TECHNICAL STANDARDS – Issue version (2020) NAMCATS: Part 173 – FLIGHT PROCEDURE DESIGN SERVICES (FPD)

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1. General

1.1 Section 227 of the Civil Aviation Act, 2016 (Act no. 6 of 2016 – hereinafter "the Act") empowers the Executive Director of Civil Aviation to issue technical standards for civil aviation "on such matters as may be prescribed". Section 227(3) of the Act further empowers the Executive Director of Civil Aviation to incorporate into a technical standard any international aviation standard or any amendment without publishing the text of such standard or any amendment "by mere reference" to the title, number and year of issue of such standard or amendment or to any other particulars by which such standard or amendment is sufficiently identified.

1.2 By way of Government Notice 89/2020 published in Government Gazette 7157 dated 27th March 2020, NAMCARS (amendment 2020) provides for Part 173 – " Flight Procedure Design Services" (FPD). This Part 173 provides for the issue of technical standards as NAM-CATS-ATS. The Executive Director of Civil Aviation has, pursuant to the empowerment mentioned above, issued technical standards relating to NAMCAR Part 173 (FPD Services) to be known as NAM-CATS-FPD as further set out in the SCHEDULE herein.

1.3 NAM-CATS-FPD comprises the standards, rules, requirements, methods, specifications, characteristics and procedures which are applicable in respect of the provision of Aeronautical Telecommunications Services to be used in all aspects of civil aviation air and ground operations.

1.4 To the extent possible, each reference to a technical standard in this document, is a reference to the corresponding regulation in the Namibian Civil Aviation Regulations.

Example: *(1) Technical standard 173.02.1 refers to regulation Part 173 of Subpart 02 of the Part 173*
(2) Technical standard 173.02.2 refers to either the whole, or more than one specific regulation, of Subpart 02 of Part 2.

1.5 Where there is any perceived disparity of meaning or inconsistency between these technical standards and the regulations, the provisions of the regulations will take precedence.

1.6 Where there is a difference between a standard and procedure prescribed in ICAO documents and the Civil Aviation Technical Standards (CATS), the CATS standard will prevail.

2. GUIDANCE MATERIAL

2.1 Guidelines and recommendations in support of any particular technical standard are contained in schedules or appendices to, and/or compliance notes inserted throughout, the technical standards. These guidelines, upon release, are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means of complying with the regulations and technical standards. They may explain certain regulatory requirements by providing interpretive and explanatory materials. It is expected that service providers will document internal actions in their own operational manuals, to put into effect those, or similarly adequate, practices.

3. AMENDMENTS TO THE TECHNICAL STANDARDS

3.1 The NCAA Safety (ANSO) Division has responsibility for the technical content of this technical standard.

3.2 This technical standard is issued, and may only be amended, under the authority of the Executive Director of Civil Aviation.

3.3 Requests for changes to the content of this technical standard must be forwarded to the Executive Director and may come from:
(a) technical areas within NCAA; or
(b) aviation industry service providers or operators; or
(c) pilots and ATC staff.

3.4 The need to change the content of this technical standard may arise for any of the following reasons:
(a) to ensure safety;
(b) to ensure standardisation;
(c) to respond to changed NCAA regulations or standards;
(d) to respond to changes initiated by ICAO;
(e) to accommodate proposed initiatives or new technologies.

3.5 NCAA may approve trials of new procedures or technologies to develop appropriate standards.

4. INTERNATIONAL STANDARDS

4.1 Section 227 of the Civil Aviation Act, 2016 empowers the Executive Director of Civil Aviation to issue technical standard for civil aviation. Section 227 of the Civil Aviation Act, 2016 further empowers the Executive Director of Civil Aviation to incorporate into a technical standard any international aviation standard or any amendment without stating the text of such standard or amendment, “by mere reference” to the title, number and year of issue of such standard or amendment, or to any other particulars by which such standard or amendment is sufficiently identified.

4.2 The following international standards, recommended practices and procedures, as amended from time to time, (art 37 of the Chicago Convention) will be incorporated into the technical standards contained in this document upon release:

(a) ICAO Procedures for Air Navigation — Air Operations, Volume II - Construction of Visual and Instrument Flight Procedures, PANS-OPS – Volume II (Doc 8168);
(b) ICAO Template Manual for Holding, Reversal and Racetrack Procedures, (Doc 9371);
(c) ICAO Required Navigation Performance Authorization Required Procedure Design Manual (Doc 9905)

(d) ICAO Collision Risk Manual (CRM) (Doc 9274);
(e) ICAO Quality Assurance Manual for Flight Procedure Design (Doc 9906):
  (1) Volume 1 – *Flight Procedure Design Quality Assurance System;*
  (2) Volume 2 – *Flight Procedure Designer Training*;
  (3) Volume 3 – *Flight Procedure Design Software Validation*;
  (4) Volume 4 – *Flight Procedures Design Construction* (to be developed);
  (5) Volume 5 – *Validation of Instrument Flight Procedures*; and
  (6) Volume 6 – *Flight Validation Pilot Training and Evaluation*;
(f) ICAO Instrument Flight Procedures Construction Manual (Doc 9368);
(g) ICAO Continuous Descent Manual of Procedure (Doc 9931);
(h) ICAO Performance Based Navigation Manual (Doc 9613); and
(i) ICAO Manual on All Weather Operations (Doc 9365);

4.3 Differences from ICAO Standards, Recommended Practices and Procedures are published in the AIP.

These Technical Standards apply with immediate effect.

Further access is available on NCAA website: www.ncaa.com.na/resources

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NAMIBIA CIVIL AVIATION AUTHORITY
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SCHEDULE

Part 173 – FLIGHT PROCEDURE DESIGN SERVICES

(NAM-CATS-FPD)

List of Technical Standards

173.01.1 Definitions and Abbreviations

1.1 Definitions

The following definitions are applicable within this technical standard:

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

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

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

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.

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.

Continuous climb operation (CCO). An operation, enabled by airspace design, procedure design and ATC, in which a departing aircraft climbs continuously, to the greatest possible extent, by employing optimum climb engine thrust and climb speeds until reaching the cruise flight level.

Continuous descent final approach (CDFA). A technique, consistent with stabilized approach procedures, for flying the final approach segment of a non-precision instrument approach procedure as a continuous descent, without level-off, from an altitude/height at or above the final approach fix altitude/height to a point approximately 15 m (50 ft) above the landing runway threshold or the point where the flare manoeuvre should begin for the type of aircraft flown.

Continuous descent operation (CDO). An operation, enabled by airspace design, procedure design and ATC, in which an arriving aircraft descends continuously, to the greatest possible extent, by employing minimum engine thrust, ideally in a low drag configuration, prior to the final approach fix /final approach point.

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

Course. The intended direction of travel of an aircraft, expressed in degrees from North (true, magnetic or grid).

Cross-track tolerance (XTT). A fix tolerance measured perpendicularly to the nominal track resulting from the airborne and ground equipment tolerances and the flight technical tolerance (FTT).

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.

Datum crossing point (DCP). The DCP is a point on the glide path directly above the LTP or FTP at a height specified by the RDH.

Dead reckoning (DR) navigation. The estimating or determining of position by advancing an earlier known position by the application of direction, time and speed data.

Decision altitude (DA) or decision height (DH). A specified altitude or height in a 3D instrument approach operation at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

Note 1. Decision altitude (DA) is referenced to mean sea level and decision height (DH) is referenced to the threshold 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 Category III operations with a decision height the required visual reference is that specified for the particular procedure and operation.

Note 3. For convenience where both expressions are used they may be written in the form "decision altitude/height" and abbreviated "DA/H".

Dependent parallel approaches. Simultaneous approaches to parallel or near-parallel instrument runways where radar separation minima between aircraft on adjacent extended runway centre lines are prescribed.

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.

Descent point (DP). A point defined by track and distance from the MAPt to identify the point at which the helicopter may descend below the OCA/H on a visual descent to the heliport/landing location.

Designer. A person adequately trained who performs the design of an instrument flight procedure.

Direct visual segment (Direct-VS). A visual segment designed as:

a) a leg in a PinS approach, which may contain a single turn, from the MAPt direct to the heliport or landing location or via a descent point to the heliport or landing location; or
b) a straight leg from the heliport or landing location to the IDF in a PinS departure.

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

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

European GNSS navigation overlay service (EGNOS). A satellite-based augmentation system providing navigation service meeting Annex 10 requirements that provides navigation service in the European Region.

Executive Director. The Chief Executive Officer of the Namibia Civil Aviation Authority appointed under the Civil Aviation Act No. 16 of 2016.

Fictitious heliport point (FHP). The FHP is a point over which the PinS final approach segment path passes at a relative height defined as the fictitious heliport point crossing height (FHPCH). It is defined by the WGS-84 latitude, longitude and ellipsoid height. The FHP replaces the FTP for PinS approaches. The FHP elevation is the same as the actual landing heliport elevation.

Fictitious threshold point (FTP). The FTP is a point over which the final approach segment path passes at a relative height specified by the reference datum height. It is defined by the WGS-84 latitude, longitude and ellipsoid height. The FTP replaces the LTP when the final approach course is not aligned with the runway extended centre line or when the threshold is displaced from the actual runway threshold. For non-aligned approaches the FTP lies on the intersection of the perpendicular from the FAS to the runway threshold. The FTP elevation is the same as the actual runway threshold elevation.

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

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

Final approach segment (FAS) data block. The set of parameters to identify a single precision approach or APV and define its associated approach path.

Final approach track. The flight track in the final approach segment that is normally aligned with the runway centre line. For offset final approach segments, the final approach track is aligned with the orientation of the FTP and the FPAP.

Flight level (FL). 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 path alignment point (FPAP). The FPAP is a point in the same lateral plane as the LTP or FTP that is used to define the alignment of the final approach segment. For approaches aligned with the runway centre line, the FPAP is located at or beyond the opposite threshold of the runway. The delta length offset from the opposite threshold of the runway defines its location.

Flight procedure design. The complete package that includes all the considerations that went into the development of an instrument flight procedure.

Flight procedure designer. A person responsible for flight procedure design who meets the competency requirements as laid down in this NAM-CATS-FPD.

Flight procedure design process. The process which is specific to the design of instrument flight procedures leading to the creation or modification of an instrument flight procedure.

Full-scale deflection (FSD). The term used to describe the maximum deviation from center of either a course deviation indicator (CDI) or a vertical deviation indicator (VDI), such as a glide slope indicator, and that applies to both linear and angular scaling.

GBAS azimuth reference point (GARP). The GARP is defined to be beyond the FPAP along the procedure centre line by a fixed offset of 305 m (1 000 ft). It is used to establish the lateral deviation display limits.

GBAS landing system (GLS). A system for approach and landing operations utilizing GNSS, augmented by a ground based augmentation system (GBAS), as the primary navigational reference.

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.

Global navigation satellite system (GNSS). A worldwide position and time determination system that includes one or more satellite constellations, aircraft receivers and system integrity monitoring, augmented as necessary to support the required navigation performance for the intended operation.

Note. GNSS performance standards are found in NAMCAR Part 171.

Ground-based augmentation system (GBAS). An augmentation system in which the user receives augmentation information directly from a ground-based transmitter.

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.

Height above surface (HAS). The difference in height between the OCA and the elevation of the highest terrain, water surface or obstacle within a radius of at least 1.5 km (0.8 NM) from the MAPt in a PinS “Proceed VFR” procedure.

Heliport reference point (HRP). The designated location of the heliport or landing location.

Holding fix. A geographical location that serves as a reference for a holding procedure.

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

Independent parallel approaches. Simultaneous approaches to parallel or near-parallel instrument runways where radar separation minima between aircraft on adjacent extended runway centre lines are not prescribed.

Independent parallel departures. Simultaneous departures from parallel or near-parallel instrument runways.

Initial approach fix (IAF). A fix that marks the beginning of the initial segment and the end of the arrival segment, if applicable.

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.

Initial departure fix (IDF). The terminal fix for the visual segment and the fix where the instrument phase of the PinS departure begins.

Instrument approach operations. An approach and landing using instruments for navigation guidance based on an instrument approach procedure. There are two methods for executing instrument approach operations:

a) a two-dimensional (2D) instrument approach operation, using lateral navigation guidance only; and
b) a three-dimensional (3D) instrument approach operation, using both lateral and vertical navigation guidance.

Note. Lateral and vertical navigation guidance refers to the guidance provided either by:

a) a ground-based radio navigation aid; or
b) computer-generated navigation data from ground-based, space-based, self-contained navigation aids or a combination of these.

Instrument approach procedure (IAP). 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 approach procedures are classified as follows:

Non-precision approach (NPA) procedure. An instrument approach procedure designed for 2D instrument approach operations Type A.

Note. Non-precision approach procedures may be flown using a continuous descent final approach (CDFA) technique. CDFAs with advisory VNAV guidance calculated by on-board equipment (see Part I, Section 4, Chapter 1, paragraph 1.8.1) are considered 3D instrument approach operations. CDFAs with manual calculation of the required rate of descent are considered 2D instrument approach operations. For more information on CDFAs, refer to Part I, Section 4, Chapter 1, paragraphs 1.7 and 1.8.

Approach procedure with vertical guidance (APV). A performance-based navigation (PBN) instrument approach procedure designed for 3D instrument approach operations Type A.

Precision approach (PA) procedure. An instrument approach procedure based on navigation systems (ILS, MLS, GLS and SBAS Cat I) designed for 3D instrument approach operations Type A or B.

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

Instrument flight procedure. A description of a series of predetermined flight manoeuvres by reference to flight instruments, published by electronic and/or printed means.

Instrument flight procedure design organisation- An organisation responsible for the design and maintenance of visual and instrument flight procedures (in the Kenya Context the Air Navigational Services Provider).

Instrument flight procedure designer- A person who has acquired and maintained the required competency level to design flight procedures in accordance with the applicable criteria.

Instrument flight procedure process. The overarching process from data origination to the publication of an instrument flight procedure.

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 approach fix and the final approach fix or point, or between the end of a reversal, racetrack or dead reckoning track procedure and the final approach fix or point, as appropriate.

Intermediate fix (IF). A fix that marks the end of an initial segment and the beginning of the intermediate segment.

Landing location. A marked or unmarked area that has the same physical characteristics as a visual heliport final approach and take-off area (FATO).

Landing threshold point (LTP). The LTP is a point over which the glide path passes at a relative height specified by the reference datum height. It is defined by the WGS-84 latitude, longitude and ellipsoid height. The LTP is normally located at the intersection of the runway centre line and threshold.

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

Localizer performance (LP). The label to denote minima lines associated with the lateral element of APV-1 performance on approach charts.

Localizer performance with vertical guidance (LPV). The label to denote minima lines associated with APV-I or APV-II performance on approach charts.

Manoeuvring visual segment (Manoeuvring-VS). PinS visual segment protected for the following manoeuvres for:

a) PinS approaches. Visual manoeuvre from the MAPt around the heliport or landing location to land from a direction other than directly from the MAPt.
b) PinS departures. Take-off in a direction other than directly to the IDF followed by visual manoeuvre to join the instrument segment at the IDF.

Minimum descent altitude (MDA) or minimum descent height (MDH). 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 instrument meteorological conditions airspeed (Vmini).The minimum indicated airspeed at which a specific helicopter is certified to operate in instrument meteorological conditions.

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

Minimum sector altitude (MSA). The lowest altitude which may be used which will provide a minimum clearance of 300 m (1 000 ft) above all objects located in an area contained within a sector of a circle of 46 km

(25 NM) radius centred on a significant point, the aerodrome reference point (ARP) or the heliport reference point (HRP).

Minimum stabilization distance (MSD). The minimum distance to complete a turn manoeuvre and after which a new manoeuvre can be initiated. The minimum stabilization distance is used to compute the minimum distance between waypoints.

Missed approach holding fix (MAHF). 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.

Missed approach turning fix (MATF). A fix different from MAPt that marks a turn in the missed approach segment.

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).

Near-parallel runways. Non-intersecting runways whose extended centre lines have an angle of convergence/divergence of 15 degrees or less.

No transgression zone (NTZ). In the context of independent parallel approaches, a corridor of airspace of defined dimensions located centrally between the two extended runway centre lines, where a penetration by an aircraft requires a controller intervention to manoeuvre any threatened aircraft on the adjacent approach.

Obstacle assessment surface (OAS).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 APV or precision approach 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 approach procedures 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 operation 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".

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.

Path and Terminator ("Path Terminator"). A two-letter code, which defines a specific type of flight path along a segment of a procedure and a specific type of termination of that flight path. Path terminators are assigned to all RNAV, SID, STAR and approach procedure segments in an airborne navigation database.

Note. Path terminators as defined in PANS-OPS are, with the exception of the RF path terminator, established in accordance with the rules set forth in ARINC Specification 424-15, Navigation System Data Base. The rules applicable to the RF path terminator are based upon ARINC 424-17.

Planned departure route - A notified instrument flight rule departure (IFR) route linking the aerodrome or a specific runway of the aerodrome with a specified significant point, normally on the boundary of controlled airspace associated with the aerodrome.

Point-in-space (PinS) approach. An approach procedure designed for helicopters only that includes both a visual and an instrument segment.

Point-in-space (PinS) departure. A departure procedure designed for helicopters only that includes both a visual and an instrument segment.

Point-in-space (PinS) visual segment. The segment of a helicopter PinS procedure between a point (MAPt or IDF) and the heliport or the landing location.

Point-in-space reference point (PRP). Reference point for the point-in-space approach as identified by the latitude and longitude of the MAPt.

Primary area. A defined area symmetrically disposed about the nominal flight track in which full obstacle clearance is provided. (See also Secondary area.)

Procedure. A specified way to carry out an activity or a process (see ISO 9000:2000 Quality management systems — Fundamentals and vocabulary, section 3.4.5).

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.

Process. A set of interrelated or interacting activities which transforms inputs into outputs (see ISO 9000:2000 Quality management systems — Fundamentals and vocabulary, section 3.4.1); hence “flight procedure design (FPD) process” or “instrument flight procedure process”.

Quality record. Objective evidence which shows how well a quality requirement is being met or how well a quality process is performing. Quality records normally are audited in the quality evaluation process.

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.

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

Required navigation performance (RNP). A statement of the navigation performance necessary for operation within a defined airspace.

Note. Navigation performance and requirements are defined for a particular RNP type and/or application.

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.

Review. An activity undertaken to determine the suitability, adequacy and effectiveness of the subject matter to achieve established objectives (see ISO 9000:2000 Quality management systems — Fundamentals and vocabulary, section 3.8.7).

Satellite-based augmentation system (SBAS). A wide coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter.

Note. SBAS performance standards are found in NAMCAR Part 171.

Secondary area. A defined area on each side of the primary area located along the nominal flight track in which decreasing obstacle clearances provided. (See also Primary area.)

Segregated parallel operations. Simultaneous operations on parallel or near-parallel instrument runways in which one runway is used exclusively for approaches and the other runway is used exclusively for departures.

Significant obstacle. Any natural terrain feature or man-made fixed object, permanent or temporary, which has vertical significance in relation to adjacent and surrounding features and which is considered a potential hazard to the safe passage of aircraft in the type of operation for which the individual procedure is designed.

Note. The term "significant obstacle" is used in this document solely for the purpose of specifying the objects considered in calculations of relevant elements of the procedure and intended to be presented on an appropriate chart series.

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.

Software validation. Acknowledgement, derived from a series of tests, of the compliance of an automation system with the applicable standards.

Standard instrument arrival (STAR) - A designated instrument flight rule arrival (IFR) 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 (SID) - A designated instrument flight rule (IFR) departure route linking the aerodrome or a specific 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. The angle between the 360°R of the VOR and true north.

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

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 must account for an area of 360 degrees around the IF.

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

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).

Validation. Confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled. The activity whereby a data element is checked as having a value that is fully applicable to the identity given to the data element, or a set of data elements that is checked as being acceptable for their purpose.

Verification. Confirmation, through the provision of objective evidence, that specified requirements have been fulfilled. The activity whereby the current value of a data element is checked against the value originally supplied.

Vertical path angle (VPA). Angle of the published final approach descent in Baro-VNAV procedures.

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

Visual segment descent angle (VSDA). The angle between the MDA/H at the MAPt/DP and the heliport crossing height.

Visual segment design gradient (VSDG). The gradient of the visual segment in a PinS departure procedure. The visual segment connects the heliport or landing location with the initial departure fix (IDF) minimum crossing altitude (MCA).

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.

Waypoint distance (WD). Distance on the WGS84 ellipsoid from a defined waypoint to the aircraft RNAV receiver.

1.2 Abbreviations and Acronyms

AC Advisory circular

AIP Aeronautical information publication

AMSL Above mean sea level

ANP Actual navigation performance

AOB Angle of bank

APV Approach procedures with vertical guidance

ATM Air traffic management

ATS Air traffic services

ATT Along-track tolerance

AZM Azimuth

BV Buffer value

CA Course to an altitude

CAT Category

CCO Continuous climb operation

CDFA Continuous descent final approach

CDI Course deviation indicator

CDO Continuous descent operation

CF Course to a fix

C/L Centre line

COP Change-over point

CRC Cyclic redundancy check

CRM Collision risk model

DA/H Decision altitude/height

DCP Datum crossing point

DER Departure end of the runway

DF Direction finding

Direct-VS Direct visual segment

DME Distance measuring equipment

DP Descent point

DR Dead reckoning

DTT System use accuracy

EDA Elevation differential area

EUROCAE European Organization for Civil Aviation Equipment

FA Course from a fix to an altitude

FAF Final approach fix

FAP Final approach point

FAS Final approach segment

FATO Final approach and take-off area

FHP Fictitious heliport point

FHPCH Fictitious heliport point crossing height

FL Flight level

FM Course from a fix to manual termination

FMC Flight management computer

FMS Flight management system

FPAP Flight path alignment point

FTE Flight technical error

FTP Fictitious threshold point

FTT	Flight technical tolerance
GARP	GBAS azimuth reference point
GBAS	Ground-based augmentation system
GLS	GBAS landing system
GNSS	Global navigation satellite system
GP	Glide path
GPA	Glide path angle
GPWS	Ground proximity warning system
HA	Holding/racetrack to an altitude
HAE	Height above ellipsoid
HAL	Horizontal alarm limit
HCH	Heliport crossing height
HF	Holding/racetrack to a fix
HL	Height loss
HM	Holding/racetrack to a manual termination
HP	Helipoint
HRP	Heliport reference point
IAC	Instrument Approach Chart
IAF	Initial approach fix
IAP	Instrument approach procedure
IAS	Indicated airspeed
IDF	Initial departure fix
IF	Intermediate approach fix
IFP	Instrument flight procedure

IFR Instrument flight rules

ILS Instrument landing system

IMAL Integrity monitor alarm

IMC Instrument meteorological conditions

ISA International standard atmosphere

KIAS Knots indicated airspeed

LDAH Landing distance available — helicopters

LF Low frequency

LOC Localizer

LORAN Long range air navigation system

LP Localizer performance

LPV Localizer performance with vertical guidance

LTP Landing threshold point

MA/H Minimum altitude/height

MAHF Missed approach holding fix

Manoeuvring-VS Manoeuvring visual segment

MAPt Missed approach point

MATF Missed approach turning fix

MCA Minimum crossing altitude

MCH Minimum crossing height

MDA/H Minimum descent altitude/height

MEA Minimum en-route altitude

MLS Microwave landing system

MM Middle marker

MOC Minimum obstacle clearance

MOCA Minimum obstacle clearance altitude

MSA Minimum sector altitude

MSD Minimum stabilization distance

MSL Mean sea level

NDB Non-directional beacon

NM Nautical mile

NPA Non-precision approach

NSE Navigational system error

NTZ No transgression zone

OAS Obstacle assessment surface

OCA/H Obstacle clearance altitude/height

OCA/Hfm OCA/H for the final approach and straight missed approach

OCA/Hps OCA/H for the precision segment

OCS Obstacle clearance surface

OFZ Obstacle free zone

OIS Obstacle identification surface

OJT On-the-job training

OLS Obstacle limitation surface

OM Outer marker

PA Precision approach

PAPI Precision approach path indicator

PAR Precision approach radar

PBN Performance-based navigation

PDG	Procedure design gradient
PinS	Point-in-space
PRP	Point-in-space reference point
R	Rate of turn
RAIM	Receiver autonomous integrity monitoring
RASS	Remote altimeter setting source
RDH	Reference datum height (for APV and PA)
RF	Constant radius arc to a fix
RNAV	Area navigation
RNP	Required navigation performance
RPDS	Reference path data selector
RSR	En-route surveillance radar
RSS	Root sum square
SA	Safety area
SARPs	Standards and Recommended Practices (ICAO)
SBAS	Satellite-based augmentation system
SD	Standard deviation
SDF	Stepdown fix
SI	International system of units
SID	Standard instrument departure
SIS	Signal in space
SOC	Start of climb
SST	Supersonic transport
ST	System computation tolerance

STAR	Standard instrument arrival
TAA	Terminal arrival altitude
TACAN	UHF tactical air navigation aid
TA/H	Turn at an altitude/height
TAR	Terminal area surveillance radar
TAS	True airspeed
TCH	Threshold crossing height
TF	Track to a fix
THR	Threshold
TMA	Terminal control area
TNA/H	Turn altitude/height
TP	Turning point
TSE	Total system error
TTT	Template tracing technique
Vmini	Minimum instrument meteorological conditions indicated airspeed
VA	Heading to an altitude
VAL	Vertical alarm limit
VASIS	Visual approach slope indicator system
VDF	Very high frequency direction-finding station
VEB	Vertical error budget
VHF	Very high frequency
VI	Heading to an intercept
VM	Heading to a manual termination
VOR	Very high frequency omnidirectional radio range

VPA	Vertical path angle
VS	Visual segment
VSDA	Visual segment descent angle
VSDG	Visual segment design gradient
VSS	Visual segment surface
WD	Waypoint distance
WGS	World geodetic system
XTT	Cross-track tolerance
5LNC	Five-letter name code

Application for flight procedure design approval or amendment thereof

173.02.2 An application for a flight procedure design approval, or an amendment thereof, must be made to the Executive Director in the appropriate form published on the NCAA website.

Renewal of flight procedure design approval

173.02.7 An application for the renewal of a flight procedure design approval, must be made to the Executive Director on the appropriate form published on the NCAA website.

Duplicate approval

173.02.8 An application for and a duplicate approval must be made and issued in the appropriate form published on the NCAA website.

173.03.1 Manual of Procedures

1. General

1.1 This section sets out the minimum requirements for the manual of procedure (manual) that must be developed and maintained by an instrument flight procedure (IFP) design organisation.

1.2 The manual is a set of documents that shows how and where an IFP design organisation provides, or proposes to provide, IFP design services in compliance with regulations and standards.

1. Content of the Manual of Procedure

2.1 A manual of procedure must contain:

(a) a table of contents based on the items in the manual, indicating the page number on which each item begins;

(b) a description of the designer's organisational structure and a statement setting out the functions that the designer performs, or proposes to perform under Part 173;

(c) the name and qualification of the chief designer, and senior designers, and the arrangements that will be put in place to replace the chief designer if that person is absent for any period of time;

(d) a description of the chain of command established, or proposed to be established, by the IFP design organisation and a statement of the duties and responsibilities of any supervisory positions within the organisational structure;

(e) a statement showing how the IFP design organisation determines the number of operational staff required including the number of operational supervisory staff;

(f) a list of the design services that the IFP design organisation provides, or proposes to provide;

(g) a statement, for each design service, that identifies the location from where the service is provided, or proposed to be provided;

(h) a statement of the responsibilities and functions for each position;

(i) a description of the arrangements made or proposed to be made by the IFP design organisation to ensure that it has, and will continue to receive, the information necessary for providing the service;

(j) a description of the arrangements made or proposed to be made by the IFP design organisation to ensure that it has, and will continue to be able to provide, information in connection with its design services to another person whose functions reasonably require that information;

(k) a description of the IFP design organisation's record keeping system;

(l) a description of the IFP design organisation's quality management system, including arrangements to comply with the ICAO Quality Assurance Manual for Flight Procedure Design (Doc 9906) - Volume 1 – Flight Procedure Design Quality Assurance System;

(m) a statement detailing any agreement entered into by the IFP design organisation in relation to the provision of a design service provided by another party, and how the quality of that 3rd party service will be maintained;

(n) a copy of the document that sets out the IFP design organisation's safety management system and how the safety management system will be applied in practice;

(o) a description of the processes and documentation used to present to staff the relevant standards, rules and procedures and any of the IFP design organisation's site-specific instructions for the provision of design services;

(p) a description of the processes and documentation used to provide operational instructions to staff;

(q) a description of the procedures to be followed to ensure all operational staff are familiar with any operational changes that have been issued since they last performed operational duties;

(r) a description of the approved designer's training and checking program;

(s) a description of the procedures to be used in commissioning new facilities, equipment and services;

(t) a description of the procedures to be used to ensure that IFP designs are completed in accordance with the drafting conventions contained in this CATS;

(u) a description of the format(s) that will be used for the issue of completed designs for publication;

(v) a description of the procedures to be used to ensure that all equipment, including software is operated in accordance with the manufacturer's operating instructions and manuals;

(w) a description of the procedures to be used to conduct environmental assessments; and

(x) the procedures to be followed for revising the Manual of Procedure.

173.03.3 Personnel and Qualification Requirements

1. Personnel Requirements

1.1 An approved design organisation must employ, contract, or otherwise engage:

(a) a senior person identified as the chief flight procedure designer (accountable executive) who:

(i) has the authority within the organisation to ensure that all activities undertaken by the organisation can be resourced and carried out to meet applicable operational requirements; and

(ii) is responsible for ensuring that the organisation complies with the requirements of Part 173.

(b) a senior person responsible to the accountable executive for ensuring that the organisation complies with the provisions in the manual of procedures approved under Part 170 and Part 173;

(c) sufficient competent and qualified technical personnel to inspect, supervise, and maintain any facilities listed in the Manual of Procedure; and

(d) sufficient competent and qualified operational staff to ensure the effective provision of IFP design services covered by the designer's approval and the Manual of Procedure.

2. Chief Designer

2.1 The minimum standard for the qualification and experience of a Chief Flight Procedure Designer is:

(a) the qualification and experience requirements for a qualified flight procedures designer; and

(b) appropriate experience in the design of the type of procedures to be designed under the Instrument Flight Procedure Design approval; and

(c) satisfactorily completed an advanced course in PANS-OPS procedure design.

2.2 The minimum standard of recent experience for appointment as a Chief Designer is:

(a) relevant design experience within the previous one year; or

(b) satisfactory completion of an approved PANS-OPS procedures design course or an advanced course on PANS-OPS procedure design within the previous two years.

2.3 In addition, a chief designer should have at least 10 years' experience in the application of instrument flight (IFP) through experience gained in air traffic control, as a flight crew member on IFR operations, in operational control of IFR operations, or other experience accepted by the Executive Director as equivalent. Experience may include time spent in the design of IFPs.

2.4 In addition, the Chief Designer must be able to demonstrate competency and experience relevant to the management of safety systems and the activities of the approval holder.

3. Qualified Designer

3.1 The minimum standard for the qualifications and experience of a Qualified Designer is:

(a) satisfactory completion of an approved PANS-OPS procedures design course or a training course accepted by the Executive Director as an equivalent; and

(b) satisfactory completion of a course of in-service training in procedures design as detailed in the designer's Manual of Procedure; and

(c) required minimum experience in accordance with paragraph 6; and

(d) a written approval by the Chief Designer as specified in paragraph 9.

3.2 In addition, a qualified designer must have at least 5 years' general experience in the application of instrument flight procedures through experience gained in air traffic control, as a flight crew member on IFR operations, in operational control of IFR operations, or other experience accepted by the Executive Director as equivalent. Experience may include time spent in the design of IFPs.

4. Unqualified Persons (trainee designers)

4.1 Personnel who are not qualified under paragraph 3 must not:

(a) design a procedure for which an approval is required under this Part, except under direct supervision; or

(b) verify or check a procedure for which a Certificate of Approval is required under this Part.

4.2 Direct supervision means supervision by a qualified designer who is engaged on a full-time basis in the same premises.

5. Supervisors

5.1 The minimum standard for the qualifications and experience of persons responsible for the supervision of other design staff is:

(a) Qualified Designer;

(b) substantial experience in the design of instrument flight procedures; and

(c) competency and experience relevant to the management of safety systems and the activities of the approval holder.

6. Minimum Design Experience

6.1 Minimum design experience is required for each type of procedure to be designed.

6.2 For the purposes of 3.1(c) the minimum practical design experience required is three designs of a particular procedure type, checked and approved by a Chief Designer, and completed within any six consecutive months.

Compliance Note: *Once a designer has completed three designs of a particular type as indicated, and provided he has satisfied the other requirements, he may act as a qualified designer – but may only work unsupervised on those IFP types for which he has completed the experience and recency requirement.*

7. Recency

7.1 A person must not design (except under direct supervision) or verify a procedure, unless he has designed, checked or been directly involved in the detailed review of a procedure of the same type within the previous year.

8. Administration – Staff Records

8.1 The Chief Designer must maintain a register of:

(a) personnel qualifications and courses attended;

(b) staff training;

(c) proficiency checks conducted;

(d) staff approvals; and

(e) staff recency.

9. Approvals

9.1 The Chief Designer must provide each staff member engaged in instrument flight procedure design as a Qualified Designer with a written statement specifying:

(a) that the person is a Qualified Designer; and

(b) the types of procedure that the person is approved to design; and

(c) any limitations or supervision requirements that apply; and

(d) any approval to supervise other design staff.

173.03.6 Training and Checking Programe

1. General

1.1 An approved design organisation must establish a training and checking program to ensure that all operational staff are appropriately qualified, and that they remain competent and current in instrument flight procedure design requirements and techniques.

1.2 Particular attention must be given to ensuring that qualified designers are developed so that they are sufficiently experienced to assume the role of Chief Designer should that person be absent for any period of time.

2. Instrument Flight Procedure Design Courses - Approval of Courses

2.1 In determining whether a course will be considered as an approved course, the following will be taken into consideration:

(a) an appropriate syllabus;

(b) adequate duration;

(c) appropriately qualified and experienced course lecturer(s);

(d) the provider/institution.

2.2 Approval of a course may require on-site inspection and observation of the conduct of the course.

2.3 Where assessment of a course is not possible due to the lapse in time since the course was provided, the Executive Director may consider a course to be approved if:

(a) sufficient evidence exists that the course was completed satisfactorily; and

(b) the course could reasonably have been expected to meet the minimum requirements of an approved course applicable at the time that it was completed; and

(c) the applicant can provide evidence of additional training or practical experience which enable the applicant to satisfy the syllabus requirements of an approved course.

3. Human Factors and Human Performance

3.1 In developing training requirements, an approved designer must ensure that human factors and human performance considerations are applied in the training for, and provision of, flight procedure design services.

173.03.7 Quality Management System

1. Context

Compliance Note I . Instrument flight procedures based on conventional ground-based navigational aids demand a high level of quality control. The implementation of area navigation and associated airborne database navigation systems, however, means that even small errors in data can lead to catastrophic results. This significant change in data quality requirements (accuracy, resolution and integrity) has led to the need for a systemic quality assurance process.

Compliance Note 2. The quality of an IFP is flight critical. The en-route structure, departure, arrival, holding and approach procedures are derived from an IFP process which covers various steps from collection of user requirements to State publication to the integration into airborne systems. In consequence, the FPD and the resulting IFP, from data origination through publication to incorporation into an end-user system, must be quality assured.

2. Requirement

2.1 A flight procedure design organisation must establish and maintain a properly organized quality assurance system containing procedures, processes and resources necessary to implement quality management at each design stage of an instrument flight procedure.

2.2 The quality system must be in conformity with the International Organization for Standardization (ISO) 9000 series of quality assurance standards.

Compliance Note: *An ISO 9001 certificate, issued by an appropriately accredited organisation, covering the design of instrument flight procedures by the approved designer will be considered as a sufficient means of compliance.*

2.3 Where an ISO 9001 certificate has been obtained, the approved designer must accept the disclosure of the documentation related to the certification to the Executive Director upon the latter’s request.

2.4 The quality system must also be in conformity with the guidance provided in the ICAO Quality Assurance Manual for Flight Procedure Design (Doc 9906) - Volume 1 to 6.

2.5 Within the context of the IFP design quality system, the skills and knowledge required for each function must be identified and personnel assigned to perform those functions must be appropriately trained.

2.6 An approved designer must ensure that personnel possess the skills and competencies required to perform specific assigned functions, and appropriate records must be maintained so that the qualifications of personnel can be confirmed.

2.7 Initial and periodic assessments are carried out to ensure that personnel demonstrate the required skills and competencies. Periodic assessments of personnel must be used as a means to detect and correct shortfalls.

2.8 All necessary measures must be taken to monitor compliance with the quality management system in place.

2.9 Within the quality assurance system, if nonconformity is identified, initiating action to correct its cause must be determined and taken as follows:

(a) the procedure required for corrective action must specify how:

(i) to correct an existing quality problem;

(ii) to follow up a corrective action to ensure the action is effective;

(iii) to amend any procedure required under this Part as a result of a corrective action; and

(iv) management will measure the effectiveness of any corrective action taken.

(b) the procedure required for preventive action must specify how:

(i) to correct a potential quality problem;

(ii) to follow-up a preventive action to ensure the action is effective;

(iii) to amend any procedure required under this Part as a result of a preventive action; and

(iv) management will measure the effectiveness of any preventive action taken.

173.03.8 Management of Records

1. Purpose

1.1 This section sets out the standards, procedures and rules for document management and record keeping that must be applied by an approved designer.

2. Document and Record Control System

2.1 Document and data control processes are those that control the authorisation, publication, distribution, and amendment of all documentation issued or required by approved designers.

2.2 These processes must ensure that:

(a) documents are authorised by the Chief Designer or a designated person;

(b) the currency of documentation can be readily determined;

(c) documents are available at locations where needed by staff;

(d) only current versions of documents are available;

(e) a master copy of all documentation is securely held; and

(f) all documents that are related to and referenced in the Manual of Procedure are indexed in the Manual of Procedure.

3. Records

3.1 An approved designer must establish procedures to record, collect, index, store, secure, maintain, access and dispose of the records that are necessary for the flight procedure design services listed in their approval.

3.2 The procedures must ensure that:

(a) there are records enabling all incoming and outgoing information and data to be readily identified, and that supplementary information can be similarly verified and, where necessary, authenticated;

(b) there is a record of each person who is authorized by the approved designer to check, edit, and publish IFPs ;

(c) there is a record of each occurrence of an error requiring corrective action under the quality assurance procedures;

(d) there is a record of each quality management system audit, of the approved designer's organisation;

(e) all records are legible and of a permanent nature; and

(f) all records are retained for a period of at least 5 years after the associated instrument flight procedure is withdrawn from use.

3.3 As a minimum, a approved designer must maintain the following records:

(a) all certificates, correspondence, data, calculations, worksheets, drawings, charts and other information pertaining to the design of a procedure;

(b) staff records.

3.4 Records must be made available for audit by the Executive Director on request.

3.5 Records relating to procedure designs must be retained for the period that a procedure is available for use and for a period of five years after a procedure ceases to be available or is withdrawn.

3.6 Staff records must be retained during the time that staff are employed and for at least five years after the staff ceases to be an employee of the organisation.

4 Document, data and record control system

4.1 An approved designer must establish, and put into effect, a system for controlling documents and records relating to the instrument flight procedure design services that it provides, including the policies and procedures for making, amending, preserving and disposing of those documents and records.

4.2 The documents and records must include the documents and records required to be kept.

173.03.9 Safety Management

1. Requirement

1.1 A flight procedure design organisation must establish and maintain a Safety Management System (SMS) in accordance with the requirements prescribed in Part 140 and the following standards.

2. Safety Management System - Standards

2.1 A Safety Management System must define the policies, processes, and practices for managing the safety of all procedure design work. A Safety Management System that meets the following criteria is to be issued under the authority of the Chief Designer.

2.3 The Safety Management System must:

(a) include a comprehensive and valid statement of the safety situation that applies in actual operations;

(b) define the organisation's safety objectives;

(c) present the safety situation in respect to compliance with all relevant safety related standards;

(d) define the safety accountabilities of all personnel;

(e) be kept under review to ensure its effectiveness;

(f) include arrangements to encourage staff to identify safety hazards or concerns and suggest methods for enhancement of safety;

(g) establish procedures for the communication and processing of safety concerns within the organisation;

(h) define the interface arrangements between internal groups of the organisation;

(i) be complied with, by all personnel of the organisation;

(j) contain a safety hazard/risk analysis and risk control/mitigation assessment in accordance with an established methodology endorsed by the Executive Director;

(k) include a quality management system based on:

  (i) those elements of ISO 9001 relevant to instrument flight procedure design; and

  (ii) the ICAO Quality Assurance Manual for Flight Procedure Design (Doc 9906) - Volume 1 – Flight Procedure Design Quality Assurance System;

(l) be documented in a manner that is readily available to all staff.

173.04.1 General Requirements

1. Introduction

1.1 This section contains the standards, rules and procedures for the provision of instrument flight procedure (IFP) design services that are additional to, or expand upon, or specify additional conditions for, the standards, rules and procedures contained in ICAO Procedures for Air Navigation — Air Operations, Volume II - Construction of Visual and Instrument Flight Procedures, PANS-OPS – Volume II (Doc 8168) and other related documents.

1.2 These standards, rules and procedures are applicable to all approved designers.

2. Applicability of the Standards of the International Civil Aviation Organization

2.1 A FPD organisation must provide services in full compliance with the applicable standards specified by ICAO.

2.2 Specifically, an approved designer must comply with the procedures and design practices prescribed in ICAO PANS-OPS (Doc 8168) and any other associated Documents as listed in this Part 173.

2.3 If there is a conflict or difference between any of the applicable design processes, standards, guidelines, or aeronautical data quality requirements, the particular design process, standard or guideline to be used by an approved designer must be acceptable to, or specified by, the Executive Director.

173.04.2 Standards for the Design of Instrument Flight Procedures

1. General

1.1 In the interest of efficiency, regularity and economy, every effort must be made to ensure that instrument flight procedures (IFPs) are evolved so as to keep to the minimum - consistent with safety - both the time taken in executing an instrument approach and the airspace necessary for the associated manoeuvres.

1.2 Except as provided in 1.3, only one IFP may be promulgated for each type of radio aid in relation to a particular runway.

1.3 More than one IFP may be promulgated for each type of radio aid in relation to a particular runway if authorized by the Executive Director and only after joint consideration by the operators concerned.

1.4 An approved designer must take steps during the development of IFPs to minimize the disturbance to the local population caused by aircraft noise. When directed by the Executive Director, an approved designer must consult local communities/towns, local authorities, aerodrome and aerodrome and airspace users.

2. Design of Instrument Flight Procedures

2.1 A flight procedure design organisation must establish detailed procedures for ensuring that every IFP developed is:

(a) designed or amended using the applicable design criteria;

(b) independently verified by a qualified person who is independent of the person directly responsible for the design; and

(c) validated as required by this Part 173.

2.2 A flight procedure design organisation must establish detailed procedures for ensuring that during the processes of design, maintenance, or transfer of data of an instrument flight procedure:

(a) the applicable aeronautical data and aeronautical information complies with the standards specified in RTCA Inc. document number RTCA/DO-201A Standards for Aeronautical Information;

(b) manipulation or processing of aeronautical data complies with the standards specified in RTCA Inc. document number RTCA/DO-200A Standards for Processing Aeronautical Data; and

(c) any transfer of aeronautical information within the custodian's organisation, or to or from external entities, complies with the standards specified in the Aeronautical Information Transfer Model (AIXM-5).

2.3 The design of an IFP must:

(a) be coordinated with all appropriate or affected air traffic service (ATS) providers; and

(b) be compatible with any air traffic service and associated procedure that is provided within the area or areas of airspace where the IFP is intended to be established; and

(c) take into account:

(i) any special air traffic rules prescribed by NAMCAR Part 91;

(ii) any other regulation restricting aircraft operations;

(iii) the classification and any associated designation of the airspace in which the IFP is to be established and any adjacent airspace that may be affected by the procedure; and

(iv) the effect that the proposed IFP may have on any other IFP established in the airspace.

2.4 An IFP must not be designed for an aerodrome (including heliports) unless the operator of the aerodrome agrees in writing that the aerodrome may be used for IFR operations using the intended IFP procedure.

2.5 An IFP must not be designed based on or use a ground based aeronautical facility unless:

(a) the aeronautical facility is operated under the authority of an aeronautical telecommunication service or aeronautical navigation service operated in accordance with Part 171 of the NAM-CARs; and

(b) the aeronautical telecommunication service provider agrees in writing that the aeronautical facility can be used for the intended IFP.

3. Use of Design Automation Tools

3.1 An approved designer must utilize design automation tools to the maximum extent practicable in the design of each IFP in order to minimize the potential for design errors.

3.2 An approved designer must ensure all design automation tools are validated prior to use using a tool validation methodology acceptable to the Executive Director.

4. Classification of Procedures

4.1 Instrument Flight Procedures for use in an aerodrome terminal area (terminal IFPs) must be classified as one of the following types:

(a) Non-precision Approach (Ground-based); or
(b) Non-precision Approach (RNAV); or
(c) Precision Approach (Ground-based); or
(d) Precision Approach (RNAV); or
(e) Approach with Vertical Guidance (APV); or
(f) Departure.

5. Validation of instrument flight procedures

5.1 When instrument flight procedure designs require flight validation, they must be flight validated in accordance with 173.04.4.

5.2 On completion of a design, the flight procedure design organisation must apply to the Executive Director for flight validation.

5.3 The application must include a completed draft copy of the design procedure prepared for publication.

5.4 The flight validation must be conducted by a pilot who is a qualified validation pilot.

5.5 The flight validation must be conducted using an aircraft of a type approved by the pilot conducting the flight validation.

5.6 The flight procedure design organisation must provide a qualified designer to be part of the validation crew.

6. Publication

Public Procedures

6.1 For a procedure which is to be published in the AIP, the flight procedure design organisation must forward to the AIS:

(a) A certificate of design signed by the Chief Designer stating that the design has been completed in accordance with prescribed standards; and

(b) A copy of the design.

Other procedures

6.2 For a procedure which is not to be published in the AIP, the flight procedure design organisation must forward to the Executive Director:

(i) a copy of the design; and

(ii) a certificate signed by the Chief Designer stating that the design has been completed in accordance with prescribed standards.

Notice of withdrawal

6.3 A flight procedure design organisation:

(a) who, in accordance with 6.1 and 6.2 above, forwards to the AIS or the Executive Director (as the case requires) a certificate of design, or a copy of a design, for a type of instrument flight procedure; and

(b) who subsequently withdraws that procedure design;

must, as soon as possible after the withdrawal, give written notice to the AIS or the Executive Director (as the case requires) that the procedure is withdrawn.

NOTAM of withdrawal

6.4 As soon as possible after receiving a notice of withdrawal, the AIS or the Executive Director (as the case requires) must ensure that a notice of the withdrawal of the procedure is published in the AIP where time permits, or a NOTAM if the notification is urgent.

7. Maintenance

7.1 Maintenance of a terminal Instrument Flight Procedure includes:

(a) general text and data amendments;

(b) redesign to conform with changes to design standards;

(c) provision of advice regarding obstructions in the vicinity of the aerodrome or procedure;

(d) redesign or amendment required as a result of changes to critical obstacles;

(e) changes as directed by the Executive Director;

(f) but excludes the periodic revalidation of procedures.

7.2 Maintenance of a type of terminal Instrument Flight Procedure requires that, if written notification about an aerodrome is received from the Executive Director (under the provisions of Part 139) that an aerodrome is not (or is no longer) a certified or registered aerodrome, the following safety procedures must be followed:

(a) withdrawal of the terminal IFP design for the aerodrome; and

(b) written notification to the aerodrome operator that, in accordance with the maintenance requirements of this paragraph, the terminal IFP has been withdrawn because the aerodrome was not a certified aerodrome or a registered aerodrome.

7.3 Re-validation of a procedure must be conducted at intervals not exceeding three years. On completion of a re-validation, the Executive Director will advise the flight procedure design organisation of any changes required.

8. Obstacle Clearance Advice to Aerodrome Operators

8.1 Prior to the effective publication date of a procedure, the flight procedure design organisation must forward to the aerodrome operator for which a procedure has been designed, diagrams and obstacle data sufficient to enable the aerodrome operator to fulfil obligations to report and monitor obstacles in the vicinity of an aerodrome as required under Part 139.

173.04.4 Procedures for Validation of Flight Procedures

1.1 Validation

1.1.1 Validation is the necessary final quality assurance step in the procedure design process, prior to publication. The purpose of validation is the verification of all obstacle and navigation data, and assessment of flyability of the procedure. Validation normally consists of ground validation and / or flight validation.

1.1.2 Ground validation must always be undertaken. Where ground validation can verify the accuracy and completeness of all obstacle and navigation data considered in the procedure design, and any other factors normally considered in the flight validation, then the flight validation requirement may be dispensed with.

1.1.3 Validation is essential before the procedure design documentation can be issued as part of the integrated aeronautical information package.

1.1.4 Ground validation consists of an independent IFP design review and preflight validation. Flight validation consists of flight simulator evaluation and/or evaluation flown in an aircraft.

1.1.5 The IFP validation process must be carried out as part of the initial IFP design as well as for any amendment to an existing IFP.

1.2 The validation process

1.2.1 Full validation process includes a ground validation and or a flight validation.

1.2.2 Ground validation must always be undertaken. Ground validation comprises a systematic review of the steps and calculations involved in the procedure design as well as the impact of the procedure on flight operations. It must be performed by persons trained in flight procedure design and with appropriate knowledge of flight validation issues.

1.2.3 If it can be verified, through ground validation, the accuracy and completeness of all obstacle and navigation data considered in the procedure design, and any other factors normally considered in the flight validation, then the flight validation requirement may be dispensed with.

1.2.4 Flight validation of instrument flight procedures must be carried out where the flyability of a procedure or the accuracy and/or integrity of obstacle and terrain data cannot be determined by other means. Flight validation must also be required where the procedure requires mitigation for deviations from design criteria, or where new procedures are being introduced and which differ significantly from existing procedures. Flight validation must be carried out for helicopter PinS procedures.

1.2.5 Detailed Guidance on the validation process is contained in Advisory Pamphlet ANSSO-FPD-AP173/03.

2. Validation Package

2.1 An approved designer must compile an IFP validation package for use in the ground /flight validation process.

2.2 Each validation package must include the following:

(a) a plan view of the final approach obstacle evaluation template, drawn on an appropriate scale topographical map to safely accommodate use for navigation, elevated terrain analysis, obstacles and obstructions evaluation;

(b) completed documents that identify associated terrain, obstacles and obstructions as applicable to the procedure. The controlling terrain/obstacle must be identified and highlighted on the appropriate chart;

(c) minimum altitudes determined to be applicable from map studies and database information for each segment of the procedure;

(d) a narrative description of the IFP;

(e) plan and profile pictorial views of the IFP;

(f) documented data as applicable for each fix, intersection, and/or holding pattern; and

(g) the output from the navigation aid coverage analysis together with any supporting data and design assumptions.

2.3 An approved designer is responsible for all elements of the validation and must document their proposed validation activities in a plan and submit as early as possible to the Executive Director for acceptance.

3 Ground Validation

3.1 Each flight procedure design organisation must establish detailed procedures for conducting the ground validation of an IFP. Ground validation is a review of the entire instrument flight procedure package by a person(s) trained in procedure design and with appropriate knowledge of flight validation issues. The aim of ground validation is to reveal errors in criteria and documentation, and evaluate on the ground, to the extent possible, those elements that will be evaluated in a flight validation. Issues identified in the ground validation should be addressed prior to any flight validation.

The ground validation will also determine if flight validation is needed for modifications and amendments to previously published procedures.

3.2 Ground validation comprises the following elements:

(a) ***Aerodrome assessment*** - Verify that the infrastructure required for the provision of an instrument runway as required by Part 139 is in place;

(b) ***Navigational aid coverage*** – Verify that the navigational aid coverage infrastructure required for the IFP as required by Part 171 and ICAO Doc. 8071 is in place;

(c) ***Obstacle clearance review*** – A review conducted by an authorized designer not involved in the design of the considered IFP for each route segment;

(d) ***Coding review*** – A review of the coding of RNAV IFP conducted by an authorized designer not involved in the design; and

(e) ***Flyability assessment*** - with the use of software tools, e.g. PC-based to full flight simulator, which can be used to evaluate a range of aircraft types in various weight, speed and centre of gravity configurations, and in various weather conditions (temperature, wind effects and visibility).

3.3 Where a flyability assessment is conducted using a full flight simulator the following elements must be evaluated:

(a) all segments of the IFP must be assessed;

(b) in the case of SIDs and PDRs, all segments of the procedure from the departure end of the runway (DER) to joining the en-route structure or termination point must be assessed; and

(c) in the case of IAPs all segments of the procedure from the Arrival/ Initial Fix through to the Missed Approach must be assessed.

3.4 Where procedures share the same segment of flight (e.g. initial), the shared segment needs only to be validated once.

3.5 In the case of RNAV IFP a test database for the full flight simulator produced by an appropriate navigation data provider for use in the flight management system (FMS) must be used.

Compliance Note: *The production of a true test database (i.e., one coded and produced by a data provider normally used by the user of the simulator) may be problematic in some cases due to coding requirements, production cycles, and so on. Where it is not possible to generate a true test database manual entry of data may be required. Caution should be exercised – particularly in relation to scaling.*

3.6 Where a ground validation cannot fully verify the accuracy and completeness of all obstacle and navigation data considered in the procedure design or the flyability of the IFP, a flight validation must be conducted. In determining whether a flight validation is required the custodian must consider a number of factors. These include, but are not limited to the following:

(a) deviation from design criteria;

(b) speed restrictions applied in the design;

(c) any segment length less than minimum prescribed optimum length;

(d) a descent gradient used in the design greater than 6.1% for a non-precision approach and 3.5° for a precision approach;

(e) procedures designed for use in a challenging terrain area and/or dense obstacle environment;

(f) use of a Step Down Fix (SDF) in the final approach segment;

(g) a track change of greater than 90° at a waypoint has been used within an RNAV procedure;

(h) the introduction of new procedures at an aerodrome;

(i) a procedure type that is new; and

(j) special crew procedures and/or operational techniques likely to be necessary to fly the procedures.

4 Flight Validation

4.1 General

4.1.1 Flight validation of instrument flight procedures must be carried out as part of the initial certification and must also be included as part of the periodic quality assurance programme to ensure that the procedure design process and its output, including the quality of aeronautical information/data, meet the requirements of NAMCAR Part 175.

4.1.2 Flight validation must be accomplished by a qualified and experienced flight validation pilot, certified or approved by the Executive Director. The purpose of flight validation is to verify database and chart information, to check all obstacles (including the identification of any unforeseen obstacles) that affect the safety of the procedure, and to assess the flyability of, and human factors issues associated with, the procedure. The flight validation pilot must occupy a seat in the cockpit with a field of view adequate to conduct the flight validation

4.1.2 The objectives of the flight validation of instrument flight procedures are to:

a) provide assurance that adequate obstacle clearance has been provided;

b) verify that the navigation data to be published, as well as that used in the design of the procedure, is correct;

c) verify that all required infrastructure, such as runway markings, lighting, and communications and navigation sources, are in place and operative;

d) conduct an assessment of flyability to determine that the procedure can be safely flown; and

e) evaluate the charting, required infrastructure, visibility and other operational factors.

4.1.3 Flight validation is required for:

(a) new instrument approach procedures;

(b) revised instrument approach procedures where the final course has been re-aligned by 3° or more or any other significant change affecting the procedure has occurred.

4.1.4 Flight validation is required where:

(a) the flyability of a procedure cannot be determined by other means;

(b) the procedure requires mitigation for deviations from design criteria;

(c) the accuracy and/or integrity of obstacle and terrain data cannot be determined by other means;

(d) new procedures differ significantly from existing procedures; and

(e) for helicopter PinS procedures.

4.1.5 Flight validation of an instrument flight procedure comprises:

(a) a review of the draft procedures from an operational perspective conducted by the validation pilot in consultation with the procedure designer; and

(b) a validation flight check.

4.1.6 Guidance material on validation of instrument flight procedures is contained in Advisory Pamphlet ANSSO-FPD-AP173/03.

4.1.7 The procedure designer must be the originator of all data applicable to conducting a flight validation provided to the flight validation or flight inspection operations activity. The procedure designer should be prepared to provide briefings to the flight validation or flight inspection crews in those cases where flight procedures have unique application or special features.

4.1.8 The procedure designer may participate in the initial validation flight to assist in its evaluation and obtain direct knowledge of issues related to the procedure's design from the flight inspection or validation pilot and/or inspector.

4.2 Maps and Charts

4.2.1 Validation flights must carry maps and charts that meet the following requirements:

(a) an appropriate topographical map of at least 1:250,000 scale or larger scale. (A scale of 1:100,000 may be necessary in areas of precipitous terrain and when checking circling, final and missed approach segments.) The map must be marked by the procedure designer with:

(1) initial, intermediate and final segment splays;

(2) missed approach segment splay/s;

(3) circling area for the appropriate categories or category groups; and

(4) controlling obstacles for each segment, MSA and holding pattern.

4.3 Weather

4.3.1 Validation flights must be undertaken in daylight hours and in VMC. The aircraft must remain in VMC throughout the flight validation process.

4.4 Responsibilities

4.4.1 The Chief Designer is responsible for the organisation of flight validation activities.

4.4.2 The procedure design flight validation crew member is responsible for the operational planning of the particular validation flight.

4.5 Aircraft

4.5.1 The standard for the type of aircraft to be used for flight validations must be an aircraft that has performance capabilities appropriate to the type and design of the procedure, together with adequate performance characteristics for low level flight operations.

4.5.2 The aircraft must be of a configuration that permits good visibility and adequate cockpit dimensions permitting maps and other documents to be readily referred to in flight.

4.5.3 The type of aircraft to be used for flight validation must be approved by the Executive Director.

Compliance note: *There are a number of key issues for flight validation including the ability to simulate the operating characteristics on aircraft in all categories (A/B, and C/D), and the ability to be able to see obstacles and terrain easily from the cockpit. The choice of aircraft can be critical to the effectiveness of flight validation.*

4.6 Crew

4.6.1 The minimum crew is a pilot (or the minimum crew required to operate the aircraft) and a procedure designer.

4.6.2 Only persons involved in the validation procedure are to be carried in the aircraft whilst flight validation is in progress.

4.7 Conduct of Operations

4.7.1 Judgment must be applied when planning the validation flight to minimise the time spent on task. Efficiently linked segments and avoiding those areas where obstacles will have no effect on the procedure will help to achieve this objective.

4.7.2 Crew responsibilities:

(a) the pilot must fly the aircraft and is legally responsible for the overall safety of the conduct of the flight;

(b) the procedure designer must:

(1) assist the pilot by providing tracks and altitudes to fly; and

(2) note any differences to the pre-determined list of obstacles;

(c) both crew members are responsible for obstacle identification (however the pilot retains ultimate responsibility for terrain and obstacle clearance);

(d) when flying the segments of the procedure, the aircraft should be configured to emulate the highest category aircraft for which the procedures are planned - this will be particularly important when the length of a particular segment is short;

(e) when checking individual obstacles, the highest practical speed, commensurate with fuel reserves and flight safety must be used;

(f) during the validation process, any lights that increase the visibility of the aircraft should be turned on.

4.8 Environment

4.8.1 Prior to conducting the validation of a procedure, especially in a populated or environmentally sensitive area, the procedure designer must:

(a) discuss with the validation pilot any options for reducing the environmental impact of the flight.

(b) as appropriate, advise the aerodrome operator, ATC, military and any other affected persons, of the details of the proposed operation, including advice that low-level flying will be required.

4.9 Validation of the Procedure

4.9.1 The actual sequence of checks is not mandated, as each situation will suggest the most economical way of arranging the elements of the task.

4.9.2 The specified altitude(s) for the validation of an instrument approach segment is/are equal to the published segment minimum altitude(s) minus the Minimum Obstacle Clearance (MOC) applicable to the segment.

4.9.3 Each controlling obstacle and/or procedure segment must be checked at the specified altitude of the obstacle to validate the obstacle data used and to determine whether there are any unforeseen obstacles extending above the specified altitude. Such a case would indicate that the unforeseen obstacle is higher than the controlling obstacle and that it may affect the procedure. If such an unforeseen obstacle is observed, its location and observed height AMSL must be recorded for subsequent detailed analysis by the procedure designer.

4.10 25 and 10 NM Minimum Sector Altitude

4.10.1 25 NM and 10 NM MSA checks must include the controlling obstacle in addition to other obviously high terrain or obstacles.

4.10.2 Where the sector/circle does not exhibit greatly differing terrain elevations, judgment may be exercised regarding the tracks flown to provide a full coverage of the area.

4.11 Terminal Arrival Altitude

4.11.1 Each Terminal Arrival Altitude (TAA) sector must be checked at its specified altitude minus the MOC. Checks must include the controlling obstacle in addition to other obviously high terrain or obstacles.

4.11.2 Where adjacent TAAs do not have greatly differing terrain elevations, judgement may be exercised regarding the tracks flown to provide a full coverage of the area.

4.12 Circling Area

4.12.1 The circling area should be checked by flying around the lateral limit of the circling area for the lowest supported aircraft category or group (usually CAT A/B) at the specified altitude for that category and looking in towards the airfield. In this manner, both the controlling obstacle and any unforeseen obstacles will be seen in the one action.

4.12.2 The same procedure is then used to check obstacles in the circling area for the next highest supported aircraft category or group (CAT C/D). By conducting the inner check first, obstacles that may affect all categories can be readily identified.

4.12.3 Controlling obstacles should be checked at their actual altitude if possible.

4.12.4 Circling area checks are not conducted in those areas designated 'No Circling'.

4.13 Final and Intermediate Segments

Compliance Note: *The following procedure may be adapted if it is more practicable when the flight validation is being planned.*

4.13.1 The final and, where implemented, the intermediate segment, must be checked as follows:

(a) fly from overhead the MAPT at the specified altitude for the final segment, at 90° to the final track, to the limit of the splay;

(b) turn to fly away from the airfield along the lateral edge of the splay at the final specified altitude to abeam the step down fix (if implemented) or abeam the FAF:

(i) abeam the step down fix, climb to the specified altitude for the next section of the final segment;

(ii) terminate abeam the FAF unless an intermediate segment is implemented, in which case continue along the lateral limit of the intermediate segment at the intermediate specified altitude until abeam the IF and terminate at that point;

(iii) during this process look across the splay to identify the controlling obstacle and any unforeseen obstacles;

(c) conduct the same process on the opposite side of the splay, but looking in the opposite direction;

(d) if the terrain and visibility are such that an unobstructed view can be had from one side of the splay to the other, the procedure outlined above can be shortened by flying along the centreline of the splay at the appropriate specified altitude.

4.14 Missed Approach Segment

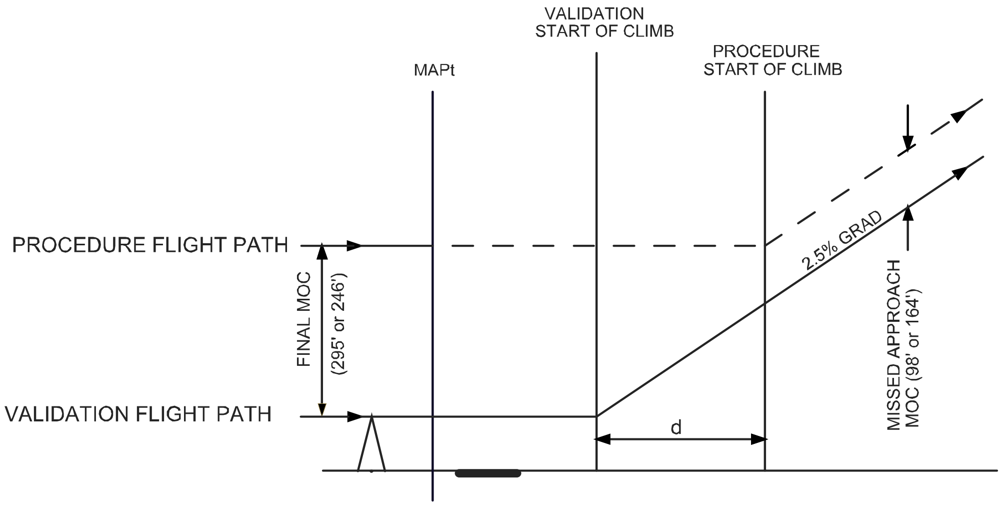
4.14.1 The missed approach segment must be checked in accordance with the following:

(a) travelling along the final approach track, position the aircraft at the start of climb point, determined in accordance with Figure 9.7-1, at the minimum descent altitude minus the final MOC;

(b) fly the aircraft along the missed approach track, climbing at a rate that equates to the missed approach design gradient, until in the final phase of the missed approach.

4.14.2 For environments with numerous obstacles, the missed approach segment should be checked by flying the missed approach splays in a similar manner to that specified for the final and intermediate segments, but climbing along the lateral edge of the splay, in accordance with the missed approach design gradient, until in the final phase of the missed approach.

4.14.3 The validation start of climb must be determined in accordance with the Figure below.

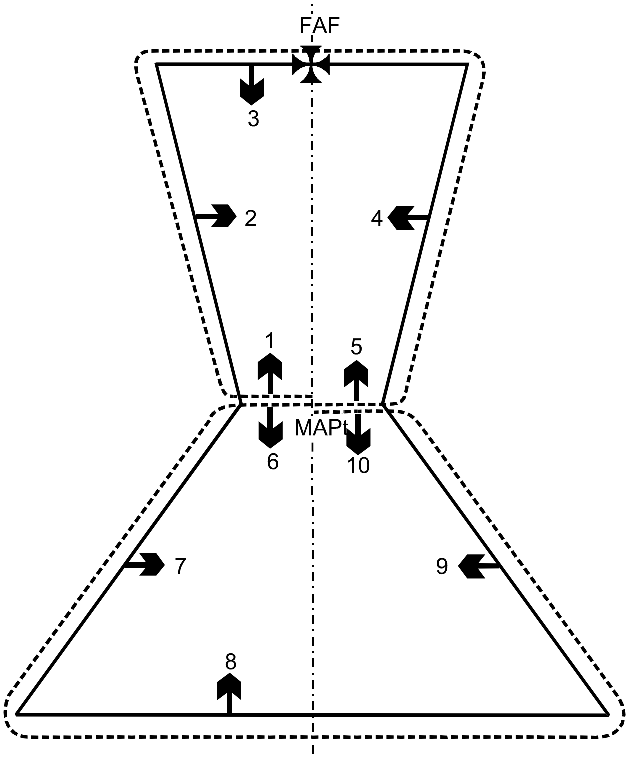


$$d = \frac{\text{Final MOC - Missed Approach MOC}}{0.025}$$

Validation start of climb

4.15 Linking the Final and Missed Approach Segments

4.15.1 The figure below shows one method for linking the checks of the final and missed approach segments. Other methods may be used as appropriate.



Final and missed approach segments

4.16 Holding and Initial Segments

4.16.1 The controlling obstacles for the holding and initial segments must be checked at their specified altitude and any unforeseen obstacles identified.

4.17 Flyability and Human Factors Issues Check

4.17.1 The complete design, as proposed for publication, must be checked for operational acceptability. This check must be flown at the maximum segment speeds for the fastest category of aircraft served by the procedure. The check includes:

(a) lead radials;

(b) outbound tracks (highest use category);

(c) outbound timing (highest use category);

(d) descent gradients;

(e) bank angle for turn onto final during base turns;

(f) runway alignment and distance from runway at the minima;

(g) descent gradient from the minima for a straight-in approach;

(h) the missed approach;

(i) acceptability of initial and intermediate segment lengths for GPS approaches; and

(j) pilot workload.

4.18 Windsocks

4.18.1 For runway aligned approaches where a windsock is not located adjacent to the runway threshold, it must be confirmed that a windsock is visible when the aircraft is at the MDA.

4.19 Flight Safety

4.19.1 Some of these checks will be conducted close to obstacles and in close proximity to airfields; therefore a visual-and-listening watch by all crewmembers is essential. In particular, the following points must be noted:

(a) pay particular attention to airspeed during manoeuvres with high angles of bank;

(b) be vigilant for inconspicuous towers and power transmission lines. Some towers are painted in low-contrast colours;

(c) be alert for birds, particularly near smoke from fires, and over mountainous areas or inland water bodies.

4.20 Traffic

4.20.1 Priority must be given to other traffic when validation requirements conflict with existing traffic patterns.

4.21 Environmental Issues

4.21.1 Flight validation flights must try to:

(a) avoid flight over built-up areas, concentrations of animals, or other noise-sensitive areas;

(b) avoid repetitious flight over the same area or areas, and

(c) minimise high RPM noise.

4.22 Reporting

4.22.1 A flight validation report form, prepared for the applicable aerodrome, must be attached as part of the validation flight request package.

4.22.2 Following completion of the validation flight:

(a) the pilot must complete the validation report; and

(b) the procedure designer must process the report form and complete the follow-up action.

4.23 Flight validation Pilots

4.23.1 The minimum qualifications and experience of Pilots-in-Command of instrument flight procedure validation flights must be as follows:

(a) airline transport pilot licence (ATPL);

(b) current command instrument rating, endorsed for the type of procedure under validation;

(c) relevant experience in multi-engine IFR procedures;

(d) a thorough knowledge of ICAO PANS-OPS procedures design principles and methods (including, where possible, completion of a course in PANS-OPS procedures design principles);

(e) adequate knowledge of the design of procedures in accordance with this CATS;

(f) satisfactory completion of a flight validation course conducted by an organisation approved by the Executive Director;

(g) possession of a letter of competency issued by an appropriate authority certifying his competence to conduct flight validation;

(h) a low flying experience; and

(i) conduct of a flight validation flight within the previous year.

4.23.2 In order to achieve the safety and quality assurance objectives of the flight validation, flight validation pilots must acquire and maintain the required competency level through training and supervised on-the-job training.

4.23.3 Helicopter procedures should be validated by helicopter pilots who, in addition to the above qualifications, are familiar with helicopter procedure design and operations.

4.23.3 Should the validation pilot not be qualified as pilot-in-command of a helicopter (or other type of aircraft) to be used for a validation flight, another pilot may be assigned to be the Pilot-in-Command (PIC) provided the validation pilot occupies either a control seat or a seat in close proximity to the PIC, and directs the conduct of the validation.

Compliance Note*: to the extent possible the PIC referred to in 4.23.3 should comply with the requirements of 4.23.1, and be thoroughly briefed prior to the flight validation operation.*

173.04.5 PROCESS FOR APPROVAL OF INSTRUMENT FLIGHT PROCEDURES

1. General

1.1.1 Each IFP intended for use by aircraft operating under IFR within the territorial limits of the Namibia must be approved by the Executive Director and entered into the Air Navigation Register.

1.1.2 This subpart sets out the requirements for:

(a) the design submission that must be submitted by the approved designer to the Executive Director prior to the approval of each IFP; and

(b) formal declarations required to be made by the approved designer's chief designer.

2. Design Submission - General

2.1 An approved designer must prepare and submit to the Executive Director a design submission for each IFP for which they seek an approval. The submission must conform to the design submission template prescribed under 173.05.3.

2.2 The content and format of the submission is intended to:

(a) provide a complete record of the design process

(b) provide all the source data and information used in the design process

(c) provide a complete record of all calculations and drawings used;

(d) provide a record of quality assurance and quality control

(e) supply a full description of the IFPs (Narrative)

(f) supply draft charts of the IFPs

(g) supply charts of the IFPs (AIP ready) for approval by the Executive Director before publication and after the approval of IFP

(h) provide all data and information required to re-design IFPs if deemed appropriate by the Executive Director.

(i) A report demonstrating how the applicable requirements have been satisfied.

2.3 The submission must include a written description of the final procedure and a draft chart for narrative description which unambiguously describes the procedure in textual format and table showing all tracks in degrees Magnetic (additional True bearing when necessary)

2.4 An approved designer must establish detailed procedures for preparing IFP design submissions as required by this sub-section. These procedures must be included in the approved designer's Manual of Procedure.

3. Design Submission - Format and Content

3.1 It is recognized that all procedures are different and therefore a fully standardized submission is not practical. The requirements in this section are intended as a minimum applicable to the specific IFP and aerodrome in question. Each IFP design submission must include the following items in the format described.

Procedure Designator

3.2 Each IFP must be assigned a unique designator in accordance with procedures prescribed in the relevant ICAO Annexes and Documents.

Data and Information

3.3 All data used in the design process must be submitted in source format as well as any modified formats created during the design process. The data handling process used by the designer must be documented including any quality assurance and quality control processes, procedures and documentation.

3.4 Where any maps or charts have been scanned or digitized such scans or digitized drawings must be included in the submission. It is the responsibility of the IFPS provider to ensure that all relevant data and information is submitted and data handling techniques and routines are subject to appropriate quality assurance and quality control measures.

3.5 Data and information must be subdivided into the following main groups:

(a) aerodrome data and information
(b) survey data (Thresholds, RWY centerline, elevations etc.)
(c) aerodrome layout plan
(d) Part 139 obstacle surfaces applicable (for ILS approaches)
(e) aerodrome operating certificate including any restrictions and/or conditions
(f) obstacle data
  (i) Surveyed obstacles
  (ii) Additional obstacles identified
(g) terrain models, if used
(h) any other overlay data used
(i) navigation aid data and information
  (i) survey data of all navigation aids
  (ii) calibration and/or commissioning reports

(iii) navigation aid information (HOO, DOC, Frequency, Power output etc.)

(j) geodetic data and information

(i) survey data on airfield geodetic reference points/monuments

(ii) local transformation parameters

(iii) local values of "N" Geoidal separation

(k) airspace data and information

(l) reference to any/all topographical maps used in design

Drawings

3.6 All procedure design drawings must be included in the submission. The drawings may be electronic drawing files generated using CAD tool and drawing format acceptable to the Executive Director or paper drawings.

3.7 Drawings must be structured in such a way that each segment of the procedure can easily be identified and isolated on the drawing

3.8 Obstacles and navigation aids must maintain same numbering and naming convention as used in the survey.

3.9 The dominant obstacle for each segment must be clearly marked, identified and referenced to the survey or other data source

3.10 Drawing must be set-up in WGS 84 as a transverse Mercator projection and all set-up parameters must be declared.

Calculations

3.11 All calculations and results of calculations must be presented in a manner that enables the Executive Director to follow and trace the logic and resultant output. A record of all relevant calculations must be kept in order to prove compliance to or variation from the standard criteria.

3.12 Formulae used during calculation must be the standard formulae as declared in ICAO Doc. 8168 Volume II and related ICAO publications.

3.13 Units of measurement and conversion factors must be as prescribed in NAMCAR Part 2. The values of the parameters must be shown in integers. Where this does not provide the required accuracy, the parameter must be shown with the required number of decimal places. Where the parameter directly affects the flight crew in its control of the aircraft, it must be rounded as a multiple of five. In addition, slope gradients must be expressed in percentages. In order to ensure the required accuracy when using the parameters specified in this CATS, only the final results of computations must be rounded. Intermediate calculations must use the maximum resolution available. Dimensions of areas related to ILS or MLS or GBAS/SBAS, when converted to non-SI units, must be rounded up to the integer foot. The rounding of values to be published on aeronautical charts must meet the corresponding chart resolution requirements in NAMCAR Part 175.

3.14 Calculation records must be accompanied by an index and be cross-referenced to the procedures they apply.

Narratives

3.15 A narrative must be included which describes the IFP in textual format.

Charts

3.16 A draft chart must reflect in graphic form the content of the narrative provided.

Design Report

3.17 A design report giving details of how the requirement has been satisfied and why the eventual procedure has evolved in its proposed form.

Validation Reports

3.18 All validation reports as required under this Part.

Declarations

3.19 The chief designer must formally declare that:

(a) the IFP has been developed, design, and validated in accordance with the approved designer's Manual of Procedure; and

(b) the IFP is to be maintained in accordance with procedures in the approved designer's Manual of Procedure.

4. Declaration of Compliance of Instrument Flight Procedures

4.1 An approved designer must establish a detailed procedure for the making of a declaration of compliance of every IFP that the approved designer proposes to promulgate.

4.2 The procedure required by 4.1 must include details of the checks to be carried out by the chief designer, who is authorized to make declarations concerning the particular type of IFP, to ensure that the IFP meets the applicable requirements and standards prescribed by this part.

4.3 An approved designer must also establish a procedure for a declaration of compliance in relation to IFPs created by the chief designer if the chief designer will create IFPs in the course of his duties.

Compliance Note: *Where the chief designer is unable to make a declaration of compliance because he has created the IFP, a procedure may be established to allow the next senior qualified designer to make the declaration.*

173.04.7 Publication of Flight Procedures

1. Notification of differences in the AIP

1.1 The obstacle protection afforded to performance-based navigation (PBN) procedures is, in most cases, predicated upon a ground track. This track is defined by a number of parameters including, inter alia, waypoint location and type, vertical path angle, maximum speed, minimum altitude, minimum bank angle and the path terminator associated with each procedure leg.

1.2 If some of the above parameters differ from those prescribed by the ICAO, they must be specified as generic to all PBN procedures with a clear statement in the GEN section of the AIP.

2. Departure and arrivals

2.1 *Chart titles*. Charts must be titled in accordance with the provisions specified in NAMCAR/NAMCATS Part 175. The required navigation specification for any published procedure must be published in the AIP, either on the chart or in the ENR 1.5 section.

2.2 ***Chart identification***

2.2.1 The chart must be identified in accordance with the provisions of NAMCAR/NAMCATS Part 175 for departures and for arrivals and must include the term RNAV or RNP, depending on the navigation specification.

2.2.2 The chart must include an identifier which is unique for that aerodrome and which may include reference to either a runway, fix or NAVAID.

2.3 ***Route designation***

2.3.1 Each route must be assigned a designator that is unique for that aerodrome. The designator must be defined in accordance with Appendix 3 to the NAM-CATS-ATS (Part 172). In addition, the first 4 letters of any 5LNC used in a route designator must be unique for the aerodrome.

Compliance Note 1. Airborne navigation databases use a maximum of 6 characters to identify a route. If the coded route designator is longer than 6 characters, the fifth character of the 5 LNC is not coded in navigation database route designation

Compliance Note 2. The coded route designator and the navigation specification name may be charted alongside the route in the plan view.

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

2.4 ***Chart notes***. Additional procedure requirements must be provided as chart notes. PBN items must be separated out and published in a PBN requirements box on the plan view of the chart immediately below the chart identifier. The PBN requirements box must include the identification of the navigation specification used in the procedure design, any navigation sensor limitations and any required functionalities that are described as options in the navigation specification, that is, not included in the core navigation specification as follows:

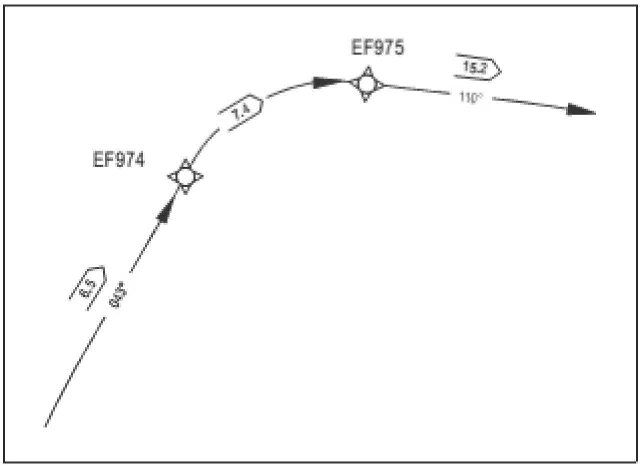
a) Navigation specification:
   (i) RNAV 5
   (ii) RNAV 1
   (iii) RNP 1
   (iv) Advanced RNP (RNP navigation accuracies must be specified, e.g. RNP 2, RNP 1)
   (v) RNP 0.3
b) Navigation sensor limitations, e.g.:
   (i) GNSS required
c) Functional requirements:
   (i) RF required.

Compliance Note. Lengthy text may be shown on the verso of the chart.

2.5 ***Depiction***

2.5.1 The RF leg must be depicted as shown in the Figure below. The along track distance of the RF leg must be charted but no course value may be shown on the RF leg. The radius and the arc centre may not be charted but must be included in the procedure description.

RF leg depiction



3. Approach

3.1 ***Chart titles***. Charts must be titled in accordance with the provisions specified in NAMCAR/NAMCATS Part 175.

3.2 ***Chart identification***

3.2.1 The chart must be identified in accordance with the provisions specified in NAMCAR/NAMCATS Part 175.

3.2.2 Until 30 November 2022, approach charts depicting procedures that meet the RNP APCH navigation specification criteria must include the term RNAV(GNSS) in the identification (e.g. RNAV(GNSS) RWY 23) or, alternatively, as described in 3.2.3.

Compliance Note. ICAO Circular 336 provides guidance to assist States and other stakeholders with the transition from RNAV to RNP approach chart identification.

3.2.3 From 1 December 2022, charts depicting procedures that mettle RNP APCH navigation specification criteria must include the term RNP in the identification (e.g. RNP RWY 23). The identification must also include a parenthetical suffix when exceptional conditions occur as described in the Table below:

Condition	***Suffix***	***Example***
Procedure has only an LPV line of minima	LPV only	RNP RWY 23 (LPV only
Procedure has only an LNAV/VNAV line of minima	LNA/VNAV only	RNP RWY 23 (LNAV/VNAV only)
Procedure has both LPV and LNAV/VNAV lines of minima but no LNAV minima	LPV, LNAV/VNAV only	RNP RWY 23 (LPV, LNAV/VNAV only)
Procedure has only an LP line of minima	LP only	RNP RWY 23 (LP only)

3.2.4 Until 30 November 2022, charts depicting procedures that meet the RNP AR APCH navigation specification must include the term RNAVRNP in the identification (e.g. RNAVRNP RWY 23) or, alternatively, as described in 3.2.5 below.

Compliance Note. ICAO Circular 336 provides guidance to assist States and other stakeholders with the transition from RNAV to RNP approach chart identification.

3.2.5 From 1 December 2022, charts depicting procedures that meet the RNP AR APCH navigation specification must include the term RNP in the identification with a parenthetical suffix (AR). (e.g. RNP RWY 23 (AR)).

3.2.6 The chart identification must include the runway identification for straight-in landing, or a letter designator (a, b, c, etc.) for circling approach.

3.2.7 When more than one PBN approach procedure exists for the same runway, the duplicate identification criteria apply. When a PBN approach procedure is combined with another PBN approach procedure on the same chart, the multiple procedure criteria apply.

Compliance Note. The text in parentheses that is part of the procedure identification does not form part of the ATC clearance.

3.3 ***Chart notes***. When amending or publishing new PBN approach procedures, additional procedure requirements must be provided as chart notes. PBN items must be separated out and published in a PBN Requirements Box which includes the identification of the navigation specification used in procedure design and any optional requirements that are not included in the core navigation specification as specified as follows:

a) Navigation specifications:
   (i) RNAV 1
   (ii) RNP 1
   (iii) RNP APCH
   (iv) RNP AR APCH
   (v) Advanced RNP
   (vi) RNP 0.3
b) Optional requirements:
   (i) RNP APCH: RF required
   (ii) RNP AR APCH: RF required, RNP < 0.3, Missed approach RNP < 1
   (iii) Advanced RNP: RNP < 1 in initial and intermediate segments
   (iv) RNP 0.3: RF required.

3.4 ***Depiction***

3.4.1 Any RF requirement must be charted in accordance with 2.4 and 2.5 above.

3.4.2 Different RNP navigation accuracy requirements on different initial segment legs must be charted with a note. The required note may be charted with the applicable leg, or as a procedure note with reference to the applicable leg. If the same RNP navigation accuracy applies to all initial and intermediate segments, then a general procedure note should be used as indicated in 3.3 above.

3.5 ***Minima***

3.5.1 Minima for approach procedures must be labelled on the chart as follows:

Minima label	Associated navigation specification
LNAV	RNP APCH
LNAV/VNA	RNP APCH
LP	RNP APCH
LPV	RNP APCH
RNP 0.x	RNP AR APCH

4. Formal textual or tabular description of the Procedure

4.1 ***General***. An accurate, complete and unambiguous RNAV procedure description is an essential publication requirement for database coding. This is accomplished by the combination of an appropriate chart, and an additional textual or tabular description of the procedure, to be used by the database coder. Where standard assumptions have been applied to the procedure design in areas such as speed and bank angle, there is no requirement to include these particular parameters in every procedure description.

4.2 An RNAV procedure is defined by one or a number of waypoints, each defined by a waypoint name, a path and terminator, and a set of constraints.

4.3 The textual or tabular description of the procedure, solely to support navigation database coding, must incorporate all the data elements, and must be published on the verso of the appropriate chart or as a separate properly referenced sheet (see NAMCAR/NAMCATS, Part 175). Three examples are provided below (the formal, the abbreviated and the tabular description methods. The tabular description provided in the Table below should be used when obstacle clearance is dependent upon the application of a particular path terminator.

Illustration of the tabular description method

Serial Number	*Path Descriptor*	*Way point Identifier*	*Fly-over*	*Course/ Track º M(º T)*	*Magnetic Variation*	*Distance (km)*	*Turn Direction*	*Altitude (m)*	*Speed (km/h*	*VPA/ TCH*	*Navigation Specification*
001	CA	-	-	221 (223.5)	–2.3	-	-	@ 150	-	-	B-RNP 1
002	DF	FOKSI	-	-	–2.3	-	R	-	-	-	B-RNP 1
003	TF	EF974	-	043 (045.7)	–2.3	12.0	-	+1400	-	-	B-RNP 1
004	RF Centre: r = 5.240 NM	EF975	-	-	–2.3	13.7	R	-	–450	-	B-RNP 1
005	TF	EF976	Y	145 (147.3)	–2.3	9.6	-	+1550	-	-	B-RNP 1
006	TF	TARTO	-	110 (112.3)	–2.3	28.2	-	-	-	-	B-RNP 1

Serial Number	*Path Descriptor*	*Way point Identifier*	*Fly-over*	*Course/ Track º M(º T)*	*Magnetic Variation*	*Distance (km)*	*Turn Direction*	*Altitude (m)*	*Speed (km/h*	*VPA/ TCH*	*Navigation Specification*
001	IF	SUSER	-	-	+2.2	-	-	+1550	–470	-	RNP APCH
002	TF	EF974	-	048 (045.7)	+2.2	12.0	-	+1400	-	-	RNP APCH
003	RF Centre: r = 5.240 NM	EF975	-	-	+2.2	13.7	R	-	–450	-	RNP APCH
004	TF	EF976	-	348 (345.8)	+2.2	9.6	-	@900	–270	-	RNP APCH
005	TF	RW35L	Y	348 (345.8)	+2.2	9.3	-	@150	-	– 3.0/50	RNP APCH
006	FA	RW35L	-	348 (345.8)	+2.2	-	-	+250	-	-	RNP APCH
007	DF	SUSER	Y		+2.2	-	L	+1550	-	-	RNP APCH
008	HM	SUSER	-	048 (045.7)	+2.2	7.4	R	+1550	–450	-	RNP APCH

4.4 *Formal textual description*. In the formal textual description, the following principles apply:

— (Waypoint) (underlined) denotes flyover.

— (Waypoint) (not underlined) denotes fly-by or RF waypoint as appropriate.

— To (Waypoint) denotes a TF path terminator.

— To (Waypoint) on course XXX°, denotes a CF path terminator.

— Direct to (Waypoint) denotes a DF path terminator.

— (Waypoint) {R, NN.N, Arc Centre Identifier} denotes an RF path terminator, the radius and the centre point of a fixed radius turn in terminal airspace.

— Climb on course XXX°, at or above yyy feet turn right/left denotes a CA path terminator.

— From (Waypoint) on track XXX°, at or above yyy feet turn left/right denotes an FA path terminator.

— Climb on heading XXX°, at or above yyy feet turn left/right denotes a VA path terminator.

— Continue on heading XXX°, denotes a VM path terminator.

— Continue on track XXX°, denotes an FM path terminator.

— (Waypoint) {HM, Turn Direction, Inbound Track, Leg Distance/Time} denotes an HM path terminator.

— The formal description method is illustrated in the Table below:

Illustration of the formal and the abbreviated description methods

Formal description	*Abbreviated description*	*Expected path terminator*	*Flyover required*
Climb on track 047° M, at or above 800 ft turn right.	[M047, A800+; R]	CA	N
Climb on heading 047° M, at or above 800 ft turn right.	[HDG M047, A800+, R]	VA	N
Direct to ARDAG at 3 000 ft	→ARDAG[A3000]	DF	N
To PF035 at or below 2 000 ft	PF035[A2000-]	TF	Y
To PF025 at or above 4 000ft, continue on heading 265° M and await radar vectors	PF025[A4000], [HDG, M265]	TF,VM, or FM	N
To OTR on course 090°M at 210 kts	OTR[M090; K210]	CF	N
To DF006 at 2 000 ft minimum, 4 000 ft maximum, minimum speed 210 kt	DF006[A2000+; A4000-; K210+]	TF	Y
To PD750 at 250 kts, turn right with 3.7 NM radius to PD751	PD750[K250]-PD751[R, 3.7, 0543451.2N 0021234.7E]	TF,RF	N,N
To STO at or above FL 100, turn left direct to WW039 at or above FL 070, to WW038 at or above 5 000 ft	STO[F100+; L] → WW039[F070+]-WW038[A5000+]	TF,DF,TF	Y,N,N

4.5 ***Abbreviated description***

4.5.1 The description may be abbreviated by placing the leg constraints (speed, track and altitude) in square brackets. If these constraints are not preceded by a waypoint name, the last calculated track must be flown until the constraint is reached.

4.5.2 Each constraint is coded in the format UNNNNNCD where:

U may be one of the following letters:

A for altitude in feet AMSL

F for flight level

K for indicated air speed in knots

M for degrees magnetic

T for degrees true

NNNNN is a number from 000 to 99999

C may be one of the following:

"+" for 'at or above'

"-" for 'at or below'

a blank space for 'at'

D is used to indicate turn direction in conditional and flyover transitions:

L for 'Turn left'

R for 'Turn right

Multiple constraints may be separated by a semi-colon (;).

4.5.3 Individual waypoints in a procedure, together with their associated constraints, may be separated by a hyphen (-), except when the subsequent leg requires a DF path terminator when an arrow (→) should be used.

4.5.4 The formal description and the abbreviated description methods are illustrated in the Table in 4.4.above.

5. Waypoint naming

5.1 Waypoints used in support of RNAV SIDs, STARs and instrument approach procedures must be designated by either a unique, five-letter, pronounceable "name-code" or a five-alphanumeric name-code. The following principles apply:

a) waypoints must be designated by a five-alphanumeric name-code only if they are used for waypoints unique to one aerodrome that has a properly assigned four-letter location indicator (in accordance with Doc 7910);

b) in the following cases a unique, five-letter, pronounceable "name-code", in accordance with NAMCAR Part 172, must be applied:

1) final waypoint of a SID;
2) initial waypoint of a STAR;
3) waypoints common to more than one terminal control area or used in a procedure common to more than one airport which are not used for en-route; and
4) waypoints for ATC purposes.

5.2 The following criteria apply when five-alphanumeric name-codes are used:

a) the five-alphanumeric name-code convention that is adopted must be applicable to all aerodromes within Namibia;

b) the five-alphanumeric name-code should consist of no more than three numbers with the alphabetic characters being taken from the airport designator;

c) the convention and the rules of application must be published in the AIP;

d) the five-alphanumeric name-code must be unique within the terminal area in which it is used;

e) as global uniqueness cannot be assured, all waypoints that have a five-alphanumeric name-code identifier should be clearly listed as terminal waypoints in the AIP; and

f) as global uniqueness cannot be assured for waypoints containing five-alphanumeric name-codes, to avoid any potential miss election by the pilot, ATC should not use waypoints designated by five-alphanumeric name-codes in any re-routing from the en-route structure into a terminal procedure.

6. Arc centre and significant point coordinates

6.1 The WGS 84 coordinates of arc centres and significant points used in support of RNAV arrival, departure and instrument approach procedures must be provided in tabular form as illustrated in the Table below:

Waypoint and arc coordinates example

Waypoint Identifier	***Coordinate***
EF974	43°34'23.8N 116°22'54.7W
EF975	43°35'39.1N 116°20'27.9W
RF Arc Centre Identifier	Coordinates
EF991	43°32'58.2N 116°19'41.6W

7. Aeronautical database publication requirements

7.1 For RNAV standard departure procedures — instrument (SID), the following data must be published in tabular form or a formal textual description on the verso of the chart or a separate, properly referenced sheet:

a) procedure designator;

b) required navigation performance or basis for the approval applicable to the procedure;

c) unambiguous description of the path and the method of termination of each specified segment;

d) names, coded designators or name-codes and the geographical coordinates in degrees, minutes, seconds, and tenths of seconds, of all significant points defining the route, including annotation as to whether the significant point is fly-by or flyover;

e) geodesic distance to the nearest tenth of a kilometre or tenth of a nautical mile between each successive designated significant point;

f) true track to the nearest tenth of a degree and magnetic track to the nearest degree between each successive significant point;

g) upper and lower altitude limit at a significant point, to the nearest higher 50 m or 100 ft/flight level, as applicable;

h) speed limit at a significant point, expressed in units of 10 knots, as applicable;

i) remarks; and

j) associated RNAV holding procedure data including:

   1) holding identification (if any);

   2) holding fix (navigation aid) or waypoint with geographical coordinates in degrees, minutes, seconds, and tenths of seconds;

   3) inbound true track to the nearest tenth of a degree and magnetic track to the nearest degree;

   4) maximum indicated air speed expressed in units of 10 knots;

   5) minimum and maximum holding level to the nearest higher 50 m or 100 ft/flight level;

   6) time/distance to the nearest tenth of a kilometre or tenth of a nautical mile outbound; and

   7) direction of the turn.

7.2 For RNAV standard arrival procedures — instrument (STAR) the following data must be published in tabular form or a formal textual description on the verso of the chart or a separate, properly referenced sheet:

a) procedure designator;

b) required navigation performance or basis for the approval applicable to the procedure;

c) unambiguous description of the path and the method of termination of each specified segment;

d) names, coded designators or name-codes and the geographical coordinates in degrees, minutes, seconds, and tenths of seconds, of all significant points defining the route, including annotation as to whether the significant point is fly-by or flyover;

e) geodesic distance to the nearest tenth of a kilometre or tenth of a nautical mile between each successive designated significant point;

f) true track to the nearest tenth of a degree and magnetic track to the nearest degree between each successive significant point;

g) upper and lower altitude limit at a significant point, to the nearest higher 50 m or 100 ft/flight level, as applicable;

h) speed limit at a significant point, expressed in units of 10 knots, as applicable;

i) vertical path angle to the nearest one one-hundredth of a degree, as applicable;

j) remarks; and

k) associated RNAV holding procedure data including:

1) holding identification (if any);
2) holding fix (navigation aid) or waypoint with geographical coordinates in degrees, minutes, seconds, and
3) tenths of seconds;
4) inbound true track to the nearest tenth of a degree and magnetic track to the nearest degree;
5) maximum indicated air speed expressed in units of 10 knots;
6) minimum and maximum holding level to the nearest higher 50 m or 100 ft/flight level;
7) time/distance to the nearest tenth of a kilometre or tenth of a nautical mile outbound; and
8) direction of the turn.

7.3 For RNAV instrument approach procedures, the following data must be published in tabular form or a formal textual description on the verso of the chart or a separate, properly referenced sheet:

a) procedure designator;

b) required navigation performance or basis for the approval applicable to the procedure;

c) unambiguous description of the path, including, in the case of SBAS APV procedures, a textual representation of the FAS Data Block and the method of termination of each specified segment;

d) names, coded designators or name-codes and the geographical coordinates in degrees, minutes, seconds, and tenths of seconds, of all significant points defining the route, including annotation as to whether the significant point is fly-by or flyover;

e) geodesic distance to the nearest tenth of a kilometre or tenth of a nautical mile between each successive designated significant point;

f) true track to the nearest tenth of a degree and magnetic track to the nearest degree between each successive significant point;

g) upper and lower altitude limit at a significant point, to the nearest higher 50 m or 100 ft/flight level, as applicable;

h) speed limit at a significant point, expressed in units of 10 knots, as applicable;

i) final approach vertical path angle to the nearest one one-hundredth of a degree;

j) threshold crossing height to the nearest foot, as applicable;

k) remarks; and

l) associated RNAV holding procedure data including:

   1) holding identification (if any);

   2) holding fix (navigation aid) or waypoint with geographical coordinates in degrees, minutes, seconds, and

   3) tenths of seconds;

   4) inbound true track to the nearest tenth of a degree and magnetic track to the nearest degree;

   5) direction of the turn;

   6) maximum indicated air speed expressed in units of 10 knots;

   7) minimum and maximum holding level to the nearest higher 50 m or 100 ft/flight level; and

   8) time/distance to the nearest tenth of a kilometre or tenth of a nautical mile outbound.

173.04.8 Maintenance of Instrument Flight Procedures

1. General

1.1 This Section sets out the requirements for the maintenance of instrument flight procedures.

2. Maintenance of Instrument Flight Procedures

2.1 An approved IFP designer must establish detailed procedures for maintaining every IFP that is maintained by the approved designer’s organisation.

2.2 Each IFP that is maintained must be reviewed, and flight validated if necessary:

(a) on a periodic basis, not to exceed five years, ensuring that the IFP continues to meet the applicable standards and requirements of this Part; or

(b) if there is a change in any of the data that may affect the integrity of the IFP.

2.3 The procedures must include and document the grounds and criteria for establishing or changing the interval between the periodic maintenance reviews for each IFP.

3. Errors in Published Instrument Flight Procedures

3.1 An approved designer must establish procedures for recording, investigating, correcting, and reporting to the Executive Director any identified error, and any identified non-conformance or suspected non-conformance with the standards and requirements of this Part, in an IFP that is maintained under the approved designer's authority.

3.2 The procedures must require that:

(a) an IFP is immediately withdrawn from operational use if the error or non-conformance affects, or may affect, the safety of an aircraft operation; and

(b) the error or non-conformance is corrected, and declared as compliant with this part by the chief designer; and

(c) the correction required is clearly identified and promulgated by the most appropriate means relative to the operational significance of the error or non-conformance; and

(d) the source of the error or non-conformance is identified, and:

(1) if possible, eliminated to prevent a recurrence; and

(2) preventive action is taken to ensure that the source of the error or non-conformance has not affected the integrity of any other IFP; and

(e) the Executive Director is notified of a promulgated information incident relating to an error or non-conformance.

173.04.9 Design Criteria for Flight Procedures

1.1 Accuracy requirements for aeronautical data related to IFP are based upon a 95 per cent confidence level, and in that respect three types of positional data must be identified: surveyed points (e.g. navigation aids positions), calculated points (mathematical calculations from the known surveyed points of points in space/fixes) and declared points.

1.2 An approved designer must ensure that integrity of data is maintained throughout the data process from survey/origin to the next intended user. Aeronautical data integrity requirements must be based upon the potential risk resulting from the corruption of data and upon the use to which the data item is put. Consequently, the following classifications and data integrity levels must apply:

(a) Critical data: there is a high probability when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;

(b) Essential data: there is a low probability when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe; and

(c) Routine data: there is a very low probability when using corrupted routine data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.

1.3 An approved designer must ensure that electronic aeronautical data sets are protected by the inclusion in the data sets of a 32-bit cyclic redundancy check (CRC) implemented by the application dealing with the data sets.

1.4 Geographical coordinates indicating latitude and longitude must be determined and reported in terms of the World Geodetic System — 1984 (WGS-84) geodetic reference datum, identifying those geographical coordinates which have been transformed into WGS-84 coordinates by mathematical means.

1.5 The order of accuracy of the field work and determinations and calculations derived therefrom must be such that the resulting operational navigation data for the phases of flight will be within the maximum deviations, with respect to an appropriate reference frame. For those fixes and points that are serving a dual purpose, e.g. holding point and missed approach point, the higher accuracy applies.

173.04.12 General Criteria and Procedures for Establishment of Aerodrome Operating Minima

1. General

1.1 The following material is provided to assist instrument procedures designers to calculate the visibility required to be published with a Minimum Descent Altitude or Height, or a Decision Altitude or Height, as appropriate.

1.2 Aerodrome operating minima means the limits of usability of an aerodrome for:

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

b) landing in precision approach and landing operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the category of the operation;

c) landing in approach and landing operations with vertical guidance, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H); and

d) landing in non-precision approach and landing operations, expressed in terms of visibility and/or runway visual range, minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions.

1.3 Aerodrome operating minima is established in order to ensure a desired level of safety for aeroplane operations at an aerodrome by limiting these operations in specified weather conditions. Such minima are generally expressed differently for take-off and for landing. For take-off, which commences with the aeroplane at rest, limitations are usually stated in terms of horizontal visibility and in some instances by both horizontal visibility and cloud base. For the approach to landing where the aeroplane is already in flight, generally a limit on the instrument approach is established, called decision altitude/height (DA/H) or minimum descent altitude/height (MDA/H) together with a horizontal visibility limitation.

1.4 Aerodrome operating minima are usually expressed as a minimum altitude or height and a minimum visibility or RVR. For take-off, they are an indication of the minimum visibility or RVR conditions in which the pilot of an aeroplane may be expected to have available the external visual reference required for the control of the aeroplane along the surface of the runway until it is airborne or until the end of a rejected take-off. For approach and landing, they are an expression of the minimum altitude or height by which the specified visual reference should be available and at which the decision to continue for landing or to execute a missed approach should be made. They are also an indication of the minimum visibility in which the pilot may have the visual information necessary for continued control of the flight path of the aeroplane during the visual phase of the approach, landing and roll-out.

1.5 In establishing the aerodrome operating minima which will apply to any particular operation, the following must be taken into account:

(a) the type, performance and handling characteristics of the aeroplane;
(b) the composition of the flight crew, their competence and experience;
(c) the dimensions and characteristics of the runways which may be selected for use;
(d) the adequacy and performance of the available visual and non-visual ground aids;
(e) the equipment available on the aeroplane for the purpose of navigation and/or control of the flight path during the approach to landing and the missed approach;
(f) the obstacles in the approach and missed approach areas and the obstacle clearance altitude/height for the instrument approach procedures;
(g) the means used to determine and report meteorological conditions; and
(h) the obstacles in the climb-out areas and necessary clearance margins

1.6 The flight phases to be considered in the determination of aerodrome operating minima are:
(a) take-off and initial climb;
(b) final approach and landing; and
(c) ground movement from the aeroplane stand to the start of take-off, and from the end of the landing roll to the aeroplane stand.

1.7 Category II and Category III instrument approach and landing operations may not be authorized unless runway visual range (RVR) information is provided.

1.8 For instrument approach and landing operations, aerodrome operating minima below 800 m visibility should not be authorized unless RVR information is provided

Compliance Note 1. Additional guidance on aerodrome operating minima can be found in the Technical Standards, NAMCATS Parts 121, 127 and 135.

Compliance Note 2. Detailed Guidance on the establishment of aerodrome operating minima can be found in the ICAO Doc 9365 – Manual of All-Weather Operations.

Compliance Not 3. Detailed guidance on establishment of Obstacle Clearance Altitude/Height (OCA/H) in relationship to aerodrome operating minima is found in ICAO Doc 8168 – OPS/611 Aircraft Operations, Volume II.

2. Obstacle Clearance Altitude/Height (OCA/H) Considerations

2.1 General

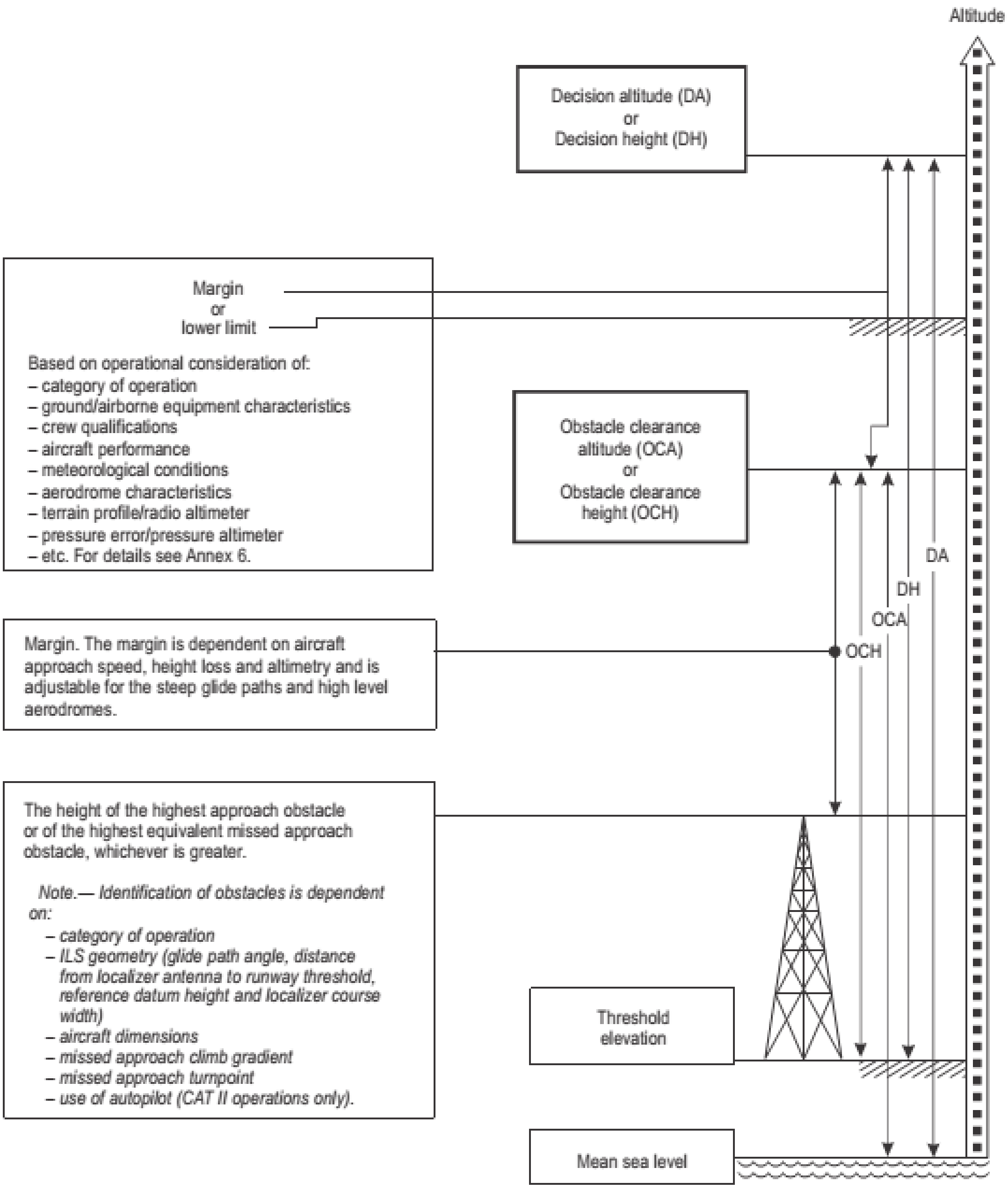
2.1.1 OCA/H is one of the factors taken into account in establishing operating minima for an aerodrome. The OCA/H is based on clearing obstacles by a specified minimum obstacle clearance (MOC). In some situations, an additional margin is added to the MOC, or an absolute lower limit must be applied, which will override the OCA/H.

2.1.2 ***Precision approach procedures/approach procedures with vertical guidance (APV)***

a) *OCA/H.* In a precision approach procedure (or APV), the OCA/H is defined as the lowest altitude/height at which a missed approach must be initiated to ensure compliance with the appropriate obstacle clearance design criteria.

b) *Reference datum.* The OCA is referenced to mean sea level (MSL). The OCH is referenced to the elevation of the relevant runway threshold.

2.1.2.1 The Figure below shows the relationship of obstacle clearance altitude/height (OCA/H) to decision altitude/height (DA/A) for precision approaches. This figure does not apply to Category H. In an instrument approach where the landing axis does not permit a straight-in approach, helicopters must conduct a visual manoeuvre under meteorological conditions adequate for seeing and avoiding obstacles in the vicinity of the FATO. The OCA/H for helicopter visual manoeuvring may not be less than 75 m (246 ft).



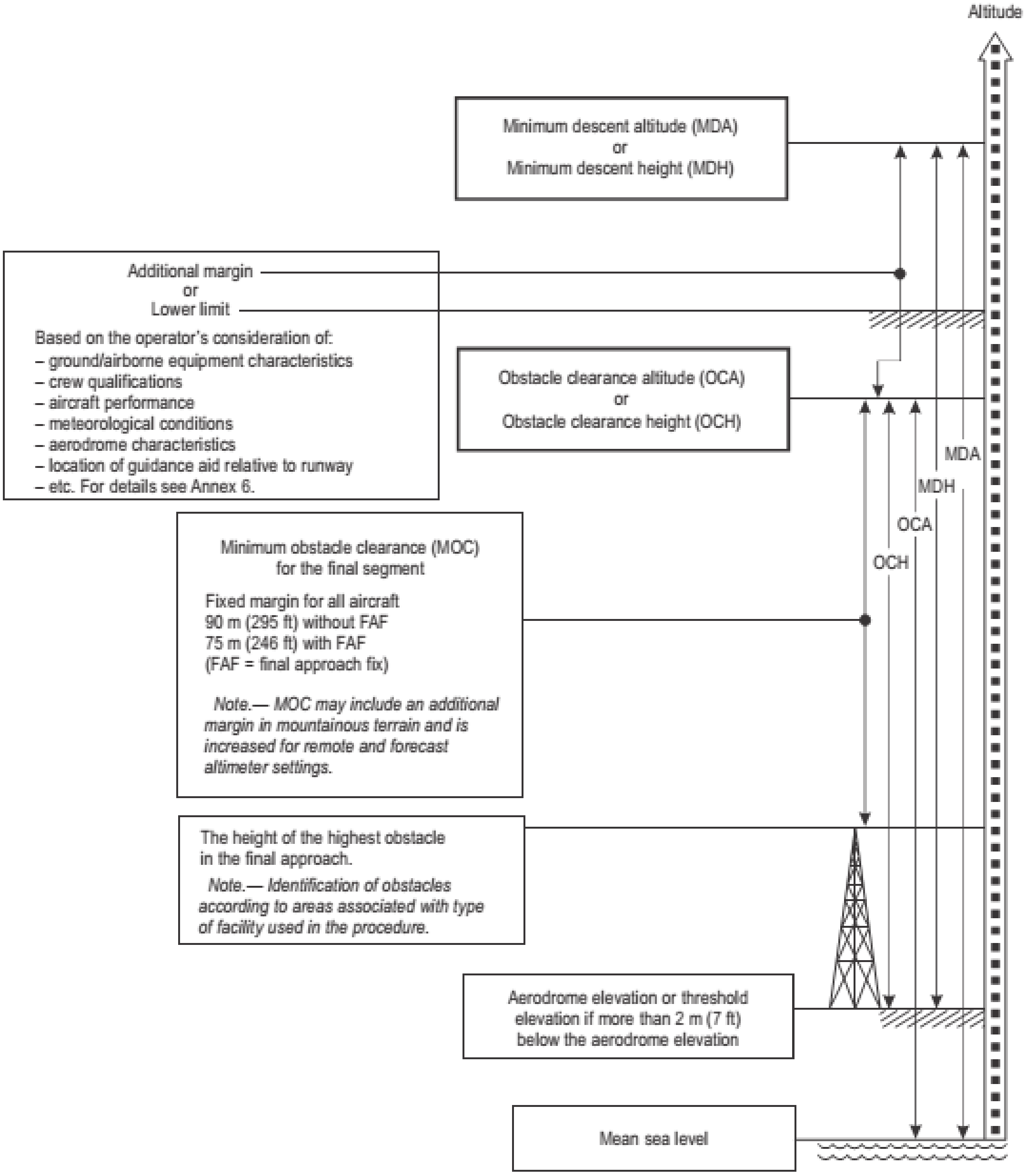
2.1.3 ***Non-precision approach procedure (straight-in)***

a) OCA/H. In a non-precision approach procedure, the OCA/H is defined as the lowest altitude or alternatively the lowest height below which the aircraft cannot descend without infringing the appropriate obstacle clearance criteria.

b) Reference datum. The OCA is referenced to mean sea level (MSL). The OCH is referenced to

1) aerodrome elevation; or
2) runway threshold elevation when the threshold elevation is more than 2 m (7 ft) below the aerodrome elevation.

2.1.3.1 The Figure below shows the relationship of obstacle clearance altitude/height (OCA/H) to minimum descent altitude/height (MDA/H) for non-precision approaches (example with a controlling obstacle in the final approach)

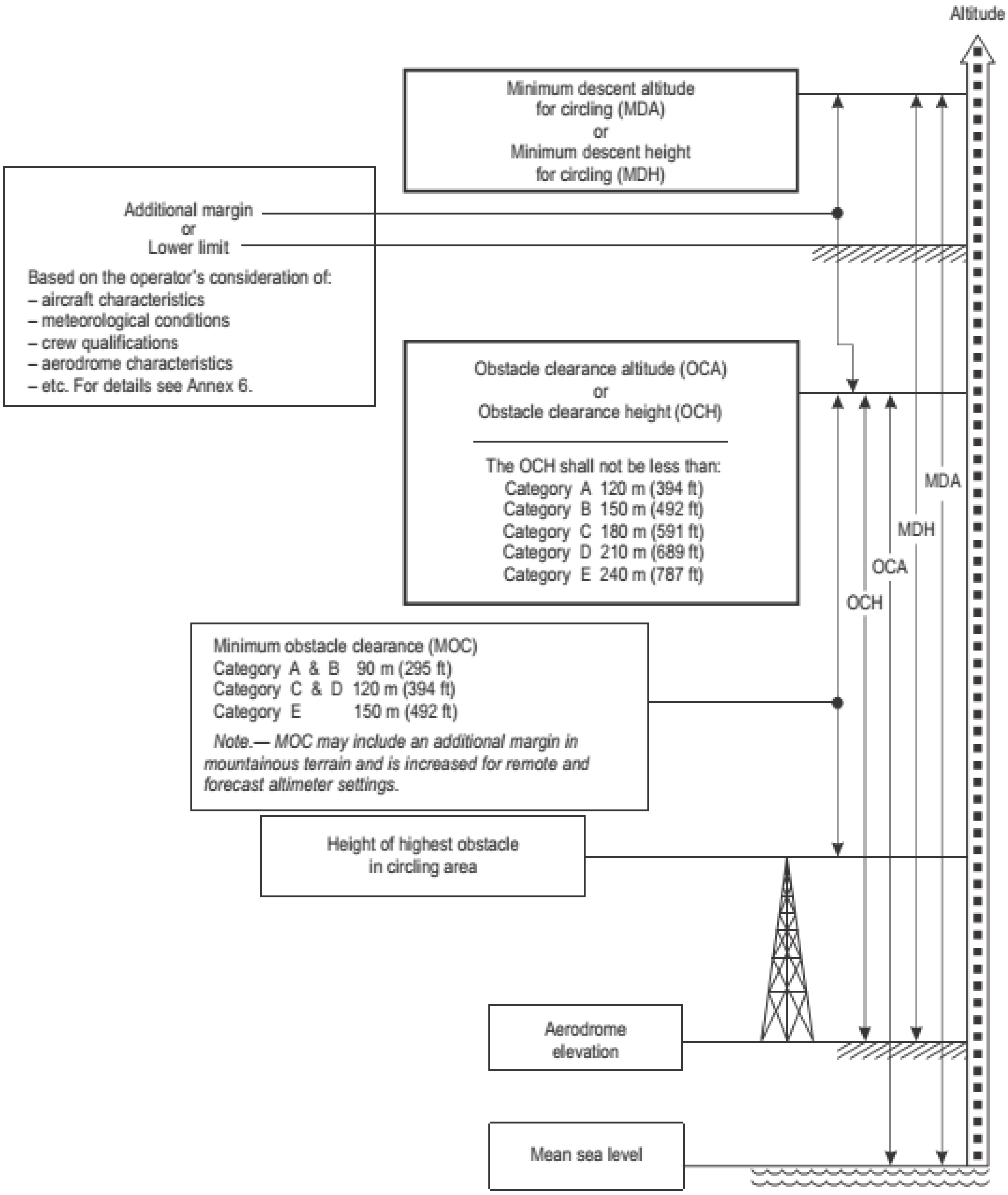


2.1.4 ***Visual manoeuvring (circling) procedure***

a) *OCA/H.* Same as in the non-precision approach procedure in 2.6 a) above.

b) *Reference datum.* The OCA is referenced to mean sea level (MSL). The OCH is referenced to the aerodrome elevation.

2.1.4.1 The figure below shows the relationship of obstacle clearance altitude/height (OCA/H) to minimum descent altitude/height (MDA/H) for visual manoeuvres (circling):



2.2 OCA/H for precision approaches and approach procedures with vertical guidance

2.2.1 The determination of OCA/H in precision approaches and approach procedures with vertical guidance must be as described in Doc 8168, Volume II, Part II, Section 1 and Part III, Section 3, Chapters 4 and 6.

2.3 OCA/H for non-precision approach (straight-in)

2.3.1 ***Aligned straight-in approach***

2.3.1.1 The OCA/H for a straight-in, non-precision approach where the angle between the track and the extended runway centre line does not exceed 5 degrees must provide the following minimum obstacle clearance (MOC) over the obstacles in the final approach area:

a) 75 m (246 ft) with FAF; and

b) 90 m (295 ft) without FAF.

2.3.1.2 The OCA/H must also ensure that missed approach obstacle clearance is provided. A straight-in OCA/H may not be published where final approach alignment or descent gradient criteria are not met. In this case, only circling OCA/H may be published.

2.3.2 ***Non-aligned straight-in approach***

2.3.2.1 For a final approach where the track intersects the extended runway centre line, OCA/H varies according to the interception angle. The OCH of the procedure must be equal to or greater than the lower limits shown in the ***Lower limit on OCH*** Table below:

Aircraft Category	***Lower limit on OCH (m (ft))***	
	5° < θ ≤15°	15° < θ ≤30°
A	105 (340)	115 (380)
B	115 (380)	125 (410)
C	125 (410)	
D	130 (430)	
E	145 (480)	

2.3.2.2 The calculations used to arrive at these values are shown in 2.3.2.3 below. For nominal descent gradients above 5.2 per cent, increase by 18 per cent the lower limits shown in the table for each per cent of gradient above 5.2 per cent.

2.3.2.3 The values shown are based on the following calculations:

Minimum OCH = 15 m + Total distance × descent gradient

Total distance = $d_{intercept}$+ d_{Add}+ d_{Turn}

where:

Minimum intercept distance ($d_{intercept}$) = 1 400 m

Additional flight time distance (d_{Add}) = TAS_{Cat}* 5/3 600

TAS_{Cat} = TAS corresponding to the maximum final approach IAS for each aircraft category + 19 km/h (10 kt) tailwind, based on a 600 m (2 000 ft) aerodrome elevation TAS corresponding to the maximum final approach IAS for each aircraft category + 19 km/h (10 kt) tailwind, based on a 600 m (2 000 ft) aerodrome elevation

Additional flight time before crossing centreline = 5 seconds

Turn distance ( ) = r_{Cat}* tan(θ_{max}/2)

r_{Cat} = Radius of turn calculated for TAS_{Cat}

Maximum turn angle (θ_{max}) = 15 degrees (for 5 < θ ≤15) or 30 degrees (for 15 < θ ≤30)

2.4 OCA/H for visual manoeuvring (circling)

2.4.1 The OCA/H for visual manoeuvring (circling) must provide the minimum obstacle clearance (MOC) over the highest obstacle in the visual manoeuvring (circling) area as specified in the Table below. It must also be:

a) above the lower limits (also specified in Table above); and
b) not less than the OCA/H calculated for the instrument approach procedure which leads to the circling manoeuvre.

Aircraft category	Minimum obstacle clearance m (ft)	Lower limit for OCH above aerodrome elevation m (ft)	Minimum visibility km (NM)

A	90 (295)	120 (394)	1.9 (1.0)
B	90 (295)	150 (492)	2.8 (1.5)
C	120 (394)	180 (591)	3.7 (2.0)
D	120 (394)	210 (689)	4.6 (2.5)
E	150 (492)	240 (787)	6.5 (3.5)

2.4.1 Circling procedures are not provided for helicopters. When a helicopter instrument approach is followed by visual manoeuvring, the OCH may not be less than 75 m (246 ft).

2.5 MOC and OCA/H adjustments

2.5.1 In certain cases the MOC and/or the OCA/H must be increased. This may involve:

a) an additional margin that is added to MOC;

b) a percentage increase in OCA/H; and

c) applying a lower limit (a minimum value) to OCA/H; as described below.

2.5.2 ***Additional Margin applied to MOC***

2.5.2.1 When procedures are designed for use in mountainous areas, consideration must be given to induced altimeter error and pilot control problems which result when winds of 37 km/h (20 kt) or more move over such areas. Where these conditions are known to exist, MOC should be increased by as much as 100 per cent.

2.5.2.2 Procedures specialists and approving authorities should be aware of the hazards involved and make proper addition, based on their experience and judgment, to limit the time in which an aircraft is exposed to lee-side turbulence and other weather phenomena associated with mountainous areas. This may be done by increasing the minimum altitude/height over the intermediate and final approach fixes so as to preclude prolonged flight at a low height above the ground. The operator’s comments should also be solicited to obtain the best local information. Such increases should be included in the Aeronautical Information Publication (AIP), Section GEN 3.3.5, “Minimum flight altitude”. These criteria are applicable to non-precision approach procedures only.

2.5.3 ***Percentage increase in OCA/H***

2.5.3.1 *Remote altimeter setting*. When the altimeter setting is derived from a source other than the aerodrome, and more than 9 km (5 NM) remote from the threshold, the OCA/H must be increased at a rate of 0.8 m for each kilometre in excess of 9 km (5 ft for each nautical mile in excess of 5 NM) or a higher value if determined by local authority. In mountainous areas or other areas where reasonably homogenous weather cannot always be expected, a procedure based on a remote altimeter setting source should *not* be provided. In all cases where the source of the altimeter setting is more than 9 km (5 NM) from the threshold, a cautionary note should be inserted on the instrument approach chart identifying the altimeter setting source.

2.5.3.2 *Remote altimeter setting source (RASS) in mountainous areas.*

a) The use of RASS in mountainous areas requires additional calculations to determine the correct OCA/H. The calculation uses the formula –

OCA/H = 2.3x + 0.14z (non SI)

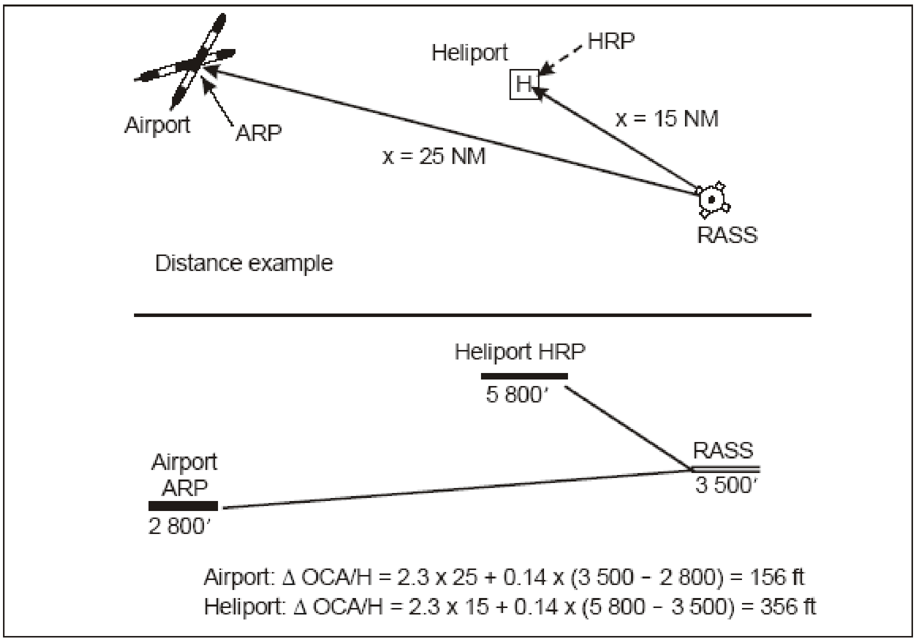
OCA/H = 0.4x + 0.14z (SI)

where: OCA/H is the RASS increased altitude/height value (m/ft);

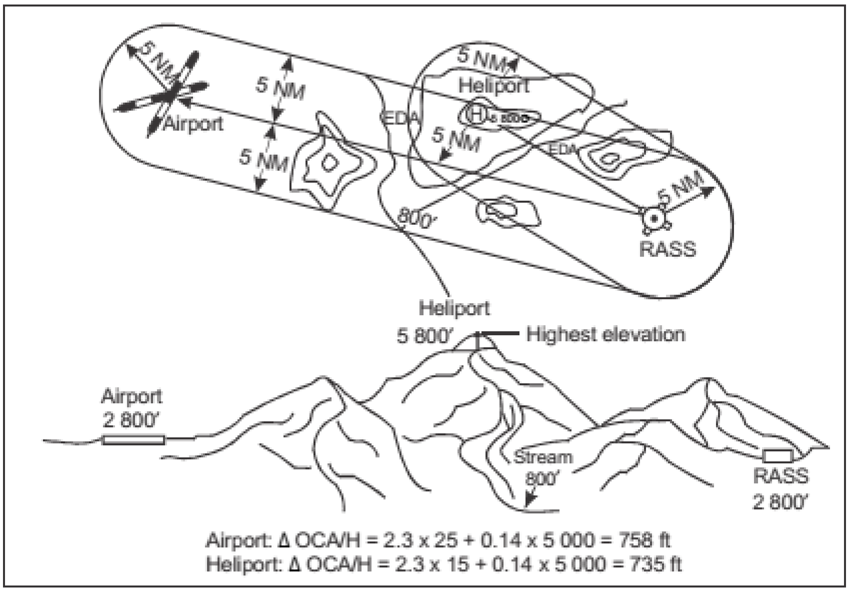
x is the distance from the RASS to the landing area (km/NM); and

z is the difference in elevation between the RASS and the landing area (m/ft).

These formulas are used where no intervening terrain adversely influences atmospheric pressure patterns. The use of this criteria is limited to a maximum distance of 138 km (75 NM) laterally or an elevation differential of 1 770 m (6 000 ft) between the RASS and the landing area. An example calculation in nautical miles and feet is illustrated in the figure below which illustrates the Remote altimeter setting source (RASS) in mountainous areas:



b) Where intervening terrain adversely influences atmospheric pressure patterns, the OCA/H must be evaluated in an Elevation Differential Area (EDA). The EDA is defined as the area within 9 km (5 NM) each side of a line connecting the RASS and the landing area, including a circular area enclosed by a 9 km (5 NM) radius at each end of the line. In this case, z becomes the terrain elevation difference (m/ft) between the highest and lowest terrain elevation points contained in the EDA. An example of a calculation in nautical miles and feet is illustrated in Figure below ***(Elevation differential area):***



2.5.4 ***Lower limit (a minimum value) applied to OCA/H***

a) *Forecast altimeter setting*. When the altimeter setting to be used with procedures is a forecast value obtained from the appropriate meteorological office, the OCA/H must be increased by a value corresponding to the forecasting tolerance for the location as agreed by the meteorological office for the time periods involved. Procedures which require the use of forecast altimeter setting must be suitably annotated on the approach charts.

b) *Final approach track intersecting the extended runway centre line between 5^0 and 30^0.* When the final approach track intersects the extended runway centre line between 5^0 and 30^0 a lower limit is applied to OCA/H (see 2.3.2, "Non-aligned straight-in approach").

c) *Final approach track intersecting the extended runway centre line between 5^0 and 30^0 or descent gradient exceeding 6.5 per cent.* When the final approach track intersects the extended runway centre line at more than 30^0, or the descent gradient exceeds 6.5 per cent, the OCA/H for visual manoeuvring (circling) becomes the lower limit and is applied to the approach procedure.

d) *Visual manoeuvring (circling).* For visual manoeuvring (circling) a lower limit consisting of the OCA/H for the associated instrument approach procedure is applied (see 2.4, “OCA/H for visual manoeuvring (circling)”).

2.6 Protection for the visual segment of the approach procedure

2.6.1 All new straight-in instrument approach procedures published on or after 15 March 2007 must be protected for obstacles in the visual segment. For this purpose no obstacles, except as provided in 2.6.4 below, may penetrate a Visual Segment Surface (VSS) laterally, defined as follows:

a) for procedures with localizer or localizer look-alike lateral guidance (LOC only, APV I, APV II and PA approaches) where the final approach track is aligned with the runway centre line, with a base width equal to the inner approach surface as defined in NAMCAR Part 139, originating 60 m prior to the runway threshold, extending parallel to the extended runway centre line, and terminating at the point where the height of the surface reaches the OCH (see Figure a) below)); and

b) for all other straight-in instrument approach procedures:

1) a base width equal to the runway strip width originating 60 m prior to the runway threshold, splaying 15 per cent on either side of the extended runway centre line, and terminating at the point where the height of the surface reaches the OCH (see Figure b) below));

2) where the final approach course is offset and intersects the extended runway centre line, the splay on the side closest to the final approach course is increased by the offset angle (see Figure c) below); and

3) where the final approach course is offset but does not intersect the extended runway centre line, the splay closest to the final approach course is increased by an amount equal to the final approach course offset at 1 400 m from the runway threshold (see Figure d) below)

Figure a) - Visual segment surface procedures with localizer or localizer look-alike lateral guidance aligned with Rwy CL

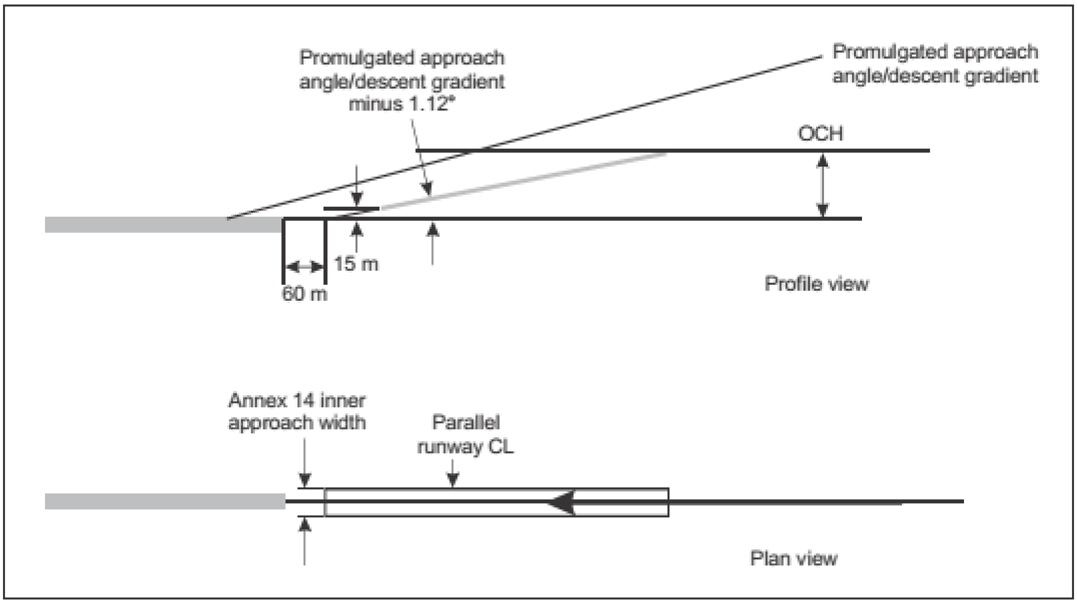


Figure b) - Visual segment surface other approach procedures normal straight-in approach

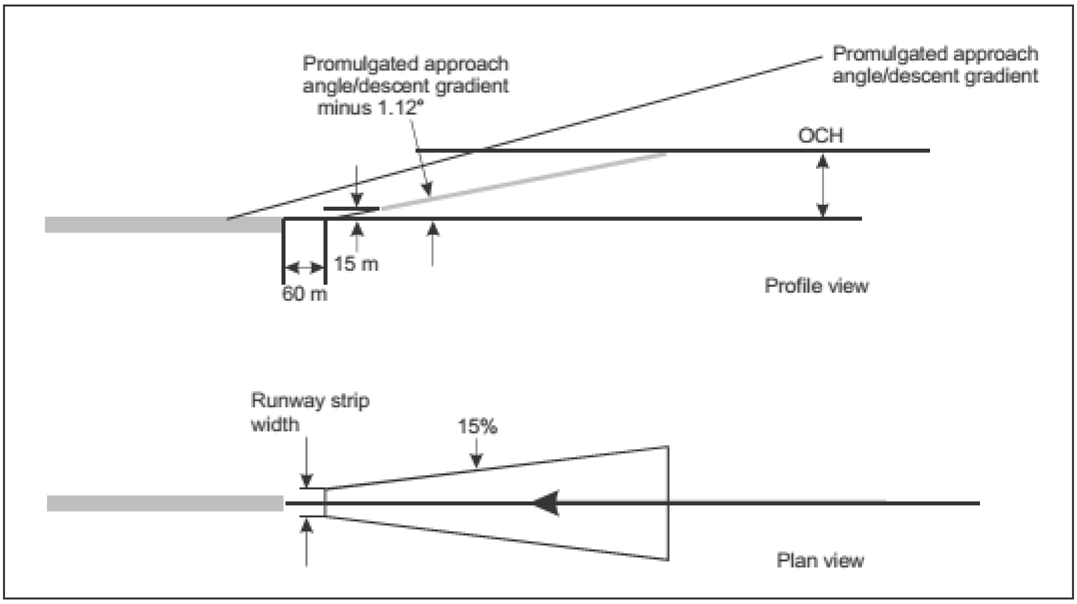


Figure c) - Plan view visual segment surface offset final approach with runway centre line crossing

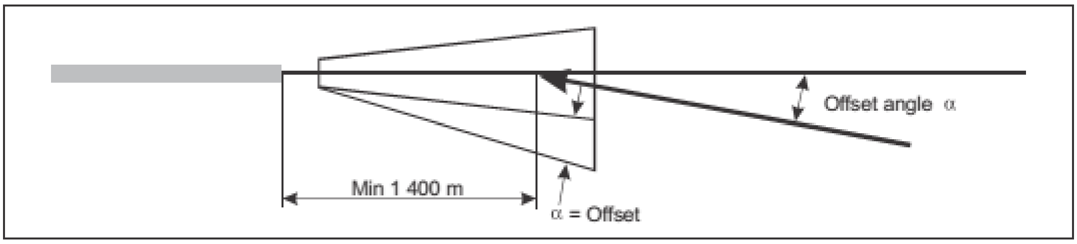
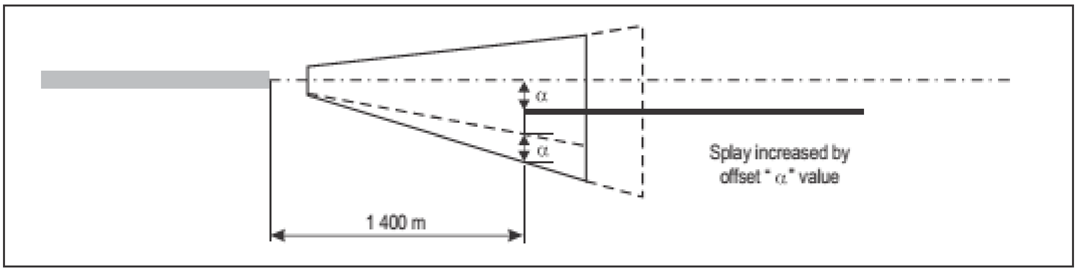


Figure d) - Plan view visual segment surface offset final approach parallel to the runway centre line



2.6.2 Vertically, the VSS originates at the runway threshold height and has a slope of 1.12 degrees less than the promulgated approach procedure angle.

2.6.3 Straight-in instrument approach procedures published before 15 March 2007 must be protected in the
visual segment by means of the VSS after the periodical review of the procedure, but not later than 15 March 2012.

2.6.4 If the VSS is penetrated, the approach procedure should not be promulgated without an aeronautical study. Mitigation action as a result of such a study may result in an increase of the descent gradient/angle and/or runway threshold displacement. Obstacles with a height less than 15 m above the threshold may be disregarded when assessing the VSS. Temporary moving obstacles such as aircraft holding at the runway hold-point are allowed.

3. Runway Visual Range (RVR) and Visibility Considerations

3.1 Non-Precision Approach (NPA) procedure

3.1.1 A non-precision approach (NPA) operation is an instrument approach and landing with a MDH not lower than 250 feet and an RVR/Visibility of not less than 800 metres.

3.1.2 Pilots may not continue approaches below the MDA/MDH unless they have visual references for the intended runway. This includes visual aids comprising **standard runway day markings** and **approach and runway lighting** (runway edge lights, threshold lights, runway end lights, and in some cases also touch-down zone and or runway centreline lights).

3.1.3 The approach light configurations acceptable are classified and listed in Table 1 below.

OPS Class of Facility	Length, Configuration and intensity of approach lights
FALS (Full Approach Lighting System)	ICAO: Precision Approach CAT I Lighting System (HIALS 720m ≥), distance coded centreline.
IALS (Intermediate Approach Lighting System)	ICAO: Simple Approach Lighting System (HIALS 420 – 717 m), single source, Barrette.
BALS (Basic Approach Lighting System)	Any other approach lighting system (HIALS, MIALS, or ALS 210 – 419 m)
NALS (No Approach Lighting System)	Any other approach lighting system (HIALS, MIALS, or ALS < 210 m) or no approach lights

Table 1 - Approach Lighting Systems

3.1.4 The visual aids are classified into three categories as shown in Table 2.

Full Facilities	Cat I lighting system (precision approach), runway edge lights, threshold lights, end lights and runway markings.
Intermediate Facilities	High intensity simple approach lighting system, runway edge lights, threshold lights, end lights and runway markings.
Basic Facilities	Low intensity simple approach lighting system, runway edge lights, threshold lights, end lights and runway markings.

Table 2 - Facility Categories

3.1.5 The minimum visibility to be associated with the MDH must be determined using Table 3 when the MDH is 320 feet or higher, and Table 4 for MDH between 250 feet and 320 feet.

3.1.6 The visibility values in Table 3 are based on the availability of full facilities. If only intermediate facilities are available, the visibility extracted from the table must be increased by 400m and if only basic facilities are available, it must be increased by 800 m.

MDH	Aircraft Category			
	A	B	C	D
Feet	Metres			
320 - 390	1600	1600	1600	2000
391 - 460	1600	1600	2000	2400
461 – 530	1600	1600	2000	2800
531 – 600	1600	1600	2400	2800
601 - 670	1600	1600	2800	3200
671 – 740	1600	1600	3200	3600
741 – 810	1600	2000	3600	4000
811 - 880	1600	2000	4000	4400

Table 3 – Approach and Landing Minima – NPA – RVR vs MDH 320 ft or higher

Category of Facility	Aircraft Category			
	A	B	C	D
	Metres			
Full Facilities	800	800	800	1600
Intermediate Facilities	1200	1200	1200	1600
Basic Facilities	1600	1600	1600	1600

Table 4 – Approach and Landing Minima – NPA – RVR vs MDH 250 ft - 320 ft

3.2. Circling Approach Minima

3.2.1 The Minimum Descent height (MDH) for a circling approach must be the higher of:

(a) the published circling OCH for the aircraft category; or

(b) the minimum circling height given in Table 5 below; or

(c) the DH/MDH of the preceding instrument approach procedure, whichever is the highest.

3.2.2 The Minimum Descent Altitude (MDA) for a circling approach must be calculated by adding the published aerodrome elevation to the MDH.

3.2.3 The minimum visibility (not RVR) for a circling approach must be the higher of:

(a) the circling visibility for the aircraft category; or

(b) the minimum visibility given in Table 5 below.

	Aircraft Category			
	A	B	C	D
MDH (ft)	400	500	600	700
Visibility (m)	1600	1600	2400	3600

Table 5 - Minimum visibility and MDH for circling vs aircraft category

3.3. Approach and landing minima for Precision Approach – Category 1

3.3.1 A category I approach is a precision approach and landing operation with a decision height not lower than 200 feet and with either a visibility not less than 800 m, or a runway visual range not less than 550 m.

3.3.2 The minimum RVR (or visibility if RVR is not reported) to be associated with the decision height between 200 feet and 250 feet is given in Table 6. If the decision height is more than 250 feet, but less than 300 feet, the minimum RVR/visibility given in Table 6 should be increased by 100m. The full, intermediate and basic facilities referred to in the Table 6 are those described in Table 2.

3.3.3 If the DH is more than 300 feet, the required RVR/visibility can be determined using the following formula:

Required RVR or Visibility (m) = ((DH in feet – 50) x 60) / (GS angle x 3.2808) rounded up to the nearest 100 m

3.3.4 The values obtained using this formula will be the RVR/visibility minima for basic facilities. If only full facilities are available, the RVR/visibility calculated must be reduced by 800 m, and if only intermediate facilities are available, the RVR/visibility calculated must be reduced by 400 m.

Category of Facility	Commercial transport Aircraft (multi-engine)	
	DH (Feet)	RVR / VIS (m)
Full Facilities	200	550/800
Intermediate Facilities	200	800
Basic Facilities	200	1200

Table 6 – Approach and landing Minima

Precision Approach CAT I – RVR/VIS vs DH of 200 feet

3.4. Approach and landing minima for Precision Approach Category II

3.4.1 A category II approach is a precision instrument approach and landing with a decision height lower than 200 feet but not lower than 100 feet., and a runway visual range not less than 350 m.

3.4.2 The minimum RVR values that can be used for Cat II operations are given in Table 7. However, in certain specific circumstances such as temporary visual aid outages, it is necessary to increase the RVR for a specific DH. Each case must be evaluated on an individual basis.

DH (ft)	Auto-Coupled / Approved HUDLS to below DH	
	RVR Aircraft category A, B, C	RVR Aircraft category D
100 – 120	350	350 / 400

121 – 140	450	450
141 and above	500	500

Table 7 – Approach and Landing Minima

Precision Approach Cat II – RVR for Cat II Operations vs DH of 200 feet

3.5. Approach and landing minima for Precision Approach Category III

3.5.1 A Category III approach is divided as follows:

(a) Category IIIA operations. A precision instrument approach and landing using ILS with:

(i) A decision height lower than 100 feet; and

(ii) A runway visual range not less than 200m.

(b) Category IIIB operations. A precision instrument approach and landing using ILS with:

(i) A decision height lower than 100 feet; and

(ii) A runway visual range lower than 200m but not less than 75 m.

3.5.2 The minimum RVR values that can be used for Cat III operations are given in Table 8. However, in case of temporary visual aid outages, the aircraft operator must contact the Executive Director to get specific approval. Each case must be evaluated on an individual basis.

Category	Decision Height (ft)	Roll out Control/Guidance System	RVR (m)
IIIA	Less than 100	Not required	Not less than 200
IIIB	Less than 100	Fail Passive	Not less than 200
IIIB	Less than 50	Fail Passive	150
IIIB	Less than 50 or no DH	Fail operational	Not less than 75

Table 8 – Approach and Landing Minima – Precision Approach Cat III

RVR for Cat III Operations vs DH and Roll-out Control/Guidance System

173.05.3 Design Submission Template

1. General

1.1 This sub-section sets out the template requirements and minimum content for an instrument flight procedure submission.

2. General Section - Common to all IFPs

(a) Runway Parameters including magnetic and true direction, variation used, threshold co-ordinates (WGS84), convergence used (if using CAD grid), and elevation
(b) Navigation aids used including frequency, magnetic variation, DOC, declination, co- ordinates (WGS84) and where appropriate whether DME zeroing applies
(c) Aerodrome Reference Point elevation and magnetic variation
(d) Airspace (ATZ, CTR, CTA) dimensions
(e) Communication frequencies associated with the procedure
(f) Purpose of the procedure and most common arrival routes
(g) Minimum equipment required for the procedure
(h) Any redundancy alternatives considered in the design

3. General Section - Relating to specific IFPs

(a) A comprehensive design rationale including references to applicable design criteria
(b) Reference points for the start and finish of each segment
(c) Details of obstacle field including controlling/dominant obstacles for each segment
(d) MOC added to the particular controlling obstacle (primary and secondary areas) and the resultant calculations including allowance for excessive length for each segment as applicable
(e) Allowances used for vegetation and buildings
(f) Segment length
(g) Details of significant terrain
(h) Descent gradient

(i) Speeds used

(j) Bank Angle used

(k) Wind Velocity used

(l) Altitudes (maximum and minimum) per segment

(m) Timings

(n) Reference navigation aid

(o) Fixes (including Step Down Fixes) and the relevant tolerances

(p) Tracks and Radials

4. Individual requirements for each segment

4.1 In addition to the general requirements prescribed above, the individual requirements for each segment and specific type of flight procedures are listed below:

(a) Holding/Racetrack/Reversal:

(i) Details of the holding facility or fix including tolerances

(ii) Inbound track, Outbound Track

(iii) Maximum speed

(iv) Maximum altitude

(v) Minimum Altitude

(vi) Outbound limit

(vii) Entry procedures

(viii) Entry sector limitations if restricted joins applicable

(ix) ICAO Template number if used

(x) Obstacle field

(xi) Dominant obstacle

(xii) Published parameters

(b) Standard Arrival Routes:

(i) Segment type and track guidance

(ii) Reference facilities

(iii) Track distances

(iv) Lead radials, and

(v) Changeover points

(vi) Step down fixes and minimum altitudes for each section

(c) Initial Segment (as a separate data set for each initial segment):

(i) How many and why

(ii) Type (if a reversal is used confirm type)

(iii) All the design parameters including the speed, timings, minimum altitude, maximum altitude, inbound timings and/or distances, outbound timing, distances and/or limits, all tolerances used, all offset angles used and template number if used

(iv) Entry sectors for reversals and racetracks

(v) IAF and IF or start of Intermediate segment as applicable

(vi) Obstacle field applicable

(vii) Descent gradients and/or rates required

(viii) Dominant obstacle

(ix) Published parameters

(d) Intermediate Segment as a separate data set for each intermediate segment):

(i) IF or start of Intermediate segment

(ii) Alignment

(iii) Descent required

(iv) Proof of provision of a level portion of flight in this segment.

(v) Segment length

(vi) Obstacle field

(vii) Dominant obstacle

(viii) Maximum altitude

(ix) Minimum Altitude

(x) Published parameters

(e) Final Segment - NPA with FAF:

(i) FAF and tolerances

(ii) Alignment and crossing point,

(iii) Reference facilities

(iv) Segment length

(v) Threshold crossing height

(vi) Missed Approach Point – how determined (timing, distance)

(vii) Missed Approach Point tolerances

(viii) Missed Approach Point distance from threshold

(ix) SOC parameters

(x) Obstacle field

(xi) Dominant Obstacle

(xii) Step Down Fixes and minimum altitudes

(xiii) Minimum Altitude - OCA(H)

(xiv) Descent Gradient

(xv) Profile – distance vs. height

(xvi) Rate of descent required

(xvii) MOC applied

(xviii) Published parameters

(xix) Recommended profile*

(xx) Timing*

(xxi) Rate of descent*

(xxii) Distance from DME to threshold*

*(*if DME available)*

(f) Final Segment - NPA no FAF:

(i) Rate of descent

(ii) Timings

(g) Precision Segment:

(i) Final Approach Point

(ii) Basic ILS Surfaces infringements list

(iii) Localizer to threshold distances

(iv) Localizer sector width

(v) Glide path angle

(vi) Missed Approach Point

(vii) Threshold crossing height

(viii) Threshold elevation

(ix) OAS infringement list

(x) CRM including input criteria (*.obs file), and

(xi) OAS coefficients as used unchanged including any adjustments to the relevant constants

(xii) Obstacle field

(xiii) Dominant Obstacle

(xiv) OCA(H)

(xv) SOC

(xvi) Height Loss margins applied

(h) Missed Approach Segment:

(i) Start of Climb

(ii) Climb Gradient

(iii) OCA(H) due to missed approach obstacles

(iv) Proof of Obstacle Clearance to the Missed Approach obstacle i.e. Nominal Altitude Greater than required Altitude

(v) Turning Point including tolerances i.e. earliest Turning Point, Latest Turning Point, Minimum Turn Altitude etc.

(vi) Turn initialization area if turn altitude defined

(vii) Termination Point & Altitude of the procedure

(viii) All Turn Parameters i.e. speed, altitude, temperature, ISA and TAS

(ix) Textual missed approach instructions

(x) Obstacle field

(xi) Dominant obstacle

(i) Minimum Sector Altitudes:

(i) Reference(s) upon which centre(s) based

(ii) Sector definitions

(iii) Distance between compound centres

(iv) DME subdivisions (if any)

(v) Obstacle field

(vi) Dominant obstacle for each sector

(vii) Published parameters

(j) Visual Maneuvering:

(i) Altitude

(ii) Speeds

(iii) Wind velocity

(iv) Bank angle

(v) Radius of turn

(vi) Rate of turn

(vii) Straight segment

(viii) Circling radius (referenced to ICAO Doc. 8168 PANS-OPS)

(ix) Divisions between circling Sectors (where appropriate)

(x) Obstacle field

(xi) Dominant obstacle for each circling sector