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Bhutan Civil Aviation Authority
Royal Government Of Bhutan
Paro : Bhutan

Advisory Circular			
Subject:	Instrument approach procedures using continuous descent final approach techniques		
Issuing Office:	Bhutan Civil Aviation Authority	Document No.:	03
File No.:	BCAA/OPS/1.03	Issue Number:	01
Available from	Mr. Bap Tobgay, Dy.Chief Flight Safety	Effective Date:	22/11/2019
		Valid until:	Indefinitely

Table of Contents

1.0 INTRODUCTION

This Advisory Circular (AC) is provided for information and guidance purposes. It may describe an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. This AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards. This AC is issued in accordance with BCAR.CAT.OP.MPA.115.

This AC may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of the regulatory requirements where applicable. The term “should” is to be understood to mean that the proposed method of compliance is strongly recommended, unless an alternative method of safety protection is implemented that would meet or exceed the intent of the recommendation.

1.1 Purpose

The purpose of this AC is to provide guidance for all operators regarding the use of the Continuous Descent Final Approach (CDFA) technique when conducting conventional or RNAV[1] Non-Precision Approach (NPA)[2] procedures or Approach Procedures with Vertical guidance (APV)[3]. It describes the rationale for using the CDFA techniques and documents the related regulations and guidance material to be applied, including some of those relating to Standard Operating Procedures (SOP) and Flight Crew Training (FCT).

1.2 Applicability

This AC does not apply to precision approaches such as ILS, GLS, and MLS

1.3 Description of Changes

(1) N/A

2.0 REFERENCES AND REQUIREMENTS

2.1 Reference Documents

The following reference material may be consulted for information purposes:

(1) FAA AC 120-108
(2) FAA AC 120-71A
(3) ICAO Doc 8168
(4) ICAO Doc 9613
(5) ICAO Doc 9849
(6) CASA CAAP 178-1(2)
(7) COSCAP AC SEA 002
(8) FAA-H-8261-1A
(9) ICAO PBN TF4 WP09 Euro Control Draft Guidance.doc
(10) PANS OPS, Volume I, Part II, Section 4, Chapter 1
(11) TSB Canada Aviation Investigation Report A09Q0203

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[1] RNAV Non-Precision Approach procedures are GNSS-predicated and charted variously as RNAV (GNSS), RNAV (GPS) or RNP APCH. To comply with the ICAO PBN Manual any description of RNAV should have an associated value. E.g. RNAV 10, RNAV 5, 2 or 1 etc.

[2] Non Precision Approaches may be referred to as 2D (two dimensional) approaches from November 2014.

[3] APV and Precision Approaches (PA) may be collectively described as 3D (three dimensional) approaches from November 2014.

2.2 Cancelled Documents

(1) Reserved

(2) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

2.3 Abbreviations Acronyms and Definitions

(1) The following **abbreviations** are used in this document:

(a) Reserved**…**

(2) The following **acronyms and definitions** are used in this document:

(a) **AC:** Advisory Circular

(b) **APV**[4]: Approach Procedure with Vertical guidance. This term is used for RNP APCH operations that include vertical guidance. That is, those flown to LNAV/VNAV or LPV minima. An APV does not meet the requirements established for precision approach and landing operations.

(c) **APV Baro**[5] : An approach (including RNP Approach) with barometric vertical guidance flown to LNAV/VNAV minima expressed as a DA/H.

(d) **APV SBAS:** Is supported by Satellite Based Augmentation Systems, such as WAAS in the US and EGNOS in Europe, to provide lateral and vertical guidance. The lateral guidance is equivalent to an ILS localizer and the vertical guidance is provided against a geometric path in space rather than a barometric altitude. RNAV (GNSS) approach to LP minima is also supported by SBAS.

(e) **APV SBAS:** An approach (including an RNP approach) with geometric vertical guidance flown to the LPV minima expressed as a DA/H.

(f) **ANSP:** Air Navigation Service Provider

(g) **ATC:** Air Traffic Control

(h) **Baro VNAV:** An on-board function where the barometric altimeter forms part of the integrated Air Data System enabling the Flight Management Computer (FMC) to compute deviation from the instrument approach procedure’s vertical design profile.

(i) **CAST:** Commercial Aviation Safety Team

(j) **CDFA:** Continuous Descent Final Approach. A flying technique where a continuous descent is made along a predefined vertical path.

(k) **DA (H):** Decision Altitude (Height) as used on a precision approach and an APV.

(l) **EGNOS:** The European Geostationary Navigation Overlay Service. This is the European SBAS System.

(m) **GASP:** Global Aviation Safety Plan

(n) **GPS NPA:** An RNP APCH flown to LNAV minima

(o) **GNSS:** Global Navigation Satellite System. GNSS is a generic term for satellite navigation systems which include GPS, Galileo (in 2015), and GLONASS.

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[4] The term APV is currently used in ICAO Annex 10-however navigation terminology is undergoing revision in other ICAO documents relevant to flight operations and PBN

[5] ICAO APV Baro procedure design criteria now allow the use of SBAS for vertical guidance. This shall however be explicitly approved by the publishing ANSP before such an operation can be conducted.

(p) **LNAV:** Lateral Navigation

(q) **LNAV:** An approach procedure without VNAV approval with minima expressed as an MDA (H). LNAV approval is according to EASA AMC 20-27 or FAA AC 90-105.

(r) **LNAV/VNAV:** An approach procedure incorporating barometric VNAV with minima expressed as a DA/ (DH). The aircraft's VNAV system may be approved in accordance with EASA AMC 20-27 or FAA AC 90-105.

(s) **LPV:** Localizer Performance with Vertical guidance. An approach procedure incorporating SBAS with minima expressed as DA (DH). The aircraft's system must be approved in accordance with AMC 20-28 or FAA AC 90-107.

(t) **LP:** Localizer Performance. An approach where the minima is expressed as an MDA flown by SBAS-capable aircraft where the vertical performance is not good enough to support LPV operations.

(u) **MDA/H:** Minimum Descent Altitude (Height) as used on a Non Precision Approach.

(v) **NPA:** A Non Precision Approach based on conventional navigation aids or RNAV, flown to a LNAV (MDA/H) or LP (MDA/H).

(w) **PBN:** Performance Based Navigation

(x) **RNAV Approach:** This is a generic name for any kind of approach which is designed to be flown using an onboard area navigation system. RNAV systems typically integrate information from sensors such as: air data; inertial reference; radio navigation and satellite navigation, together with inputs from internal databases and data entered by the crew to perform: navigation; flight plan management; guidance and control; display and system control- functions.

(y) **RNP AR APCH:** An approach which requires special operational approval. Such procedures are useful in terrain rich environments or operations with airspace constraints.

(z) **RNP APCH:** RNP approach procedures include existing RNAV (GNSS) or RNAV (GPS) approach procedures designed with a straight segment[6].

(aa) **RNP:** Required Navigation Performance.

(bb) **SEI:** Safety Enhancement Initiative

(cc) **SBAS:** Satellite Based Augmentation System

(dd) **VNAV:** Vertical Navigation

(ee) **WAAS:** USA-Wide Area Augmentation System

3.0 BACKGROUND

3.1 The United States Commercial Aviation Safety Team (CAST) was founded in 1998 with a goal to reduce the commercial aviation fatality rate in the United States by 80 percent by 2007. To achieve this ambitious goal, the CAST developed and started implementing a comprehensive Safety Enhancement Plan. By 2007, the CAST was able to report that, by implementing the most promising safety enhancements, the fatality rate of commercial air travel in the United States was reduced by 83 percent (%). CAST continues to develop, evaluate and add safety enhancements to the CAST plan for continuing accident rate reduction.

[6] ICAO Doc 9613 Part II C 5.1.1.2. See also ICAO Doc 8168 Vol1 Part II Section 3 Figure II-3-1-1

3.2 ICAO in its Global Aviation Safety Plan (GASP) 2013[7] prioritized action in three areas of aviation safety – improving runway safety, reducing the number of Controlled Flight Into Terrain (CFIT) accidents and reducing the number of loss of control in-flight accidents and incidents. All of these actions will contribute to the overarching priority of the GASP to continually reduce the global accident rate.

3.3 In line with the ICAO's GASP and the CAST initiatives, the RASG/APRAST CFIT sub working group developed a Safety Enhancement Initiative (SEI) focused on Instrument Approach Procedures (IAP) utilising CDFA techniques[8] with a goal of precluding future CFIT accidents.

[7] This is re-iterated in the GASP 2014-2016

[8] Such procedures can be described as 'precision like' in the sense that they allow flight crew to conduct the final approach to land at a constant descent rate and angle in a manner similar to that practiced by following the (externally referenced) glideslope during an ILS precision approach.

4.0 NPA OPERATIONAL PROCEDURES AND FLIGHT TECHNIQUES

4.1 NPAs are designed to permit safe descent to a Minimum Descent Altitude (MDA). Unlike a Decision Altitude (DA) associated with a precision approach (or an Approach Procedure with Vertical guidance (APV)) where the loss of height during the initial stage of a missed approach is taken into account, obstacle clearance is not assured if descent below the MDA occurs, and flight crew need to ensure that the aircraft's descent is arrested prior to reaching the MDA.

4.2 NPAs terminate in a visual segment that may provide for:

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

4.3 Traditionally NPAs were flown as a series of descending steps conforming to the minimum published altitudes. This technique is referred to, colloquially, as the "dive and drive" method. Unfortunately many CFIT accidents have been attributed to, flight crew descending before clearing a limiting step or flight crew failing to arrest descent when approaching a limiting step or other such human lapses/ errors/ factors. An aircraft's descent is more difficult for the flight crew to manage where changes are required in power, rate of descent, and aircraft configuration as is the case during a stepped descent. This can lead to an increased flight crew workload and a corresponding reduction in their situational awareness.

4.4 Where NPAs are published with a Vertical Descent Angle (VDA)[9], the conduct of a stable approach complying with all limiting altitudes is facilitated.

4.5 CDFA approach techniques contribute to an approach characterized by a stable:

- Airspeed
- Descent rate, and
- Flight path in the landing configuration to a point where the landing manoeuver begins.

A CDFA approach is not only safer but also:

- Improves fuel efficiency by minimizing the flight time at low altitudes.
- Reduces noise levels
- Reduces the probability of infringement of the required obstacle clearance during the final approach segment.

[9] Also referred to as Vertical Path Angle (VPA)

4.6 Equipment Requirement

CDFA is primarily a concept therefore it requires no specific aircraft equipment other than that specified in the title of the NPA procedure. Once in the landing configuration and when at an appropriate approach fix the flight crew will simply select a rate / angle of descent and adjust it as required to manage the aircraft’s flight path within the charted limits of the instrument approach procedure while maintaining the required approach speed and respecting the aircraft’s performance envelope. The key is to determine an appropriate descent point and descent rate / angle.

Although RNAV systems and RNAV overlay procedures may be used to assist flight crew in conducting NPA based on legacy azimuth radio navigation aids such as: the Non Directional Beacon (NDB); VHF Omnidirectional Range (VOR); or Localiser (LLZ), it is still necessary for the flight crew to ensure that the approach is monitored and flown within the tolerances of the navigation aid on which the IAP has been designed.

4.7 Identifying the Type of Approach

Whenever the approach minimum is expressed as a MDA the Instrument Approach Procedure (IAP) is a Non-Precision Approach (Refer to the Annex, Figures 1A and 1B).

A NPA procedure, when conducted with reference to representations of the aircraft’s vertical profile calculated by the onboard flight guidance computers, does not necessarily ensure compliance with all altitude constraints or the approach design gradient.[10] That is- a NPA must not be flown using flight directors as command instruments to provide guidance in the vertical plane. Any representation of the aircraft’s vertical profile must be considered **advisory** only.

4.8 Preparation

Before conducting a NPA ensure:

a) The aircraft’s navigation, flight management and instrument systems have been approved for NPA operations, and

b) Where required, GNSS Receiver Autonomous Integrity Monitoring (RAIM) is available and verified by NOTAM or a prediction service, and

c) Where required the Actual Navigation Performance (ANP) meets the RNP standard applicable to the instrument procedure being flown, and

d) The aircraft manufacturer has approved the aircraft for NPA operations and the aircraft complies with the minimum equipment listed to enable the conduct of NPA’s, and

e) The crew are appropriately qualified and meet all recency requirements, and

f) The operator has approved the conduct of NPA for the aircraft type and the aerodrome, and

g) The airport meets the applicable runway and lighting standards.

[10] This is not always clearly documented by the flight management system manufacturers.

4.9 Recommended Operating Procedures

(1) Lateral Navigation/ LNAV

- GNSS /Inertial Navigation System (INS) or VOR; LLZ; NDB
- A NPA can be flown with lateral guidance provided by conventional navigation aids such as VOR; NDB; LLZ as well as by using an approved RNAV system. All RNAV operations are critically dependent on valid data. The operator must have in place quality processes that ensure database validity.

(2) Vertical Information

- The approach should be flown to the NPA MDA respecting all altitude constraints primarily by reference to the altimeter, supplemented by reference to the vertical advisory information provided by flight guidance computers
- Where an accurate local QNH source is / is not available the approach minima may need to be adjusted
- In addition to normal SOPs it is necessary for each crewmember to independently verify the destination altimeter subscale setting.

(3) Visual

- Non-standard temperature effects and altimeter subscale setting round down can cause vertical errors from the nominal path. Flight crew must understand this effect and be aware that a lack of harmony with visual approach slope aids may occur, and indeed should be anticipated
- Operators must ensure that flight crew are aware of the effects of non-standard temperatures and altimeter subscale round down.

4.10 Computing Rate of Descent

CDFA requires use of the approach path angle / Vertical Descent Angle (VDA) published in the IAP.

A VDA incorporated in a navigation database can be used by the flight guidance computers and presented as a vertical profile (pseudo glideslope) to the pilot. Any such representation is to be regarded as advisory only.

Aircraft equipped with a Flight Path Angle (FPA) capability enable the flight crew to more precisely fly the design VDA (whether manually or by use of an autopilot). Pilots of aircraft without flight guidance systems or a flight path angle capability will need to compute a rate of descent which correlates with the design VDA.

The table presented in Figure 3 to the Annex offers flight crew a way to compute a rate of descent or, knowing the altitude change required per nautical mile (NM) - the angle of descent.

Exercise:

Refer to LOC/ NDB Runway 2 approach at La Porte Municipal Airport (Shown in the Annex, Figure 4).

(1) Find the published VDA[11]

(2) From the table find the descent gradient expressed in ft. /NM which equates to the published VDA[12]

(3) From the table, convert that gradient to a descent rate based on groundspeed[13]

4.11 VDA Design

The VDA is calculated from the Final Approach Fix (FAF) altitude to the threshold crossing height (TCH). The optimum NPA descent angle (VDA) is 3.0 degrees[14].

On approaches with step-down fixes, the goal is to publish a VDA that keeps the aircraft's vertical path above the step-down fixes. In some cases, the VDA is calculated from a step-down fix altitude to the TCH. In this situation, the VDA is published on the profile chart after the associated step-down fix (Refer to the Annex, Figure 5). In most cases, the descent angle between the FAF altitude and the step-down fix altitude is slightly shallower than the published VDA for the segment between the step-down fix and the runway.

Operators should determine how they would like their pilots to fly such approaches.

- Option 1: Descend from the FAF at the shallower rate in order to cross above the step-down fix altitude and then transition to published VDA, or

- Option 2: Begin descent at a point past the FAF to allow the aircraft to descend at the published VDA and still clear the step-down fix altitude. Refer to the Tallahassee Regional, VOR RWY 18 approach (Annex, Figure 5).

    - To calculate the descent point beyond the FAF:

        1. First determine the desired altitude to lose: (FAF (2,000 ft.) – (Airport Elevation (81 ft.) + TCH (46 ft.))) = 1,873 ft.

        2. Take the desired altitude to lose (1,873 ft.) and divide by the descent gradient (316 ft. /NM) that equates to the 2.98º VDA.

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[11] In this example, it is 3.20 degrees

[12] 340 feet (ft.) per nautical mile (NM).

[13] A groundspeed of 120 knots (kts) requires a rate of descent of 680 fpm to fly the 3.20-degree descent angle.

[14] The minimum and maximum VDA can range from 2.75 º to 3.77 º depending on the Instrument Approach Procedure Design standard used.

3. This produces a distance of 5.9 NM from the runway threshold or 2.8 DME when outbound on the 173 radial from the SZW VORTAC.

4. The descent rate will be 632 fpm at a groundspeed of 120 knots.

CAUTION: When conducting a NPA any representation of the aircraft's vertical profile should be considered to be advisory ONLY. Strict adherence by the flight crew to the limiting or minimum altitudes is essential for obstacle clearance.

4.12 Timing-Dependent Approaches

Control of airspeed and rate of descent is particularly important on approaches solely dependent on timing to identify the Missed Approach Point (MAP). Pilots should cross the FAF already configured for landing and at the correct speed for the final approach segment.

4.13 Derived Decision Altitude (DDA)

Pilots must not descend below the MDA when executing a missed approach from a NPA. Operators should instruct their pilots to initiate the go-around at an altitude above the MDA (referred to as the DDA) which ensures the aircraft does not descend below the published MDA.

4.14 Decision Approaching MDA

Flying the published VDA will have the aircraft intersect the plane established by the MDA at a point before the MAP. Approaching the MDA, the pilot has two choices: continue the descent to land with required visual references, or execute a missed approach, not allowing the aircraft to descend below the MDA. (See the Annex, Figure 1B- Approach Example Using Continuous Descent Final Approach.)

4.15 Executing a Missed Approach Prior to the MAP

When executing a missed approach prior to the MAP and not cleared otherwise by an Air Traffic Control (ATC) climb-out instruction, fly the published missed approach procedure. Proceed on track to the MAP before accomplishing a turn.

4.16 Visibility Minima Penalty

The appropriate Operations Specification (OpSpec); Management Specification (MSpec) document, and /or Letter of Authorization (LOA) will detail the visibility penalty to be applied to the published approach minima in the event that an operator does not use the CDFA technique when conducting NPAs.

5.0 APV OPERATIONAL PROCEDURES AND FLIGHT TECHNIQUES

5.1 APV by design incorporates the CDFA concept. The conduct of an APV approach contributes positively to situational awareness by reducing flight crew workload at a critical stage of flight. This in turn reduces the risk of CFIT.

5.2 APV approaches are designed to provide vertical guidance to a Decision Altitude (DA). Where an approach is designed to a DA the loss of height during the initial stage of a missed approach is taken into account.

The 36th ICAO Assembly in 2007 passed a resolution encouraging States to implement approach procedures with vertical guidance (Baro-VNAV and/orSBAS) for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016. This resolution was reiterated at the 37th Assembly in 2010, where RNAV (GNSS) NPA was also recognised as an acceptable alternative where APV cannot be implemented.

5.3 APV approaches terminate in a visual segment and provide for a ‘straight-in’ landing. An APV approach is not a precision approach.

5.4 APV (like CDFA) procedures contribute to a stabilized approach and are characterized by a stable:

- Airspeed
- Descent rate, and
- Flight path, in the landing configuration to the point where the flare manoeuver begins.

An APV approach is not only safer but also:

- Improves fuel efficiency by minimizing the flight time at low altitudes.
- Reduces noise levels.
- Reduces the probability of infringement of the required obstacle clearance during the final approach segment.

5.5 Equipment Requirements

APV approaches **require** specific aircraft equipment. To ensure that the obstacle clearance requirements of the approach are met, the procedure must be flown within the tolerances of the navigation system on which the procedure is based **and** the barometric altimeter *system* must be within the manufacturer’s and operator’s accuracy limits.

5.6 Identifying the Type of Approach

- If an IAP minimum is expressed as LNAV/VNAV (DA); LPV (DA); or RNP AR APCH (DA) it means that the approach is an APV approach and that representations on aircraft navigation systems of the aircraft’s vertical profile with respect to the design VDA can be considered as providing guidance. Flight directors systems can be used as command instruments in order to maintain the correct approach profile.

Note: It is good practice to determine the rate of descent required to achieve the design VDA. (Refer Figure 2 in the Annex).

- An approach conducted using the flight directors as command instruments can provide a higher level of safety over CDFA NPA since a flight crew's workload can be further reduced leading to a corresponding increase in their situational awareness.

5.7 Preparation

Before commencing an APV approach the flight crew must ensure:

a) The aircraft's navigation, flight management and instrument systems have been approved for APV operations, and

b) GNSS RAIM is available and verified by NOTAM or a prediction service, and

c) Where required the Actual Navigation Performance (ANP) meets the RNP standard applicable to approach being flown, and

d) The aircraft manufacturer has approved the aircraft for APV operations and the aircraft complies with the minimum equipment listed to enable the conduct of an APV approach, and

e) The crew are appropriately qualified and meet all recency requirements, and

f) The operator has approved the conduct of a APV approaches for the aircraft type and the aerodrome, and

g) The airport meets the applicable runway and lighting standards.

5.8 Recommended Operating Procedures

(1) Lateral Navigation/ LNAV

GNSS or GNSS/INS

- An APV approach must be extracted from the aircraft database. All RNAV and RNP operations are critically dependent on valid navigation data. The operator must have in place quality processes to ensure database validity. Where corrective action is required it must be taken prior to the effective date of the database or if a problem is discovered in a current database, corrective action must be taken such as issuing a company NOTAM or withdrawal of the procedure.

- No alterations are to be made to the database procedure between the Final Approach Point (FAP) and the MAP, except to add/ modify speed constraints.

- GNSS RAIM is available and the aircraft meets the RNAV or RNP standard required by the instrument approach procedure.
- Positive crew action is required when cross track deviation reaches ½ RNP for the relevant segment.
- A missed approach must be initiated when cross track deviation exceeds the RNP value for the segment.

(2) Vertical Navigation/ VNAV

BARO

- The approach is flown to a DA.
- If an approved local QNH source is/ is not available an adjustment to the DA may be required.
- The reported temperature must be above the minimum specified on the IAP chart.
- When conducting an LNAV/VNAV approach, the primary means of obstacle clearance is provided by the VNAV system rather than the altimeter, and adherence to the vertical flight path within reasonable tolerance is required. Vertical deviations from the defined path shall be limited to +/-75 ft.
- As the flight path guidance provided by a barometric VNAV system is directly affected by the altimeter subscale setting, particular attention needs to be placed to pressure setting.
    - In addition to normal Standard Operating Procedures (SOPs) it is necessary for each crewmember to independently verify the destination altimeter subscale setting.
    - In addition to the existing aircraft system design features that will alert crew to some altimeter setting errors it is recommended that at least one Radio Altimeter (RA) and the Enhanced Ground Proximity Warning System (EGPWS) are serviceable prior to commencing any APV approach.
- Altimeter subscales can be miss-set for a variety of reasons. It is important to remember that this issue is not unique to Baro VNAV operations. Any approach which relies on barometric information for vertical profile information will be affected by a miss-set altimeter subscale.

Augmented GNSS [15]

- Where a SBAS[16] is available and the vertical performance is in accordance with AMC 20-28 an approach to LPV (DA) can be conducted otherwise a NPA to a LP (MDA) must be made.

(3) Visual

- Non-standard temperature effects and altimeter subscale setting round down can cause offset errors from the nominal path. Flight crew must understand this effect and be aware that a lack of harmony with visual approach slope aids may occur, and indeed should be anticipated.

- Operators must ensure that flight crew are aware of the effects of non-standard temperatures and altimeter subscale round down.

5.10 Decision Altitude (DA)

At the DA, the pilot has two choices:

1. Continue the descent to land with required visual references, or

2. Execute a missed approach.

5.11 Executing a Missed Approach prior to the MAP

When executing a missed approach prior to the MAP, unless directed otherwise by an Air Traffic Control (ATC) instruction, fly the published missed approach procedure. This means, proceed on track to the MAP, before accomplishing a turn.

Note 1.— Guidance on the operational approval for approach and landing operations with vertical guidance using BARO-VNAV equipment can be found in the Performance Based Navigation Manual (Doc 9613) Volume II Attachment A titled 'Barometric-VNAV'.

Note 2. — For challenging obstacle environments or where tight separation requirements exist, specific procedure design criteria are available for approach and landing operations with vertical guidance. Associated operational approval guidance for RNP AR APCH operations can be found in the Performance Based Navigation Manual (Doc 9613) Volume II Part C Chapter 6 titled 'Implementing RNP AR APCH'.

5.12 Approach Requirement

APV requires the use of the approach path angle / Vertical Descent Angle (VDA) published on the IAP.

[15] Some flight management system equipment manufacturers claim their navigation equipment will provide LNAV/VNAV capability but this may not be true if the equipment is reliant on an augmentation system which has not yet been established in the region.

[16] The Civil Aviation Safety Authority of Australia (CASA) refers to SBAS as Space Based Augmentation System in CAAP 178-1(2)

5.13 Computing Rate of Descent.

The table presented in Figure 2 of the Annex offers the flight crew a way to compute a rate of descent based on either the altitude change required per nautical mile (NM) or the angle of descent. Knowledge of the rate of descent required enables flight crew to cross check that the IAP design VDA is being correctly flown.

6.0 SOP and FCT

Operators should revise their SOP and Flight Crew Training (FCT) programs to identify CDFA as a standard method of conducting NPA and APV. Operators should consult: the relevant State regulations; Original Equipment Manufacturer (OEM) bulletins; and advisory documents such as the FAA AC 120-71A; COSCAP AC SEA 002A; and the *RASG- APAC Model Advisory Circular regarding Standard Operating Procedures for Flight Deck Crew Members (currently under development)*- in order to develop procedures specific to their needs.

7.0 INSTRUMENT APPROACH CHARTS

7.1 Navigation terminology is subject to ongoing revision. For this reason operators should **consider** charting options which minimize the likelihood of instrument approach charts being misused, misinterpreted or misread by the flight crew. One such method would be the customisation of charts such that only those which bear the operator's logo are to be used by that operator's flight crew. This will minimise the chance of flight crew members conducting an approach for which they or the operator are not authorised. Operating minima (MDA/DA) should also be customised to reflect corrections to be applied by the flight crew to the approach minima stemming from Management Specifications (MSpecs) or those imposed by a State in Operational Specifications (OpSpec) documents or Letters of Authorisation (LOA).

8.0 ACTION BY STATES

States should further enhance aviation safety by:

9.0 INFORMATION MANAGEMENT

(1) Not applicable.

10.0 DOCUMENT HISTORY

(1) Not applicable.

11.0 CONTACT OFFICE

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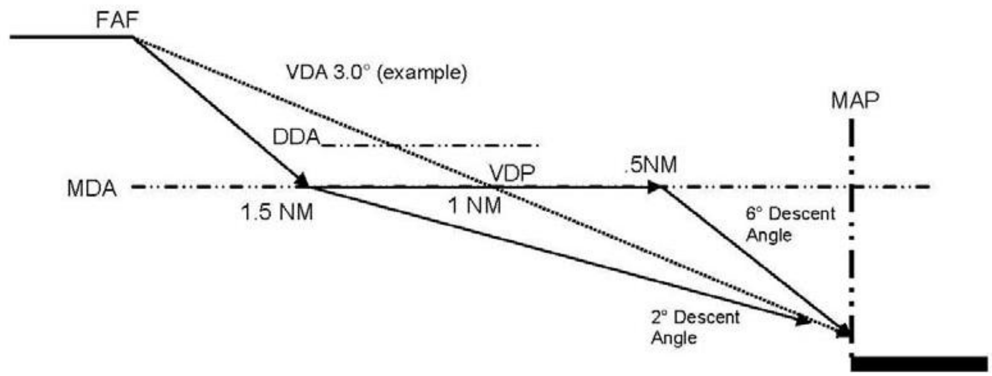
00975-17641040

12.0 ANNEX

FIGURE 1A
APPROACH WITHOUT USING CONTINUOUS DESCENT FINAL APPROACH

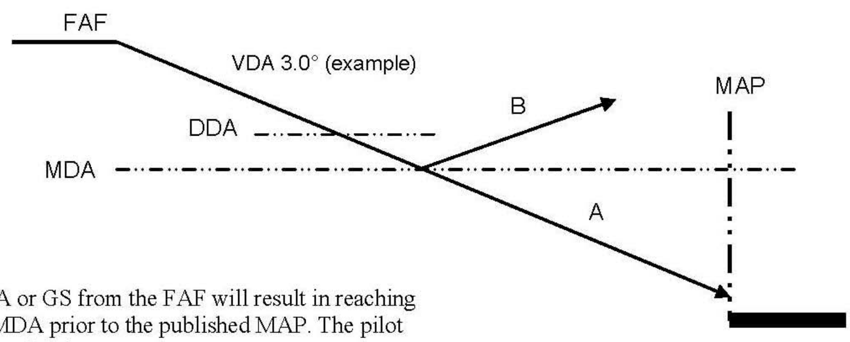


In this example, the aircraft leveled at the MDA (dive and drive) and is proceeding to the MAP in an attempt to acquire the required visual references to continue the approach below the MDA. The 3.0° VDA would be used in this example to fly a CDFA.

A. As the aircraft approaches the published MAP, the required descent angle to the runway threshold steepens. At approximately.5 NM from the MAP, the required angle has increased to 6°. At a groundspeed of 120 kts, a 1270 FPM rate of descent would be required to cross the threshold at a planned TCH of 50 ft. The steep final angle, low-power setting and high descent rate may result in an unstable approach and unsafe condition in the transition to landing.

B. If a pilot descends .5NM early, a 2° descent angle is required. At a groundspeed of 120 kts., this corresponds to a 425 FPM rate of descent. Higher power settings and increased deck angles are required, the aircraft is closer to the ground and the TCH may be reduced to an unsafe height for large aircraft.

FIGURE 1B
APPROACH USING CONTINUOUS DESCENT FINAL APPROACH TECHNIQUE



Flying the VDA or GS from the FAF will result in reaching the DDA and MDA prior to the published MAP. The pilot has two courses of action:

A. If required visual cues are acquired, continue visually to the landing runway.

B. If required visual cues are not acquired, execute a missed approach. Do not descend below the MDA. Proceed on track to the MAP before accomplishing a turn.

FIGURE 2
INSTRUMENT APPROACH PROCEDURE LEGEND

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LEGEND
INSTRUMENT APPROACH PROCEDURES (CHARTS)

PROFILE VIEW

Two different methods are used for vertical guidance:
a. "GS" indicates an electronic glide slope or barometric vertical guidance is present. In the case of an Instrument Landing System (ILS) and Wide Area Augmentation System (WAAS) LPV approach procedures, an electronic signal provides vertical guidance. Barometric vertical guidance is provided for RNP and LNAV/VNAV instrument approach procedures. All ILS, LPV, RNP, and LNAV/VNAV will be in this format GS 3.00°/TCH 55, located in the lower left or right corner.
b. Other charts without electronic or barometric vertical guidance will be in this format ∠3.00°/TCH 55, indicating a non-precision vertical descent angle to assist in preventing controlled flight into terrain. On Civil (FAA) procedures, this information is placed above or below the procedure track following the fix it is based on.

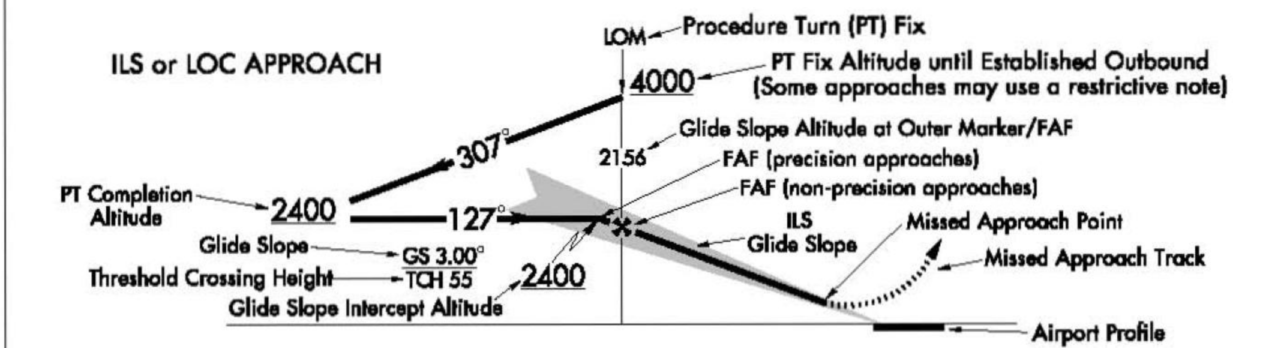


FIGURE 3
RATE OF DESCENT TABLE

CLIMB/DESCENT TABLE 10042

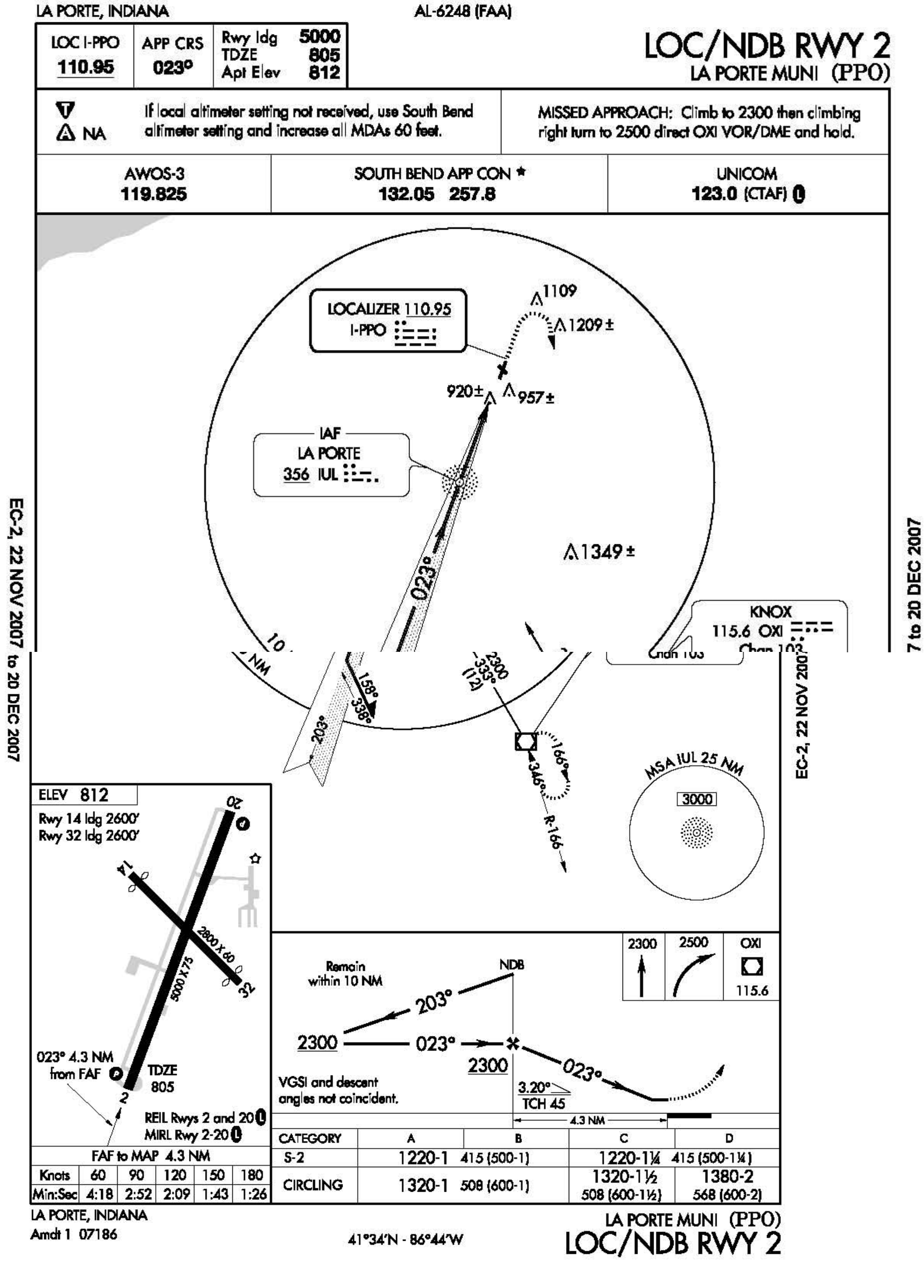
INSTRUMENT TAKEOFF OR APPROACH PROCEDURE CHARTS
RATE OF CLIMB/DESCENT TABLE
(ft. per min)

A rate of climb/descent table is provided for use in planning and executing climbs or descents under known or approximate ground speed conditions. It will be especially useful for approaches when the localizer only is used for course guidance. A best speed, power, altitude combination can be programmed which will result in a stable glide rate and altitude favorable for executing a landing if minimums exist upon breakout. Care should always be exercised so that minimum descent altitude and missed approach point are not exceeded.

CLIMB/ DESCENT ANGLE (degrees and tenths)	ft/NM	GROUND SPEED (knots)										
		60	90	120	150	180	210	240	270	300	330	360
2.0	210	210	320	425	530	635	743	850	955	1060	1165	1275
2.5	265	265	400	530	665	795	930	1060	1195	1325	1460	1590
VERTICAL PATH ANGLE 2.7	287	287	430	574	717	860	1003	1147	1290	1433	1576	1720
2.8	297	297	446	595	743	892	1041	1189	1338	1486	1635	1783
2.9	308	308	462	616	770	924	1078	1232	1386	1539	1693	1847
3.0	318	318	478	637	797	956	1115	1274	1433	1593	1752	1911
3.1	329	329	494	659	823	988	1152	1317	1481	1646	1810	1975
3.2	340	340	510	680	850	1020	1189	1359	1529	1699	1869	2039
3.3	350	350	526	701	876	1052	1227	1402	1577	1752	1927	2103
3.4	361	361	542	722	903	1083	1264	1444	1625	1805	1986	2166
3.5	370	370	555	745	930	1115	1300	1485	1670	1860	2045	2230
4.0	425	425	640	850	1065	1275	1490	1700	1915	2125	2340	2550
4.5	480	480	715	955	1195	1435	1675	1915	2150	2390	2630	2870
5.0	530	530	795	1065	1330	1595	1860	2125	2390	2660	2925	3190
5.5	585	585	880	1170	1465	1755	2050	2340	2635	2925	3220	3510
6.0	640	640	960	1275	1595	1915	2235	2555	2875	3195	3510	3830
6.5	690	690	1040	1385	1730	2075	2425	2770	3115	3460	3805	4155
7.0	745	745	1120	1490	1865	2240	2610	2985	3355	3730	4105	4475
7.5	800	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800
8.0	855	855	1280	1710	2135	2560	2990	3415	3845	4270	4695	5125
8.5	910	910	1360	1815	2270	2725	3180	3630	4085	4540	4995	5450
9.0	960	960	1445	1925	2405	2885	3370	3850	4330	4810	5295	5775
9.5	1015	1015	1525	2035	2540	3050	3560	4065	4575	5085	5590	6100
10.0	1070	1070	1605	2145	2680	3215	3750	4285	4820	5355	5890	6430

FIGURE 4

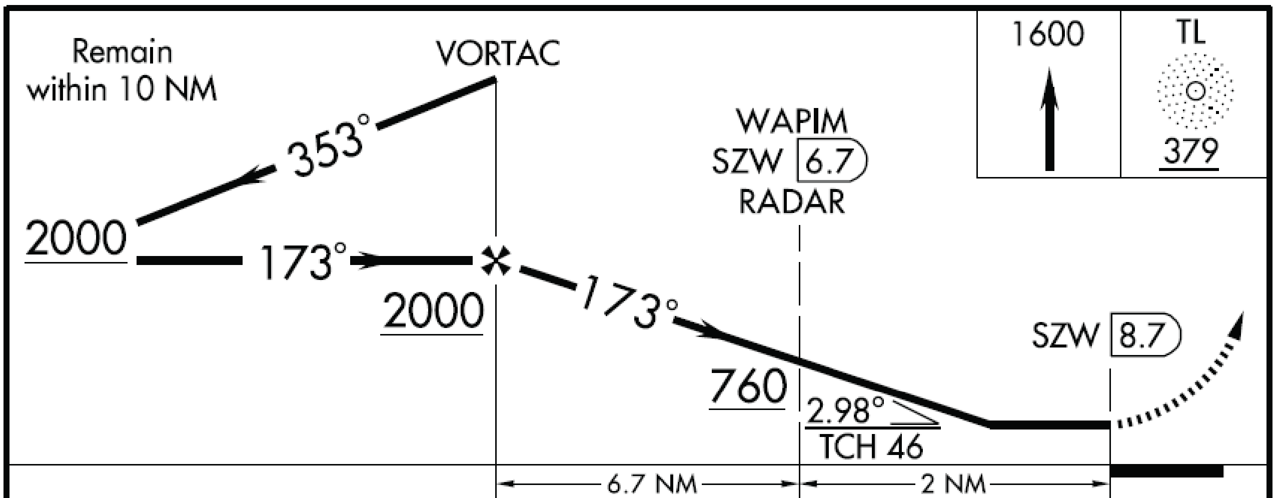
APPROACH: LOCALIZER / NON-DIRECTIONAL BEACON RUNWAY 02



FAF to MAP 4.3 NM					
Knots	60	90	120	150	180
Min:Sec	4:18	2:52	2:09	1:43	1:26

CATEGORY	A	B	C	D
S-2	1220-1 415 (500-1)		1220-1¼ 415 (500-1¼)	
CIRCLING	1320-1 508 (600-1)		1320-1½ 508 (600-1½)	1380-2 568 (600-2)

FIGURE 5
INSTRUMENT APPROACH PROCEDURES WITH CONTROLLING STEPDOWN FIX



CATEGORY	A	B	C	D
S-18	760-1 679 (700-1)		760-2 679 (700-2)	760-2¼ 679 (700-2¼)
CIRCLING	760-1 679 (700-1)		760-2 679 (700-2)	760-2¼ 679 (700-2¼)
WAPIM FIX MINIMUMS				
S-18	540-1 459 (500-1)		540-1¼ 459 (500-1¼)	540-1½ 459 (500-1½)
CIRCLING	540-1 459 (500-1)		580-1½ 499 (500-1½)	640-2 559 (600-2)

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