Advisory Circular
AC173-1

Instrument Flight Procedure - Design Criteria & Validation of Instrument Flight Procedures

Revision 1
18 July 2019

GENERAL

Civil Aviation Advisory Circulars contain information about standards, practices, and procedures that the Director has found to be an Acceptable Means of Compliance (AMC) with the associated rule.

An AMC is not intended to be the only means of compliance with a rule, and consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate Advisory Circular.

An Advisory Circular may also include Guidance Material (GM) to facilitate compliance with the rule requirements. Guidance material must not be regarded as an acceptable means of compliance.

PURPOSE

This Advisory Circular provides an acceptable means of compliance with Civil Aviation Rule Part 173 Subpart D *Design criteria-instrument flight procedure*. And Rule 173.205 *Validation of Instrument Flight Procedures.*

RELATED RULES

This Advisory Circular relates specifically to Civil Aviation Rule 173.201 & 173.205

CHANGE NOTICE

This is the revision 1 of AC173-2.

Published by Civil Aviation Safety Authority of Papua New Guinea

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1 Introduction

Civil Aviation Rule Part 173 provides for the certification and operation of organisations undertaking instrument flight procedure design within Papua New Guinea. It also includes the technical standards for design of an instrument flight procedure (IFP).

Civil Aviation Rule Part 173 Subpart D specifies the design criteria for instrument flight procedures in particular the relevant ICAO documents and standards. ICAO Document 8168, Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) – Volume I Flight Procedures, and Volume II Construction of Visual and Instrument Flight Procedures is the base instrument procedure document. The content of Document 8168 Volume II contains several requirements which can be ambiguous and interpreted in different ways. In order to ensure all Part 173 certificated organisations are working to the same criteria this Advisory Circular clarifies the application of ICAO Document 8168 requirements for Papua New Guinea.

Civil Aviation Rule 173.205 Validation of instrument flight procedures
The purpose of this rule part on the validation of Conventional, Precision and RNAV instrument flight procedures (IFP). It is considered as part of the criteria that will be applied for the introduction of Performance Based Navigation.

The following ICAO documentation form the requirements and basis for the design, validation and publication of CA IFP:

- ICAO PANS-OPS Doc 8168;
- ICAO Doc 8071 Volume 1 Chapter 8 and Volume II Chapter 5;
- Doc 9274 – AN/904 Manual on the Use of the Collision Risk Model (CRM) for ILS Operations
- Doc 9368 – AN/911 Instrument Flight Procedure Construction Manual
- Doc 9674 – AN/946 World Geodetic System 1984 (WGS-84) Manual
- Doc 9365 - Manual of All-Weather Operations
- Doc 9613 – Performance - based navigation (PBN) manual
- Doc 9905 - Required Navigation Performance Authorization Required (RNP AR) Procedure Design Manual
- Doc 9931 - Continuous Descent Operations (CDO) Manual
- Doc 9906 - The Quality Assurance Manual for Flight Procedure Design VOLUME 1 to 6

2 Maintenance of instrument flight procedures

Instrument Flight Procedure Review

Civil aviation rule 173.101 requires the holder of an instrument flight procedure service certificate to continue to meet the standards and comply with the requirements of Subpart B prescribed for certification under Part 173. In this regard, the certificate holder is required under rule 173.61, to review all instrument flight procedures on a periodic basis.

The purpose of the periodic review is to ensure continuous compliance with changing criteria, to confirm adequate obstacle clearance and ensure that the IFP continues to meet user requirements.

It is considered that the maximum acceptable period for an IFP review is 5 years.

The holder shall maintain each flight procedure, at periodic intervals and upon the conditions prescribed in CASA PNG Instrument Procedure Design Manual (IPDM).

Flight Re-Validation of instrument flight procedures at intervals not exceeding three years. The aim of these checks is to ensure the safety and continuing viability of published procedures.

Visual Segment Surface

PANS-OPS Volume II, Part I, Section 4, Chapter 5, paragraph 5.4.6 introduced the requirement for a Visual Segment Surface (VSS) for procedures designed after 15 March 2007. Paragraph 5.4.6.3 requires that straight-in instrument approach procedures published before 15 March 2007 shall be protected in the visual segment by means of the VSS after the periodic review of the procedure, but no later than 15 March 2012.

Due to the volume of instrument procedures to be reviewed the deadline for implementation of VSS on existing straight-in approaches for Papua New Guinea is extended to 2016. An Aeronautical Information Circular (AIC) listing the aerodromes with VSS assessed and those where the VSS has not been assessed will be issued. The AIC will be regularly updated until the review programme and VSS implementation completed.

Base width

The base width of the VSS is detailed in paragraph 5.4.6.1 as 300 metres for Code 3 and 4 runways and 150 metres for Code 1 and 2. Many Papua New Guinea aerodromes do not have 150 or 300 metre strips and to meet this requirement would require additional survey and obstacle removal. The Australian Civil Aviation Safety Authority has allowed the use of the runway strip in lieu of the PANS-OPS criteria and proposed a change to ICAO. The ICAO Instrument Flight Procedures Panel have agreed to a proposed change to the PANS-OPS criteria to make the VSS base width equal to the runway strip which should be updated in 2013.

The CASA PNG accepts the base width of the VSS as the published and surveyed runway strip width.

VSS Penetration

If the VSS is penetrated in accordance with PANS-OPS Volume II, Part I, Section 4, Chapter 5, paragraph 5.4.6.4 an aeronautical study must be undertaken. The preferred mitigation options are to increase the nominal vertical path angle (VPA) or displace the runway threshold. To ensure a consistent application of aeronautical study mitigations the following are other acceptable mitigations to be applied:

Aircraft Track

When an approach is offset due to terrain the VSS area may be penetrated by the terrain which the approach is offset away from. For offset approaches the VSS areastill diverges by 15% on the side opposite the offset to protect aircraft positioning along the extended runway centreline once visual. It may be possible to mitigate these situations by requiring aircraft to fly the published track until past the VSS penetration.

Visibility

When the VSS is penetrated the IFP minimum visibility must be 1600m.

Identify Obstacle on Chart

The obstacle or associated spot height must be displayed on the approach chart in the PNG Aeronautical Information (PNG AIP). A boxed warning can also be used to identify

VSS penetrations.

Lighting

For approaches used at night VSS penetrations not otherwise mitigated must be lit. If the approach requires the obstacle to be lit then the lighting must have a monitoring system and a process established for when the lighting is not operational. If there is already lighting in the vicinity of the penetration that can be taken into account in assessing the necessity for other lighting.

3 Final Approach Segment

Straight-in approach criteria

To qualify as a straight-in NPA, a RWY must meet more requirements than those specified in Pans Ops. Design work should not commence until the following aspects are addressed. If any requirement cannot be fully met, the procedure may only be designed as Circling or Cloud break, though the final segment may still be aligned with a runway when appropriate.

The runway to be served by the approach:

a) meets requirements for a “non-precision approach runway”, in accordance with Annex 14.and CAR Part 139; and
b) provides Obstacle Limitation Surfaces based on available strip width and in accordance with ICAO Annex 14; and
c) by night, has RWY edge lighting with a maximum spacing of 90 metres between the lights on each side of the runway; and
d) is equipped with a WDI (IWDI for night use) near the THR, to provide surface wind information to pilots on approach to land. If not so equipped, the following alternatives are acceptable:
    1. a WDI in a position that is clearly visible from DA/MDA during approach to the RWY; or
    2. an approved automatic weather information (AWIS) facility that broadcasts aerodrome weather (including surface wind) information; or
    3. an approved observer who has a suitable communication link with pilots.

If the WDI is not suitably positioned, its’ adequacy must be assessed during flight validation.
If any other aspect of the requirements above cannot be met, at a domestic aerodrome, acceptability of the procedure shall be assessed by the CASA, in consultation with Instrument Flight Procedure Service Organisation (IFPSO) and operators who may use the approach. The flight check crew will be tasked to provide an assessment of procedure acceptability prior to the consultation process.

PANS-OPS Volume II, Part I, Section 4, Chapter 5, paragraph 5.2.2 provides details on the criteria for the straight-in approach area in the final approach segment. This section needs clarification and expansion in regard to the Papua New Guinea application. The following applies to straight-in approaches:

- **Minimum distance for intersect**

  In addition to PANS-OPS criteria in paragraph 5.2.2, the missed approach point (MAPt) for an approach with offset final approach track (FAT) must be located on or prior to the intersection with the runway extended centreline. Where this criteria cannot be met (VOR only or NDB only procedures) the FAT must be aligned to be within 150m laterally of the extended runway centre line at a distance of 1400m out from the runway threshold in order to be published as a straight- in approach.

A FAT can intersect the extended runway centreline at a distance less than 1400m provided the maximum FAT offset is 5° or less and the FAT is aligned to be within 150m laterally of the extended runway centre line at a distance of 1400m out from the runway threshold.

A FAT intersecting the extended runway centreline at a distance down to 900m is allowed for aircraft categories up to Cat C where operationally justified. The PNG AIP chart is to be annotated

"Not in accordance with ICAO PANS-OPS straight-in criteria, FAT intersects RWY CL at
<*xx*> M from RWY"

- **Maximum angle between final approach track and centreline**

  The maximum allowable offset angle between the FAT and the runway centreline is 30° for aircraft categories up to Category C in situations where operationally justified. The chart is to be annotated "Not in accordance with ICAO PANS-OPS straight-in criteria, FAT offset <*xx*> degrees"

  The obstacle clearance altitude/height (OCA/H) adjustment as per PANS OPS Volume II, Part I, Section 4, Chapter 5, Appendix A applies. The actual value is be calculated rather than using a tabulated value.

- **Exceptions**

  An IFP published prior to January 2012 that do not meet expanded PANS-OPS criteria as detailed above can be approved for continued use subject to written approval from the CASA.

  In some situations, there may be procedures that do not meet the guidelines outlined in regard to the PANS OPS alignment requirements but an operator may request to have the procedure published as straight in. In this situation an aeronautical study must be carried out and if the procedure is published it will require aircraft and aircrew special authorisation by the CASA. Authorisation is only available to Part 121, Part 125 & Part 135 certificated operators.

Circling approach

Alignment of the FAT

In addition to the FAT alignment within 1NM of the usable landing surface detailed in PANS- OPS Volume II, Part I, Section 4, Chapter 5, paragraph 5.2.3 the MAPt is to be located within the area assessed for circling.

For example - The following distances apply for each aircraft category: CAT A 1.68NM, CAT B 2.66NM, CAT C 4.2NM, CAT D 5.28NM. If the procedure is to accommodate CAT A aircraft then the MAPt normally needs to be within 1.68NM of the runway. If the circling areas are combined for assessment, then the larger value will apply e.g. CAT A & B circling.

Cloud-break procedures

Cloud-break procedures can be designed in cases where a straight-in approach is not possible and the circling approach criteria regarding final approach track alignment cannot be met, or the MAPt is not located within the circling area applicable to the aircraft category. Or, if a Circling area cannot be established, due to overly penalistic terrain, a Cloudbreak procedure is used to provide the best possible MDA.

The following criteria must be met for cloud-break procedures:

- The procedure is only available to Category A, B & C aircraft
- The Obstacle Clearance Height (OCH) lower limit is 500ft
- The Final approach MOC is 150m.
- The Minimum visibility is 5km (Dependent on Aerodrome Location)
- The MAPt for the procedure cannot be more than 10 NM from the destination aerodrome reference point
- The procedure is available for day operations only.
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The procedure is to be published using the naming convention for circling approach. The approach chart shall be annotated:
"This procedure is specified to enable aircraft to establish required visual reference for continuation of visual approach to the landing RWY."

An IAP shall be designated as "Cloudbreak" when the MAPt is located outside of the Circling Area applicable to the highest category of aircraft for which the procedure is approved.

The procedure is still designed in accordance with Pans Ops criteria for the specific type of NPA to be employed, including a missed approach. As the distance from the MAPt to the nearest usable THR can be up to 10 NM, the designer must calculate the nominal track and distance involved in the visual segment and provide the information in the approach chart. This visual segment is identified on charts as a dotted line, clearly labeled with the words "If Visual".

Cloud-break procedures should only be designed in exceptional cases when all other design options have been assessed as inadequate and it is an imperative to enable IFR operations at an aerodrome.

Descent gradient

Gradient/angle limits

The minimum gradient in the final approach segment of a NPA procedure with a FAF is 4.7% (≈ 286 FT/NM). Optimum descent gradient is that which equates to a 3° glide path. If a steeper gradient is necessary, the maximum permitted gradient is as follows:

a) CAT A and B aircraft is 6.5% (≈ 400 FT/NM), which is equivalent to a 3.8° glide path angle; and
b) CAT C, D and E aircraft is 6.1% (≈ 370 FT/NM), which is equivalent to a 3.5° glide path angle).

Gradients steeper than 5.24% (3°) shall only be used in exceptional circumstances, and implemented after consultation with FOIs and relevant operators.

If a gradient steeper than 5.24% must be used, an assessment must be made of rate of descent to ensure that this remains within the limits prescribed in Pans Ops.

The nominal climb gradient of the missed approach surface is 2.5% (≈ 152 FT/NM) and should be used wherever possible. Refer to paragraph 3.1.4 for cases where steeper climb gradients may be used to gain an operational advantage. When a gradient other than the nominal gradient is used in the construction of the missed approach procedure, it must be indicated in the instrument approach chart,

Determination of descent gradient for a non-precision approach with FAF

The descent gradient (g) for a non-precision approach with a FAF is computed using the equation: g = h/d. The values to be used are:

For cloud-break procedures use:

d = the horizontal distance from the FAF to 1NM before the MAPt (this to enable sufficient time for assessment of meteorological conditions for continuation of flight under VFR beyond MAPt)

h = the vertical distance between the altitude/height over the FAF and the OCA/H.

4 Approach Naming Conventions

ICAO Doc 8168 – PANS-OPS approach naming principles are to be used including the following:

Circling only approaches

For annotation of the circling-only approach procedures (i.e. not aligned with a specific RWY for straight-in landing). Example: VOR A
If more than one circling approach exists at an aerodrome, or at adjacent aerodromes managed by the same approach unit, each approach is to have a different suffix assigned to it, starting with the letter A.
(e.g. VOR A, VOR B, NDB C).

Two same type approaches

To differentiate between two separate approaches of the same type (e.g. VOR, NDB or RNAV), to the same RWY, suffixes are assigned starting from the letter Z. Any subsequent suffixes follow the inverse alphabetic order.
Example: RNAV (GNSS) Z RWY 16, RNAV (RNP) Y RWY 16

Helicopter approaches

A helicopter approach to a point in space or a helipad is to include the final approach track in the approach name.
Example: RNAV (GNSS) 027 or VOR 027

5 Aerodrome Operating Minima

The MDA, DA and RH published on IAL charts is in accordance with ICAO Annex 6 Part 1. Operations are not permitted to MDA, DA or RH lower than those published on IAL charts. Unless otherwise noted on the approach chart, MDA and DA equals the OCA

Aircraft Landing Minima (ALM). Operators must, in accordance with ICAO Annex 6 Part 1, Chapter 4, establish ALM for each aerodrome to be used for operations. After consideration of the factors listed in Annex 6, operators may determine that their ALM should be higher than the stated aerodrome operating minima. In any event, all DA must be adjusted to determine an ALM which accounts for aircraft pressure error. Operators may apply aircraft pressure error correction or, alternatively, add at least 50 FT to the published DA.
Compensation for aircraft pressure error is not required when determining ALM for non-precision approaches.

Publication of DA and MDA

If the altitude difference between any two categories is less than 100 feet, those categories shall be combined, using the higher value of DA or MDA.

Approach procedures are not normally provided for aircraft in category E. Such aircraft may conduct any approach that is available to aircraft in category D, but only at the exclusive risk of the aircraft's owner and operator. The owner and/or operator must determine suitability of the landing runway, in advance of the operation. If it is unsuitable and an Exemption is not available, neither the airport nor any of the related approaches may be used.

If RWY length is less than 1,000 metres, approach procedures are normally restricted to category A and B aircraft. In such cases, the minima box must show a heading for Category C but the relevant column must be "greyed out" and in the MDA row, the words "Not Permitted" shall be used.

This requirement must be applied when a location is served by other procedures that cater for aircraft in higher performance categories, if any of the procedures are restricted to specific categories. The requirement may be applied to procedures serving aerodromes where runway length is less than 1,000 metres, for consistency.

In order to avoid any possibility of confusion by chart users, a similar concept must be applied whenever it is necessary to exclude any category of aircraft from using a procedure.

Alternate Criteria

Alternate criteria is specified for each chart and based on circling MDA for each aircraft category. The specification is expressed as a ceiling and visibility value, based on circling MDH plus 500 feet and circling visibility plus 2000 metres.

In cases where different procedures at the same location provide different Circling MDA, Alternate Criteria must be based on the worst-case Circling MDH and visibility. When creating a new approach at a location served by other approaches, Alternate Criteria must be reviewed, to ensure continued application of this policy.

6 Validation of Instrument Flight Procedures

The process for producing instrument flight procedures encompasses the acquisition of data, and the design and promulgation of procedures. It starts with the compilation and verification of the many inputs and ends with ground and/or flight validation of the finished product and documentation for publication.

Consequently, ground and/or flight validation and, in the case of RNAV IFP, an additional navigation database validation become part of the package of IFP design activities

Validation is the final step in the procedure design process, prior to publication in PNG AIP. The purpose of validation is to confirm the accuracy and completeness of all relevant obstacle and navigation data, and to assess the flyability and human factors of the IFP.

Validation Package.

IFPS provider must compile an IFP validation package for use in the ground/flight validation process. Each validation package must include the following:

(1) A plan view of the final approach obstacle evaluation template, drawn on an

appropriate topographical map of scale 1:50,000 to safely accommodate use for navigation, elevated terrain analysis, obstacles and obstructions evaluation;

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

(3) Minimum altitudes determined to be applicable from map studies and database information for each segment of the procedure;
(4) A narrative description of the IFP;
(5) Plan and profile pictorial views of the IFP;
(6) Documented data as applicable for each fix, intersection, and/or holding pattern; and
(7) The output from the NAVAID coverage analysis together with any supporting data and design assumptions.

IFPS provider is responsible for all elements of the validation and must document their proposed validation activities in a plan and submit as early as possible to CASA PNG for acceptance.

Ground Validation.

a. IFPS provider must establish detailed procedures for conducting the ground validation of an IFP. The aim of ground validation is to reveal any errors in criteria application and documentation, and assess the flyability of the IFP.

b. Ground validation must comprise the following elements:

(1) Aerodrome assessment - Verification that the infrastructure required for the provision of an instrument runway as required by CAR Part 139 is in place;
(2) Navigational aid coverage – Verification that the navigational aid coverage infrastructure required for the IFP as required by CAR Part 173 and ICAO Doc. 8071 is in place;
(3) Obstacle clearance review – A review conducted by an authorized designer not involved in the design of the considered IFP for each route segment;
(4) Coding review – A review of the coding of RNAV IFP conducted by an authorized designer not involved in the design; and
(5) Flyability assessment – Verification that the IFP can actually be flown. The use of software tools is preferred, (e.g. PC-based to full flight simulator), in order to evaluate a range of aircraft types in various weight, speed and center of gravity configurations, and in various weather conditions (temperature, wind effects and visibility).

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

(1) All segments of the IFP must be assessed;
(2) In the case of SIDs and PDRs, all segments of the procedure from the departure end of the runway (DER) to joining the en-route structure or termination point must be assessed; and
(3) In the case of IAPs all segments of the procedure from the Arrival/ Initial Fix

through to the Missed Approach must be assessed.

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

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

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

(1) Deviation from design criteria prescribed in Subpart D;

(2) Speed restrictions applied in the design;

(3) Any segment length less than minimum prescribed optimum length;

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

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

(6) Use of a Step Down Fix (SDF) in the final approach segment;

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

(8) The introduction of new procedures at an aerodrome;

(9) A procedure type that is new; and

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

Flight Validation.

(a) IFPS provider must establish detailed procedures for conducting the flight validation of an IFP as required by this rule. The flight validation procedures must include the use of equipment that—

(1) Has the precision, and accuracy traceable to appropriate standards, that are necessary for the validation being performed;

(2) Has known measurement uncertainties including, but not limited to, the software, firmware and crosswind uncertainties;

(3) Records the actual flight path of the validation aircraft;

(4) Is checked before being released for use, and at intervals not exceeding the calibration intervals recommended by the manufacturer, to establish that the system is capable of verifying the integrity of the IFP; and

(5) Is operated in accordance with flight validation system procedures and criteria by persons who are competent and current on the system used.

(b) Each IFP must be flight validated to ensure that—

(1) The IFP allows aircraft using the procedure to maneuver consistently within safe operating practices and pilot workloads for the categories of aircraft that the procedure is intended for;

(2) The IFP provides azimuth and distance information, and vertical guidance information for a precision approach ensure that an aircraft using the procedure remains clear of obstacles;

(3) The IFP is not affected by any radio frequency interference; and

(4) Visual guidance systems and cues for the runway are appropriate for the IFP and are not confused by lighting, pyrotechnic or laser displays, or any other visual distraction.

(c) The following IFP procedures do not require flight validation if it can be shown that current obstacle data meets the design requirements of the IFP:

(1) An en-route or an instrument arrival procedure unless—

(i) There is doubt about the coverage of the navigation system supporting the requirements of the procedure; or
(ii) The procedure limits the flyability and performance characteristics of the class of aircraft the procedure is designed for:

(2) An instrument departure procedure unless the procedure limits the flyability and performance characteristics of the class of aircraft the procedure is designed for:

(3) An amendment of a previously flight validated IAP if —

(i) The design change can be verified during the design process; and
(ii) A safety assessment of the proposed amendment has been completed and confirms that no additional risks to the safety of the procedure are introduced by the amendment.

(d) Where a flight validation is conducted the following elements must be evaluated:

(1) All segments of the IFP must be flown;
(2) In the case of SIDs and PDRs, all segments of the procedure from the departure end of the runway (DER) to joining the en-route structure or termination point must be flown; and
(3) In the case of IAPs all segments of the procedure from the Arrival/ Initial Fix through to the end of the Missed Approach must be flown.
(4) Flight validation of the visual maneuvering area must also be carried out.

(e) Where procedures share the same segment of flight (e.g. initial), the shared segment needs only to be validated once.
(f) In the case of RNAV IFP a test database produced by an appropriate navigation data- coding provider for use in the RNAV system must be used.
(g) In the case of RNAV (GNSS) IAPs of a T- or Y- bar design, manual entry of the procedure into the RNAV system in use is acceptable. In this case the validating pilot will need to manually activate the Course Deviation Indicator (CDI) scaling changes during the different

phases of the flight.
(h) Each custodian of the IFP must establish procedures for justifying the application of paragraph (c) to an instrument flight procedure.
(i) Unless it is not practical to do so, the IFP designer must participate in the initial validation flight to assist in its evaluation and obtain direct knowledge of issues related to the procedure's design from the flight validation pilot.

Crew Requirements.

Flight validations must be performed by qualified and experienced flight validation pilots. The qualifications and experience for flight validation pilots are specified in Appendix B to this AC.

The minimum crew of the validation aircraft shall be one pilot to validate the IFP and an observer to assist the pilot in the validation process while observing the “out of cockpit” environment. In the case of an aircraft requiring two pilots, one of the pilots may carry out the observer role. It is required that the observer has ICAO PANS-OPS Volume II knowledge (the procedure designer who designed the approach can be this observer)

Where the procedure to be flight validated is an RNAV (GNSS) IFP of a T- or Y- bar design and is to be manually loaded into the RNAV system, the flight validation pilot shall ensure that the observer is fully competent in the use of the RNAV system to be used for the flight.

Aircraft Requirements

The aircraft to be used for flight validation of an IFP shall have the performance capabilities appropriate to the categories for which the IFP has been designed and to provide an adequate and safe climb and maneuverability performance due to the nature of the operation in close proximity to variable terrain.

Meteorological Conditions

All IFP validation flights shall be conducted during daylight hours in visual meteorological conditions (VMC), which allow the flight to be carried out with a flight visibility of not less than 8KM, and in sight of the surface throughout the flight validation of the procedure

Navigation Database Validation

(a) Navigation database validation is only applicable to RNAV instrument flight procedures. Such procedures are coded using ARINC 424 path terminators to define specific nominal tracks, which are defined by waypoint location, waypoint type, and path terminator and, where appropriate, speed constraint, altitude constraint and course.

(b) The key element of a navigation database validation is to ensure that the coding of the procedure in the RNAV/FMS system does not compromise the flyability and human factors of the procedure.

(c) For small projects and/or individual flight procedure designs the following is an acceptable method of conducting a navigation database validation.

    (a) On the successful outcome of the ground and/or flight validation, the IFP would then be published in the AIP. Once a database is available with the IFP included (normally available 7-10 days before the effective date of the procedure), it will require validation

    in the RNAV system on the ground.

(d) For large projects affecting multiple procedures in an airspace change, where it may not be practicable to use the previous method, the Navigation Data Integrity Assurance Methodology may be considered as an acceptable means of navigation database validation. It is also recommended that CASA liaise with AOC holders to take account of findings from their own navigation database checks prior to the IFP effective date. The suitability of any method employed for navigation database validation shall be discussed with the CASA at an early opportunity, in the context of the overall validation plan.

(e) If the database validation is unable to take place until after the effective date of the IFP, then NOTAM action must be required to delay the effective date.

Reports

Where a ground and/or flight and navigation database validation has been conducted, a report shall be completed by each of the following where applicable:

(a) Instrument flight procedure approved designer;
(b) Validating pilot;
(c) Relevant ATS unit.

Validation reports shall be forwarded to CASA after the final validation of the IFP has been completed. Completed reports shall be forwarded to the Director.

For unsatisfactory validation, return the IFP to the procedure design entity for corrections by providing a detailed feedback to the CASA and other stakeholders, and suggest mitigation and corrections for unsatisfactory results.

APPENDIX A –AERODROME OPERATING MINIMA

Landing

Category I Precision Approach

Published ILS CAT 1 DA and visibility minima are available to all aircraft except that:

a. visibility 1.5KM is required when HIAL is not available; and
b. visibility 1.2KM is required unless:
1. the aircraft is manually flown for the entire approach using a flight director or the aircraft is flown to the CAT 1 DA with an autopilot coupled (LLZ and GP); and
2. the aircraft is equipped with a serviceable failure warning system for the primary attitude and heading reference systems; and
3. high intensity runway edge lighting is available.

A Category I operation is a precision instrument approach and landing using ILS, MLS with a decision height not lower than 200 ft and with a runway visual range not less than 550 m.

Category I minima				
Decision height	**Facilities/RVR[1]**			
	Full[2&6]	**Intermediate[3&6]**	**Basic[4&6]**	**Nil[5&6]**
200 ft	550m	700m	800m	1,000m
201–250 ft	600 m	700 m	800 m	1,000m
251–300 ft	650 m	800 m	900 m	1,200m
301 ft and above	800m	900m	1,000m	1,200m

Note 1: These figures are either the reported RVR or the meteorological visibility when reported RVR not available.

Note 2: Full facilities comprise runway markings, 720 m or more of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.

Note 3: Intermediate facilities comprise runway markings, 420–719 m of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.

Note 4: Basic facilities comprise runway markings, <420 m of HI/MI approach lights, any length of LI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.

Note 5: Nil approach light facilities comprise runway markings, runway edge lights, threshold lights, runway end lights or no lights at all.

Note 6: The Table is applicable to conventional approaches with a glide slope angle up to and including 4°.

Category II Precision Approach

Availability. All engines operating ILS CAT 2 DA, RH and visibility minima are authorised for approved operators.

Operating Criteria

a. Ground Facilities
- Precision approach runway CAT 2.
- Transmissometer or other approved RVR measurement available from at least one touchdown and one rollout reading.

b. Airborne Equipment An approved:
- flight director system; and
- auto pilot coupled approach system; and
- auto-land system (for RVR less than 880M); and
- instrument failure warning system.

c. Environmental Conditions
- Maximum head-wind component including gust of 25KT, Maximum tail-wind component including gust of 10KT,
- Maximum crosswind component including gust of 10KT.

Note: Operators are advised that the facilities required for Category 2 minim are not currently available at aerodromes in Papua New Guinea

A Category II operation is a precision instrument approach and landing using ILS or MLS with a decision height below 200 ft but not lower than 100 ft and a runway visual range of not less than 300 m.

Category II minima		
Decision height	**RVR[1]**	
	Aeroplane Category A, B & C	**Aeroplane Category D**
100 ft–120 ft	300m	300m[2]/350m
121 ft–140 f t	400m	400m
141 ft and above	450m	450m

Note 1: The values in the table represent the absolute minimum RVR under the most favourable operating conditions (e.g auto-coupled flight to below DH).

Note 2: If autoland operations supported by the airport facilities, RVR for cat D can be reduced to 300m

Category III Precision Approach

Category III operations are subdivided as follows:

(i) A operations. A precision instrument approach and landing using ILS or MLS with:

a) A decision height lower than 100 ft; and

b) A runway visual range not less than 200 m.

(ii) B operations. A precision instrument approach and landing using ILS or MLS with:

a) A decision height lower than 50 ft, or no decision height; and

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

Note: Where the decision height (DH) and runway visual range (RVR) do not fall within the same Category, the RVR will determine in which Category the operation is to be considered.

(iii) No Decision Height Operations. Operations with no decision height may only be conducted if:

a) The operation with no decision height is authorised in the Aircraft Flight Manual;

b) The approach aid and the aerodrome facilities can support operations with no decision height; and

c) The operator has an approval for CAT III operations with no decision height.

Note: In the case of a CAT III runway it may be assumed that operations with no decision height can be supported unless specifically restricted as published in the AIP or NOTAM.

Category III minima		
Approach Category	Decision Height (ft)	RVR (m)[1]
IIIA	Less than 100 ft	200m
IIIB	Less than 100 ft	150m
IIIB	Less than 50 ft	125m
IIIB	Less than 50 ft or No Decision Height	75m

Note1: Reported RVR must be available at the aerodrome in order to conduct Cat II or Cat III operations

Non-Precision Approach

The system minima for non-precision approach (NPA) procedures are not lower than the minimum descent height (MDH) values below.

System minima	
Facility	**Lowest MDH**
NPA with FAF	250 ft
NPA without FAF	300 ft

The following four tables are only applicable to conventional approaches with a nominal descent slope of not greater than 4°. Greater descent slopes will usually require that visual glide slope guidance (e.g. PAPI) is also visible at the Minimum Descent Height. The distance figures are either reported RVR or meteorological visibility.

RVR for non-precision approach – full facilities

Full facilities comprise runway markings, 720 m or more of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.

Non-precision approach minima - Full facilities				
MDH	**RVR/Aeroplane Category**			
	A	**B**	**C**	**D**
250–299 ft	800m	800m	800m	1,200m
300–449 ft	900m	1,000m	1,000m	1,400m
450–649 ft	1,000m	1,200m	1,200m	1,600m
650 ft and above	1,200m	1,400m	1,400m	1,800m

RVR for non-precision approach – intermediate facilities
Intermediate facilities comprise runway markings, 420–719 m of HI/MI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.

Non-precision approach minima - Intermediate facilities				
MDH	**RVR/Aeroplane Category**			
	A	**B**	**C**	**D**
250–299 ft	1,000m	1,100m	1,200m	1,400m
300–449 ft	1,200m	1,300m	1,400m	1,600m
450–649 ft	1,400m	1,500m	1,600m	1,800m
650 ft and above	1,500m	1,500m	1,800m	2,000m

RVR for non-precision approach – basic facilities
Basic facilities comprise runway markings, <420 m of HI/MI approach lights, any length of LI approach lights, runway edge lights, threshold lights and runway end lights. Lights must be on.

Non-precision approach minima - Basic facilities				
MDH	**RVR/Aeroplane Category**			
	A	**B**	**C**	**D**

250–299 ft	1,000m	1,300m	1,400m	1,600m
300–449 ft	1,300m	1,400m	1,600m	1,800m
450–649 ft	1,500m	1,500m	1,800m	2,000m
650 ft and above	1,500m	1,500m	2,000m	2,000m

RVR for non-precision approach– Nil approach light facilities
Nil approach light facilities comprise runway markings, runway edge lights, threshold lights, runway end lights or no lights at all.

Non-precision approach minima - Nil approach light facilities				
MDH	**RVR/Aeroplane Category**			
	A	**B**	**C**	**D**
250–299 ft	1,500m	1,500m	1,600m	1,800m
300–449 ft	1,500m	1,500m	1,800m	2,000m
450–649 ft	1,500m	1,500m	2,000m	2,000m
650 ft and above	1,500m	1,500m	2,000m	2,000m

Take-off minima

Standard Take-off Minima are applicable at all aerodromes except where otherwise detailed on individual Aerodrome Charts.
Standard Take-Off Minima, day and night, are contained in the following table. These take- off minima are not applicable when in the case of an engine failure in multi-engined aircraft, a retum to land at the departure aerodrome is necessary.
Meteorological conditions are then to be above IAL minima or such as to allow a visual approach:

	Ceiling	Visibility
1. IFR multi-engined aircraft above 5700KG which are: a. two pilot operated, or b. single-pilot operated turbojet or equipped with operative auto-feather; and c. with RWY edge lighting and either RWY centre line lighting or centre line marking. (See notes 1, 2, 4, 5)	0 0	800m 500m
2. IFR multi-englned aircraft not above 5700KG which are: a. two pilot operated, or b. single-pilot operated turbojet or equipped with operative auto- feather, and c. c. with RWY edge lighting and either RWY centreline lighting or centre line marking. (see notes 2, 3, 4, 5).	0 0	800m 500m

3. All other IFR aircraft, at aerodrome without approved instrument approach procedure: a. DAY (see note 4) b. b. NIGHT	 500FT Not permitted	 4000m Not permitted
4. 4. All other IFR aircraft. (see note 4)	300FT	2000m
5. All other IFR aircraft, at aerodrome with or without approved instrument approach procedure: a. DAY (see note 4) b. NIGHT	 VMC criteria Not permitted	 VMC criteria Not permitted

Note 1: Aeroplanes/helicopters must comply with pertinent obstacle clearance requirements of CAR Parts 121, 125, 135, 136.

Note 2: Visibilities may be reduced by specific approval; such approvals along with mandatory requirements must be inserted in Company Operations Manuals.

Note 3:

a. Aircraft engine out climb gradient under ambient conditions (manufacturer's data) must be at least 0.3% greater than the obstacle free gradient for the runway length required.

b. Aircraft may use published obstacle free gradients, provided such gradients are surveyed to at least a distance of 7,500M from end of TODA. All runways with strip widths of 150M or greater are surveyed to 7,500M unless otherwise annotated.

c. Where an operator can establish an obstacle free gradient (150M baseline at end of TODA, 12.5% splays, 7500M distance) not more than 30 degrees from runway heading, and whose procedures involve not more than 15 degrees of bank to track within the splay, and 3(a) above can be met, these minima may be used.

Note 4: The pilot In command is responsible for ensuring that:

e. terrain clearance is assured until reaching the applicable safety altitude;

f. in the· case of a multi-engined aircraft, 4(a) above can be complied with should engine failure occur at any time after V1, or lift-off, or encountering non-visual conditions;

g. if a return to the departure aerodrome is not possible, that the aircraft performance and fuel availability is adequate to enable the aircraft to proceed to a suitable aerodrome, having regard to terrain, obstacles and route distance limitations.

Note 5: Requirements for two pilot operations are:

a. endorsed on type;

b. multi-crew trained on type;

c. multi-crew proficiency checked within the previous 13 months; and

d. instrument rated.

APPENDIX B – REQUIREMENTS FOR FLIGHT VALIDATION PILOTS

(a) *Qualifications* - Flight validation shall be accomplished by a pilot with all of the following current qualifications:

(1) Commercial Pilot's Licence or Airline Transport Pilot's Licence (A) or (H) as applicable Instrument Rating; and

(2) knowledge and skill requirements for issue of the commercial pilot licence and instrument rating in the aircraft category appropriate for the flight procedure to be validated; and

(3) In addition, flight validation pilots shall meet all the experience requirements for the airline transport pilot licence in the relevant category of aircraft as stipulated in CAR Part 61 or equivalent requirements.

(4) Should a flight validation pilot not be the pilot-in-command of the flight validation aircraft, then the provisions of above shall also apply to the pilot-in-command of the flight validation aircraft.

(b) *Training* - flight validation pilot must have successfully completed:

(1) An ICAO PANS-OPS training course, or a training course accepted by the Director that provides a thorough knowledge of ICAO PANS-OPS procedures design principles and methods related to the design and validation of instrument flight procedures;

(2) The safety and quality assurance objectives of the flight validation, flight validation pilots shall have acquired and maintain the required competency level through formal ground training, supervised on-the-job training and recurrent training in accordance with ICAO Document 9906, Volume 6 - Flight Validation Pilot Training and Evaluation.

(c) *Experience* - IFP flight validation pilot must have:

(1) At least 2 years' experience in the flight validations of IFP; and
(2) Completed an IFP flight validation flight within the previous year.

(d) *Rotorcraft* - Rotorcraft IFP procedures must be flight validated by pilots who, in addition to the above qualifications, are certificated in the rotorcraft category and helicopter class rating and are familiar with rotorcraft procedure design and operations. Should the validation pilot not be qualified as pilot-in-command of a helicopter (or other type of aircraft) to be used for a validation flight, another qualified pilot may be assigned to be the pilot in command (PIC) provided the validation pilot *occupies* either a control seat or a seat in close proximity to the PIC, and directs the conduct of the validation.

(e) Where required by the Director, flight validation pilots must also comply with any additional requirements contained in the Quality Assurance Manual for Flight Procedure Design (ICAO Doc. 9906) – Volume 5: Validation of Instrument Flight Procedures, and Volume 6: Flight Validation Pilot Training and Evaluation.