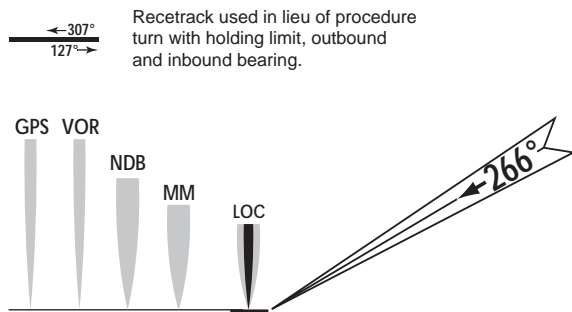


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02nd	2008-Oct-15	EXPLANATION OF TERMINAL CHART TERMS AND SYMBOLS	Hendra Andi Lundy
Approved by :		Sign :	Date : 2004-May-22

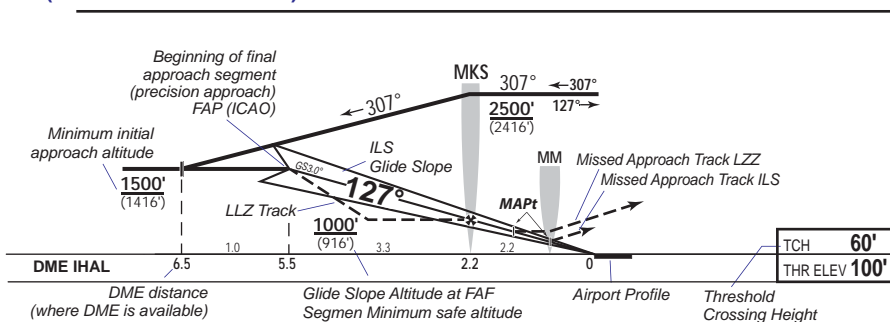
IAP (Instrument Approach Procedure Chart)

APPROACH PROFILE SYMBOLS

- Approach procedure flight track
- Visual procedure flight track
- Missed approach track
- Distance fixed and MAPt fix
- Visual Descent Point (VDP)
- Missed approach fix
- Final Approach Fix (FAF) (for non-precision approaches)
- Airport profile

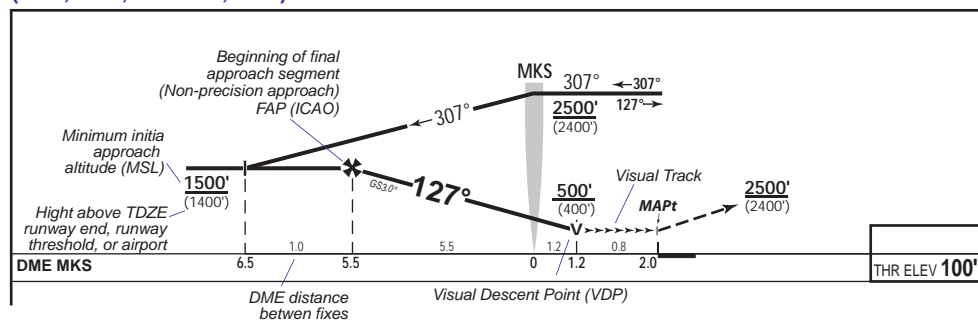


PRECISION APPROACH PROFILE (ILS or LOC APPROACH)



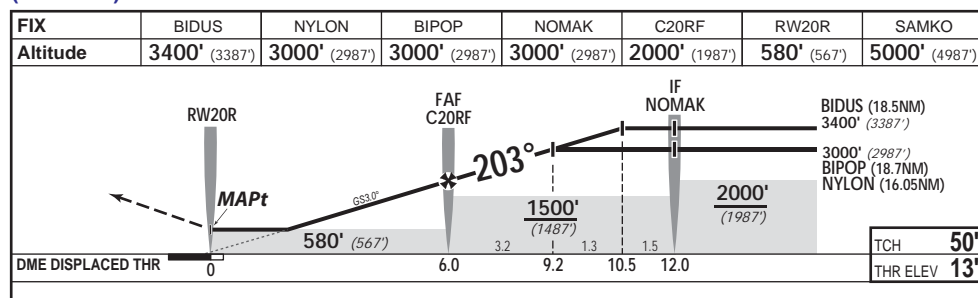
- Precision approaches and systems**
- ILS Instrument Landing System
 - MLS Microwave Landing System
 - PAR Precision Approach Radar (Military)
 - GPS (with vertical navigation via WAAS or EGNOS) - Global Positioning System
 - LAAS Ground Based Augmentation System (GBAS) for (GNSS)
 - JPALS Joint Precision Approach and Landing System
 - GCA Ground-Controlled Approach (mostly military)

NON PRECISION APPROACH PROFILE (LOC, VOR, VORTAC, NDB)



- Nonprecision approaches and systems**
- Localizer
 - VOR
 - NDB, Non-Directional Beacon
 - Localizer Type Directional Aid or LDA
 - Simplified Directional Facility or SDF
 - GPS - Global Positioning System
 - TACAN
 - SRA - Surveillance Radar Approach

NON PRECISION APPROACH PROFILE (MODEL.2)




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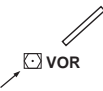
IAP (Instrument Approach Procedure Chart)

LANDING MINIMA

The speed table related aircraft approach speeds to the rate of descen for ILS glide slope (descen in feet per minutes).
For non-precision approach it related speed to the distance show from the final approach point (FAP) or other speciefied fix to the missed approach point (MAPt)

A, B, C, D	Aircraft categories
ILS	ILS Decision altitude (DA)
LLZ (GS out)	Localizer approach (ILS without GS)
360'	Minimum Descent Altitude (MDA) MSL Altitude
(276')	LLZ-Height above Runway at minimum Descent Altitude
- 900m	Ground Visibility in metres or kilometre
CIRCLING	Circling landing minimum application for all runway
MDA(H)	Minimum Descen Altitude (Hight)
FAP / FAF	Beginning of final approach segment (precision approach) FAP (ICAO) / FAF (US)
VIS	Visibility
RVR	Runway Visual Range

CATEGORY	A	B	C	D			
STRAIGHT IN	ILS	360' (276)- 900m	360' (276)- 900m	360' (276)- 900m	360' (276)- 900m		
	LLZ (Gs out)	485' (401)-900m	485' (401)-900m	485' (401)-1200m	485' (401)-1600m		
	CIRCLING MDA(H)	690' (605)- 1600m	690' (605)- 1600m	690' (605)- 2800m	780' (695)- 3600m		
Ground Speed-Kts	70	90	100	120	140	160	HIALS PAPI REIL LDA 2800 A 45
FAP to MAPt 6.7	5 : 45	4 : 28	4 : 01	3 : 21	2 : 52	2 : 31	
VIS (feet / min) GS 3°	377	484	538	646	853	861	
<small>Data Source : AIP AMDT 12, 14, 15 NOV 06.</small>							
<small>Change: Jakarta Appch. Freq. Instr. Appch. Minima.</small>							
<small>© Indoavis 2008</small>							

CATEGORY	A	B	C	D			
STRAIGHT IN	VOR/DME	490' (400)- 1400m	490' (400)- 1400m	490' (400)- 1400m	490' (400)- 1600m		
	VOR						
CIRCLING MDA(H)	800' (710)- 2200m	800' (710)- 2200m	800' (710)- 3200m	800' (710)- 3600m			
Ground Speed-Kts	120	130	140	150	160	HIALS PAPI REIL LDA 2625 A 45	
MAPt at D3.0							
VIS (ft/min)	635	690	745	795	850		
<small>Data Source : AIP AMDT 12, 15 NOV 06.</small>							
<small>Change: New issue</small>							
<small>© Indoavis 2008</small>							

ICAO MODEL

OCA/H	A	B	C	D
Straight-in Approach	VOR/DME	580 (559)		
	VOR	1 000 (979)		
Circling	1 000 (979)		1 100 (1 079)	

AIRCRAFT CATEGORIES

- A : less than 91 knots; weight less than 30,001 pounds.
 B : 91 knots or more but less than 121 kn. weight 30,001 pounds or more but less than 60,001 pounds.
 C : 121 knots or more but less than 141 kn. weight 60,001 pounds or more but less than 150,001 pounds.
 D : 141 knots or more but less than 166 kn. weight 150,001 pounds or more.
 E : 166 knots or more; any weight.

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IAP (Instrument Approach Procedure Chart) STANDARD CALCULATING

GENERAL.

The OPTIMUM final segment descent angle for all category aircraft is 3.00°, which approximates a 318 ft/NM or 5.24% gradient.

The MAXIMUM final segment descent angle for all category aircraft is 3.77°, which approximates a 400 ft/NM or 6.59% descent gradient, and

the MAXIMUM final segment descent angle for original procedures submitted for publication for categories D and E is 3.50° (USN 3.77°) which approximates 372 ft/NM or 6.12%.

Where category C, D, and E minimums are to be published on **original procedures**, achieve as close to the OPTIMUM final segment descent angle as possible while remaining within the following preferred ranges:

FAA	2.50°-3.77° (CAT A & B)
	2.75°-3.77° (CAT C)
	2.75°-3.50° (CAT D & E)
USAF	2.50°-3.50°
USN	2.50°-3.77°

Calculate descent angles based on the distance from the plotted position of one fix to lotted position of the next fix/FEP, and the difference in altitude between the:

- FAF and [THRe+TCH] or FAF and lowest CMDA (CAT A or CAT D as appropriate)
- FAF and S/D
- S/D and [THRe+TCH] or S/D and lowest CMDA (CAT A or CAT D as appropriate)

STRAIGHT-IN APPROACHES.

Where the MAXIMUM descent angle is exceeded, do not publish straight -in minimums. See paragraph 3.0 for circling approach applicability.

CALCULATING STRAIGHT-IN DESCENT ANGLE

Calculate the descent angle using the following formula:

$$\text{angle} = \arctan \left(\frac{a-b}{d} \right)$$

Where:

- a = FAF or S/D altitude
- b = S/D altitude or (THRe + TCH) as appropriate
- d = Distance in ft from the FAF or S/D to S/D or FEP as appropriate
(to convert NM to feet : ft = NM x 6076.11548)

If the equivalent gradient is desired, use the following formulas:

$$\text{gradient(ft / NM)} = \tan(\text{angle}) 6076.11548$$

$$\text{gradient(\%)} = \tan(\text{angle}) 100$$

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IAP (Instrument Approach Procedure Chart) STANDARD CALCULATING

DETERMINING STRAIGHT-IN FAF LOCATION BASED ON DESCENT ANGLE

(Use where feasible; e.g., FAF is an RNAV, DME, or intersection fix)

Select an appropriate fix location to provide, where feasible, a vertical path coincident in angle ($\pm 0.20^\circ$) and TCH ($\pm 3'$) with the lowest published VGSI angle. Where VGSI is not installed, select a fix location to achieve a near optimum descent angle. For stand-alone LNAV and non-RNAV approaches where the FAF is not a facility, determine the FAF location (distance from threshold to FAF) using the method described in figure 1.

Figure 1. Determining Straight-In FAF Distance from Threshold Based on Required FAF Altitude

$$d = \frac{(a-b)}{\tan(\text{angle})}$$

where: d = Distance from FEP to FAF in feet

a = FAF Altitude

b = THRe + TCH

THRe = Threshold Elevation

TCH = TERPS table 18A or the VGSA TCH as appropriate
angle = designed angle or VGSA angle as appropriate

EXAMPLE / CONTOH

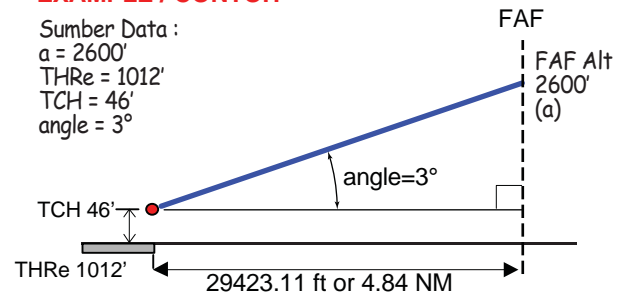
Sumber Data :

a = 2600'

THRe = 1012'

TCH = 46'

angle = 3°



$$d = \frac{2600 - (1012 + 46)}{\tan(3^\circ)} = 29423.11$$

DETERMINING OPTIMUM STRAIGHT-IN FAF ALTITUDE BASED ON FIXED FAF LOCATION

(Use where FAF location is dictated by other factors; e.g., FAF is a facility, ATC requires FAF to be at a specific location, etc)

Select an appropriate fix altitude to provide a descent angle to TCH coincident ($\pm 0.20^\circ$, $\pm 3'$) with the lowest published VGSI angle, where feasible. Where VGSI is not installed, select a fix altitude to achieve a near optimum descent angle. When the FAF location is a facility or fixed by ATC, calculate the OPTIMUM FAF altitude using the method described in figure 2.

Figure 2. Determining Straight-In FAF Altitude Based on Fixed FAF Location

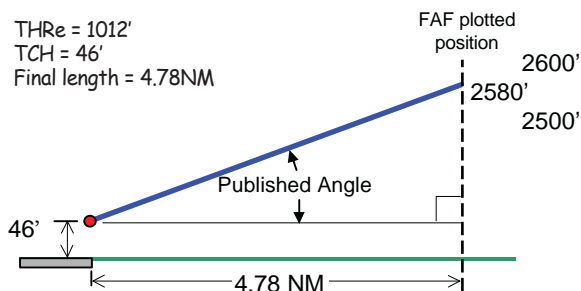
$$\text{FAF Altitude} = \text{THRe} + \text{TCH} + [\tan(\text{VGSI angle}) \times d]$$

where: THRe = THRElevation

d = Distance from FEP to FAF in feet

EXAMPLE / CONTOH

THRe = 1012'
TCH = 46'
Final length = 4.78NM



$$\text{angle} = \arctan$$

$$\text{FAF Alt} = 1012 + 46 + [\tan(3^\circ) \times (4.78 \times 6076.11548)] = 2580.12 \sim 2600$$

$$\text{Published angle} = \arctan \left(\frac{a-b}{d} \right)$$

$$\text{Published angle} = \arctan \left(\frac{2600 - (1012 + 46)}{4.78 \times 6076.11548} \right) = 3.04$$

Round the answer to the nearest 100-foot increment. Publish the angle from the rounded FAF altitude to the TCH value.

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IAP (Instrument Approach Procedure Chart) STANDARD CALCULATING

CIRCLING APPROACHES

DETERMINING CIRCLING DESCENT ANGLE

The circling approach descent angle shall not exceed MAXIMUM. Calculate the descent angle on circling approaches based on Category A and/or DCMDAs as appropriate instead of THRe + TCH. See figure 3.

Figure 3. Calculating Descent /Angle for Circling Approaches

$$\text{Descent angle} = \arctan\left(\frac{a - b}{d}\right)$$

Where a = FAF alt

b = CMDA for CAT A and/or CAT D

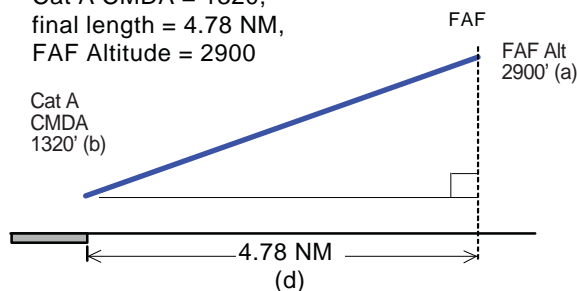
d = Final length in feet

(to convert NM to feet : ft = NM × 6076.11548)

EXAMPLE / CONTOH

Cat A CMDA = 1320,
final length = 4.78 NM,
FAF Altitude = 2900

Cat A
CMDA
1320' (b)



$$\text{Descent Angle} = \arctan\left(\frac{2900 - 1320}{4.78 \times 6076.11548}\right) = 3.12^\circ$$

Do not publish a descent angle on circling approaches except where straight-in alignment requirements are met. In this case, calculate the published descent angle as described in paragraph 2.1, assuming descent from FAF altitude to THRe + TCH.

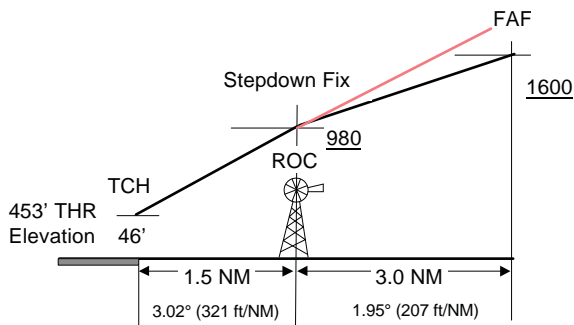
ESTABLISHING CIRCLING-ONLY PROCEDURE FAF LOCATION

A circling approach is not normally flown using a stabilized descent from the FAF to landing. Therefore, the location of the FAF is not predicated on the descent angle from FAF altitude to CMDA. Establish the FAF under the alignment and segment length criteria applicable to the final approach NAVAID or system.

STEPDOWN FIXES

For approaches with a published descent angle, select the S/D location that allows a minimum S/D altitude at or below the descent angle from the FAF to TCH. When the minimum S/D altitude at or below the descent angle from the FAF to TCH. When the altitude at the S/D is above the descent angle from the FAF to TCH, increase the FAF altitude or adjust the S/D location accordingly. See figure 5. Where this is not feasible, publish the angle from the S/D to TCH rather than the angle from FAF to TCH.

Figure 5. Comparing Descent Before and After a Stepdown Fix



$$\text{Descent Angle} = \arctan\left(\frac{1600 - 980}{3 \times 6076.11548}\right) = 1.95^\circ$$

$$\text{Descent Angle} = \arctan\left(\frac{980 - (453 + 46)}{1.5 \times 6076.11548}\right) = 3.02^\circ$$

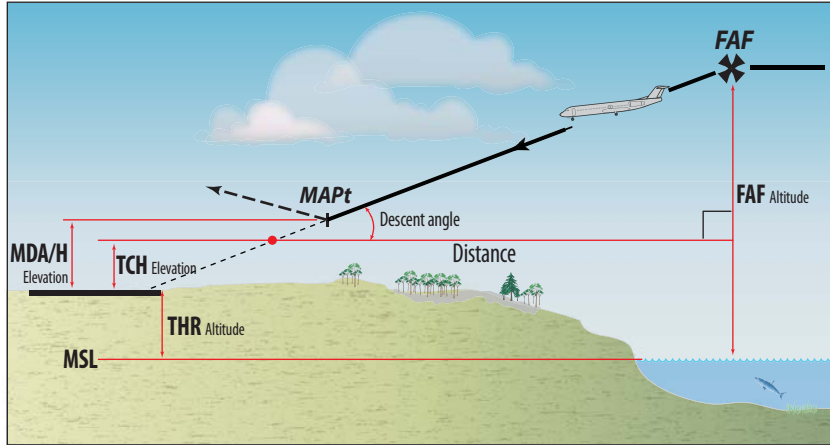
If possible, raise the FAF altitude as described in paragraph 2.3 to achieve at least a 3.02° angle

Reference by:
http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/afs420/policies_guidance/tls/media/TIL00012Aatt.pdf

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IAP (Instrument Approach Procedure Chart)

Non-Precision Straight-in Descent Angle Calculator



- FAF : Final Approach Fix
- TCH : TERPS Table 18A or the VGSITCH as appropriate
- THR : Threshold Elevation
- MDA/H : Minimum Descent Altitude/Height
- MSL : Mean Sea Level
- MAPt : Missed Approach Point

Note: Units conversion used by FAA: 1 NM = 6076.11548 ft

Rates and Time of Descent and per Ground Speeds indoavis 2006

Angle ° <=> % descent angle (standard=2.50°~3.77°, common=3°)

Distance NM distance from FAF to MAPt

Ground Speed	70	80	90	100	110	120	130	140	150	160	(other)	kts
Descent rate												ft/min
Time of Descent												min:sec
Decline	<input type="text"/> ft (altitude drop from FAF to MAPt)											

Altitude of Descent per Distance indoavis 2006

Angle ° <=> % descent angle (standard=2.50°~3.77°, common=3°)

THR ft threshold altitude (MSL)

TCH ft touchdown elevation (from THR)

Distance	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	(other)	NM
FAF Altitude											ft (MSL)

Distance of Descent indoavis 2006

Angle ° <=> % descent angle (standard=2.50°~3.77°, common=3°)

FAF ft FAF altitude (MSL)

THR ft threshold altitude (MSL)

TCH ft touchdown elevation (from THR)

Distance ft <=> NM

Programing/script by : Indoavis Nusantara (Ismu Riyanto)
 Reference by : http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/afs420/policies_guidance/tls/media/TIL00012Aatt.pdf