สำนักงานการบินพลเรือนแห่งประเทศไทย
The Civil Aviation Authority of Thailand

Guidance Material for Continuous Descent Final Approach

CAAT-GM-OPS-CDFA

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Abbreviations

Abbreviations	Meaning
ANP	Actual Navigation Performance
APV	Approach Procedure with Vertical Path
CDFA	Continuous Descend Final Approach
CFIT	Controlled Flight into Terrain
DDA	Derived Decision Altitude
DME	Distance Measuring Equipment
EPE	Estimated Position Error
FAF	Final Approach Fix
FAS	Final Approach Segment
FMS	Flight Management System
FPA	Flight Path Angle
FPM	Feet per Minute
GLS	Ground Based Augmentation System (GBAS) Landing System
GNSS	Global Navigation Satellite System
GS	Glide Slope
IAP	Instrument Approach Procedure
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IRS	Inertial Reference System
LLZ	Localizer
LNAV	Lateral Navigation
MAPt	Missed Approach Point
MDA	Minimum Descend Altitude
NDB	Non-Directional Beacon
NOTAM	Notices to Airman
NPA	Non-Precision Approach
OCA/H	Obstacle Clearance Altitude/ Height
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
PF	Pilot Flying
PM	Pilot Monitoring
RAIM	Receiver Autonomous Integrity Monitoring
RNAV	Area Navigation
SOP	Standard Operating Procedure
TCH	Threshold Crossing Height
VASI	Visual Approach Slope Indicator
VDA	Vertical Descent Angle
VOR	Very High Frequency Omni-Directional Range

0. Introduction

0.1 Background

Controlled flight into terrain (CFIT) is a primary cause of worldwide commercial aviation fatal accidents. Unstabilized approaches are a key contributor to CFIT events. Present NPAs are designed with and without step-down fixes in the final approach segment. Step-downs flown without a constant descent will require multiple thrust, pitch, and altitude adjustments inside the final approach fix (FAF). These adjustments increase pilot workload and potential errors during a critical phase of flight. NPAs designed without step-down fixes in the final segment allow pilots to immediately descend to the MDA after crossing the FAF. In both cases, the aircraft remains at the MDA until descending for the runway or reaching the missed approach point (MAPt). This practice, commonly referred to as “dive and drive,” can result in extended level flight as low as 250 feet above the ground in instrument meteorological conditions (IMC) and shallow or steep final approaches.

0.2 Purpose

This guidance material provides guidance for all operator using the continuous descent final approach (CDFA) technique while conducting conventional or RNAV Non-Precision Approach (NPA) procedures.

It describes the rationale for using the CDFA technique, as well as recommended general procedures and training guidelines for implementing CDFA as a standard operating procedure (SOP).

0.3 Applicability (is subjected to)

This guidance applies to all NPAs published with a glideslope/approach path angle/vertical descent angle (VDA). It does not apply to APV approaches and precision approaches such as ILS, GLS, and PAR.

0.4 Reference (Refer regulation)

- AC 120-108 (Continuous Descent Final Approach)
- EASA EU (965/2012) CAT.OP.MPA.115 Approach flight technique — aeroplanes

1. Operational Procedures and Flight Techniques

1.1 Equipment Requirement

CDFA requires no specific aircraft equipment other than that specified in the title of the NPA procedure. Pilots can safely fly suitable NPAs with CDFA using basic piloting techniques, aircraft flight management systems (FMS), and RNAV systems. Pilots can use points defined by a DME fix, crossing radial, GNSS distance from the runway, etc., on the approach plate to track their progress along both the lateral and vertical approach paths to the Missed Approach Point (MAPt).

Although an RNAV system may be used to assist in flying a conventional approach, it is necessary for the navigation system upon which the procedure is based to be monitored (NDB, VOR, etc.) to ensure that the obstacle clearance requirements of the approach are met, and that the procedure is flown within the tolerances of the navigation system on which the procedure is based.

1.2 Identifying the Type of Approach

Whenever the approach minimum is expressed as an MDA the Instrument Approach Procedure (IAP) is a Non-Precision Approach which does not provide vertical guidance. It is recommended that operators provide training to their flight crew clearly identifying the type of approach and the minima applicable.

1.3 Preparation

Before conducting a NPA, the operator has to ensure;

(a) the aircraft's navigation, flight management and instrument systems are serviceable,
(b) where required, GNSS Receiver Autonomous Integrity Monitoring (RAIM) is available and verified by NOTAM or a prediction service,
(c) where required the Actual Navigation Performance (ANP) or Estimated position error (EPE) meets the RNP standard applicable to the instrument procedure being flown,
(d) the aircraft manufacturer has approved the aircraft for NPA operations and the aircraft complies with the minimum equipment listed (MEL) to enable the conduct of NPA,
(e) the crew are appropriately qualified and meet all recency requirements,
(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, if any.

1.4 Recommended Operating Procedures

1.4.1 Lateral Navigation/LNAV

(a) GNSS or IRS or VOR, LLZ, NDB
(b) A NPA can be flown with lateral guidance provided by conventional navigation aids such as VOR, NDB, and 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.

1.4.2 Vertical Information

(a) Altimeter
(b) The approach is flown to the NPA MDA by reference to the altimeter.
(c) Where an accurate local QNH[1] source is / is not available the approach minima may need to be adjusted.

[1] Local altimeter setting should be used for conducting RNP APCH.

(d) In addition to normal SOPs it is necessary for each crewmember to independently verify the destination altimeter subscale setting.

1.4.3 Visual

(a) Non-standard temperature effects and subscale setting round off can cause vertical errors from the nominal path. Crews must understand this effect and be aware that a lack of harmonization with visual approach slope aids may occur, and indeed should be anticipated.

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

1.5 Computing Rate of Descent

CDFA requires use of the published Instrument Approach Procedure (IAP), glide slope angle/approach path angle / vertical descent angle (VDA). The published VDA may be incorporated in a navigation database to enable profile deviation information to be presented to the pilot via the flight directors or the flight management guidance computers interface. Any ***such presentation is to be regarded as advisory only.***

Aircraft which are equipped with a Flight Path Angle (FPA) capability allow the pilot to precisely fly the nominated VDA manually or using the autopilot.

Pilots flying aircraft without such capability must compute a required rate of descent based on the ground speed, distance to threshold and desired altitude to lose (FAF altitude – aerodrome elevation +TCH) This computed rate of descent can be flown manually or using the autopilot.

1.6 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 although VDA should not exceed 4.5 degrees for Cat A and CAT B aeroplanes or 3.77 degrees for CAT C and CAT D aeroplanes.

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. 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.

Note 1: When approach profile information is provided in association with a NPA the strict adherence by the flight crew to the limiting or minimum altitudes is essential for obstacle clearance.

Note 2: When conducting a NPA using a flight director system which provides lateral and vertical displacement information, that information should be considered advisory only.

1.7 Timing-Dependent Approaches

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

1.8 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 a DDA) to ensure the aircraft does not descend below the published MDA. It is required that flight crews add a prescribed altitude increment to the MDA depending on type of aircraft, (minimally 50 feet) to determine the altitude at which the vertical transition to the missed approach should be initiated in order to prevent descent below the MDA or transgression below the OCH past the MAPt. In such cases, there is no need to increase the RVR or visibility requirements for the approach.

1.9 Decision Approaching MDA

Flying the published VDA will have the aircraft intersect the plane established by the MDA at a point before the MAPt. 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.

1.10 Executing a Missing Approach Prior to MAPt

When executing a missed approach prior to the MAPt and not cleared otherwise by an air traffic control (ATC) climb-out instruction, fly the published missed approach procedure. Proceed on track to the MAPt.

1.11 Visibility Minima Penalty

Operators should consider visibility penalty[2] of 200 m for Cat A and B, 400 m for Cat C and D aeroplanes and apply to the published approach minima if operators do not use CDFA on NPAs.

[2] EASA requires the operator to increase RVR by 200 m for CAT A and B aeroplanes and by 400 m for CAT C and D aeroplanes when the CDFA technique cannot be applied.

2. Flight Crew Training

2.1 Use of CDFA

The use of CDFA must become a standard procedure in the performance of suitable NPAs. Accordingly, operators should incorporate training on CDFA in those elements of their training programs where non-precision approaches are performed and evaluated.

2.2 Manuals and Standard Operating Procedure (SOPs)

Operators should revise their Operations Manual including SOPs to identify CDFA as a standard method of performing NPAs.

2.3 Training

Additional flight training to use the CDFA technique is not required for pilots qualified to conduct NPA. However, operators should provide flight crews with appropriate ground training before performing CDFA operations. The ground training may be computer-based, published in-flight operations bulletins, or provided via other similar means. Crewmembers should receive training specific to the aircraft type, the installed flight guidance, and navigation system, and on how to utilize the system when using the CDFA technique for applicable approach profiles.

2.4 Training Programme Topics

Each operator's CDFA training program should specifically address the following topics:

(a) emphasis on the stabilized approach concept and the safety benefits of using the CDFA.
(b) approach characteristics (e.g., circling-only minima) and environmental factors (e.g., icing) that could make the use of CDFA inadvisable.
(c) use of baro-VNAV, if applicable, to provide a vertical profile during a non-precision approach.
(d) methods for translating the published GS angle or VDA into the required rate of descent for aircraft not equipped with baro-VNAV.
(e) means for tracking progress along the final approach vertical profile.
(f) means for ensuring compliance with any altitude restrictions during the final approach segment, to include start of descent past FAF to meet step-down fix altitudes.
(g) the altitude additive required for ensuring the aircraft does not descend below the MDA or DDA.
(h) understanding the impact on approach stabilization by flying to the MAPt at the MDA to acquire runway visual references.
(i) Pilot Flying (PF) and Pilot Monitoring (PM) callouts and other crew coordination activities needed to ensure safe transition from the vertical profile to either landing or a go-around at MDA or DDA.
(j) procedures for executing a go-around prior to reaching the MAPt.
(k) the need to comply with the visual glide slope indicator (PAPI/VASI) if available, and discussion of the obstacle protection in the visual segment it provides.