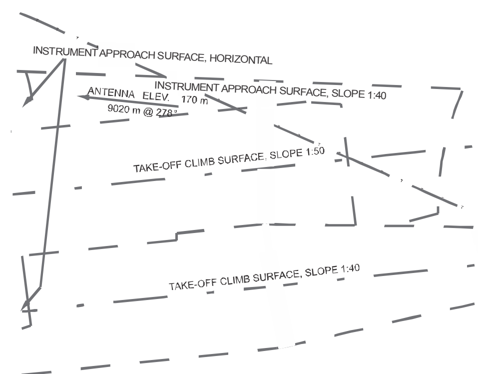
Annex 4 reference	*Details*	*Drafting illustration*
4.4	**Coverage and scale**	
4.4.1	The extent of each chart must be sufficient to cover all significant obstacles. Isolated distant obstacles that would unnecessarily increase the sheet size may be indicated by the appropriate symbol and an arrow, provided that the distance and bearing from the aerodrome reference point and elevation are given.	
4.4.2	The horizontal scale must be within the range of 1:10 000 to 1:20 000.	HORIZONTAL SCALE 1 : 20 000 
4.4.3	A horizontal linear scale showing both metres and feet must be included in the chart. When necessary, a linear scale for kilometres and nautical miles must also be shown.	
4.5	**Format**	
	The charts must include:	
	a) any necessary explanation of the projection used; and	TRANSVERSE MERCATOR PROJECTION DONLON STATE GRID - CENTRAL ZONE
	b) any necessary identification of the gird used;	
	c) a notation indicating that obstacles are those which penetrate the surfaces specified in Annex 14, Volume I, Chapter 4;	OBSTACLES SHOWN ARE THOSE WHICH PENETRATE THE SURFACES SPECIFIED IN ANNEX 14, CHAPTER 4
	d) a box for recording amendments and dates thereof; and	**AMENDMENT RECORD** **NO.** | **DATE** | **ENTERED BY**

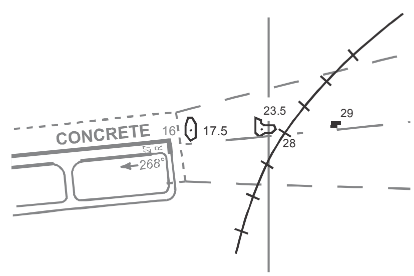
Annex 4 reference	*Details*	*Drafting illustration*
	e) outside the neat line, every minute of latitude and longitude marked in degrees and minutes. Lines of latitude and longitude may be shown across the face of the chart.	
	Projection The projection can be that of any suitable topographic chart series of the area, used for the compilation of this chart.	
2.2	**Title** The title must be "Aerodrome Obstacle Chart — ICAO, Type B". This title must not include "ICAO" unless the chart conforms with all standards specified in Annex 4, Chapters 2 and 4.	
4.6	**Identification** The chart must 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.	
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on specimen chart 2. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.3.1 to 2.3.4, inclusive.	
2.4	**Symbols** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	

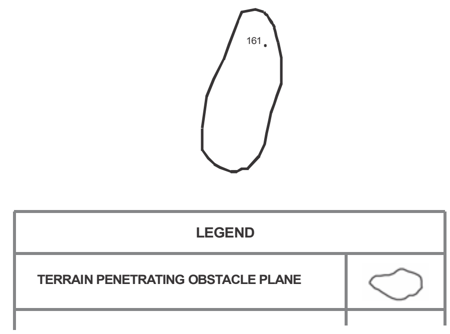
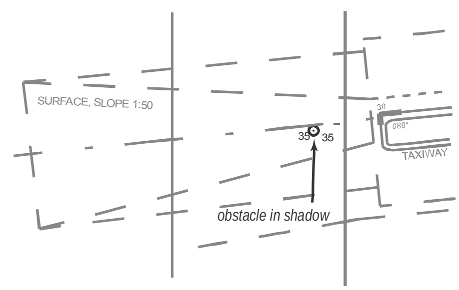
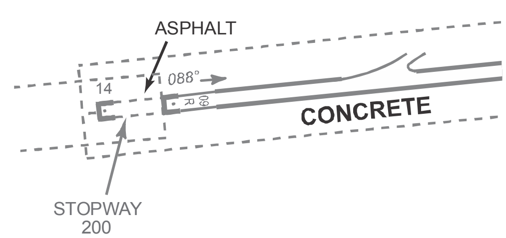
Annex 4 reference	*Details*	*Drafting illustration*
4.3	**Units of measurement** Elevations must be shown to the nearest half-metre or nearest foot and linear dimensions must be shown to the nearest half-metre. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7.	
2.7	**Date of aeronautical information** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	 DATE OF AERONAUTICAL INFORMATION
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4.	
2.9	**Abbreviations** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	
2.10	**Political boundaries** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.10.1 and 2.10.2.	
2.11	**Colours** The chart should be prepared for single colour reproduction.	
2.16	**Typography** Samples of type suitable for use on charts are provided later in this section under Annex 4, reference 2.16.	

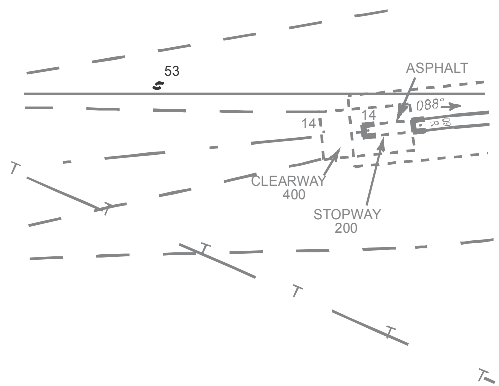
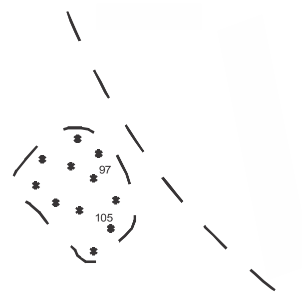
Annex 4 reference	*Details*	*Drafting illustration*
4.7	**Culture and topography**	
4.7.1	Drainage and hydrographic details must be kept to a minimum.	*See specimen chart 2*
4.7.2	Buildings and other prominent features associated with the aerodrome must be shown. Wherever possible, they must be shown to scale.	
4.7.3	All objects, either cultural or natural, that project above the take-off and approach surfaces specified under Aeronautical Data or the clearing and marking surfaces specified in Annex 14, Volume I, Chapter 4 must be shown.	*See specimen chart 2*
4.7.4	Roads and railways within the take-off and approach area, and less than 600 m (2 000 ft) from the end of the runway or runway extensions must be shown. Buildings and other features associated with the aerodrome can be transposed from the aerodrome chart. Hydrographic details, roads, railroads, towns, etc., can be transposed from the instrument and visual approach charts. Geographical name of features may be shown if of significance.	

Annex 4 reference	*Details*	*Drafting illustration*
4.8	**Magnetic variation** The chart must show a compass rose orientated to True North, or a North point, showing the magnetic variation to the nearest degree with the date of magnetic information and annual change. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.15.1 and 2.15.2.	
4.9 4.9.1	**Aeronautical data** The charts must show: a) the aerodrome reference point and its geographical position;	
	b) the outline of the runways depicted by a solid line; c) the length and width of the runway;	
	d) the magnetic bearing to the nearest degree of the runway and 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;	

Annex 4 reference	*Details*	*Drafting illustration*
	f) taxiways, aprons and parking areas identified as such, and the outlines depicted 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. These surfaces are specified in Annex 14, Volume I, Chapter 4, and are: 1) take-off climb surface; 2) approach surface; 3) inner horizontal surface; 4) conical surface; 5) transitional surface. The specifications in Annex 14, Volume I, Chapter 4, are minimum requirements. Where the competent authority has established lower surfaces, they may be used in the determination of significant obstacles. In order not to clutter the chart with extraneous lines, only the limits of the lowest surface at any given point should be shown. The competent authority should establish and determine the elevation datum and point, or points, for the	

Annex 4 reference	*Details*	*Drafting illustration*
	measurement of the limits of the inner horizontal surface. In the example shown in specimen chart 2, the inner horizontal surface was located 45 m above the official aerodrome elevation, defined as the highest point of the landing area. The outer limits were fixed taking into account the following considerations: 1) to provide protection consistent with that of the approach surfaces; and 2) to provide the smallest area in regard to removal and restriction of obstacles consistent with the specifications of Annex 14, Volume I. The centre of the inner horizontal surface was located mid-way between the two parallel runways, and the radius was chosen so that the surface would include all the inner sections of the approach and take-off climb surfaces. l) take-off and approach areas; *Note.— The take-off area is described in Section 7.3. under Annex 4 reference 3.8.2.1. The approach area consists of an area on the surface of the Earth laying directly below the approach surface as specified in Annex 14, Volume I, Chapter 4.* m) significant obstacles at their exact location, including: 1) a symbol indicative of their type; 2) elevation; 3) identification; and	

Annex 4 reference	*Details*	*Drafting illustration*
	4) limits of penetration of large extent depicted 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; and	
	n) any additional obstacles, as determined by 3.8.1.1 of Annex 4 including the obstacles in the shadow of a significant obstacle, which would otherwise be exempted. Those objects which penetrate the above-mentioned surfaces (ref. Annex 14, Volume I, Chapter 4) are considered to be significant obstacles, and it is imperative that they be plotted on the chart to a high degree of accuracy and clearly identified. As in the case of the Aerodrome Obstacle Chart — Type A, the authority concerned should make every effort to have removable obstacles eliminated, preferably before the chart is finalized for production, but this should not delay publication of the chart. Other objects, e.g., chimneys, antennae, trees or terrain, which might affect visual manoeuvring (circling) procedures should be included on the chart and identified.	
4.9.1.1	The nature of the runway and stopway surfaces should be given.	

Annex 4 reference	*Details*	*Drafting illustration*
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 significant obstacles should be shown.	
4.10	**Accuracy**	
4.10.1	The order of accuracy attained must be shown on the chart.	**ORDER OF ACCURACY** **HORIZONTAL 00 M** **VERTICAL 00 M**
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.	

Annex 4 reference	*Details*	*Drafting illustration*
	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 must be stated and identified as assumed.	

7.5 AERODROME TERRAIN AND OBSTACLE CHART — ICAO (ELECTRONIC)

Annex 4 reference	*General*
5.1	**Function**
	This electronic chart must portray the terrain and obstacle data in combination with aeronautical data, as appropriate, necessary to:
	a) enable an operator to comply with the operating limitations of Annex 6, Part I, Chapter 5, and Part III, Section II, Chapter 3, by developing contingency procedures for use in the event of an emergency during a missed approach or take-off, and by performing aircraft operating limitations analysis; and
	b) support the following air navigation applications:
	1) instrument procedure design (including circling procedure);
	2) aerodrome obstacle restriction and removal; and
	3) provision of source data for the production of other aeronautical charts.
5.2	**Applicability**
5.2.1	From 12 November 2015, Aerodrome Terrain and Obstacle Charts — ICAO (Electronic) must be available in the manner prescribed in 1.3.2 of Annex 4 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 Annex 4, 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 Annex 4, 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 of Annex 4 for all aerodromes regularly used by international civil aviation.
5.2.3	The Aerodrome Terrain and Obstacle Chart — ICAO (Electronic) must 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 must 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 must be identified by the name of the country in which the aerodrome is located, the

Annex 4 reference	*General*
	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 must be sufficient to cover Area 2 as specified in Annex 15, 10.1.
5.5	**Chart content**
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 must be specified by an application schema. Portrayed information must be provided on the basis of portrayal specifications applied according to defined portrayal rules. Portrayal specifications and portrayal rules must not be part of the data set. Portrayal rules must be stored in a portrayal catalogue which must make reference to separately stored portrayal specifications.
	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 must 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 must be based on the electronic terrain data sets which satisfy the requirements of Annex 15, Chapter 10 and Appendix 8.
5.5.2.2	The terrain feature must be portrayed in a manner that provides an effective general impression of a terrain. This must 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).
	In accordance with Annex 15, Chapter 10 and Appendix 8, the DEM for Area 2 post spacing (grid) is specified at 1 arc second (approximately 30 m).
5.5.2.3	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 must 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.

Annex 4 reference	*General*
5.5.2.6	Other terrain attributes specified in Annex 15, Appendix 8, Table A8-3, 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 must be based on electronic obstacle data sets which satisfy the requirements of Annex 15, Chapter 10 and Appendix 8.
5.5.3.3	The portrayed obstacle feature must 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 Annex 15, Appendix 8, Table A8-4, 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 must be based on aerodrome data which satisfy the requirements of Annex 14, Volume I, Appendix 5 and Annex 15, Appendix 7.
5.5.4.2	The following aerodrome features must 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 must 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);

Annex 4 reference	*General*
	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. Annex 14, Volume I, Attachment A, provides guidance on declared distances.
5.5.5	Radio navigation aid features Each radio navigation aid feature located within the chart coverage must 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 must be as specified in Annex 11, Appendix 5, and Annex 14, Volume I, Appendix 5, and Volume II, Appendix 1. The order of accuracy of terrain and obstacle data must be as specified in Annex 15, Appendix 8.
5.6.2	The aeronautical data resolution must be as specified in Annex 15, Appendix 7, while the resolution for terrain and obstacle data must be as specified in Annex 15, Appendix 8.
5.7	**Electronic functionality**
5.7.1	It must be possible to vary the scale at which the chart is viewed. Symbols and text size must vary with chart scale to enhance readability.
5.7.2	Information on the chart must be geo-referenced, and it must be possible to determine cursor position to at least the nearest second.
5.7.3	The chart must 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 must 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 must 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 must be possible to print the chart in hard copy format according to the content specifications and scale determined by the user. Printed output may consist of "tiled" sheets or specific selected areas according to user requirements. Feature attribute information available through database link may be supplied separately on appropriately referenced sheets.

Annex 4 reference	*General*
5.8	**Chart data product specifications**
5.8.1	A comprehensive statement of the data sets comprising the chart must 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 must 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 must provide an informal description of the product and must contain general information about the data product. The specification scope of the chart data product specifications must contain the spatial (horizontal) extent of the chart coverage. The chart data product identification must 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 must clearly identify the type of coverage and/or imagery and must provide a narrative description of each. ISO Standard 19123 contains schema for coverage geometry and functions.
5.8.5	The chart data product specifications must include information that defines the reference systems used. This must include the spatial reference system (horizontal and vertical) and, if appropriate, temporal reference system. The chart data product specifications must identify the data quality requirements. This must include a statement on acceptable conformance quality levels and corresponding data quality measures. This statement must 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 must include a data capture statement which must 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 must also be provided in the chart data product specifications, including the frequency with which the chart product is updated. Of particular importance must 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 must contain information on how data are portrayed on the chart, as detailed in 5.5.1.1. The chart data product specifications must also contain data product delivery information which must include delivery formats and delivery medium information.
5.8.8	The core chart metadata elements must be included in the chart data product specifications. Any additional metadata items required to be supplied must be stated in the product specifications together with the format and encoding of the metadata.

Annex 4 reference	*General*
	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.

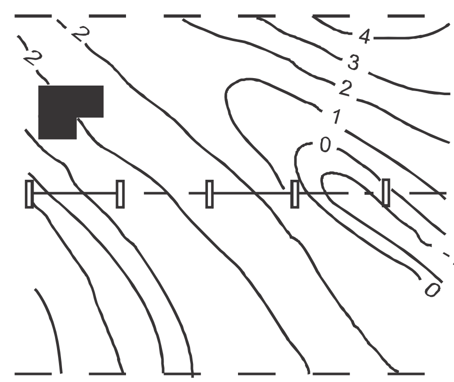
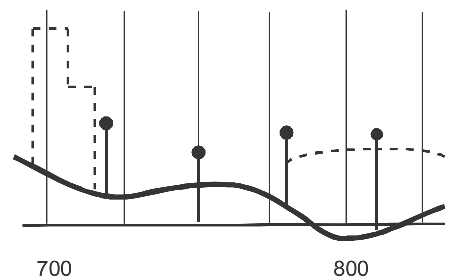
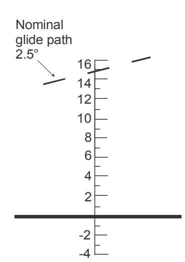
7.6 PRECISION APPROACH TERRAIN CHART — ICAO

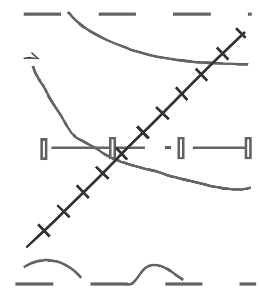
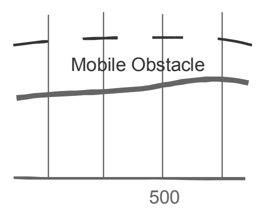
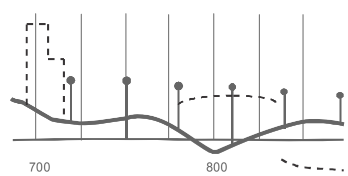
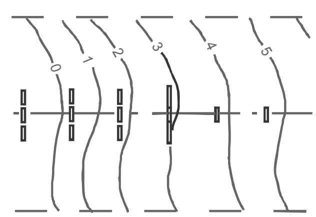
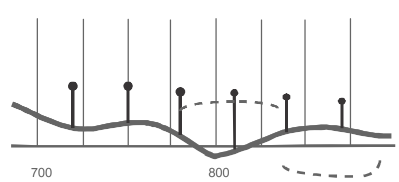
Annex 4 reference	*General*
6.1	**Function**
	The Precision Approach Terrain Chart — ICAO is designed to provide detailed terrain profile information (including natural and man-made objects) within a defined portion of the final approach which will enable aircraft operating agencies to assess, using radio altimeters, the effect of the terrain on decision height determination.
6.2	**Applicability**
6.2.1	The Precision Approach Terrain Chart — ICAO must 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 Section 7.5 .
6.2.2	The Precision Approach Terrain Chart — ICAO must be revised whenever any significant change occurs.
	Changes in the height of obstacles by more than 3 m (10 ft) could be a common occurrence. Another critical change would be a change in the glide path angle. Such changes necessitate revision of the chart, and a new edition should be issued as soon as practicable if the chart is to retain its utility.
	Planning
	To compile a Precision Approach Terrain Chart — ICAO, detailed surveys of the topography of the defined area from the runway end to the limit of the horizontal distance to be portrayed will be necessary, using standard survey methods to an accuracy of 0.5 m (1.5 ft) in the horizontal and vertical dimensions. Terrain profile data for the two ends of a runway may be shown on the same or on separate charts. Due cognizance should, however, be taken of the interrelationship between this chart, the Aerodrome/ Heliport Chart and the Aerodrome Obstacle Chart — Type A. A judicious utilization of surveys for all these types of charts could eliminate the need for a separate survey for this particular chart.

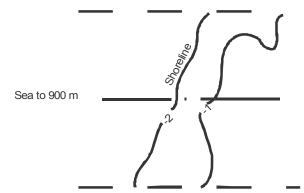
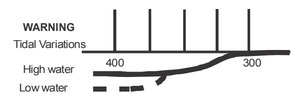
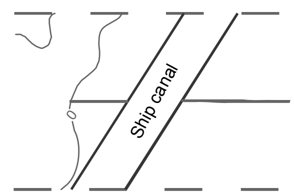
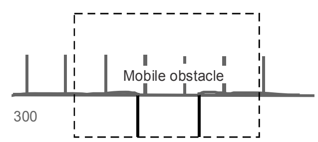
Annex 4 reference	*Details*	*Drafting illustration*
6.3	**Scale**	
	The extent of the chart coverage is given in Section 7.6, under Annex 4 reference 6.5.1 and 6.5.2.	*See specimen chart 4*
6.3.1	The horizontal scale should be 1:2 500 and the vertical scale 1:500.	
6.3.2	When the chart includes a profile 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.	

Annex 4 reference	*Details*	*Drafting illustration*
	Format For the format of this chart, see specimen chart 4. The chart is appropriate for inclusion in the Aeronautical Information Publication (AIP).	
2.2	**Title** The title must be "Precision Approach Terrain Chart — ICAO". This title must not include "ICAO" unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 6.	**PRECISION APPROACH TERRAIN CHART — ICAO**
6.4	**Identification** The chart must 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.	CITY / AERODROME COUNTRY RWY 27 R/09 L *(Note. Name of Country may be omitted where chart is published as part of an AIP — See Annex 4, reference 2.3.4)*
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on specimen chart 4. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.3.1 to 2.3.4, as applicable.	
2.4	**Symbols** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	
2.5	**Units of measurement** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	DISTANCES AND HEIGHT IN METRES

Annex 4 reference	*Details*	*Drafting illustration*
2.7	**Date of aeronautical information** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	DATE OF AERONAUTICAL INFORMATION
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, as applicable.	
2.9	**Abbreviations** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	*See specimen chart 4*
	Colours The chart should be prepared for monocolour publication.	
2.16	**Typography** Samples of type suitable for use on aeronautical charts are provided in Section 7.2.	
	Culture and topography See plan and profile information.	
6.5	**Plan and profile information**	*See specimen chart 4*
6.5.1	The chart is required to portray, in plan and profile, details of the terrain in an area 120 m (400 ft) by 900 m (3 000 ft) extending from the runway threshold along the extended centre line of the runway as indicated below:	

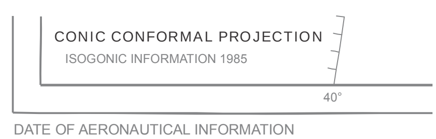
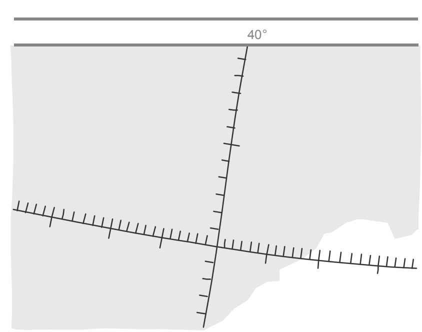
Annex 4 reference	*Details*	*Drafting illustration*
	a) a plan showing contours at 1 m (3 ft) intervals in the areas 60 m (200 ft) on either side of the extended runway centre line, to the same distance as the profile, the contour elevations to be related to the elevation of the runway threshold; b) an indication where the terrain or any object thereon, within the plan, 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 (300 ft) from the runway threshold along the extended centre line of the runway. To determine the profile lines, draw lines from the points on the plan view where the extended runway centre line bisects a contour, down to the profile area. Horizontal grid lines should then be drawn at 2-metre intervals across the profile, to measure the contour height. The actual position and height of the centre line profile is then extrapolated from the plan to the profile area in a series of points, which are then joined together by a single solid line. The same procedure is followed for any supplementary profiles, which, in application of the 3 m (10 ft) criterion, will terminate in mid-air.	*PLAN VIEW*  *PROFILE VIEW* 
6.5.2	Where the terrain at a distance beyond 900 m (3 000 ft) from the threshold is mountainous or otherwise significant to the user of the chart, the plan and profile of the terrain should be portrayed to a distance not exceeding 2 000 m (6 500 ft) from the runway threshold.	
6.5.3	An indication on the vertical scale of the height of the ILS reference datum should be given. The competent authority designated by the State for this purpose should provide this height information.	

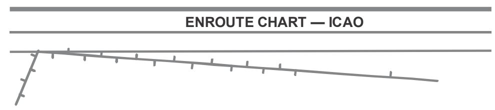
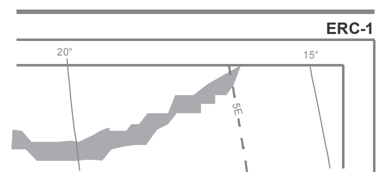
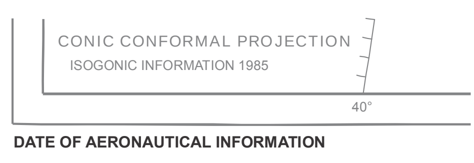
Annex 4 reference	*Details*	*Drafting illustration*
	Obstacles Moving objects within the defined area such as trains and vehicular traffic should be taken into consideration and labelled as mobile obstacles if they differ by more than ± 3 m (10 ft) in height from the elevation of the centre line profile. All topographical and cultural obstacles not related to the function of the chart are superfluous.	PLAN VIEW  PROFILE VIEW 
	Those objects and portions of terrain which differ by ± 3 m (10 ft) in height from the centre line profile should be portrayed on the profile by a short-dashed line.	
	Approach light installations must be shown in the plan view extending along the centre line from the runway end for the full length of the installation, but only if the installation, in whole or in part, differs by ± 3 m (10 ft) in height from the centre line profile.	
	In the profile view, only those approach light installations which differ by more than ± 3 m (10 ft) in height from the centre line profile need be shown. When shown, they should be identified. Any appropriate symbol could be used provided it does not impair the legibility of the chart. The symbol “ ” is used for this purpose on the specimen chart.	

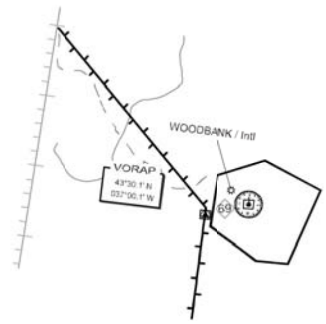
Annex 4 reference	*Details*	*Drafting illustration*
	At locations where an aerodrome is adjacent to water areas and the runway is so positioned that the direction of a final approach is over a body of water subject to tides in the defined area, it is necessary to indicate on the chart the maximum rise and fall of the tide relative to the extended centre line of the runway, together with a warning that allowance must be made for tidal variations within the limits of rise and fall.	 
	It is highly unlikely that a shipping channel will exist within 900 m (3 000 ft) of the threshold of a precision approach runway. If, however, one exists within the area of concern to the chart, it will need to be shown on the chart if it occasions a difference in height ± 3 m (10 ft) from the centre line profile. As to the height of ships in such a channel, these will need to be shown by the mobile obstacle symbol which will indicate the height of the tallest ship that may be expected to use the channel.	 

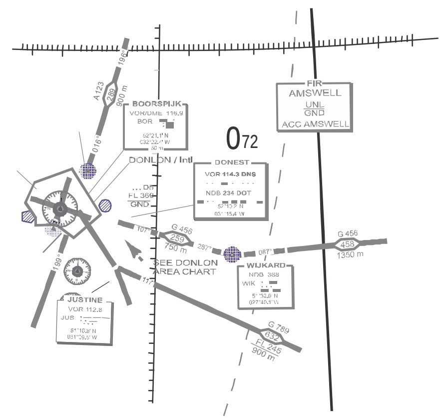
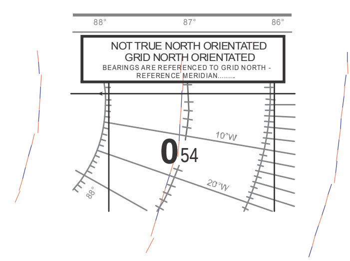
7.7 ENROUTE CHART — ICAO

Annex 4 reference	*General*
7.1	**Function**
	The Enroute Chart — ICAO must provide flight crews with information to facilitate navigation along ATS routes in compliance with air traffic services procedures.
	A simplified version of this chart may be included in an Aeronautical Information Publication (AIP) to complement the tabulation of communication and navigation facilities.
7.2	**Availability**
7.2.1	The Enroute Chart — ICAO must be made available for all areas where flight information regions have been established.
	Where the air traffic services routes or position reporting requirements are complex and cannot be adequately shown on an Enroute Chart — ICAO, an Area Chart — ICAO may have to be provided. (See Section 7.8, Area Chart — ICAO.)
	In that case, the Enroute Chart — ICAO need not duplicate information peculiar to the Area Chart — ICAO; appropriate identification and referencing of the area covered by the Area Chart — ICAO concerned should be included on the Enroute Chart — ICAO.
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 must be provided.
	For instance, a separate chart may be necessary for the upper airspace and one for the lower airspace configuration.
	Operational requirements
	See Chapter 7 — General Specifications, Annex 4 reference 2.1.1 to 2.1.8, inclusive.
	Planning
	The initial compilation of the chart can be achieved by tracing the base and grid data from existing topographical charts. The sheet-line configuration chosen should be such that the air traffic services system is conveniently and economically encompassed.

Annex 4 reference	*Details*	*Drafting Illustration*
7.3	**Coverage and scale**	
Note 1	A uniform scale for charts of this type cannot be specified due to the variation in the area covered and to the varying degree of congestion of information in certain areas. The scale selected should be sufficiently large to portray clearly all the required details.	*See specimen chart 5*
Note 2	In addition to the proportional scale, it would be useful to include a linear scale based on the mean scale of the chart.	*See specimen chart 5*
7.3.1	Layout of sheet lines should be determined by the density and pattern of the ATS route structure.	*See specimen chart 5*
7.3.2	Large variations of scale between adjacent charts showing a continuous route structure must be avoided.	*See specimen chart 5*
7.3.3	An adequate overlap of charts must be provided to ensure continuity of navigation.	*See specimen chart 5*
	Format	
	The format of this chart should be in accordance with specimen chart 5.	
7.4	**Projection**	
7.4.1	A conformal projection (e.g. Lambert conformal) on which a straight line approximates a great circle should be used.	
7.4.2	Parallels and meridians must be shown at suitable intervals.	*See specimen chart 5*
7.4.3	Graduation marks must be placed at consistent intervals along selected parallels and meridians. The intervals selected should minimize the amount of interpolation required when plotting.	

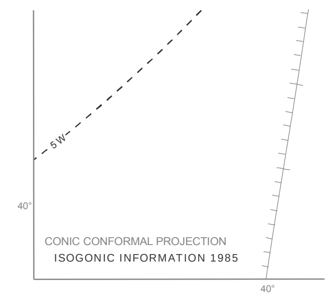
Annex 4 reference	*Details*	*Drafting Illustration*
2.2	**Title** The title must be “Enroute Chart — ICAO”, except that such title must not include “ICAO” unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 7.	
7.5	**Identification** Each sheet must be identified by chart series and number.	
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on specimen chart 5. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.3.1 to 2.3.4, inclusive.	
2.4	**Symbols** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	
2.5	**Units of measurement** See Chapter 7 — General Specification, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	
2.7	**Date of aeronautical information** See Chapter 7 — General Specification, Section 7.2, Annex 4 reference 2.7.	
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, inclusive.	

Annex 4 reference	Details	Drafting Illustration
2.9	**Abbreviations** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	
2.10	**Political boundaries** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.10.1 and 2.10.2.	
2.11	**Colours** Two colours will suffice for an easily interpreted chart. However, if an air traffic services system in more than one layer of airspace can be portrayed on a single chart a third colour may be required. Economy in colours can be achieved by the careful use of fine dot percentage screens for the portrayal of selected information which, on a two-colour chart, provides an alternative to two additional colours in effect. Colours recommended are dark blue, light blue, black, grey, light brown and red or combinations thereof (cf. Annex 4, Appendix 3). The benefits derived from the use of more than two colours will have to be weighed by the producing agency against the cost involved. A monocolour edition is acceptable for areas portraying simpler air traffic services systems if printed in black or dark blue ink on a good quality white paper. Here too, fine dot percentage screens for the portrayal of selected information will help in the interpretation of the chart. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.11.	*See specimen chart 5*

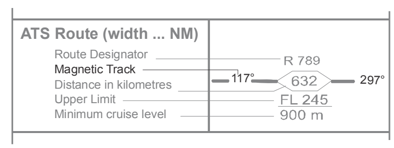
Annex 4 reference	*Details*	*Drafting Illustration*
2.16	**Typography**	
	Samples of type suitable for use on charts are provided in Section 7.2.	
7.6	**Culture and topography**	
7.6.1	Generalized shorelines of all open water areas, large lakes and rivers must be shown except where they conflict with data more applicable to the function of the chart.	*See specimen chart 5*
7.6.2	Within each quadrilateral formed by the parallels and meridians, the Area Minimum Altitude must be shown, except in areas of high latitude where it is determined by the appropriate authority that True North orientation of the chart is impractical.	
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 must be clearly indicated. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.12.1 to 2.12.3.1 inclusive, as applicable.	

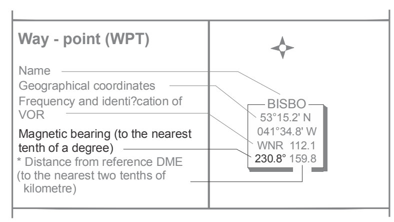
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td>7.7</td><td>Magnetic variation

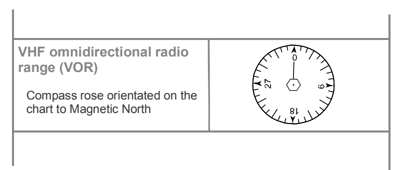
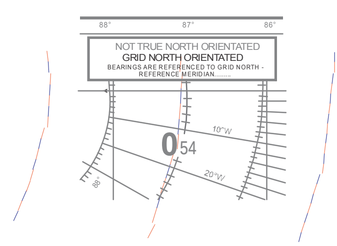
Isogonals should be shown and the date of the isogonic information given.

See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.15.1 and 2.15.2.</td><td>
</td></tr>
<tr><td>7.8</td><td>Bearings, tracks and radials</td><td></td></tr>
<tr><td>7.8.1</td><td>Bearings, tracks and radials must be magnetic, except as provided for in areas of high latitude.

Where bearings and tracks are additionally provided as true values for RNAV segments, they must be shown in parentheses to the nearest tenth of a degree, e.g. 290° (294.9°T).

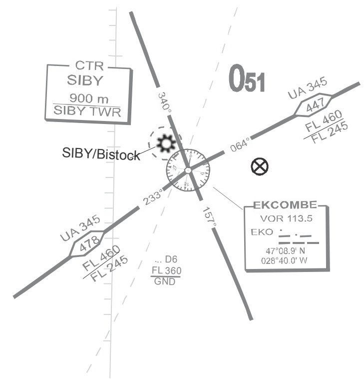
A note to this effect may be included on the chart.</td><td>



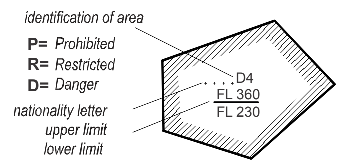

</td></tr>
<tr><td>7.8.2</td><td>In areas of high latitude where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.</td><td>
</td></tr>
<tr><td>7.8.3</td><td>Where bearings, tracks and radials are given with reference to True North or Grid North, this must be clearly indicated. When Grid North is used its reference grid meridian must be identified.</td><td></td></tr>
</table>

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td>7.9</td><td>Aeronautical data</td><td></td></tr>
<tr><td>7.9.1</td><td>Aerodromes

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

Other aerodromes may also be shown. Abandoned aerodromes must be identified as such. This could be done by adding the label “ABANDONED” if this would not cause clutter, or preferably by the symbol ⊗ which should be explained in a legend.</td><td>

<table>
<tr><th colspan="2">LEGEND</th></tr>
<tr><td>Aerodrome</td><td>✲</td></tr>
<tr><td>Abandoned aerodrome</td><td>⊗</td></tr>
</table></td></tr>
<tr><td>7.9.2</td><td>Prohibited, restricted and danger areas

Prohibited, restricted and danger areas relevant to the layer of airspace, must be depicted with their identification and vertical limits. To avoid congestion, details of these areas (e.g. coordinates, identification, vertical limits) may be shown on the reverse of the chart. A listing in tabular form may be included on the face of the chart, space permitting.</td><td>

<table>
<tr><th colspan="2">PROHIBITED, RESTRICTED AND DANGER AREAS</th></tr>
<tr><th>IDENTIFICATION AND LATERAL LIMITS</th><th>UPPER LIMIT / LOWER LIMIT</th></tr>
<tr><td>DANGER AREAS

... D4 Burgenvalk

Area bounded by lines joining successively the following points:
48 48 N 03400W - 49 00N 038 28W - 50 28 N 038 28W - 50 26N 034 00W - 48 48N 034 00W</td><td>FL 360
GND</td></tr>
</table></td></tr>
<tr><td>7.9.3</td><td>Air traffic services system</td><td></td></tr>
<tr><td>7.9.3.1</td><td>Where appropriate, the components of the established air traffic services system must be shown.</td><td>See specimen chart 5</td></tr>
</table>

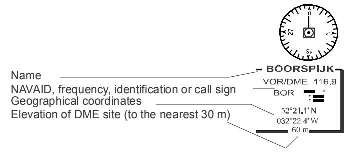
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td>7.9.3.1.1</td><td>The component must include the following:

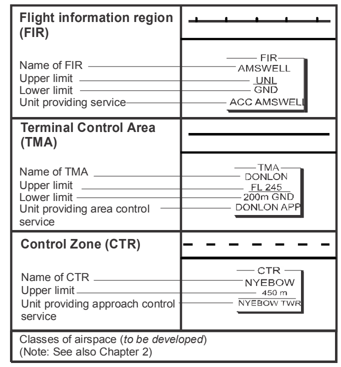
a) the radio navigation aids associated with the air traffic services system together with their names, identification, frequencies and geographical coordinates to at least one-tenth of a minute;

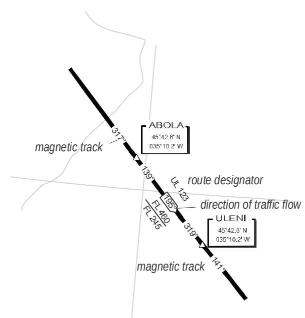
b) in respect of DME, additionally the elevation of the DME site to the nearest 30 m (100 ft);

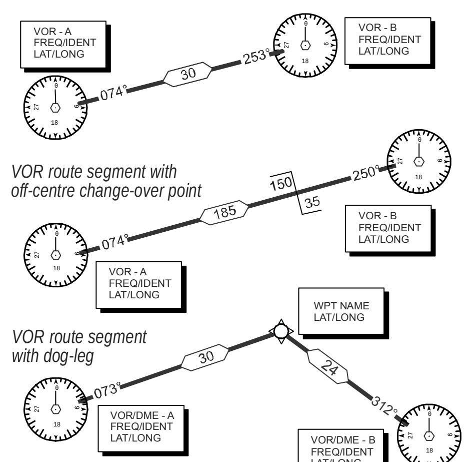
c) an indication of all designated airspace, including lateral and vertical limits and the appropriate class of airspace;

d) all ATS routes for en-route flight including route designators, the track 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;</td><td>

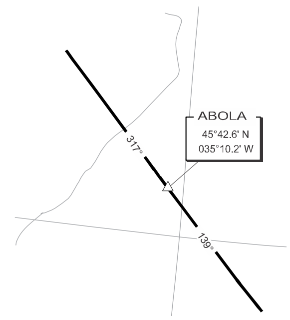




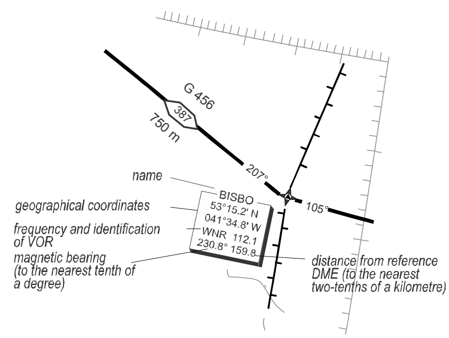


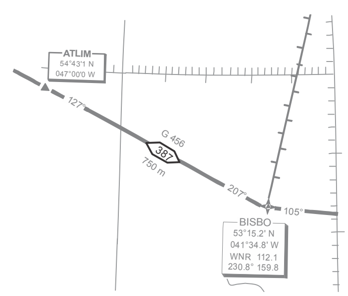


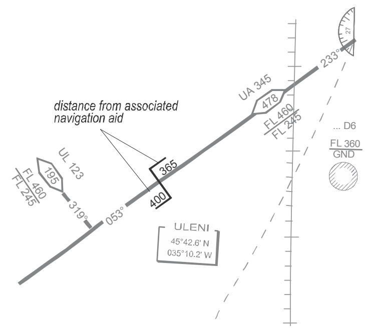
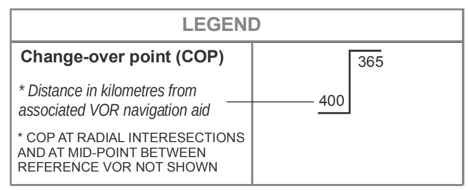
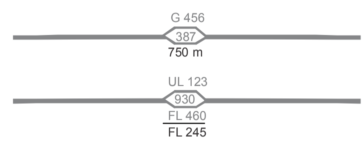
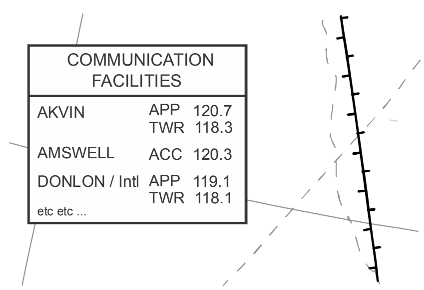
</td></tr>
</table>

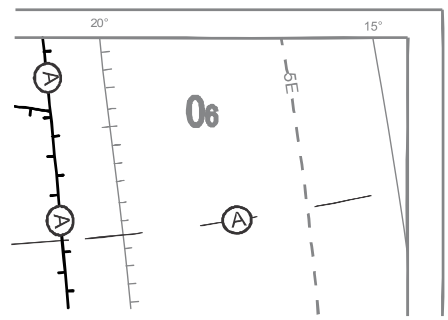
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>e) all significant points which define the ATS routes and are not marked by the site of a radio navigation aid, together with their name-codes and geographical coordinates to at least one-tenth of a minute;</td><td>
</td></tr>
<tr><td></td><td>f) in respect of defining way-points 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;</td><td>
</td></tr>
<tr><td></td><td>g) an indication of all compulsory and “on request” reporting points and ATS/MET reporting points;</td><td><table>
<tr><td rowspan="2">Reporting point (REP)</td><td>Compulsory</td><td>▲</td></tr>
<tr><td>On request</td><td>△</td></tr>
<tr><td rowspan="2">ATS/MET reporting point (MRP)</td><td>Compulsory</td><td></td></tr>
<tr><td>On request</td><td></td></tr>
</table></td></tr>
<tr><td></td><td>h) the distances between significant points constituting turning points or reporting points;

Overall distances between radio navigation aids may also be shown.</td><td>
</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
	i) change-over points on route segments defined by reference to very high frequency omnidirectional radio ranges, indicating the distances to the navigations 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 m or 100 ft (See Annex 11, Chapter 2, 2.22); and	
	k) communications facilities listed with their channels and, if applicable, logon address; It is desirable that a complete listing of communication facilities (control tower, area control centre and flight information centre frequencies) be available for ready reference, preferably in tabular form on the face of the chart.	
	l) air defence identification zone (ADIZ) properly identified. Note.— ADIZ procedures may be described in the chart legend.	
7.9.4	Supplementary Information	*See specimen charts 6, 7 and 8*
7.9.4.1	Details of departure and arrival routes and associated holding patterns in terminal areas must 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.	

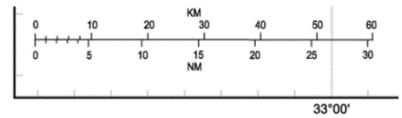
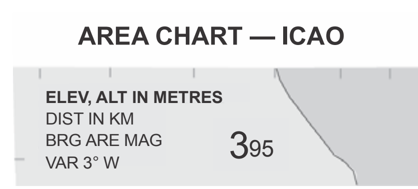
Annex 4 reference	*Details*	*Drafting Illustration*
	For specifications of these charts see Chapters 8, 9, and 10 of Annex 4 and for guidance material see Sections 7.8, 7.9 and 7.10 of this manual. Departure routes normally originate at the end of a runway; arrival routes normally terminate at the point where an instrument approach is initiated.	
7.9.4.2	Where established, altimeter setting regions must be shown and identified. The altimeter setting region boundary, where it differs from another boundary, could be identified by a combination of line or broken line with a letter (e.g. --- Ⓐ ---). The letter Ⓐ in conjunction with, say a flight information region (FIR) boundary symbol, e.g. — Ⓐ — could adequately indicate the dual role of the boundary.	

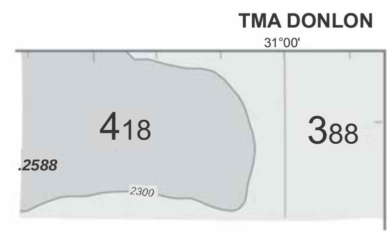
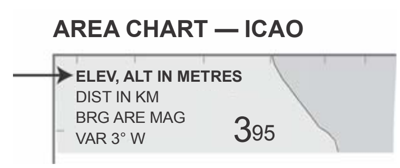
7.8 AREA CHART — ICAO

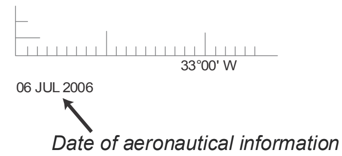
Annex 4 reference	*General*
8.1	**Function**
	The Area Chart — ICAO must provide the flight crew with information to facilitate the following phases of instrument flight: a) the transition between the en-route phase and approach to an aerodrome; b) the transition between take-off/missed approach and en-route phase of flight; and c) flights through areas of complex ATS routes or airspace structure. 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 must be made available in the manner prescribed by Annex 4 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 must be provided. Under certain conditions a Standard Departure Chart — Instrument (SID) — ICAO and a Standard Arrival Chart — Instrument (STAR) — ICAO may have to be provided. (See Sections 7.9 and 7.10.) The Area Chart — ICAO is usually made available for the terminal area around one or more aerodromes where the air traffic congestion is such that specific arrival, departure and transit routes are required to permit the safe and efficient flight operation of aircraft landing in, taking off from, or overflying, the area. In certain instances, it will be necessary to prepare and publish a separate chart or charts for either the arrival or departure routes, or both, for example: a) wherever a standard arrival route — instrument (STAR) or a standard departure route — instrument (SID) has been established which cannot be shown with sufficient clarity on the Area Chart — ICAO; and b) when several aerodromes are involved, or when the aerodrome on which the terminal area is centred includes two or more parallel runways. The assessment of the air traffic services data required to be portrayed on an Area Chart — ICAO is the task of the authority responsible for air traffic services within a State, which should ensure that the cartographic agency assigned to prepare the chart is provided with necessary guidance and information. The production of the chart will require collaboration between the air traffic services procedure specialist and the cartographer. See also Annex 11 — *Air Traffic Services*, Appendix 3 and the *Air Traffic Services Planning Manual* (Doc 9426) regarding the establishment and identification of standard departure and arrival routes.

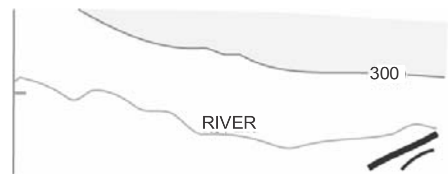
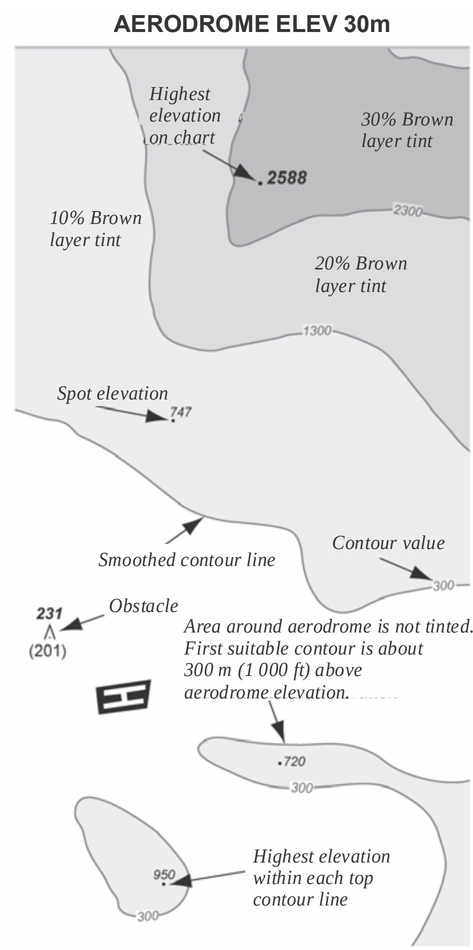
Annex 4 reference	*General*
	Operational requirements See Chapter 7 — General Specifications, Annex 4 references 2.1.1 to 2.1.7. It may be noted that to provide the required coverage at an appropriate scale, the Area Chart — ICAO will most likely exceed the basic sheet size recommended by Annex 4, 2.1.8. **Planning** At the planning stage, the interrelationships between the Enroute Chart — ICAO, Area Chart — ICAO, Standard Departure Chart — Instrument (SID) — ICAO, Standard Arrival Chart — Instrument (STAR) — ICAO, Instrument Approach Chart — ICAO and Radar Minimum Altitude Chart — ICAO should be considered. The availability and complexity of those charts will influence the design of the Area Chart — ICAO particularly with regard to coverage, scale and the potential for chart clutter. The presentation of information must be designed to permit a smooth transition from chart to chart. A considerable amount of duplication, particularly in surveys and in the selection of base material, can be avoided by including requirements for all these types of charts at the planning stage of production. Terrain and obstacle information to be shown should be selected from an electronic terrain and obstacle database (Annex 15 — *Aeronautical Information Services*, Chapter 10, refers). If suitable electronic data are not available, information from up-to-date topographical charts at scales of 1:250 000 or larger may be appropriate. When developing relief portrayal for the Area Chart — ICAO, and particularly in areas of significant relief, it is important to plan an integrated approach to relief portrayal on the Standard Departure Chart — Instrument (SID) — ICAO, the Standard Arrival Chart — Instrument (STAR) — ICAO and the Instrument Approach Chart — ICAO. Further information on relief portrayal for the Instrument Approach Chart — ICAO and these associated charts appears in Section 7.2.

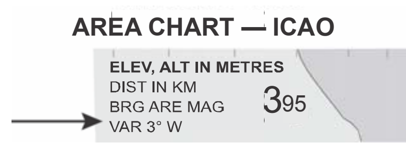
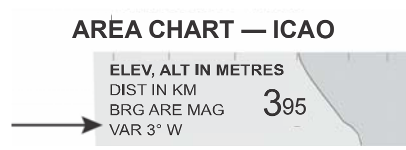
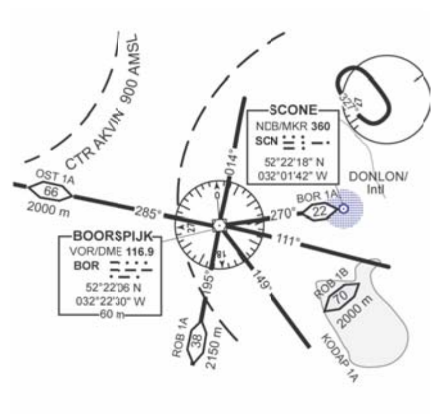
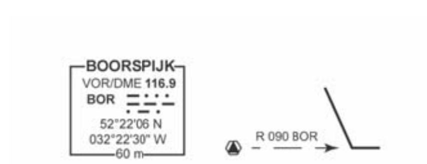
Annex 4 reference	*Details*	*Drafting Illustration*
8.3	**Coverage and scale**	
8.3.1	The coverage of each chart must extend to points that effectively show departure and arrival routes. The departure route normally begins at the end of a runway and ends at a specified significant point at which the en-route phase of flight along a designated ATS route can be commenced. An arrival route begins where the en-route phase of flight ends, and ends where the approach phase of flight begins.	*See specimen chart 6*

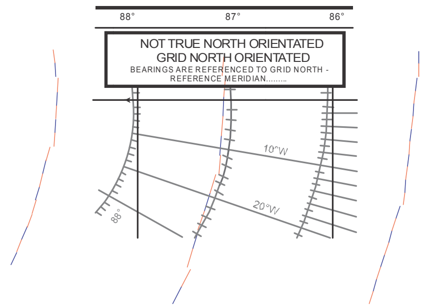
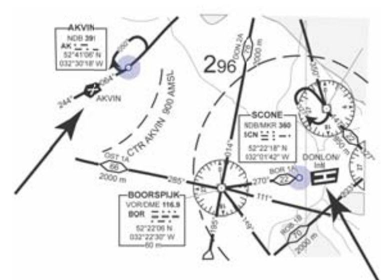
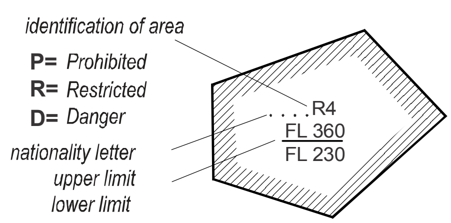
Annex 4 reference	*Details*	*Drafting Illustration*
8.3.2	The chart must be drawn to scale and a scale-bar must be shown. The scale-bar may be shown in the lower left corner of the chart. Variation in the extent of the area to be included on an individual sheet and the degree of complexity of the air traffic system information make it impracticable to standardize a specific scale at which the Area Chart — ICAO should be published. However, the scale employed should be one which would enable the depiction of required data with sufficient clarity. A scale within the range of 1:250 000 and 1:2 000 000 may be required.	
	Format	
	The format should be in accordance with specimen chart 6.	*See specimen chart 6*
8.4	**Projection**	
8.4.1	A conformal projection on which a straight line approximates a great circle should be used. A Lambert Conic Conformal Projection is well suited as a basis for this type of chart. The projection type need not be indicated on the chart.	*See specimen chart 6*
8.4.2	Parallels and meridians must be shown at suitable intervals. In specimen chart 6, the parallels and meridians are shown at one degree intervals.	*See specimen chart 6*
2.2	**Title**	
	The title must be "Area Chart — ICAO". Such title must not include "ICAO" unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 8. The chart title is placed at the top left corner of the chart in bold upper-case type.	

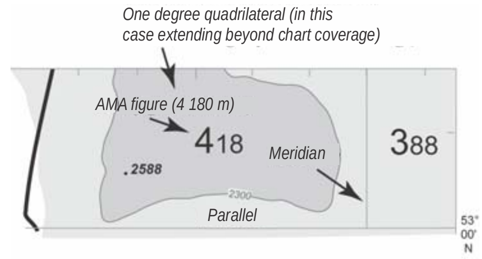
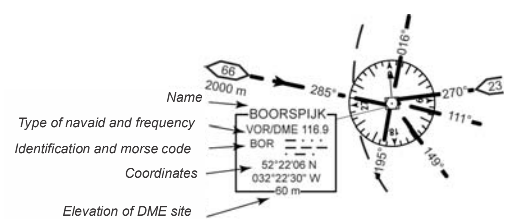
Annex 4 reference	*Details*	*Drafting Illustration*
8.5	**Identification** The chart must be identified by a name associated with the airspace portrayed. The name may be that of the air traffic services centre, the largest city or town situated in the area covered by the chart or the city that the aerodrome 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. The chart identification is placed at the top right corner of the chart in bold upper-case type.	
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on specimen chart 6. In accordance with Annex 4, 2.3.3 and 2.3.4, as this type of chart is published as part of the Aeronautical Information Publication (AIP) or a related aeronautical document, the legend to the symbols and abbreviations used, and the address of the producing agency must be placed in the front of the AIP. (See Annex 15, Appendix 1, GEN 2.2, GEN 2.3 and GEN 3.2 for specific placement in the AIP.)	*See specimen chart 6*
2.4	**Symbols** See Chapter 7 — General Specifications and Annex 4, Appendix 2.	
2.5	**Units of measurement** See Chapter 7 — General Specifications. The descriptions of units of measurement used may be grouped together in the upper left corner of the chart.	

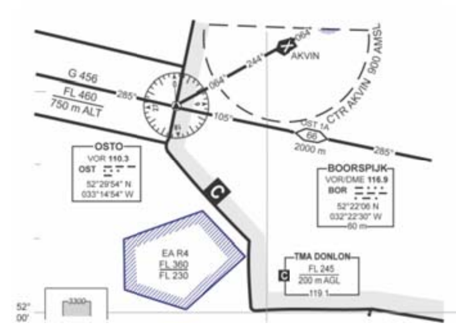
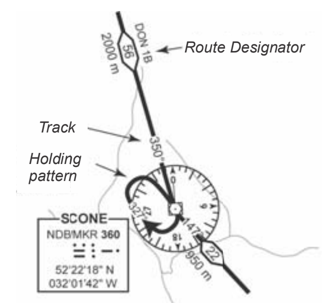
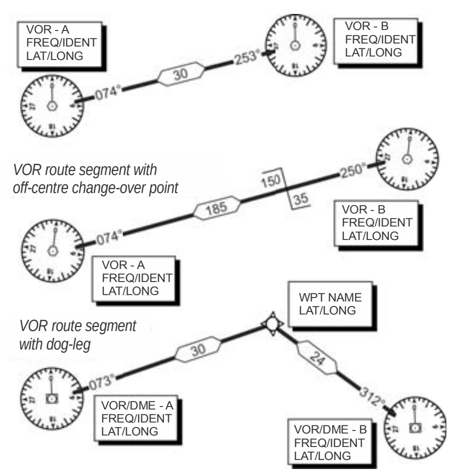
Annex 4 reference	*Details*	*Drafting Illustration*
2.7	**Date of validity of aeronautical information** See Chapter 7 — General Specifications. The date of aeronautical information is shown at the bottom left corner of the chart outside the neat line. A day/month/year format using abbreviations (e.g. 06 JUL 2006) from the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400) is appropriate.	
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications.	
2.9	**Abbreviations** See Chapter 7 — General Specifications.	
2.10	**Political boundaries** See Chapter 7 — General Specifications. International boundaries must be portrayed in accordance with the Annex 4, Appendix 2, symbol number 63 and labelled with country names. Unless of special importance, this information may be subdued by a half-tone screen of about 30 per cent.	
2.11	**Colours** Colours used should conform to the Colour Guide in Annex 4, Appendix 3. The chart should be produced in two colours, except that one colour will suffice when there is no relief information to provide. Charts should be printed on a good quality paper, preferably white, using brown for relief if shown (see also Annex 4, 8.6.2) and black for all other elements. Base topography and cartographic information, such as neat lines and projection elements, may be appropriately screened to promote the readability of aeronautical information. The use of selected percentage screens, either fine dots or light rulings, will provide visual separation for such elements as water areas and built-up areas.	*See specimen chart 6*

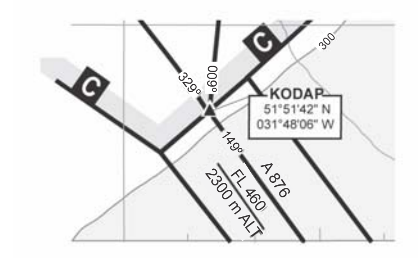
Annex 4 reference	Details	Drafting Illustration
2.16	**Typography** For samples of type suitable for use on charts see Chapter 7 — General Specifications.	
8.6	**Culture and topography**	
8.6.1	Generalized shore lines of all open water areas, large lakes and rivers must be shown except where they conflict with data more applicable to the function of the chart. To avoid such conflict, the presentation of these hydrographical features may be subdued by a half-tone screen of about 30 per cent. Topographic features may be named only when necessary to facilitate the understanding of such information.	
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. 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 the Colour Guide in Annex 4, Appendix 3. Appropriate spot elevations, including the highest elevation within each top contour line, should be shown printed in black. The highest elevation on the chart may be emphasized by larger bold or “boxed” type in accordance with Annex 4, Appendix 2, symbol number 12. Obstacles should also be shown, using the correct symbol selected from Annex 4, Appendix 2, Obstacles, and printed in the colour used for aeronautical information. Appropriate spot elevations and obstacles are those provided by the procedures specialist. It is essential that relief portrayal on the Area Chart — ICAO be designed as a subdued presentation so as not to interfere with readability of procedural information or create chart clutter. A harmonized portrayal of relief between the area chart, associated SID, STAR and instrument approach charts is also important. Further guidance is given	 *See specimen chart 6 for colour illustration.*

Annex 4 reference	*Details*	*Drafting Illustration*
	in Chapter 7 — General Specifications, Portrayal of relief on the Instrument Approach Chart — ICAO and other relevant charts.	
8.7	**Magnetic variation**	
	The average magnetic variation of the area covered by the chart must be shown to the nearest degree. This information may be grouped with the indication of units of measurement at the upper left corner of the chart.	
	See also Chapter 7 — General Specifications, Annex 4 references 2.15.1 and 2.15.2.	
8.8	**Bearings, tracks and radials**	
8.8.1	Bearings, tracks and radials must be magnetic, except as provided for in 8.8.2. Where bearings and tracks are additionally provided as true values for RNAV 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 grouped with the indication of units of measurement at the upper left corner of the chart.	
	Bearing and track values are to be shown using three digits and a degree sign (e.g. 016°).	
	Radial values are to be indicated by three digits preceded by the letter and followed by the identification of the facility (e.g. R 090 BOR). A degree sign is not shown with radial values.	

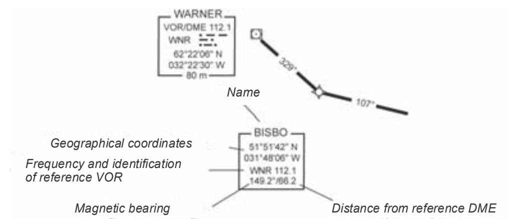
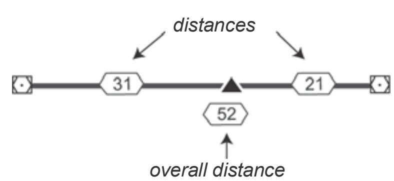
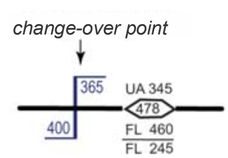
Annex 4 reference	*Details*	*Drafting Illustration*
8.8.2	In areas of high latitude, where it is determined by the appropriate authority that reference to Magnetic North is impractical, another suitable reference, i.e. True North or Grid North, should be used.	
8.8.3	Where bearings, tracks or radials are given with reference to True North or Grid North, this must be clearly indicated. When Grid North is used, its reference grid meridian must be identified.	
8.9	**Aeronautical data**	
8.9.1	Aerodromes All aerodromes which affect the terminal routings must be shown. Where appropriate, such as for major aerodromes, a runway pattern symbol must be used.	
8.9.2	Prohibited, restricted and danger areas Prohibited, restricted and danger areas must be depicted with their identification and vertical limits. The depiction of prohibited, restricted and danger areas must not obliterate procedural information. If necessary to reduce chart clutter, a half-tone screen of approximately 40 per cent may be used to subdue the portrayal of prohibited, restricted and danger areas. See also Chapter 7 — General Specifications, Annex 4 reference 2.13. The “nationality letters” part of the identification of these areas may be omitted. Nationality letters are those contained in Doc 7910 — *Location Indicators*.	
8.9.3	Area minimum altitudes (AMA) Area minimum altitudes (AMA) must be shown within quadrilaterals formed by the parallels and meridians. Although dependent on the selected chart scale, quadrilaterals formed by the parallels	

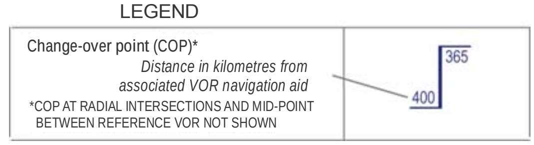
Annex 4 reference	*Details*	*Drafting Illustration*
	and meridians normally correspond to the whole degree of latitude and longitude. An AMA represents the lowest altitude to be used under instrument meteorological conditions (IMC) that will provide a minimum clearance of 300 m (1 000 ft), or in a designated mountainous area 600 m (2 000 ft), above all obstacles located in the quadrilateral. A mountainous area is defined as an area of changing terrain profile where the changes of terrain elevation exceed 900 m (3 000 ft) within a distance of 18.5 km (10.0 NM). AMA figures are printed in black and are shown in two sizes of figures, the larger representing units of thousands of metres (feet) and the smaller, units of tens of metres (hundreds of feet in the case of a chart using feet). The figures are to be positioned in the central area of each quadrilateral and to avoid conflict with procedural information. The AMA figure applies to the entire quadrilateral even if only a portion of the quadrilateral is shown within the coverage of the chart.	 AMA figure examples On chart using metres 060 = 600 m 123 = 1 230 m 126 = 1 260 m On chart using feet 20 = 2 000 ft 22 = 2 200 ft 122 = 12 200 ft
8.9.4	Air traffic services system	
8.9.4.1	The components of the established relevant air traffic services system must be shown.	*See specimen chart 6*
8.9.4.1.1	The components must 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. The Morse code for the identification may also be shown. Text boxes associated with radio navigation aids should be of a size consistent with the information contained therein. In the text box, the radio navigation aid name, frequency and identification may be emphasized by bold text. Lead lines are to be used in congested areas to position the boxes for optimum readability; b) in respect of DME, additionally the elevation of the transmitting antenna of the DME to the nearest 30 m (100 ft);	

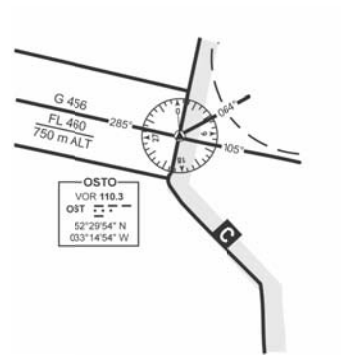
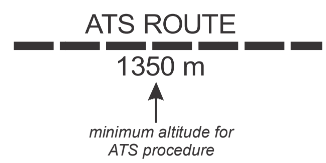
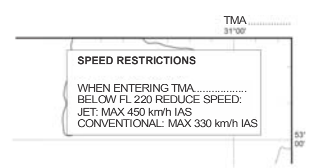
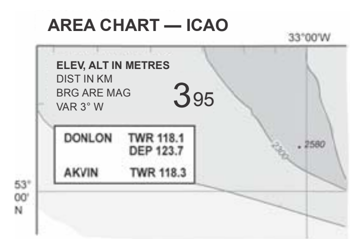
Annex 4 reference	*Details*	*Drafting Illustration*
	c) terminal radio aids which are required for outbound and inbound traffic and for holding patterns;	*See specimen chart 6*
	d) the lateral and vertical limits of all designated airspace and the appropriate class of airspace. Symbols for airspace classes are provided in Annex 4, Appendix 2; 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;	
	The centre lines of VOR-defined routes and information on each segment, consisting of the following elements: 1) specific VORs with their details defining the segments; 2) VOR-defined track to the nearest degree; 3) the segment distance to the nearest kilometre or nautical mile;	

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>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;</td><td>
</td></tr>
<tr><td></td><td>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;</td><td>
</td></tr>
<tr><td></td><td>i) an indication of all compulsory and "on-request" reporting points;</td><td><table>
<tr><td rowspan="2">Reporting point (REP)</td><td>Compulsory</td><td>▲</td></tr>
<tr><td>On request</td><td>△</td></tr>
<tr><td rowspan="2">ATS/MET reporting point (MRP)</td><td>Compulsory</td><td>$\boxed{\blacktriangle}$</td></tr>
<tr><td>On request</td><td>$\boxed{\triangle}$</td></tr>
</table></td></tr>
<tr><td></td><td>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;</td><td>
</td></tr>
<tr><td></td><td>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 forming the segment. 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;</td><td>

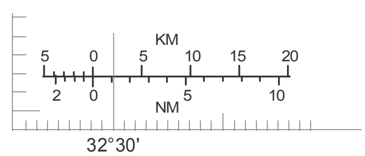
LEGEND

</td></tr>
</table>

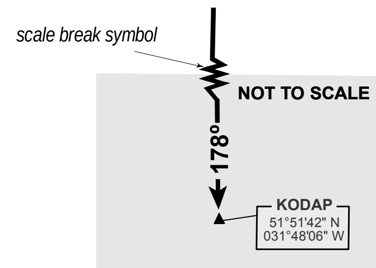
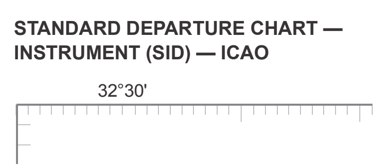
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>l) minimum en-route altitudes and minimum obstacle clearance altitudes, on ATS routes to the nearest higher 50 m or 100 ft (see Annex 11, Chapter 2, 2.22);</td><td>
</td></tr>
<tr><td></td><td>m) 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.</td><td>
</td></tr>
<tr><td></td><td>Where excessive chart clutter will result, an ATC Surveillance Minimum Altitude Chart — ICAO may be provided (see Section 7.21), in which case the elements indicated by 8.9.4.1.1, l) need not be duplicated on the Area Chart — ICAO.</td><td>See specimen chart 14</td></tr>
<tr><td></td><td>n) area speed and level/altitude restrictions where established;</td><td>
</td></tr>
<tr><td></td><td>o) communication facilities listed with their channels and, if applicable, logon address. These may be shown in the top left area of the chart;</td><td>
</td></tr>
<tr><td></td><td>p) an indication of “flyover” significant points.</td><td></td></tr>
</table>

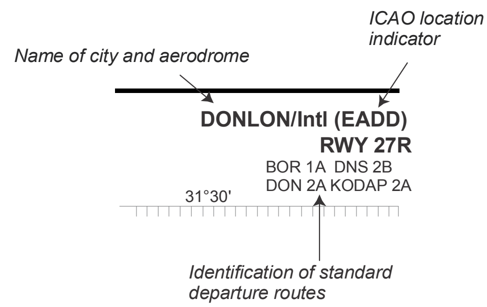
7.9 STANDARD DEPARTURE CHART — INSTRUMENT (SID) — ICAO

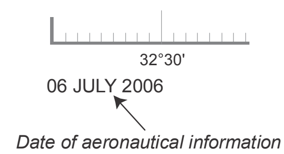
Annex 4 reference	*General*
9.1	**Function** The Standard Departure Chart — Instrument (SID) — ICAO must provide the flight crew with information to enable it to comply with the designated standard departure route — instrument from the take-off phase to the en-route phase. The departure route normally begins at the end of a runway and ends at a specified significant point at which the en-route phase of flight along a designated ATS route can be commenced. Provisions governing the identification of standard departure routes are in Annex 11 — *Air Traffic Services*, Appendix 3. Guidance material relating to the establishment of such routes is contained in the *Air Traffic Services Planning Manual* (Doc 9426). Provisions governing obstacle clearance criteria and details of the minimum information to be published are contained in the *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168), Volume II, Part II.
9.2	**Availability** The Standard Departure Chart — Instrument (SID) — ICAO must be made available wherever a standard departure route — instrument has been established and cannot be shown with sufficient clarity on the Area Chart — ICAO. The assessment of the air traffic services data required to be portrayed on a Standard Departure Chart — Instrument (SID) — ICAO is the task of the authority responsible for air traffic services within a State, which should ensure that the cartographic agency assigned to prepare the chart is provided with necessary guidance and information. The production of the chart will require collaboration between the air traffic services procedure specialist and the cartographer. **Operational requirements** See Chapter 7 — General Specifications, Annex 4 reference 2.1.1 to 2.1.8. **Planning** At the planning stage, the interrelationships between the Enroute Chart — ICAO, Area Chart — ICAO, Standard Departure Chart — Instrument (SID) — ICAO, Standard Arrival Chart — Instrument (STAR) — ICAO, Instrument Approach Chart — ICAO and Radar Minimum Altitude Chart — ICAO should be considered. The availability and complexity of those charts will influence the design of the Standard Departure Chart — Instrument (SID) — ICAO particularly with regard to coverage, scale and the potential for chart clutter. Annex 4, 2.1.6, specifies that the presentation of information must be designed to permit a smooth transition from chart to chart. Accordingly, the Standard Departure Chart — Instrument (SID) — ICAO must terminate at a common point which is also charted on the associated Enroute Chart — ICAO.

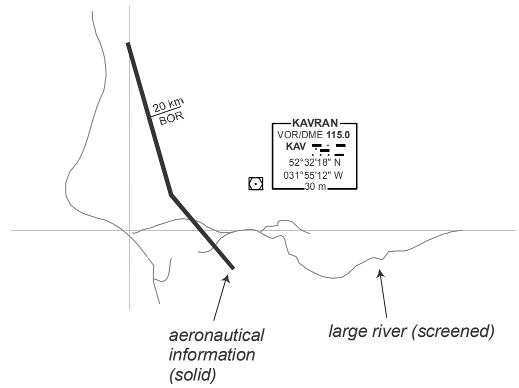
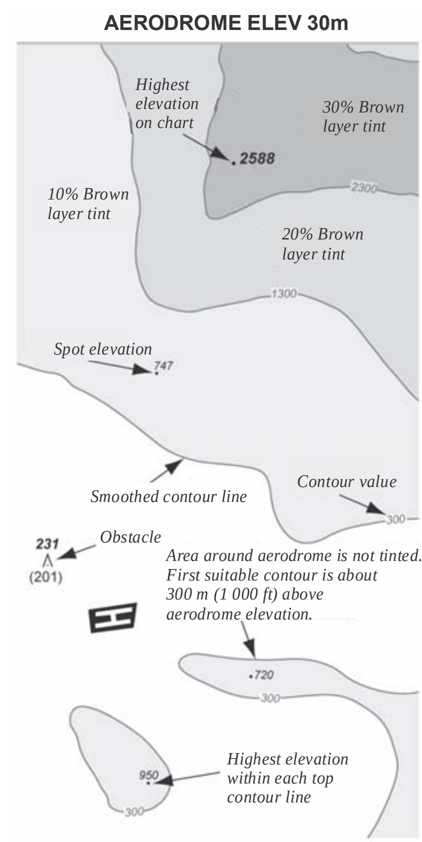
Annex 4 reference	*General*
	A considerable amount of duplication, particularly in surveys and in the selection of base material, can be avoided by including requirements for all these types of charts at the planning stage of production. Terrain and obstacle information to be shown should be selected from an electronic terrain and obstacle database (Annex 15 — *Aeronautical Information Services*, Chapter 10, refers). If suitable electronic data are not available, information from up-to-date topographical charts at scales of 1:250 000 or larger may be appropriate. When developing relief portrayal for the Standard Departure Chart — Instrument (SID) — ICAO, and particularly in areas of significant relief, it is important to plan an integrated approach to relief portrayal on the Area Chart — ICAO, the Standard Arrival Chart — Instrument (STAR) — ICAO and the Instrument Approach Chart — ICAO. Further information on relief portrayal for the Instrument Approach Chart — ICAO and these associated charts appears in Section 7.2.

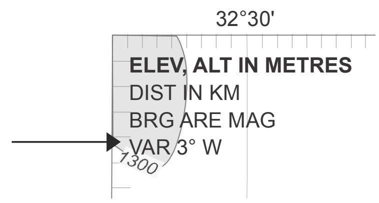
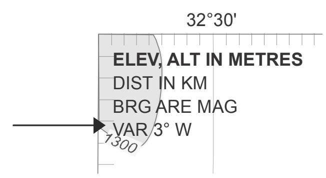
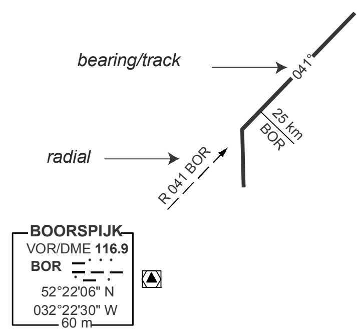
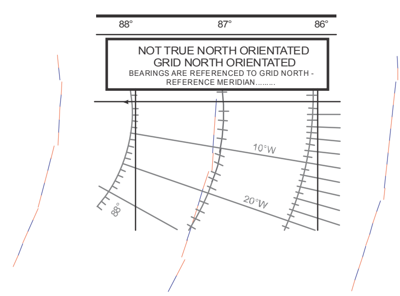
Annex 4 reference	*Details*	*Drafting Illustration*
9.3	**Coverage and scale**	
9.3.1	The coverage of the chart must be sufficient to indicate the point where the departure route begins and the specified significant point at which the en-route phase of flight along a designated air traffic services route can be commenced. The departure route normally originates at the end of a runway.	*See specimen chart 7*
9.3.2	The chart should be drawn to scale. The selected scale should provide optimum legibility consistent with the procedure shown on the chart and with the sheet size. Insets and scale-breaks may be used to maintain an appropriate scale for charts with a large area of coverage, however, these should be used judiciously and identified in compliance with 9.3.4.	
9.3.3	If the chart is drawn to scale, a scale-bar must be shown. The scale-bar may be shown in the lower left corner of the chart.	

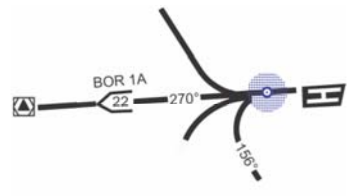
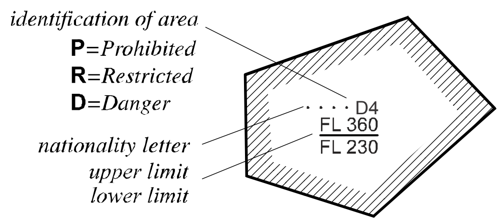
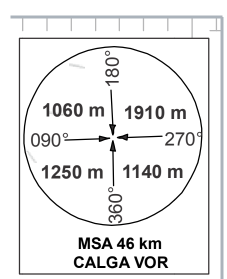
Annex 4 reference	*Details*	*Drafting Illustration*
9.3.4	When the chart is not drawn to scale, the annotation “NOT TO SCALE” must be shown. When it is necessary to show part of the chart not to scale, the symbol for scale-break must be used on tracks and other aspects of the chart that are too large to be drawn to scale. In addition, not-to-scale portions of the chart may be differentiated by a light half-tone screen overlay and annotated “NOT TO SCALE”.	
	Format	
	The format of this chart should be in accordance with specimen chart 7.	*See specimen chart 7*
9.4	**Projection**	
9.4.1	A conformal projection on which a straight line approximates a great circle should be used. A Lambert Conic Conformal Projection is well suited as a basis for this type of chart. The projection type need not be indicated on the chart.	*See specimen chart 7*
9.4.2	When the chart is drawn to scale, parallels and meridians should be shown at suitable intervals. In specimen chart 7, the parallels and meridians are shown at thirty-minute intervals.	*See specimen chart 7*
9.4.3	Graduation marks must be placed at consistent intervals along the neat lines. In specimen chart 7, graduation marks have been placed at one-minute intervals with extended graduation marks every ten minutes. Parallels, meridians and graduation marks may be screened for a subdued presentation.	*See specimen chart 7*
2.2	**Title**	
	The title must be “Standard Departure Chart — Instrument (SID) — ICAO”. Such title must not include “ICAO” unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 9. The chart title is placed at the top left corner of the chart in bold upper-case type.	

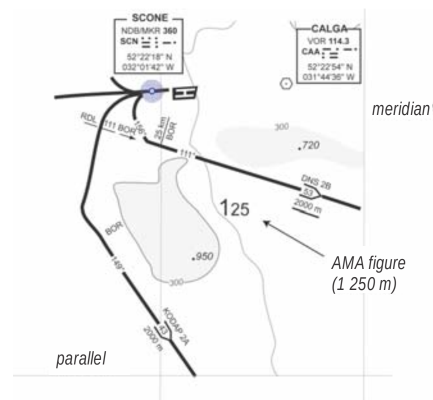
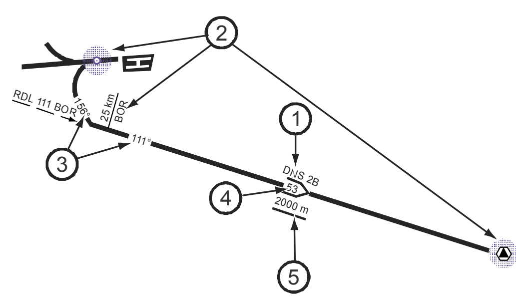
Annex 4 reference	*Details*	*Drafting Illustration*
9.5	**Identification**	
	The chart must be identified by the name of the city or town, or area, that the aerodrome serves, the name of the aerodrome, and the identification of the standard departure route(s) — instrument as established in accordance with the PANS-OPS, Volume II, Part I, Section 3. The identification of the standard departure route(s) — instrument is provided by the procedures specialist. The ICAO location indicator may also be included with the name of the aerodrome. The chart identification is placed at the top right corner of the chart in bold upper-case type.	
2.3.1	**Marginal note layout**	
	The marginal note layout must conform to that provided on specimen chart 7. In accordance with Annex 4, 2.3.3 and 2.3.4, as this type of chart is published as part of the Aeronautical Information Publication (AIP) or a related aeronautical document, the legend to the symbols and abbreviations used and the address of the producing agency must be placed in the front of the AIP. (See Annex 15, Appendix 1, GEN 2.2, GEN 2.3 and GEN 3.2 for specific placement in the AIP.)	*See specimen chart 7*
2.4	**Symbols**	
	See Chapter 7 — General Specifications and Annex 4, Appendix 2.	
2.5	**Units of measurement**	
	See Chapter 7 — General Specifications. The descriptions of units of measurement used may be grouped together in the upper left corner of the chart.	

Annex 4 reference	*Details*	*Drafting Illustration*
2.7	**Date of validity of aeronautical information** See Chapter 7 — General Specifications. The date of aeronautical information is shown at the bottom left corner of the chart outside the neat line. A day/month/year format (e.g. 06 JUL 2006), using abbreviations from the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400), is appropriate.	
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications.	
2.9	**Abbreviations** See Chapter 7 — General Specifications.	
2.10	**Political boundaries** See Chapter 7 — General Specifications. International boundaries must be portrayed with the Annex 4, Appendix 2, symbol number 63 and labelled with country names. Unless of special importance, this information may be subdued by a half-tone screen of about 30 per cent.	
2.11	**Colours** Colours used on charts should conform to the Colour Guide in Annex 4, Appendix 3. The chart should be produced in two colours, except that one colour will suffice when there is no relief information to provide. Charts should be printed on a good quality paper, preferably white, using brown for relief if shown (see also Annex 4 reference 9.6.2) and black for all other elements. The use of selected percentage screens, either fine dots or light rulings, will provide visual separation for such elements as water areas or built-up areas.	*See specimen chart 7*
2.16	**Typography** For samples of type suitable for use on charts, see Chapter 7 — General Specifications.	

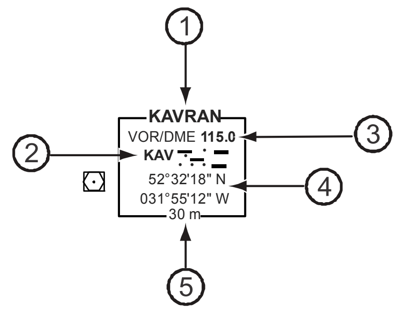
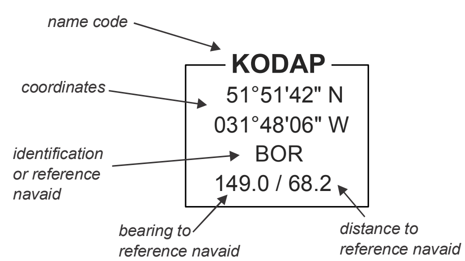
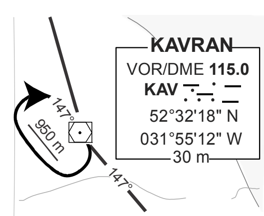
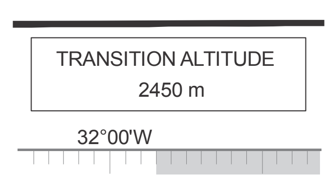
Annex 4 reference	Details	Drafting Illustration
9.6	**Culture and topography**	
9.6.1	Where the chart is drawn to scale, generalized shore lines of all open water areas, large lakes and rivers must be shown except where they conflict with data more applicable to the function of the chart. Significant topographical and cultural features may be selected to facilitate the transition from visual flight to instrument flight. These features may be named only when necessary to facilitate the understanding of such information. On specimen chart 7, aside from relief, the only features shown are major rivers. These rivers are screened so as not to conflict with aeronautical information.	
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. 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 the Colour Guide in Annex 4, Appendix 3. Appropriate spot elevations, including the highest elevation within each top contour line, should be shown printed in black. The highest elevation on the chart may be emphasized by larger bold or "boxed" type in accordance with Annex 4, Appendix 2, symbol number 12. Obstacles should also be shown, using the correct symbol selected from Annex 4, Appendix 2, Obstacles, and printed in the colour used for aeronautical information. Appropriate spot elevations and obstacles are those provided by the procedures specialist. It is essential that relief portrayal on the Standard Departure Chart — Instrument (SID) — ICAO be designed as a subdued presentation so as not to interfere with readability of procedural information or create chart clutter. A harmonized portrayal of relief between the area chart and associated SID, STAR and instrument approach charts is also	 *See specimen chart 7 for colour illustration.*

Annex 4 reference	*Details*	*Drafting Illustration*
	important. Further guidance is given in Chapter 7 — General Specifications, Portrayal of relief on the Instrument Approach Chart — ICAO and other relevant charts.	
9.7	**Magnetic variation**	
	The magnetic variation used in determining the magnetic bearings, tracks and radials must be shown to the nearest degree. This information may be grouped with the indication of units of measurement at the upper left corner of the chart. See also Chapter 7 — General Specifications, Annex 4 reference 2.15.1 and 2.15.2.	
9.8	**Bearings, tracks and radials**	
9.8.1	Bearings, tracks and radials must be magnetic, except as provided for in 9.8.2. Where bearings and tracks are additionally provided as true values for RNAV 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 grouped with the indication of units of measurement at the upper left corner of the chart. Bearing and track values are to be shown using three digits and a degree sign (e.g. 041°E). Radial values are to be indicated by three digits preceded by the letter and followed by the identification of the facility (e.g. R 041 BOR). A degree sign is not shown with radial values	 
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 must be clearly indicated. When Grid North is used its reference grid meridian must be identified.	

Annex 4 reference	*Details*	*Drafting Illustration*
9.9	**Aeronautical data**	
9.9.1	Aerodromes	
9.9.1.1	The aerodrome of departure must be shown by the runway pattern.	
9.9.1.2	All aerodromes which affect the designated standard departure route — instrument must be shown and identified. Where appropriate, the aerodrome runway patterns must be shown.	
9.9.2	Prohibited, restricted and danger areas Prohibited, restricted and danger areas which may affect the execution of the procedures must be shown with their identification and vertical limits. The depiction of prohibited, restricted and danger areas must not obliterate procedural information. If necessary to reduce chart clutter, a half-tone screen of approximately 40 per cent may be used to subdue the portrayal of prohibited, restricted and danger areas. See also Chapter 7 — General Specifications, Annex 4 reference 2.13. The “nationality letters” part of the identification of these areas may be omitted. Nationality letters are those contained in Doc 7910 — *Location Indicators*.	
9.9.3	Minimum sector altitude	
9.9.3.1	The established minimum sector altitude (MSA), based on a navigation aid associated with the procedure, must be shown with a clear indication of the sector to which it applies. Annex 4, Appendix 2 provides a specific symbol for MSA portrayal. The MSA symbol is intended to be modified to reflect particular sector shapes. It is to be presented in an easily readable size and accompanied by appropriate text as illustrated. The optimum location for the MSA symbol is in the top right area of the chart.	

Annex 4 reference	*Details*	*Drafting Illustration*
9.9.3.2	Where the MSA has not been established, the chart must be drawn to scale, and AMA must be shown within quadrilaterals formed by the parallels and meridians. The AMA must also be shown in those parts of the chart not covered by the MSA. Depending on the selected chart scale, quadrilaterals formed by the parallels and meridians normally correspond to the half-degree of latitude and longitude. An AMA represents the lowest altitude to be used under instrument meteorological conditions (IMC) that will provide a minimum clearance of 300 m (1 000 ft), or in a designated mountainous area 600 m (2 000 ft), above all obstacles located in the quadrilateral. A mountainous area is defined as an area of changing terrain profile where the changes of terrain elevation exceed 900 m (3 000 ft) within a distance of 18.5 km (10.0 NM). AMA figures are printed in black and shown in two sizes of figures, the larger representing units of thousands of metres (feet) and the smaller, units of tens of metres (hundreds of feet in the case of a chart using feet). The figures are to be positioned in the central area of each quadrilateral and to avoid conflict with procedural information. The AMA figure applies to the entire quadrilateral even if only a portion of the quadrilateral is shown within the coverage of the chart.	 AMA figure examples On chart using metres 060 = 600 m 123 = 1 230 m 126 = 1 260 m On chart using feet 20 = 2 000 ft 22 = 2 200 ft 122 = 12 200 ft
9.9.4	Air traffic services system	
9.9.4.1	The components of the established relevant air traffic services system must be shown.	*See specimen chart 7*
9.9.4.1.1	The components must comprise the following: a) a graphic portrayal of each standard departure 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;	

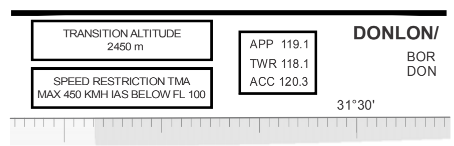
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>5) minimum obstacle clearance altitudes, along the route or route segments and altitudes required by the procedure to the nearest higher 50 m or 100 ft and flight level restrictions where established. Specific Annex 4 symbology for minimum altitudes is shown at the right;</td><td>
<table>
<tr><td>Altitude/flight level “window”</td><td>$\overline{17\ 000}$
$\underline{10\ 000}$</td><td>$\overline{FL\ 220}$
$\underline{10\ 000}$</td></tr>
<tr><td>“At or above” altitude/flight level</td><td>$\underline{7\ 000}$</td><td>$\underline{FL\ 70}$</td></tr>
<tr><td>“At or below” altitude/flight level</td><td>$\overline{5\ 000}$</td><td>$\overline{FL\ 50}$</td></tr>
<tr><td>“Mandatory” altitude/flight level</td><td>$\overline{\underline{3\ 000}}$</td><td>$\overline{\underline{FL\ 30}}$</td></tr>
<tr><td>“Recommended” procedure altitude/flight level</td><td>5 000</td><td>FL 50</td></tr>
<tr><td>“Expected” altitude</td><td>Expect 5 000</td><td>Expect FL 50</td></tr>
</table>
</td></tr>
<tr><td></td><td>6) 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;</td><td>
</td></tr>
<tr><td></td><td>Where ATS surveillance is used to vector aircraft to or from significant points on a published standard departure route, the radar procedures may be shown on the Standard Departure Chart — Instrument (SID) — ICAO unless excessive chart clutter will result.</td><td></td></tr>
<tr><td></td><td>Where excessive chart clutter will result, an ATC Surveillance Minimum Altitude Chart — ICAO may be provided (see Section 7.21), 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.</td><td>See specimen chart 14</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
	b) the radio navigation aid(s) associated with the route(s) including: 1) plain language name; 2) identification and Morse code; 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); The Morse code for the identification may also be shown. Text boxes associated with radio navigation aids should be of a size consistent with the information contained therein. In the text box, the radio navigation aid name, frequency and identification may be emphasized by bold text. Lead lines are to be used in congested areas to position the boxes for optimum readability;	
	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. The transition altitude may be prominently shown as "boxed text" at the top centre of the chart;	

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>f) the position and height of close-in obstacles which penetrate the obstacle identification surface (OIS). A note must be included whenever close-in obstacles penetrating the OIS exist but were not considered for the published procedure design gradient. In cases where detailed information on close-in obstacles would create chart clutter, a reference may be made to the associated aerodrome obstacle chart.

In accordance with the PANS-OPS, Volume II, information on close-in obstacles is provided by the procedures specialist.</td><td>CLOSE-IN OBSTACLES
RWY 27 -Trees 44m HGT,
243 m from departure end

or

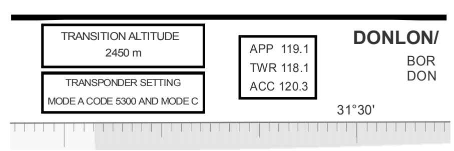
CLOSE-IN OBSTACLES
SEE AOC AD....</td></tr>
<tr><td></td><td>g) area speed restrictions, where established. This information may be included with the transition altitude, or if space does not permit, shown as a separate note within the chart neat lines;</td><td>
</td></tr>
<tr><td></td><td>h) the designation of the navigation specification(s) including any limitations, where established;</td><td></td></tr>
<tr><td></td><td>i) all compulsory and “on-request” reporting points;</td><td><table>
<tr><td rowspan="2">Reporting point (REP)</td><td>Compulsory</td><td>▲</td></tr>
<tr><td>On request</td><td>△</td></tr>
<tr><td rowspan="2">ATS/MET reporting point (MRP)</td><td>Compulsory</td><td>▲</td></tr>
<tr><td>On request</td><td>△</td></tr>
</table></td></tr>
<tr><td></td><td>j) radio communication procedures, including:

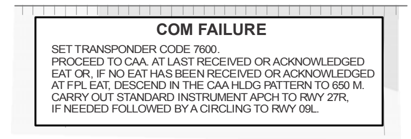
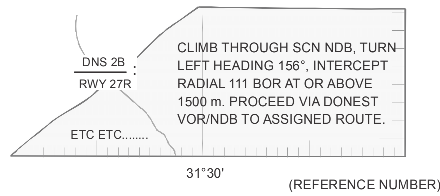
1) call sign(s) of ATS unit(s);

2) frequency;

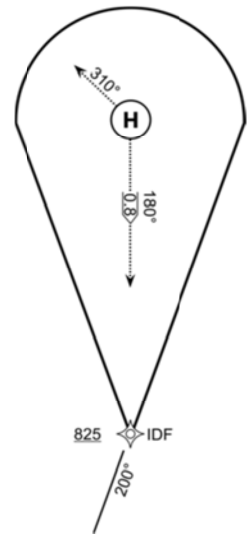
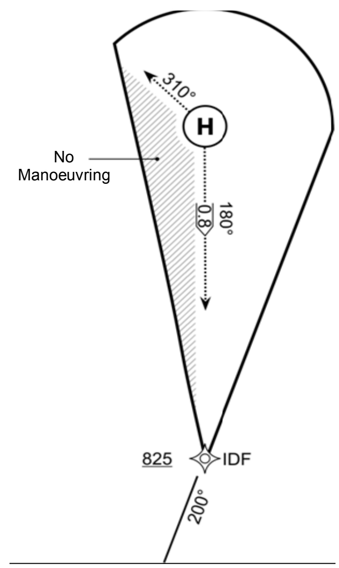
3) transponder setting, where appropriate;

These may be shown in the top left area of the chart.

k) an indication of “flyover” significant points.</td><td>
</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
9.9.4.2	A textual description of standard departure route(s) — instrument (SID) and communication failure procedures in relation to radar control should be provided and should, whenever feasible, be shown on the chart or on the same page which contains the chart. Communication failure procedures are ideally shown near the listing of communication facilities. In some cases it may not be feasible to include these descriptions and procedures on the face of the chart due to chart clutter or the necessity for a small text size which would compromise readability. If the information is shown on the reverse of the chart or on a separate sheet, an appropriate reference is to be provided on the face of the chart.	 
9.9.4.3	Aeronautical database requirements Appropriate data to support navigation database coding must be published in accordance with the *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168), Volume II, Part III, Section 5, Chapter 2, 2.1, on the verso of the chart or as a separate, properly referenced sheet. Appropriate data are those provided by the procedures specialist. Helicopter point-in-space (PinS) departure manoeuvring visual segment (VS) The departure manoeuvring visual segment (VS) area may be charted in an inset or on a chart separate from the departure procedure chart. The heliport and the initial departure fix (IDF) shall be charted on the departure manoeuvring segment inset. Other items included on the chart are: a) centre line(s) of the take-off climb surface, which shall be charted with a dotted line with an arrowhead. The centre line of the take-off climb surface direction shall be charted; b) the IDF minimum crossing altitude (MCA) shall be charted;	

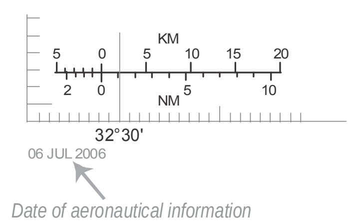
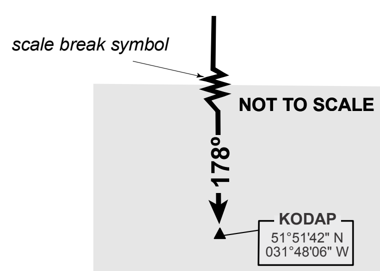
Annex 4 reference	*Details*	*Drafting Illustration*
	c) manoeuvring area boundaries without dimensions. The boundaries shall be charted as light lines; d) the track of the first segment in the instrument phase of the departure procedure shall be charted; e) all penetrations of the obstacle identification surface (OIS) shall be charted; f) the plan view shall contain a note that the procedure is for CAT H only. The information in the inset shall be depicted to scale.	
	Annotation on the Departure Procedure Chart. If the departure manoeuvring visual area inset for VS departures is depicted on a separate chart, the departure procedure chart shall contain a box note directing the pilot to the verso of the chart or a continuation sheet. There are two types of Departure Manoeuvring VS Areas: a) departure manoeuvring VS area without a “No manoeuvring” area; b) departure manoeuvring VS area with a “No manoeuvring” area.	*See specimen chart 19*

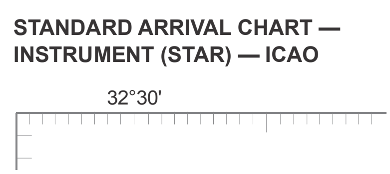
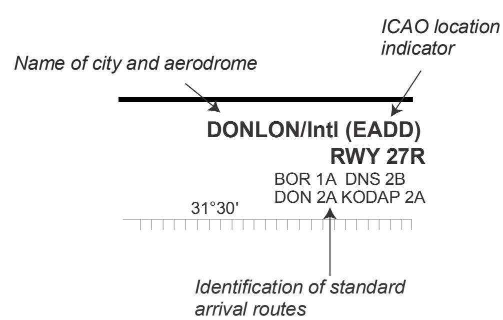
Annex 4 reference	*Details*	*Drafting Illustration*
	Depiction of Departure Manoeuvring VS Chart without a "No manoeuvring" Area. Without a "No manoeuvring" area the departure manoeuvring area is centred on the Heliport Reference Point (HRP) with no restriction as to the direction of turn.	
	Depiction of Departure Manoeuvring VS Chart with a "No manoeuvring" Area. The boundaries of the departure manoeuvring area shall be depicted along with the heliport centre line of the take-off climb surface including the direct VS departure track if one exists.	

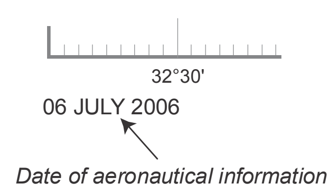
7.10 STANDARD ARRIVAL CHART — INSTRUMENT (STAR) — ICAO

Annex 4 reference	*General*
10.1	**Function** The Standard Arrival Chart — Instrument (STAR) — ICAO chart must 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. The arrival route normally begins at a specified significant point in the en-route phase and terminates at the point where an instrument approach is initiated. 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. Provisions governing the identification of standard arrival routes are in Annex 11 — *Air Traffic Services*, Appendix 3. Guidance material relating to the establishment of such routes is contained in the *Air Traffic Services Planning Manual* (Doc 9426).
10.2	**Availability** The Standard Arrival Chart — Instrument (STAR) — ICAO must be made available wherever a standard arrival route — instrument has been established and cannot be shown with sufficient clarity on the Area Chart. The assessment of the air traffic services data required to be portrayed on a Standard Arrival Chart — Instrument (STAR) — ICAO is the task of the authority responsible for air traffic services within a State, which should ensure that the cartographic agency assigned to prepare the chart is provided with necessary guidance and information. The production of the chart will require collaboration between the air traffic services procedure specialist and the cartographer. **Operational requirements** See Chapter 7 — General Specifications, Annex 4 references 2.1.1 to 2.1.8. **Planning** At the planning stage, the interrelationships between the Enroute Chart — ICAO, Area Chart — ICAO, Standard Departure Chart — Instrument (SID) — ICAO, Standard Arrival Chart — Instrument (STAR) — ICAO, Instrument Approach Chart — ICAO and Radar Minimum Altitude Chart — ICAO should be considered. The availability and complexity of those charts will influence the design of the Standard Arrival Chart — Instrument (STAR) — ICAO particularly with regard to coverage, scale and the potential for chart clutter. Annex 4, 2.1.6, specifies that the presentation of information must be designed to permit a smooth transition from chart to chart. Accordingly, the Enroute Chart — ICAO, Area Chart — ICAO, Standard Arrival Chart — Instrument (STAR) — ICAO and Instrument Approach Chart — ICAO must portray a continuous flight path with common transitional points between charts. A considerable amount of duplication, particularly in surveys and in the selection of base material, can be avoided by including requirements for all these types of charts at the planning stage of their production. Terrain and obstacle information to be shown should be selected from an electronic terrain and obstacle database (Annex 15 — *Aeronautical Information Services*, Chapter 10, refers). If suitable electronic data

Annex 4 reference	*General*
	are not available, information from up-to-date topographical charts at scales of 1:250 000 or larger may be appropriate. When developing relief portrayal for the Standard Arrival Chart — Instrument (STAR) — ICAO, and particularly in areas of significant relief, it is important to plan an integrated approach to relief portrayal on the Area Chart — ICAO, Standard Departure Chart — Instrument (SID) — ICAO and the Instrument Approach Chart — ICAO. Further information on relief portrayal for the Instrument Approach Chart — ICAO and these associated charts appears in Section 7.2.

Annex 4 reference	*Details*	*Drafting Illustration*
10.3	**Coverage and scale**	
10.3.1	The coverage of the chart must be sufficient to indicate the points where the en-route phase ends and the approach phase begins. For standard arrival routes — instrument, the en-route phase ends where the aeroplane leaves the en-route ATS route structure and the approach phase begins at the initial approach fix.	*See specimen chart 8*
10.3.2	The chart should be drawn to scale. The selected scale should provide optimum legibility consistent with the procedure shown on the chart and with the sheet size. Insets and scale-breaks may be used to maintain an appropriate scale for charts with a large area of coverage, however, these should be used judiciously and identified in compliance with 10.3.4.	
10.3.3	If the chart is drawn to scale, a scale-bar must be shown. The scale-bar may be shown in the lower left corner of the chart.	
10.3.4	When the chart is not drawn to scale, the annotation “NOT TO SCALE” must be shown. When it is necessary to show part of the chart not to scale, the symbol for scale-break must be used on tracks and other aspects of the chart that are too large to be drawn to scale. In addition, not-to-scale portions of the chart may be differentiated by a light half-tone screen overlay and annotated “NOT TO SCALE”.	

Annex 4 reference	*Details*	*Drafting Illustration*
	Format	
	The format of this chart should be in accordance with specimen chart 8.	*See specimen chart 8*
10.4	**Projection**	
10.4.1	A conformal projection on which a straight line approximates a great circle should be used. A Lambert Conic Conformal Projection is well suited as a basis for this type of chart. The projection type need not be indicated on the chart.	*See specimen chart 8*
10.4.2	When the chart is drawn to scale, parallels and meridians should be shown at suitable intervals. In specimen chart 8, the parallels and meridians are shown at thirty-minute intervals.	*See specimen chart 8*
10.4.3	Graduation marks must be placed at consistent intervals along the neat lines. In specimen chart 8, graduation marks have been placed at one-minute intervals with extended graduation marks every ten minutes. Parallels, meridians and graduation marks may be screened for a subdued presentation.	*See specimen chart 8*
2.2	**Title**	
	The title must be “Standard Arrival Chart — Instrument (STAR) — ICAO”. Such title must not include “ICAO” unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 10. The chart title is placed at the top left corner of the chart in bold upper-case type.	
10.5	**Identification**	
	The chart must be identified by the name of the city or town, or area, that the aerodrome serves, the name of the aerodrome, and the identification of the standard arrival route(s) — instrument as established in accordance with the *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168), Volume II, Part I, Section 4, Chapter 2. The identification of the standard arrival route(s) — instrument is provided by the procedures specialist.	

Annex 4 reference	*Details*	*Drafting Illustration*
	The ICAO location indicator may also be included with the name of the aerodrome. The chart identification is placed at the top right corner of the chart in bold upper-case type.	
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on specimen chart 8. In accordance with Annex 4, 2.3.3 and 2.3.4, as this type of chart is published as part of the Aeronautical Information Publication (AIP) or a related aeronautical document, the legend to the symbols and abbreviations used and the address of the producing agency must be placed in the front of the AIP. (See Annex 15, Appendix 1, GEN 2.2, GEN 2.3 and GEN 3.2 for specific placement in the AIP.)	*See specimen chart 8*
2.4	**Symbols** See Chapter 7 — General Specifications and Annex 4, Appendix 2.	
2.5	**Units of measurement** See Chapter 7 — General Specifications. The descriptions of units of measurement used may be grouped together in the upper left corner of the chart.	
2.7	**Date of validity of aeronautical information** See Chapter 7 — General Specifications. The date of aeronautical information is shown at the bottom left corner of the chart outside the neat line. A day/month/year format (e.g. 06 JUL 2006), using abbreviations from the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400), is appropriate.	
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications.	

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td>2.9</td><td>Abbreviations

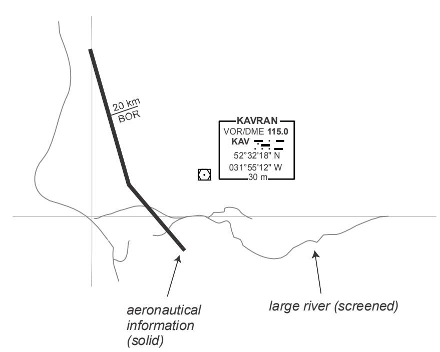
See Chapter 7 — General Specifications.</td><td></td></tr>
<tr><td>2.10</td><td>Political boundaries

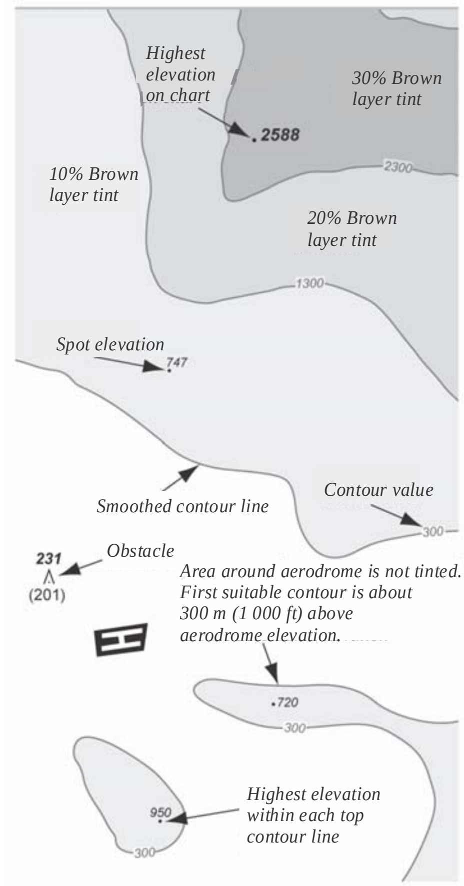
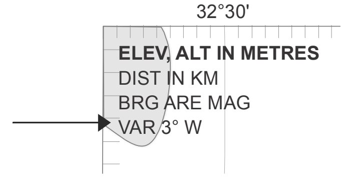
See Chapter 7 — General Specifications. International boundaries must be portrayed with the Annex 4, Appendix 2, symbol number 63 and labelled with country names. Unless of special importance, this information may be subdued by a half-tone screen of about 30 per cent.</td><td>
</td></tr>
<tr><td>2.11</td><td>Colours

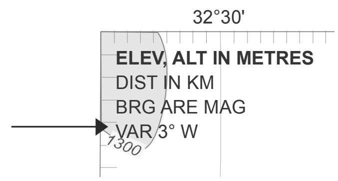
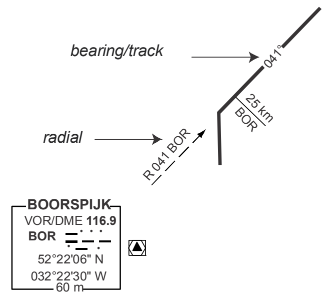
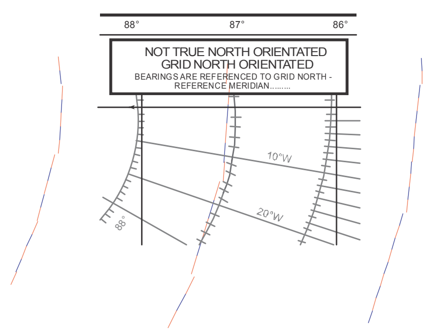
Colours used on charts should conform to the Colour Guide in Annex 4, Appendix 3.

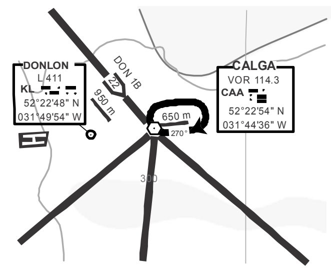
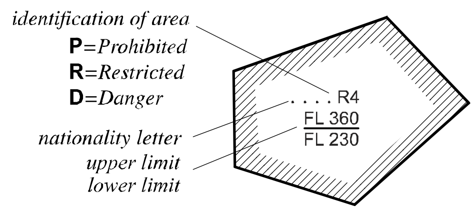
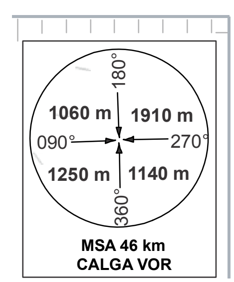
The chart should be produced in two colours, except that one colour will suffice when there is no information to provide on relief and obstacles. Charts should be printed on a good quality paper, preferably white, using brown for relief if shown (see also Annex 4 reference 10.6.2) and black for all other elements.

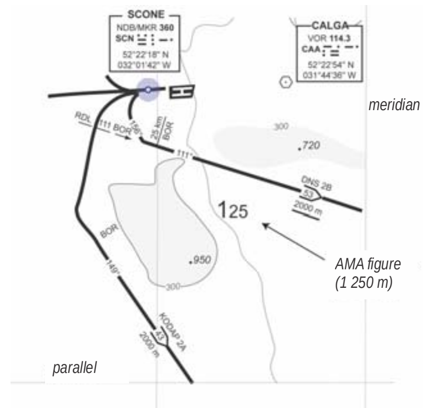
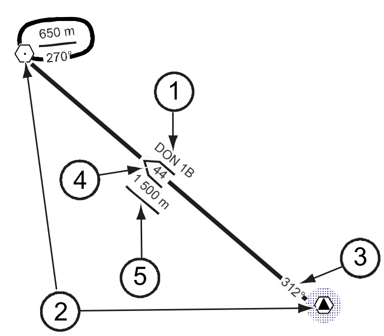
The use of selected percentage screens, either fine dots or light rulings, will provide visual separation for such elements as water areas or built-up areas.</td><td>See specimen chart 8</td></tr>
<tr><td>2.16</td><td>Typography

For samples of type suitable for use on charts, see Chapter 7 — General Specifications.</td><td></td></tr>
<tr><td>10.6</td><td>Culture and topography</td><td></td></tr>
<tr><td>10.6.1</td><td>Where the chart is drawn to scale, generalized shore lines of all open water areas, large lakes and rivers must be shown except where they conflict with data more applicable to the function of the chart. Significant topographical and cultural features may be selected to facilitate the transition from instrument flight to visual flight. On specimen chart 8, aside from relief, the only features shown are some major rivers. These rivers are screened so as not to conflict with aeronautical information.</td><td>
</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
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. 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 the Colour Guide in Annex 4, Appendix 3. Appropriate spot elevations, including the highest elevation within each top contour line, should be shown printed in black. The highest elevation on the chart may be emphasized by larger bold or “boxed” type in accordance with Annex 4, Appendix 2, symbol number 12. Obstacles should also be shown, using the correct symbol selected from Annex 4, Appendix 2, Obstacles, and printed in the colour used for aeronautical information. Appropriate spot elevations and obstacles are those provided by the procedures specialist. It is essential that relief portrayal on the Standard Arrival Chart — Instrument (STAR) — ICAO be designed as a subdued presentation so as not to interfere with readability of procedural information or create chart clutter. A harmonized portrayal of relief between the area chart and associated SID, STAR and instrument approach charts is also important. Further guidance is given in Chapter 7 — General Specifications, Portrayal of relief on the Instrument Approach Chart — ICAO and other relevant charts.	**AERODROME ELEV 30m**  *See specimen chart 8 for colour illustration.*
10.7	**Magnetic variation** The magnetic variation used in determining the magnetic bearings, tracks and radials must be shown to the nearest degree. This information may be grouped with the indication of units of measurement at the upper left corner of the chart. See also Chapter 7 — General Specifications, Annex 4 references 2.15.1 and 2.15.2.	

Annex 4 reference	*Details*	*Drafting Illustration*
10.8	**Bearings, tracks and radials**	
10.8.1	Bearings, tracks and radials must be magnetic, except as provided for in 10.8.2. Where bearings and tracks are additionally provided as true values for RNAV segments, they must be shown in parentheses to the nearest tenth of a degree, e.g. 290° (294.9°T). A note to this effect may be grouped with the indication of units of measurement at the upper left corner of the chart.	
	Bearing and track values are to be shown using three digits and a degree sign (e.g. 041°E). Radial values are to be indicated by three digits preceded by the letter and followed by the identification of the facility (e.g. R 041 BOR). A degree sign is not shown with radial values	
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 must be clearly indicated. When Grid North is used its reference grid meridian must be identified.	
10.9	**Aeronautical data**	
10.9.1	Aerodromes	
10.9.1.1	The aerodrome of landing must be shown by the runway pattern.	

Annex 4 reference	*Details*	*Drafting Illustration*
10.9.1.2	All aerodromes which affect the designated standard arrival route — instrument must be shown and identified. Where appropriate the aerodrome runway patterns must be shown.	
10.9.2	Prohibited, restricted and danger areas Prohibited, restricted and danger areas which may affect the execution of the procedures must be shown with their identification and vertical limits. The depiction of prohibited, restricted and danger areas must not obliterate procedural information. If necessary to reduce chart clutter, a half-tone screen of approximately 40 per cent may be used to subdue the portrayal of prohibited, restricted and danger areas. See also Chapter 7 — General Specifications, Annex 4 reference 2.13. The “nationality letters” part of the identification of these areas may be omitted. Nationality letters are those contained in Doc 7910 — *Location Indicators*.	
10.9.3	Minimum sector altitude	
10.9.3.1	The established minimum sector altitude (MSA), based on a navigation aid associated with the procedure, must be shown with a clear indication of the sector to which it applies. Annex 4, Appendix 2 provides a specific symbol for MSA portrayal. The MSA symbol is intended to be modified to reflect particular sector shapes. It is to be presented in an easily readable size and accompanied by appropriate text as illustrated. The optimum location for the MSA symbol is in the top right area of the chart.	

Annex 4 reference	*Details*	*Drafting Illustration*
10.9.3.2	Where the MSA has not been established, the chart must be drawn to scale, and AMA must be shown within quadrilaterals formed by the parallels and meridians. The AMA must also be shown in those parts of the chart not covered by the MSA. Depending on the selected chart scale, quadrilaterals formed by the parallels and meridians normally correspond to the half-degree of latitude and longitude. An AMA represents the lowest altitude to be used under instrument meteorological conditions (IMC) that will provide a minimum clearance of 300 m (1 000 ft), or in a designated mountainous area 600 m (2 000 ft), above all obstacles located in the quadrilateral. A mountainous area is defined as an area of changing terrain profile where the changes of terrain elevation exceed 900 m (3 000 ft) within a distance of 18.5 km (10.0 NM). AMA figures are printed in black and are shown in two sizes of figures, the larger representing units of thousands of metres (feet) and the smaller, units of tens of metres (hundreds of feet in the case of a chart using feet). The figures are to be positioned in the central area of each quadrilateral and to avoid conflict with procedural information. The AMA figure applies to the entire quadrilateral even if only a portion of the quadrilateral is shown within the coverage of the chart.	 AMA figure examples On chart using metres 060 = 600 m 123 = 1 230 m 126 = 1 260 m On chart using feet 20 = 2 000 ft 22 = 2 200 ft 122 = 12 200 ft
10.9.4	Air traffic services system	
10.9.4.1	The components of the established relevant air traffic services system must be shown.	*See specimen chart 8*
10.9.4.1.1	The components must 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;	 

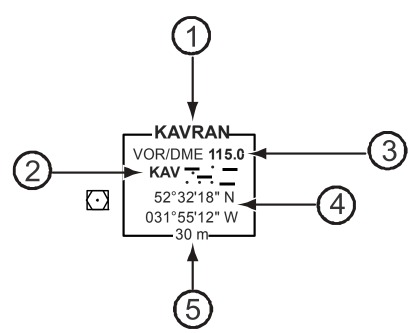
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>5) minimum obstacle clearance altitudes, along the route or route segments and altitudes required by the procedure to the nearest higher 50 m or 100 ft and flight level restrictions where established. Specific Annex 4 symbology for minimum altitudes is shown at the right;</td><td>
<table>
<tr><td>Altitude/flight level “window”</td><td>17 000
10 000</td><td>FL 220
10 000</td></tr>
<tr><td>“At or above” altitude/flight level</td><td>7 000</td><td>FL 70</td></tr>
<tr><td>“At or below” altitude/flight level</td><td>5 000</td><td>FL 50</td></tr>
<tr><td>“Mandatory” altitude/flight level</td><td>3 000</td><td>FL 30</td></tr>
<tr><td>“Recommended” procedure altitude/flight level</td><td>5 000</td><td>FL 50</td></tr>
<tr><td>“Expected” altitude</td><td>Expect 5 000</td><td>Expect FL 50</td></tr>
</table>
</td></tr>
<tr><td></td><td>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;</td><td>
</td></tr>
<tr><td></td><td>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 MSA during arrival, the radar procedures may be shown on the Standard Arrival Chart — Instrument (STAR) — ICAO unless excessive chart clutter will result.</td><td></td></tr>
<tr><td></td><td>Where excessive chart clutter will result, an ATC Surveillance Minimum Altitude Chart — ICAO may be provided (see Section 7.21), 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.</td><td>See specimen chart 14</td></tr>
<tr><td></td><td>b) the radio navigation aid(s) associated with the route(s) including:

1) plain language name;

2) identification and Morse code;

3) frequency;

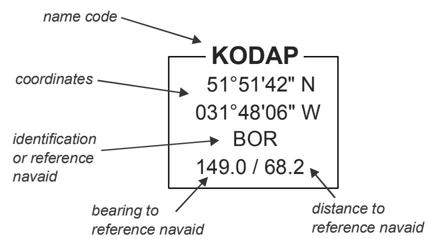
4) geographical coordinates in degrees, minutes and seconds;

5) for DME, the channel and the elevation of the transmitting antenna of the DME to the nearest 30 m (100 ft);</td><td>
</td></tr>
</table>

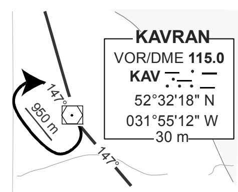
Annex 4 reference	Details	Drafting Illustration

The Morse code for the identification may also be shown. Text boxes associated with radio navigation aids should be of a size consistent with the information contained therein. In the text box, the radio navigation aid name, frequency and identification may be emphasized by bold text. Lead lines are to be used in congested areas to position the boxes for optimum readability;

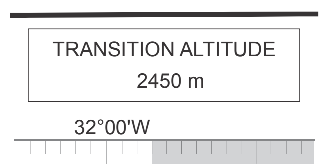
c) the name-codes of the significant points not marked by the position of a radio navigation aid, their geographical coordinates in degrees, minutes and seconds and the bearing to the nearest tenth of a degree and distance to the nearest two-tenths of a kilometre (tenth of a nautical mile) from the reference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



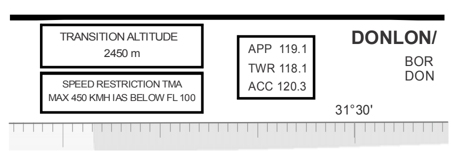
d) applicable holding patterns;



e) transition altitude/height to the nearest higher 300 m or 1 000 ft. The transition altitude may be prominently shown as “boxed text” at the top centre of the chart;



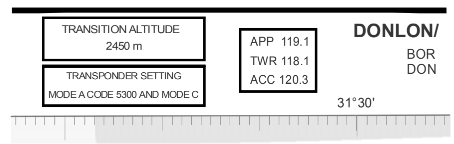
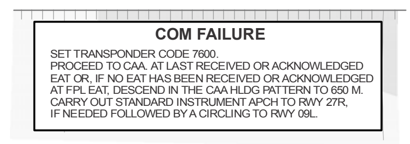
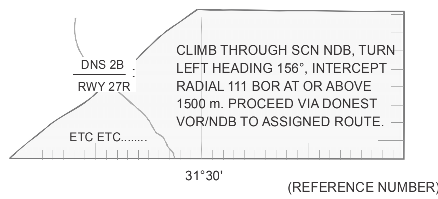
f) area speed restrictions, where established. This information may be included with the transition altitude, or if space does not permit, shown as a separate note within the chart neat lines;



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

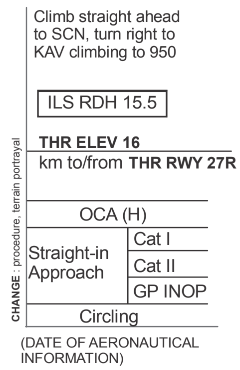
h) all compulsory and “on-request” reporting points;

Reporting point (REP)	Compulsory	▲
	On request	△
ATS/MET reporting point (MRP)	Compulsory	$\boxed{\blacktriangle}$
	On request	$\boxed{\triangle}$

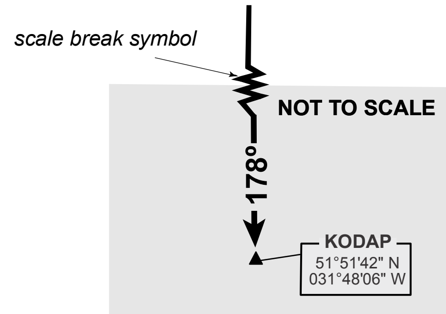
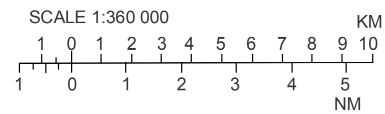
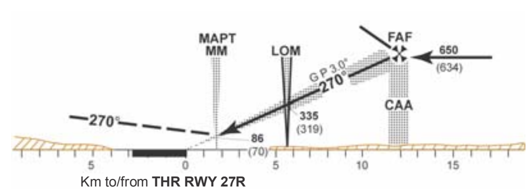
Annex 4 reference	*Details*	*Drafting Illustration*
	i) radio communication procedures, including: 1) call sign(s) of ATS unit(s); 2) frequency; 3) transponder setting, where appropriate. These may be shown in the top left area of the chart.	
	j) an indication of “flyover” significant waypoints.	
10.9.4.2	A textual description of standard arrival route(s) — instrument (STAR) and relevant communication failure procedures in relation to radar control should be provided and should, whenever feasible, be shown on the chart or on the same page which contains the chart. In some cases it may not be feasible to include these descriptions and procedures on the face of the chart due to chart clutter or the necessity for a small text size which would compromise readability. If the information is shown on the reverse of the chart or on a separate sheet, an appropriate reference is to be provided on the face of the chart.	 
10.9.4.3	Aeronautical database requirements Appropriate data to support navigation database coding must be published in accordance with the *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168), Volume II, Part III, Section 5, Chapter 2, 2.2, on the verso of the chart or as a separate, properly referenced sheet. *Note.— Appropriate data are those provided by the procedures specialist.*	

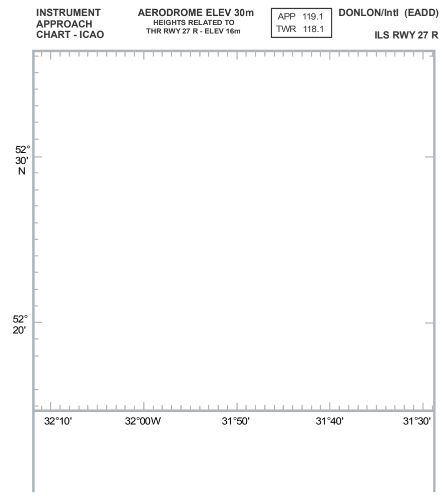
7.11 INSTRUMENT APPROACH CHART — ICAO

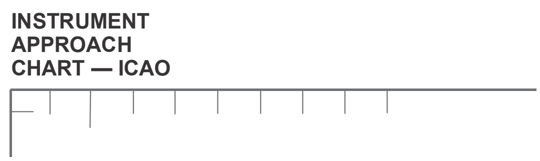
Annex 4 reference	*General*
11.1	**Function**
	The primary function to be satisfied by this type of chart is to provide flight crews with information which will enable them to fly an approved instrument approach procedure to the runway of intended landing including the missed approach procedure and, where applicable, the associated holding patterns.
	Normally, the authority responsible for the development of instrument approach procedures will have been guided by the *Procedures for Air Navigation Services — Aircraft Operations*, (PANS-OPS, Doc 8168) Volume II, *Construction of Visual and Instrument Flight Procedures*. It contains the basic guidelines to the procedures specialist who provides the cartographer with a textual/diagrammatic description of the instrument approach procedure. The procedures specialist will have been guided also by the *Instrument Flight Procedures Construction Manual* (Doc 9368), which deals with the implementation of procedures defined in the PANS-OPS. The criteria and examples in these two documents will be useful to the cartographer in understanding such procedures, visualizing their application and understanding what information is to be supplied by the procedures specialist to the cartographer for charting and associated publication. There should be a functional collaboration between the procedures specialist and the cartographer to ensure that the published charted procedures accord with relevant ICAO documents, both for procedure design and charting.
11.2	**Availability**
11.2.1	The Instrument Approach Chart — ICAO must 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 and 11.2.3	A separate instrument approach chart normally must be provided for each precision approach and procedure established by the State. Furthermore, a separate instrument approach chart normally must be provided for each non-precision approach procedure established by the State. 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.
2.1.6	In compliance with Annex 4, paragraph 2.1.6, the Instrument Approach Chart — ICAO must permit a smooth transition from the Area Chart — ICAO or Standard Arrival Chart — Instrument (STAR) — ICAO, as appropriate. There must be no gaps between the charted procedures, and overlaps of procedural track information should be avoided.
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 must be provided. Information on categories of aircraft is included in the PANS-OPS, Volume II, Part I, Section 4, Chapter 1.

Annex 4 reference	*General*
11.2.5	Instrument approach charts must be revised whenever information essential to safe operation becomes out of date. An indication of what information has changed from the previous publication of the chart may be stated along the lower left neat line as illustrated here. 
	Operational requirements See Chapter 7 — General Specifications, Annex 4 references 2.1.1 to 2.1.8. **Planning** At the planning stage, consideration should be given to the interrelationship between this type of chart, the Area Chart — ICAO, Standard Arrival Chart — Instrument (STAR) — ICAO, Standard Departure Chart — Instrument (SID) — ICAO, Visual Approach Chart — ICAO, and Aerodrome Obstacle Charts — ICAO. A considerable amount of duplication, particularly in surveys and in the selection of base material can be avoided by including requirements for all these types of charts at the planning stage of production. Terrain and obstacle information to be shown should be selected from an electronic terrain and obstacle database (Annex 15 — *Aeronautical Information Services*, Chapter 10, refers). If suitable electronic data are not available, information from up-to-date topographical charts at scales of 1:250 000 or larger may be appropriate. When developing relief portrayal for the Instrument Approach Chart — ICAO, and particularly in areas of significant relief, it is important to plan an integrated approach to relief portrayal on the Area Chart — ICAO or, if appropriate, on the Standard Departure Chart — Instrument (SID) — ICAO and the Standard Arrival Chart — Instrument (STAR) — ICAO. Further information on relief portrayal for the Instrument Approach Chart — ICAO and these associated charts appears in Section 7.2.

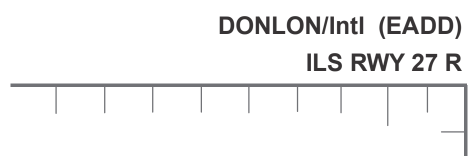
Annex 4 reference	*Details*	*Drafting Illustration*
11.3	**Coverage and scale**	
11.3.1	The coverage of the chart must be sufficient to include all segments of the instrument approach procedure and such additional areas as may be necessary for the type of approach intended. The chart is normally centred to include a depiction of the procedure from the initial approach fix to the aerodrome and including the missed approach track.	*See specimen chart 9*

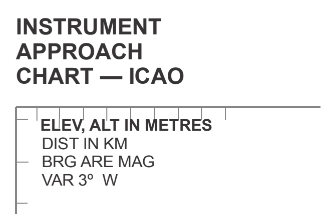
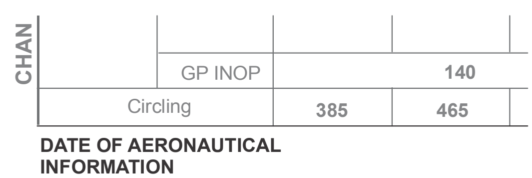
Annex 4 reference	*Details*	*Drafting Illustration*
11.3.2	The scale selected must ensure optimum legibility consistent with the procedure shown on the chart and with the sheet size. In exceptional cases, to provide a scale for optimum legibility it may be necessary to show a part of the chart not to scale. Where this occurs, the symbol for scale-break must be used on tracks and other aspects which are not to scale. In addition, not-to-scale portions of the chart may be differentiated by a light half-tone screen overlay and annotated “NOT TO SCALE”.	
11.3.3	A scale indication must be shown. This is normally displayed on the plan view as both a representative fraction and as a bar scale showing kilometres and nautical miles.	
11.3.3.1	Except where it is not practicable to do so, 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, must be shown. Its radius must be indicated on the circumference. The distance circle is generally shown by a solid thin black line which may be broken or over printed with procedural information.	*See specimen chart 9*
11.3.3.2	A distance scale should be shown directly below the instrument procedure profile and be annotated to indicate its reference point (e.g. km to/from THR RWY 27R). The profile distance scale will not necessarily be the same scale shown on the plan view.	
11.4	**Format**	
	The format should be in accordance with specimen chart 9, and the sheet size should be 210 × 148 mm (8.27 × 5.82 in).	*See specimen chart 9*
11.5	**Projection**	
11.5.1	A conformal projection on which a straight line approximates a great circle must be used. A Lambert Conic Conformal Projection is well suited as a basis for this type of chart. The projection type need not be indicated on the chart.	

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td>11.5.2</td><td>Graduation marks should be placed at consistent intervals along the neat lines. In specimen chart 9, graduation marks have been placed at one-minute intervals with extended graduation marks every ten minutes. Graduation marks may be screened or presented in a fine line weight. They may be identified only on the bottom and left neat lines.</td><td>
</td></tr>
<tr><td>2.2</td><td>Title

The title must be “Instrument Approach Chart — ICAO”. Such title must not include “ICAO” unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 11. The chart title is placed at the top left corner of the chart in bold upper case type.</td><td>
</td></tr>
<tr><td>11.6</td><td>Identification

The chart must be identified by the name of the city or town, or area, that the aerodrome serves, the name of the aerodrome and the identification of the instrument approach procedure as established in accordance with the PANS-OPS, Volume II, Part I, Section 4, Chapter 9.

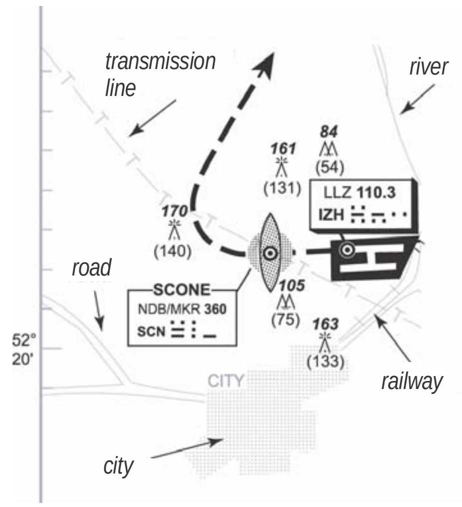
Proper and standardized chart identification is important to avoid ambiguity between titles shown on paper charts, in electronic cockpit displays and in clearances issued by air traffic control. The procedures specialist is the most appropriate person to provide this standardized identification information. The ICAO location indicator may also be included with the name of the aerodrome. The chart identification is placed at the top right corner of the chart in bold upper-case type.</td><td>
</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on specimen chart 9. See also Chapter 7 — General Specifications. In accordance with Annex 4, 2.3.3 and 2.3.4, as this type of chart is published as part of the Aeronautical Information Publication (AIP) or a related aeronautical document, the legend to the symbols and abbreviations used and the address of the producing agency must be placed in the front of the AIP. Annex 15, Appendix 1, GEN 2.2, GEN 2.3 and GEN 3.2 provides for specific placement in the AIP.	*See specimen chart 9*
2.4	**Symbols** See Chapter 7 — General Specifications and Annex 4, Appendix 2.	
2.5	**Units of measurement** See Chapter 7 — General Specifications. The descriptions of units of measurement used may be grouped together in the upper left corner of the chart.	
2.7	**Date of validity of aeronautical information** See Chapter 7 — General Specifications. The date of aeronautical information is shown at the bottom left corner of the chart outside the neat line. A day/month/year format using abbreviations (e.g. 06 JUL 2006) from the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS-ABC, Doc 8400) is appropriate.	
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications.	

Annex 4 reference	*Details*	*Drafting Illustration*
2.9	**Abbreviations** See Chapter 7 — General Specifications. Due to the small sheet size of this chart type and the typical high density of information, the use of abbreviations is particularly appropriate to reduce chart clutter.	
2.10	**Political boundaries** See Chapter 7 — General Specifications. International boundaries must be portrayed with the Annex 4, Appendix 2, symbol number 63 and labelled with country names. Unless of special importance, this information may be subdued by a half-tone screen of about 30 per cent.	
2.11	**Colours** The chart should be produced in two colours, except that one colour may be sufficient when information on relief is not provided in accordance with Annex 4, 11.7.2 or 11.7.3. Charts should be printed on a good quality paper, preferably white, using brown for relief and black for all other elements. A brown colour suitable for contours and topographic features is specified in the Colour Guide in Annex 4, Appendix 3. The use of selected percentage screens, either fine dots or light rulings, will provide visual separation for such elements as water areas or built-up areas.	*See specimen chart 9*
2.16	**Typography** For samples of type suitable for use on charts, see Chapter 7 — General Specifications.	

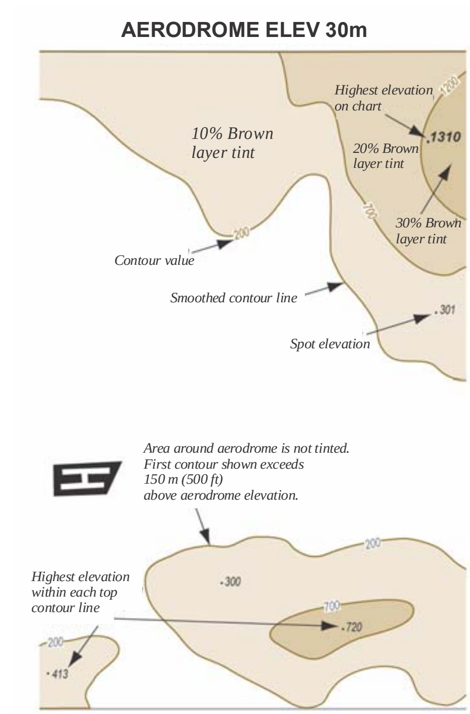
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td>11.7</td><td>Culture and topography</td><td></td></tr>
<tr><td>11.7.1</td><td>Culture and topographic information pertinent to the safe execution of the instrument approach procedure, including the missed approach procedure, associated holding procedures and visual manoeuvring (circling) procedure when established, must be shown. Topographic information must be named only when necessary to facilitate the understanding of such information. The minimum must be a delineation of land masses and significant lakes and rivers.

The careful selection of culture and topographic features and their portrayal in a subdued manner is important to avoid chart clutter and to ensure that procedural information is prominent. To create the desired subdued portrayal, a half-tone screen of about 30 per cent may be appropriate.</td><td>



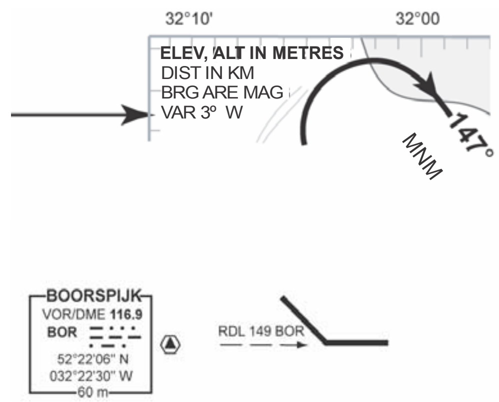
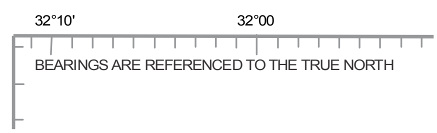
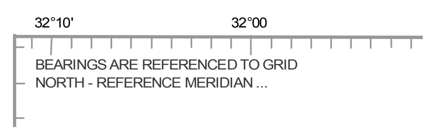
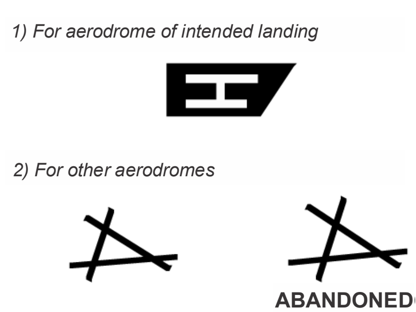
</td></tr>
<tr><td>11.7.2</td><td>Relief must be shown in a manner best suited to the particular elevation characteristics of the area. In areas where relief exceeds 1 200 m (4 000 ft) above the aerodrome elevation within the coverage of the chart or 600 m (2 000 ft) within 11 km (6 NM) of the aerodrome reference point, or when the 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 must be shown by smoothed contour lines, contour values and layer tints printed in brown.

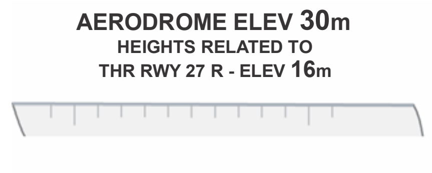
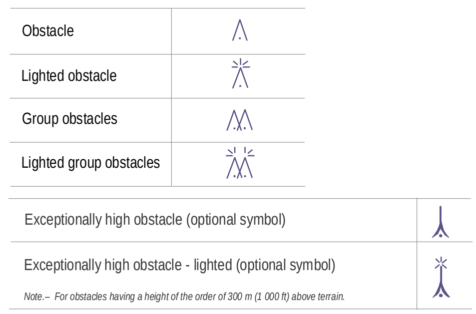
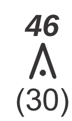
Appropriate spot elevations, including the highest elevation within each top contour line, must also be shown printed in black. The highest elevation on the chart may be emphasized by larger bold or “boxed” type in accordance with Annex 4, Appendix 2, symbol number 12. Appropriate spot elevations are those provided by the procedures specialist. 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 the Colour Guide in Annex 4, Appendix 3 for contours and topographic features. See specimen chart 9 for colour illustration.</td><td>

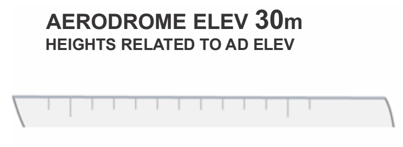
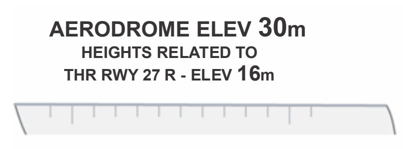


See specimen chart 9 for colour illustration</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
	It is essential that relief portrayal on the Instrument Approach Chart — ICAO be designed as a subdued presentation so as not to interfere with readability of procedural information or create chart clutter. A harmonized portrayal of relief between all instrument approach charts to the same aerodrome and associated SID, STAR and area charts is also important. Further guidance is given at Chapter 7 — General Specifications, Portrayal of relief on the Instrument Approach Chart — ICAO and other relevant charts.	
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. Being the same portrayal method as 11.7.2 above, this recommendation promotes the standardization of relief portrayal on instrument approach charts for all aerodromes and should be a planned objective.	
11.8	**Magnetic variation**	
11.8.1	Magnetic variation should be shown to the nearest degree. This information may be grouped with the indication of units of measurement at the upper left corner of the chart. See also Chapter 7 — General Specifications, Annex 4 references 2.15.1 and 2.15.2.	
11.8.2	When shown, the value of the variation must agree with that used in determining magnetic bearing, tracks and radials.	

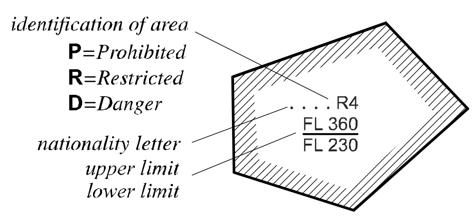
Annex 4 reference	*Details*	*Drafting Illustration*
11.9	**Bearings, tracks and radials**	
11.9.1	Bearings, tracks and radials must be magnetic, except as provided for in areas of high latitude. Where bearings and tracks are additionally provided as true values for RNAV segments, they shall be shown in parentheses to the nearest tenth of a degree, e.g. 290° (294.9°T). A note to this effect may be grouped with the indication of units of measurement at the upper left corner of the chart. Bearing and track values are to be shown using three digits and a degree sign (e.g. 061°). Radial values are to be indicated by three digits preceded by the letter and followed by the identification of the facility (e.g. R 090 BOR). A degree sign is not shown with radial values.	
11.9.2	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.	
11.9.3	Where bearings, tracks and radials are given with reference to True North or Grid North, this must be clearly indicated. When Grid North is used its reference grid meridian must be identified.	
11.10	**Aeronautical data**	
11.10.1	Aerodromes	
11.10.1.1	All aerodromes which show a distinctive pattern from the air must be shown by the appropriate symbol. Abandoned aerodromes must be identified as abandoned.	
11.10.1.2	The runway pattern, at a scale sufficiently large to show it clearly, must 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.	

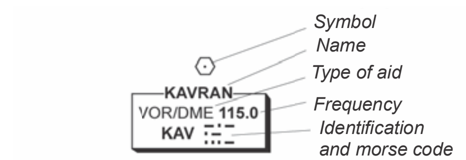
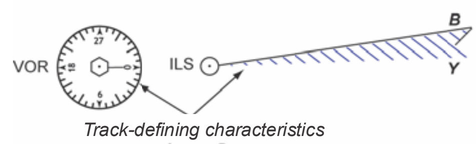
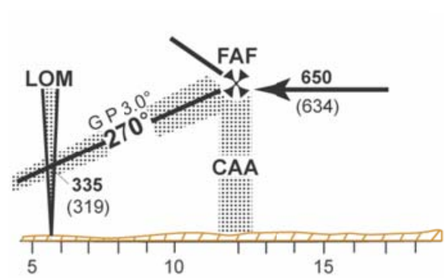
Annex 4 reference	*Details*	*Drafting Illustration*
11.10.1.3	The aerodrome elevation must be shown to the nearest metre or foot in a prominent position on the chart. On specimen chart 9, it is depicted next to the chart title in bold upper-case type.	
11.10.1.4	The threshold elevation or, where applicable, the highest elevation of the touchdown zone, must be shown to the nearest metre or foot. This may be depicted in a less prominent manner under the aerodrome elevation.	
11.10.2	Obstacles	
11.10.2.1	Obstacles must be shown on the plan view of the chart using the correct obstacle symbol selected from Annex 4, Appendix 2, Obstacles. A careful selection of obstacles, based on the procedure design, is required to provide appropriate information and yet avoid chart clutter. Appropriate obstacles are to be provided to the cartographer by the procedures specialist. Further information on the portrayal of obstacles is given in Chapter 7 — General Specifications, Section 7.2.	
11.10.2.2	If one or more obstacles are the determining factor of an obstacle clearance altitude/height, those obstacles should be identified. This may be achieved by using a heavier line for the symbol representing those obstacles and explained by a note or in a legend on the chart.	
11.10.2.3	The elevation of the top of obstacles must be shown to the nearest (next higher) metre or foot. Italic type is used.	
11.10.2.4	The heights of obstacles above a datum other than mean sea level (see 11.10.2.5) should be shown. When shown, they should be indicated by upright type in parentheses to the nearest (next highest) metre or foot.	

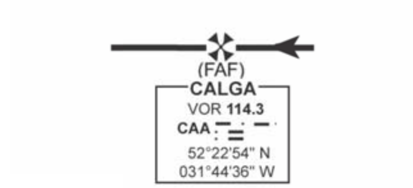
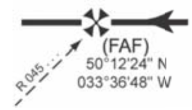
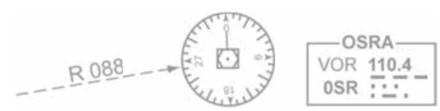
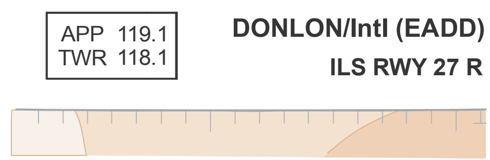
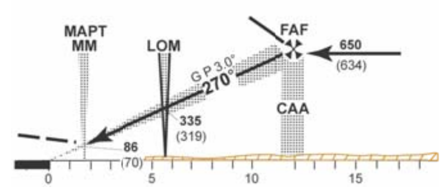
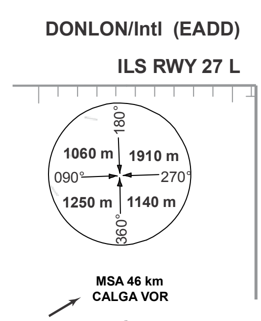
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td>11.10.2.5</td><td>When the heights of obstacles above a vertical datum other than mean sea level are shown, the reference datum must be the aerodrome elevation except that, at aerodromes having an instrument runway (or runways) with a threshold elevation more than 2 m (7 ft) below the aerodrome elevation, the chart datum must be the threshold elevation of the runway to which the instrument approach is related.</td><td>
</td></tr>
<tr><td>11.10.2.6</td><td>Where a datum other than mean sea level is used, it must be stated in a prominent position on the chart. Under the aerodrome elevation is an appropriate position.</td><td>
</td></tr>
<tr><td>11.10.2.7</td><td>Where an obstacle free zone has not been established for a precision approach runway Category I, this must be indicated.</td><td>NO OFZ RWY 27R
<table>
<tr><td colspan="2">OCA (H)</td><td>A</td><td>B</td><td>C</td></tr>
<tr><td rowspan="3">Straight-in Approach</td><td>Cat I</td><td>64 (48)</td><td>67 (51)</td><td>70 (54)</td></tr>
<tr><td>Cat II</td><td>(13)</td><td>(18)</td><td>(22)</td></tr>
<tr><td>GP INOP</td><td></td><td>140</td><td>(124)</td></tr>
<tr><td colspan="2">Circling</td><td>385</td><td>465</td><td>630</td></tr>
</table></td></tr>
<tr><td>11.10.3</td><td>Prohibited, restricted and danger areas</td><td></td></tr>
<tr><td>11.10.3.1 and 2.13</td><td>Prohibited areas, restricted areas and danger areas which may affect the execution of the procedures must be shown with their identification and vertical limits.

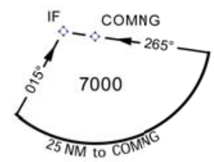
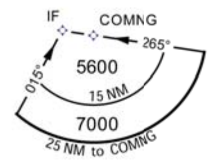
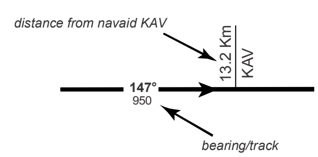
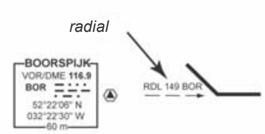
The depiction of prohibited, restricted and danger areas must not obliterate procedural information. If necessary to reduce chart clutter, a half-tone screen of approximately 40 per cent may be used to subdue the portrayal of prohibited, restricted and danger areas.

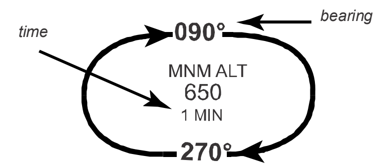
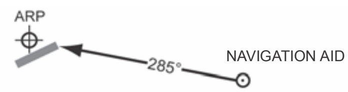
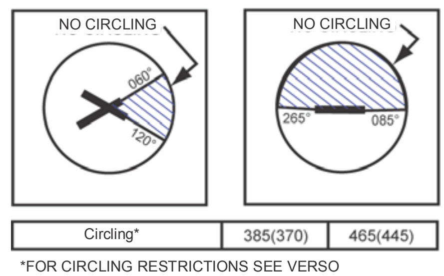
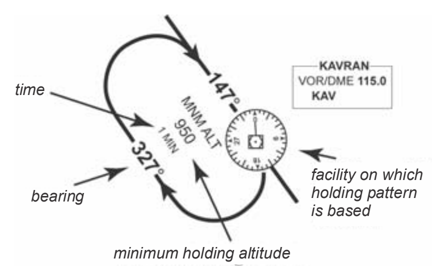
See also Chapter 7 — General Specifications, Annex 4 reference 2.13.

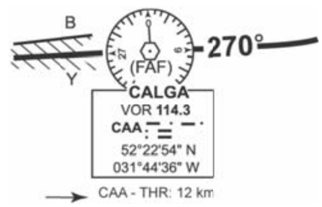
The “nationality letters” part of the identification of these areas may be omitted. Nationality letters are those contained in Doc 7910 — Location Indicators.</td><td>
</td></tr>
</table>

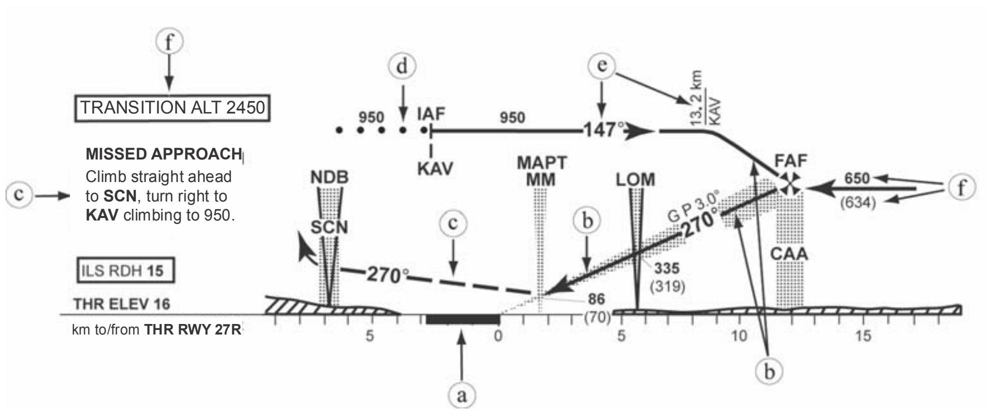
Annex 4 reference	*Details*	*Drafting Illustration*
11.10.4	Radio communication facilities and navigation aids	
11.10.4.1	Radio navigation aids required for the procedures together with their frequencies, identifications and track-defining characteristics, if any, must be shown. The Morse code for the identification may also be shown. Radio navigation aids upon which the procedure track is based are to be presented in solid colour. Text boxes associated with radio navigation aids should be of a size consistent with the information contained therein. In the text box, the radio navigation aid name, frequency and identification may be emphasized by bold text. Lead lines are to be used in congested areas to position the boxes for optimum readability. 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 must be clearly identified. Text associated with this primary facility may be in bold and emphasized by the use of a shadow box. In addition, consideration may be given to the elimination from the approach chart of those facilities that are not used by the procedure. If it is necessary to retain certain facilities not used by the procedure, the portrayal of such facilities may be subdued with a half-tone screen of approximately 40 per cent.	 
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 instrument landing system (ILS) approach procedure, the missed approach point (MAPt), where established, and other essential fixes or points comprising the procedure, must be shown and identified. Annex 4, Appendix 2, symbol 124, provides a specific symbol for final approach fix. These positions may be emphasized by associated abbreviated text in bold.	

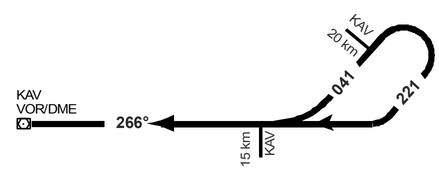
Annex 4 reference	*Details*	*Drafting Illustration*
11.10.4.3	The final approach fix or final approach point for an instrument landing system (ILS) approach procedure should be identified with its geographical coordinates in degrees, minutes and seconds.	 
11.10.4.4	Radio navigation aids which might be used in diversionary procedures together with their track-defining characteristics, if any, must be shown or indicated on the chart. The portrayal of these may be subdued with a halftone screen of approximately 40 per cent.	
11.10.4.5	Radio communication frequencies, including call signs, that are required for the execution of the procedures must be shown. These may be "boxed" next to the aerodrome name at the top centre of the chart.	
11.10.4.6	When required by the procedures, the distance to the aerodrome from each radio navigation aid concerned with the final approach must be shown to the nearest kilometre or nautical mile.	
11.10.5	Minimum sector altitude or terminal arrival altitude The minimum sector altitude (MSA) or terminal arrival altitude (TAA) established by the competent authority must be shown, with a clear indication of the sector to which it applies.	 *Navigation aid on which MSA is based*

Annex 4 reference	*Details*	*Drafting Illustration*
	Annex 4, Appendix 2, provides specific symbols for MSA and TAA portrayal. The optimum location for the MSA symbol is in the top right area of the chart. The TAA symbol should be placed in the area of the plan view to which it applies. The combined TAAs associated with an approach procedure must account for an area of 360 degrees around the intermediate approach fix. MSA and TAA symbols are to be modified to reflect particular sectors or TAA shapes. They are to be presented in easily readable sizes and accompanied by appropriate text as illustrated. For examples of TAA symbol placement see the PANS-OPS, Volume II, Part III, Section 2, Chapter 4, Figures III-2-4-3 to III-2-4-5.	 
11.10.6	Portrayal of procedure tracks	
11.10.6.1	The plan view must 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;	 

Annex 4 reference	*Details*	*Drafting Illustration*
		
	e) where no track-defining aid is available, the magnetic bearing to the nearest degree to the aerodrome from the radio navigation aid concerned with the final approach;	
	f) the boundaries of any sector in which visual manoeuvring (circling) is prohibited; The diagram may be printed at a larger scale on the back of the chart. If it is necessary to print circling restrictions on the back of the chart, an asterisk may be added to the word “circling” and an explanatory note included below the minima data as illustrated.	
	g) where specified, the holding pattern and minimum holding altitude/height associated with the approach and missed approach. A race track type symbol is used for holding patterns. The symbol may be expanded laterally, when required, to include fixes, intersections, or other facilities upon which the holding pattern may be based. Holding patterns are to be orientated according to flight path bearing or radial, and both inbound and outbound bearings to the nearest degree (including degree symbol) are to be shown. Cases where the procedure segment bearing coincides with the holding bearing may preclude the need for the holding pattern bearing;	
	h) caution notes where required, prominently displayed on the face of the chart. Caution notes are to be concise and, if practicable, placed in the area of the chart relevant to the subject of the caution note. A “boxed” caution note may be used for increased prominence.	**CAUTION ILS BACK BEAM RADIATING BUT NOT FOR OPERATIONAL USE**
	i) an indication of “flyover” significant points.	

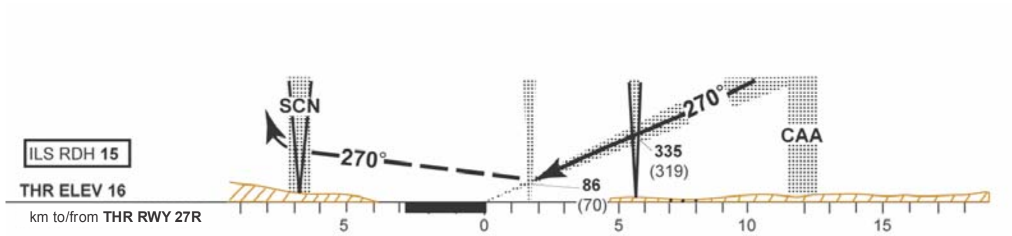
Annex 4 reference	*Details*	*Drafting Illustration*
	See also Section 7.2, paragraph 2.7, Placement of note and text boxes.	
11.10.6.2	The plan view should show the distance to the aerodrome from each radio navigation aid concerned with the final approach.	
11.10.6.3	A profile must be provided, normally below the plan view, showing the following information: a) the runway by a solid block at aerodrome or landing threshold elevation. The solid block is positioned below and adjacent to the line representing the aerodrome elevation or landing threshold elevation; b) the profile of the approach procedure segments by an arrowed continuous solid line indicating the direction of flight. This solid line may be broken to include bearings and is not continued below the missed approach point (MAPt); c) the profile of the missed approach procedure segment by an arrowed broken line and a description of the procedure which may be placed adjacent to its graphic illustration; 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. Times required by the procedure are normally shown in a table under the profile as illustrated at 11.10.8.1; f) altitudes/heights required by the procedures, including transition altitude and procedure altitudes/heights, where established;	

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td colspan="3">
</td></tr>
<tr><td></td><td>g) when specified, limiting distance on a procedure turn to the nearest kilometre or nautical mile;

h) the intermediate approach fix or point, on procedures where no course reversal is authorized;</td><td>
</td></tr>
<tr><td>

11.10.6.4

11.10.6.5</td><td colspan="2">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.



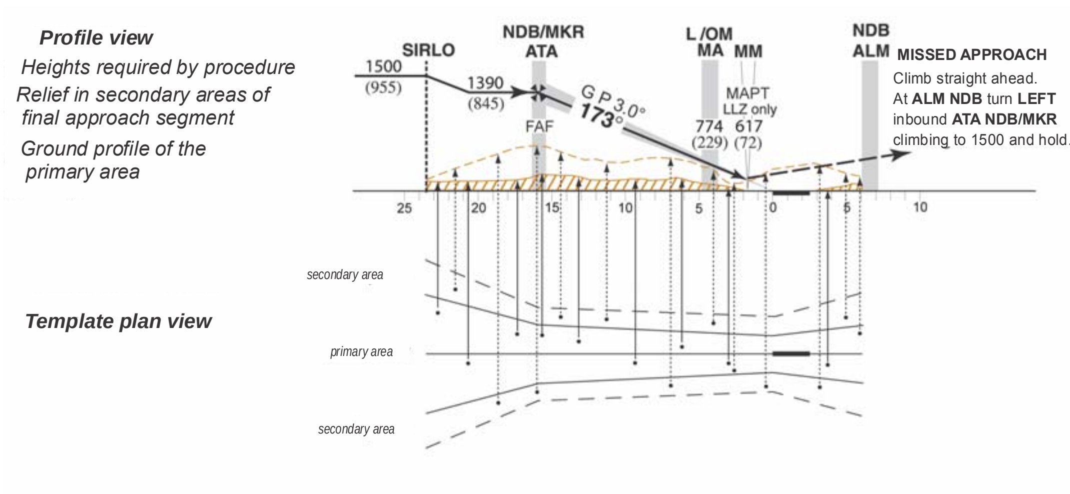
The aerodrome elevation or threshold elevation, as appropriate, and the origin of the distance scale may be identified at the line.

Heights required by procedures should be shown in parentheses, using the height datum selected in accordance with Annex 4, 11.10.2.5.

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 should be shown on the profile by a dashed line. In the same manner as for the final approach segment, the ground profiles may also be extended to show the highest elevations of relief occurring in the intermediate and missed approach segments where they are depicted on the profile.</td></tr>
</table>

Annex 4 reference	Details	Drafting Illustration

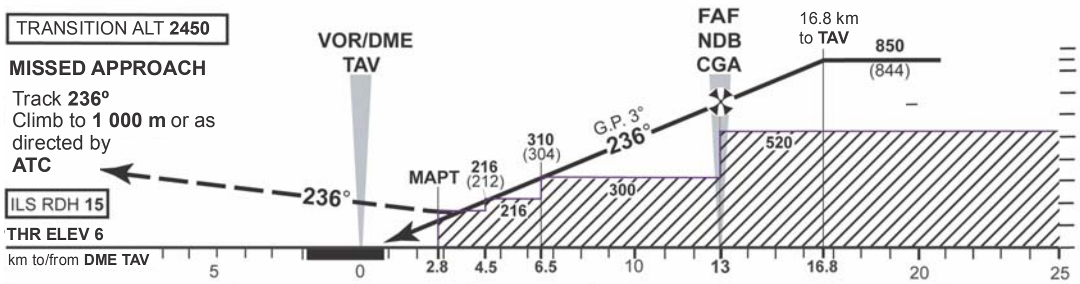


The vertical dashed lines on the above illustration show how the highest elevations of relief in each secondary area are transferred to the profile view to create a combined presentation of relief occurring in the secondary areas. The transfer of the highest elevations of relief in the primary area are shown by thin solid lines.

For the ground profile portrayed, actual templates of the primary and secondary areas of the final approach segment are provided to the cartographer by the procedures specialist. The ground profile line may be portrayed by a thin solid line with a line pattern beneath. The line pattern may be positioned at a 45-degree angle to the base line. There is no line pattern associated with the thin dashed line indicating the highest elevations of the relief occurring in the secondary areas. The presentation of ground profiles may be subdued by half-tone screening (e.g. 30 per cent) to emphasize the procedure information. On charts where relief is presented on the plan view by brown contour lines, the ground profile should also be presented in the same brown colour. In these cases, ground profile lines and the line pattern may be based on the brown colour provided in the Colour Guide in Annex 4, Appendix 3, for contours and topographic features and subdued with a 40 per cent half-tone screen.

b) minimum altitudes/heights in the intermediate and final approach segments indicated within bounded shaded blocks. The minimum altitude/height portrayal is intended for use on charts depicting non-precision approaches with a final approach fix.

Annex 4 reference	*Details*	*Drafting Illustration*



DME DIST (km)	3.8	6	8	10	12	14	16.8
ALT (HGT) 3.0° APCH	**180** (174)	**294** (288)	**395** (389)	**498** (492)	**598** (592)	**700** (694)	**850** (844)

OCA (H)		A	B	C	D
Straight-in Approach	CAT I	**64** (48)	**67** (51)	**70** (54)	**73** (57)
	CAT II	(13)	(18)	(22)	(26)
	GP INOP	**140** (124)			
Circling		**385**	**465**	**630**	**680**

GS	km/h	100	150	200	250	300
Rate of descent	m/s	**1.4**	**2.2**	**2.9**	**3.6**	**4.3**

For the minimum altitude/height portrayed within bounded shaded blocks a similar line pattern to that used in the ground profile illustration may be used to shade the blocks. Shading may be cleared under altitude/height text. The details of this illustration are supplied by the procedures specialist.

11.10.7 Aerodrome operating minima

11.10.7.1 Aerodrome operating minima when established by the State must be shown. This information is tabulated below the profile view.

See specimen chart 9

11.10.7.2 The obstacle clearance altitudes/heights for the aircraft categories for which the procedure is designed must be shown. For precision approach procedures, additional OCA/H for Cat DL 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) must be published, when necessary. This table may be placed in the left corner, below the profile view of the procedure.

OCA (H)		A	B	C	D	DL
Straight-in Approach	Cat I	**64** (48)	**67** (51)	**70** (54)	**73** (57)	**76** (60)
	Cat II	(13)	(18)	(22)	(26)	(30)
	LLZ	**140** (120)				
Circling		**385** (370)	**465** (445)	**630** (615)	**680** (665)	N/A

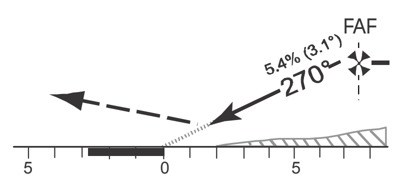
11.10.8 Supplementary information

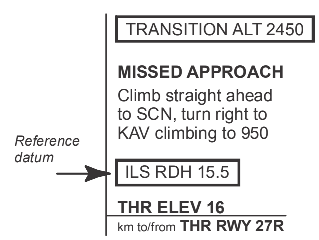
11.10.8.1 When the missed approach point is defined by:

11.10.8.4 — a distance from the final approach fix, or

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

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>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 must be shown.

A rate of descent table should be shown. This table may be placed in the right corner, below the profile view of the procedure.</td><td>
<table>
<tr><td>GS</td><td>km/h</td><td>100</td><td>150</td><td>200</td><td>250</td><td>300</td></tr>
<tr><td>Rate of descent</td><td>m/s</td><td>1.4</td><td>2.2</td><td>2.9</td><td>3.6</td><td>4.3</td></tr>
</table>
</td></tr>
<tr><td>11.10.8.2</td><td>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, must be shown. The table must not include distances which would correspond to altitudes/heights below the OCA/H. The table may be placed directly above the profile view. See also the illustration at 11.10.6.5 b).</td><td rowspan="2">
<table>
<tr><td>DME KRG, km</td><td>10</td><td>8</td><td>6</td><td>etc.</td></tr>
<tr><td>ALT (HGT) 2.4°APCH</td><td>491 (482)</td><td>398 (388)</td><td>305 (296)</td><td>etc.</td></tr>
</table>
</td></tr>
<tr><td>11.10.8.3</td><td>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. The table may be placed directly above the profile view.</td></tr>
<tr><td>11.10.8.5</td><td>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.</td><td>


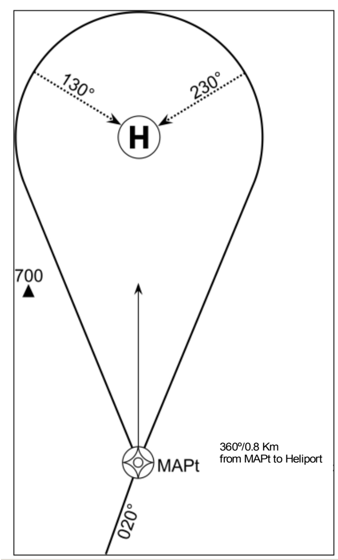
</td></tr>
<tr><td>11.10.8.6</td><td>For ILS/MLS and LNAV/VNAV precision approach procedures and approach procedures with vertical guidance, the reference datum height to the nearest half metre or foot and the glide path/elevation/vertical path angle to the nearest one-tenth of a degree must be shown.</td><td rowspan="2">


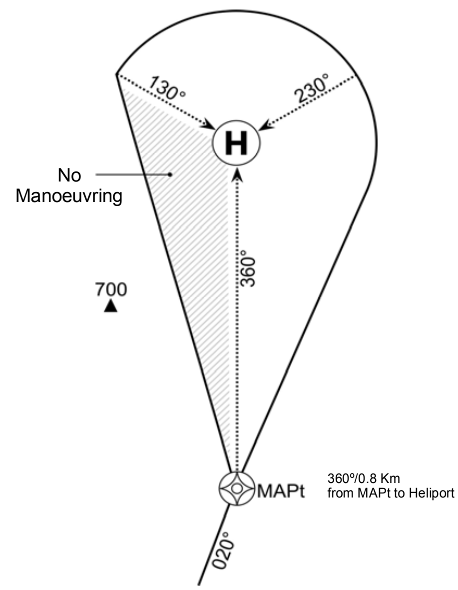
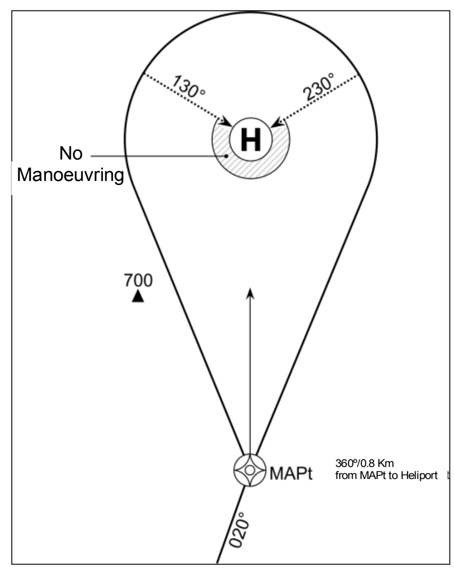
Example of note used when ILS/MLS glide path/elevation angle exceeds 3.5°

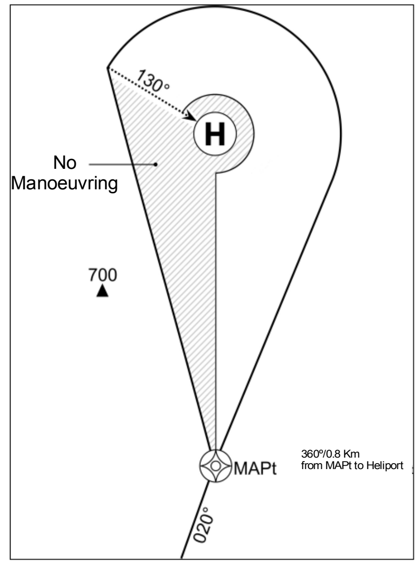
CAUTION - Steep angle approach. Authorized operators only.
</td></tr>
<tr><td>11.10.8.7</td><td>When a final approach fix is specified at the final approach point for ILS, a clear indication must be given whether it applies to the ILS, the associated ILS localizer-only procedure, or both. In the case of MLS, a clear indication must be given when an FAF has been specified at the final approach point. This information is provided by the procedures specialist.</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
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 *Procedures for Air Navigation Services — Aircraft Operations* (PANS-OPS, Doc 8168), Volume II, Part I, Section 4, Chapter 5, a cautionary note must be included.	
	Details *Depiction of SBAS Supplemental Information.* The Service Provider, SBAS Channel Number and the Reference Path Identifier (RPI) must be shown.	EGNOS *(Service Provider)* CH 45513 *(Channel Number)* E17A *(Reference Path Identifier)*
	Details *Depiction of GBAS Supplemental Information.* The GBAS Channel Number and the Reference Path Identifier (RPI) must be shown.	CH 25513 *(Channel Number)* G17A *(Reference Path Identifier)* *or* AFTG *(Reference Path Identifier)*
11.10.9	Aeronautical database requirements	
	Appropriate data to support navigation database coding must be published on the verso of the chart or as a separate, properly referenced sheet. *Note.— Appropriate data are those provided by the procedures specialist.* This data is provided by the procedures specialist and is based on the aeronautical database requirements stated in the PANS-OPS, Volume II, Part III, Section 5, Chapter 2, 2.3 for RNAV procedures and Volume II, Part I, Section 4, Chapter 9, 9.4.1.3 for non-RNAV procedures.	*See verso of specimen chart 9*
	Helicopter point-in-space (PinS) approach procedures The plan view shall include: a) heliport/landing location name and elevation to the nearest metre or foot; b) bearing to the nearest degree, and distance to the nearest two-tenths of a kilometre or tenth of a nautical mile from the missed approach point (MAPt) to the heliport/landing location;	

Annex 4 reference	Details	Drafting Illustration
	c) textual instructions to "Proceed VFR from xxxx" (MAPt identifier) or "Proceed visually from xxxx" (MAPt identifier) or "Manoeuvre visually from xxxx" (MAPt identifier), as appropriate; d) obstacles, if not included in an inset; and e) a note that the procedure is for CAT H only. An inset shall be used to show the following: a) obstacles; b) final approach course to the MAPt; c) text to either "Proceed VFR from (MAPt)", or to "Proceed visually from (MAPt)", or "Manoeuvre visually from (MAPt)", as appropriate; d) for all "Proceed visually PinS" procedures only, the visual segment, the descent point (if established) and bearings and distances from MAPt to DP and from MAPt or DP to the heliport/landing location; and e) for "Proceed visually PinS" procedures with approach manoeuvring visual segment(s) only, the centre line(s) of the approach surface(s), shown with a dotted line and an arrowhead, and the boundary of the approach manoeuvring area without dimensions; f) for "Proceed visually PinS" procedures with approach manoeuvring visual segment(s) and a No Manoeuvring area. The boundary of the No Manoeuvring area shall be shown and labelled No Manoeuvring; g) for "Proceed visually PinS" procedures with approach manoeuvring visual segment(s) and over flight of the heliport/landing location is prohibited, the bearing and distance and a line from the MAPt to short of the heliport/landing location and the boundary of the prohibited over flight area; and	

Annex 4 reference	*Details*	*Drafting Illustration*
	h) for "Proceed VFR" procedures only, a height above surface (HAS) shall include the difference in height between the OCA and the elevation of the highest terrain or water surface; i) for proceed visually "PinS" procedures, heliport elevation; j) for proceed visually "PinS" procedures, "close-in" features. *Manoeuvring Area without a No Manoeuvring Area*. If there is not a No Manoeuvring area, the approach manoeuvring area shall be established, depending on the approach manoeuvring VS centre line(s) of the approach surface(s) and extension of the manoeuvring area may be on one or both sides of the direct VS track or of the track from the MAPt direct to the heliport if a direct VS does not exist.	

Annex 4 reference	*Details*	*Drafting Illustration*
	Manoeuvring Area with a No Manoeuvring Area. If there is a No Manoeuvring area, the boundary limit of the approach manoeuvring area shall be charted as the approach manoeuvring VS centre line of the approach surface. The boundary of the No Manoeuvring VS area shall be depicted and the manoeuvring area hachured.	
	Manoeuvring Area with Heliport Over Flight Prohibited. When there is no direct VS there is usually an obstacle that prevents over flying the heliport or landing location. When over flight of the heliport is prohibited, there is a minor adjustment to the boundaries of the No Manoeuvring area. The boundary shall arc around the heliport terminating prior to the approach manoeuvring VS centre line(s) of the approach surface(s).	

Annex 4 reference	*Details*	*Drafting Illustration*
	Manoeuvring Area with Heliport Over Flight Prohibited and a "No Manoeuvring" area. The charting of the approach manoeuvring area is a combination of the charting depicted in the previous two figures.	
	The inset for either type of PinS procedure shall not be used to depict instructions, non-operational notes, descent gradients/angles, or missed approach track or instructions. The profile view shall contain information relating to the instrument procedure profile and the direct visual segment profile, if it exists, with the text "Proceed VFR", "Proceed visually" or "Manoeuvre visually", as appropriate. There is no profile view information for either "Proceed VFR" or "Manoeuvre visually" procedures. The profile view of the direct visual segment shall include: a) fixes, altitudes and distances up to the MAPt; b) the profile and track from the MAPt to the heliport or landing location; c) the descent point if established; d) the descent angle from the MAPt or DP; e) the heliport crossing height (HCH); f) the text "Proceed VFR" or, "Proceed visually" or "Manoeuvre visually", as appropriate, which shall be located under the visual segment profile.	

**CONCEPT OF MINIMUM OBSTACLE/TERRAIN ALTITUDE
DEFINED BY AREA PORTRAYAL IN INSTRUMENT APPROACH CHARTS**

The function of the Instrument Approach Chart is to provide the pilot with information which will enable the pilot to perform an approved instrument procedure to the runway of intended landing, or carry out an established missed approach procedure. The chart must provide the pilot with navigation and terrain information to enable the pilot to decide whether to accept clearance to altitudes below the minimum sector altitude shown on the chart.

Terrain information

The object of portraying terrain information is to enable the pilot to know the minimum altitude at which it is safe to fly in circumstances where flight is conducted below the minimum sector altitude shown on the Instrument Approach Chart.

Devices used for displaying high ground include individual spot elevations/heights and contour lines.

Spot elevations/heights have the following disadvantages:

a) they take time to interpret correctly;

b) they give no indication of the lateral extent of high ground, slope or low ground, therefore they can be misleading if used as a basis for determining the minimum altitude at which it is safe to fly in a given area;

c) they cannot provide an instantaneous appreciation of relief because they give no indication of the shape of the terrain;

d) they do not emphasize either higher or more extensive areas of high ground;

e) they increase “clutter” on the chart, to the detriment of other information displayed, without providing the pilot with enough useful information on the configuration of the terrain; and

f) their absence may be misinterpreted as indicating low ground.

Contour lines, on the other hand, have none of these disadvantages except that they are difficult to interpret quickly, unless accompanied by layer tinting and unless their intricate shapes are “smoothed” to form “contour envelopes”.

Contour envelope

A contour envelope may be defined as a “smoothed” contour line, omitting small valleys, enclosing all terrain and obstacles above a specified elevation. Figures 1 to 3 below show how they are derived.

It must be emphasized that, as in the case of a true geographical contour line, the contour envelope line simply shows that on one side of it the ground is lower than on the contour line and on the other side it is higher than on the contour line; it does not show by how much the ground is lower, nor by how much the ground is higher. It must be assumed therefore, that the maximum elevation the ground may reach within each area between contour envelope lines is that of the higher contour line.

The contour envelope line is better considered *not as a line enclosing ground above a certain elevation but as a line outside which the ground is lower.*

Once this understanding of the meaning of contour envelopes is reached, it becomes clear that the only spot elevations/heights of any use are the highest within each top contour line, each of which indicates simply the upper limit of high ground.

By a combination of contour envelopes, layer tinting in three shades of green, and the inclusion of only the highest spot elevation/height within each top contour line, a readily interpreted portrayal of terrain can be achieved. The following technical specifications relate to the layer tinting shades of green:

Specification of screens used in the production of printing plates

(The dot area information relates to the interposing screen used to make the printing plate. It does not relate to the final print of the colour tints.)

SCREEN PER CENTIMETRE/INCH	ANGLEº	DOT AREA %	DIAMETER MILLIMETRES/INCHES
52.36 per cm 133 per inch	45º	60%	0.136 mm 0.0054 ins
52.36 per cm 133 per inch	45º	90%	0.068 mm 0.0027 ins

Note.— The third colour tint is solid colour, i.e. no screen required.

For application on Instrument Approach Charts, contour lines are to be selected to start at the first even 300 m (1 000 ft) contour line which is at least 150 m (500 ft) above aerodrome elevation. This ensures that the area immediately surrounding the aerodrome of intended landing is not obscured by the lowest layer tinting. Subsequent contour intervals are to be selected at 150 m (500 ft), or exceptionally 300 m (1 000 ft) or 600 m (2 000 ft), in order to give a satisfactory presentation of terrain. The larger intervals may be selected to take account of the increasing steepness usually associated with higher ground, thus avoiding close spacing of the contour lines and providing a clean appearance. Topographic charts at a scale of 1:500 000 are recommended as a source for the contour data.

Area Minimum Altitude (AMA) envelope

The contour envelopes described above include all known obstacles and, where necessary, the shape of the contour envelope is adjusted accordingly to become an Area Minimum Altitude envelope. Isolated obstacles higher than 150 m (500 ft) above the aerodrome elevation in the area immediately surrounding the aerodrome will create their own contour envelope which will be drawn as a circle, radius 1.8 km (1 NM) centred on the obstacle. In the case of group obstacles exceeding 150 m (500 ft) above the aerodrome elevation, such as two chimneys or towers, the two overlapping or adjacent circles around the obstacles should be represented by the two outer semicircles joined by common tangents. Other group obstacles with more than two obstacles should be given similar treatment.

To avoid the need for the mental processes of interpreting the contour envelope elevation (or top spot elevation/height) and adding the necessary minimum vertical terrain clearance, the areas between the contour envelope lines are marked with the appropriate AMA figures (see definition for AMA). These figures are printed in BLACK, include a minimum vertical clearance of 300 m (1 000 ft) above all terrain and obstacles and have been rounded up to the next higher 30 m (100 ft). They are shown in two sizes of figures, the larger representing units of thousands of metres (feet) and the smaller, units of tens of metres (hundreds of feet in the case of a chart using feet).

Example

a) on chart using metres

060 = 600 m
123 = 1 230 m
126 = 1 260 m

b) on chart using feet

20 = 2 000 ft
22 = 2 200 ft
122 = 12 200 ft

It can be noticed that when using metres, the figures will be three digits, while the use of feet will result in two (or exceptionally three) digits. As a consequence, each top contour envelope now contains the relevant AMA figures instead of the highest spot elevation/height and the contour envelopes have now become AMA envelopes. Figure 4 below illustrates the AMA envelope.

This has the following advantages from an operational point of view:

a) it presents information which is of prime significance, has a built-in safety margin and needs no further interpretation or calculation;

b) it is compatible with the concept of AMA proposed for use on the Enroute Chart; and

c) it has eliminated the disadvantages mentioned in regard to the portrayal of terrain and obstacles by spot elevations/heights and geographical contours.

Derivation of contour envelope/AMA envelope (values in metres)

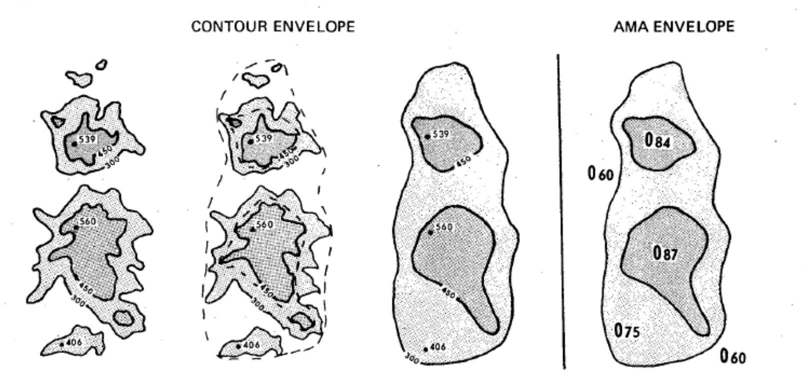


Figure 1 Figure 2 Figure 3 Figure 4

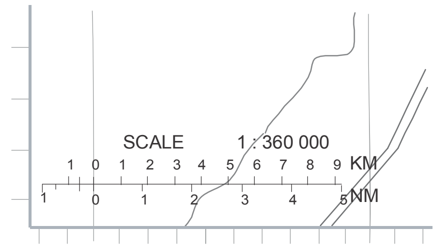
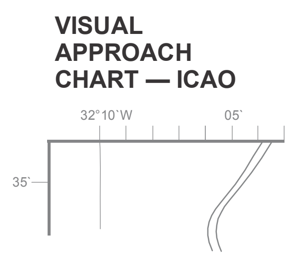
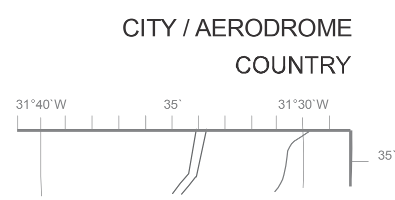
Note.— The cartographer draws the "smoothed" contour line just outside, i.e. on the "lower" side, of the actual contour. Minor indentations in the topography such as valleys not more than 5.5 km (3 NM) in width, should be ignored. Similarly, where two groups of contours at the same elevation come within 5.5 km (3 NM) of each other (e.g. a pass between hills), they should be combined into one envelope.

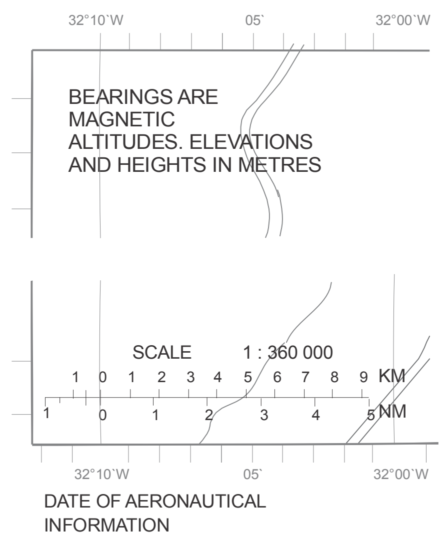
An example of an Instrument Approach Chart, showing the concept of minimum obstacle/terrain clearance altitude defined by area portrayal (AMA envelope) is shown as specimen chart 9.

7.12 VISUAL APPROACH CHART — ICAO

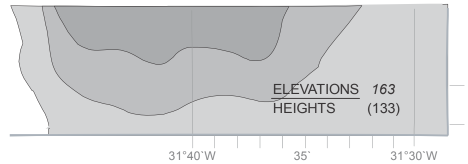
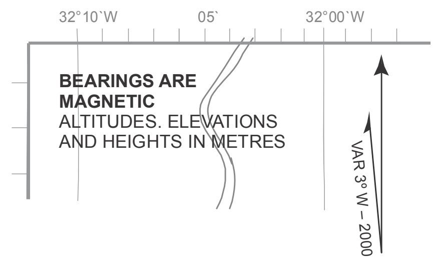
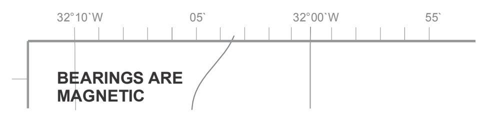
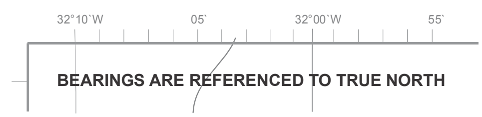
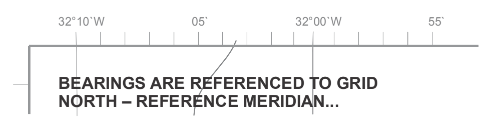
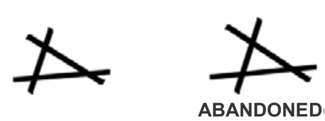
Annex 4 reference	*General*
12.1	**Function** This chart must provide flight crews with information which will enable them to transit from the en-route/descent to approach phases of flight to the runway of intended landing by means of visual reference.
12.2	**Applicability** The Visual Approach Chart — ICAO must be made available for all aerodromes used by international civil aviation where: 1) only limited navigation facilities are available; or 2) radio communication facilities are not available; or 3) no adequate aeronautical charts of the aerodrome and its surroundings at 1:500 000 or greater scale are available; or 4) visual approach procedures have been established. **Operational requirements** See Chapter 7 – General Specifications, Section 7.2, Annex 4 reference 2.1.1 to 2.1.8, inclusive. **Planning** In the planning stage cognizance should be taken of the interrelationship between the Visual Approach Chart, the Instrument Approach Chart and the Aerodrome Obstacle Chart — Type B, which show much of the same basic data. Surveys for obstacle information, and drawings of the aerodrome layout should be available from the aerodrome authority which would provide the details required for the chart. Drafting can be expedited by tracing from existing topographical charts such as 1:250 000 scale chart series.

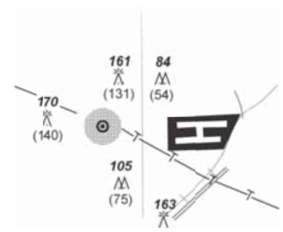
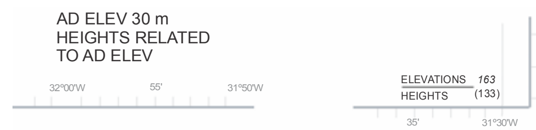
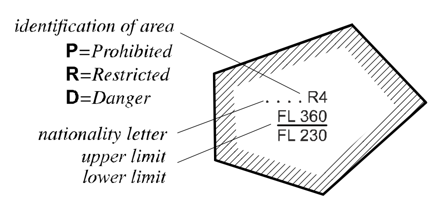
Annex 4 reference	*Details*	*Drafting Illustration*
12.3	**Scale**	
12.3.1	The scale must be sufficiently large to permit depiction of significant features and indication of the aerodrome layout.	*See specimen chart 10*
12.3.2	The scale should not be smaller than 1:500 000. A scale of 1:250 000 or 1:200 000 is preferred.	

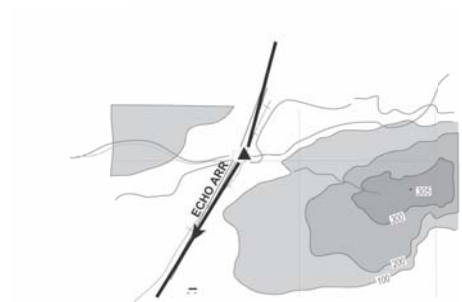
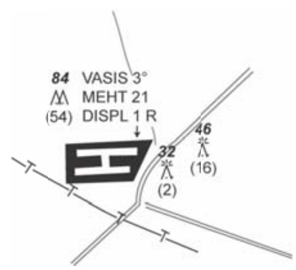
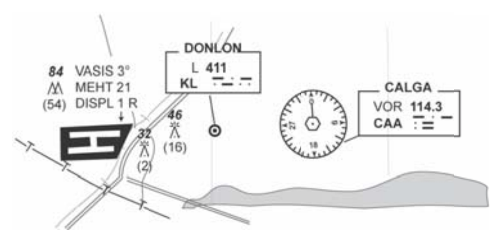
Annex 4 reference	*Details*	*Drafting Illustration*
12.3.3	When an Instrument Approach Chart — ICAO is available for a given aerodrome, the Visual Approach Chart — ICAO should be drawn to the same scale.	
2.6.2	A linear scale must be shown.	
12.4	**Format**	
	The sheet size should be 210 x 148 mm (8.276 x 5.82 in) and the format should be in accordance with specimen chart 10. Dark blue or magenta is recommended for aeronautical data to contrast with the other data which should be printed in lighter colours.	
12.5	**Projection**	
12.5.1	A conformal projection on which a straight line approximates a great circle must be used.	*See specimen chart 10*
12.5.2	Graduation marks should be placed at consistent intervals along the neat lines.	*See specimen chart 10*
2.2	**Title** The title must be “Visual Approach Chart — ICAO” except that such title must not include “ICAO” unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 12.	
12.6	**Identification** The chart must be identified by the name of the country in which the aerodrome is located, name of the city or town which the aerodrome serves and the name of the aerodrome.	 *(Note.— Name of Country may be omitted where chart is published as part of an AIP. - See Annex 4 reference 2.3.4)*

Annex 4 reference	*Details*	*Drafting Illustration*
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on specimen chart 10. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.3.1 to 2.3.4 inclusive.	
2.4	**Symbols** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	
2.5	**Units of measurement** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	
2.7	**Date of aeronautical information** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	
2.8	**Spelling of geographical names** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4 inclusive.	
2.9	**Abbreviations** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	
2.10	**Political boundaries** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.10.1 and 2.10.2.	*See specimen chart 10*

Annex 4 reference	*Details*	*Drafting Illustration*
2.11	**Colours** The chart should be produced in two or more colours, except that one colour will suffice when there is no information to provide on relief and significant obstacles. Charts should be printed on a good quality white paper. The use of selected percentage screens, either fine dots or light rulings, will provide visual separation for such elements as water areas and built-up areas. See also Chapter 7 – General Specifications, Section 7.2, Annex 4 reference 2.11.	*See specimen chart 10*
2.16	**Typography** Samples of type suitable for use on charts are provided in Section 7.2.	
12.7	**Culture and topography**	
12.7.1	Natural and cultural landmarks must be shown (e.g. bluffs, cliffs, sand dunes, cities, towns, roads, railroads, isolated lighthouses).	*See specimen chart 10*
12.7.1.1	Geographical place names should be included only when they are required to avoid confusion or ambiguity.	
12.7.2	Shorelines, lakes, rivers and streams must be shown.	*See specimen chart 10*
12.7.3	Relief must be shown in a manner best suited to the particular elevation and obstacle characteristics of the area covered by the chart.	*See specimen chart 10*
12.7.4	When shown, spot elevations should be carefully selected. The value of certain spot elevation/heights in relation to both mean sea level and aerodrome elevation may be given.	*See specimen chart 10* 

Annex 4 reference	*Details*	*Drafting Illustration*
12.7.5	The figures relating to different reference levels must be clearly differentiated in their presentation. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.12.1 to 2.12.3.1, as applicable.	
12.8	**Magnetic variation**	
	Magnetic variation must be shown. The value of the variation must agree with that used in determining magnetic bearing, tracks and radials. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.15.1 and 2.15.2.	
12.9	**Bearings, tracks and radials**	
12.9.1	Bearings, tracks and radials must be magnetic, except as provided for in areas of high latitude. A note to this effect may be included on the chart.	*See specimen chart 10* 
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 and radials are given with reference to True North or Grid North, this must be clearly indicated. When Grid North is used its reference grid meridian must be identified.	
12.10	**Aeronautical data**	
12.10.1.1	Aerodromes All aerodromes must be shown by the runway pattern. Restrictions on the use of any landing direction must be indicated. Where there is any risk of confusion between two neighbouring aerodromes this must be indicated. Abandoned aerodromes must be identified as abandoned.	*1) For aerodrome of intended landing*  *2) For other aerodromes* 

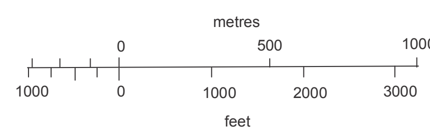
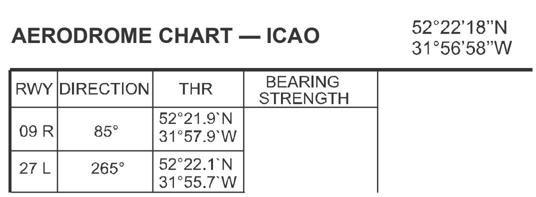
Annex 4 reference	*Details*	*Drafting Illustration*
12.10.1.2	The aerodrome elevation must be shown in a prominent position on the chart.	
12.10.2	Obstacles	
12.10.2.1	Significant obstacles must be shown and identified.	
12.10.2.2	The elevation of the top of obstacles must be shown to the nearest (next 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 must be stated in a prominent position on the chart and the heights must be given in parentheses on the chart.	
12.10.3	Prohibited, restricted and danger areas	
12.10.3.1	Prohibited areas, restricted areas and danger areas must be depicted with their identification and vertical limits.	

Annex 4 reference	*Details*	*Drafting Illustration*
12.10.4	Designated airspace	
12.10.4.1	Where applicable, control zones and aerodrome traffic zones must 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 must be shown where applicable.	
12.10.5.2	Visual aids for navigation must be shown as appropriate.	
12.10.5.3	Location and type of the visual approach slope indicator systems with their nominal approach slope angle or angles, minimum eye height or heights over the threshold of the on-slope signal or signals 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, must be shown.	
12.10.6	Supplementary information	
12.10.6.1	Radio navigation aids together with their frequencies and identifications must be shown as appropriate.	
12.10.6.2	Radio communication facilities with their frequencies must be shown as appropriate.	

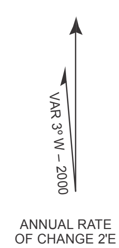
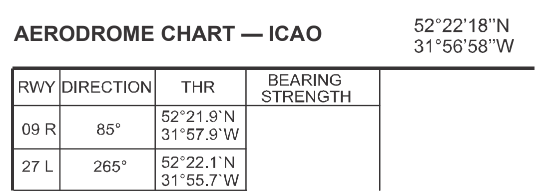
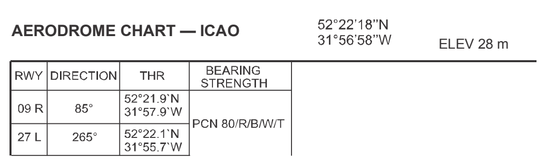
7.13 AERODROME/HELIPORT CHART — ICAO

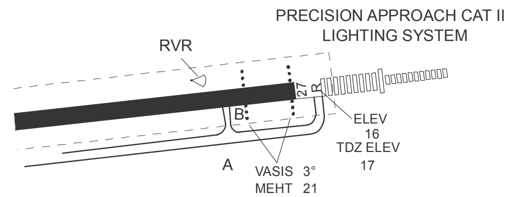
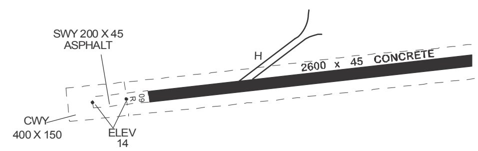
Annex 4 reference	*General*
13.1	**Function**
	The main function of the Aerodrome/Heliport Chart — ICAO is to provide flight crews with information which will facilitate the ground movement of aircraft: a) from the aircraft stand to the runway; and b) from the runway to the aircraft stand; and helicopter 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. In addition, the chart must provide essential operational information at the aerodrome/heliport.
13.2	**Applicability**
13.2.1	The Aerodrome/Heliport Chart — ICAO must be made available for all aerodromes/heliports regularly used by international civil aviation.
13.2.2	It is recommended that this chart be made available also 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 Section 7.14, Annex 4 reference 14.2 and Section 7.15, Annex 4 reference 15.2); in which case, the elements portrayed on these supplementary charts need not be duplicated on the Aerodrome/Heliport Chart — ICAO.
	Operational requirements
	See Chapter 7 — General Specifications, Annex 4 reference 2.1.1 to 2.1.8 inclusive.

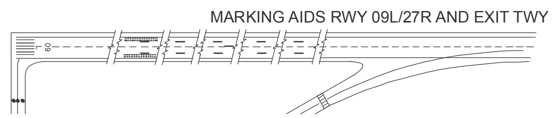
Annex 4 reference	*General*
	Planning Ground surveys will have been made to a high level of accuracy and detailed drawings of the aerodrome and surrounding areas will have been prepared by the authority charged with the planning, construction and maintenance of the aerodrome, and this material should be available to the unit assigned to prepare the Aerodrome/Heliport Chart — ICAO. The drafting and production of the Aerodrome/Heliport Chart — ICAO therefore involve the preparation of finished drawings by tracing selected data from the aforementioned engineering and architectural plans on transparent material. Consultation between the map-producing personnel and operational personnel will be required in order to select the essential details for inclusion on the chart. It will be necessary to maintain a consistent liaison with these other technical activities within the aeronautical administration to ensure that new details or amendments to existing data are applied to the chart.

Annex 4 reference	*Details*	*Drafting Illustration*
13.3	**Coverage and scale**	
13.3.1	The coverage and scale of this chart must be sufficiently large to show clearly all the elements listed under Aerodrome/Heliport Data. There is no mandatory scale; it will depend largely on the extent of the movement area and the area devoted to terminal facilities. A scale of 1:10 000 appears to be suitable for the average aerodrome but it may be necessary to use smaller scales to accommodate extremely large aerodromes and/or to maintain the basic A5 sheet size.	*See specimen chart 11*
13.3.2	A linear scale must be shown.	
2.1.8	**Format** The format of this chart should be in accordance with specimen chart 11.	
2.2	**Title** The title must be "Aerodrome/Heliport Chart – ICAO", except that such title must not include "ICAO" unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 13.	

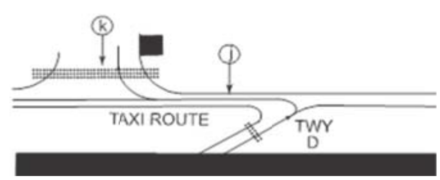
Annex 4 reference	*Details*	*Drafting Illustration*
13.4	**Identification** The chart must be identified by the name of the country in which the aerodrome/heliport is located, the name of the city or town, or area, which the aerodrome/heliport serves and the name of the aerodrome/heliport.	CITY AERODROME COUNTRY *(Note.— Name of Country may be omitted where chart is published as part of an AIP. — See Annex 4, reference 2.3.4)*
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on specimen chart 11. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.3.2 to 2.3.4, inclusive.	
2.4	**Symbols** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	
2.5	**Units of measurement** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	
2.7	**Date of aeronautical information** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	
2.8	**Spelling of geographical names** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, as applicable.	
2.9	**Abbreviations** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	

Annex 4 reference	*Details*	*Drafting Illustration*
2.11	**Colours** Although a single colour is acceptable for this type of chart, particularly for uncomplicated aerodromes, a second colour would serve to clearly identify important aeronautical features. It is obvious that a second colour will increase the cost, and any benefits would need to be assessed. Single colour charts are normally printed in black ink on white paper. The application of percentage screens to the movement areas and buildings can provide a more easily interpreted chart. When two or more colours are used, a light grey should be used for the movement area and buildings and dark blue for dimensions, characteristics of visual aids, identification of facilities and services, etc.	
2.16	**Typography** Samples of type suitable for use on charts are provided in Section 7.2. **Culture and topography** As requested under Aerodrome/Heliport data.	
13.5	**Magnetic variation** True and Magnetic North arrows and magnetic variation to the nearest degree and annual change of the magnetic variation must be shown. See also Chapter 7 – General Specifications, Section 7.2, Annex 4 reference 2.15.2.	
13.6 13.6.1	**Aerodrome/heliport data** This chart must show: a) geographical coordinates of the aerodrome/heliport reference point to at least one-tenth of a minute: b), c)elevations of the aerodrome/heliport, runway thresholds, highest point of touchdown zones and apron (pre-flight altimeter check locations), where applicable;	 

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>Guidance material on the most suitable locations for pre-flight altimeter checking is contained in Annex 14, Chapter 2.</td><td>
</td></tr>
<tr><td></td><td>d) all runways including those under construction with designation number, length, width, bearing strength, displaced thresholds, stopways, clearways, runway directions to the nearest degree magnetic, type of surface, and runway markings;</td><td>

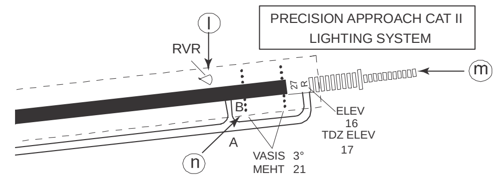

</td></tr>
<tr><td></td><td>Bearing strengths or aircraft type restrictions for aprons may be shown in tabular form on the face or verso of the chart.</td><td><table>
<tr><th>RWY</th><th>DIRECTION</th><th>THR</th><th>BEARING STRENGTH</th></tr>
<tr><td>09 R</td><td>85°</td><td>52°21.9`N<br>31°57.9`W</td><td rowspan="4">PCN 80/R/B/W/T

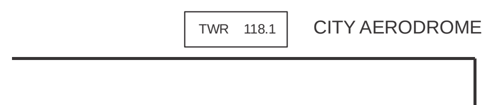
all runways
taxiways
and apron</td></tr>
<tr><td>27 L</td><td>265°</td><td>52°22.1`N<br>31°55.7`W</td></tr>
<tr><td>09 L</td><td>85°</td><td>52°22.5`N<br>31°57.8`W</td></tr>
<tr><td>27 R</td><td>265°</td><td>52°22.7`N<br>31°55.4`W</td></tr>
<tr><td colspan="2">HELIPORT</td><td colspan="2">BEARING STRENGTH
40/R/B/X/T</td></tr>
</table></td></tr>
<tr><td></td><td>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;</td><td>See specimen chart 13</td></tr>
<tr><td></td><td>Bearing strengths or aircraft type restrictions for aprons may be shown in tabular form on the face or verso the chart.</td><td>See specimen chart 13</td></tr>
</table>

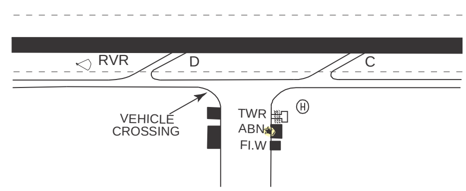
Annex 4 reference	*Details*	*Drafting Illustration*
	f) geographical coordinates to at least one-tenth of a minute for thresholds and aircraft stands;	*See specimen chart 13*
	This requirement may be met by a graticule which will permit the coordinates of the locations selected to be read to the required accuracy.	*See specimen chart 12*
	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;	*See specimen chart 12*
	Bearing strengths or aircraft type restrictions for taxiways may be shown in tabular form on the face or verso of the chart.	*See specimen chart 12*
	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;	

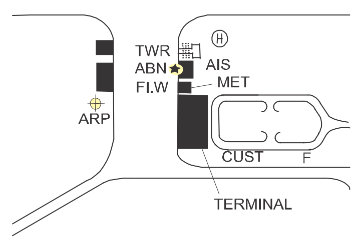
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>
l) position of runway visual range (RVR) observation sites;

m) approach and runway lighting;

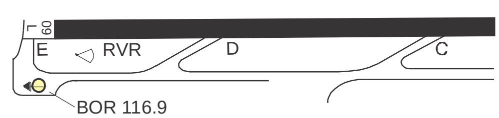
n) location and type of the visual approach slope indicator systems and their nominal approach slope angle or angles, minimum eye height or heights over the threshold of the on-slope signal or signals and where the axis of the system is not parallel to the runway centre line, the angle and direction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


See specimen chart 11 for runway lighting
</td></tr>
<tr><td></td><td>o) relevant communication facilities listed with their channels and, if applicable, logon address;</td><td>


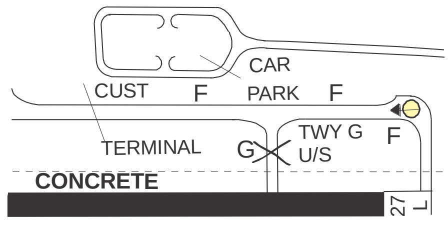
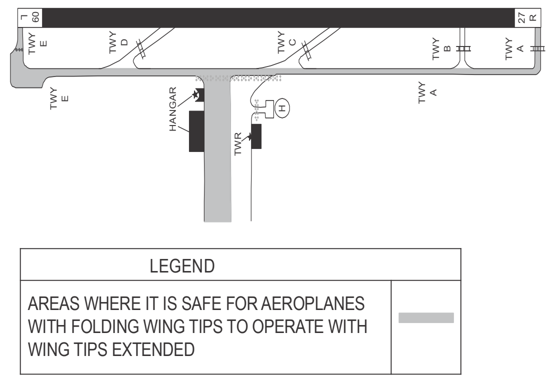
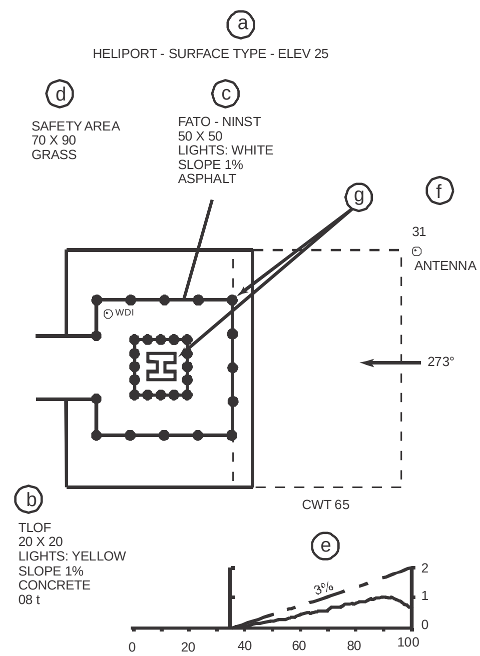
</td></tr>
<tr><td></td><td>p) obstacles to taxiing;</td><td>


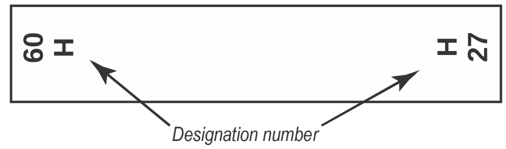
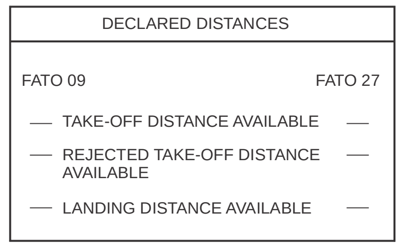
</td></tr>
<tr><td></td><td>q) aircraft servicing areas and buildings of operations significance;</td><td>


</td></tr>
<tr><td></td><td>r) VOR checkpoint and radio frequency of the aid concerned;

Guidance on the selection of VOR aerodrome checkpoints will be found in Annex 10, Volume I, Attachment E to Part I.</td><td>


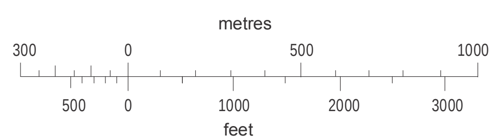
</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
	s) any part of the depicted movement area permanently unsuitable for aircraft, clearly identified as such.	
	t) where established, locations and all ground areas where it is safe for aeroplanes with folding wing tips to operate with wing tips extended.	
13.6.2	In addition to the items a) to s), Annex 4 reference 13.6.1 relating to heliports, the chart must show: a) heliport type; Heliport types are identified in Annex 14, Volume II as surface level, elevated or helideck. b) touchdown and lift-off area including dimensions, slope, type of surface and bearing strength in tonnes; c) final approach and take-off area including type, magnetic bearing, designation number (where appropriate), length, width, slope and type of surface; d) safety area including length, width and type of surface; e) helicopter clearway including length and ground profile; f) significant obstacles including type and elevation of the top of the obstacles to the nearest (next higher) metre or foot;	

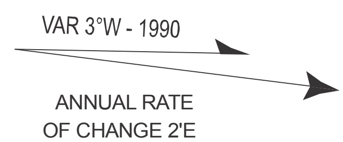
Annex 4 reference	*Details*	*Drafting Illustration*
	g) visual aids for approach procedures, marking and lighting of final approach and take-off area, and of touchdown and lift-off area;	
	h) declared distances for heliports, where relevant, including: 1) take-off distance available; 2) rejected take-off distance available; 3) landing distance available.	

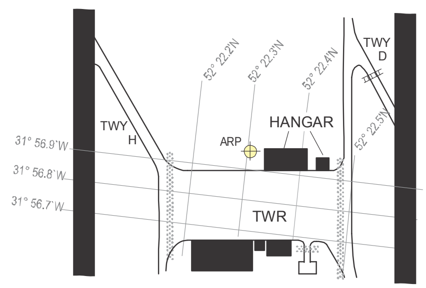
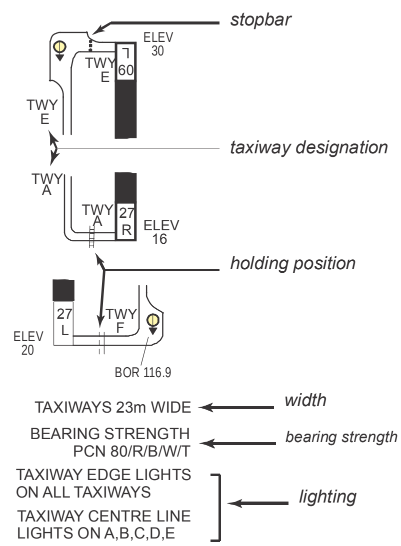
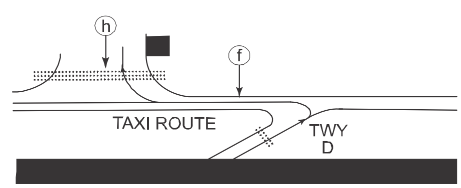
7.14 AERODROME GROUND MOVEMENT CHART — ICAO

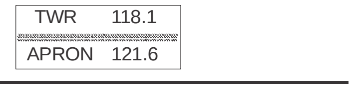
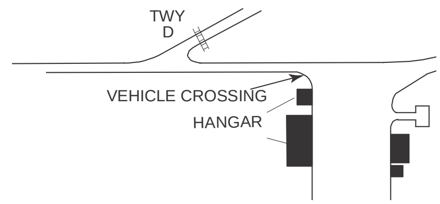
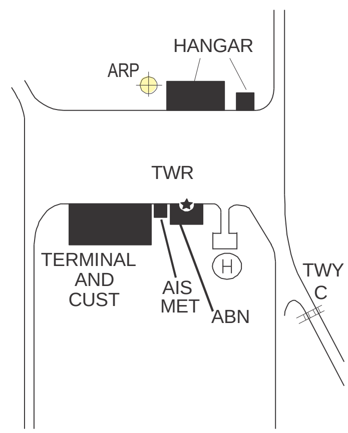
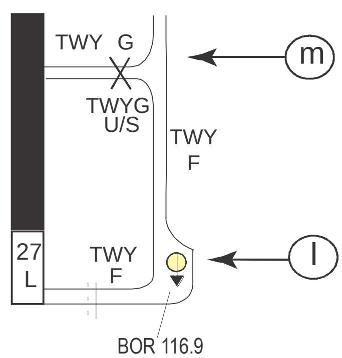
Annex 4 reference	*General*
14.1	**Function** The Aerodrome Ground Movement Chart — ICAO is a supplementary chart providing flight crews with detailed information to facilitate the ground movement of aircraft to and from the aircraft stands and the parking/docking of aircraft.
14.2	**Applicability** The Aerodrome Ground Movement Chart — ICAO should be made available 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. **Operational requirements** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.1.1 to 2.1.8, inclusive. **Planning** At the planning stage of preparing the Aerodrome Ground Movement Chart — ICAO, consideration should be given to the interrelationship between this type of chart, the Aerodrome/Heliport Chart — ICAO and the Aircraft Parking/Docking Chart — ICAO. A considerable amount of duplication, particularly in surveys and in the selection of base material, can be avoided by planning the project to include requirements for the three types of charts at this stage their production. The same features may appear on all three charts.

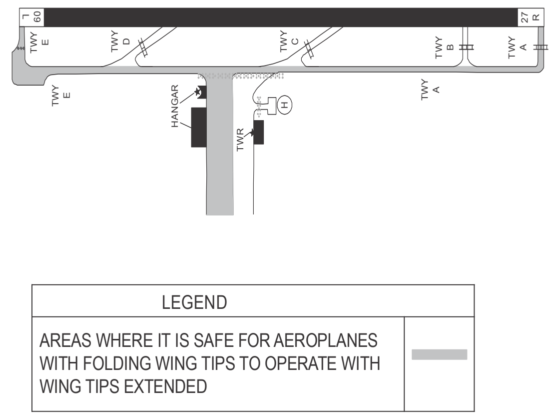
Annex 4 reference	*Details*	*Drafting Illustration*
14.3	**Coverage and scale**	
14.3.1	The coverage and scale must be sufficiently large to show clearly all the elements listed under Aerodrome Data.	
14.3.2	A linear scale should be shown.	
2.1.8	**Format** The format of this chart should be in accordance with specimen chart 12.	

Annex 4 reference	*Details*	*Drafting Illustration*
2.2	**Title** The title must be "Aerodrome Ground Movement Chart — ICAO". This title must not include "ICAO" unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 14.	**AERODROME GROUND MOVEMENT CHART — ICAO**
14.4	**Identification** The chart must 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.	CITY AERODROME COUNTRY *(Note.— Name of Country may be omitted where chart is published as part of an AIP. — See Annex 4, reference 2.3.4)*
2.3.1	**Marginal note layout** The marginal note layout must conform to that provided on the specimen chart 12. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.3.2 to 2.3.4, inclusive.	
2.4	**Symbols** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	
2.5	**Units of measurement** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	
2.7	**Date of aeronautical information** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, as applicable.	

Annex 4 reference	*Details*	*Drafting Illustration*
2.9	**Abbreviations**	
	See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	
2.11	**Colours**	
	Although a single colour is acceptable for this type of chart, particularly for uncomplicated aerodromes, a second colour would serve to clearly identify important aeronautical features. It is obvious that a second colour will increase the cost, and any benefits would need to be assessed. Single colour charts are normally printed in black ink on white paper. The application of percentage screens to the movement areas and buildings can provide a more easily interpreted chart. When two or more colours are used, a light grey should be used for the movement area and buildings and dark blue for dimensions, characteristics of visual aids, identification of facilities and services, etc.	
2.16	**Typography**	
	Samples of type suitable for use on charts are provided in Section 7.2.	
	Culture and topography	
	As required under Aerodrome Data.	
14.5	**Magnetic variation**	
14.5.1	A True North arrow must be shown.	
14.5.2	Magnetic variation and its annual change should be shown.	
	This chart need not be True North orientated.	
	See Chapter 7 – General Specifications, Section 7.2, Annex 4 reference 2.15.2.	
14.6	**Aerodrome data**	
	This chart must show in a similar manner all the information on the Aerodrome/Heliport Chart — ICAO relevant to the area depicted, including:	*See specimen chart 11*
	a) apron elevation;	

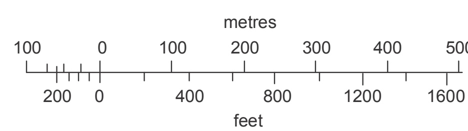
Annex 4 reference	*Details*	*Drafting Illustration*
	b) aprons, with aircraft stands, bearing strengths or aircraft type restrictions, lighting, marking and other visual guidance and control aids, where applicable, including location and type of visual docking guidance system;	*See specimen chart 13*
	c) geographical coordinates to at least one-tenth of a minute for aircraft stands; This requirement may be met by a graticule which will permit the coordinates of the locations selected to be read to the required accuracy.	 *(Note.— Graticule is 30% screened on specimen chart 12)*
	d) taxiways with designations, width, bearing strength or aircraft type restrictions where applicable, lighting, markings, including runway-holding positions (and, where established, intermediate holding positions), stopbars and other visual guidance 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;	

Annex 4 reference	*Details*	*Drafting Illustration*
	i) relevant radio 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; and m) any part of the depicted movement area permanently unsuitable for aircraft, clearly identified as such.	

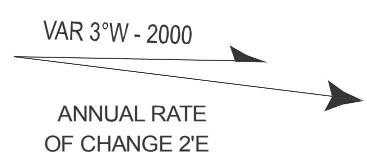
Annex 4 reference	*Details*	*Drafting Illustration*
	n) where established, locations and all ground areas where it is safe for aeroplanes with folding wing tips to operate with wing tips extended.	

7.15 AIRCRAFT PARKING/DOCKING CHART — ICAO

Annex 4 reference	*General*
15.1	**Function** The Aircraft Parking/Docking Chart — ICAO is a supplementary chart providing 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	**Applicability** The Aircraft Parking/Docking Chart — ICAO should be made available 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. **Operational requirements** See Chapter 7 — General Specifications, Section 7.2, Annex 4, reference 2.1.1 to 2.1.8, inclusive. **Planning** At the planning stage of preparing the Aircraft Parking/Docking Chart — ICAO, consideration should be given to the interrelationship between this type of chart, the Aerodrome/Heliport Chart — ICAO and the Aerodrome Ground Movement Chart — ICAO. A considerable amount of duplication, particularly in surveys and in the selection of base material, can be avoided by planning the project to include requirements for the three types of charts at this stage of their production. Many of the same features may appear on all three charts.

Annex 4 reference	*Details*	*Drafting Illustration*
15.3	**Coverage and scale**	
15.3.1	The coverage and scale must be sufficiently large to show clearly all the elements listed under Aerodrome Data. A linear scale should be shown.	
2.1.8	**Format** The format should be in accordance with specimen chart 13.	

Annex 4 reference	*Details*	*Drafting Illustration*
2.2	**Title** The title of the chart must be “Aircraft Parking/Docking Chart — ICAO”. This title must not include “ICAO” unless the chart conforms with the Standards specified in Annex 4, Chapters 2 and 15.	**AIRCRAFT PARKING** **DOCKING CHART — ICAO**
15.4	**Identification** The chart must 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.	CITY AERODROME COUNTRY *(Note.— Name of Country may be omitted where chart is published as part of an AIP. — See Annex 4, reference 2.3.4)*
	Marginal note layout	
2.3.1	The marginal note layout must conform to that provided on specimen chart 13. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.3.2 to 2.3.4, inclusive.	
2.4	**Symbols** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	
2.5	**Units of measurement** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	
2.7	**Date of aeronautical Information** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, as applicable.	

Annex 4 reference	*Details*	*Drafting Illustration*
2.9	**Abbreviations** See Chapter 7 – General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	
2.11	**Colours** Although a single colour is acceptable for this type of chart, particularly for uncomplicated aerodromes, a second colour would serve to clearly identify important aeronautical features. It is obvious that a second colour will increase the cost, and any benefits would need to be assessed. Single colour charts are normally printed in black ink on white paper. The application of percentage screens to the movement areas and buildings can provide a more easily interpreted chart. When two or more colours are used, a light grey should be used for the movement area and buildings and dark blue for dimensions, characteristics of visual aids, identification of facilities and services, etc.	
2.16	**Typography** Samples of type suitable for use on charts are provided in Section 7.2. **Culture and Topography** As required under Aerodrome Data.	
15.5	**Magnetic Variation**	
15.5.1	A True North arrow must be shown.	
15.5.2	Magnetic variation and its annual change should be shown. This chart need not be True North orientated. See also Chapter 7 – General Specifications, Section 7.2, Annex 4 reference 2.15.2.	

Annex 4 reference	*Details*	*Drafting Illustration*
15.6	**Aerodrome Data**	

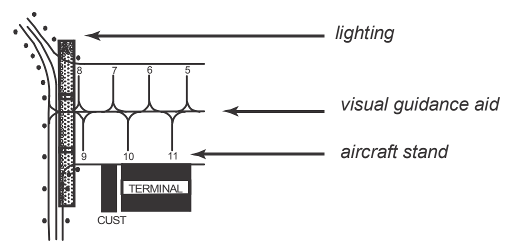
This chart must show in a similar manner all the information on the Aerodrome Chart — ICAO and the Aerodrome Ground Movement Chart — ICAO relevant to the area depicted, including:

See specimen charts 11 and 12

a) apron elevation;

APRON ELEV
28 m

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;



TAXIWAYS AND APRON BEARING STRENGTH PCN 80/R/B/W/T ← *bearing strength*

AIRCRAFT STANDS 1 AND 8 NOT FOR B747 ← *aircraft type restrictions*

AIRCRAFT STANDS 10 TO 13 AGNIS EQUIPPED ← *visual docking guidance system*

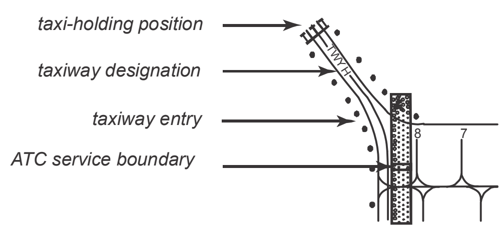
c) geographical coordinates to at least one-tenth of a minute for aircraft stands;

This requirement may be met by a graticule which will permit the coordinates of the locations selected to be read to the required accuracy.

INS COORDINATES FOR AIRCRAFT STANDS					
1	52°22.5'N	031°56.9'W	8	52°22.2'N	031°56.9'W
2,3	52°22.4'N	031°56.9'W	9,10	52°22.2'N	031°56.7'W
4,5	52°22.3'N	031°56.9'W	11,12	52°22.3'N	031°56.7'W
6,7	52°22.2'N	031°56.9'W	12,13	52°22.4'N	031°56.7'W

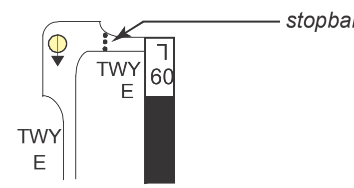
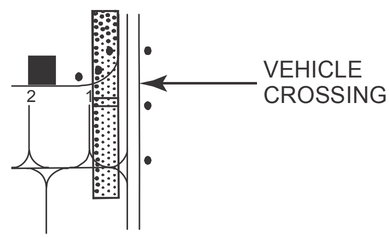
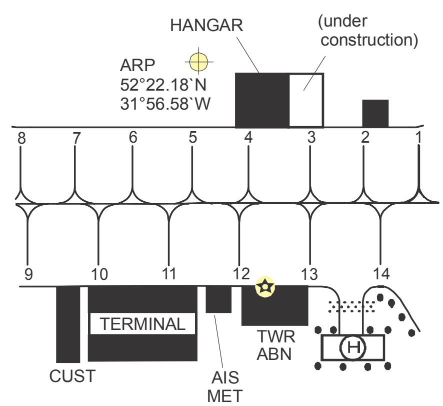
See specimen chart 12

d) taxiway entries with designations, including runway-holding positions and, where established, intermediate holding positions, stopbars. Two taxi-holding position symbols are given in Annex 4. The application of these symbols is governed by Annex 14, Volume I, Chapter 5, 5.2.



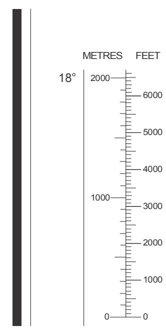
e) where established, hot spot locations with additional information properly annotated;

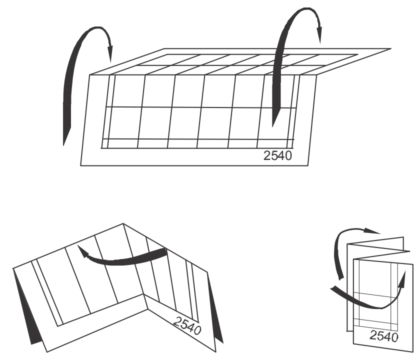
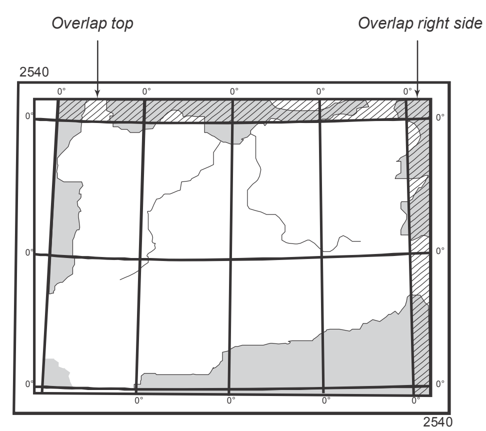
Additional information regarding hot spots may be shown in tabular form on the face or verso of the chart.

Annex 4 reference	*Details*	*Drafting Illustration*
	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 frequency channels and, if applicable, logon address;	TWR 118.1 APRON 121.6
	i) obstacles to taxiing;	
	j) aircraft servicing areas and buildings of operational significance;	
	k) VOR checkpoint and radio frequency of the aid concerned; and	*See specimen charts 11 and 12*
	l) any part of the depicted movement area permanently unsuitable for aircraft clearly identified as such.	*See specimen chart 12*

7.16 WORLD AERONAUTICAL CHART — ICAO — 1:1 000 000

Annex 4 reference	*General*
16.1	**Function** The function of the World Aeronautical Chart — ICAO 1:1 000 000 is to satisfy the requirements of visual navigation. In addition, this chart serves: a) as a basic aeronautical chart: 1) when specialized charts (e.g. Area Chart — ICAO, Enroute Chart — ICAO) lacking visual information do not provide essential data; 2) to provide complete world coverage at a constant scale with a uniform presentation of planimetric (i.e. features other than relief) data; 3) in the production of other aeronautic charts; b) as a pre-flight planning chart.
16.2	**Applicability**
16.2.1	The World Aeronautical Chart — ICAO 1:1 000 000 must be made available for all areas delineated in Appendix 5 of Annex 4. 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. **Operational requirements** See Chapter 7 – General Specifications, Section 7.2, Annex 4 reference 2.1.1 to 2.1.7.

Annex 4 reference	*Details*	*Drafting Illustration*
16.3	**Scales**	
16.3.1	Linear scales for kilometres and nautical miles must be shown in the margin, arranged in the following order; — kilometres — nautical miles with their zero points in the same vertical line.	
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) must be shown in the margin.	
16.4	**Format**	
16.4.1	The title and marginal notes should be in one of the ICAO working languages. The language of the publishing country may be used in addition to the ICAO working language.	*See example 1 in this Section.*
16.4.2	The information regarding the number of the adjoining sheets and the unit of measurement to express elevations must be so located as to be clearly visible when the sheet is folded.	*See example 1 on in this Section.*

Annex 4 reference	*Details*	*Drafting Illustration*
16.4.3	The method of folding should be as follows: Step 1 — fold the sheet on the long axis, near the mid-parallel, face out, the bottom half of the chart upward; Step 2 — fold inwards near the centre meridian; and Step 3 — fold both halves backwards in accordion folds.	
16.4.4	Whenever practicable, the sheet lines should conform with those shown in the sheet layout in Annex 4, Appendix 5.	
Note 1	The area covered by a sheet may vary from the lines shown to satisfy particular requirements.	
Note 2	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 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 if possible up to 28 kilometres (15 nautical miles) on both the top and side from the limiting parallels and meridians of each sheet to the neat line.	

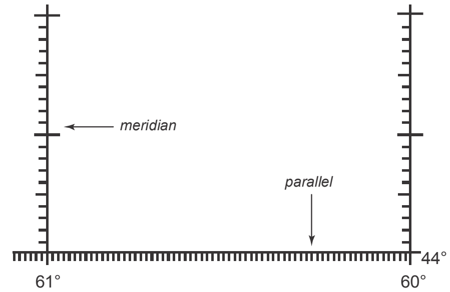
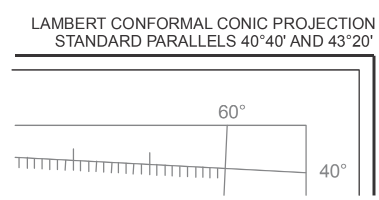
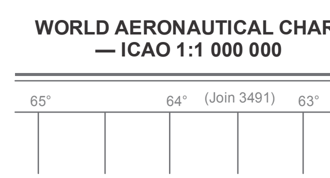
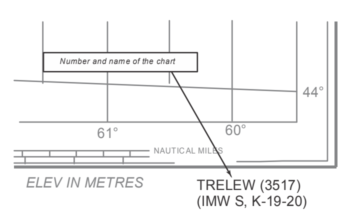
Annex 4 reference	*Details*	*Drafting Illustration*
16.5	**Projection**	
16.5.1	The projections to be used are as follows: a) between the Equator and 80^{o} latitude: the Lambert conformal conic projection, in separate bands for each tier of charts. The standard parallels for each 4^{o} band must be 40' south of the northern parallel and 40' north of the southern parallel; b) between 80^{o} and 90^{o} latitude: the Polar stereographic projection with scale matching that the Lambert conformal conic projection at latitude 80^{o} except that in the northern hemisphere the Lambert conformal conic projection may be used between 80^{o} and 84^{o} latitude and the Polar stereographic projection between 84^{o} and 90^{o} with the scales matching at 84^{o} North.	
16.5.2	Graticules and graduations must be shown as follows:	

1) Parallels:

Latitude	Distance between parallels	Graduations on parallels
0^{o} to 72^{o}	30'	1'
72^{o} to 84^{o}	30'	5' only on degree parallels
84^{o} to 89^{o}	30'	1^{o} only on degree parallels
89^{o} to 90^{o}	30'	5^{o}

2) Meridians:

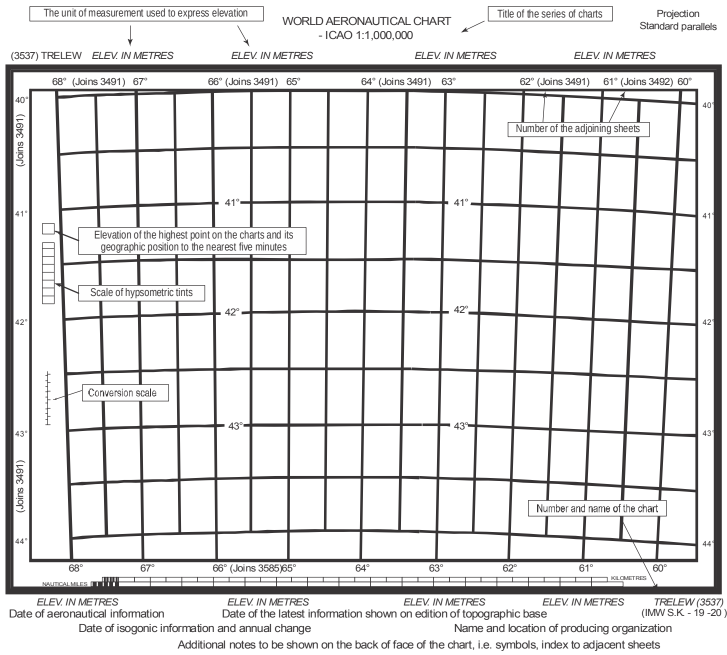
Latitude	Interval between meridians	Graduations on meridians
0^{o} to 52^{o}	30'	1' only on even numbered meridians
52^{o} to 72^{o}	30'	1' only on even numbered meridians
72^{o} to 84^{o}	1^{o}	1' only on every fourth meridian
84^{o} to 89^{o}	5^{o}	1' only on every fourth meridian
89^{o} to 90^{o}	15^{o}	1' only on every fourth meridian

Annex 4 reference	*Details*	*Drafting Illustration*
16.5.3	The graduation marks at 1’ and 5’ intervals must extend away from Greenwich Meridian and from the Equator. Each 10’ interval must 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, 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 must be numbered in the borders of the charts. In addition, each parallel must 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.	*See example 1 in this Section.*
16.5.5	The name and basic parameters of the projection must be indicated in the margin.	
2.2	**Title** The title must be “World Aeronautical Chart – ICAO 1:1 000 000”. The title must not include “ICAO” unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 16.	
16.6	**Identification** Sheet numbering must be in conformity with the sheet layout in Appendix 5 of Annex 4. The corresponding International Map of the World (IMW) sheet number may also be shown.	

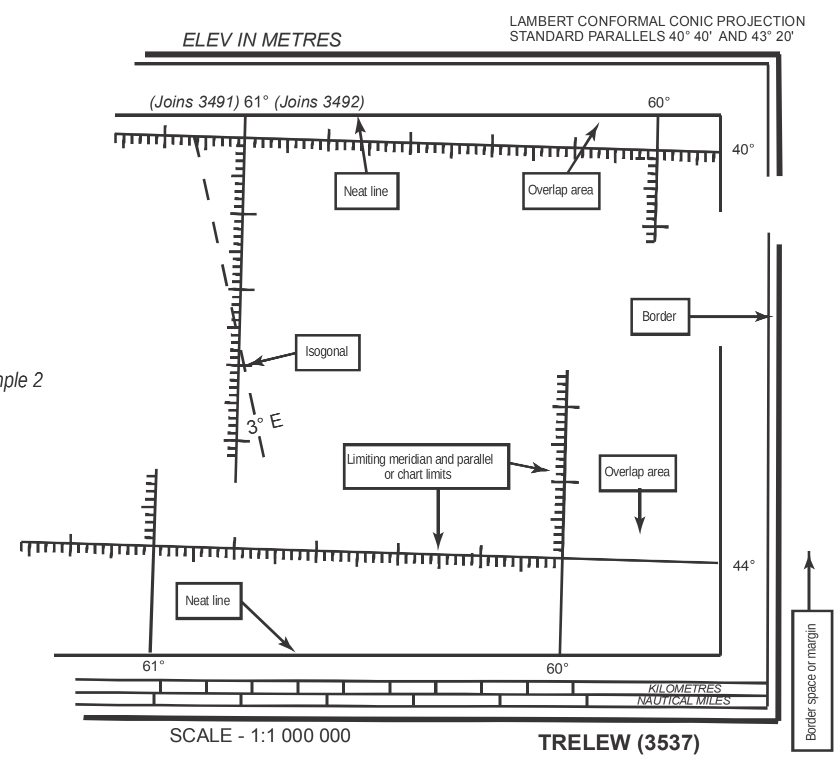
Annex 4 reference	*Details*	*Drafting Illustration*

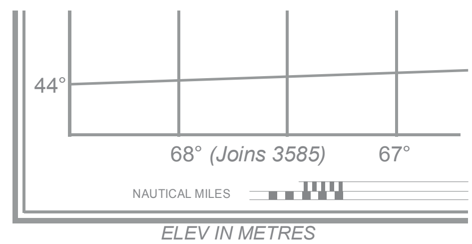
The MARGINAL NOTE LAYOUT should be in accordance with the following examples:

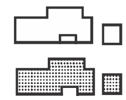
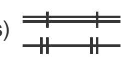
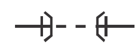
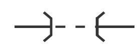
Example 1

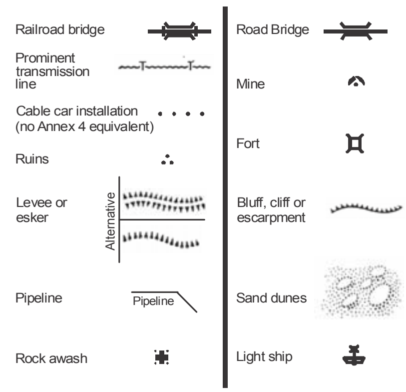
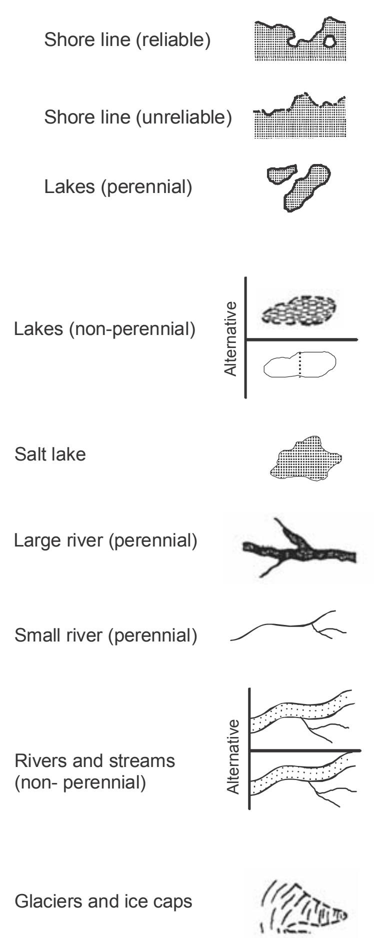


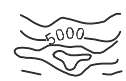
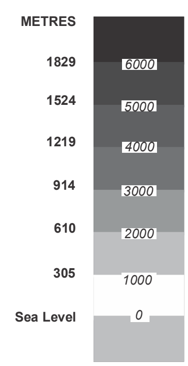
Example 2

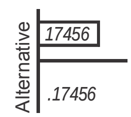


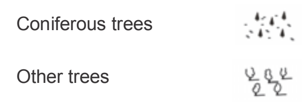
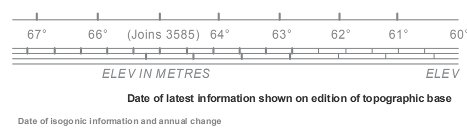
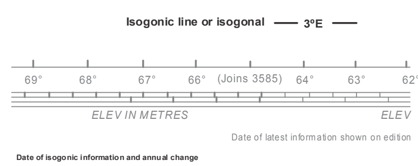
Annex 4 reference	*Details*	*Drafting Illustration*
2.4	**Symbols** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	
2.5	**Units of measurement** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	
2.7	**Date of aeronautical information** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	***Date of aeronautical information***
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, inclusive.	
2.9	**Abbreviations** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	
16.7.5	**Political boundaries** International boundaries must be shown. Undemarcated or defined boundaries must be distinguished by descriptive notes. See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.10.1 and 2.10.2.	**Boundary undetermined**
2.11	**Colours** Colours used on these charts should conform to Annex 4, Appendix 3 – Colour Guide and Appendix 4 – Hypsometric Tint Guide. (See also Chapter 5 of this manual.)	

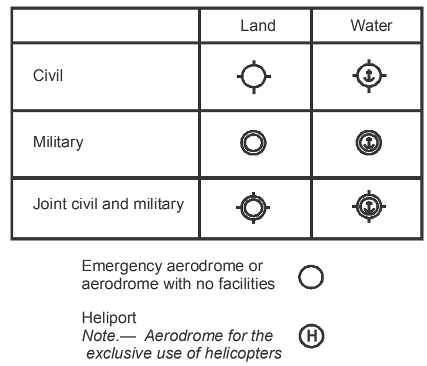
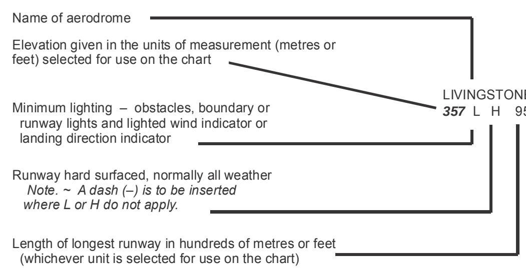
Annex 4 reference	*Details*	*Drafting Illustration*
	Typography	
	Samples of type suitable for use on charts are provided in Section 7.2.	
16.7	**Culture and topography**	City or large town 
16.7.1	Built-up areas	
16.7.1.1	Cities, towns and villages must be selected and shown according to their relative importance to visual air navigation.	Town  Village
16.7.1.2	Cities and towns of sufficient size should be indicated by the outline of their built-up areas and not by the outline of their established city limits.	
16.7.2	Railroads	Railroad (single track) 
16.7.2.1	All railroads having landmark value must be shown. In congested areas, some railroads may be omitted in the interest of legibility.	Railroad (single two or more tracks) 
	Railroads may be named where space permits.	Railroad (under construction) 
16.7.2.2	Important tunnels should be shown.	Railroad tunnel 
	A descriptive note may be added.	Road tunnel 
16.7.3	Highways and roads	Dual highway 
16.7.3.1	Road systems must be shown in sufficient detail to indicate significant patterns from the air.	Primary road 
16.7.3.2	Roads should not be shown in built-up areas unless they can be distinguished from the air as definite landmarks.	Secondary road
	The numbers or names of important highways may be shown.	Trail

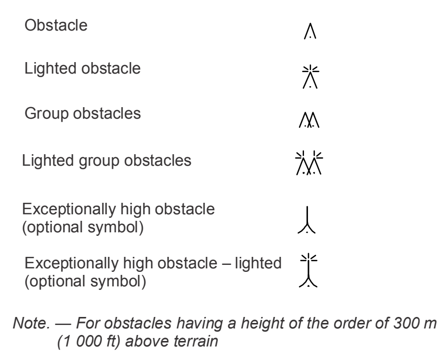
Annex 4 reference	*Details*	*Drafting Illustration*
16.7.4	Landmarks Natural and cultural landmarks, such as bridges, prominent transmission lines, permanent cable car installations, wind turbines, mine structures, forts, ruins, levees, pipelines, and rocks, bluffs, cliffs, sand dunes, isolated lighthouses, lightships, etc., when considered to be of importance for visual air navigation should be shown. Descriptive notes may be added.	
16.7.6	Hydrography	
16.7.6.1	All water features compatible with the scale of the chart comprising shorelines, lakes, rivers and streams (including those non-perennial in nature), salt lakes, glaciers and ice caps must be shown.	
16.7.6.2	The tint covering large open water areas should be kept very light. (cf Colour Guide — Annex 4, Appendix 3) A narrow band of darker tone may be used along the shoreline to emphasize this feature.	

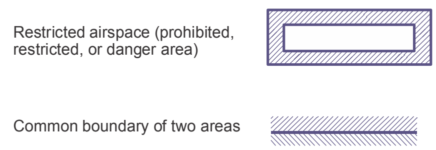
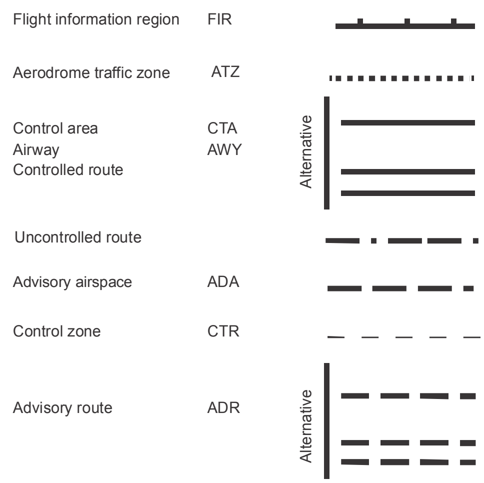
Annex 4 reference	*Details*	*Drafting Illustration*
16.7.6.3	Reefs and shoals including rocky ledges, tidal flats, isolated rocks, sand, gravel, stone and all similar areas should be shown by symbols when of significant landmark value. Groups of rocks may be shown by a few representative rock symbols within the area.	Coral reefs and ledges  Shoals  Tidal flats  Charted isolated rock Sand area  Gravel 
16.7.7	Contours	Contours 
16.7.7.1	Contours must be shown. The selection of intervals must be governed by the requirement to depict clearly the relief features required in air navigation.	Approximate contours 
16.7.7.2	The values of the contours used must be shown.	
16.7.8	Hypsometric tints	
16.7.8.1	When hypsometric tints are used, the range of elevations for the tints must be shown.	
16.7.8.2	The scale of the hypsometric tints used on the chart must be shown in the margin.	*See example 1 in this Section.*

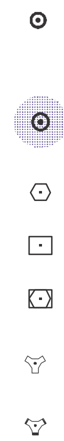
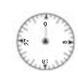
Annex 4 reference	*Details*	*Drafting Illustration*
16.7.9	Spot elevations	Spot elevation .6397 .8975
16.7.9.1	Spot elevations must be shown at selected critical points. The elevations selected must always be the highest in the immediate vicinity and must generally indicate the top of a peak, ridge, etc. Elevations in valleys and at lake surface levels which are of special value to the aviator must be shown. The position of each selected elevation must be indicated by a dot.	Spot elevation (of doubtful accuracy) .6370±
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 must be indicated in the margin.	Highest elevation on chart 
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 data	Areas not surveyed for contour information or relief data incomplete 
16.7.10.1	Areas that have not been surveyed for contour information must be labelled “Relief data incomplete”, and hypsometric tinting omitted.	*to be tinted “Golden Buff” (see Annex 4, page A-3-2)*
16.7.10.2	Charts on which spot elevations are generally unreliable must 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.” See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.12.3.1.	
16.7.11	Escarpments	Bluff, cliff or escarpment
16.7.11.1	Escarpments should be shown when they are prominent landmarks or when cultural detail is very sparse.	

Annex 4 reference	*Details*	*Drafting Illustration*
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. If shown, these areas may be depicted by either the colour prescribed in Appendix 3 of Annex 4 or by a symbol which should be explained in the legend of the chart.	
16.7.12.2	Where shown, the approximate extreme northern by southern limits of tree growth must be indicated by a dashed black line and must be appropriately labelled.	
16.7.13	Date of topographic information The date of latest information shown on the topographic base must be indicated in the margin.	
16.8	**Magnetic variation**	
16.8.1	Isogonic lines must be shown.	
16.8.2	The date of the isogonic information must be indicated in the margin. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.15.1 and 2.15.2.	
16.9	**Aeronautical data**	
16.9.1	Aeronautical data shown must be kept to a minimum consistent with the use of the chart for visual navigation and the revision cycle (see Annex 4 reference 16.9.6 in this Section). *Note.— Revision cycle* *Approximate period between revisions:* *Base: 4 years* *Aeronautical data: 1-2 years* The aeronautical data, being of a changeable nature, will have to be carefully selected so that the revision cycle for this chart can be adhered to.	

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td>16.9.2</td><td>Aerodromes</td><td></td></tr>
<tr><td>16.9.2.1</td><td>Land and water aerodromes and heliports must 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.</td><td>
</td></tr>
<tr><td>16.9.2.2</td><td>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 of Annex 4, provided they do not cause undesirable clutter on the chart, must be indicated.</td><td>
</td></tr>
<tr><td>16.9.2.3</td><td>Abandoned aerodromes which are still recognizable as aerodromes from the air must be shown and identified as abandoned.</td><td>
</td></tr>
<tr><td>16.9.3</td><td>Obstacles</td><td></td></tr>
<tr><td>16.9.3.1</td><td>Obstacles must be shown.

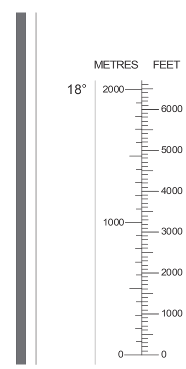
Obstacles of a height of 100 m (300 ft) or more above the ground are normally regarded as significant obstacles.</td><td rowspan="2">
</td></tr>
<tr><td>16.9.3.2</td><td>When considered of importance to visual flight, prominent transmission lines, permanent cable car installations and wind turbines which are significant obstacles, must be shown.</td></tr>
</table>

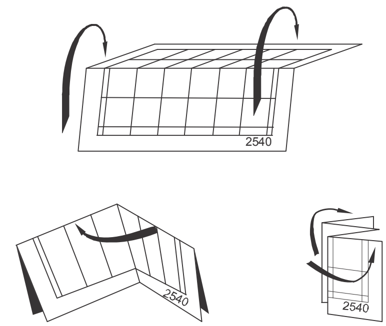
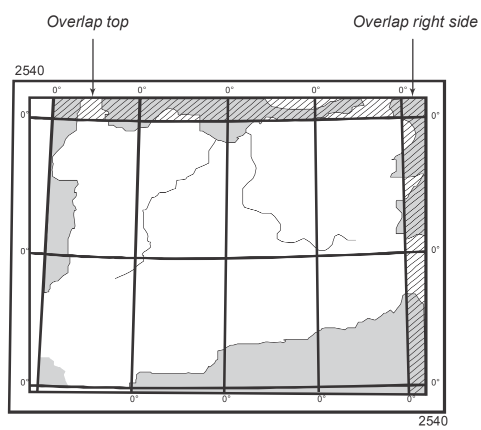
Annex 4 reference	*Details*	*Drafting Illustration*
16.9.4	Prohibited, restricted and danger areas Prohibited, restricted and danger areas must be shown. With regard to prohibited, restricted and danger areas, see also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.13.	 *Note.— The angle and density of rulings may be varied according to scale and the size, shape and orientation of the area.*
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 must be shown together with the appropriate class of airspace.	
16.9.5.2	Where appropriate, the air defence identification zone (ADIZ) must be shown and properly identified. *Note.—* ADIZ procedures may be described in the chart legend.	*(Note.— See also Section 7.2 for depiction of airspace classification to be developed.)*

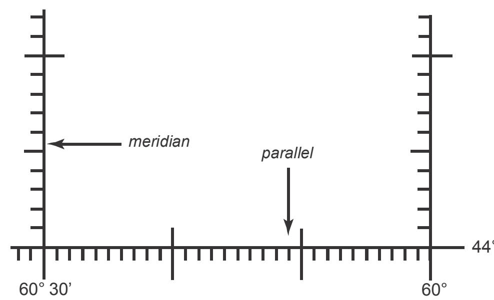
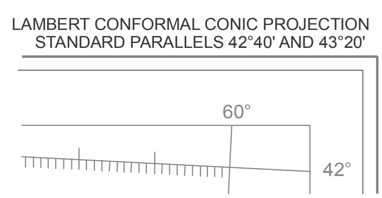
Annex 4 reference	*Details*	*Drafting Illustration*
16.9.6	Radio navigation aids Radio navigation aids must be shown by appropriate symbol and named, but excluding their frequencies, coded designators, times of operation and other characteristics unless any or all of this information which is shown is kept up to date by means of new editions of the chart.	Basic radio navigation aid symbol *Note.— This symbol may be used with or without a box to enclose the data.* Non-directional radio beacon — NDB VHF omnidirectional radio range — VOR Distance measuring equipment — DME Collocated VOR and DME radio navigation aids — VOR/DME UHF tactical air navigation aid — TACAN Collocated VOR and TACAN radio navigation aids — VORTAC  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.*
16.9.7	Supplementary information	
16.9.7.1	Aeronautical ground lights together with their characteristics or their identifications or both must be shown.	Aeronautical ground light Marine light F 
16.9.7.2	Marine lights on outer prominent coastal or isolated features of not less than 28 kilometres (15 nautical miles) visibility range must 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.	*Note 1.— Marine alternating lights are red and white unless otherwise indicated. Marine lights are white unless colours are stated.* *Note 2.— Characteristics are to be indicated as follows:* Alt Alternating B Blue F Fixed F1 Flashing G Green Gp Group Occ Occulting R Red SFC Sector sec Second (U) Unwatched W White

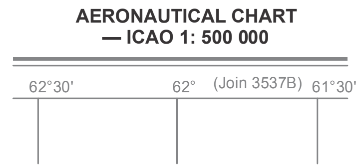
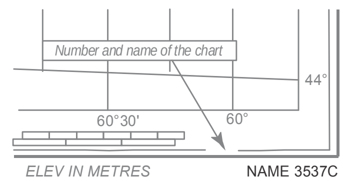
7.17 AERONAUTICAL CHART — ICAO 1:500 000

Annex 4 reference	*General*
17.1	**Function** The Aeronautical Chart — ICAO 1:500 000 is designed: a) to provide information to satisfy the requirements of visual air navigation for low speed, short- or medium-range operations at low and intermediate altitudes; b) to serve as a basic aeronautical chart; c) to provide a suitable chart for basic pilot and navigation training; d) to supplement specialized charts (e.g. Area Chart — ICAO and Enroute Chart — ICAO) which do not provide essential visual information; e) for use in pre-flight planning. Uniformity in the presentation of all the base features and aeronautical information is essential. Hydrographical, topographical and cultural features are to be shown to the fullest extent compatible with legibility and scale of the chart.
17.2	**Applicability** Availability of this chart is recommended for all areas delineated in Annex 4, Appendix 5 — sheet layout for the World Aeronautical Chart — ICAO (WAC) 1:1 000 000. There is no obligation to publish charts at a scale of 1:500 000, unless chart production considerations (such as congested air route systems; an existing topographical chart series) or the operational requirements indicate that the production of a chart series at a scale larger than the mandatory WAC — ICAO 1:1 000 000 is necessary. The Aeronautical Chart — ICAO 1:500 000 may be made available as an alternative to the World Aeronautical Chart – ICAO 1:1 000 000. **Operational requirements** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.1.1 to 2.1.7 inclusive. **Planning** Consideration should be given to the interrelationship between this type of chart, the WAC — ICAO 1:1 000 000 and the Visual /Instrument Approach Charts — ICAO. Considerable savings can be effected at the compilation stage by utilizing data obtained during preparation of these related charts.

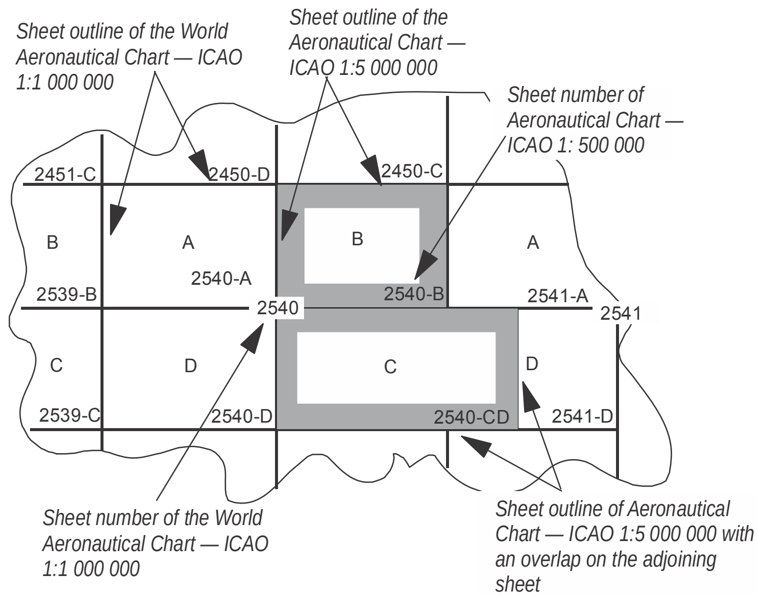
Annex 4 reference	*Details*	*Drafting illustration*
17.3	**Scales**	
	It is intended that these charts be provided for land areas where charts of this scale are required for civil air operations employing visual air navigation independently or in support of other forms of air navigation.	
	Where States produce charts of this series covering their national territories, the entire area being portrayed is usually treated on a regional basis.	
17.3.1	Linear scales for kilometres and nautical miles must be shown in the margin, arranged in the following order: — kilometres, — nautical miles, with their zero points in the same vertical line.	
17.3.1.1	The length of the linear scale should not be less than 200 mm (8 in).	
17.3.2	A conversion scale (metres/feet) must be shown in the margin.	
17.4	**Format**	
17.4.1	The title and marginal notes must be in one of the working languages of ICAO.	*See example 1 in this Section.*
	The language of the publishing country or any other language may be used in addition to the ICAO working language.	*See example 1 in this Section.*

Annex 4 reference	*Details*	*Drafting illustration*
17.4.2	The information identifying the name and sheet number of the chart, numbering of the adjoining sheets and the unit of measurement used to express elevations must be so located as to be visible when the sheet is folded.	
17.4.3	The recommended method of folding is as follows: Step 1 — fold sheet on the long axis, near the mid-parallel, face out, with the bottom part of the chart upward; Step 2 — fold inwards near the centre meridian; and Step 3 — fold both halves backwards in accordion folds.	
17.4.4	Whenever practicable the chart should be a quarter sheet of the World Aeronautical Chart (WAC) — ICAO 1:1 000 000. Sheet lines may vary to satisfy particular requirements e.g. to contain the national boundaries of a State on the same chart, one edge of the sheet could be extended to overlap an adjoining sheet. An index to the adjoining sheets showing relationship between the Aeronautical Chart — ICAO 1:500 000 and WAC — ICAO 1:1 000 000 sheets should be included on the face of the chart, or on the reverse side.	*See drafting illustration in this Section under Annex 4 reference 17.6.1.1.*
17.4.5	Overlaps should be provided by extending the chart area on the top and right side beyond the area portrayed on the index. This overlap area should contain aeronautical, topographical, hydrographical and cultural information, and should extend, if possible, up to 15 kilometres (8 nautical miles) on both the top and side from the limiting parallels and meridians of each sheet to the neat line.	

Annex 4 reference	*Details*	*Drafting illustration*
17.5	**Projection**	
17.5.1	The chart must be drawn on a conformal (orthomorphic) projection and the following is recommended: Between the Equator and 80° latitude the Lambert conformal conic projection, in separate bands for each tier of charts. The standard parallels for each 2° band shall be 40’ south of the northern parallel and 40’ north of the southern parallel. *Note.— The need for a 1:500 000 chart north or south of 80° latitude is not envisaged since the geographical features and elements in these areas are not normally useful for visual flight operations.*	
17.5.3	Parallels must be shown at intervals of 30’.	
17.5.3.1	Meridians must normally be shown at intervals of 30’. At high latitudes this interval may be increased.	
17.5.4	Graduation marks must 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 must 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, 2 mm (0.08 in) for the 5’ intervals and 2 mm (0.08 in) extending on both sides of the graticule line for 10’ intervals.	
17.5.5	All meridians and parallels shown must be numbered in the borders of the chart.	*See example 1 in this Section.*
17.5.5.1	Each meridian and parallel should be numbered within the body of the chart whenever this data is required operationally.	*See example 1 in this Section.*
17.5.6	The name and basic parameters of the projection must be indicated in the margin.	

Annex 4 reference	*Details*	*Drafting illustration*
2.2	**Title** The title must be “Aeronautical Chart — ICAO 1:500 000”, except that this title must not include “ICAO” unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 17.	
17.6	**Identification**	
17.6.1	Each sheet must be identified by name. The name 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	

Annex 4 reference	*Details*	*Drafting illustration*



Notes: Sheet 2540 is the number of the WAC - ICAO 1:100 000 sheet;

Sheet 2540-B is the number of a single Aeronautical Chart — ICAO 1:5 000 000 sheet in the North-East quadrant of the WAC - ICAO 1:1 000 000 sheet; and

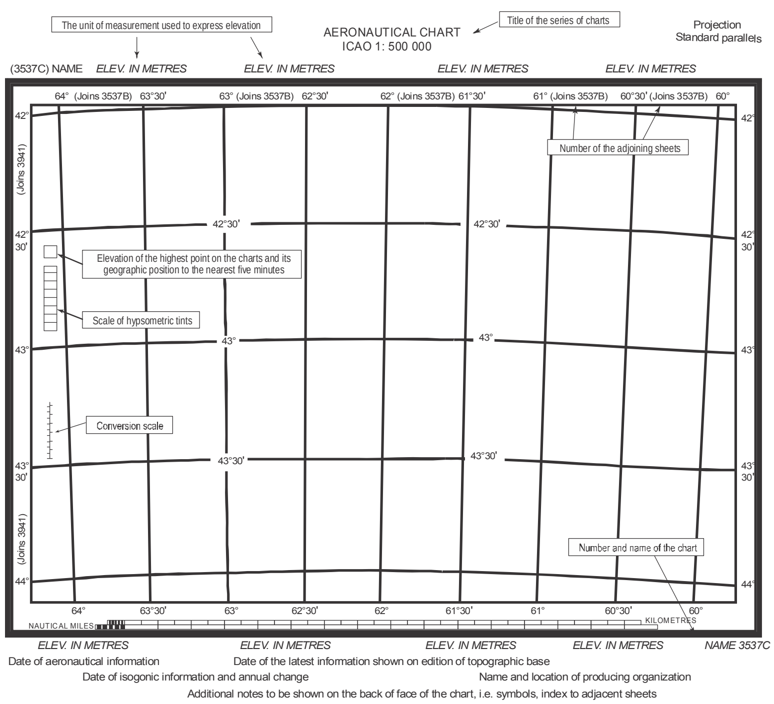
Sheet 2540-CD is the number of the Aeronautical Chart — ICAO 1:5 000 000 in the South-East quadrant, which overlaps on the South-West quadrant of the adjoining sheet 2541-D. To convey this, both the letters "CD" are added to the sheet number.

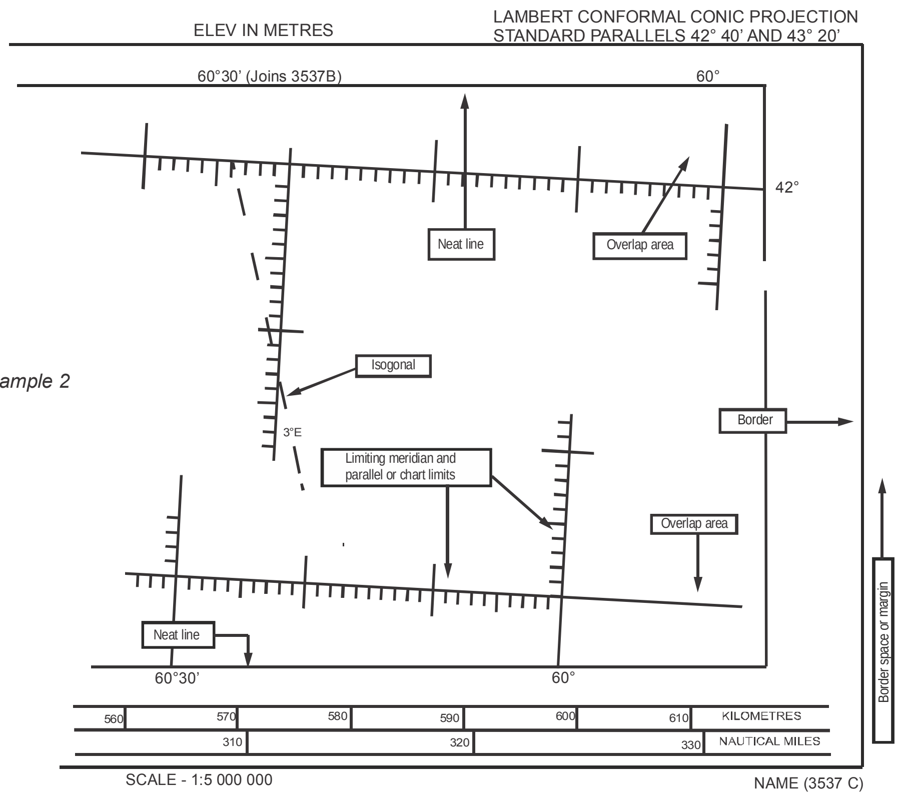
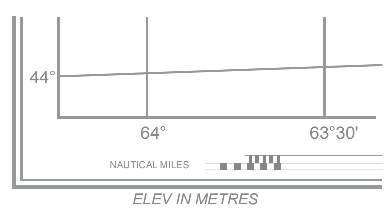
	Marginal note layout	
2.3.1	The marginal note layout must conform to that provided in Appendix 1 to Annex 4.	
2.3.2	The marginal notes must include: a) the title of the chart series; b) the name and reference number of the sheet; c) on each margin, the number of the adjoining sheet (as applicable); d) a legend to the symbols and abbreviations on the face or reverse of each sheet; e) name and address of the producing agency; f) name and standard parallels of the projection;	*See examples 1 and 2 in this Section.*

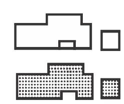
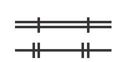
Annex 4 reference	*Details*	*Drafting illustration*
	g) a scale of the hypsometric tints used on the chart; h) a conversion scale (metres/feet); i) the elevation of the highest point on the chart and its geographical position to the nearest five minutes; j) date of validity of the aeronautical information; k) date of the latest information shown on the topographic base; l) date and the annual change of the isogonic information; m) linear scales in kilometres and nautical miles.	

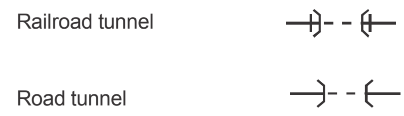
The MARGINAL NOTE LAYOUT should be in accordance with the following examples:

Example 1



Annex 4 reference	*Details*	*Drafting illustration*
	Example 2 	
2.4	**Symbols** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	
2.5	**Units of measurement** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	
2.7	**Date of aeronautical information** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	 ***Date of aeronautical information***
2.8	**Spelling of geographical names** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, inclusive.	

Annex 4 reference	*Details*	*Drafting illustration*
2.9	**Abbreviations**	
	See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	
17.7.5	**Political boundaries**	
	International boundaries must be shown. Undemarcated or undefined boundaries must be distinguished by descriptive notes.	**Boundary undetermined**
	Other boundaries may be shown.	
	See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.10.1 and 2.10.2.	
2.11	**Colours**	
	Colours used on these charts should conform to Annex 4, Appendix 3 — Colour Guide and Appendix 4 — Hypsometric Tint Guide. (See also Chapter 5, page 5-4).	
2.16	**Typography**	
	Samples of type suitable for use on aeronautical charts are provided in Section 7.2.	
17.7	**Culture and topography**	City or large town 
17.7.1	Built-up areas	
17.7.1.1	Cities, towns and villages must be selected and shown according to their relative importance to visual air navigation.	Town  Village
17.7.1.2	Cities and towns of sufficient size should be shown by the outline of their built-up areas and not by the outline of their established city limits.	
17.7.2	Railroads	Railroad (single track) 
17.7.2.1	All railroads having landmark value must be shown. In congested areas, some railroads may be omitted in the interest of legibility.	Railroad (single two or more tracks) 
	Railroads may be named and rail stations may be shown.	Railroad (under construction) 

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting illustration</th></tr>
<tr><td>17.7.2.2</td><td>Tunnels must be shown when they serve as prominent landmarks and a descriptive note may be added, to accentuate this feature.</td><td>
</td></tr>
<tr><td>17.7.3

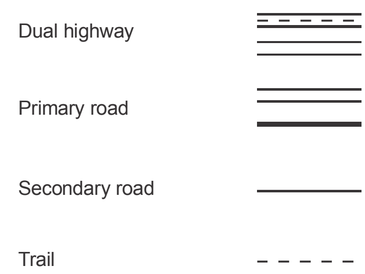
17.7.3.1

17.7.3.2</td><td>Highways and roads

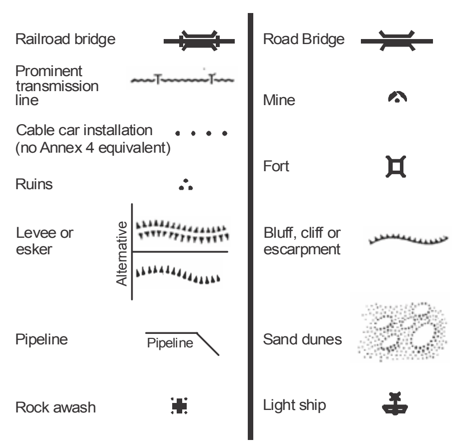
Road systems are to be shown in sufficient detail to indicate significant patterns when viewed from the air.

Roads under construction may also be shown.

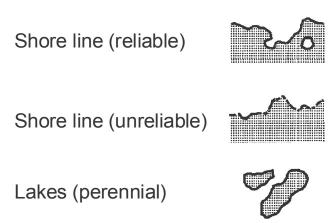
Roads in built-up areas should not be shown unless they can be distinguished from the air as definite landmarks.

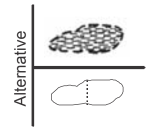
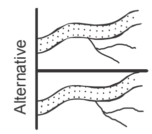
The numbers and names of important highways may be shown.</td><td>
</td></tr>
<tr><td>17.7.4</td><td>Landmarks

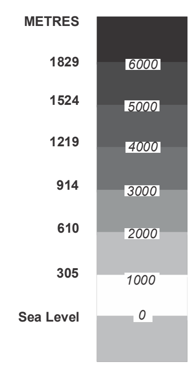
Natural and cultural landmarks such as bridges, mine structures, lookout towers, forts, ruins, levees, pipelines, prominent transmission lines, permanent cable car installations, wind turbines, cliffs, bluffs, rocks, sand dunes, isolated lighthouses, stadia, race courses, television towers, etc., should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

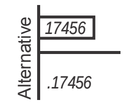
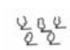
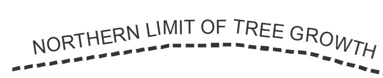
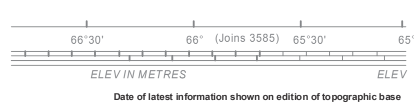
Descriptive notes may also be added.</td><td>
</td></tr>
<tr><td>17.7.6

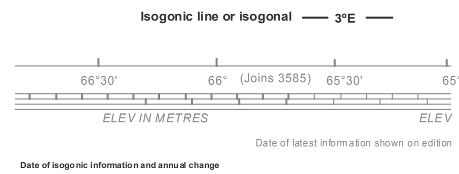
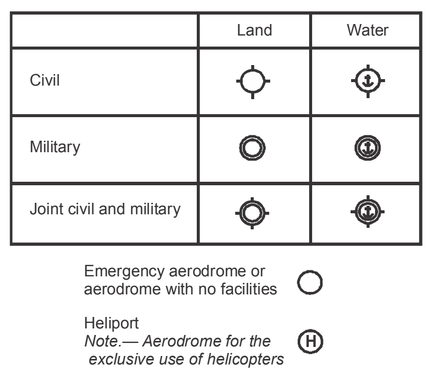
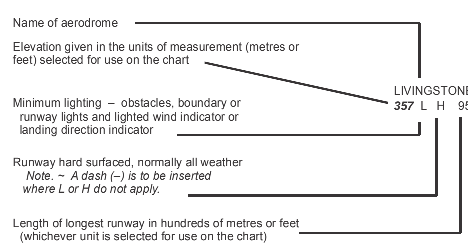
17.7.6.1</td><td>Hydrography

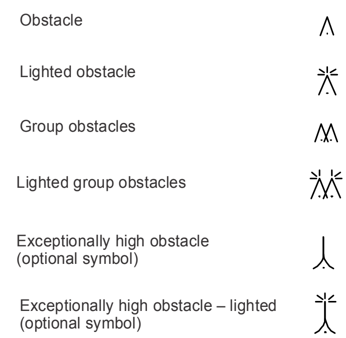
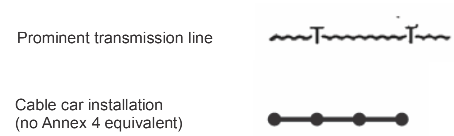
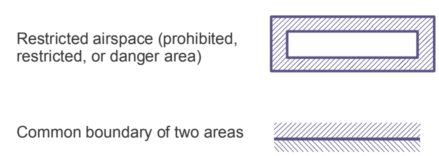
All water features compatible with the scale of the chart comprising shorelines, lakes, rivers and streams (including non-perennial), salt lakes, glaciers and ice caps must be shown.</td><td>
</td></tr>
</table>

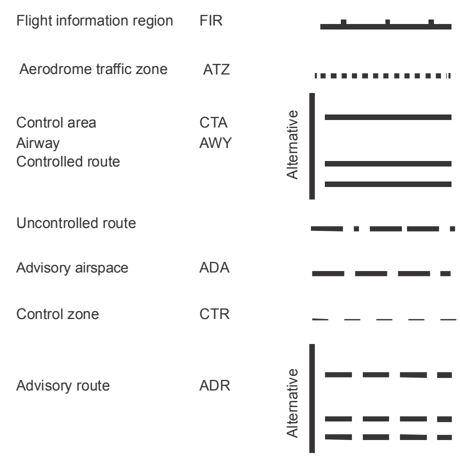
Annex 4 reference	*Details*	*Drafting illustration*
17.7.6.2	The tint covering large open areas should be kept very light (cf Colour Guide – Annex 4, Appendix 3). A narrow band of darker tone may be used along shorelines for emphasis.	Lakes (non-perennial)  Salt lake  Large river (perennial)  Small river (perennial)  Rivers and streams (non- perennial)  Glaciers and ice caps 
17.7.6.3	Reefs and shoals, including rocky ledges, tidal flats, isolated rocks, sand, gravel, stone and all similar areas should, when of significant landmark value, be shown by the appropriate symbols. Groups of rocks may be shown by a few representative rock symbols within the area.	Coral reefs and ledges  Shoals  Tidal flats  Charted isolated rock Sand area  Gravel 

Annex 4 reference	*Details*	*Drafting illustration*
17.7.7	Contours	
17.7.7.1	Contours must be shown. The selection of intervals must be governed by the requirement to depict clearly the relief features required in air navigation.	Contours  Approximate contours 
17.7.7.2	The values of the contours used must be shown.	
	Relief is normally portrayed by a combination of contours, spot elevations, hypsometric tints and shaded relief. Choice of the techniques employed depends on the intended use and scale of the chart. It is considered that a combination of all the aforementioned techniques is appropriate for the Aeronautical Chart — ICAO 1:500 000. Selection of contour intervals must be consistent with the need to portray, clearly and accurately, relief features used for air navigation.	
	Shaded relief is a highly sophisticated technique used in conjunction with contours and hypsometric tints to produce a three-dimensional effect, or impression, such as that which might be gained from viewing a model of terrain spotlighted from one angle.	
17.7.8	Hypsometric tints	
17.7.8.1	When hypsometric tints are used, the range of elevations for the tints must be shown.	
	It would aid visual interpretation if hypsometric tints consisting of a succession of shades or colour graduations depicting ranges of elevations were used in conjunction with the contour lines to provide a ready indication of variations in the terrain.	
17.7.8.2	The scale of the hypsometric tints used on the chart must be shown in the margin.	*See example 1 in this Section.*
17.7.9	Spot elevations	Spot elevation .6397 .8975
17.7.9.1	Spot elevations must be shown at selected critical points (e.g. the top of a peak or ridge, etc.). Other spot elevations in valleys and at lake surface levels which are considered to be of navigational value are to be shown. The position of the selected elevation is to be indicated by a dot.	Spot elevation (of doubtful accuracy) .6370±

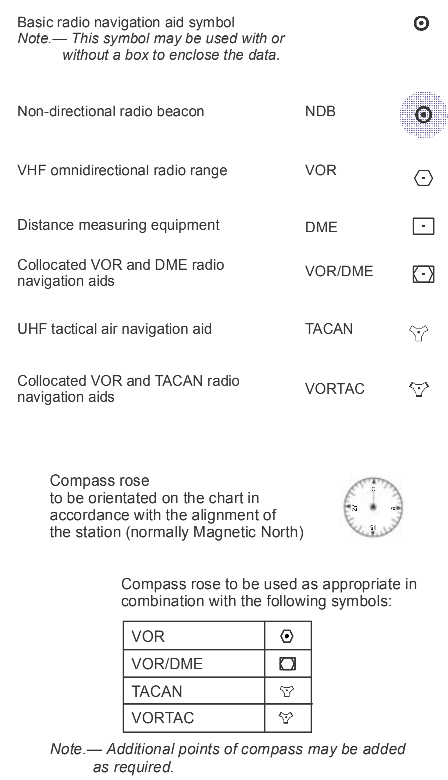
Annex 4 reference	*Details*	*Drafting illustration*
17.7.9.2	The elevation (in metres or feet) of the highest point on the chart and its geographical position to the nearest five minutes must be indicated in the margin.	Highest elevation on chart 
17.7.9.3	It is recommended that the spot elevation of the highest point on any sheet be cleared of hypsometric tinting.	
17.7.10	Incomplete or unavailable relief	Areas not surveyed for contour information or relief data incomplete 
17.7.10.1	Areas which have not been surveyed for contour information must be labelled “Relief data incomplete” and hypsometric tinting omitted.	*to be tinted “Golden Buff”* *(see Annex 4, page A-3-2)*
17.7.10.2	Charts on which spot elevations are generally unreliable must carry a prominent warning note as follows, on the face of the chart in the colour used for aeronautical information: “Warning – the reliability of relief information on this chart is doubtful and the elevations given should be used with caution”. See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.12.3.1.	
17.7.11	Escarpments It is recommended that escarpments be shown when they are prominent landmarks or when cultural detail is very sparse.	Bluff, cliff or escarpment
17.7.12	Wooded areas	Coniferous trees 
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. If shown, these areas may be depicted by either the colour prescribed in Appendix 3 of Annex 4 or by a symbol which should be explained in the legend of the chart.	Other trees 
17.7.12.2	Where shown, the approximate extreme northern or southern limits for tree growth must be indicated by a dashed black line and must be appropriately labelled.	
17.7.13	Date of topographics information The date of the latest information shown on the topographic base must be indicated in the margin.	

Annex 4 reference	*Details*	*Drafting illustration*
17.8	**Magnetic variation**	
17.8.1	Isogonic lines must be shown.	
17.8.2	The date of the isogonic information must be indicated in the margin. See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.15.1 and 2.15.2.	
17.9	**Aeronautical data**	
17.9.1	Aeronautical data must be shown consistent with the use of the chart and the revision cycle. *Note.— Revision cycle* *Approximate period between revisions:* *Base: 4 years* *Aeronautical data: 1-2 years* The aeronautical data, being of a changeable nature, will have to be carefully selected so that the revision cycle for this chart can be adhered to.	
17.9.2	Aerodromes	
17.9.2.1	Land and water aerodromes and heliports must 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 of Annex 4, provided they do not cause undesirable clutter on the chart must be indicated.	

Annex 4 reference	*Details*	*Drafting illustration*
17.9.2.3	Abandoned aerodromes which are still recognizable as aerodromes from the air must be shown and identified as abandoned.	
17.9.3	Obstacles	
17.9.3.1	Significant obstacles must be shown. Obstacles of a height of 100 m (300 ft) or more above ground are normally regarded as significant obstacles.	 *Note. — For obstacles having a height of the order of 300 m (1 000 ft) above terrain*
17.9.3.2	When considered of importance to visual flight, prominent transmission lines, permanent cable car installations and wind turbines which are significant obstacles, must be shown.	
17.9.4	Prohibited, restricted and danger areas Prohibited, restricted and danger areas must be shown. With regard to prohibited, restricted and danger areas, see also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.13.	 *Note.— The angle and density of rulings may be varied according to scale and the size, shape and orientation of the area.*

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting illustration</th></tr>
<tr><td>17.9.5</td><td>Air traffic services system</td><td></td></tr>
<tr><td>17.9.5.1</td><td>Significant elements of the air traffic services system including, where practicable, control zones, aerodrome traffic zones, control areas, flight information regions and other airspace in which VFR flights operate must be shown together with the appropriate class of airspace.</td><td rowspan="2">
</td></tr>
<tr><td>17.9.5.2</td><td>Where appropriate, the air defence identification zone (ADIZ) must be shown and properly identified.

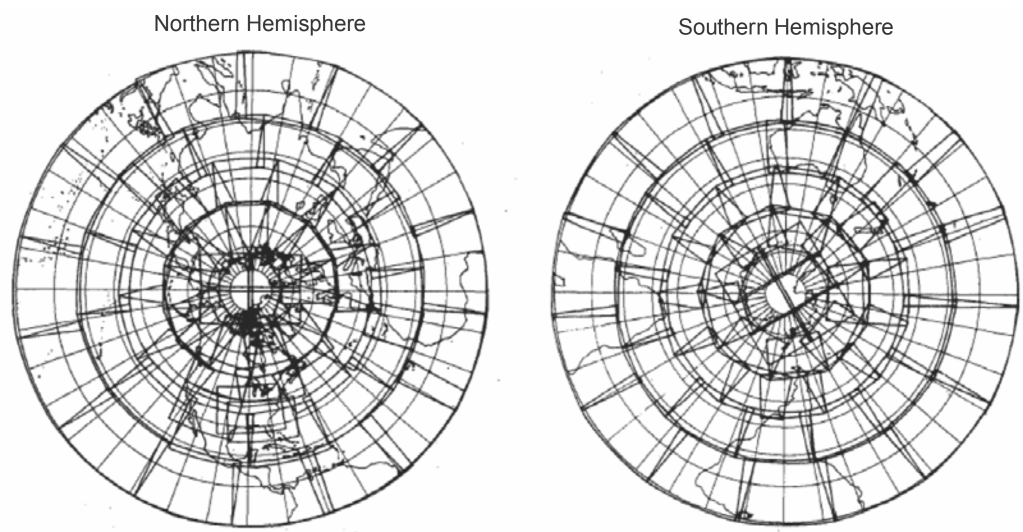
Note.— ADIZ procedures may be described in the chart legend.</td></tr>
<tr><td>17.9.6</td><td>Radio navigation aids

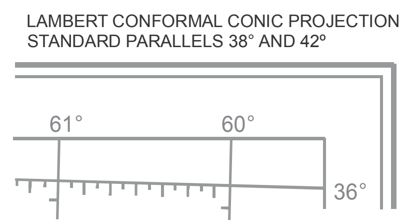
Radio navigation aids must be shown by the appropriate symbol and named, but excluding their frequencies, coded designators, time of operation and other characteristics unless any or all of this information which is shown is kept up to date by means of new editions of the chart.</td><td>
</td></tr>
</table>

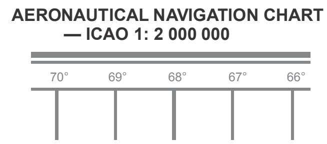
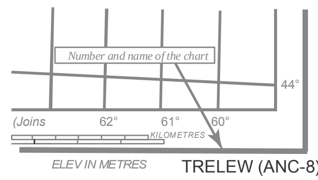
Annex 4 reference	*Details*	*Drafting illustration*
17.9.7	Supplementary information	
17.9.7.1	Aeronautical ground lights together with their characteristics or their identifications or both must be shown.	Aeronautical ground light ☆ Marine light F ●
17.9.7.2	Marine lights on outer prominent coastal or isolated features of not less than 28 kilometres (15 nautical miles) visibility range must 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.	*Note 1.— Marine alternating lights are red and white unless otherwise indicated. Marine lights are white unless colours are stated.* F1 Flashing G Green Gp Group Occ Occulting R Red SFC Sector sec Second (U) Unwatched W White *Note 2.— Characteristics are to be indicated as follows:* Alt Alternating B Blue F Fixed

7.18 AERONAUTICAL NAVIGATION CHART — ICAO SMALL SCALE

Annex 4 reference	*General*
18.1	**Function** The functions of the Aeronautical Navigation Chart — ICAO Small Scale are: a) to serve as an air navigation aid for aircrews of long-range aircraft at high altitudes; b) to provide selective checkpoints over extensive ranges for identification at high altitudes and speeds, which are required for visual confirmation of position; c) to provide for continuous visual reference to the ground during long-range flights over areas lacking radio or other electronic navigation aids, or other areas where visual navigation is preferred or becomes necessary; and d) to provide a general purpose chart series for long-range flight planning and plotting.
18.2	**Applicability** This chart should be made available for all areas delineated in Annex 4, Appendix 5 (Sheet layout for the World Aeronautical Chart — ICAO 1:1 000 000). A State is permitted to produce the Aeronautical Navigation Chart — ICAO Small Scale in lieu of the World Aeronautical Chart — ICAO 1:1 000 000 when operational or other chart production considerations indicate that operational requirements can be effectively satisfied thereby. **Operational requirements** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.1.1 to 2.1.7 inclusive.

Annex 4 reference	*Details*	*Drafting Illustration*
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. The sheet size may represent the maximum printing press size available to the production agency. A suggested layout for the charts at a scale of 1:2 000 000 follows:  	
18.3.2	The scale must be in the range of 1:2 000 000 to 1:5 000 000.	*Aeronautical Navigation Chart — ICAO 1:2 000 000*
18.3.3	The scale of the chart must be substituted in the title for the words "Small Scale".	
18.3.4	Linear scales for kilometres and nautical miles must be shown in the margin, arranged in the following order: — kilometres — nautical miles, with their zero points in the same vertical line.	*Similar to illustrations for 1:1 000 000 and 1:500 000 scale charts in Sections 7.16 and 7.17.*
18.3.5	The length of the linear scale should not be less than 200 mm (8 in).	
18.3.6	A conversion scale (metres/feet) must be shown in the margin.	
18.4	**Format**	
18.4.1	The title and marginal notes must be in one of the working languages of ICAO.	*Refer to the example in this Section.*

Annex 4 reference	*Details*	*Drafting Illustration*
	The language of the publishing country 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 used to express elevations must be so located as to be clearly visible when the sheet is folded. There is no internationally agreed sheet numbering.	*Refer to the example on in this Section.*
18.5	**Projection**	
18.5.1	A conformal (orthomorphic) projection must be used.	
18.5.1.1	The name and basic parameters of the projection must be shown in the margin.	
18.5.2	Parallels must be shown at intervals of 1^{o}.	*Refer to the example in this Section.*
18.5.2.1	Graduations on the parallels must be shown at sufficiently close intervals compatible with the latitude and scale of the chart.	
18.5.3	Meridians must be shown at intervals compatible with the latitude and the scale of the chart.	
18.5.3.1	Graduations on the meridians must be shown at intervals not exceeding 5'.	
18.5.4	The graduation must extend away from the Greenwich Meridian and from the Equator.	*Refer to the example in this Section.*
18.5.5	All meridians and parallels shown must be numbered in the borders of the chart. In addition, when required, meridians and parallels must be numbered within the body of the chart in such a manner that they can be readily identified when the chart is folded.	*Refer to the example in this Section.*

Annex 4 reference	*Details*	*Drafting Illustration*
2.2	**Title** The title must be "Aeronautical Navigation Chart — ICAO" followed by the scale of the chart, in the range of 1:2 000 000 to 1:5 000 000. The title must not include "ICAO" unless the chart conforms with all the Standards specified in Annex 4, Chapters 2 and 18.	
	Identification Each sheet must be identified. Because no sheet numbers have been agreed to, any convenient series number and sheet numbering system may be used. Also, where a State produces only one such chart or only a few, each chart may be identified by the name of the most prominent city, region, country, group of countries or other feature depicted on the chart.	
2.3.1	**Marginal note layout** See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.3.1 to 2.3.4 inclusive.	*Refer to the Example in this Section.*

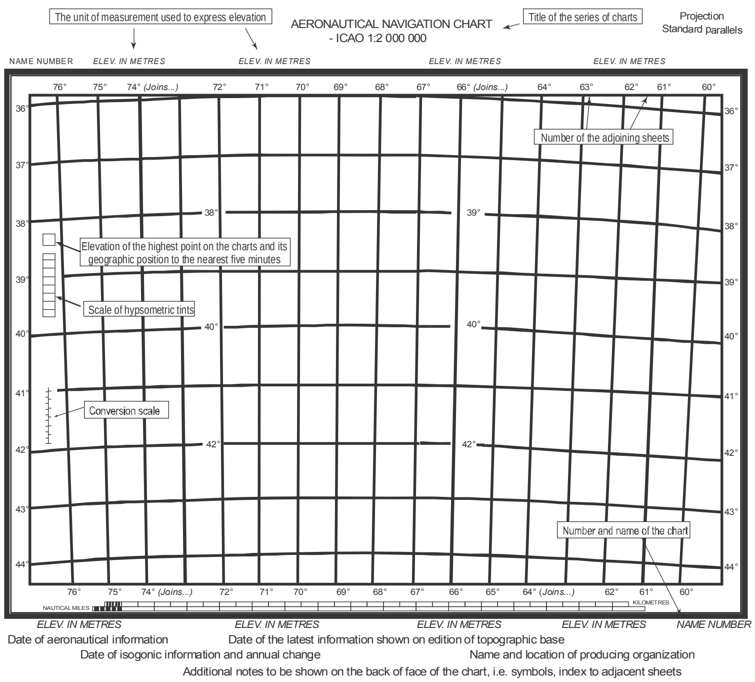
Annex 4 reference	*Details*	*Drafting Illustration*

2.4 **Symbols**

See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.

The MARGINAL NOTE LAYOUT should be in accordance with the following example:

Example

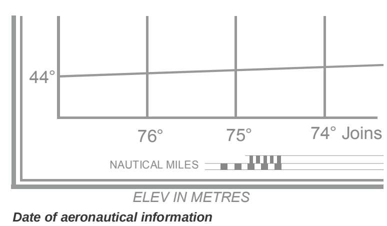


2.5 **Units of measurement**

See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.

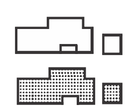
2.7 **Date of aeronautical information**

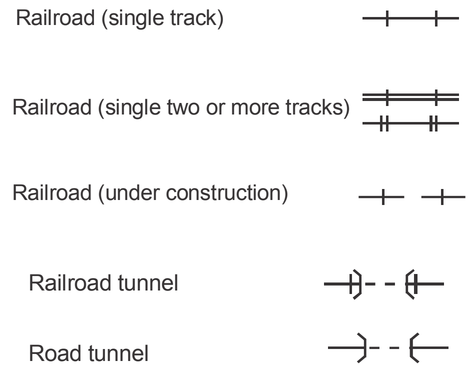
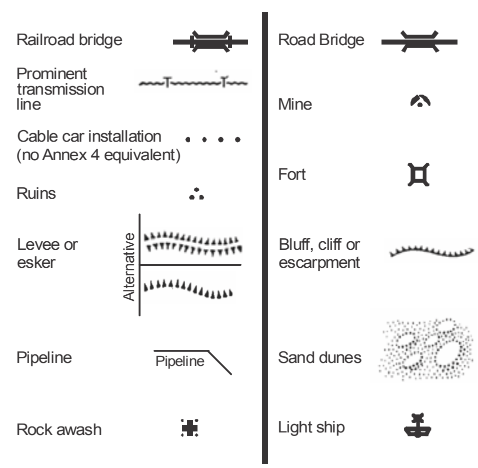
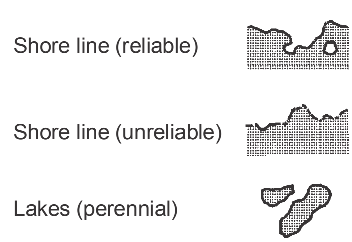
See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.

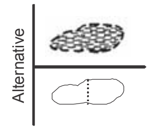
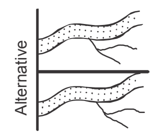
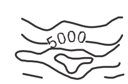


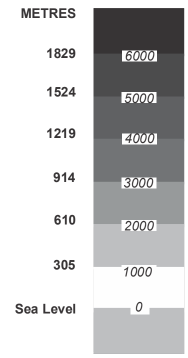
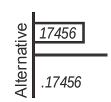
2.8 **Spelling of geographical names**

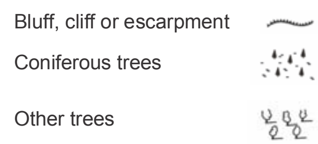
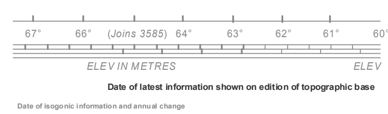
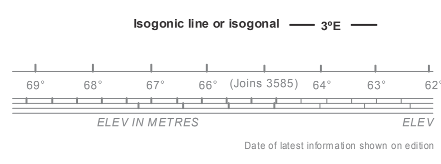
See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, inclusive.

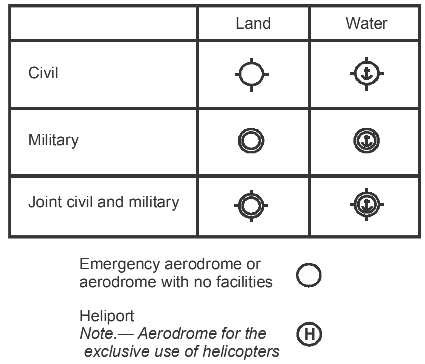
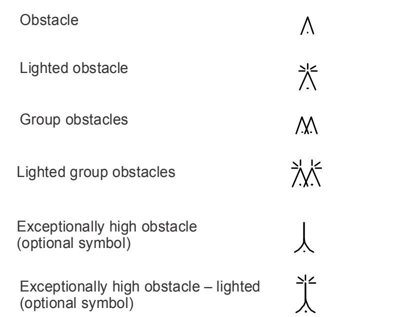
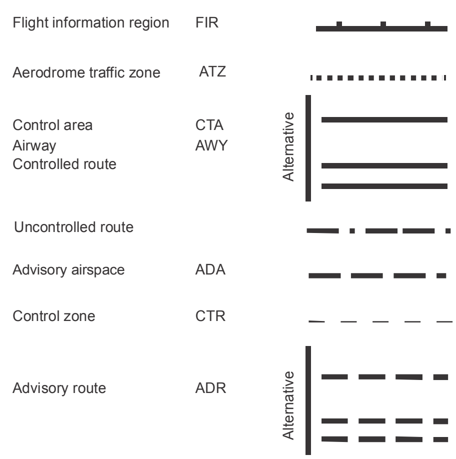
Annex 4 reference	*Details*	*Drafting Illustration*
2.9	**Abbreviations**	
	See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	
18.6.5	**Political boundaries**	
	International boundaries must be shown. Undemarcated and undefined boundaries must be distinguished by descriptive notes.	**Boundary undetermined** 
	See Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.10.1 and 2.10.2.	
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.	
2.11	Colours used on this chart should conform to Annex 4, Appendix 3 — Colour Guide. See also Chapter 5 of this manual.	
2.16	**Typography**	
	Samples of type suitable for use on aeronautical charts are provided in Section 7.2.	
18.6	**Culture and topography**	
18.6.1	Built-up areas	
18.6.1.1	Cities, towns and villages must be selected and shown according to their relative importance to visual air navigation.	City or large town 
18.6.1.2	Cities and towns of sufficient size should be indicated by the outline of their built-up areas and not by the outline of their established city limits.	Town  Village

Annex 4 reference	*Details*	*Drafting Illustration*
18.6.2	Railroads	
18.6.2.1	All railroads having landmark value must 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 must 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	
18.6.4.1	Natural and cultural landmarks, such as bridges, prominent transmission lines, permanent cable car installations, mine structures, forts, ruins, levees, pipelines and rocks, bluffs, cliffs, sand dunes, isolated lighthouses, etc., when considered to be of importance for visual air navigation, should be shown. Descriptive notes may be added.	
18.6.6	Hydrography	
18.6.6.1	All water features compatible with the scale of the chart comprising shorelines, lakes, rivers and streams (including those non-perennial in nature), salt lakes, glaciers and ice caps must be shown.	

Annex 4 reference	*Details*	*Drafting Illustration*
18.6.6.2	The tint covering large open water areas should be kept very light (cf Colour Guide – Annex 4, Appendix 3). A narrow band of darker tone may be used along the shoreline to emphasize this feature.	Lakes (non-perennial)  Salt lake  Large river (perennial)  Small river (perennial)  Rivers and streams (non- perennial)  Glaciers and ice caps 
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 a symbol when of significant landmark value.	Coral reefs and ledges  Shoals  Tidal flats  Charted isolated rock Sand area  Gravel 
18.6.7	Contours	Contours 
18.6.7.1	Contours must be shown. The selection of intervals must be governed by the requirement to depict clearly the relief features required in air navigation.	Approximate contours 
18.6.7.2	The values of the contours used must be shown.	

Annex 4 reference	*Details*	*Drafting Illustration*
18.6.8	Hypsometric tints	
18.6.8.1	When hypsometric tints are used, the range of elevations for the tints must be shown.	
18.6.8.2	The scale of the hypsometric tints used on the chart must be shown in the margin.	*Refer to the example in this Section.*
18.6.9	Spot elevations	
18.6.9.1	Spot elevations must be shown at selected critical points. The elevations selected must always be the highest in the immediate vicinity and must 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 must be indicated by a dot.	Spot elevation *.6397* *.8975* Spot elevation (of doubtful accuracy) *.6370±*
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 must be indicated in the margin.	Highest elevation on chart 
18.6.9.3	The spot elevation of the highest point of 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 must be labelled “Relief data incomplete” and hypsometric tinting omitted.	Areas not surveyed for contour information or relief data incomplete  *to be tinted “Golden Buff” (see Annex 4, page A-3-2)*

Annex 4 reference	*Details*	*Drafting Illustration*
18.6.10.2	Charts on which spot elevations are generally unreliable must 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." See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.12.3.1.	
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. Where shown, these areas may be depicted by the colour prescribed in Appendix 3 of Annex 4 or by a symbol which should be explained in the legend of the chart.	
18.6.13	Date of topographic information The date of latest information shown on the topographic base must be indicated in the margin.	
18.7	**Magnetic variation**	
18.7.1	Isogonic lines must be shown.	
18.7.2	The date of isogonic information must be indicated in the margin. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.15.1 and 2.15.2.	

Annex 4 reference	*Details*	*Drafting Illustration*
18.8	**Aeronautical data**	
18.8.1	Aerodromes	
18.8.1.1	Land and water aerodromes and heliports must 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 Significant obstacles must be shown.	 *Note. — For obstacles having a height of the order of 300 m (1 000 ft) above terrain*
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. With regard to prohibited, restricted and danger areas, see also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.13.	
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.	

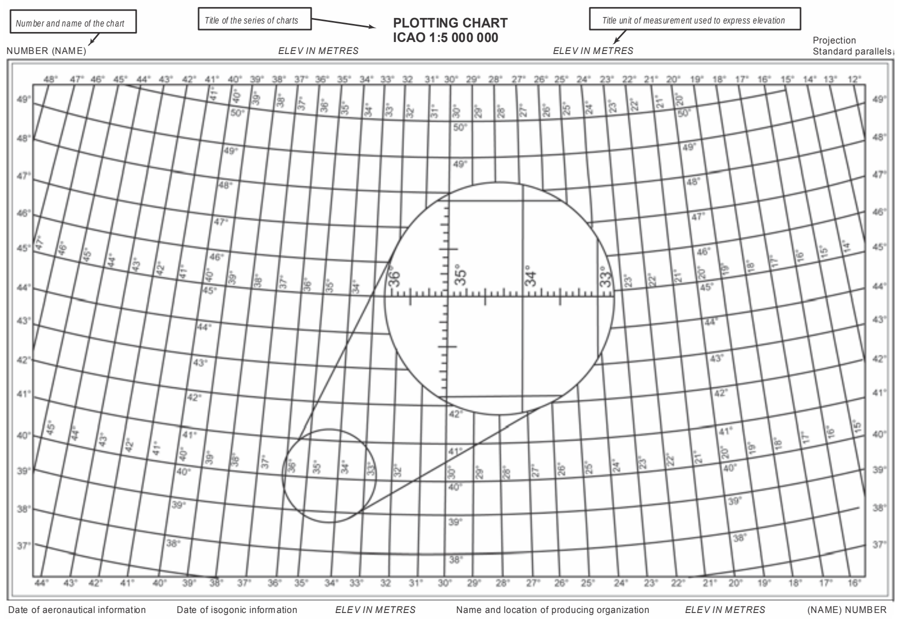
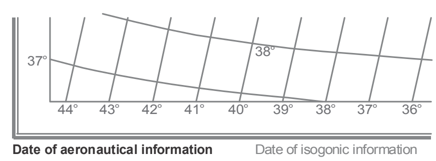
Annex 4 reference	*Details*	*Drafting Illustration*		
18.8.5	Radio navigation aids Radio aids to navigation may be shown by the appropriate symbol and named.	Basic radio navigation aid symbol *Note.— This symbol may be used with or without a box to enclose the data.*		
		Non-directional radio beacon	NDB	
		VHF omnidirectional radio range	VOR	
		Distance measuring equipment	DME	
		Collocated VOR and DME radio navigation aids	VOR/DME	
		UHF tactical air navigation aid	TACAN	
		Collocated VOR and TACAN radio navigation aids	VORTAC	

7.19 PLOTTING CHART — ICAO

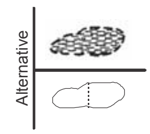
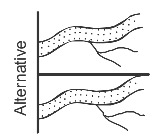
Annex 4 reference	*General*
19.1	**Function** The function of plotting charts is to provide a means of maintaining a continuous flight record of the aircraft position by various fixing methods and dead reckoning and to maintain an intended flight path.
19.2	**Applicability** This chart should be made available 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 — ICAO.
	Operational requirements See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.1.1 to 2.1.7, inclusive.

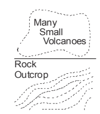
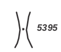
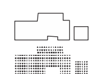
Annex 4 reference	*Details*	*Drafting Illustration*
19.3	**Coverage and scale**	
19.3.1	Where practicable, the chart for a particular region should cover major air routes and their terminals on a single sheet.	
19.3.2	The scale should be governed by the area to be covered. Normally the scale will range from 1:3 000 000 to 1:7 500 000. See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.6.1.	**PLOTTING CHART ICAO 1:5 000 000**
19.4	**Format** The sheet size should be of manageable proportions for use on the flight deck (e.g. adaptable for use on a navigator's plotting table).	*Refer to the example in this Section.*

Annex 4 reference	*Details*	*Drafting Illustration*
19.5	**Projection**	
19.5.1	A conformal projection on which a straight line approximates a great circle, should be used.	LAMBERT CONFORMAL CONIC PROJECTION STANDARD PARALLELS 40° AND 47°
19.5.2	Parallels and meridians must be shown.	*Refer to the example in this Section.*
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 must be shown at consistent intervals along an appropriate number of parallels and meridians. The interval selected must, regardless of scale, minimize the amount of interpolation required for accurate plotting.	*Refer to the example in this Section.*
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 must comprise lines parallel to the Meridian or anti-Meridian of Greenwich.	
2.2	**Title**	
	The title must be “Plotting Chart — ICAO” except that this title must not include “ICAO” unless the chart conforms with all Standards specified in Annex 4 Chapters 2 and 19.	**PLOTTING CHART — ICAO 1:5 000 000**
19.6	**Identification**	
	Each chart is to be identified by a series and sheet number. The name of the area covered may be included.	*Refer to the example in this Section.*
	Marginal note layout	*Refer to the example in this Section.*
	See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.3.1 to 2.3.4, inclusive.	

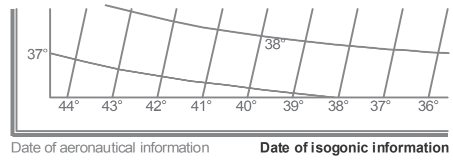
Annex 4 reference	*Details*	*Drafting Illustration*
	EXAMPLE  	
2.4	**Symbols** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.4.1.	
2.5	**Units of measurement** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.5.1 to 2.5.7, inclusive.	
2.7	**Date of aeronautical information** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.7.	

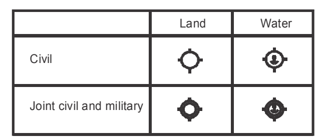
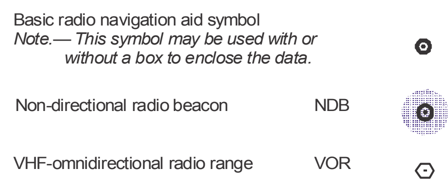
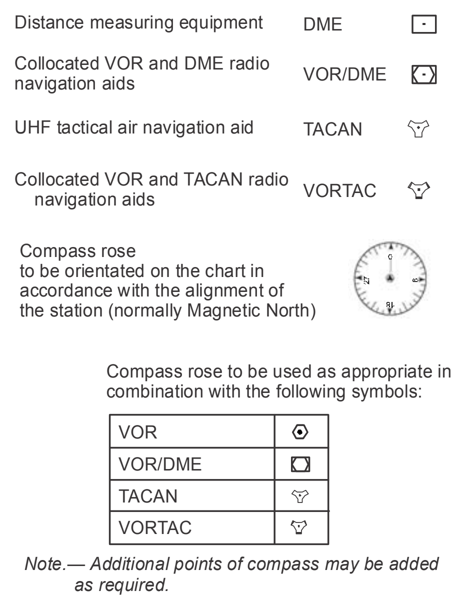
Annex 4 reference	*Details*	*Drafting Illustration*
2.8	**Spelling of geographical names** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.8.1 to 2.8.4, inclusive.	
2.9	**Abbreviations** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.9.1 and 2.9.2.	
2.10	**Political boundaries** See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.10.1 and 2.10.2.	
2.11	**Colours** Subdued colours should be used for the chart background to facilitate plotting. Good colour contrast should be ensured to emphasize features important to the intended use of the chart. Colours used on this chart should conform to Annex 4, Appendix 3 — Colour Guide. See also Chapter 5 of this manual.	
2.16	**Typography** Samples of type suitable for use on charts are provided in Section 7.2.	

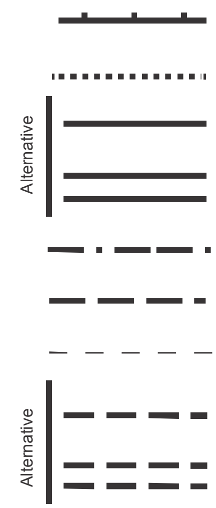
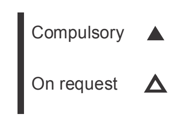
Annex 4 reference	*Details*	*Drafting Illustration*
19.7	**Culture and topography**	
19.7.1	Generalized shorelines of all open water areas, large lakes and rivers must be shown.	Shore line (reliable)  Shore line (unreliable)  Lakes (perennial)  Lakes (non-perennial)  Salt lake  Large river (perennial)  Small river (perennial)  Rivers and streams (non- perennial)  Glaciers and ice caps 

Annex 4 reference	*Details*	*Drafting Illustration*
19.7.2	Spot elevations for selected features constituting a hazard to air navigation must be shown.	Spot elevation .6397 .8975 Spot elevation (of doubtful accuracy) .6370± Highest elevation on chart 17456 Alternative .17456
19.7.3	Particularly hazardous or prominent relief features should be emphasized.	Contours  Relief shown by hachures  Unusual land features appropriately labelled  Bluff, cliff or escarpment Mountain pass 
	Large cities and towns may be shown.	City or large town 
19.8	**Magnetic variation**	
19.8.1	Isogonals – (i.e. lines which join points of equal magnetic variation) or in higher latitudes, isogrivs (i.e. lines which join points of equal angular difference between grid north and magnetic north), or both, must be shown at consistent intervals throughout the chart. The interval selected must, regardless of scale, minimize the amount of interpolation required.	**Isogonic line or isogonal —— 3°E ——**

<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td>19.8.2</td><td>The date of the isogonic information must be shown.

See also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.15.1 and 2.15.2.</td><td>
</td></tr>
<tr><td>19.9</td><td>Aeronautical data</td><td></td></tr>
<tr><td>19.9.1</td><td>The following aeronautical data must be shown:

a) aerodromes regularly used by international commercial air transport together with their names;</td><td>
</td></tr>
<tr><td></td><td>b) selected radio aids to navigation which will contribute to position-finding, together with their names and identifications;</td><td>
</td></tr>
<tr><td></td><td>c) lattices of long range-range electronic aids to navigation as required or available;</td><td>
</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
	d) boundaries of flight information regions, control areas and control zones necessary to the function of the chart; Other aeronautical data (e.g. air traffic services systems, restricted areas) may be shown provided they do not detract from the legibility of essential information. With regard to prohibited, restricted and danger areas, see also Chapter 7 — General Specifications, Section 7.2, Annex 4 reference 2.13.	Flight information region FIR Aerodrome traffic zone ATZ Control area CTA Airway AWY Controlled route Uncontrolled route Advisory airspace ADA Control zone CTR Advisory route ADR 
	e) designated reporting points necessary to the function of the chart;	Reporting point REP 
	f) ocean station vessels.	
19.9.2	Aeronautical ground lights and marine lights useful for air navigation should be shown where other means of navigation are non-existent.	Aeronautical ground light Marine light  *Note 1.— Marine alternating lights are red and white unless otherwise indicated. Marine lights are white unless colours are stated.* F1 Flashing G Green Gp Group Occ Occulting R Red SFC Sector sec Second (U) Unwatched W White *Note 2.— Characteristics are to be indicated as follows:* Alt Alternating B Blue F Fixed

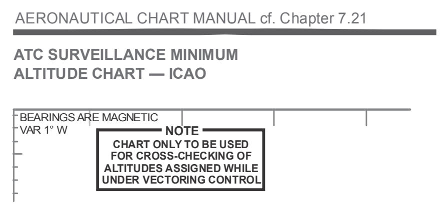
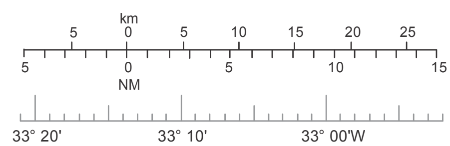
7.20 ELECTRONIC AERONAUTICAL CHART DISPLAY — ICAO

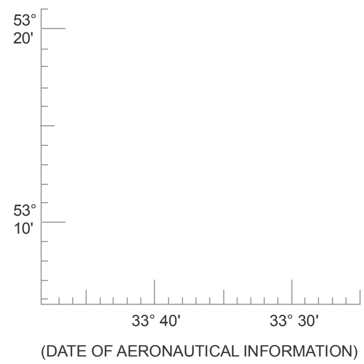
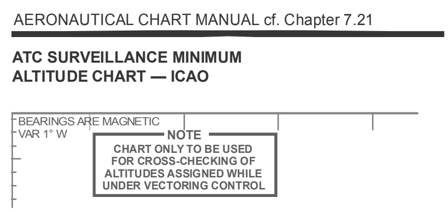
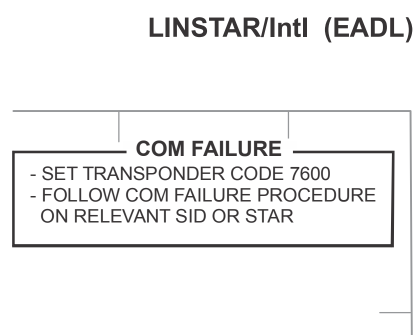
(under development)

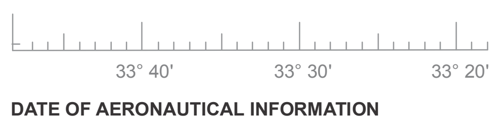
7.21 ATC SURVEILLANCE MINIMUM ALTITUDE CHART — ICAO

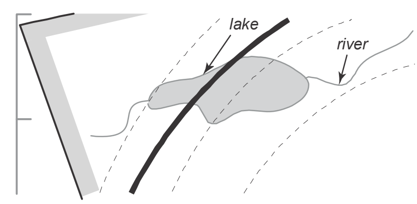
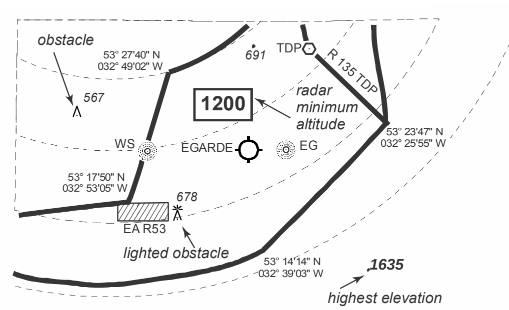
Annex 4 reference	*General*
21.1	**Function**
21.1.1	This supplementary chart must provide information which will enable flight crews to monitor and cross-check altitudes assigned by a controller using an ATS surveillance system. *Note.— The objectives of the air traffic control service as prescribed in Annex 11 do not include prevention of collision with terrain. The procedures prescribed in the* Procedures for Air Services — Air Traffic Management *(PANS–ATM, Doc 4444) do not relieve pilots of their responsibility to ensure that any clearances issued by air traffic control units are safe in this respect. When an IFR flight is vectored, or is given a direct routing which takes the aircraft off an ATS route, the PANS–ATM (Doc 4444), Chapter 8, 8.6.5.2 applies.* A note indicating that the chart may be used only for cross-checking of altitudes assigned while the aircraft is identified must 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 Annex 4, 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. Annex 4, 8.9.4.1.1 l) and m), provide for the inclusion on the Area Chart — ICAO of established minimum altitudes and indicate that vectoring procedures on departure or arrival routes may be shown unless excessive chart clutter will result. Also, Annex 4, 9.9.4.1.1 a) 5) and 6) and 10.9.4.1.1 a) 5) and 6) specify similar requirements for the Standard Departure Chart — Instrument (SID) — ICAO and Standard Arrival Chart — Instrument (STAR) — ICAO, respectively. In practice, this information frequently produces excessive clutter and is often not practical to show on the Area Chart — ICAO or associated SID and STAR charts. The ATC Surveillance Minimum Altitude Chart — ICAO is intended to supplement the Area Chart — ICAO. Where the ATC Surveillance Minimum Altitude Chart — ICAO is made available, minimum altitudes and vectoring procedures need not be duplicated on associated Area, SID and STAR charts. As for the Area Chart — ICAO, the assessment of the air traffic services data required to be portrayed on the ATC Surveillance Minimum Altitude Chart — ICAO is the task of the authority responsible for air traffic services within a State, which should ensure that the cartographic agency assigned to prepare the chart is provided with the necessary guidance and information. The production of the chart will require collaboration between the air traffic services procedure specialist and the cartographer. **Operational requirements** See Chapter 7 — General Specifications, Annex 4 references 2.1.1 to 2.1.8.

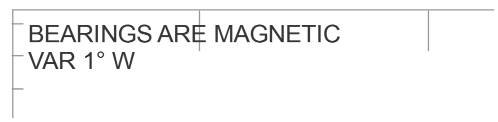
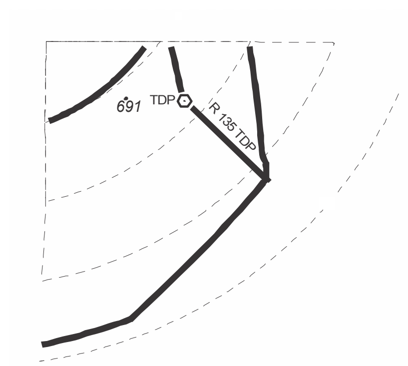
Annex 4 reference	*General*
	Planning At the planning stage, the interrelationship with the Area Chart — ICAO should be taken into account. The ATC Surveillance Minimum Altitude Chart — ICAO should be designed for in-flight use in conjunction with the Area Chart — ICAO and thus similarities in coverage and scale will be beneficial to facilitate spatial orientation and the assimilation of information when using both charts. Nevertheless, portrayed information should be directly related to the chart's function and unnecessary duplication avoided.

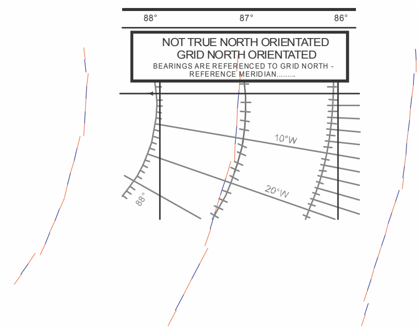
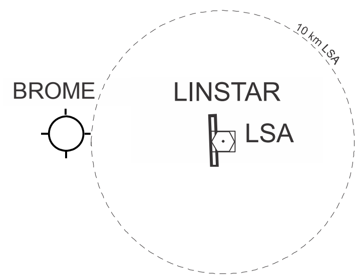
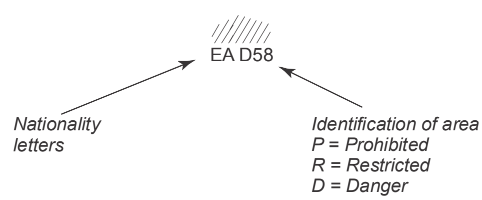
Annex 4 reference	*Details*	*Drafting Illustration*
21.1.2	To stress that the ATC Surveillance Minimum Altitude Chart — ICAO is not to be used as a procedural tool, a note indicating that the chart may only be used for cross-checking of altitudes assigned while under vectoring control must be prominently displayed on the face of the chart. A "boxed" presentation with bold type may be used.	
21.3	**Coverage and scale**	
21.3.1	The coverage of the chart must be sufficient to effectively show the information associated with radar vectoring procedures.	*See specimen chart 14*
21.3.2	The chart must be drawn to scale, and a scale-bar must be shown. The scale-bar may be shown in the lower left corner of the chart.	
21.3.3	The chart should be drawn to the same scale as the associated Area Chart — ICAO to facilitate continuity of spatial orientation and the assimilation of information when using both charts. Nevertheless, the chart should be produced at a scale that is convenient for in-flight use.	*See specimen chart 14*
	Format	
	The format should be in accordance with specimen chart 14.	*See specimen chart 14*
21.4	**Projection**	
21.4.1	A conformal projection on which a straight line approximates a geodesic line should be used. A Lambert Conformal Conic Projection is well suited	*See specimen chart 14*

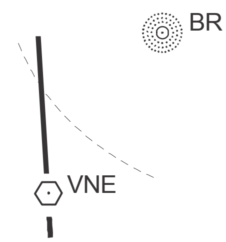
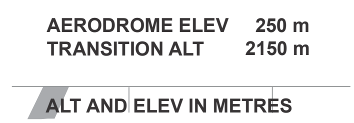
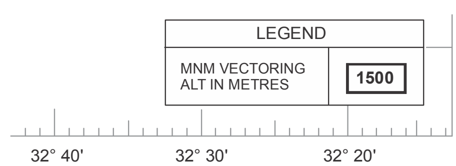
Annex 4 reference	*Details*	*Drafting Illustration*
	as a basis for this type of chart. The projection type need not be indicated on the chart.	
21.4.2	Graduation marks should be placed at consistent intervals along the neat lines. On specimen chart 14, graduation marks have been placed, along the left and bottom neat lines, at one-minute intervals with extended graduation marks every ten minutes. Graduation marks may be screened for a subdued presentation.	
2.2	**Title** The title must be "ATC Surveillance Minimum Altitude Chart — ICAO". Such title must not include "ICAO" unless the chart conforms with all Standards specified in Annex 4, Chapters 2 and 21. The chart title is placed at the top left corner of the chart in bold upper-case type.	
21.5	**Identification** Each sheet must 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 or town that the aerodrome serves or, when the procedures apply to more than one aerodrome, that of air traffic services centre or the largest city or town situated in the area covered by the chart. The name would normally be the same as that for the associated Area Chart — ICAO. The ICAO location indicator may also be included with the name of the aerodrome. The chart identification is placed at the top right corner of the chart in bold upper-case type.	

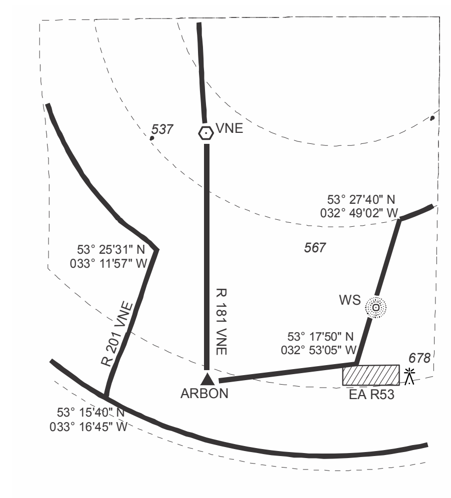
Annex 4 reference	*Details*	*Drafting Illustration*
	Marginal note layout	
	The marginal note layout must conform to that provided on specimen chart 14.	*See specimen chart 14*
	In accordance with Annex 4, 2.3.3 and 2.3.4, as this type of chart is published as part of the Aeronautical Information Publication (AIP) or a related aeronautical document, the legend to the symbols and abbreviations used, and the address of the producing agency must be placed in the front of the AIP. (See Annex 15 — Aeronautical Information Services, Appendix 1, GEN 2.2, GEN 2.3 and GEN 3.2 for specific placement in the AIP.)	
2.4	**Symbols**	
	See Chapter 7 — General Specifications and Annex 4, Appendix 2.	
2.5	**Units of measurement**	
	See Chapter 7 — General Specifications. The descriptions of units of measurement used may be grouped together in the upper left corner of the chart.	
2.7	**Date of aeronautical information**	
	See Chapter 7 — General Specifications. The date of aeronautical information is shown at the bottom left corner of the chart outside the neat line. A day/month/year format (e.g. 06 JUL 2006), using abbreviations from the *Procedures for Air Navigation Services — ICAO Abbreviations and Codes* (PANS–ABC, Doc 8400), is appropriate.	
2.8	**Spelling of geographical names**	
	See Chapter 7 — General Specifications.	
2.9	**Abbreviations**	
	See Chapter 7 — General Specifications.	

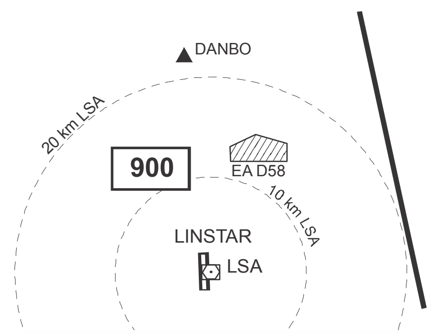
Annex 4 reference	*Details*	*Drafting Illustration*
2.10	**Political boundaries**	
	See Chapter 7 — General Specifications. International boundaries must be portrayed with the Annex 4, Appendix 2, symbol number 63 and labelled with country names. Unless of special importance, this information may be subdued by a half-tone screen of about 30 per cent.	
2.11	**Colours**	
	This chart is generally produced in black only. The use of selected percentage screens may be used to subdue the presentation of less important information. Charts should be printed on a good quality paper, preferably white. If colours are used, they should conform to the Colour Guide in Annex 4, Appendix 3.	*See specimen chart 14*
2.16	**Typography**	
	For samples of type suitable for use on charts, see Chapter 7 — General Specifications.	
21.6	**Culture and topography**	
21.6.1	Generalized shore lines of all open water areas, large lakes and rivers must be shown except where they conflict with data more applicable to the function of the chart. This information may be screened so as not to conflict with aeronautical information.	
21.6.2	Appropriate spot elevations and obstacles must be shown. Appropriate spot elevations and obstacles are those provided by the procedure specialist. Appropriate obstacle symbols selected from Annex 4, Appendix 2, Obstacles are to be placed at their exact coordinate locations, however, should several appear within a small area only the highest in the group need be shown with the appropriate group obstacle symbol. Elevation values are shown in italic type. Underlying information should be cleared to increase legibility of spot elevations and obstacles.	

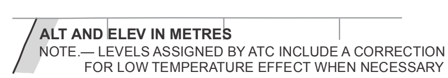
Annex 4 reference	*Details*	*Drafting Illustration*
	The highest elevation on the chart may be emphasized by larger bold italic type. This is in accordance with one of two presentations specified by Annex 4, Appendix 2, symbol number 12. The alternative “boxed” symbol for highest chart elevation should not be used on this chart as it may be confused with a radar minimum altitude.	
21.7	**Magnetic variation**	
	The average magnetic variation of the area covered by the chart must be shown to the nearest degree. This information may be provided at the upper left corner of the chart. See also Chapter 7 — General Specifications, Annex 4 references 2.15.1 and 2.15.2.	
21.8	**Bearings, tracks and radials**	
21.8.1	Bearings, tracks and radials must be magnetic, except as provided for in 21.8.2. A note to this effect may be provided at the upper left corner of the chart. Bearing and track values are to be shown using three digits and a degree sign (e.g. 061°E). Radial values are to be indicated by three digits preceded by the letter and followed by the identification of the facility (e.g. R 135 TDP). A degree sign is not shown with radial values.	 
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.	

Annex 4 reference	*Details*	*Drafting Illustration*
21.8.3	Where bearings, tracks and radials are given with reference to True North or Grid North, this must be clearly indicated. When Grid North is used, its reference grid meridian must be identified.	
21.9	**Aeronautical data**	
21.9.1	Aerodromes	
21.9.1.1	All aerodromes which affect the terminal routings must be shown. Where appropriate, such as for the primary aerodrome and other major aerodromes of intended landing, a runway pattern symbol must be used.	
21.9.1.2	The elevation of the primary aerodrome to the nearest metre or foot must be shown. This information is shown at the top centre of the chart.	**AERODROME ELEV 250 m** **TRANSITION ALT 2150 m** **ALT AND ELEV IN METRES**
21.9.2	Prohibited, restricted and danger areas Prohibited, restricted and danger areas must be depicted with their identification. See also Chapter 7 — General Specifications, Annex 4 reference 2.13. The “nationality letters” part of the identification of these areas may be omitted. Nationality letters are those contained in Doc 7910 — *Location Indicators*.	

Annex 4 reference	*Details*	*Drafting Illustration*
21.9.3	Air traffic services system	
21.9.3.1	The chart must 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;	
	Note.— Routes used in the vectoring of aircraft to and from the significant points may be shown.	
	d) transition altitude, where established. This information is shown at the top centre of the chart;	
	e) information associated with vectoring including: 1) minimum vectoring altitudes to the nearest higher 50 metres or 100 feet, clearly identified;	

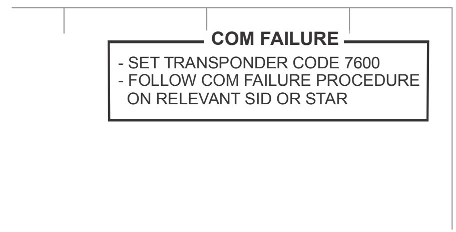
<table>
<tr><th>Annex 4 reference</th><th>Details</th><th>Drafting Illustration</th></tr>
<tr><td></td><td>2) lateral limits of minimum vectoring altitude sectors normally defined by bearings and radials to/from radio navigation aids to the nearest degree, or, if not practicable, geographical coordinates in degrees, minutes and seconds and shown by heavy lines so as to clearly differentiate between established radar sectors. In congested areas geographical coordinates may be omitted in the interest of legibility;</td><td>


</td></tr>
<tr><td></td><td>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;</td><td>


</td></tr>
<tr><td></td><td>4) notes concerning correction for low temperature effect, as applicable;</td><td>


</td></tr>
<tr><td></td><td>f) communications procedures including call sign(s) and channels of the ATC unit(s) concerned. This information may be boxed at the top right margin of the chart.</td><td>


</td></tr>
</table>

Annex 4 reference	*Details*	*Drafting Illustration*
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. In some cases it may not be feasible to include these procedures on the face of the chart due to chart clutter or the necessity for a small text size which would compromise readability. If the information is shown on the reverse of the chart or on a separate sheet, an appropriate reference is to be provided on the face of the chart.	

Appendix

REFERENCE MATERIAL — ICAO PUBLICATIONS

Annexes to the Convention

Annex 2 — *Rules of the Air*
Annex 4 — *Aeronautical Charts*
Annex 5 — *Units of Measurement to be used in Air-Ground Communication*
Annex 6 — *Operation of Aircraft*
  Part I — *International Commercial Air Transport — Aeroplanes*
  Part II — *International General Aviation — Aeroplanes*
  Part III — *International Operations — Helicopters*
Annex 10 — *Aeronautical Telecommunications*
  Volume I — *Radio Navigation Aids*
  Volume II — *Communication Procedures including those with PANS status*
  Volume III — *Communication Systems*
  Volume IV — *Surveillance Radar and Collision Avoidance Systems*
  Volume V — *Aeronautical Radio Frequency Spectrum Utilization*
Annex 11 — *Air Traffic Services*
Annex 14 — *Aerodromes*
  Volume I — *Aerodrome Design and Operations*
  Volume II — *Heliports*
Annex 15 — *Aeronautical Information Services*

Procedures for Air Navigation Services (PANS)

ABC — *ICAO Abbreviations and Codes* (Doc 8400)
ATM — *Air Traffic Management* (Doc 4444)
OPS — *Aircraft Operations* (Doc 8168)
  Volume I — *Flight Procedures*
  Volume II — *Construction of Visual and Instrument Flight Procedures*

Facility and Service Documents

Aeronautical Information Services Provided by States (Doc 7383)

Designators and Indicators

Location Indicators (Doc 7910)

Technical Manuals

Aerodrome Design Manual (Doc 9157)
Part 1 — *Runways*
Part 2 — *Taxiways, Aprons and Holding Bays*
Aeronautical Information Services Manual (Doc 8126)
Airport Services Manual (Doc 9137)
Part 6 — *Control of Obstacles*
Heliport Manual (Doc 9261)
Instrument Flight Procedures Construction Manual (Doc 9368)
Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476)
World Geodetic System — 1984 (WGS-84) Manual (Doc 9674)

Miscellaneous

International Civil Aviation Vocabulary (Doc 9713)

Products and Services Catalogue 2015 — available at www.icao.int

— END —

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