Australian Government
Civil Aviation Safety Authority

ADVISORY CIRCULAR
AC 91-27 v1.0

Instrument flight procedures (operational information)

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Acknowledgement of Country

The Civil Aviation Safety Authority (CASA) respectfully acknowledges the Traditional Custodians of the lands on which our offices are located and their continuing connection to land, water and community, and pays respect to Elders past, present and emerging.

Artwork: James Baban.

Advisory circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Advisory circulars should always be read in conjunction with the relevant regulations.

Audience

This advisory circular (AC) applies to:

- aviation personnel and organisations in Australia who are involved in IFR flights using instrument approach procedures.

Purpose

This AC provides information on the use of instrument approach procedures in Australia.

For further information

For further information or to provide feedback on this AC, visit CASA's contact us page.

Status

This version of the AC is approved by the National Manager, Flight Standards Branch.

Table 1: Status

Version	Date	Details
v1.0	February 2026	Draft AC for consultation.

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this AC are references to the *Civil Aviation Safety Regulations 1998 (CASR)*.

Contents

1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Table 2: Acronyms

Acronym	Description
AC	advisory circular
ADF	automatic direction finder
AFM	aircraft flight manual
AIP	Aeronautical Information Publication **Note:** In this AC, AIP means the Australian AIP.
APV	approach procedure with vertical guidance
ATC	air traffic control
ATPL	air transport pilot licence
CASA	Civil Aviation Safety Authority
CASR	*Civil Aviation Safety Regulations 1998*
CDFA	constant descent final approach
CDI	course deviation indicator
CFIT	controlled flight into terrain
CPL	commercial pilot licence
DA/H	decision altitude or height
DAP	departure and approach procedures
DME	distance measuring equipment
EGPWS	enhanced ground proximity warning system
FAF	final approach fix
FMS	flight management system
GBAS	ground based augmentation system
GLS	GBAS landing system
GNSS	global navigation satellite system
GPS	global positioning system
GPWS	ground proximity warning system
HLS	helicopter landing site

Acronym	Description
IAC	instrument approach chart
IAF	initial approach fix
IAP	instrument approach procedure
IF	intermediate fix
IFR	instrument flight rules
ILS	instrument landing system
IMC	instrument meteorological conditions
IPC	instrument proficiency check
ISA	International Standard Atmosphere
LNAV	lateral navigation
LNAV+V	lateral navigation with advisory vertical guidance
LOC	localizer
LP	localizer performance
LPV	localizer performance with vertical guidance
LSALT	lowest safe altitude
MAPt	missed approach point
MDA/H	minimum descent altitude or height
MOS	manual of standards
NAP	noise abatement procedures
NDB	non directional beacon
NPA	non precision approach
PA	precision approach
PBN	performance-based navigation
PIFR	private IFR rating
PPL	private pilot licence
PRM	precision runway monitoring
RoD	rate of descent
RMI	remote magnetic indicator
RNAV	area navigation
RNP APCH	required navigation performance (RNP) approach
RNP AR APCH	required navigation performance authorization required approach

Acronym	Description
RNP	required navigation performance
RVR	runway visual range
SBAS	satellite-based augmentation system
S-I	straight in
TAWS	terrain awareness warning system
VFR	visual flight rules
VMC	visual meteorological conditions
VNAV	vertical navigation
VOR	very high frequency (VHF) omnidirectional range
VPA	vertical path angle

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below. Where definitions from the civil aviation legislation have been reproduced for ease of reference, these are identified by 'grey shading'. Should there be a discrepancy between a definition given in this AC and the civil aviation legislation, the definition in the legislation prevails.

Table 3: Definitions

Term	Definition
advisory VNAV guidance	VNAV guidance that does **not** meet the technical standards for VNAV guidance required for an Approach Procedure with Vertical guidance (APV) or a Precision Approach (PA) procedure. Use of advisory VNAV guidance for descent below a specified MDA/H in IMC is not permitted.
approach procedure with vertical guidance	A PBN IAP designed for 3D instrument approach operations Type A.
approved GNSS	means: a. a GNSS system that is authorised in accordance with any of the following: i (E)TSO-C129; ii (E)TSO-C145; iii (E)TSO-C146; iv (E)TSO-C196a; or b. a multi-sensor navigation system that: i includes GNSS and inertial integration; and ii is approved under Part 21 of CASR as providing a level of performance equivalent to a GNSS system mentioned in subparagraph (a) (ii), (iii) or (iv). **Note:** This note is not part of the legal definition. (E)TSO is an abbreviation meaning TSO or ETSO. (E)TSO is defined in section 1.07 of the Part 91 MOS.

Term	Definition
area navigation	means a method of navigation which permits aircraft operations on any desired flight path within: a. the coverage of ground or space-based navigation aids; or b. the limits of the capability of self-contained navigation aids; or c. a combination of paragraphs (a) and (b). Note: Area navigation includes PBN as well as other operations that do not meet the definition of PBN.
Australian aircraft	means: a. aircraft registered in Australia; and b. aircraft in Australian territory, other than foreign registered aircraft and state aircraft. **Note:** Some references to Australian aircraft may be affected by the operation of section 4A [sic - of the Civil Aviation Act 1988].
Chicago Convention	means: a. the Convention on International Civil Aviation done at Chicago on 7 December 1944, whose English text is set out in Schedule 1 to the Air Navigation Act 1920; b. the Protocols amending that Convention, being the Protocols referred to in subsection 3A(2) of that Act, whose English texts are set out in Schedules to that Act; and c. the Annexes to that Convention relating to international standards and recommended practices, being Annexes adopted in accordance with that Convention.
Contracting State	means a foreign country that is a party to the Chicago Convention.
decision altitude or height	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:** DA is referenced to mean sea level and DH is referenced to the threshold elevation. **Note 2:** For the required visual reference to be established the flight visibility must be not less than the landing minima specified in section 15.10 of the Part 91 MOS, and at least 1 of the visual references required to be in view by section 15.11 of the Part 91 MOS must 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 in section 15.11 of the Part 91 MOS for the particular procedure and operation.
foreign registered aircraft	means an aircraft registered: a. in a foreign country; or b. under a joint registration plan or an international registration plan. **Note:** Definitions of the terms joint registration plan and international registration plan can be found in section 3 of the Civil Aviation Act 1988.
ground based augmentation system	An augmentation system in which the user receives augmentation information directly from a ground-based transmitter.

Term	Definition
IFR (short for instrument flight rules)	means the rules and procedures set out in Subdivision 91.D.4.3. [sic - of CASR]
IMC (short for instrument meteorological conditions)	means meteorological conditions other than VMC.
instrument approach procedure	means 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.
International Standard Atmosphere	is a static atmospheric model of how the pressure, temperature, density, and viscosity of the Earth's atmosphere change over a wide range of altitudes or elevations that has been established to provide a common reference for temperatures and pressures at various altitudes. **Note:** The International Organization for Standardization (ISO) publishes the ISA as an international standard, ISO 2533:1975.
landing minima	means the minimum values of the following that are used for the purpose of determining whether an aerodrome may be used for landing aircraft: a. visibility, including runway visibility and runway visual range; b. cloud ceiling height.
landing minima requirements	for an aerodrome: see regulation 91.307.
minimum descent altitude or height	A specified altitude or height in a 2D instrument approach operation or circling approach operation below which descent must not be made without the required visual reference. **Note 1:** MDA is referenced to Mean Sea Level (MSL) and MDH is referenced to the aerodrome elevation or to the threshold elevation if that is more than 7FT below the aerodrome elevation. A minimum descent height for a circling approach is referenced to the aerodrome elevation. **Note 2:** For the required visual reference to be established the flight visibility must be not less than the landing minima specified in section 15.10 of the Part 91 MOS, and at least 1 of the visual references required to be in view by section 15.11 of the Part 91 MOS must 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.
navigation specification	means a set of aircraft and aircrew requirements needed to support PBN operations within a defined airspace, being either: a. RNAV specification which is a navigation specification based on area navigation that does not include the requirement for on-board performance monitoring and alerting, and is designated by the prefix RNAV, for example, RNAV 5, RNAV 1; or b. RNP specification which is a navigation specification based on area navigation that includes the requirement for on-board performance monitoring and alerting, and is designated by the prefix RNP, for example, RNP 2, RNP APCH.
non precision approach	An IAP designed for 2D instrument approach operations Type A.

Term	Definition
PBN, or performance-based navigation	means area navigation based on performance requirements for aircraft operating: a. along ATS routes; or b. on an IAP; or c. in designated airspace. Note 1: Performance requirements are expressed in navigation specifications (RNAV specification, and RNP specification) in terms of the accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular class of airspace. Note 2: ATS routes is a defined term: see the CASR Dictionary.
precision approach	An IAP based on an ILS, an MLS, a GLS or an SBAS CAT I, and which is designed for 3D instrument approach operations Type A or B.
QNH	That pressure altimeter setting which, when placed on the pressure setting sub-scale of a sensitive altimeter of an aircraft located at the reference point of an aerodrome, will cause the altimeter to indicate the vertical displacement of the reference point above mean sea level.
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.
satellite-based augmentation system	An augmentation system in which the user receives augmentation information directly from a satellite-based transmitter.
specialised helicopter operation	means a helicopter operation that involves the carriage of persons or cargo: a. between the coast of Australia and an off-shore installation; or b. between off-shore installations; or c. to or from the helipad of: i a hospital; or ii a State or Territory service (however described) established to provide assistance in emergencies.
specified aircraft performance category	for an aircraft, means the aircraft performance category prescribed for an aircraft's Vat (as worked out in accordance with the aircraft's flight manual) by the Part 91 Manual of Standards. **Note:** See section 2.02 of the Part 91 MOS (this note is not part of the legal definition).
VMC (short for visual meteorological conditions)	means meteorological conditions that meet the VMC criteria.
VMC criteria	a. for a class of aircraft (other than Part 131 aircraft) and a class of airspace (including flight visibility and distance from cloud)—means the criteria prescribed for the class of aircraft and class of airspace by the Part 91 Manual of Standards; and b. for Part 131 aircraft and a class of airspace (including flight visibility and distance from cloud)—means the criteria prescribed for the aircraft and class of airspace by the Part 131 Manual of Standards.

Term	Definition
	Note: This note is not part of the legal definition. The VMC criteria relevant to the topic of this AC are contained in section 2.07 of the Part 91 MOS.

1.3 References

Legislation

Legislation is available on the Federal Register of Legislation website https://www.legislation.gov.au/

Table 4: Legislation references

Document	Title
CASR Dictionary	Part 1, Part 2, Part 3 of the CASR Dictionary - Volume 5 of the Civil Aviation Safety Regulations 1998
Part 61 MOS	Part 61 (Flight crew licensing) Manual of Standards Instrument 2014
Part 91 MOS	Part 91 (General operating and flight rules) Manual of Standards 2020
Part 139 MOS	Part 139 (Aerodromes) Manual of Standards 2019
Part 173 MOS	Manual of Standards Part 173 Standards Applicable to Instrument Flight Procedure Design

International Civil Aviation Organization documents

International Civil Aviation Organization (ICAO) documents are available for purchase from http://store1.icao.int/

Many ICAO documents are also available for reading, but not purchase or downloading, from the ICAO eLibrary (https://elibrary.icao.int/home).

Table 5: ICAO references

Document	Title
Doc 8168	Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) **Note:** The Procedures for Air Navigation Services — Aircraft Operations (PANS-OPS) consists of three volumes, as follows: • Volume I – Flight Procedures • Volume II – Construction of Visual and Instrument Flight Procedures • Volume III – Aircraft Operating Procedures.
Doc 9613	Performance-based Navigation (PBN) Manual
Doc 9905	Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual
Doc 9992	Manual On the Use of Performance Based Navigation (PBN) in Airspace Design
Doc 9997	Performance-based Navigation (PBN) Operational Authorization Manual

Advisory material

CASA's advisory materials are available at https://www.casa.gov.au/publications-and-resources/guidance-materials

Table 6: Advisory material references

Document	Title
AC 91-05	Performance-based navigation
AC 121-11	Part 121 alternate aerodromes **Note:** At the time of publishing v1.0 of this AC, AC 121-11 had not yet been published.
Part 91 AMC/GM	Acceptable means of compliance and guidance material - general operating and flight rules
RTCA DO-236()	Minimum Aviation System Performance Standards: Required Navigation Performance for Area Navigation

1.4 Forms

CASA's forms are available at http://www.casa.gov.au/forms

Table 7: Forms

Form number	Title
	Application - Part 91 Approval Low Visibility (CASR Part 91)
	Application - Navigation Authorisation RNP AR and RVSM (CASR 91.655 / 91.660)

2 Background

2.1 IFR flight and managing your limitations

2.1.1 Flight under the visual flight rules (VFR) is characterized by controlling the aircraft while looking outside at a visible horizon.

2.1.2 Flight under the instrument flight rules (IFR), due to the possible lack of external reference to the horizon, needs to replace the visual cues gained by looking outside with data found on multiple different instruments located throughout the cockpit.

SAFETY CRITICAL INFORMATION

VFR-only pilots are not authorised to conduct operations under the IFR (for example, IFR enroute or instrument approach procedure(s) (IAPs)).

Safely flying in conditions less than visual meteorological conditions (VMC) is not something that can easily or quickly be picked up during flight and it cannot be adequately taught without professional input.

IFR operations require formal training, compliance with Part 61 requirements, demonstrated proficiency, and ongoing currency, all exercised within the pilot's personal and regulatory limitations.

As such, this AC is not adequate to replace professional instruction and training; however, it attempts to document some of the many details required to be understood and managed to safely conduct IFR flight, with a particular focus on instrument approaches.

2.1.3 A quote from the FAA Instrument Flying Handbook (FAA-H-8083-15B) page 6-16:

Pilots flying under visual flight rules (VFR) maneuver their aircraft by reference to the natural horizon, …. In order to operate the aircraft in other than VFR weather, with no visual reference to the natural horizon, pilots need to develop additional skills. These skills come from the ability to maneuver the aircraft by reference to flight instruments alone.

2.1.4 IFR flight requires successfully undertaking many smaller tasks in a repetitive cycle but prioritised for a safe outcome. This has colloquially been referred to as 'juggling' the many tasks required for IFR flight.

2.1.5 Thorough preparation is needed for success, as completing tasks before your flight reduces your inflight workload and makes the flight less demanding. The more preparation is done during the planning phase, the lower your inflight workload, thereby leaving more capacity and time to manage normal flight tasks and unforeseen situations.

2.1.6 Such preparation also extends to considering that every pilot has their own limitations, which must be managed to produce a safe outcome. **Realising your own limitations and not going beyond them is a skill that each pilot needs to master.** Training, qualifications, proficiency and recency can be used to prepare the individual, expanding their limits, but does not completely replace human limitations.

2.1.7 Situational awareness is needed to successfully manage an aircraft during an IFR flight. Even once licenced for IFR operations, the skill of maintaining adequate situational awareness while conducting high workload phases of flight is critical to a safe flight. Within the aviation industry it is widely known that under high workload situations a pilot's situational awareness can suffer from overload. It is a dangerous situation where the workload reduces situational awareness, which can 'snowball' ultimately leading to a fatal outcome.

2.1.8 CASA acknowledges that the requirements for safely conducting an IFR operation are extensive and varied. Therefore, pilots must assess and manage their own personal limitations both before and during flight to ensure a safe outcome. If you reach your limitations during flight and become overloaded, which is often indicated by reducing situational awareness, task fixation and/or an erratic or failing scan, prioritise safety by reducing your workload.

Key tip

If overloaded, prioritise safe flight by reducing your workload.

Consider returning to a safe altitude, regain situational awareness, mentally get ahead of the aircraft and replan for safe flight.

2.2 The instrument flight rules (IFR)

2.2.1 The CASR Dictionary defines the IFR to be the rules and procedures set out in Subdivision 91.D.4.3 of CASR. The regulations in this Subdivision are supported by the requirements in Chapters 14, 15 and 16 of the Part 91 MOS.

2.2.2 Guidance for all these regulations is contained in CASA's Part 91 Acceptable Means of Compliance / Guidance Material (AMC/GM) document. For low-visibility operations detailed guidance, see AC 91-11.

2.3 Navigation

2.3.1 Historically, IFR navigation was based on transitioning from one conventional ground-based aid to another while the instrument approaches flown on arrival were based on ground-based aids, being non directional beacon (NDB), very high frequency (VHF) omnidirectional range (VOR), distance measuring equipment (DME), LOC and instrument landing system (ILS). Navigation was mostly limited to tracking direct to conventional ground-based navigation aids. The capability to navigate directly between any two points in space, known as area navigation (RNAV), became feasible only when a sufficient number of conventional ground-based aids were within range or with the introduction of satellite-based navigation systems.

2.3.2 The introduction of satellite-based navigation systems, initially known as GPS and now referred to as global navigation satellite system (GNSS), significantly enhanced the feasibility and availability of area navigation[1]. With the advent of technology, GNSS capability became more accurate to the point where this technology can be used to conduct an instrument approach procedure (IAP) to the point of landing. It is these IAPs, using GNSS and ground-based aids, that this AC will expand on.

2.4 Performance-based navigation

2.4.1 The International Civil Aviation Organization (ICAO) has adopted the concept of performance-based navigation (PBN)[2], a form of area navigation (RNAV). PBN shifts the focus from specific ground-based navigation aids, such as NDB, VOR and ILS, to navigation performance requirements needed for a particular instrument flight procedure or designated airspace (referred to as an 'airspace concept' in the ICAO Doc. 9613 Performance-based navigation (PBN) Manual).

[1] Area navigation is defined in the definitions section of this AC.

[2] PBN is defined in the definitions section of this AC.

> **Note:** More information on PBN is contained in AC 91-05.

2.4.2 PBN terminology has evolved as technology has advanced. Within the PBN concept the term RNAV refers to navigation specifications that do not incorporate on-board performance monitoring and alerting. In comparison, the term required navigation performance (RNP), which was introduced later as technology evolved, is used to designate specific navigation specifications that require and incorporate on-board performance monitoring and alerting. The specification of the required performance for RNAV or RNP navigation are called *navigation specifications*[3].

2.4.3 RNP and RNAV capable avionics need to match the required navigation specification for the airspace (if required) to be used or IAP to be flown. Guidance about the choice of RNP or RNAV designations for airspace is contained in ICAO Doc 9613 and ICAO Doc 9992.

2.4.4 The navigation performance requirements for conventional ground-based aids are reflected in the naming convention of the instrument approach type (e.g., NDB, VOR or ILS). These designations indicate the specific equipment required to conduct the instrument approach procedure, while the navigation performance requirements for GNSS based instrument approach procedures are not self-evident.

2.4.5 All GNSS based instrument approach procedures, other than GBAS landing system (GLS), are named in accordance with the ICAO Doc 9613 conventions, namely required navigation performance (RNP) approach (RNP APCH). In Australia, all approaches that were previously designated as RNAV (GNSS) were renamed to RNP APCH by late 2024.

> **Note:** Currently, all publicly available area navigation instrument approach procedures in Australia are based on GNSS. Although many aircraft fitted with modern flight management systems (FMS) have the capability to conduct area navigation not solely based on GNSS through the integration of conventional navigation aids, the use of this kind of area navigation is not used in Australia.

2.4.6 Not all aircraft fitted with GNSS, including FMS equipped aircraft, are approved to conduct instrument approach operations. Pilots must verify the specific operational approvals for each aircraft based on its installed navigation equipment.

> **Note:** The AMC 91.287 entry in CASA's Part 91 AMC/GM document contains matrices and explanations of older navigation approvals to contemporary terminology and navigation specifications.

SAFETY CRITICAL INFORMATION

Section 14.02 of the Part 91 MOS requires pilots to use an approved GNSS[4] for IAPs that require GNSS.

2.4.7 GNSS based RNP APCH and required navigation performance authorization required approach (RNP AR APCH) IAPs have different navigation specification requirements on the different segments of the approach. Only RNP AR APCH instrument approach procedures have the final approach segment RNP values indicated on the charted instrument approach minima box.

[3] Navigation specification is defined in the definitions section of this AC.

[4] Approved GNSS is defined in the definitions section of this AC.

Unless noted differently on the instrument approach chart, the standard RNP APCH and RNP AR APCH instrument approach segment values are:

Table 8: Required RNP values for each segment of RNP APCH and RNP AR APCH IAPs

Segment	RNP APCH Standard	RNP AR APCH Standard Maximum	RNP AR APCH Standard Minimum
Initial	1	1	0.1
Intermediate	1	1	0.1
Final	0.3	0.3	0.1
Missed Approach	1	1	0.1*
		Above values are the available range, where value will depend on design, location etc. * There are operational implications associated with missed approach segments which require low RNP values, which will be part of the RNP AR APCH procedure.	

2.4.8 Subsection 14.01(2) (and subsection 13.02(4)) of the Part 91 MOS requires that the aircraft navigation system is approved for the required navigation specifications needed for the approaches to be flown. Table 9 below outlines which RNAV/RNP navigation specifications are supported by the different (E)TSO equipment standards.

Table 9: GNSS (E)TSO acceptable means of compliance with navigation specifications

Courtesy of Part 91 AMC/GM for 91.287.

TSO	RNAV 10 (RNP 10) Oceanic and remote navigation	RNAV 5 En-route and terminal[1] navigation	RNAV 2 En-route and terminal[1] navigation	RNAV 1 En-route and terminal[1] navigation	RNP 4 Oceanic and remote navigation	RNP 2 Oceanic and remote, en-route and terminal[1] navigation	RNP 1 En-route and terminal[1] navigation	RNP APCH Non-precision approach
TSO-C129	Acceptable[3]	Acceptable[3]	Class A1 or Class B[2] or C[2]	Class A1 or Class B[2] or C[2]	Acceptable[3]	Class A1 or Class B[2] or C[2]	Class A1 or Class B[2] or C[2]	Class A1, B1[2], B3[2], C1[2] and C3[2]
(E)TSO-C129a	Acceptable[3]	Acceptable[3]	Class A1 or Class B[2] or C[2]	Class A1 or Class B[2] or C[2]	Acceptable[3]	Class A1 or Class B[2] or C[2]	Class A1 or Class B[2] or C[2]	Class A1, B1, B3, C1 and C3
(E)TSO-C145	Acceptable[3]	Acceptable[3]	Acceptable[2]	Acceptable[2]	Acceptable[3]	Class 1[2], 2[2] or 3[2]	Class 1[2], 2[2] or 3[2]	LNAV - Classes 1, 2, 3 LNAV/VNAV - Classes 2, 3 LP/LPV - Class 3
(E)TSO-C146	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Class Gamma and Operational Class 1, 2 or 3	Class Gamma and Operational Class 1, 2 or 3	Class Gamma: LNAV - Classes 1, 2, 3 LNAV/VNAV - Classes 2, 3 LP/LPV - Class 3
(E)TSO-C196	Acceptable[3]	Acceptable[3]	Acceptable[2]	Acceptable[2]	Acceptable[3]	Acceptable[2]	Acceptable[2]	LNAV

Notes:

1. 'Terminal' navigation terminology is included to enable operators with equipment classified in that manner to identify its capability.
2. Also requires a (E)TSO-C115b FMS installed IAW with FAA AC 20-138D.
3. Also requires a navigation system meeting the requirements of FAA AC 20-130A or AC-138B (or later version).

2.4.9 RNP APCH instrument approach procedures with localizer performance (LP) and localizer performance with vertical guidance (LPV) landing minima are not currently available in Australia, as these require the use of satellite-based augmentation system (SBAS).

2.4.10 It is currently anticipated that an SBAS will be available for aviation use in late 2028, which will enable the development of GNSS procedures with LP or LPV landing minima for aircraft with navigation systems approved for RNP APCH instrument approach procedures utilising SBAS.

Note: The globally harmonised criteria for an SBAS and instrument approach design will limit the availability of LP or LPV minima in some locations. Not every aerodrome will be capable of having these lines of minima promulgated for its location.

2.4.11 Procedures that require pilots or operators to hold CASA approval

2.4.11.1 Some Australian IAC state at the top and sometimes bottom of the chart "**FOR CASA APPROVED OPERATORS ONLY**".

2.4.11.2 There are 3 kinds of instrument procedures that require the pilot or operator to hold a CASA approval:

- an RNP AR APCH, marked by an AR in the IAC title and RNP AR APCH in the top right corner of the IAC immediately above the aerodrome name
- an RNP AR DP (as ICAO Doc 9905 does not yet contain publicly available design criteria for these procedures, none are published for general use in Australia)
- an RNP APCH containing only CAT H minima to a location that is not a certified aerodrome under Part 139 of CASR.

2.4.11.3 Regulation 91.660 of CASR[5] states that pilots must not conduct any part of the flight using an RNP AR APCH or RNP AR DP navigation specification unless the operator of the aircraft for the flight or the pilot in command hold the approval mentioned below to use that navigation specification during the flight or part of the flight:

- for an Australian aircraft—an approval under regulation 91.045
- for a foreign registered aircraft—an approval by the national aviation authority of the aircraft's State of registry or of the State of the operator.

2.4.11.4 RNP APCH containing only CAT H minima to locations that are not certified aerodromes under Part 139 of CASR are specialised helicopter operations authorised under section 8.8 of the Part 173 MOS. Paragraph 8.8.2.1 of the Part 173 MOS requires operators to hold an approval from CASA to conduct these procedures. Key points:

- These procedures used to be called, under Civil Aviation Order (CAO) 20.91 which is no longer in force, Helicopter RNP 0.3 instrument flight procedures (IFP). However, over time and with evolving standards, these types of IFP are now referred to as Helicopter PinS RNP APCH IFP, or simply 'PinS' approaches.
- Helicopter PinS "0.3" RNP APCH IFP differ from Helicopter RNP AR APCH IFP, noting the ICAO criteria for this latter AR APCH have not yet been published in ICAO Doc 9905.
- Operators seeking this approval should submit their application directly to the email address cns.atm@casa.gov.au, along with the relevant exposition / operations manual content which meets the requirements specified in section 8.8.3 of the Part 173 MOS. There is no specific application form for this approval.

[5] Supported by Chapter 22 of the Part 91 MOS.

Note: The current “Note” in paragraph 8.8.2.1 of the Part 173 MOS that mentions requests for approval of these procedures is managed by a CASA Area Office is incorrect and will be removed in a future MOS update.

- Helicopter PinS RNP APCH IFP are designed by a Part 173 Certified Designer in accordance with ICAO PANS-OPS Doc 8168 Vol II Part IV criteria, to an RNP 0.3 navigation specification. The other Australia-specific criteria outlined in section 8.8 of the Part 173 MOS are old and therefore procedure designers are currently designing PinS procedures according to the PANS-OPS criteria. Section 8.8 of Part 173 MOS is being reviewed as part of CASA's Part 173 post implementation review project.
- The reason a specific approval is required from CASA for these procedures is due to absence of terrain and obstacle controls resulting from the procedures being designed to locations other than certified aerodromes.

3 Airspace and ground infrastructure requirements

3.1 Airspace requirements

3.1.1 At the time of publication of v1.0 of this AC, minimum aircraft navigational requirements are not specified in Australian-administered airspace based on the kind of airspace volume. However, specific navigation requirements do exist for instrument flight procedures or to use certain published IFR lowest safe altitudes (referred to in other countries as minimum obstacle clearance altitudes or MOCA). You should carefully read the relevant AIP chart or instrument flight procedure for details of any required navigation specification.

3.1.2 Within controlled airspace, air traffic control (ATC) provides separation based, in part, on the aircraft navigation capability notified on the filed flight plan.

Note: For an Australian aircraft navigating in oceanic airspace and filing a navigation capability of RNP 2, RNP 4 or RNP 10 on their flight plan, specific requirements must be met which are outlined in section 11.03 of the Part 91 MOS.

3.2 Ground and aerodrome infrastructure

3.2.1 In Australia, except for specialised helicopter operations[6], instrument approach or departure procedures can only be published to aerodromes that are certified under Part 139 of CASR[7]. For an aerodrome to be certified, minimum standards of infrastructure must be maintained and the area surrounding the aerodrome must be monitored for the growth or addition of obstacles by the aerodrome operator.

Note: Instrument approach procedures for specialised helicopter operations can only be conducted by operators approved by CASA under section 8.8.2.1 of the Part 173 MOS.

3.2.2 For conventional ground-based navigation aids (NDB, VOR or ILS), pilots must tune, identify, and test the NAVAID before using it for an instrument approach to ensure the correct NAVAID is being received, the accuracy and reliability of the NAVAID signal and the correct functioning of the aircraft receiver. The NAVAID is crucial for providing precise guidance when the aircraft is flown below the en-route lowest safe altitude (LSALT). During the approach, the pilot needs to ensure the NAVAID signal is maintained.

3.2.3 The published approach will indicate the correct frequency for the NAVAID on the chart, along with a 3-character ident. The frequency needs to be **tuned** into the receiving equipment, the aural signal from the aid needs to be **identified** by listening to the audio signal from the aid and confirming that the broadcasted morse code represents the correct ident. The receiving equipment needs to be **test**ed to confirm correct operation. For NAVAIDs where there is no failure flag built into the aircraft equipment, the NAVAID needs to be monitored during its use by selecting the aural signal and listening to it consistently. The NAVAID can be considered unserviceable if the ident is not consistently heard during the approach.

[6] Specialised helicopter operation is defined in the definitions section of this AC.

[7] The technical standards for certified aerodromes, including for runway defined as an instrument runway, are in the Part 139 MOS.

3.2.4 This **Tune - Identify - Test** procedure is essential for flight safety, as it minimizes the likelihood of infrastructure errors during critical stages of flight, particularly during instrument approaches when the aircraft is below en-route LSALT.

4 Instrument Approach Procedures (IAPs)

4.1 Types of IAPs

4.1.1 An instrument approach procedure[8] (IAP) is a series of predetermined manoeuvres performed by reference to flight instruments with specified protection from obstacles from the initial approach fix (IAF) 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.

4.1.2 An IAP can be designed to different standards as determined by the State[9] responsible for the procedure. Australia, along with other ICAO Contracting States, except for IAP unique to Australia, uses the ICAO instrument approach procedure design standards outlined in ICAO Doc 8168 (PANS-OPS).

4.1.3 Based on the guidance provided by the navigation infrastructure on which an IAP is based, an IAP is classified as one of the following:

- non-precision approach (NPA)
- approach procedure with vertical guidance (APV)
- precision approach (PA).

4.1.4 An IAP may have up to 4 separate segments that provide for changes in performance of the aircraft as it transitions from a descent to the approach and landing or missed approach, if visual reference is not established. The 4 segments include the initial, intermediate, final and missed approach segments which are defined by the fix at the beginning and end of each segment or a specified point where no fix is available. The fixes or points are the following:

- initial approach fix (IAF)
- intermediate fix (IF)
- final approach fix (FAF)
- missed approach point (MAPt).

4.1.5 An IAP is designed to utilise either conventional ground-based navigation aids or computer-generated navigation information derived from ground-based, space-based, self-contained navigation data, or a combination of these to provide lateral navigation (LNAV) guidance and possibly vertical navigation (VNAV) guidance, when available.

4.1.6 The navigation infrastructure on which the procedure is based is/are identified on each IAP chart. The performance and integrity of the specified navigation infrastructure and associated navigation tolerances, used by aircraft to conduct the approach, determine the area considered for obstacles during the IAP design process.

4.1.7 Instrument approaches are classified into 2 types of operations based on the designed lowest operating minima below which an approach operation can only be continued with the required visual reference. These operation types are summarised below:

a. Type A: a minimum descent height or decision height at or above 250ft

[8] Instrument approach procedure is a term defined in the CASR Dictionary. The definition is repeated in the definitions section of this AC.

[9] State is the international term for a country. This is not referring to the individual states within Australia.

a. Type B: a minimum descent height or decision height below 250 ft. Type B instrument approach operations are further categorised as follows:

   i. Category I (CAT I): a DH not lower than 200 ft and either a visibility not less than 800 m or a runway visual range (RVR) not less than 550 m.

   ii. Category II (CAT II): a DH lower than 200 ft but not lower than 100 ft and an RVR not less than 300 m.

   iii. Category IIIA (CAT IIIA): a DH lower than 100 ft, or no DH, and an RVR not less than 175 m.

   iv. Category IIIB (CAT IIIB): a decision height lower than 50 ft, or no DH, and an RVR less than 175 m but not less than 50 m.

   v. Category IIIC (CAT IIIC): no DH and no RVR limitations.

4.1.8 The method by which an IAP is executed (the operation) is classified on the basis of the way the procedure is presented to and flown by the pilots. These operation methods are summarised below, being either:

a. Two-dimensional (2D) instrument approach operations, using lateral navigation guidance only, flown to a minimum descent altitude or height (MDA/H), such as NDB, VOR, LOC approach, or RNP APCH with LNAV minima.

b. Three-dimensional (3D) instrument approach operations, using both lateral and vertical navigation guidance, flown to a decision altitude or height (DA/H), such as an ILS or GLS approach, or RNP APCH with LNAV/VNAV minima, or RNP AR APCH.

4.1.9 The 2D and 3D operations method describes the manner in which the aircraft's vertical profile is designed and managed. For conventional ground-based aids, APV and PA IAPs, the operation method will naturally be associated with particular instrument approach procedures. However, for NPA IAPs with distance measuring, ICAO has determined that while they are designed as a 2D operation they can potentially be flown as a 3D operation if the navigation system extracts the vertical path and represents it to the pilot as a 3D operation, referred to as **advisory VNAV guidance**.

SAFETY CRITICAL INFORMATION

It is critical to flight safety that pilots recognise that when flying an NPA IAP as a 3D operation **using advisory VNAV guidance**, the aircraft navigation system does not supply the required terrain separation and therefore the pilot **must** ensure they do not descent below the segment minimum safe altitudes and comply with all the normal requirements of an MDA IAP.

When flying an NPA IAP as a 3D operation using **advisory VNAV guidance**, pilots are strongly recommended to initiate any missed approach at an altitude above the MDA/H to ensure the aircraft does not descend below published MDA/H.

See section 7.4 of this AC.

4.1.10 IAP charts do not contain any direct references to operation method, being 2D or 3D, or operation type, being type A or type B, within the chart. For the pilot, the approach procedure technology and minima type determine if the IAP is 2D or 3D and type A or type B.

4.1.11 Approach procedure types and classifications are described in multiple ways. The purpose of Table 10 below is to link these different descriptions together in an informative way.

Table 10: IAP terminology and interrelationships

Operation Type	Procedure and Operation Method	Procedure Classification	Approach Procedure Technology	Procedure Minima Type[10]		
Type A[2]	2D	Non-precision approach (NPA)	Conventional Ground Based[4]	VOR (MDA/H)	NDB (MDA/H)	LOC (MDA/H)
			PBN: (RNP APCH)	LNAV (MDA/H)	LP (MDA/H)[7]	
	3D	Approach procedure with vertical guidance (APV)		LNAV/VNAV (DA/H)[5]	LPV (DH at or above 250ft) (DA/H)[7]	
			PBN: (RNP AR APCH)	RNP (0.x) (DA/H)[6]		
Type B[3&9]		Precision approach (PA) procedure	PBN: (RNP APCH)	LPV (DH below 250ft) (DA/H)[7&8]		
			Conventional Ground Based	ILS (DA/H)[9]		
			GNSS Based	GLS (DA/H)[9]		

Notes:

1. This table should be read from left to right and shows IAP terminology interrelationships.
2. Type A: a minimum descent height or decision height at or above 250 ft.
3. Type B: a decision height below 250 ft.
4. DME or GNSS arrivals are technically classified as NPA but will only have circling minima published.
5. Barometric input is needed to compute the VNAV component in LNAV/VNAV procedures, hence they are sometimes referred to as BARO VNAV procedures.
6. For a RNP AR APCH procedure the minima are represented as RNP 0.x where 0.x refers to the RNP value specific to the final approach segment (for example 0.3). RNP AR APCH procedures are for use by CASA approved operators only.
7. IAPs with LP and LPV minima are not currently available in Australia as they rely on the availability of an SBAS (satellite based augmentation system). An SBAS is expected to be available for Australian IAPs in late 2028 via the Australia / New Zealand Southern Positioning Augmentation Network (SouthPAN).
8. SBAS is required for all IAP’s with LPV minima and can potentially provide minima similar to ILS CAT I minima. Hence an IAP with LPV minima below 250 ft are sometimes referred to as SBAS Cat I procedures.

9. Obstructions and/or lack of infrastructure (for example related to non-precision approach runways as defined in the Part 139 MOS) may limit ILS or GLS PA to a decision height of 250 ft or above. In these situations, the procedure classification is still a PA but the operation type is Type A.
10. Multiple minima types may be included on the same chart when the procedure technology for the IAP allows. This can occur for ILS with LOC, ILS with multiple CAT I, II or III minima, LNAV with LNAV/VNAV, RNP AR APCH with multiple RNP values and any RWY approach with circling minima.

4.2 Instrument Approach Charts (IAC) and naming

4.2.1 The titles on Australian instrument approach charts (IAC) conform to a convention to allow commonality of names between the chart title and electronic databases. Key points:

- the IAC title contains chart name, location name and airport identifier
- only the navigation aid providing final approach lateral guidance is mentioned in the title

Note: If another navigation aid is required to fly a different segment of the instrument approach procedure, then it will be identified in the top right-hand corner of the chart, directly under the title in the 'NAVAID RQ' box.

- a straight-in IAP is identified using the runway direction in the chart name, noting that for runways where multiple straight-in IAP's exist, a single letter suffix starting with the letter "Z" following the radio navigation aid type is used if two or more procedures to the same runway cannot be distinguished by the radio navigation aid type only

Example (straight-in IAP chart name)

Single straight-in IAP: NDB RWY 14 or RNP RWY 27.

Multiple straight-in IAP: ILS-Z RWY 15, LOC-X RWY 33 or RNP Y RWY 15.

- an IAP that only has circling minima does not use a runway direction in the chart name, except that the title for circling only RNP APCH IAPs indicates the direction from which the final approach track originates to assist the pilot with situational awareness

Example (circling minima only chart name)

NDB or VOR-A for IAP using ground-based NAVAID.

RNP-E indicates an approach from an easterly direction. The letters N, S, E, and W are used as suffixes.

- for an IAP based on ground-based NAVAIDs, where confusion might exist between multiple IAPs, a suffix may be included in the approach title using the letters from the beginning of the alphabet

Example (delineate different IAPs using ground-based NAVAIDs)

NDB-A or VOR-A.

Note: At the time of publishing v1.0 of this AC, the old Australian IAC titles RNAV(GNSS) and RNAV (RNP) have been renamed as RNP APCH.

4.2.2 In relation to the instrument approach procedure minima, the following key points apply:

- For straight-in instrument approach procedures, they may also be annotated in the minima box by the letters S-I (straight-in), For RNP APCHs the minima is identified as LNAV and/or LNAV/VNAV. For RNP AR APCH the minima is identified by the RNP value
- Circling will also be annotated in the minima title box
- for convenience and to avoid duplication, more than one landing minima can often be provided on the IAC when the same navigation infrastructure is utilised to provide the same lateral or LNAV guidance.

Note: The chart title does not indicate if multiple minima are included but will be specified in the minima box if the IAP is designed with multiple approach minima.

The pilot then determines which approach procedure minima type can be used based on their authorised Part 61 capabilities and the aircraft's equipment capabilities.

Examples (multiple IAP on a single IAC)

An IAC titled ILS or LOC RWY XX describes both a PA procedure being an ILS (utilising glideslope and LOC) and a NPA procedure being a localizer (utilising only the LOC).

The landing minima for the LOC procedure will be prescribed as an MDA/H as no vertical guidance is provided.

The landing minima for the ILS procedure will be prescribed as a DA/H, as vertical guidance is provided.

Similarly, an IAC titled RNP RWY XX may describe both an NPA procedure utilising an LNAV minima and an APV procedure utilising an LNAV/VNAV minima.

The LNAV minima for the NPA will be prescribed as an MDA/H as no VNAV guidance is provided and hence is designed as a 2D procedure.

The LNAV/VNAV minima for the APV will be prescribed as a DA/H, as LNAV and VNAV guidance is provided and hence is designed as a 3D procedure.

4.3 2D and 3D Instrument approach operation methods

SAFETY CRITICAL INFORMATION

It is recommended that pilots fly IAPs using continuous descent final approach (CDFA) techniques, whether that is achieved via the use of certified vertical guidance, advisory vertical guidance or a pilot-calculated descent path.

Using a CDFA technique reduces the risk of an accident from controlled flight into terrain (CFIT).

To conduct the approach using the CDFA technique, pilots can calculate an approximate rate of descent (RoD) by using the formula:

- RoD (fpm) = glide slope angle (degrees) x Ground Speed (kts) x 100/60

Using the above to achieve a 3° glide path, the formula becomes:

- RoD (fpm) = Ground Speed (kts) x 5 or 1/2 x Ground Speed (kts) x 10

For example, 3° glide path at 120KTS Ground Speed, then approximate RoD is 600 fpm.

4.3.1 Prior to the introduction of PBN procedures, there was a simple relationship between procedure classifications and operation method:

a. NPAs were designed and flown as a two-dimensional (2D) operation

b. PA were designed and flown as a three-dimensional (3D) operation.

4.3.2 With the introduction of APVs, which are not precision approaches and not non-precision approaches, there is no longer a simple relationship between the procedure classification (NPA, APV or PA) and the operation method (2D or 3D). See Table 10 above for their current interrelations.

4.3.3 One indicator of whether an IAP is a 2D or 3D procedure is the minima type. 2D procedures are indicated by VOR, NDB, localizer (LOC), LNAV or LP in the minima box, which represents MDA/H minima. Whereas 3D procedures are indicated by GLS, ILS, LPV, RNP (0.X) or LNAV/VNAV in the minima box, which represents DA/H minima.

4.3.4 2D and 3D profiles can exist on the same chart. In these circumstances, the 2D profile is shown as a horizontal line at the MDA/H extending to the missed approach point (MAPt), whereas the 3D profile is shown by the solid line to the DA/H and the arrow indicating a climb into the missed approach. See Figure 1 at the end of this section.

4.3.5 A 2D operation method describes the conduct of an IAP using **only** lateral guidance displayed to the pilot. Hence the pilot is required to manage the vertical path of the aircraft using cognitive skills, cross referencing altitude, rate of descent and lateral position against IAP profile, without the aid of any direct vertical guidance cues. Pilots are responsible for complying with descent limitations specified for the instrument approach procedure (step-down profile sometimes referred to as descent steps) and are not permitted to descend below the prescribed MDA/H instrument approach minima unless the required visual reference has been established.

4.3.6 A 3D operation method describes the conduct of an IAP using **both** lateral and vertical guidance displayed to the pilot. An IAP designed for navigation infrastructure that can provide lateral and vertical guidance, will include landing minima prescribed as a DA/H where descend below the prescribed DA/H is not permitted unless the required visual reference has been established.

4.3.7 The term *lateral guidance* is used to describe ground-based aids and GNSS based IAPs horizontal guidance, where LNAV (lateral navigation) is typically only in context to GNSS based IAPs, even though by definition this is not stated.

4.3.8 *Vertical guidance* is the general term used to describe ground-based NAVAID and GNSS based IAP vertical guidance, where VNAV (vertical navigation) as a term is typically only used in relation to GNSS based IAPs, even though by definition this is not stated.

4.3.9 Technology improvements have resulted in equipment that can interpret the IAP coded descent limitations or steps specified for a 2D operation and present that information to the pilot as a glide path. While the IAP is a 2D procedure by design and charted as such, the display to the pilot is now represented as 3D, which results in the pilot managing the glide path as a 3D operation. Under these circumstances the operation method is considered as 3D, as it is represented that way. It must be remembered that the IAP is still a 2D procedure and it is only the equipment that is representing the IAP as a 3D operation, hence the vertical guidance is referred to as **advisory VNAV guidance** or lateral navigation with advisory vertical guidance **(LNAV+V),** and pilots must ensure, via cross referencing altitude, rate of descent and lateral position against IAP profile, that the vertical flight path of the aircraft complies with all descent limitations or steps specified for the procedure, including not descending below the MDA/H when initiating a missed approach.

To fly a 2D IAP using a navigation system that can display **advisory VNAV guidance** (sometimes called 'LNAV+V') requires:

- 3D licencing and recency requirements as detailed in the Part 61 Manual of Standards (MOS)
- pilots to ensure that their flown vertical path complies with the charted IAP 2D altitude limitations (step-down profile or descent steps)
- pilots to ensure they treat the published minima as an MDA/H (not a DA/H) as no allowance for flight below the minima is included in the design and this advisory vertical guidance may not be used for descent below the MDA/H
- if the IAP is flown as a 3D operation, pilots must log recency for a 3D operation, not a 2D operation.

4.3.10 When conducting a 2D operation the vertical flight path (ground speed, RoD and distance to run) needs to be managed so that the descent limitations or steps specified for the IAP are complied with. Due to the lack of vertical information presented to the pilot, 2D operations require separate recency and licencing requirements from 3D operations. See section 4.9 below and the Part 61 MOS for these requirements.

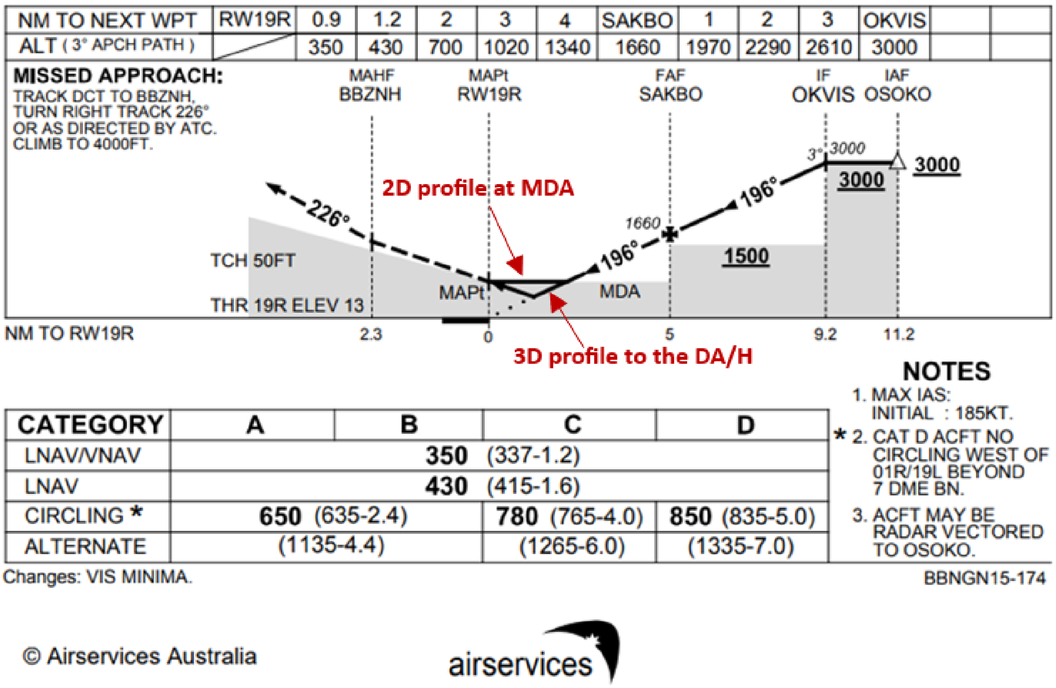


Figure 1: Extract of IAP Chart depicting both 2D and 3D profiles on the same chart

Source: Airservices Australia.

4.4 Aircraft performance categories

4.4.1 Instrument approach procedures are designed to accommodate varying aircraft performance through the use of defined aircraft performance categories, which under Part 91 of CASR are called the *specified aircraft performance category*. See section 2.02 of the Part 91 MOS for the definition of this term.

4.4.2 These categories are based upon V_{at} (except for CAT H). V_{at} is the indicated airspeed at the threshold which is equal to the stalling speed V_{so} multiplied by 1.3 or the stalling speed V_{s1g} multiplied by 1.23. Both V_{so} and V_{s1g} apply to aircraft in the landing configuration at the maximum certificated landing weight. If both V_{so} and V_{s1g} are available for an aircraft, the higher resulting V_{at} must be used.

Category H: see paragraph 4.4.3 below.

Category A: speeds up to 90KT IAS

Category B: speeds from 91KT to 120KT IAS

Category C: speeds from 121KT to 140KT IAS

Category D: speeds from 141KT to 165KT IAS

Category E: speeds from 166KT to 210KT IAS

4.4.3 For helicopters, the following points apply:

- the stall speed method of calculating aircraft category does not apply to helicopters
- procedures developed for the specific use of helicopters are designated CAT H and promulgated on separate IAC, i.e. they are not included on IAC containing procedures for other aircraft performance categories

- where helicopters are operated similarly to aeroplanes, or there is no promulgated CAT H minima, they use CAT A minima.

4.4.4 Each segment of the IAP is limited to a maximum or range of IAS by design. Approach procedures in Australia are designed for Categories H, A, B, C, D & E. Category A applies to aircraft with low approach speeds (up to 90KT), and each successive category applies to aircraft with higher approach speeds. A separate Category H applies to approaches designed for use by helicopters only.

Table 11: IAP segment speeds courtesy of Table 14.09(2) from Part 91 MOS

Item	Column 1 Specified aircraft performance category	Column 2 Range of speeds for initial and intermediate approach (kts)	Column 3 Range of speeds for final approach (kts)	Column 4 Max. speed for visual manoeuvring (circling) (kts)	Column 5 Max. speed for missed approach (kts)
1	H	70-120	60-90	None specified	90
2	A	90-150	70-100	100	110
3	B	120-180	85-130	135	150
4	C	160-240	115-160	180	240
5	D	185-250	130-185	205	265
6	E	185-250	155-230	240	275

4.5 Procedure altitude

4.5.1 The AIP defines the term 'procedure altitude' as follows:

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

DIST BY DME	2.1	3	4	5	6	7	8	9.1					
ALT (3° APCH PATH)	580	855	1175	1495	1810	2130	2450	2800					

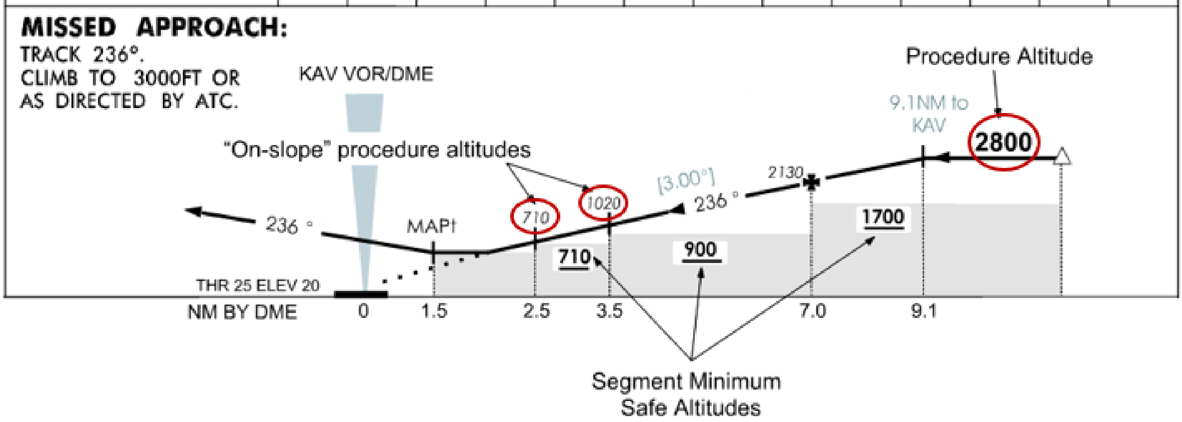


Figure 2: Typical approach profile showing procedure altitudes required to safely achieve the designed approach path angle

Source: Airservices Australia

4.5.2 Procedure altitudes are promulgated to facilitate flying the procedure. This contrasts with segment minimum safe altitudes that provide the minimum obstacle clearance. All procedure altitudes are recommended levels that ensure terrain clearance while maintaining the designed approach path angle. A procedure altitude will always be at or above the segment minimum safe altitudes for obstacle clearance. Aircraft are not required to maintain the procedure altitudes unless instructed by ATC.

4.5.3 Procedure altitudes are shown on the profile view of the IAC from the IAF and at each fix or significant point on the approach. The coded navigation data for IAPs will follow the procedure altitudes.

4.6 Landing minima[10]

Note: This AC does not elaborate on the specifics of low visibility operations as described in section 15.09(1)(a) and 15.11(2)(c) of the Part 91 MOS.

4.6.1 See section 15.10 of the Part 91 MOS for altitude or height, and visibility, requirements in determining the landing minima.

4.6.2 Before flight and prior to executing an IAP, the landing minima requirements[11] should be reviewed and compared to the forecast and any actual reported weather to determine what is expected during the IAP.

The cloud base from an **area forecast** is referenced to **AMSL** which can be directly compared to the MDA or DA.

[10] The term 'landing minima' is defined in the definitions section of this AC.

[11] The term 'landing minima requirements' is defined in the definitions section of this AC.

The cloud base from an **aerodrome forecast** or report is referenced to **height** above the aerodrome which can be directly compared to the MDH or DH.

The visibility from any authorised weather forecast or report (area or aerodrome) can be directly compared to the landing minima's required visibility.

4.6.3 As the aircraft approaches the MDA/H or DA/H the pilot(s) must be prepared to decide whether to continue the approach or initiate a missed approach. Ultimately this is a decision if the aircraft can continue visually to land or execute a missed approach. The full requirements for this are detailed in subsections 15.11(1) and (2) of the Part 91 MOS.

4.6.4 The landing minima visibility is the theoretical geometrical slant visibility that is needed at the MDA/H or DA/H to be able to see the landing environment or lighting that leads to the landing environment; whereas the details in subsection 15.11(2) of the Part 91 MOS are a theoretical description of what needs to occur to be visual and likely able to proceed via visual reference to the landing point.

The landing minima visibility should be compared with the forecast(s) and aerodrome report(s), prior to the approach to inform the pilot what conditions might be likely at the MDA/H or DA/H.

When approaching the MDA/H or at the DA/H, the pilot must conduct a missed approach if the conditions, visibility or cloud ceiling, are below the landing minima or at least 1 of the visual references, from paragraph 15.11(2)(b) of the Part 91 MOS, is not visible.

The decision at or after the MDA/H or DA/H, of what flight visibility is present is not an infallible method to determine visibility to an accuracy of +/- 100 metres, as the pilot can only estimate the distance that they can see.

Full details of missed approach requirements are contained in section 15.11 of the Part 91 MOS.

4.6.5 See Chapter 7 of the Part 91 MOS for the requirements for forecasts for flight planning and Chapter 8 of the Part 91 MOS for requirements when alternate aerodromes are needed[12].

4.7 Minimum Descent Altitude (MDA) and Decision Altitude (DA)

4.7.1 Obstacle clearance is the basis of safe flight. IAPs are by design intended to guarantee obstacle clearance as they must be suitable for flight in instrument meteorological conditions (IMC).

4.7.2 The term obstacle clearance altitude/height (OCA/H) is a defined term used in the design of IAPs that guarantees appropriate clearance from obstacles and terrain. The OCA/H is an essential baseline for determining both MDA/H and DA/H, ensuring the safety of the approach by maintaining proper obstacle clearance. MDA/H and DA/H are established by considering the OCA/H, ensuring that pilots have sufficient clearance from obstacles while also giving them a clear decision-making point during the approach.

4.7.3 Obstacle clearance is guaranteed at the MDA/H and DA/H, and during the missed approach when the appropriate profile is maintained.

4.7.4 The MDA/H is the lowest altitude or height that can be used during a 2D approach in IMC, with pilots being able to fly at but not below the MDA/H, providing all other previous minimum segment altitudes have been followed, until reaching the missed approach point (MAPt). Flight below the MDA/H reduces the clearance above obstacles and is not permitted in IMC.

[12] Note that Part 121 of CASR has different alternate aerodrome requirements: see Chapter 4 of the Part 121 MOS and AC 121-11.

4.7.5 The DA/H is the lowest allowable altitude or height during a 3D approach in IMC before initiating a missed approach (assuming the required visual criteria was not established at or before the DA/H and the approach continued to a landing). The design of a 3D approach accounts for aircraft inertia resulting in a slight descent below the DA/H during the initiation of a missed approach before the aircraft begins climbing. Pilots must not unduly delay commencing the missed approach climb however this does not mean unusual aircraft manoeuvres are necessary, just that the pilot actions their normal aircraft missed approach procedures without delay. The pilot must initiate a missed approach by no lower than the DA/H.

4.7.6 See section 15.11 of the Part 91 MOS for the mandatory requirements to continue the approach to landing below the MDA/H or DA/H.

4.8 Manual Altitude Temperature Correction

4.8.1 All IAPs rely on a barometric altimeter reference for the pilot to conduct the approach. Barometric altimeters reference air pressure and are calibrated to the International Standard Atmosphere (ISA). The subscale setting on a barometric altimeter compensates for variations of atmospheric pressure from ISA, but the accuracy of the altimeter remains affected by temperature deviations from ISA.

4.8.2 Temperatures above ISA effectively expand the atmosphere, which makes any indicated altitude physically higher and further from obstacles. Whereas temperatures below ISA effectively compress the atmosphere, which makes any indicated altitude physically lower and closer to obstacles. Hence temperatures below ISA reduce obstacle separation, until the reduction in obstacle clearance becomes unsafe in the event of large deviations below ISA temperatures.

4.8.3 All altitude information, for all IAPs, have been designed and calculated for ISA conditions. In Australia, temperature correction to an IAPs procedure altitudes, including MDA/H or DA/H, must be made when the temperature at the QNH source (usually the destination aerodrome) is 15 degrees Celsius less (colder) than the ISA temperature (ISA minus 15) for the elevation of the ground at the QNH source (again, normally the destination aerodrome).

4.8.4 Manual altitude **temperature correction** charts, for any IAP, when flown at temperatures less (colder) than ISA minus 15 are **available in AIP DAP[13] page 1-1 paragraph 1.5 and AIP DAP pages 2-2 and 2-3**. These charts enable pilots to calculate the appropriate cold temperature additive to add to the procedure altitude values, including MDA/H or DA/H, published on the IAC.

4.8.5 Conducting approaches without temperature correction, when the QNH source (usually the destination aerodrome) temperature is less (colder) than ISA minus 15 results in unsafe lower and flatter (shallower) approaches.

Key points

Manual altitude **temperature correction** is required for all IAPs, if temperature is colder than ISA minus 15, unless *temperature compensation* is used that adjusts procedure altitudes and MDA/H or DA/H.

Temperature compensation is the capability of a navigation system to calculate and adjust the VNAV guidance displayed to pilots and some or all procedure altitudes coded into the database for the IAP. See section 8.4 for information on temperature compensation.

[13] The Australian AIP is divided into multiple documents all separately available in electronic form without charge from the Airservices Australia website (Aeronautical Information Package (AIP) - Airservices). The AIP DAP, or the Departure and Approach Procedures, is available in 2 documents, DAP East which includes the aerodromes in the eastern half of Australia and DAP West which includes the aerodromes in the western half of Australia.

Pilots must confirm the navigation system's compliance with RTCA/DO-236() Appendix H.2 or an equivalent airworthiness approval, and also the temperature compensation's specific capability and limitations before use.

4.9 Licencing

4.9.1 Part 61 of CASR introduced changes to harmonise the qualifications required by pilots to conduct a flight under the IFR with the standards specified in ICAO Annex 1 Personnel Licensing. For IFR flight, including instrument departures and approaches, a person is required to be Part 61 qualified, have ongoing proficiency and continuing recency:

4.9.2 Part 61 qualification

4.9.2.1 A pilot has a qualification to fly under the IFR if they hold the following licence and rating combinations:

- Air transport pilot licence with an aeroplane category rating (ATPL-A) or powered-lift category rating (ATPL-PL)[14]
- Private pilot licence (PPL), commercial pilot licence (CPL), or ATPL-H, and an Instrument Rating (IR)
- PPL or CPL, and a private IFR rating (PIFR).

4.9.2.2 PIFR and IR holders must also hold endorsements that define the privileges of the ratings. The kinds of endorsements are different between the PIFR and IR.

4.9.2.3 The PIFR is highly modular, with 26 separate endorsements available covering category/class, navigation, departure, approach/arrival, and night operations. Each kind of approach, such as ILS, NDB, RNP APCH – 2D, requires a separate endorsement.

4.9.2.4 For the IR, there are no specific navigation aid endorsements. Two broader navigation endorsements, based on the navigation guidance information used by the pilot, reflect the differences in cognitive skills used to manage the lateral and vertical flightpath of the aircraft. These are:

- IAP 2D, where only lateral instrument guidance is provided. The vertical path of the aircraft is managed without reference to instrumented vertical path guidance. For example, a LLZ approach with a pictorial profile representation of a CDFA with altitude restrictions as steps.
- IAP 3D, where the pilot is provided with both lateral and vertical instrumented navigation guidance (e.g., ILS).

4.9.2.5 The holder of an ATPL-A or ATPL-PL does not need to hold an IAP 2D or IAP 3D endorsement. However, they are required to demonstrate competency conducting both 2D and 3D instrument approach operations, in the flight test for the grant of the licence or associated category rating.

4.9.2.6 For ATPL and IR holders, the removal of specific navigation aid endorsements provides for the introduction of new technology and alternative presentations of navigation guidance information. Prior to conducting an approach of a specific kind, such as NDB, pilots must demonstrate competency conducting an approach with each kind of procedure.

4.9.2.7 Part 61 also provides for the differences in the display of lateral navigation (LNAV) guidance. Where an ATPL or IR holder wishes to use either of the different LNAV display options they must have demonstrated competency in each kind of procedure, being:

[14] At the time of publishing v1.0 of this AC, it is not possible to obtain an ATPL-PL in Australia as no knowledge or competency standards have been developed.

- a lateral deviation/displacement from a defined path or track, presented as either a distance or angle to or from a selected station or waypoint by a course deviation indicator (CDI) type display, the origin being the VOR instrument

  or

- a relative bearing from a specified point or beacon, presented as an angle to or from a selected station or waypoint by a remote magnetic indicator (RMI) or an automatic direction finder (ADF) providing azimuth guidance, the origin being the ADF instrument for tracking off an NDB.

4.9.2.8 Likewise, Part 61 provides for differences in completing the IAP via a circling approach. Where an ATPL or IR holder wishes to conduct a circling approach, they must have completed a circling approach during their last instrument proficiency check (IPC). PIFR holders are subject to flight review requirements.

4.9.3 Ongoing proficiency

4.9.3.1 To operate under the IFR, ATPL and IR holders are required to complete an annual IPC. PIFR holders are required to complete a PIFR flight review every 2 years.

4.9.3.2 In some cases, pilots completing operator proficiency checks or participating in a training and checking system may meet the ongoing proficiency requirement in a different way. Likewise, pilots may meet the IPC requirement by completing a flight test for certain licences, ratings or endorsements.

4.9.3.3 Pilots of aircraft certified for multi-crew operations must complete an IPC in a multi-crew certified aircraft within the previous 24 months.

4.9.3.4 Pilots conducting a flight under the IFR in a turbo-jet powered aircraft as a single pilot operation must have completed an IPC in a single plot turbojet aircraft within the previous 12 months.

4.9.4 Continuing recency

4.9.4.1 Recent experience requirements aim to ensure pilots maintain competency to conduct operations under the IFR between formal assessments. ATPL and IR holders must have completed within the previous 90 days:

- 3 instrument approach operations to be able to fly under the IFR
- 1 instrument approach operation of the type to be used (2D or 3D)
- 1 instrument approach operation using the lateral guidance instrumentation type to be used (azimuth or CDI).

Note: Pilots completing operator proficiency checks or participating in a training and checking system may be able to meet recency requirements in a different way. See regulations 61.685 and 61.870 of CASR.

4.9.4.2 The recency requirements are different for PIFR holders:

- To act as PIC during an IFR flight, the pilot must have piloted an aircraft under the IFR as PIC within the previous 6 months.
- To conduct a specific kind of instrument approach in IMC as PIC, the pilot must have conducted 1 instrument approach operation of the kind being used (NDB, ILS, RNP APCH-2D etc.) within the previous 6 months in an aircraft of the same category (or approved flight simulation training device).

5 Standard Instrument Departures (SIDs)

5.1 Reserved

6 Standard Instrument Arrivals (STARs)

6.1 Reserved

7 Non-Precision Approaches (NPAs)

7.1 What is a Non-Precision Approach (NPA)?

7.1.1 The term NPA has been historically used to describe an instrument approach procedure (IAP) that was not a PA. With the advent of APVs the term NPA now refers to an instrument approach procedure other than an APV or PA.

7.1.2 NPAs use **NDB, VOR, LOC** or **GNSS** navigation systems (**RNP APCHs with LNAV and LP minima**) for lateral course guidance and are characterised by:

- being a 2D procedure, lacks any externally referenced electronic vertical course guidance
- an MDA/H
- a MAPt.

Some avionics may display the electronic coded data of a 2D NPA approach presenting it as a 3D operation with a glideslope. This is known as **advisory VNAV guidance (sometimes called LNAV+V)**, but this is not externally referenced and is still an NPA which was designed as a 2D operation, not an APV or PA. See section 4.3 for 2D and 3D approach requirements.

The displayed **advisory VNAV guidance (LNAV+V)** glideslope may not comply with 2D altitude limitations (step-down profile or descent steps) of the IAP. Therefore, when using **LNAV+V guidance** the pilot must confirm, during flight, that the displayed glide path complies with the 2D altitude limitations of the IAP.

7.1.3 NPAs are designed to permit safe descent to an MDA/H, noting obstacle clearance is not assured if descent below the MDA/H occurs. Pilots need to ensure that the aircraft's descent has ceased on reaching the MDA/H, unless the pilot has met the relevant visual reference requirements to continue below MDA/H for a landing or to conduct a circling approach.

7.1.4 The minima line on the IAC is indicated by combinations of either:

- the navigation aid that provides the navigation service (NDB, VOR etc.)
- LNAV or LP for GNSS based procedures

Note: LP minima lines will not be published in Australia until the satellite-based augmentation service (SBAS) for Australia and New Zealand, SouthPAN, is certified for aviation safety of life services and the relevant approach procedure with an LP line of minima is designed and certified.

- the circling minima.

7.2 Reference QNH for NPAs

7.2.1 An NPA is designed with specific tolerances for different QNH sources to ensure the approach remains accurate and safe.

7.2.2 As per subsection 14.03(1) of the Part 91 MOS, before passing the IAF the QNH must be set, being either:

- actual aerodrome QNH from an approved source
- forecast aerodrome QNH from an authorised weather forecast (see subsection 1.07(6) of the Part 91 MOS for the definition of *aerodrome forecast*)

- forecast area QNH from the Australian Bureau of Meteorology (see subsection 1.07(6) of the Part 91 MOS for the definition of area QNH).

7.2.3 Requirements and adjustments that may arise from the use of different altimeter sources are detailed below.

An actual aerodrome QNH cannot be used for an IAP more than 15 minutes after receiving it. See subsection 14.03(2) of the Part 91 MOS.

In cases where **no allowance** for the accuracy of the QNH source is applied in the IAP design, the actual aerodrome QNH is expected be used, as indicated by **no shading** in the minima box on the approach chart. This typically applies when a 24-hour air traffic service is available to provide the actual aerodrome QNH.

When a 100 ft barometric **allowance** is incorporated into the design this is indicated by **grey shading** in the minima box on the approach chart. The barometric allowance is included in the published MDA/H (landing minima) to account for errors in the **forecast aerodrome QNH**. If the actual aerodrome QNH is available, such as from an Automatic Weather Station, the 100 ft tolerance for forecast accuracy is not required, and the MDA/H can be reduced by 100 ft.

If the **minima box is grey shaded** (indicating a 100 ft barometric allowance) and an aerodrome QNH (either forecast or actual) is not available, a **forecast area QNH** may be used. However, the 100 ft allowance may not be sufficient to account for the accuracy of the forecast area QNH, and the pilot **must add 50 ft** to the published MDA/H (landing minima) when using an area QNH.

7.2.4 If the QNH setting is incorrect, the altimeter will reference an incorrect datum (QNH) and provide altitude based on that incorrect datum. This will lead to incorrect altitude indications during the approach, potentially causing either inefficiency (lower QNH values result in higher approach altitudes) or unsafe conditions (higher QNH values result in lower approach altitudes).

7.2.5 Altitude errors caused by incorrect QNH settings cannot be detected by cross-checking distance versus altitude profiles. It is recommended to perform a gross error check when setting QNH by comparing with forecast aerodrome QNH or area QNH, if available. Furthermore, paying particular attention to accurately transferring the supplied QNH value onto the altimeter subscale is critical in preventing errors related to QNH settings.

7.2.6 When available on an aircraft, radar altimeters, ground proximity warning systems (GPWS), or enhanced ground proximity warning systems (EGPWS) offer a safeguard against incorrectly set QNH values. These systems provide height relative to the actual or predicted terrain ahead of the aircraft and may offer early warning of controlled flight into terrain.

7.3 Lateral guidance for NPAs

7.3.1 For holding and approach procedures using timing to limit tracking, the IAP design includes an allowance for adverse winds. However, pilots should not rely solely upon the IAP design allowances. Adjustment to the procedure timing should be made for known or estimated winds to ensure that the aircraft remains within the designed obstacle protection area and the approach is flown within normal rates of descent.

7.3.2 Lateral guidance is displayed in two basic forms, being:

- a lateral deviation/displacement from a defined path or track, presented as either a distance or angle to or from a selected station or waypoint by a CDI type display, the origin being the VOR instrument

  or

- a relative bearing from a specified point or beacon, presented as an angle to or from a selected station or waypoint by an RMI or ADF providing azimuth guidance, the origin being the ADF instrument for tracking off an NDB.

Due to the difference in lateral navigation guidance and how this is represented and displayed to the pilot, the use of either presentation requires the pilot to be qualified, proficient and recent prior to conducting either guidance for an approach. See section 4.9 Licensing for more details.

7.3.3 Approaches based on conventional ground-based navigation aids (NDB, VOR, DME, outer or middle markers) may be conducted using GNSS guidance, instead of guidance from the designed ground-based aid, under certain circumstances. This substitution is allowed where the navigation system can achieve the required navigation specification for the segment of the approach (or phase of flight) as indicated in subsection 14.05(2) of the Part 91 MOS. This substitution of GNSS for ground-based aids is referred to as an 'overlay approach'.

GNSS may be used as an 'overlay' or substitute to a ground-based navigation aid for the procedure or phase of flight mentioned in column 1 of the Table 12 below, only if the aircraft is approved for operation under the particular navigation specification shown in the corresponding line of column 2.

Operators and pilots should ensure the navigation database includes the appropriate 'overlay' procedure to support use of GNSS as a substitute to a ground-based navigation aid. Operators must regularly check the navigation database for integrity and report any discrepancies as stated in section 14.07(5) of the Part 91 MOS.

Table 12: Copy of Table 14.05 (2) from 91 MOS - Use of GNSS instead of a ground-based navigation aid

Item	Column 1 Procedure or phase of flight	Column 2 Navigation specification
1	En route phase	RNP 2
2	SID or STAR	RNP 1
3	Initial, intermediate or missed approach segment	RNP 1
4	Final approach segment	RNP APCH

7.3.4 Substituting the lateral guidance provided by NDB or VOR with GNSS when conducting a GNSS arrival or DME or GNSS arrival **is not permitted**. This is due to the lateral navigation tolerances for the ground-based aids getting smaller as you get closer to the ground-based navaid. The lateral GNSS guidance does not change with distance (it does not get smaller as you get closer to the NAVAID) but is determined by a navigation specification defined for each segment of an IAP, which does not give an equivalent navigation tolerance at small distances from the NAVAID.[15]

7.3.5 Substitution of GNSS for a decommissioned ground-based NAVAID **is not permitted**. Once the ground-based NAVAID is decommissioned there is no monitoring of obstacles or obstructions in its vicinity. As a result, the pilot has no assurance that the designed obstacle clearances and minima is appropriate and safe to use.[16]

[15] See section 14.04(1)(a) and 14.05(1A) of the Part 91 MOS.

[16] See section 14.05(4) of the Part 91 MOS.

7.4 Vertical guidance for NPAs

7.4.1 Australian NPAs are published with specific segment minimum safe altitudes at various points along the approach, and pilots must ensure that these steps or descent limitations are complied with while following the approach path.

7.4.2 NPA procedures may also feature a distance/altitude table to assist pilots in managing the vertical flight path. At each stage of an NPA a segment minimum safe altitude, depicted as a 'not below altitude' identifies the lowest altitude that provides the required obstacle clearance. Australian IAC contain grey shading beneath the segment minimum safe altitude to graphically indicate the presence of obstacles or terrain to aid vertical situational awareness. See Figure 3 below.

7.4.3 An NPA with a straight-in approach minima, while being a 2D approach, may be flown using the CDFA technique (refer to section 4.3 of this AC) by planning a constant angle vertical path. This can be achieved by calculating an approximate RoD that will achieve the glide slope angle of the approach, considering the ground speed being flown. The approach is then monitored against the segment minimum safe altitudes colloquially referred to as steps or descent limitations, where the RoD is adjusted so that the aircraft is flown above the steps, keeping the approach not below the segment minimum safe altitudes indicated on the profile.

The CDFA technique is recommended to facilitate a stabilised approach, as it reduces the adjustments in power and attitude required to manage the vertical path of the aircraft. CDFA is recognised as an effective method to mitigate the risk of CFIT.

Flying an NPA using the CDFA technique based on a pilot calculated approximate RoD is **not** a 3D operation. A 3D operation requires some form of displayed glidepath (which could be advisory or certified).

7.4.4 Pilots conducting a 2D NPA with advisory VNAV guidance, such as LNAV+V, must confirm that the flown CDFA complies with the altitude limitations of the procedure. Although LNAV+V provides an advisory vertical path, pilots must still adhere to the published segment minimum safe altitudes, such as the step-down profiles or the MDA/H, and ensure they do not descend below the prescribed minima when initiating a missed approach.

Obstacle clearance is not provided below segment minimum safe altitudes as indicated by the shaded areas.

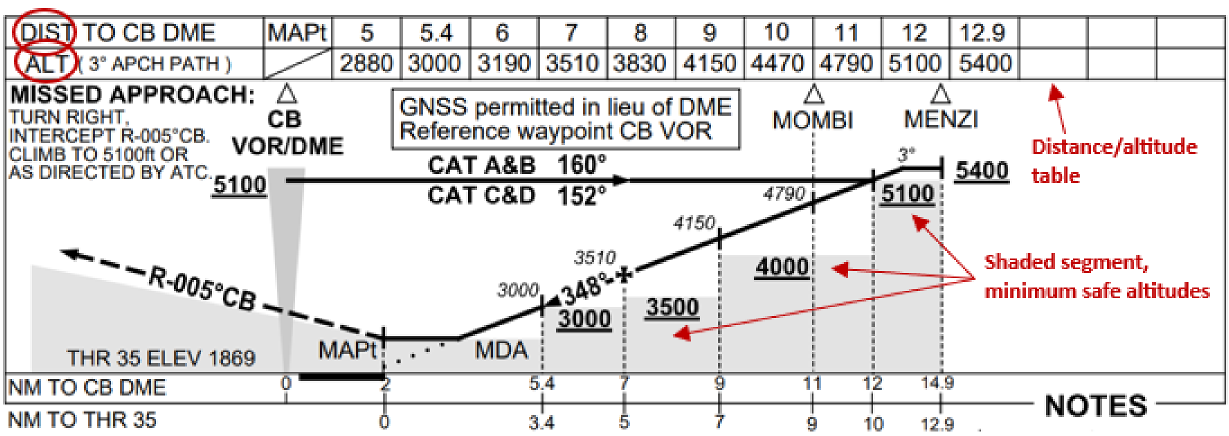


Figure 3: Extract of IAC showing distance/altitude table and shaded segment minimum safe altitudes

Source: Airservices Australia.

7.5 Landing minima for NPAs

7.5.1 For an NPA the landing minima is expressed in terms of visibility and MDA/H. The visibility can be either a runway visibility or runway visual range (RVR) depending on if the aerodrome infrastructure supports providing RVR measurements. The MDA/H is the minimum altitude or height that can be used without having the required visual reference.

> **Note:** See section 15.10 of the Part 91 MOS for details how to determine landing minima.
>
> For adjustments to procedure altitudes including MDA/H, see section 4.8 of this AC for manual altitude temperature correction and section 8.4 of this AC for temperature compensation.

7.5.2 By design, upon reaching the MDA/H, but not below this altitude/height, flight can continue at or above the MDA/H until reaching the MAPt. The intention is, before reaching the MAPt, the conditions allow for a descent for landing whilst maintaining the required visual references. When level flight at the MDA/H is continued beyond the point where the vertical descent path meets the MDA/H a straight-in landing may not be possible as abnormally high rates of descent may be necessary, hence a circling approach would need to be conducted.

> **Note:** See section 15.09 of the Part 91 MOS for landing minima requirements.

7.5.3 If the required visual references do not exist for a landing or circling, then when the aircraft reaches the MAPt a missed approach must be initiated.

> **Note:** See section 15.11 of the Part 91 MOS for missed approach requirements.

> Pilots must ensure that the aircraft does not descend below MDA/H unless the required visual reference has been established.
>
> See section 15.11(2)(b) of the Part 91 MOS for what constitutes the required visual reference.

7.5.4 Every NPA will provide for a circling approach where the landing minima on the IAC contains a line annotated 'circling', which is the circling approach minima. For IAP designs enabling a straight-in (S-I) approach, the NPA will provide a straight-in minima as well as a circling approach minima.

7.5.5 At some locations, even though the final approach segment is aligned with the runway, only a circling minima is published. This occurs when the design criteria for a straight-in approach cannot be met. In these circumstances, if a pilot assesses that the aircraft is in a suitable position to land straight-in and it is safe to do so, the pilot can conduct a straight-in landing provided the requirements for a circling approach are met.

7.5.6 Where the same navigation infrastructure is utilised to provide the same lateral guidance, there may be other landing minima lines listed, such as APV or PA landing minima along with NPA landing minima. See Chapter 6 for APV and Chapter 7 for PAs.

CATEGORY	A	B	C	D
CIRCLING *	**520** (510-2.4)		**1010** (1000-4.0)	**1230** (1220-5.0)
ALTERNATE	(1010-4.4)		(1500-6.0)	(1720-7.0)

Figure 4: Example 1 - Circling landing minima only (no shading in minima box)

CATEGORY	A	B	C	D
S-I VOR/DME	**2880** (1011-4.9)			
CIRCLING *	**3350** (1463-2.4)		**3580** (1693-4.0)	**3720** (1833-5.0)
ALTERNATE	(1963-4.4)		(2193-6.0)	(2333-7.0)

Figure 5: Example 2 - Straight-in and circling landing minima (shading in minima box, see section 7.2)

CATEGORY	A	B	C	D
LNAV/VNAV	**680** (617-3.5)		NOT APPLICABLE	
LNAV	**810** (745-4.3)			
CIRCLING	**1010** (945-2.4)			
ALTERNATE	(1445-4.4)			

Figure 6: Example 3 - LNAV/VNAV, LNAV only and circling landing minima (shading in minima box, see section 7.2)

7.6 Landing from an NPA (circling or straight-in)

7.6.1 To land from an NPA IAP a transition to flight using visual references, instead of instrument references, is required. This visual segment (remember that 'visual' in this context is not the same as VMC) may be either:

- a circling approach that requires manoeuvring to align the aircraft with the landing runway
- a ‘straight-in’ landing
- a visual leg from a point where the MDA is reached to the circling area of the aerodrome.

7.6.2 When transitioning to flight using visual references, the pilot must be fully aware that the IAP design protections no longer exist. At this stage, the design of the IAP, via lateral and vertical guidance, no longer guarantees obstacle clearance. Instead, the protection from obstacles is now achieved by being visual with them or remaining inside the circling area at or above the circling minima.

7.6.3 The IAC contains landing minima, in the form of straight-in landing minima and/or circling approach minima, that specify a vertical limitation and/or minimum visibility that now must be used to maintain an appropriate obstacle clearance visually from the obstacles. This requires heightened situational awareness, precise flight path management, and proactive decision-making to ensure a safe and controlled landing.

7.6.4 If weather conditions are at or above visual meteorological conditions (VMC), a pilot is not required to continue executing the IAP or its associated visual extension. Instead, they may transition to flight in VMC, as the prevailing conditions provide sufficient visual references to safely navigate and land without reliance on the IAP or a circling procedure.

Visual flight requires minimum weather conditions, being either:

- under the **IFR**, defined by the IAC **landing minima**, or
- under the **VFR**, defined by the **VMC criteria**.[17]

7.6.5 Visual circling manoeuvres

Note: This section (7.6.5 Visual Circling Manoeuvres) also applies to APVs and PAs, if the situation arises, and is not limited to NPAs only.

7.6.5.1 Visual circling manoeuvres, referred to as ‘circling’ in Australian terminology, describes the phase of flight used to position an aircraft for landing on a runway that is not aligned for a straight-in approach[18].

7.6.5.2 Circling is a visual extension of an instrument approach from at or above the published circling MDA/H, flying part of the circuit to align with the intended runway and descending to land. When below the published circling MDA/H, the responsibility for maintaining adequate obstacle clearance remains with the pilot and caution should be exercised.

7.6.5.3 Each circling situation is different due to variables such as aerodrome runway layout, final approach track, terrain, obstructions, wind and weather conditions. Consequently, there can be no single procedure that defines the conduct of a circling approach in every situation.

There are 3 distinct visual manoeuvres that must be recognised as being distinctly different and are appropriate under different circumstances:

- A **VFR circuit**, only possible under VFR conditions, see AIP ENR 1.1 paragraph 9.12
- A **visual approach**, during specific circumstances under the IFR while not commencing or discontinuing an IAP, see AIP ENR 1.5 paragraph 1.15. Alternatively, when cleared for a **visual approach** while VFR in controlled airspace, while not relevant to IFR see AIP ENR 1.5 paragraph 1.16
- **Circling**, a visual extension of an instrument approach as described in this section.

7.6.5.4 Circling inherently carries higher levels of risk compared to other types of approaches. This is primarily due to the manoeuvring required at low altitudes and low airspeeds during the final segment, which increases the potential for loss of control or terrain collision. These risks are further exacerbated when circling approaches are conducted under marginal or reduced visibility conditions, demanding heightened situational awareness and concentration from pilots.

7.6.5.5 In IMC, transitioning from instrument references to visual ground references during a circling approach can introduce additional challenges. For instance, the phenomenon of illusion of high speed may occur if pilots do not maintain consistent monitoring of their instruments during this critical phase.

7.6.5.6 While circling, all these factors can lead to un-stabilised approaches which add further flight risk.

[17] See section 2.07 of the Part 91 MOS for the VMC criteria.

[18] A final approach track not align within ±30° of the runway centreline for Category A or B operations and within ±15° for Categories C or D operations, is not a straight-in approach procedure, which then requires circling to align with the runway and land.

7.6.5.7 Careful planning, evaluation of weather conditions, and adherence to stabilised approach criteria are essential to mitigate these risks and ensure safe circling approach operations. Prior to initiating a circling approach, ensure that it is the most appropriate course of action under the circumstances. Subsequently, thoroughly brief the approach procedure, develop a detailed execution plan, and critically assess any operational limitations that may impact its safe completion.

7.6.5.8 The requirements[19] for circling are:

a. Laterally, the pilot should manoeuvre the aircraft, at or above the circling minima, while continuing to:
   i. **maintain visual reference** with runway environment or runway of intended landing, and
   ii. remain within the **circling area**, and
   iii. **intercept normal circuit** on downwind, base or final approach path.
b. Vertically, while maintaining the lateral requirements above, descent below the promulgated circling minima when:
   i. **visibility along intended flight path** is not less than the landing minima and visual reference is maintained throughout the manoeuvre, and
   ii. a **continuous descent** to the landing threshold can be made using rates of descent and flight manoeuvres which are normal for the aircraft type, and
   iii. **maintain obstacle clearance** of 300ft (CAT A&B) or 400ft (CAT C&D) until the aircraft is aligned with the landing runway.

7.6.5.9 Conditional early descent below MDA/H is available when the visibility allows for the required obstacle clearance of 300 ft (Categories A and B) or 400 ft (Categories C and D) to be maintained until the aircraft is aligned with the landing runway. Accordingly, this is limited to operations during daylight hours, as obstacles are likely not visible at night. Where this is possible an early descent below the circling MDA/H should only occur when necessary to avoid weather and remain visual, but this same weather may preclude maintaining the required obstacle clearance and maintaining the required visual reference. Final descent to land occurs when visually aligned with the landing runway using normal rates of descent and flight manoeuvres for the aircraft type. Remembering that any descent below circling MDA/H reduces separation with obstacles and caution must be exercised.

SAFETY CRITICAL INFORMATION

The information provided by spot heights on IAL charts must be treated with caution. Spot heights on IAL charts do not necessarily indicate the highest terrain, or all obstacles in the circling area.

Visual circling conducted at or above the circling minima will provide protection from obstacles within the circling area. Once the pilot initiates descent below published circling minima, the obstacle protection offered by the circling minima ends.

7.6.5.10 Where an IAP contains areas of no circling, this only applies to circling manoeuvres being a visual extension of an IAP. During daylight hours, in weather conditions at or above VMC, when

[19] Regulation 91.305 of the CASR defines minimum height for IFR flight, while (3)(b)(ii) allows flight below these minimum heights when the aircraft is flown in accordance with an authorised instrument approach procedure (IAP). When the IAP contains a circling minima, these requirements for circling are the conditions that must be met to be in accordance with the procedure which then allows flight below CASR 91.305 minimum heights, at or above the circling minima.

visual circling is discontinued because a normal VFR circuit can be conducted at VFR heights, the IAP no circling area does not apply.

7.6.5.11 Where the circling requirements cannot be safely achieved a missed approach must be conducted, see section 7.7 for missed approaches.

7.6.5.12 Where a straight-in (runway aligned) approach is flown and circling is necessary, a circling manoeuvre should only be initiated at or above the circling MDA/H. The decision to conduct circling should only be made at or above the circling MDA/H. The published circling MDA is the minimum altitude at which an aircraft must remain to ensure obstacle clearance appropriate to its performance category (A, B, C, or D) within the whole circling area.

7.6.5.13 One technique that can be used to position the aircraft correctly within the circling area is shown at Figure 7, however there are multiple other flightpath options when conducting circling approaches. It is critical that pilots exercise sound planning and judgment and carefully evaluate current weather conditions and terrain information to ensure that the aircraft remains within the circling area. Pilots should discuss such techniques with their local instrument rating instructor or examiner.

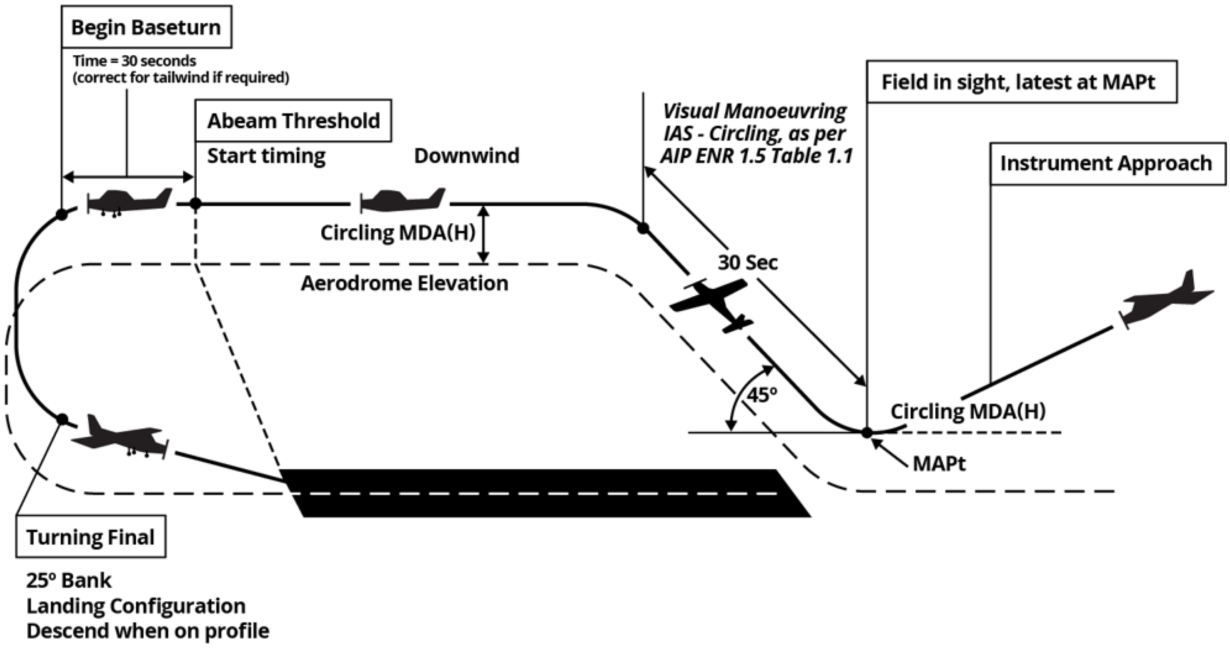


Figure 7: Typical visual circling manoeuvre

7.6.5.14 The lateral dimensions for circling area obstacle assessment areas are developed by instrument flight procedure designers in accordance with the standards and criteria contained in ICAO DOC 8168: Procedures for Air Navigation Services – Operations (PANS-OPS) Vol II. To remain within the circling area, pilots must be fully aware of:

- Size of the circling area; The circling area is determined by drawing an arc centred on the threshold of each usable runway and joining these arcs by tangents, see Figure 8 below. The radius used to define the circling area is calculated by the procedure designer using specific criteria including aircraft IAS at maximum for circling calculated at 1000 ft above aerodrome elevation, assumed 25 kts tailwind, lesser of 20° bank angle or standard rate 1 turn and ISA + 15°C temperatures. Aerodromes at higher elevations will have larger circling areas due to increased TAS, bank angles and turn radius parameters. See Table 13 below for the circling area radius values at indicative aerodrome altitudes.

- Maximum IAS when performing a circling approach; The maximum IAS values are provided in column 4 of Table 11 of section 4.4 above and in Table 13 below. If it is necessary to operate at a speed more than the maximum circling IAS for an aircraft's category, the MDA/H for the next higher performance category should be used. This may occur with certain aircraft types operating in conditions such as strong or gusting wind, icing, or emergency/non-normal events.

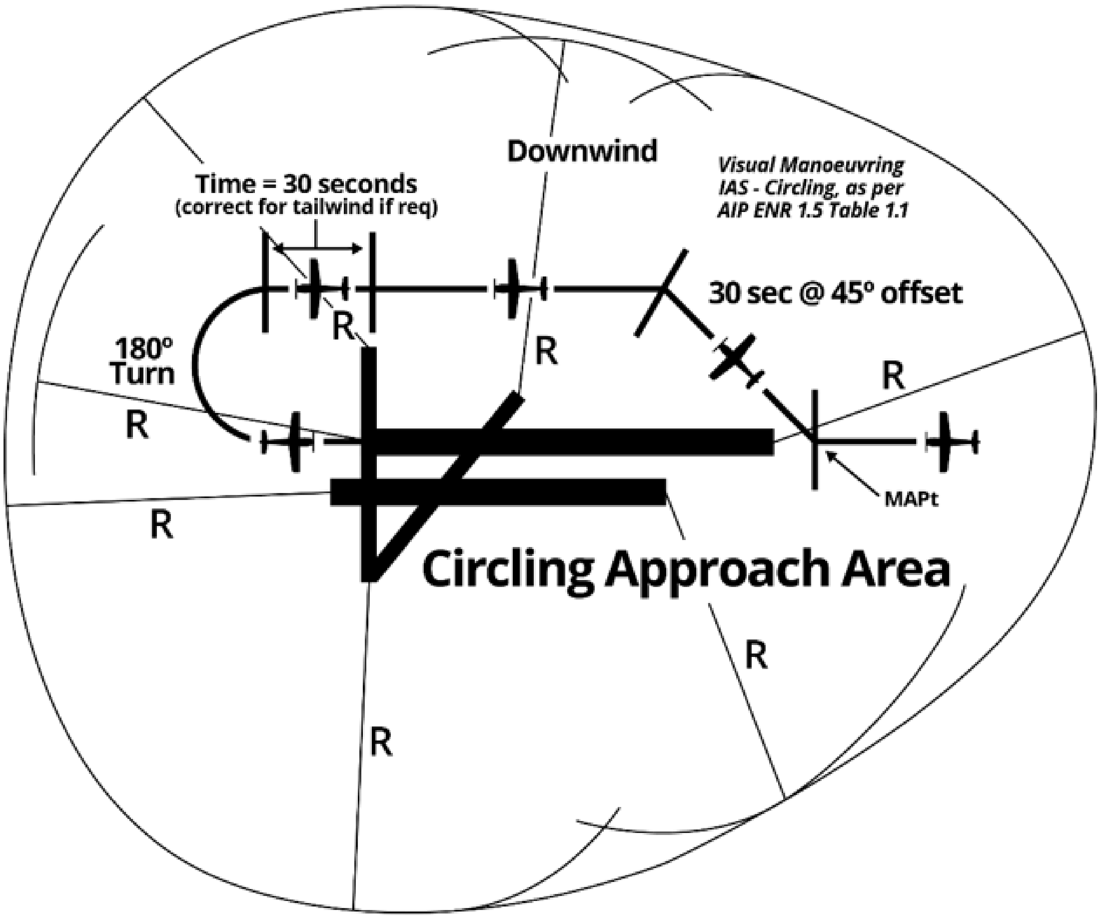


Figure 8: Example of Circling Area within which obstacle assessment has occurred

Source: AIP ENR 1.5 paragraph 1.6.7.7.

Table 13: Actual circling area radius values for varying aerodrome elevations and aircraft performance categories

Note: These radius values are valid for aerodromes at these exact altitudes only (0FT or sea level, 1000FT AMSL, 2000FT AMSL etc). The historical values used for many years (CAT A 1.68NM, CAT B 2.66NM, CAT C 4.20NM, CAT D 5.28NM and CAT E 6.94NM) were taken from an ICAO example of an aerodrome at 1000FT but did not contain an explanation that values increase at altitude and should not be used. The table values below for aerodromes at 1000FT increments are exact values at these elevations only.

Aircraft Performance Category		CAT A	CAT B	CAT C	CAT D
Max IAS for Visual Manoeuvring (Circling)		100KT	135KT	180KT	205KT
Aerodrome elevation AMSL	At 0FT	1.67NM	2.59NM	4.11NM	5.15NM
	1000 FT	1.69NM	2.65NM	4.21NM	5.28NM
	2000FT	1.70NM	2.71NM	4.31NM	5.40NM
	3000FT	1.74NM	2.77NM	4.41NM	5.54NM
	4000FT	1.77NM	2.83NM	4.52NM	5.67NM
	5000FT	1.81NM	2.90NM	4.63NM	5.82NM

Source: Adapted extract from AIP ENR 1.5 paragraph 1.6.5.

7.6.5.15 Considering higher elevation aerodromes, nothing precludes operators or PICs using the next lower whole 1000 ft elevation value, for a closer approximation of the actual circling radius.

Example (circling area dimensions)

For Category B aircraft operations at Canberra airport (ICAO identifier YSCB, aerodrome elevation 1887 ft), the circling area is based on arcs determined by instrument flight procedure designers in accordance with ICAO standards.

The actual circling area radius:

- will not be less than the 2.59 NM (CAT B sea level value), and
- will be between 2.65 NM (CAT B 1000 ft value) and 2.71 NM (CAT B 2000 ft value), hence will not be less than 2.65 NM, and
- will not be known by the pilot(s) (unless the aerodrome elevation is exactly a multiple of 1000 ft), and
- cannot be calculated by interpolation between the 1000’s of feet values as the radius does not vary linearly. Hence interpolation may give an unsafe value larger than the actual circling radius value.

SAFETY CRITICAL INFORMATION

Pilots can have surety that the aircraft is within the actual circling area, if the sea level circling area radii are referenced.

Key point

It is not recommended that Table 13 be memorised as this becomes too complex for pilot use during circling.

It is recommended that the 0 ft AMSL values (sea level) are memorised by pilots as the minimum circling radius values for each performance category.

7.6.5.16 Any cross reference with DME or GNSS distances is likely an approximate guide as actual circling radii are referenced to the nearest runway threshold.

SAFETY CRITICAL INFORMATION

Circling approaches require **visual manoeuvring** to align the aircraft with a suitable runway and can be very **hazardous if not executed safely**. The **responsibility** for maintaining adequate obstacle clearance **remains with the pilot** and caution should be exercised.

300 ft (Categories A and B) or 400 ft (Categories C and D) **clearance above obstacles must be maintained** while circling, until the aircraft is aligned with the landing runway.

7.6.5.17 To maintain obstacle clearance along the flight path, pilots must be fully aware of:

- The obstacles within the circling area (intended flight path); Terrain and obstruction elevations should be verified using all means possible including IAL charts, topographical maps, digital terrain databases and local knowledge. IAL charts provide spot heights but do not necessarily indicate the highest terrain, or all obstacles in the circling area. As such, pilots should always exercise caution when using spot heights and undertake thorough preparation before conducting a circling approach, especially for unfamiliar locations.
- The minimum obstacle clearance required within the circling area; The clearance above the highest obstacle within the circling area is Categories A and B - 300FT and Categories C and D - 400FT. These values are rounded for simplicity and may differ from those calculated by the procedure designer:
- Where a prominent obstacle or obstacles within the circling area prevent circling in that sector it may be eliminated from the visual circling area. Sectors which have been eliminated from the visual circling area are annotated No Circling. Under the IFR, circling is prohibited in No Circling sectors unless the pilot transitions from conducting the IAP and conducts a VFR circuit requiring VFR conditions. See section 2.07 of the Part 91 MOS for VMC criteria and Figure 9 for examples of no circling areas.
- If flight through the no circling area is prescribed as part of the final and/or missed approach, obstacle clearance is provided by the design of the procedure (refer Figure 9 below).

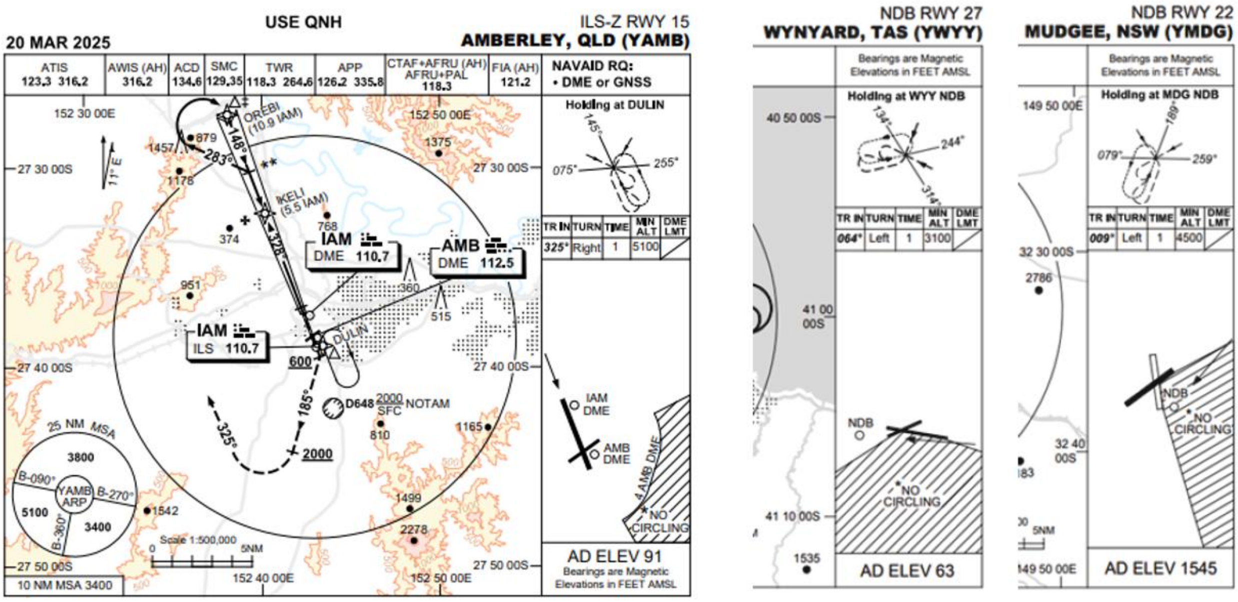


Figure 9: Example of No Circling Areas on IAC

Source: Airservices Australia.

7.6.5.18 If a pilot is operating in controlled airspace and conducting an instrument approach that requires circling, but circling is only permitted in one direction due to a designated no-circling area, they must obtain an ATC clearance for a visual approach if they intend to manoeuvre in the No Circling area while weather conditions are at or above VMC.

7.6.5.19 In uncontrolled airspace, if weather conditions are at or above VMC and permit VFR, a pilot is not required to obtain a clearance to deviate from the instrument approach or manoeuvre in the No Circling area. However, they remain responsible for maintaining situational awareness and must broadcast appropriate position reports and intentions to ensure traffic awareness and separation.

7.6.6 Straight-in Instrument Approach Procedures

7.6.6.1 An NPA that is aligned with a suitable runway that meets the instrument runway requirements may be designed to permit a pilot who becomes visual to continue descent and land ‘straight-in’. This is commonly referred to as a straight-in approach or runway approach. Straight-in NPA may be aligned with the runway centreline or may be offset by up to 15° (Category C & D) or 30° (Category A & B). Procedures with offset angles greater than 5° are designed such that aircraft cross the runway centreline no closer than 1,400 m to the threshold. For offset angles equal to or less than 5°, the final approach track is designed to be within 150 m of the runway centreline at 1,400 m. Some older procedures may use 900 m in place of 1,400 m.

7.6.6.2 A decision must be made, without descending below the MDA/H, to transition to visual flight or conduct a missed approach. To aid this decision, when conducting an IAP to the straight-in minima pilots may apply a safety buffer to the published MDA/H to allow time for the decision-making process. This allows for either level flight at or before reaching the MDA/H or smooth transition (CDFA) to the visual segment.

7.6.6.3 Straight-in approaches may be designed up to 30° from runway heading for a Category A or Category B aircraft, and up to 15° from runway heading for a Category C or Category D aircraft, in accordance with the design criteria in ICAO Doc 8618 PAN OPS Vol II. Where the final approach is not aligned with the runway heading, the final approach will intercept the runway centreline an appropriate distance from the runway to allow for aligning the aircraft with the runway.

7.6.6.4 For a safe straight-in approach the intent is for the pilot to establish the required visual reference at or before reaching the MDA/H, continue descent without significant changes to the descent rate, align the aircraft with the centreline, visually avoiding any terrain in the runway approach area and land on the runway. In many locations a straight-in approach has a lower MDA/H than the circling approach minima, due mainly to obstacle clearance area requirements. A lower MDA/H limits the amount of time and distance available to the pilot to complete the visual segment of the approach.

7.6.6.5 It is commonly acknowledged that straight-in approaches are safer than visual circling manoeuvres. In Australia, IAPs are designed as straight-in procedures wherever possible.

7.6.6.6 Multiple factors, including the final approach alignment, descent gradient, runway dimensions and obstacle limitation surfaces (OLS), all need to comply with the appropriate IAP design criteria. Where these criteria are met, a straight-in approach can be designed, but in those cases where compliance is not achievable only a circling approach minima will be published.

7.7 Missed approach procedures for NPAs

Note: Section 7.7 Missed approach procedures for NPAs also applies to APV and PAs, where not specifically applied to NPAs only.

7.7.1 The intent of the missed approach procedure is to allow the aircraft to return to a safe altitude while avoiding terrain and obstacles.

7.7.2 The intent is that a missed approach procedure is flown when the flight cannot safely continue for a landing.

7.7.3 At different positions during the IAP or the subsequent visual segment for landing, different factors can affect safety by removing the designed protections for that phase of flight. Once a required protection is removed or becomes compromised, continuing that phase of flight becomes unsafe, and a missed approach becomes the safest option.

Pilots knowing what designed protection exists for each phase of flight is critical to making a timely appropriate decision to execute a missed approach.

7.7.4 The missed approach can be initiated at any stage during the IAP or the subsequent visual segment for landing below the MDA/H (or DA/H), but must be flown if:

- during an instrument approach and below the MSA (as specified on the IAC) the performance of the radio/navigation aid becomes suspect, or the radio/navigation aid fails; (below the MSA the designed protection is the designed IAP which can't be flown without the NAVAID)
- during the final segment of an IAP, the aircraft is not maintained within the applicable navigational tolerance for the radio/navigation aid in use (see section 1.07(6) of the Part 91 MOS definition of *navigational tolerance*) (during the IAP the designed protection is 'staying on' the defined track of the IAP)
- at the MAPt (or DA/H), from which the missed approach procedure commences, visual reference has not been established (when continuing past the MAPt or DA/H to the visual segment to land, the designed protection is being able to see the landing environment and hence the surrounding terrain and obstructions)
- during a circling approach weather conditions are worse than those specified for circling (the design protection during a circling approach is being visual at a safe altitude with appropriate visibility)

- during a circling approach visual reference is lost (the design protection during a circling approach is being able to see where you are landing).

> **Note:** Refer to section 15.11 of the Part 91 MOS.

7.7.5 Due to the varied locations along an IAP where the pilot may decide to conduct a missed approach, it is not possible to describe all possible options and scenarios regarding when to conduct a missed approach. But the intent is that the aircraft avoids terrain and is climbed to conform to the missed approach tracking requirements.

7.7.6 For flights where the missed approach is initiated before the MAPt (or DA/H), the expectation is that the aircraft continues tracking as per the published IAP towards the MAPt (or DA/H) while climbing towards the missed approach altitude. At the MAPt (or DA/H) the aircraft then tracks as per the published tracking instructions for the missed approach.

7.7.7 For flights where the missed approach procedure is started at the MAPt (or DA/H), the expectation is that the aircraft tracks as per the published missed approach tracking instructions while climbing towards the missed approach altitude.

7.7.8 For flights where the missed approach is initiated from below the MDA/H (or DA/H), after initially descending visually, as the area directly above the aerodrome is generally free of hazardous obstacles the expectation is that the aircraft tracks overhead the runway or in a climbing turn towards the MAPt. From overhead the runway or the MAPt, the aircraft then tracks as per the published tracking instructions for the missed approach while climbing to the missed approach altitude.

7.7.9 For flights where the missed approach is initiated during circling, as the area directly above the aerodrome is generally free of hazardous obstacles and terrain clearance is assured within the circling area at and above the circling minima, the expectation is that the aircraft tracks in a climbing turn towards the aerodrome. The aircraft should continue climbing overhead the aerodrome while the aircraft tracks to establish flight on the published missed approach.

7.7.10 The missed approach procedure may use the same or a different navigation system from that used during the approach, depending on procedure design and available navigation infrastructure. Lateral tracking guidance may be provided for GNSS based approaches. Where the approach is based on ground-based aids, there may be tracking guidance based on a radial or azimuth. When no lateral guidance is provided the expectation is that the pilot will use dead reckoning (DR) to achieve the nominated track. Allowance for wind must be made to make good this nominated track.

7.7.11 The text of the missed approach procedure will take the form of: ‘Turn Left (or Right), Track xxx°, climb to…’

8 Approach Procedures with Vertical Guidance (APVs)

8.1 What is an Approach Procedure with Vertical Guidance (APV)?

8.1.1 Historically IAPs were only classified as NPA or PA. With technology advances with GNSS, the ability to have satellite based IAPs with vertical guidance which approach the accuracy of PAs has become possible. These GNSS approaches are called approaches with vertical guidance or APVs.

8.1.2 ICAO Doc 8168 PANS-OPS Volume I defines an APV as 'An instrument approach procedure which utilises lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations'. As such, APV is an approach classification that lies between NPA and PA and offers vertical guidance but does not offer the accuracy associated with PA procedures. APVs use GNSS technology to derive the lateral navigation solution and a vertical navigation solution based on either:

- a geometrically calculated vertical path that relies on barometric information from an air data system to indicate deviations from that path, with barometric input being needed to compute the VNAV component in **RNP APCH with LNAV/VNAV minima** (sometimes referred to as Baro-VNAV procedures) and **RNP AR APCH**

  or

- a geometrically calculated vertical path that relies on three dimensional GNSS positioning to indicate deviations from that path, where the GNSS is augmented to achieve this accuracy.

> **Note:** In Australia and New Zealand, this augmentation will be implemented by a space-based augmentation system (SBAS) called SouthPAN.
>
> This SBAS is not yet available for aviation use, hence **RNP APCH with LPV minima** (Localiser-like Performance with Vertical guidance) are not yet available.
>
> Approach procedures with Localiser-like Performance only – known as LP – will also be supported, but their lack of vertical guidance means they are NPAs.

8.1.3 APV's are characterised by being a 3D procedure, having a decision altitude or height (DA/H) minima.

8.1.4 The minima box on the IAC for an APV is indicated by combinations of either:

- LNAV/VNAV (GNSS based approach using Baro-aiding)
- LPV (GNSS based approach using SBAS - not yet available in Australia)
- RNP (0.x) (GNSS based RNP AR APCH which require the operator or pilot to hold a specific CASA approval), where the minima are represented as RNP 0.x where 0.x refers to the RNP value specific to the final approach segment (for example 0.3)
- the CIRCLING minima.

VNAV guidance derived from a barometric source, for LNAV/VNAV minima or for RNP AR APCH, is dependent on QNH and temperature.

Accurate **aerodrome QNH and temperature limits** or **temperature compensation must be used** for APVs with VNAV guidance derived from a barometric source (LNAV/VNAV minima and RNP AR APCHs).

8.1.5 Although not yet available in Australia, SBAS derived vertical guidance can be used to fly an LNAV/VNAV approach. The SBAS derived vertical path is not affected by temperature or QNH as it is based on the GNSS 3D position in space.

8.1.6 APVs are designed to permit safe descent to a DA/H by reference to instruments, beyond which the pilot must only proceed when the required visual references are established. If the required references are not established, the pilot must conduct the missed approach. When initiating the missed approach at the DA/H, the IAP accounts for the aircraft slightly descending below the DA/H prior to the start of climb, but pilots should not delay commencing the climb, although normal missed approach procedures should be followed (i.e. no abnormal manoeuvres are needed).

8.2 Reference QNH for APVs

8.2.1 The design constraints of non-SBAS APVs dictate that these approaches need to be referenced to an accurate local QNH which is sometimes known as an actual aerodrome QNH.

Note: Section 14.03 of the 91 MOS describes generally what sources of QNH are suitable for use for IAPs, but due to the design constraints of APVs the only source of QNH that is suitable for use while conducting an APV is an actual aerodrome QNH[20].

8.2.2 Therefore, before passing the IAF, the QNH must be set to the actual aerodrome QNH from an approved source, being either:

- Automatic Aerodrome Information Service (AAIS)
- ATC
- Automatic Terminal Information Service (ATIS)
- Aerodrome Weather Information Service (AWIS)
- Certified Air/Ground Radio Service (CA/GRS)
- Weather and Terminal Information Reciter (WATIR).

8.2.3 An actual aerodrome QNH cannot be used for an IAP more than 15 minutes after receiving it[21].

Note: For APVs using a barometric input for a VNAV solution (LNAV/VNAV minima or non-SBAS RNP AR APCH), an accurate VNAV is achieved by the navigation system only with reference to an accurate QNH. Therefore, APV approaches with LNAV/VNAV minima and RNP AR APCH are only published at aerodromes which have access to an approved source of accurate QNH.

[20] See section 14.03 (1)(a) of the Part 91 MOS.

[21] See section 14.03(2) of the 91 MOS.

SAFETY CRITICAL INFORMATION

Where an incorrect QNH is set on an APV, the navigation system will use the incorrect QNH and provide a VNAV path that ends at the correct lateral location but at a DA/H based on the incorrect QNH.

Read the remaining paragraphs in this section carefully.

See EUR OPS BULLETIN Serial Number 2023_001 for more information.

8.2.4 If a QNH larger than the actual aerodrome QNH is used, the VNAV will be below the desired flight path, which takes the aircraft closer to obstacles and terrain. For every 1 HPa over the actual aerodrome QNH, the flight path will be nominally 30 ft below the designed flight path.

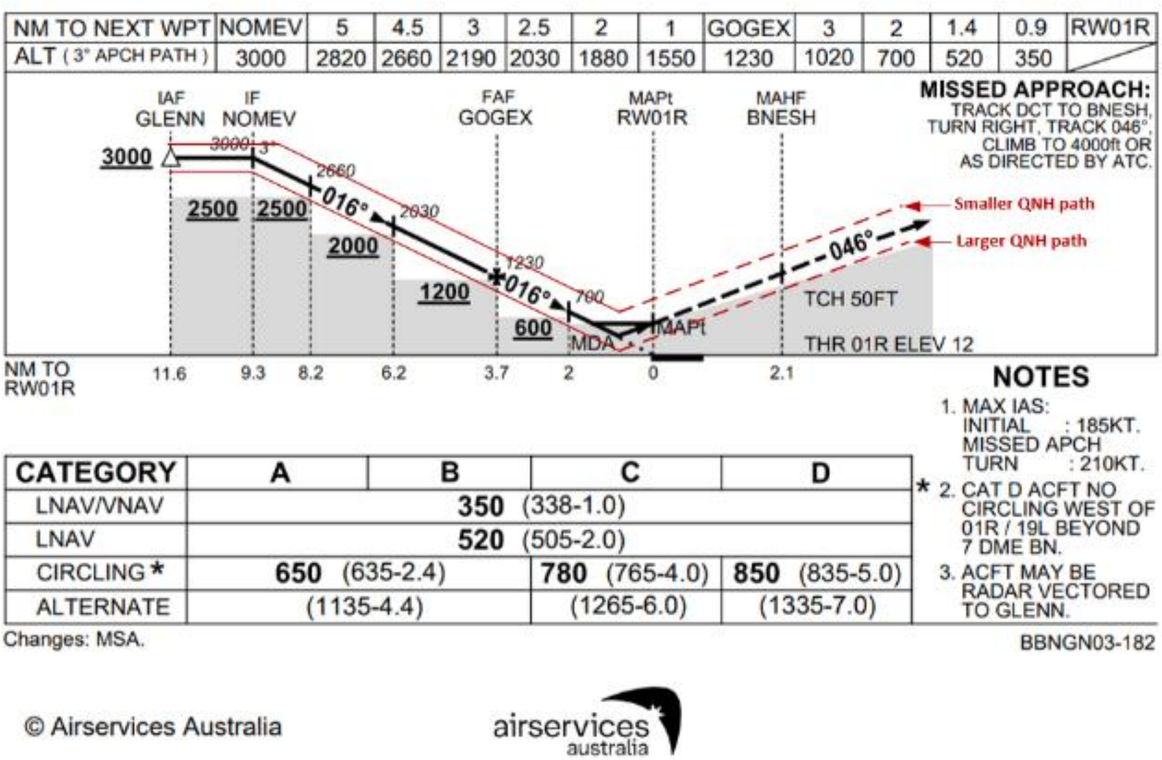


Figure 10: Brisbane RNP Z RWY 01R approach profile and minima showing various QNH paths

Source: Airservices Australia

8.2.5 If a QNH 1 HPa larger than the actual aerodrome QNH was used, the whole flight path would be nominally 30 ft closer to terrain than the designed flight path. Considering the segment minimum safe altitudes in the example in Figure 10 above, those at 6.2 and 3.7 NM to the threshold, the indicated altitudes would be 2030 and 1230 ft respectively but are now 30 ft lower and closer to terrain than allowed for in the design, which is effectively at the segment minimum safe altitudes. At the minima, the indicated altitude would nominally match the 350 ft minima, but the height above terrain would be 308 ft (not 338 ft).

8.2.6 This issue becomes more critical the larger the error above the actual aerodrome QNH. If the actual aerodrome QNH is 1003 HPa but 1013 HPa is used, the whole approach will appear as expected but will be flown nominally 300 ft below designed profile. In the example above in Figure 10, this would result in nominal altitudes of 1730 ft at 6.2 NM, 930 ft at 3.7 NM, 400 ft at 2 NM and 50 ft at DA/H (which is 38 ft DH, not 338 ft DH).

8.2.7 Similarly, if setting a QNH smaller than the actual aerodrome QNH, the aircraft will fly higher than the intended VNAV profile. For example, setting 1010 HPa when the actual QNH is 1016 HPa would result in the aircraft being 180 ft above the designed LNAV/VNAV terrain clearance at all points while indicating the nominal glide path as per the IAC. In effect the DA/H would be higher than the correct referenced QNH LNAV-only MDA/H, which is inefficient, reducing the likelihood of becoming visual and if visual could lead to challenges requiring higher than expected rates of descent to achieve landing.

Using **larger QNH values** than actual aerodrome QNH results in **unsafe flight paths** below the nominal VNAV flight path, but the indication will indicate the nominal flight path.

Using **smaller QNH values** than actual aerodrome QNH results in **inefficient flight paths** above the nominal VNAV flight path, but the indication will indicate the nominal flight path.

SAFETY CRITICAL INFORMATION

Altitude errors due to incorrect QNH use are not detectable by cross checking distance verses altitude.

It is strongly recommended to use a gross error check when setting QNH by comparing the supplied actual aerodrome QNH with forecast aerodrome QNH and area QNH.

Paying particular attention to accurately transfer the supplied QNH onto the altimeter subscale setting is the only defence against errors in setting QNH.

8.2.8 Because of the requirement for access to aerodrome temperature during APVs with LNAV/VNAV minima and RNP AR APCH, these procedures will not be published to locations that do not have access to actual weather conditions (approved accurate QNH - see section 14.03(1)(a) of the Part 91 MOS and actual aerodrome temperature).

8.3 Lateral guidance for APVs

8.3.1 The design criteria for APVs require these procedures to be designed as straight-in runway procedures. Procedures with offset angles greater than 5° are designed such that aircraft cross the runway centreline no closer than 1,400 m to the threshold. For offset angles equal to or less than 5°, the final approach track is designed to be within 150 m of the runway centreline at 1,400 m. Some older procedures may use 900 m in place of 1,400 m.

8.3.2 Lateral navigation guidance is displayed as an indicator of lateral deviation from a defined path or track, like that presented by a CDI type display.

8.4 Vertical guidance for APVs

8.4.1 Avionics that are capable of APVs will display the vertical path in an ILS-like display (vertical deviation indicator). The vertical path displayed by the avionics will be the same as that depicted on the approach chart and the chart will show a line of minima identified by the term LNAV/VNAV or LPV.

8.4.2 Terrain separation is assured by the vertical path defined by an APV, when used within its limitations. This APV VNAV should not be confused with NPA approach operations using **advisory VNAV guidance** (sometimes called **LNAV + V**), which do not provide assurance of terrain separation or compliance with altitude limitations.

SAFETY CRITICAL INFORMATION

All APV procedures are reliant on accurate altimeter readings, which is dependent on correct altimeter subscale setting and temperature deviations from ISA.

Vertical error will be introduced by incorrect QNH setting and temperatures deviations from ISA.

8.4.3 APVs using a barometric input for a VNAV solution (RNP APCH with LNAV/VNAV minima or RNP AR APCH) have temperature limitations because barometric pressure is affected by temperature. When temperature at the QNH source (usually the destination aerodrome) is colder than ISA the approach becomes lower and flatter (shallower) than designed. When the temperature is hotter than ISA the approach becomes higher and steeper than designed. The minimum temperature on the chart relates to a minimum vertical path angle (VPA) of 2.5°, while the maximum temperature on the chart relates to a maximum VPA of 3.5°. **Hence conducting approaches outside of the temperature limits results in situations that are unsafe**.

8.4.4 APV procedures using SBAS (RNP APCH with LPV minima) have VNAV guidance derived from satellite-delivered geometric height via GNSS and the VPA is not dependant on correct QNH or ISA temperature deviations. But altimeter indications are reliant on correct QNH and ISA temperature. Incorrect larger QNH values will cause the altimeter to overread promoting lower flight which reduces obstacle clearances, see section 8.2 above. Similarly, temperatures colder than ISA will cause the altimeter to overread promoting lower flight which reduces obstacle clearances and may require appropriate DA/H increases. See section 4.8 for manual altitude temperature correction and/or below for temperature compensation.

8.4.5 Some modern navigation systems include a **temperature compensation** function. Temperature compensation uses the actual aerodrome temperature to calculate adjustments to procedure altitudes and possibly DA/H values for the approach, that can then be applied to the procedure. Navigation systems capable of providing automated temperature-based altitude compensations must comply with RTCA/DO-236(), Appendix H.2 or an equivalent airworthiness approval basis. Manufacturers should document compliance to this standard.

8.4.6 For APVs using a barometric input for a VNAV solution (RNP APCH with LNAV/VNAV minima or RNP AR APCH), a **temperature compensation** capable navigation system can adjust the VNAV guidance displayed to the pilot(s), returning the VPA to the designed angle (usually 3°), and may adjust other procedure altitudes including DA/H. If the temperature compensation is not available or does not adjust procedure altitudes or DA/H for temperatures below ISA minus 15 then manual altitude temperature correction as per Section 4.8 must still be appropriately used.

8.4.7 For APV procedures using SBAS (RNP APCH with LPV minima), **temperature compensation**, if available, does not affect the VNAV guidance (VPA) and does not adjust other procedure altitudes including DA/H. Therefore, for temperatures below ISA minus 15, manual altitude temperature correction as per Section 4.8 must still be appropriately used.

8.4.8 The temperature compensation for some navigation systems:

- only allows temperature deviations below ISA (that is, only for cold temperatures)
- provides temperature compensation for deviations above and below ISA
- may or may not have an available adjustment for DA/H values or require additional steps to adjust DA/H
- enables temperature limits published on RNP APCH with LNAV/VNAV minima or RNP AR APCH to be disregarded.

8.4.9 It is the pilot's responsibility to understand how the navigation system being used provides temperature compensation and its limitations.

8.4.10 Pilots always remain responsible for ensuring safe obstacle clearance and therefore must confirm:

- the procedures for temperature compensation use (see navigation system, company and/or aircraft flight manual (AFM) documentation)
- the manner and limitations of the temperature compensation
- if manual altitude temperature correction is also needed for temperatures less than ISA minus 15
- the navigation system is properly configured with the correct surface temperature and QNH values.

Manual altitude **temperature correction** is required, for all approaches, whenever temperature at the QNH source (usually the destination aerodrome) is colder than ISA minus 15. See section 4.8 above.

If **temperature compensation** is available, the navigation systems documentation should identify which altitudes are temperature compensated. Where procedure altitudes and DA/H or MDA/H are not adjusted by temperature compensation then manual altitude temperature correction is still required for those altitudes.

Conducting approaches outside of the temperature limitations is prohibited, unless temperature compensation is used and the navigation systems documentation confirms the temperature limitations as published on IACs can be disregarded.

Pilots must confirm the navigation systems compliance with RTCA/DO-236(), Appendix H.2 or an equivalent airworthiness approval, and also the temperature compensation's specific capability and limitations before use.

Using manual altitude temperature correction **does not allow temperature limitations to be disregarded**.

SAFETY CRITICAL INFORMATION

In all circumstances altitude indications appear normal and the effect of temperature cannot be seen, which makes temperature affects even more dangerous.

Temperatures **below ISA** result in **lower flatter (shallower) flight paths** below the nominal VNAV flight path.

Temperatures **above ISA** results in **higher steeper flight paths** above the nominal VNAV flight path.

Temperatures **below ISA minus 15 require manual corrections** for altitudes/heights shown on procedures.

8.4.11 When available on an aircraft, radar altimeters, GPWS, EGPWS or TAWS offer additional safety protections against CFIT due to incorrectly set QNH values or temperature affects. These systems, except for radar altimeters, provide height relative to the actual or predicted terrain ahead of the aircraft and may offer early warning of controlled flight into terrain.

8.5 Landing Minima for APVs

Note: This section (8.5 Landing Minima for APVs) also applies to PAs, unless an element is stated to specifically apply to APVs only.

8.5.1 The landing minima is expressed in terms of visibility and DA/H, with the visibility being either a runway visibility or runway visual range depending on whether the aerodrome infrastructure supports RVR measurements. DA/H is the 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: See section 15.10 of the Part 91 MOS for details how to determine landing minima.

See section 4.8 for manual altitude temperature correction and section 8.4 for temperature compensation for adjustments to procedure altitudes including DA/H.

8.5.2 The intent is that upon reaching the DA/H, a decision has been made by the pilot to either continue flight visually for a landing or execute a missed approach.[22]

8.5.3 If visual conditions do not exist for a landing, upon reaching the DA/H a missed approach needs to be initiated.[23]

Pilots must ensure that a decision has been made at or before the DA/H, to continue visually to land if the required visual references[24] are established or execute a missed approach.

The aircraft might descend below the DA/H prior to the start of climb, but this altitude loss is accounted for in the design of the procedure however should be minimised.

8.5.4 Where the same navigation infrastructure is utilised to provide the same lateral guidance, there may be other landing minima lines listed. As such APV (or PA) landing minima may be shown with NPA landing minima on an IAC.

8.6 Landing from an APV

Note: This section (8.6 Landing from an APV) also applies to PAs, unless an element is stated to specifically apply to APVs only.

8.6.1 To land from an APV (or PA) a transition to visual flight is required. This visual segment may be either:

- a ‘straight-in’ landing
- a circling approach that requires manoeuvring to align the aircraft with the landing runway.

8.6.2 Straight-in Instrument Approach Procedures

8.6.2.1 An APV (or PA) is generally aligned with the runway track, but small offsets can be permitted. Procedures with offset angles greater than 5° are designed such that aircraft cross the runway centreline no closer than 1,400 m to the threshold. For offset angles equal to or less than 5°, the final approach track is designed to be within 150 m of the runway centreline at 1,400 m

8.6.2.2 For a safe straight-in approach the intent is for the pilot to establish the required visual reference at or before reaching the DA/H, continue descent without significant changes to the

[22] See section 15.09 the Part 91 MOS for landing minima requirements.

[23] See section 15.11 of the Part 91 MOS for missed approach requirements.

[24] See paragraph 15.11(2)(b) of the Part 91 MOS for what constitutes the required visual reference.

descent rate, align the aircraft with the centreline, visually avoiding any terrain in the runway approach area and land on the runway.

8.6.2.3 In many locations a straight-in approach has a lower DA/H than the circling approach minima, due mainly to obstacle clearance area requirements. A lower DA/H limits the amount of time and distance available to the pilot to complete the visual segment of the approach.

8.6.2.4 An APV (or PA) is identified by the use of the runway direction in the title, such as RNP APCH RWY 14, and may be annotated in the minima box by the letters S-I (straight-in), although this terminology is being replaced by the term LNAV.

8.6.2.5 It is commonly acknowledged that straight-in approaches are safer than circling approaches. In Australia, instrument approach procedures are designed as straight-in approaches wherever possible.

8.6.3 Visual circling manoeuvres

Note: See subsection 7.6.5 - Visual Circling Manoeuvres for requirements for circling.

8.7 Missed approach procedures for APVs

Note: See Section 7.7 - Missed Approach Procedures for NPAs for requirements for missed approaches for APVs.

9 Precision Approach Procedures (PAs)

9.1 What is a Precision Approach Procedure (PA)?

9.1.1 The PA IAPs currently in use in Australia are ILS and GLS and are characterised by:

- externally referenced electronic vertical course guidance (3D operation)
- a DA/H.

9.1.2 It is expected that RNP APCH with LPV minima may achieve the accuracy and precision needed to be classified as a PA once an SBAS is available in Australia.

> **Note:** An SBAS is being developed for Australia and New Zealand called SouthPAN. It is not expected to be available until at least 2028, following which relevant IAP must be designed and certified before LPV could be available for use.

9.1.3 The minima line on the procedure chart is indicated by combinations of either:

- ILS/LOC (ILS provides precision guidance, LOC is non-precision)
- GLS (GNSS based PA using GBAS)
- LPV (GNSS based RNP APCH using SBAS with minima below 250 ft (see Note above)
- may include circling.

9.1.4 ILS IAPs are classified as per Appendix B of this AC. These classifications are used for Cat II or III ILS and can be found in the AIP En Route Supplement Australia (ERSA) under the Radio Navigation and Landing Aids entry for aerodromes with CAT II and III ILS.

9.2 Reference QNH for PAs

9.2.1 To support the accuracy required, a check height is included at a determined position on the glide path to validate the approach. As such, these approaches need to be referenced to an appropriate QNH, based on if the minima background is grey shaded or not.

9.2.2 Requirements and adjustments that may arise from the use of different altimeter sources are detailed below.

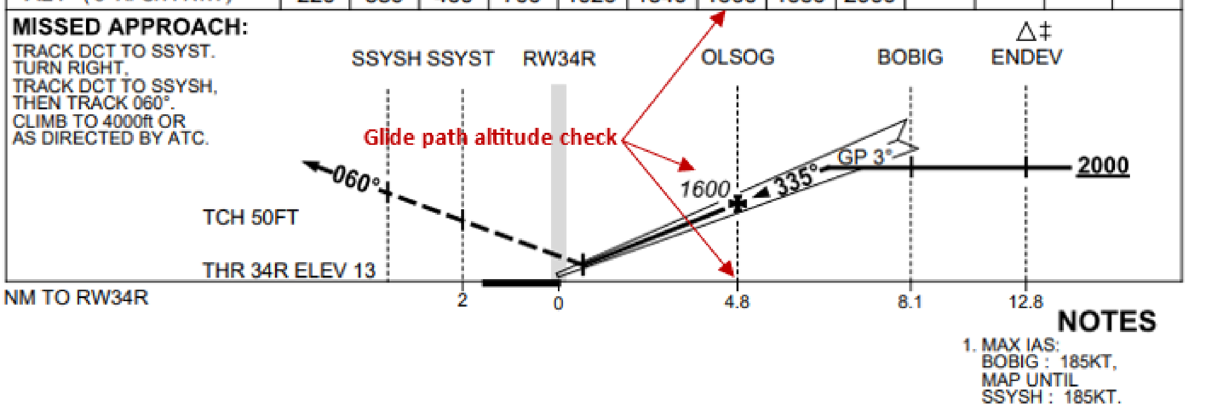
- When the minima box on the approach chart is **not shaded**, the minima is designed to be used with an **actual aerodrome QNH**. Typically, this is due to the aerodrome having a 24-hour air traffic service, which can always provide an actual aerodrome QNH. The promulgated minima does not have a 100 ft barometric allowance incorporated into it.
- When the minima box on the approach chart is **grey shaded**, the minima is designed to be used with a **forecast aerodrome QNH**. Typically, this is due to the aerodrome not having a 24-hour air traffic service but is covered by an aerodrome forecast. The promulgated minima have a 100 ft barometric allowance incorporated into them.
- If the minima box is **grey shaded** (indicating a 100ft barometric allowance) and an aerodrome QNH (either forecast or actual) is not available, a **forecast area QNH** may be used. However, the 100 ft allowance may not be sufficient to account for the accuracy of the forecast area QNH, and the pilot must **add 50 ft** to the published DA/H (landing minima) when using an area QNH.

- An actual aerodrome QNH cannot be used for an IAP more than 15 mins after receiving it.[25]

9.2.3 If the QNH setting is incorrect, the altimeter will reference an incorrect datum (QNH) and provide height based on that incorrect datum. This will lead to incorrect altitude indications during the approach, potentially causing either inefficiency (lower QNH values result in higher approach altitudes) or unsafe conditions (higher QNH values result in lower approach altitudes).

9.2.4 Altitude errors due to incorrect QNH are detectable by cross checking distance verses altitude along the glideslope. Additionally, the nominal GP/altitude check ensures verification of QNH setting by checking altitude at the check distance while on glideslope. Where an unexplained difference with the IAC check altitude exists, the pilot must conduct a missed approach immediately as the relationship between glideslope and altitude has not been verified. Being on the glideslope and having the actual aerodrome QNH set accurately help with conducting the nominal GP/altitude check. Particular attention to transferring the supplied QNH accurately onto the altimeter subscale setting is the only defence against errors in setting QNH.

NM TO RW34R	0.5	1	1.2	2	3	4	4.8	5	6.1				
ALT (3° APCH PATH)	220	380	460	700	1020	1340	1600	1660	2000				



CATEGORY	A	B	C	D
S-I GLS (3.6% MAP)	220 (207-1.2) 1000 RVR			
S-I GLS (2.5% MAP)	460 (447-2.2)			
CIRCLING	NOT AUTHORISED			
ALTERNATE	(1189-4.4)		(1479-6.0)	(1479-7.0)

Changes: ABN DCMSD, Editorial. SSYGL06-179

CAUTION: CLOSELY SPACED PARALLEL RUNWAYS ^

© Airservices Australia

Figure 11: Brisbane GLS RWY 34R approach profile and minima with glide path/altitude check

Source: Airservices Australia.

Using **larger QNH** values than actual aerodrome QNH results in **higher altitudes indicated** along the nominal glide path. Potential to travel further down the glideslope to get the indicated DA/H - **unsafe situation** as closer to the ground at the indicated DA/H.

[25] See section 14.03(2) of the Part 91 MOS.

Using **smaller QNH** values than actual aerodrome QNH results in **lower altitudes indicated** along the nominal glide path. Potential to be further up the glideslope when indicating DA/H - inefficient situation as further from the ground at the indicated DA/H.

At the **nominal GP/altitude check**, conduct a **missed approach if unexplained discrepancy** exists.

9.2.5 QNH (and temperature) will affect check height accuracy. When using a more accurate QNH source the expected discrepancy when conducting the nominal GP/altitude check should be smaller, while larger discrepancies may occur with forecast QNH. Temperatures above (or below) ISA introduce lower (or higher) indicated altitudes at the nominal GP/altitude check which will potentially add to any indicated discrepancies.

9.3 Lateral Guidance for PAs

9.3.1 Typically, PA approaches are aligned directly with the runway, despite the design allowance below.

9.3.2 The design criteria for PAs do not allow these procedures to be offset from the runway centreline greater than 5°.

9.3.3 Lateral navigation guidance is displayed as an indicator of lateral deviation from a defined path or track, like that presented by a CDI type display.

9.4 Vertical guidance for PAs

9.4.1 Avionics that are capable of PAs will display the vertical path as an indicator of vertical deviation or angle above or below a defined glide path, like that presented by CDI type display but in a vertical plane.

9.4.2 Terrain separation is assured by the glide path defined by a PA. This assurance should not be confused with NPA approach operations using **advisory VNAV guidance, which do not provide assurance of terrain separation or compliance with altitude limitations.**

9.4.3 If fitted to an aircraft, a GPWS, EGPWS or TAWS provides a defence to inadvertent flight into terrain.

9.4.4 A known issue associated with ILS approaches is the existence of false glide slopes above the nominal 3° glide slope, sometimes at 6° and always at 9°, for many ILS installations (associated with M-array ILS antenna arrangements common in Australia). This may manifest, when intercepting an ILS glide slope from above, as a severe and sudden pitch-up command during an ILS approach. See Appendix C of this AC for further details.

Pilots should be vigilant for the **possibility of a severe and sudden pitch-up command** while **intercepting an ILS glide slope from above**, due to some ILS installations emitting false glide slopes above the nominal glide slope.

9.5 Landing minima for PAs

Note: See Section 8.5 - Landing Minima for APVs for requirements for landing minima for PAs.

9.6 Landing from a PA

Note: See Section 8.6 - Landing from an APV for requirements for landing from a PA.

9.7 Missed approach procedures for PAs

Note: See Section 7.7 - Missed Approach Procedures for NPAs for requirements for missed approaches from PAs.

10 Procedure entry, holding procedures and noise abatement procedures

10.1 Procedure entry

10.1.1 Reserved.

10.2 Holding procedures

10.2.1 Reserved

10.3 Noise abatement procedures (NAP)

10.3.1 Reserved

11 Precision runway monitor (PRM) instrument approach procedures (IAP)

11.1 When are PRM IAP designed?

11.1.1 Under ICAO provisions, independent parallel approaches may be conducted without additional surveillance systems only where the distance between the centrelines of parallel runways is at least 1310 metres. Where runway centreline spacing is less than 1310 metres but not less than 1035 metres, independent parallel approaches are not permitted under standard procedures due to the increased risk of aircraft deviating from the localiser or final approach track and infringing the protected airspace of the adjacent runway. It is within this narrow spacing band (1035 m to 1310 m) that PRM operations become applicable. PRM IAPs are specifically designed to allow simultaneous independent approaches to closely spaced parallel runways by mitigating the reduced lateral separation through enhanced surveillance, controller procedures, and pilot response requirements.

11.2 Rules for PRM IAP

11.2.1 Section 14.08 of the Part 91 MOS states that the PIC must not carry out a PRM IAP unless all pilots required by the AFM for the conduct of such an IAP have received training from an appropriate source that ensures familiarisation with the following:

- the guidance on PRM approaches provided in the AIP
- the PRM user instructions for the aerodrome of intended operation
- the relevant instrument approach charts for the aerodrome of intended operation
- relevant training material available on the websites of Airservices Australia and CASA.

11.3 AMC - who can deliver PRM IAP training and what should it include?

> The contents of this section constitute an acceptable means of compliance (AMC) with the training requirements of section 14.08 of the Part 91 MOS.

11.3.1 For pilots operating under an AOC or aerial work certificate holder training and checking system, PRM IAP training would be included in that system.

11.3.2 For all pilots, it is an acceptable means of compliance for the training to be conducted by an instructor or examiner working for a Part 141 or Part 142 operator.

11.3.3 For pilots operating under an AOC or aerial work certificate holder training and checking system, it is an acceptable means of compliance for the training to be conducted under that system

11.3.4 In relation to the training content, it is an acceptable means of compliance if the training includes all of the following:

- an overview of PRM IAP operations (a pilot training presentation is available from the Airservices Australia website)

- an assessment of the pilot's knowledge to ensure that the pilot understands and can apply PRM approach procedures (including the breakout procedures and phraseology) completely and correctly.

DRAFT

12 Helicopter procedures

12.1 What approaches can I fly in a helicopter?

12.1.1 All fixed-wing Category A approaches can be flown by appropriately equipped helicopters, provided the speeds flown are within the Cat A range. The use of V_{at} is not applicable to helicopters.

12.2 Are helicopter approaches different to fixed wing approaches?

12.2.1 Yes. Approaches which are designated Category H are designed to different parameters and can only be flown by helicopters. Helicopter approach procedures are designed to criteria that are more appropriate to the flying speeds, performance, and handling characteristics of helicopters. Differences include increased maximum permissible approach gradients, shorter segment lengths, and may include increased missed approach gradients.

12.2.2 ICAO Doc 9613 provides for a unique helicopter specification which allows the use of RNP 0.3 throughout those approaches that are so designed.

12.3 Why do some IAPs with CAT H minima published in the AIP DAP state "For CASA approved operators only"?

12.3.1 See section 2.3.12 of this AC.

12.4 What is the VAA-H?

12.4.1 The Visual Approach Area - Helicopter (VAA-H) is an Australian concept devised to facilitate the visual termination of a helicopter RNP APCH at an HLS and performs a similar function to the circling area at an aerodrome. The VAA-H starts at the commencement of the missed approach segment with a width equal to the width of the final segment primary area at that point. Its boundaries join at a tangent to a circle of 926 m radius centred on the HLS

12.4.2 The VAA-H provides obstacle clearance within an area 0.5 NM either side of the nominal track from the MAPt to the HLS, and relies upon visual navigation using key features or 'lead-in points' to navigate to the HLS so that continued flight past the MAPt to the HLS is possible in visibility that may be as low as 800 m. Descent from the MDA is not permitted until the HLS is sighted and a normal approach can be completed.

12.4.3 A particular feature of the VAA-H is that missed approach obstacle protection is assured provided the missed approach is commenced at the MDA from a position within the VAA-H. This enables the helicopter to proceed past the MAPt in circumstances where the successful completion of the visual segment is not assured without compromising the safety of the missed approach.

Appendix A
Approach requirements - DME or GNSS Arrivals

A.1 Is a DME or GNSS Arrival an NPA?

A.1.1 Yes.

A.1.2 A DME or GNSS arrival procedure is designed to enable an aircraft to descend from an en-route altitude, at or above the applicable lowest safe altitude (LSALT), to a specified minimum altitude at an aerodrome, using DME or GNSS distance information in conjunction with ground-based azimuth guidance. The procedure is prescribed for defined tracks or sectors and consists of a series of stepped descent levels at nominated distances, providing obstacle-protected descent guidance. DME or GNSS arrivals are published instrument approach procedures. Although DME or GNSS arrival procedures are not explicitly defined in ICAO Doc 8168 (PANS-OPS), Volume II, they are designed using the non-precision approach criteria contained within that document. Accordingly, such procedures comprise initial, intermediate, and final approach segments, consistent with PANS-OPS methodology. In Australia, DME or GNSS arrival procedures are designed in accordance with the Part 173 Manual of Standards (MOS), which establishes the applicable design requirements and safeguards.

A.2 Should foreign pilots use DME or GNSS Arrival procedures?

A.2.1 CASA does not recommend foreign pilots use DME or GNSS arrival procedures published in the AIP DAP unless the pilots and operators have received an appropriate knowledge, skills and competency briefing from an Australian flying school, flight instructor or flight examiner authorised to instruct, or examine the competency of Australian pilots in these procedures.

A.3 What is different about a DME or GNSS Arrival?

A.3.1 DME or GNSS Arrivals are normally designed to permit descent from the en-route phase without the need to locate the aircraft overhead the navigation aid or to conduct a sector entry.

A.3.2 Entry to the procedure is often available from any direction but commonly is limited to sectors or specific tracks.

A.3.3 Where sectors are promulgated, an aircraft can be manoeuvred to intercept any particular track, provided this is done prior to reaching the FAF. This procedure enables an arriving aircraft to be positioned on a convenient track for subsequent circuit entry or a straight-in approach.

A.3.4 However, prior to reaching the FAF the aircraft must be established on the final approach course and from the FAF the aircraft speed must be established within the range of speeds specified for the final leg.

A.4 Where is the FAF on a DME or GNSS Arrival?

A.4.1 The FAF is normally located 5 NM prior to the MAPt. Its location is indicated on the IAC.

A.5 How are DME or GNSS Arrivals charted?

A.5.1 The charting of DME or GNSS Arrivals varies between chart suppliers but in general they have usually been shown as series of descending steps on particular tracks or within a specified sector.

A.5.2 AIP DAP DME or GNSS Arrival charts are in a similar format to normal NPA charts and incorporate a constant approach path table of distances and altitudes. The constant approach path is designed to provide a 3° constant angle approach where possible, terminating at a circling MDA within the circling area (Refer Figure 9).

A.6 Can I use GNSS to substitute for DME on a DME arrival

A.6.1 Yes.

A.7 Can I use GNSS for track guidance on a GNSS arrival?

A.7.1 No.

A.7.2 GNSS Arrivals are designed using the navigation tolerances applicable to the ground-based aid. The NDB across-track design tolerance at the navigation aid is ±1.25 NM and splays at an angle of 10.3° and that for the VOR is ±1.0 NM with a splay angle of 7.8°. Because the GNSS system is assumed to operate in the 'terminal mode' the design across-track tolerance at the reference point is ±2.5 NM. Although the GNSS splay angle is zero, the NDB splay remains narrower than the GNSS splay within 6.8 NM of the reference point and for VOR the distance is 11 NM.

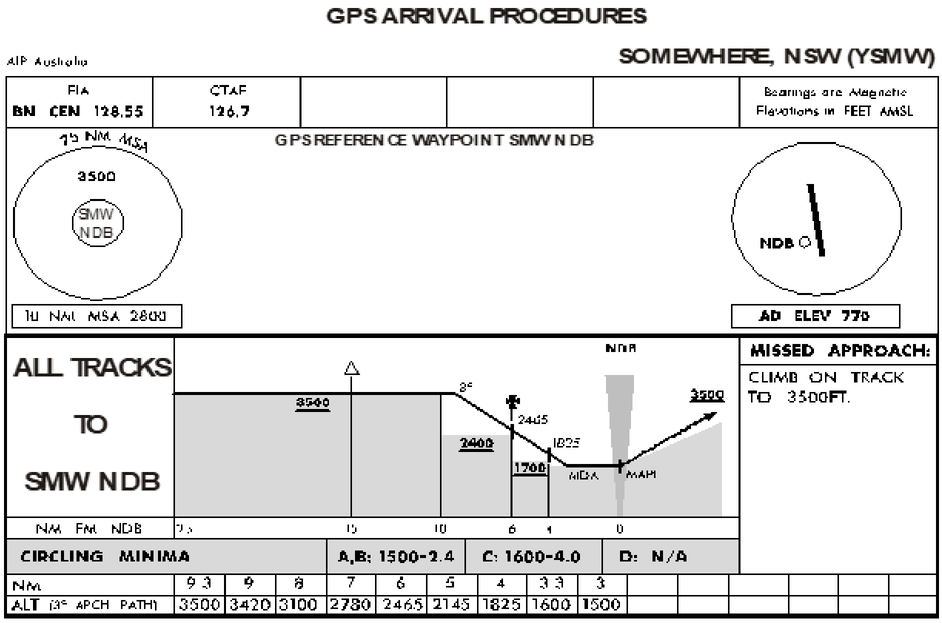


Figure 12: Example of the Format DME or GNSS Arrival Chart

Appendix B Classification of Instrument Landing Systems

Source:

This content is reproduced from AIC H15/14 which will be withdrawn shortly after this AC is published. See also Section 9.1.4.

B.1 Introduction

B.1.1 These ILS classifications can be found in the AIP En Route Supplement Australia (ERSA) under the Radio Navigation and Landing Aids entry for aerodromes with CAT II and III ILS.

B.1.2 This information provides details on the International Civil Aviation Organization (ICAO) system for classifying an Instrument Landing System (ILS). This classification system is generally used in association with ILS facilities intended for precision approach category (CAT) II or III (and similar) operations.

B.1.3 In order to fully exploit the benefits of modern aircraft automatic flight control systems, there is a need to describe ground-based ILS facilities more specifically than the simple Facility Performance Category I/II/III. This is achieved by the ILS classification system using three designated characters detailed in paragraph B 2.1. The ILS classification scheme provides a means for identifying the additional capabilities that may be available from a particular ILS ground facility in order to determine the particular operational application.

B.2 ILS classification system

B.2.1 An ILS facility classification is defined by a 3 character string with each character separated by a slash (/) according to the following:

a. The first character - Roman numeral I, II, or III. indicates conformance with the Facility Performance standards contained in International Civil Aviation Organization (ICAO) Annex 10, and indicates that the ILS is CAT I, CAT II or CAT III-capable.

b. The second character - Letter A, B, C, T, D, or E, defines the point along the approach path or runway to which the localizer conforms to the facility performance Category II/III course structure tolerances. The character indicates ILS conformance to a physical location as follows:

   i. A: 7.5 km (4 NM) before the threshold

   ii. B: 1050 m (3500 ft) before the threshold (CAT I decision point)

   iii. C: Glidepath altitude of 100 ft height above touchdown (HAT) (CAT II decision point)

   iv. T: Threshold

   v. D: 900 m (3000 ft) beyond the threshold (Touchdown guidance)

   vi. E: 600 m (2000 ft) before the runway end (Roll out guidance).

c. The third character - Number 1, 2, 3, or 4. indicates the minimum level of integrity and Continuity of Service (CoS) of the ILS. Integrity is needed to ensure that an aircraft on approach will have a low probability of receiving false guidance; CoS is needed to ensure that an aircraft in the final stages of approach will have low probability of being deprived of a guidance signal. The interpretation of each number is as follows:

i. 1: The performance objective of the ILS equipment has not been demonstrated or is less than Level 2.

Note: Level 1 performance can support low-visibility operations for which positioning guidance below approximately 200 ft height above threshold (HAT) is supplemented by other means, such as visual cues or advanced avionics.

ii. 2: The performance objective for ILS equipment used to support low visibility operations when ILS guidance for position information in the landing phase is supplemented by visual cues. This level is a recommended objective for equipment supporting Category I operations.

iii. 3: The performance objective for ILS equipment used to support operations which place a high degree of reliance on ILS guidance for positioning through touchdown. This level is a required objective for equipment supporting Category II and IIIA operations.

iv. 4: The performance objective for ILS equipment used to support operations which place a high degree of reliance on ILS guidance throughout touchdown and rollout. This level basically relates to the needs of the full range of Category III operations.

B.3 Classification example

B.3.1 An ILS that conforms to the ICAO Annex 10 Facility Performance CAT III standards, meets the CAT III localizer course structure criteria to ILS point "E," and conforms to the integrity and CoS objectives of Level 4 would be described as Class "III/E/4".

B.4 Impact of classification on approach minima

B.4.1 The following shows the typical relationship between Runway Visual Range (RVR) minimum and ILS classification:

Table 14: Runway Visual Range (RVR) minimum and ILS classification

Facility classification	Typical touchdown zone runway visual range minimum CAT II	Typical touchdown zone runway visual range minimum CAT III
II/T/2	≤ 350 m	N/A
II/D/2	≤ 300 m	N/A
III/D/3		≥ 200 m
III/E/3		≥ 175 m
III/E/4		≤ 175 m

B.4.2 Some States, like Australia and the United States of America, will publish instrument flight procedure charts which contain State minima. In such cases, the minima will generally account for the ILS Classification for the particular runway.

B.4.3 System issues can occasionally result in a temporary degradation of performance and advice of change of classification. This change may be in the form of a NOTAM or directed advice. Pilots would be expected to adjust minima as appropriate to any reported downgrade.

Appendix C Potential safety issue when above normal glidepath on ILS approaches

Source:

The content is reproduced from AIC H14/14 which will be withdrawn shortly after this AC is published. See also Section 9.4.4.

C.1 Introduction

C.1.1 The information in this Appendix describes a potential safety issue in relation to instrument approach operations using the Instrument Landing System (ILS) ground stations used in Australia and in many other parts of the world. Specifically, the ILS ground station can generate a false pitch up signal, possibly severe and sudden, if the aircraft:

- intercepts the glidepath from above
- during an approach, goes above the normal glidepath angle.

C.1.2 Caution should be exercised in such situations particularly for autopilot coupled approaches.

C.2 Background

C.2.1 In 2013, the Dutch Safety Board investigated an occurrence where an aircraft suffered a severe and sudden pitch-up upset during an ILS approach. The aircraft’s airspeed dropped rapidly to a near stall situation (stick shaker), and the flight crew carried out a go-around.

C.2.2 During the investigation the Board found a history of similar events. Analysis revealed that the common factor linking these events was the particular ILS antenna type - M-array (Capture effect) ILS antenna.

C.3 The issue

C.3.1 The M-array ILS antenna type is widely used for ILS installations in Australia and in many other parts of the world. Accordingly, it is important for pilots, aircraft operators and air traffic controllers to be aware of different ILS signal characteristics and the potential of aircraft pitch-up upset due to capturing a false glide slope, which can lead to (approach to) stall conditions.

C.3.2 The information in this Appendix is taken directly from the Safety Alert issued by the Dutch Safety Board.

C.4 Discussion

C.4.1 ILS systems are periodically checked with a Flight Inspection in order to be certified for operational use. The Flight Inspection focuses exclusively on the 3° glide slope area. The signal characteristics in the area above the 3° glide slope were examined as part of the Dutch Safety Board’s investigation. Flight tests were conducted to measure the M-array antenna signal and determine the ‘glide slope field’ characteristics above the 3° glide path while established on the localiser.

C.4.2 Analysis of the measurements shows that between the 3° and 9° glide path, signal strength changes. For the pilot this can result in observable movement of the ILS glide slope marker on the primary flight display. At this time two important characteristics of the M-array ILS antenna ‘glide slope field’ have been identified:

- A signal reversal was always present at approximately 9° glide path.
- A signal reversal was sometimes present at approximately 6° glide path.

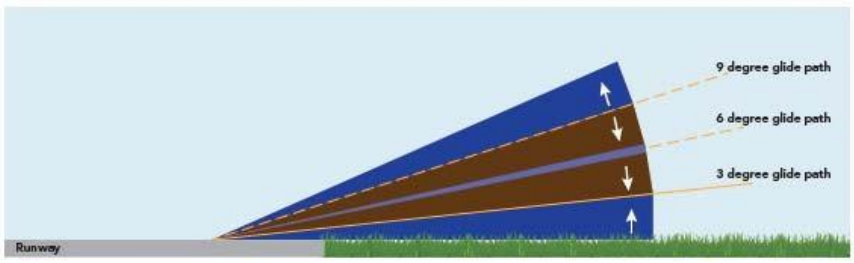


Figure 13: Cross section view of the M-array ILS antenna system and schematic overview of the “Fly up”(blue) and “Fly down”(brown) indication

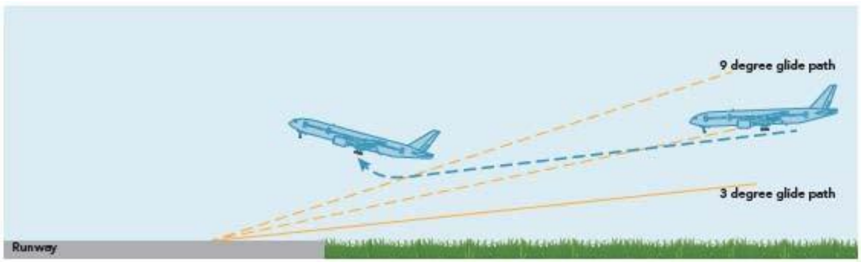


Figure 14: Example of glide slope capture with a pitch upset above 3° glide path

C.4.3 Depending on the glide slope field, signal reversal occurs occasionally at 6°, and always at the 9° glide path. This reversal activates the glide slope capture mode after which the autopilot follows the glide slope signal without restrictions. During flight tests the reversal resulted in the automatic flight control system commanding a severe pitch-up. Immediate flight crew intervention was required to regain aircraft control.

C.4.4 Furthermore, the flight tests have shown that commonly available information on false glide slope (internet, manuals and literature) does not necessarily reflect glide slope signal characteristics of all ILS antenna types in use worldwide.

Example

In some aircraft manuals, it is noted that a false glide slope signal can be identified by a higher-than-normal descent rate.

This particular description does not accurately reflect what happens when a false glide slope of an M-array antenna is captured.

C.4.5 Thus far (noting these words were sourced from a 2013 Dutch report) the investigation has revealed that aircraft from four different manufacturers operated by different airlines have experienced a pitch-up upset caused by a false glide slope either under test conditions or during operation.

C.5 Advice for pilots

C.5.1 Pilots should be vigilant for potential false glide slope signals when intercepting any ILS glide slope from above, and aware of the potential issues associated with flying in the area above the 3° glide path during the approach. This is particularly important while flying on autopilot with the glide slope mode armed.

C.6 Advice for aircraft operators

C.6.1 Operators should consider the need to implement additional operational procedures or provide additional guidance in order to mitigate the risks of unexpected autopilot behaviour when on ILS approaches.

C.7 Advice for air traffic control

C.7.1 Whenever possible, ATC should issue control instructions that will position the aircraft to intercept the glide slope from below.