Procedures & Techniques

Continuous Descent Final Approach (CDFA)

Figure: CDFA versus conventional approach, from Eddie's notes.

Eddie Sez:

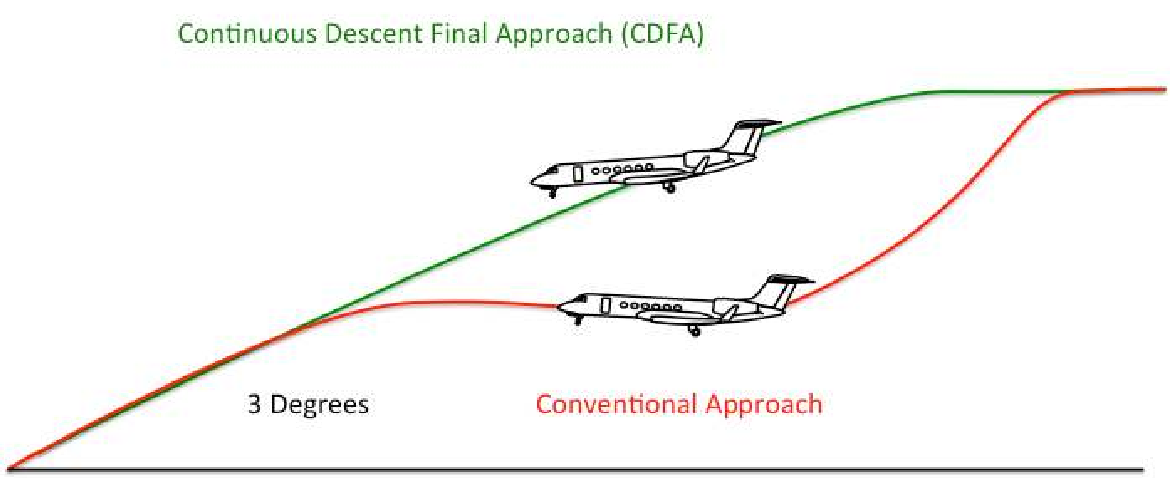
Years ago, following a "dive and drive" mishap, a major airline had to remind its pilots that a non-precision approach must be flown with great precision. In my distant past, I think the U.S. Air Force must have lost a few airplanes to "dive and drive" because our evaluation criteria required crews be busted for even an inch of deviation below the MDA. For most limits we allowed momentary deviations with signs of a positive correction, but the MDA was a brick floor, none were allowed to go below it until the runway was sighted and the airplane was in a position to land.

Levelling off at the MDA can be problematic if there are distractions or turbulence. Keeping the airplane at the MDA until the runway is sighted is another issue. But the worst problem may be resisting the urge to descend when you spot the runway too far out. Why not bypass all this?

Flying a Continuous Descent Final Approach (CDFA) eliminates the MDA level off, puts the airplane in a position to land when the runway is sighted, and forces you to go around if the runway is not sighted before a normal visual descent point. It is easier to fly than a dive and drive approach and you don't need any special equipment. But technology does help.

It makes sense to use a CDFA on most non-precision approaches. About the only exceptions would be a circling approach or an approach where last minute maneuvering is required. Besides, it is mandatory in many parts of the world.

What follows are quotes from the relevant regulatory documents, listed below, as well as my comments in blue.



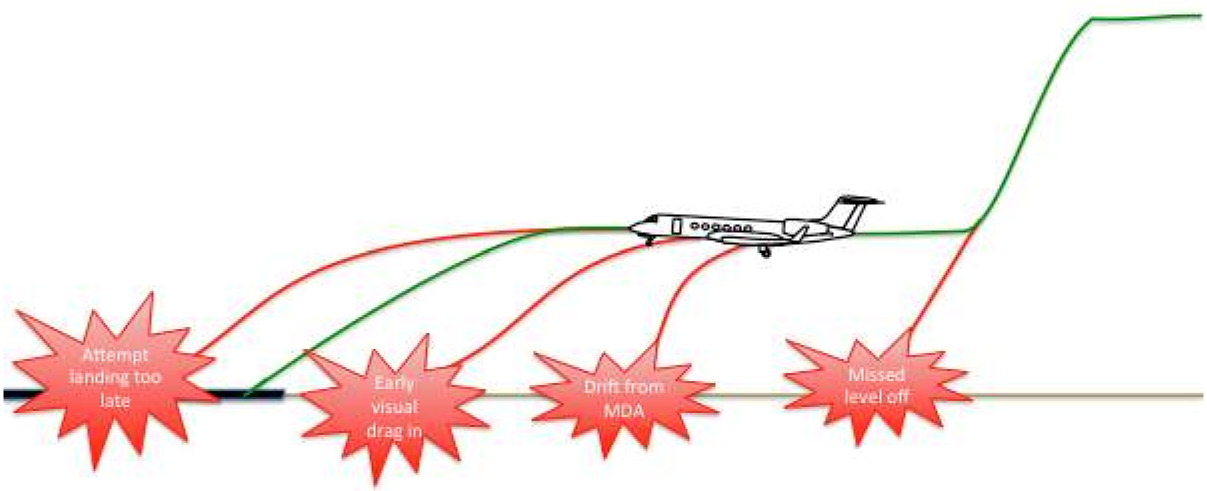
What is it?

Figure: CDFA, from Eddie's notes.

A continuous descent final approach is what you do for every straight-in ILS and what you attempt to do for every visual straight-in approach: you hit the glide path and start down on an angle that ends up in the touchdown zone of the runway. You can also do this when in instrument conditions flying a non-precision approach, which we are probably better off calling an "approach without vertical guidance."

[AC 120-108 §4.c] CDFA is a technique for flying the final approach segment of an NPA as a continuous descent. The technique is consistent with stabilized approach procedures and has no level-off. A CDFA starts from an altitude/height at or above the FAF and proceeds to an altitude/height approximately 50 feet (15 meters) above the landing runway threshold or to a point where the flare maneuver should begin for the type of aircraft being flown. This definition harmonizes with the ICAO and the European Aviation Safety Agency (EASA).

[ICAO Doc 8168, Vol I, Part I, Amdt 3, Definitions] CDFA: a technique, consistent with stabilized approach procedures, for flying the final approach segment of a non-precision instrument approach procedure as a continuous descent, without level-off, from an altitude/height at or above the final approach fix altitude/height to a point approximately 15 m (50 ft) above the landing runway threshold or the point where the flare manoeuvre should begin for the type of aircraft flown.



Why is it needed?

Figure: Dive and drive problems, from Eddie's notes.

Some of us began our instrument jet experience without the benefit of an autopilot or flight director and flying an approach without vertical guidance was an invitation to making fatal mistakes. Even with the best technology, flying an approach without vertical guidance can be a problem:

- We often pull the throttles and head down from the final approach fix at 1,000 feet per minute or more, knowing we have to level off at the Minimum Descent Altitude. But we seldom fly without distractions and some pilots have missed this step right into the ground. Example: Mishaps / American Airlines 1572.

- Even if you succeed at leveling off at the MDA, you need to keep the airplane there until the runway is spotted and the airplane is in a position to land. Example: Mishaps / Corporate Airlines 5966.

- In a low visibility approach we can't always perceive the angle to the runway and it can be tempting to push the nose over the minute we see the runway. But if you do this too early you don't have a good idea of the descent rate required or you could lose sight of the runway. Example: Mishaps / Crossair 3597.

- If you are level at the MDA you should have an idea of where you will intercept a normal glide path to the touchdown zone. Once you've passed this point, you really ought to go missed approach. You could be tempted to try the landing, not really knowing how much pavement you have ahead of you. Example: Mishaps / Korean Air 2033.

[AC 120-108 §4] 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 stepdown fixes in the final approach segment. Stepdowns 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 stepdown 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 (MAP). 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.

Is it Required?

In some countries: yes. In other countries: it is recommended but not mandatory.

ICAO Preferred Technique.

ICAO Doc 8168, Vol I, Part I, Amdt 3, ¶ 1.7.1] Studies have shown that the risk of controlled flight into terrain (CFIT) is high on non-precision approaches. While the procedures themselves are not inherently unsafe, the use of the traditional step down descent technique for flying non-precision approaches is prone to error, and is therefore discouraged. Operators should reduce this risk by emphasizing training and standardization in vertical path control on non-precision approach procedures. Operators typically employ one of three techniques for vertical path control on non-precision approaches. Of these, the continuous descent final approach (CDFA) technique is preferred. Operators should use the CDFA technique whenever possible as it adds to the safety of the approach operation by reducing pilot workload and by lessening the possibility of error in flying the approach.

EU Required.

EU Ops 1, OPS 1.430, Appendix 1, ¶(d)2.] All non-precision approaches shall be flown using the continuous descent final approaches (CDFA) technique unless otherwise approved by the Authority for a particular approach to a particular runway. When calculating the minima in accordance with Appendix 1 (New), the operator shall ensure that the applicable minimum RVR is increased by 200 metres (m) for Cat A/B aeroplanes and by 400 m for Cat C/D aeroplanes for approaches not flown using the CDFA technique, providing that the resulting RVR/CMV value does not exceed 5 000 m.

FAA Recommended

[AC 120-108 §5] The FAA recommends CDFA for all of the following NPAs published with a vertical descent angle (VDA) or glideslope (GS):

- Very high frequency (VHF) Omnidirectional Range (VOR),
- VHF omni-directional range station/distance measuring equipment (VOR/DME),
- Non-directional radio beacon (NDB),
- NDB/distance measuring equipment (DME),
- Localizer (LOC), Localizer Back-Course (LOC-BC),
- LOC/DME,
- Localizer-type directional aid (LDA),
- LDA/DME,

- Simplified Directional Facility (SDF),
- SDF/DME,
- Area Navigation (RNAV), and
- Global Positioning System (GPS).

Required by Some Countries.

ICAO Doc 8168, Vol I, Part I, Amdt 3, ¶ 1.7.2.1] Many Contracting States require the use of the CDFA technique and apply increased visibility or RVR requirements when the technique is not used.

Many countries do require CDFA techniques be used for flying approaches without vertical guidance, but the application of the technique is not consistent. Some countries list a CDFA approach with "CDFA" in the minimums section while others use "DA" or "DA/MDA" to signify such approaches. Even the countries that list "CDFA" are not consistent about the meaning. In India, for example, you are required to add the height loss additive to the CDFA altitude. But in France, you normally do not. The only way to ensure you are following the rules of the host nation is to look it up in the country's Aeronautical Information Publication or the Jeppesen Airways Manual ATC pages.

Do you need special equipment?

Photo: T-37 "Shot Gun" cockpit, from Eddie's sordid past.

If you have the equipment to fly an instrument approach, you have what you need to fly a continuous descent final approach. The more technology you have, however, the easier it will be to do that.

[AC 120-108 §6.a] CDFA requires no specific aircraft equipment other than that specified by 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.

[AC 120-108 §6.b]

- Aircraft with FMS, barometric vertical navigation (baro-VNAV), wide area augmentation system (WAAS), or that are similarly equipped typically provide the published VDA or GS when the IAP is selected from the database.

- Aircraft equipped with Flight Path Angle (FPA) allow the pilot to enter an electronic descent angle based on the published GS or VDA. Pilots flying aircraft without either type of equipment must compute a required rate of descent.

What kind of approach is suitable for a CDFA?

Published Angle — Chart Legends

In the United States there is a stipulation in AC 120-108 requiring that you see a published angle on the chart. The presence of the angle varies with approach type and is also depicted differently between FAA and Jeppesen charts. There are four variations, described below.

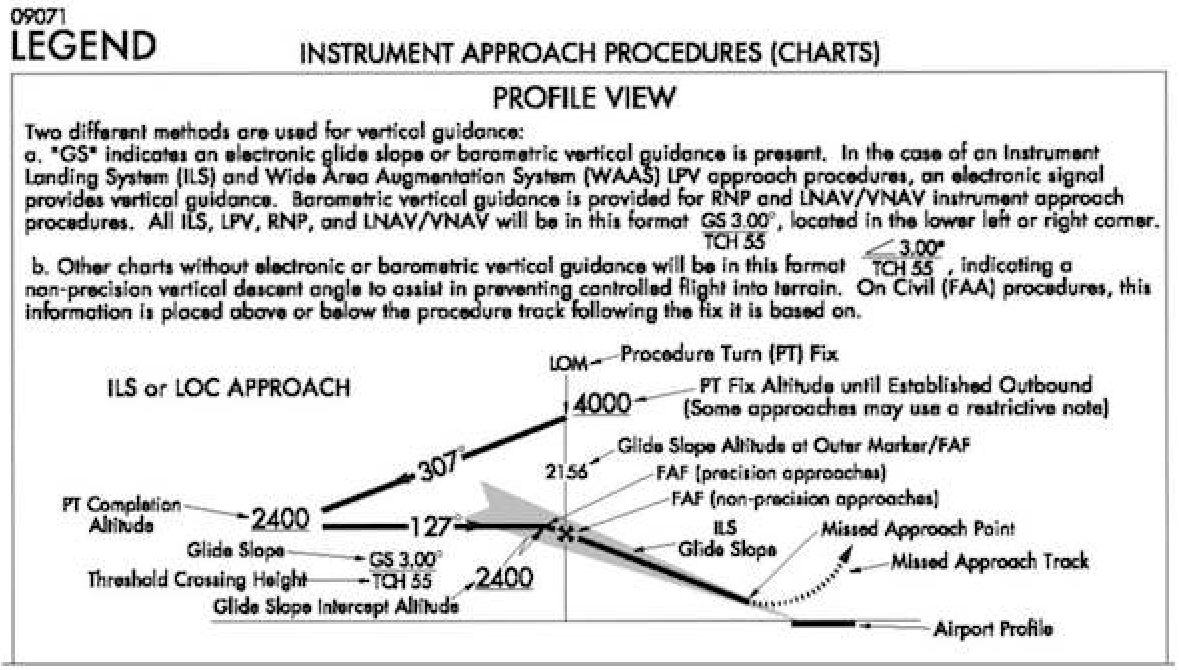
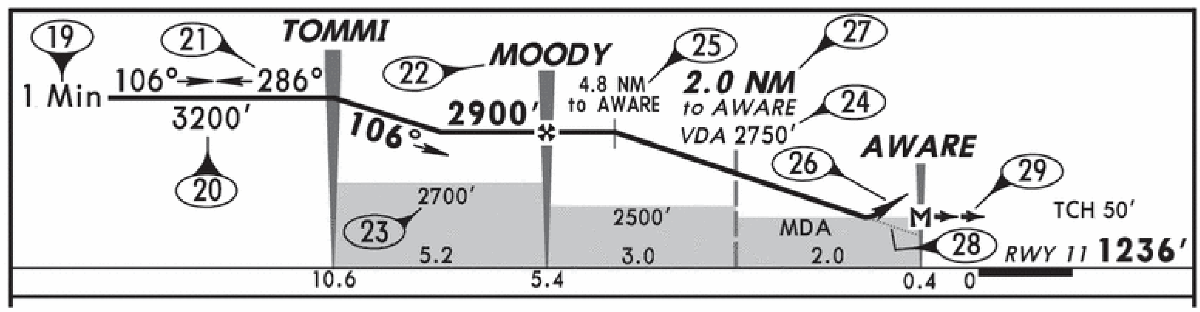


Figure: Instrument approach procedure legend, from AC 120-108, appendix 1, figure 2.

[AC 120-108 §6.b]

- CDFA requires the use of a published VDA or barometric vertical guidance (GS) on the IAP. Figure 2, Instrument Approach Procedure Legend, shows the legend for an IAP and defines the GS and VDA.
- RNAV approaches with lateral navigation (LNAV)/vertical navigation (VNAV) minima are published with a GS.
- Non-RNAV NPAs or RNAV approaches with LNAV-only minima are published with a VDA.



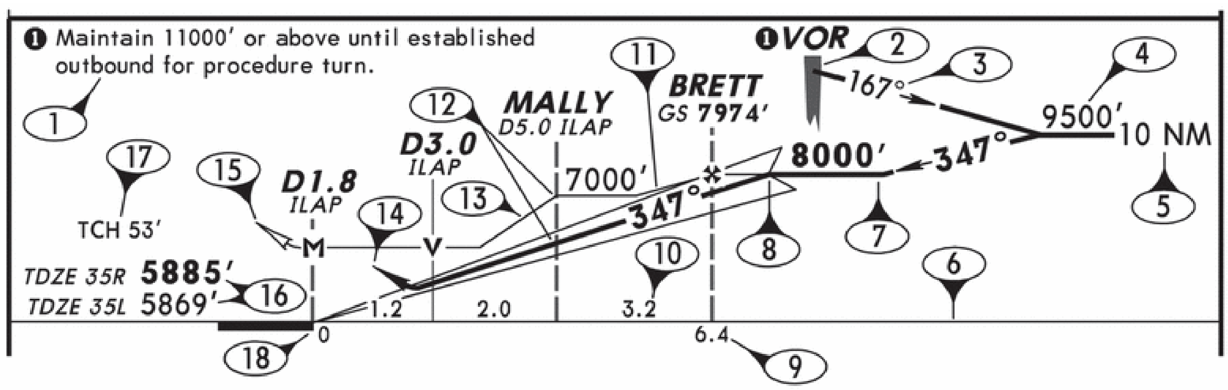
[[Jeppesen Airways Manual](), Approach Chart Legend, 12 April 2013]

24. Altitudes that correspond to the VDA

26. Pull-up along the VDA at the DA/MDA is depicted relative to the missed approach point.

28. A dotted gray line indicates the continuance of the VDA below the DA/MDA.

29. Visual flight track is shown when the missed approach point is prior to the runway threshold.



[[Jeppesen Airways Manual](), Approach Chart Legend, 12 April 2013]

14. Pull-up representing the DA/MDA or when reaching the descent limit along the GS/VDA.

15. Pull-up arrow associated to a non-precision approach not using a CDFA technique.

Published Angle — Examples with Glide Slopes

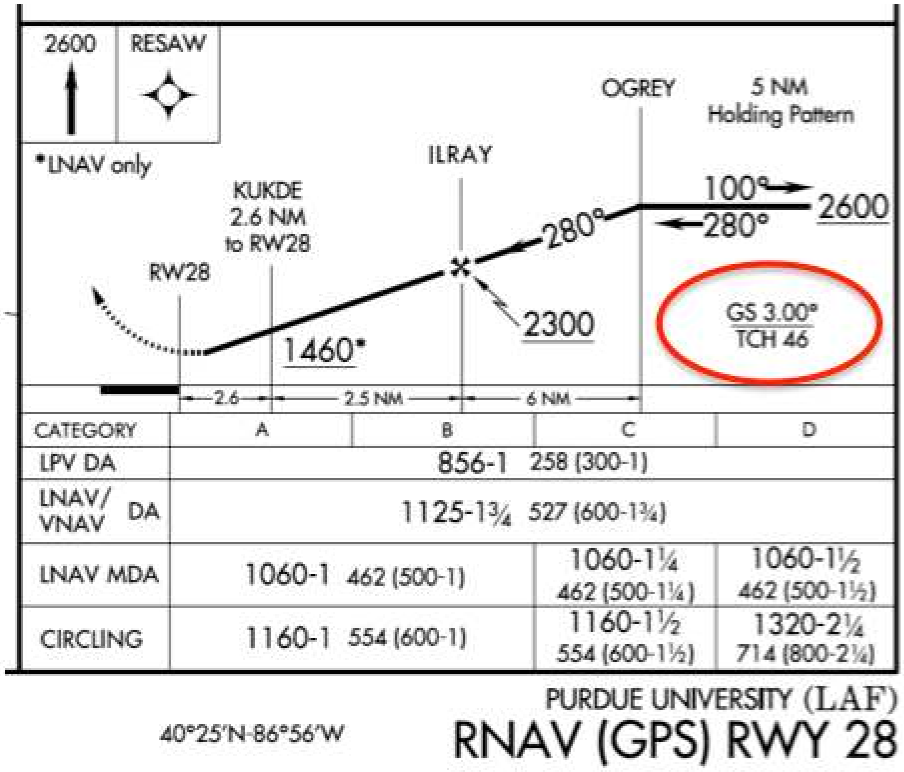


Figure: KLAF RNAV(GPS) Rwy 28 profile view, from AL-200(FAA), 01 May 2014

On an FAA chart, an RNAV(GPS) will contain the glide slope angle in the profile view.

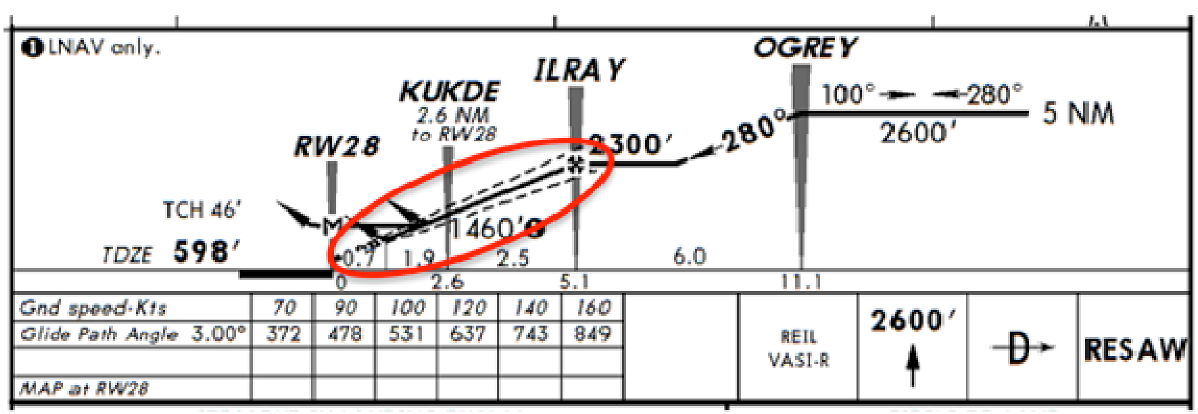


Figure: KLAF RNAV(GPS) Rwy 28 profile view, from Jeppesen Airways Manual, KLAF page 12-2, 16 Sep 11.

On a Jeppesen chart, an RNAV(GPS) will be depicted with glide feathers in the profile view.

Published Angle — Examples with Vertical Descent Angles

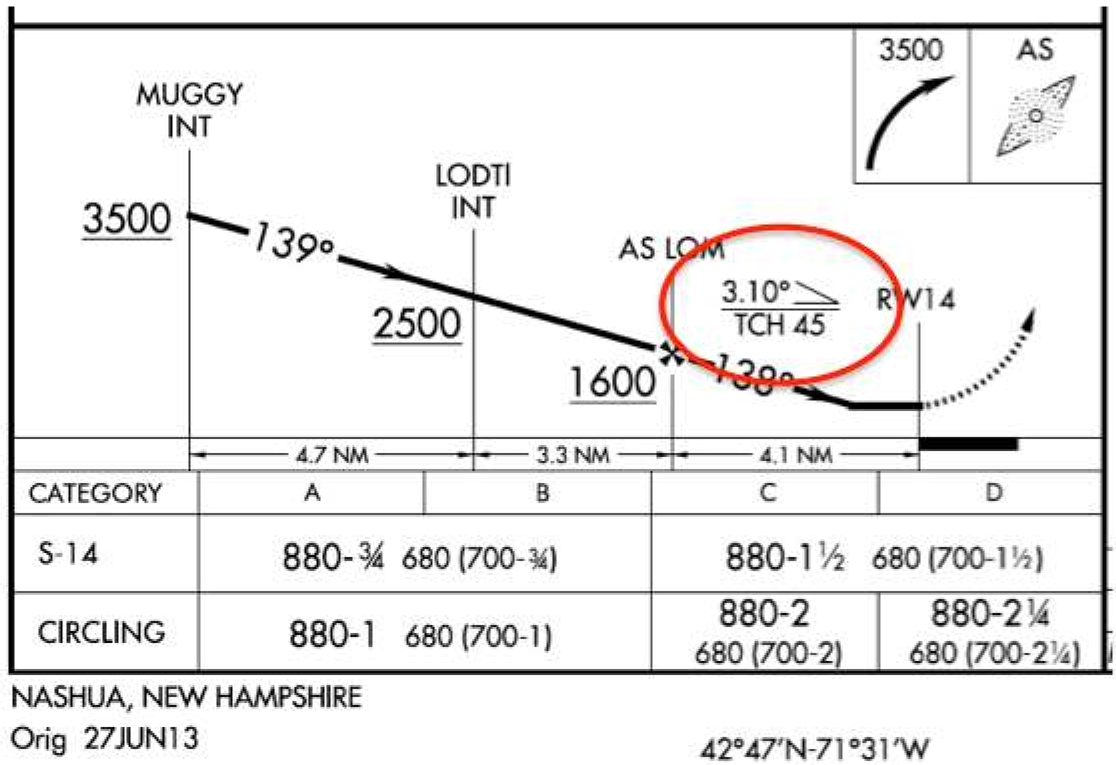


Figure: KASH NDB Rwy 14 profile view, from AL-5036(FAA), 01 May 2014

On an FAA chart, a non-RNAV or RNAV without vertical guidance will contain the vertical descent angle in the profile view.

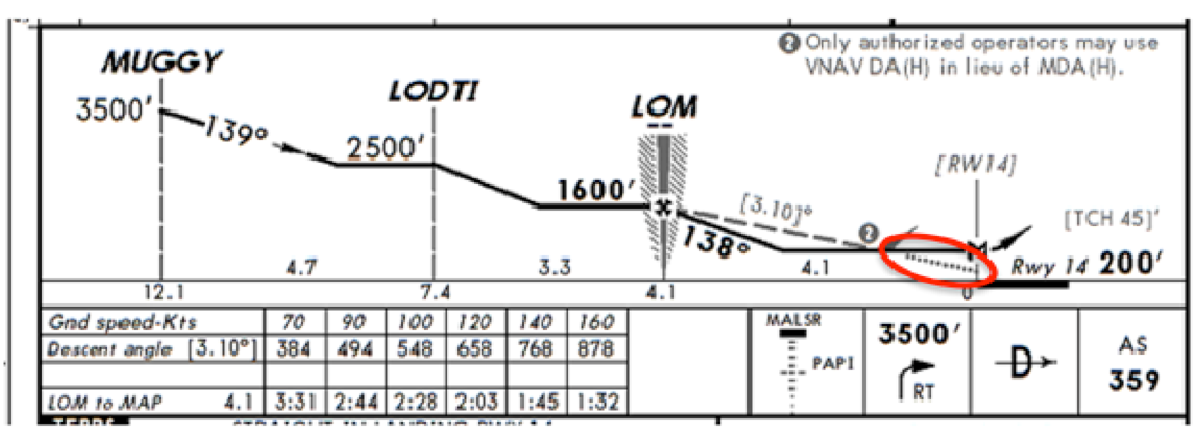


Figure: KASH NDB Rwy 14 profile view, from Jeppesen Airways Manual, KASH page 16-1, 31 Jan 14

On a Jeppesen chart, a non-RNAV or RNAV without vertical guidance will depict the vertical descent angle with a dotted gray line below the MDA in the profile view.

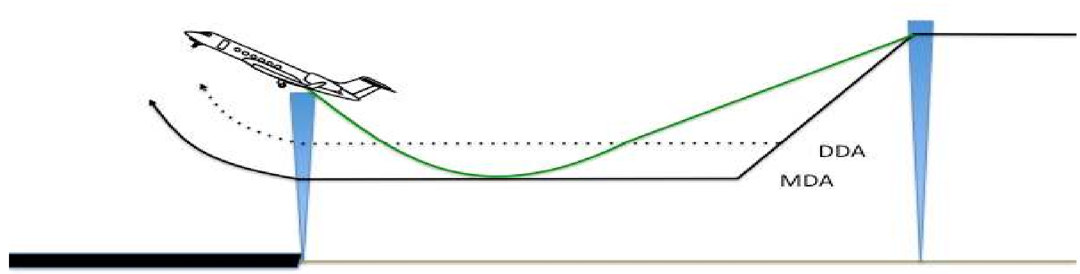
Vertical Path Angle — Limitations

AC 120-108 does not impose a maximum vertical path angle, *per se*, but if you have OpSpec, MSpec, or LOA C073 you are already familiar with a VNAV DA(H) in lieu of MDA(H) provision that limits you to 3.77° (Category A, B, and C) or 3.5° (Category D and E). You really should adopt those limits for CDFA as well. More about this: Procedures & Techniques / Vertical Navigation (VNAV).

[AC 120-108 §6.d] The VDA or GS is calculated from the FAF/precise final approach fix (PFAF) altitude to the threshold crossing height (TCH). The optimum NPA descent angle (VDA or GS) is 3.0 degrees. Descent angles are found in the following range when the optimum VDA is not possible: 2.75°–3.77° (IAPs w/≤ Category (CAT) C minimums), 2.75°–3.50° (IAPs w/CAT D/E minimums). On approaches with stepdown fixes, the goal is to publish a VDA that keeps the Vertical Path (VPATH) above the stepdown fix altitude. However, in some cases, the VDA is calculated from the stepdown fix altitude to the TCH.

Procedures: Determining a Derived Decision Altitude (DDA)

Figure: MDA vs. DDA, from Eddie's notes.



The MDA, under most cases, is still an altitude you cannot go below. The CDFA technique adds an altitude pad to account for the aircraft's tendency to go below the altitude at which the missed approach is initiated, usually due to autopilot reaction time. The new altitude, that resulting from the addition of this pad to the MDA, is known as the Derived Decision Altitude (DDA).

Increment Added to MDA.

ICAO Doc 8168, Vol I, Part I, Amdt 3, ¶ 1.7.2.5] An increment for the MDA/H may be prescribed by the operator to determine the altitude/height at which the vertical portion of the missed approach shall be initiated in order to prevent descent below the MDA/H. In such cases, there is no need to increase the RVR or visibility requirements for the approach. The RR and/or visibility published for the original MDA/H should be used.

[AC 120-108 §6.F] Pilots must not descend below the MDA when executing a missed approach from a CDFA. Operators should instruct their pilots to initiate the go-around at an altitude above the MDA (sometimes referred to as a DDA) to ensure the aircraft does not descend below the published MDA. Operators conducting approaches authorized by operations specification (OpSpec) C073, IFR Approach Procedures Using Vertical Navigation (VNAV), may use MDA as a DA.

C073 is now available also as a Letter of Authorization. These approaches, those with the "Only Authorized Operators" ball note, take into consideration the aircraft's momentary dip below the MDA. More about this: Normal Procedures & Techniques / Vertical Navigation (VNAV).

Some countries add the altitude pad into the approach minimums, pilots need not "double add." Examples below.

G450 Autopilot Performance.

[G450 Airplane Flight Manual §1-22-20] Maximum demonstrated altitude loss for coupled go-around is 60 ft.

While some countries specify the method used to determine the DDA, most do not. In the case of a G450, pilots will add 60' to the MDA to determine the DDA.

Procedures: Leaving the Final Approach Fix

Figure: G450 VGP captured, from G450 Aircraft Operating Manual, §2B-08-00, page 92.

Aircraft Configuration

The objective of CDFA is to leave the final approach fix fully configured, on speed, and ready to land. You should not have to destabilize the aircraft by making airspeed or trim adjustments when spotting the runway. GV and G550 pilots often withhold the last increment of flaps as a courtesy to faster moving aircraft, but if flying a CDFA in instrument conditions, it may be wiser to configure earlier.

Methodology: High Tech

Some aircraft allow a CDFA be flown with ILS-like indications so that procedures can be identical. Others may require adjustments, such as lowering the altitude select to field elevation. The closer CDFA procedures can be to an ILS, the better. Pilots simply follow the needles down to minimums, being mindful of the decision altitude. (In either case, pilots should consult their aircraft manuals and practice these procedures in a simulator until comfortable.)

The G450 can adhere to CDFA techniques by either:

- Using LNAV/VNAV on most non-precision approaches, setting the altitude preselector to the minimum descent altitude plus 60 feet. If the runway is not sighted visually or using EVS, the autopilot would initiate a level off prior to the MDA/DA and the pilot would then accomplish a missed approach. If the runway is sighted, the pilot would press APPR which turns the VPATH into a VGP, causing the autopilot to ignore the altitude preselector. (At this point the altitude preselector would be set to the missed approach altitude.)

- Using APPR on most non-precision approaches, setting the altitude preselector to missed approach altitude and treating the MDA plus 60 feet as you would an ILS decision height, taking care to go around if you do not have what it takes to land at DA + 60 feet.

While the first method prevents you from going below minimums if you attain visual contact, it increases your work load if you do. I recommend the second method, making sure both pilots understand it will be flown like an ILS.

RATE OF DESCENT TABLE

A rate of descent table is provided for use in planning and executing precision 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.

	ANGLE OF DESCENT (degrees and tenths)	FEET /NM	GROUND SPEED (knots)										
			30	45	60	75	90	105	120	135	150	165	180
	2.0	210	105	160	210	265	320	370	425	475	530	585	635
	2.5	265	130	200	265	330	395	465	530	595	665	730	795
VERTICAL PATH ANGLE	2.7	287	143	215	287	358	430	501	573	645	716	788	860
	2.8	297	149	223	297	371	446	520	594	669	743	817	891
	2.9	308	154	231	308	385	462	539	616	693	769	846	923
	3.0	318	159	239	318	398	478	557	637	716	796	876	955
	3.1	329	165	247	329	411	494	576	658	740	823	905	987
	3.2	340	170	255	340	425	510	594	679	764	849	934	1019
	3.3	350	175	263	350	438	526	613	701	788	876	963	1051
	3.4	361	180	271	361	451	541	632	722	812	902	993	1083
	3.5	370	185	280	370	465	555	650	740	835	925	1020	1110
	4.0	425	210	315	425	530	635	740	845	955	1060	1165	1270
	4.5	475	240	355	475	595	715	835	955	1075	1190	1310	1430
	5.0	530	265	395	530	660	795	925	1060	1190	1325	1455	1590
	5.5	580	290	435	580	730	875	1020	1165	1310	1455	1600	1745
	6.0	635	315	475	635	795	955	1110	1270	1430	1590	1745	1950
	6.5	690	345	515	690	860	1030	1205	1375	1550	1720	1890	2065
	7.0	740	370	555	740	925	1110	1295	1480	1665	1850	2035	2220
	7.5	795	395	595	795	990	1190	1390	1585	1785	1985	2180	2380
	8.0	845	425	635	845	1055	1270	1480	1690	1905	2115	2325	2540
	8.5	900	450	675	900	1120	1345	1570	1795	2020	2245	2470	2695
	9.0	950	475	715	950	1190	1425	1665	1900	2140	2375	2615	2855
	9.5	1005	500	750	1005	1255	1505	1755	2005	2255	2510	2760	3010
	10.0	1055	530	790	1055	1320	1585	1845	2110	2375	2640	2900	3165
	10.5	1105	555	830	1105	1385	1660	1940	2215	2490	2770	3045	3320
	11.0	1160	580	870	1160	1450	1740	2030	2320	2610	2900	3190	3480
	11.5	1210	605	910	1210	1515	1820	2120	2425	2725	3030	3335	3635
	12.0	1260	630	945	1260	1575	1890	2205	2520	2835	3150	3465	3780

Methodology: Low Tech

Figure: Rate of Descent Table, from FAA-H-8083-15B, figure 1-19. Download a copy: Descent Table.

[AC 120-108 §6.c]

1. Find the published VDA.
2. Find the descent gradient that equates to [the] VDA.
3. Find the descent rate based on groundspeed.

If you don't have an FMS that does all this for you, or if you are flying an approach that prevents your FMS from doing all this for you, this table gives you an idea of what vertical descent rate you are going to need. If you don't have the table, you can approximate a 3° angle of descent by dividing your groundspeed by 2 and multiplying that by ten. A 120 knot ground speed, for example, yields 600 fpm.

You can check your progress during the approach by placing tick marks at each mile from the final approach fix to the missed approach point with the appropriate altitude. A 3° glide path should lose 318' every nautical mile. If, for example, the final approach fix altitude is 2,000 feet, you should be at 1,682' after one mile, 1,364' after two miles, 1,046' after three miles, and so on. You can figure these out during your approach briefing, marking each target on the approach plate.

Descent to MDA/DA.

ICAO Doc 8168, Vol I, Part I, Amdt 3, ¶ 1.7.2.2] This technique requires a continuous descent, flown either with VNAV guidance calculated by on-board equipment or based on manual calculation of the required rate of descent, without level-offs. The rate of descent is selected and adjusted to achieve a continuous descent to a point approximately 15m (50 ft) above the landing runway threshold or the point where the flare manoeuvre should begin for the type aircraft flown. The descent shall be calculated and flown to pass at or above the minimum altitude at any step down fix.

Procedures: When to go Missed Approach

The CDFA places the aircraft right on glide path in a position to land in the touchdown zone of the runway. If the runway is sighted after this point, the aircraft will be too far down the runway to make that happen and a missed approach will be needed. This eliminates the judgement calls when sighting the runway early or late.

ICAO Doc 8168, Vol I, Part I, Amdt 3, ¶ 1.7.2.3] If the visual references required to land have not been acquired when the aircraft is approaching the MDA/H, the vertical (climbing) portion of the missed approach is initiated at an altitude above the MDA/H sufficient to prevent the aircraft from descending through the MDA/H. At not time is the aircraft flown in level flight at or near the MDA/H. Any turns on the missed approach shall not begin until the aircraft reaches the MAPt. Likewise, if the aircraft reaches the MAPt before descending to near the MDA/H, the missed approach shall be initiated at the MAPt.

ICAO Doc 8168, Vol I, Part I, Amdt 3, ¶ 1.7.2.6] It should be emphasized that upon reaching the MDA/H only two options exist for the crew: continue the descent below MDA/H to land with the required visual references in sight; or, execute a missed approach. There is no level flight segment after reaching the MDA/H.

Examples (see next page)

BRIEFING STRIP ™

LFPB/LBG
LE BOURGET

JEPPESEN

2 MAR 12 (33-1) **Eff 8 Mar**

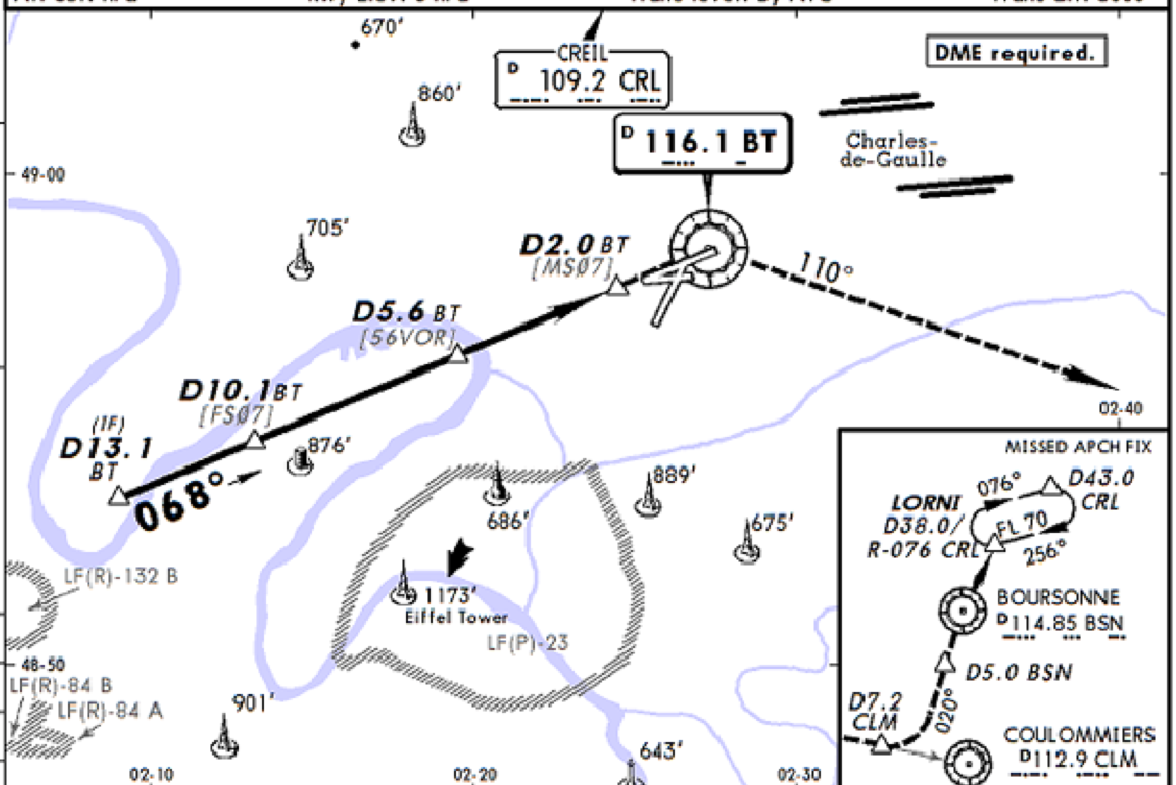
PARIS, FRANCE
VOR Rwy 07

*ATIS	*LE BOURGET Tower	*Ground
120.0	118.92	121.9

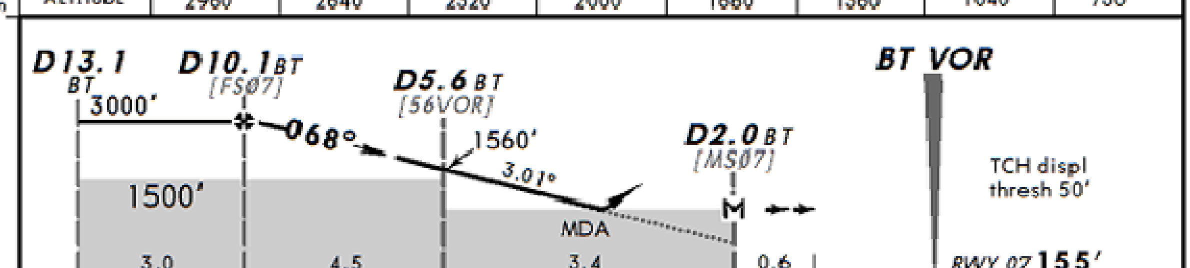
VOR	Final Apch Crs	Procedure Alt	DA/MDA(H)	Apt Elev	MSA ARP
BT **116.1**	**068°**	D10.1 BT **3000'** (2845')	**590'** (435')	220' Rwy **155'**	3200'

MISSED APCH: Climb on R-248 inbound to BT VOR. At BT VOR turn RIGHT to intercept and follow R-110 BT to CLM VOR climbing to 3000'. At D7.2 before CLM turn LEFT, intercept R-200 inbound BSN VOR. At D5.0 before BSN climb to FL 70. At BSN VOR proceed to LORNI, or as directed. MAX 185 KT. Climb to 1100' prior to level acceleration.

Alt Set: hPa | Rwy Elev: 6 hPa | Trans level: By ATC | Trans alt: 5000'



BT DME	10.0	9.0	8.0	7.0	6.0	5.0	4.0	3.0
ALTITUDE	2960'	2640'	2320'	2000'	1680'	1360'	1040'	730'



Gnd speed-Kts		70	90	100	120	140	160
Descent Angle	3.01°	373	479	532	639	745	852
MAP at D2.0 BT							

HIALS
REIL

Refer to Missed Apch above

Standard

	STRAIGHT-IN LANDING RWY 07 CDFA DA/MDA(H) 1 590' (435') ALS out	Max Kts	CIRCLE-TO-LAND 2 Prohibited North of airport between R-268 and R-088 BT MDA(H)	VIS
A	RVR 1500m	110	740' (585')	1500m
B		135	740' (585')	1600m
C		180	1290' (1135')	2400m

CFDA Published — LFPB VOR Rwy 07

Figure: Le Bourget VOR Rwy 07, from Jeppesen LFPB, pg. 33-1.

The Jeppesen State Rules and Procedures pages for France: "The operational minima published on French non-precision approach charts have been determined based on the assumption that these approaches are flown using CDFA flight technique unless otherwise stated by the Authority for a particular approach to a particular runway.

This approach has already added the altitude pad so you can fly it down to the posted DA (590'). There is no provision in the French ATC pages stating you may fly this approach using RNAV.

By the book, you would have to fly this using the VOR as your navigation source, estimate your descent rate to fly the given altitudes on the chart, and 590 feet. Is that the best way to fly this approach? Probably not.

As technique, if you have the technology, the following will probably be safer:

- Fly the approach using APPR, the FMS as your navigation source.
- Have the raw data available, with CDI, some place in the cockpit. You could use the copilot's display or the standby flight director.
- Set the missed approach altitude in the altitude preselector.
- Fly the approach LNAV/VNAV, using the published CDFA as your decision point to continue or go around.

If you don't have the technology, you can determine your ground speed and compute an initial descent rate and a target altitude loss per nautical mile using the chart given above, Descent Table. Let's say you are moving along at 120 knots ground speed:

- At 120 knots ground speed your feet/nm is 318 and your rate of descent will be 637 feet/minute.

- Check first that you can clear the step down fix restriction using this descent rate. This fix is 4.5 nm from the final approach fix, which means a 3° glide path will lose (4.5) (318) = 1,431' and you will cross the step down at 3,000 - 1,431 = 1,569' which places you above the restriction.

- You can start your descent from the final approach fix using a 637 feet/minute descent rate.

- You can check your progress by subtracting 318 feet per nautical mile from the final approach fix altitude. Specifically:
  - At 9.1 DME you should be at 3,000 - 318 = 2,682'
  - At 8.1 DME you should be at 3,000 - 636 = 2,364'
  - At 7.1 DME you should be at 3,000 - 954 = 2,046'
  - At 6.1 DME you should be at 3,000 - 1,272 = 1,728'
  - At 5.1 DME you should be at 3,000 - 1,590 = 1,410'
  - At 4.1 DME you should be at 3,000 - 1,908 = 1,092'
  - At 3.1 DME you should be at 3,000 - 2,226 = 774'
  - At 2.1 DME you should be well on your way to landing or executing the missed approach.

LSGG/GVA
GENEVA

JEPPESEN

29 MAY 09 (13-1) **Eff 4 Jun**

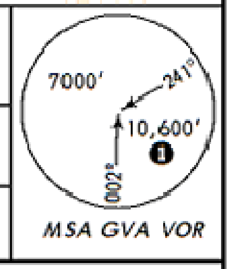
GENEVA, SWITZERLAND
(GPS)VOR DME Rwy 05

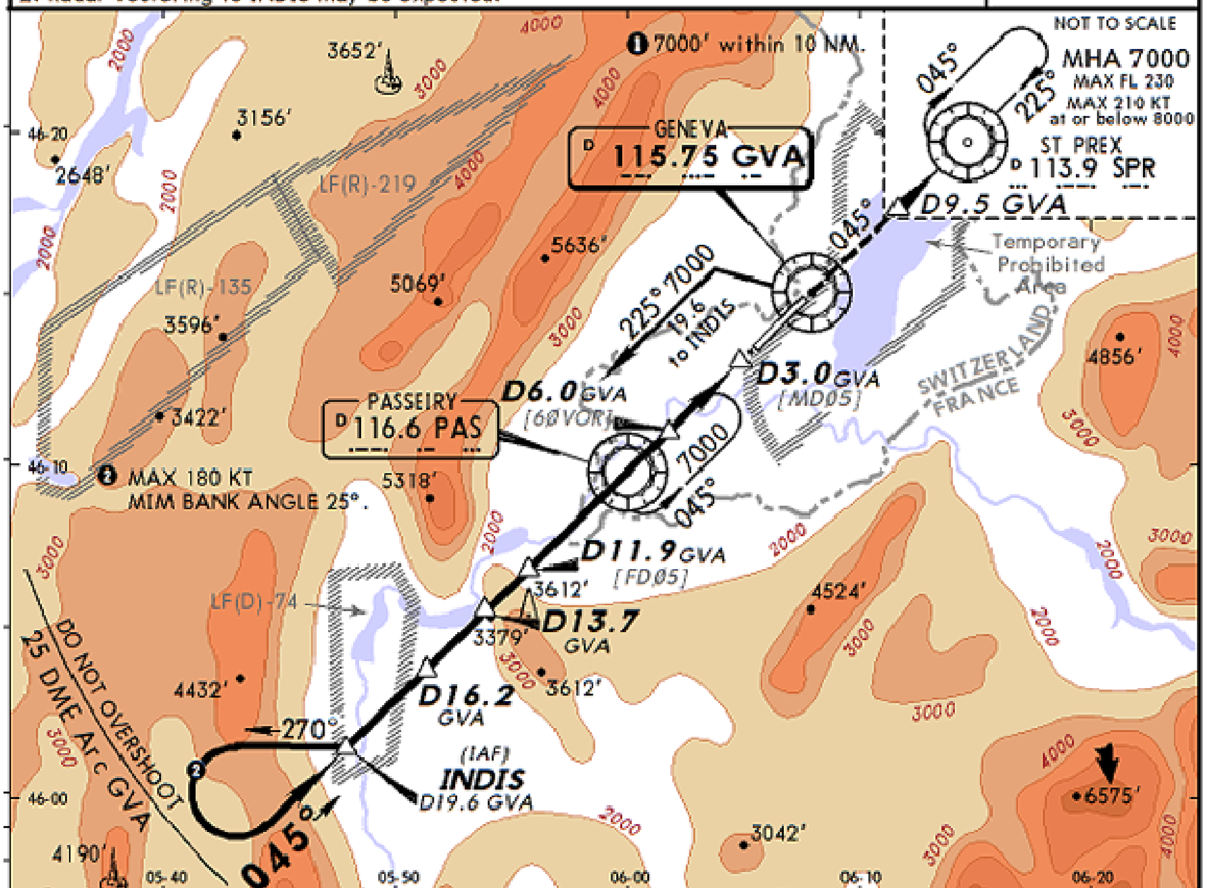
ATIS	GENEVA Arrival (APP)	GENEVA Final (APP)	GENEVA Tower	Ground
135.57	136.25	120.3	118.7	121.67

VOR GVA	Final Apch Crs	Procedure Alt D11.9 GVA	DA(H)	Apt Elev 1411′
115.75	**045°**	**5300′** (3889′)	**1890′** (479′)	RWY **1411′**

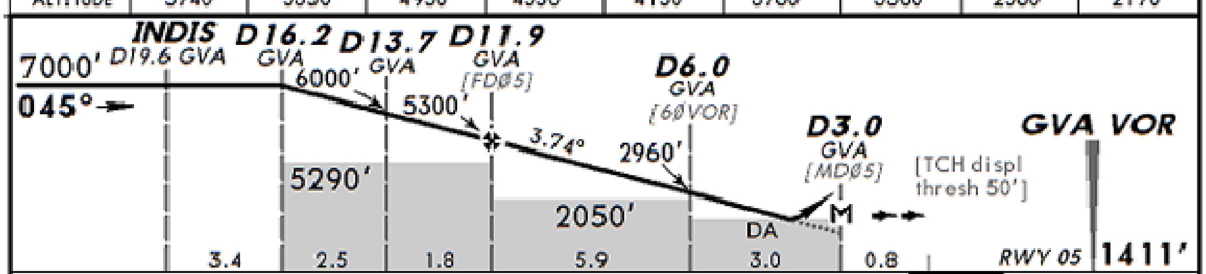
MISSED APCH: Climb STRAIGHT AHEAD on R-045 GVA to 7000′. Proceed to SPR VOR. Cross D9.5 GVA at 4000′ or above.

Alt Set: hPa Rwy Elev: 51 hPa Trans level: By ATC Trans alt: 7000′
1. CAUTION: Expect turbulence on base and final apch.
2. Radar vectoring to INDIS may be expected.





GVA DME	13.0	12.0	11.0	10.0	9.0	8.0	7.0	5.0	4.0
ALTITUDE	5740′	5350′	4950′	4550′	4150′	3760′	3360′	2560′	2170′



Gnd speed-Kts	70	90	100	120	140	160
Descent Angle 3.74°	463	596	662	794	927	1059
MAP at D3.0 GVA						

HIALS
PAPI-PAPI

7000′ on GVA **115.75** **R-045**

Standard

STRAIGHT-IN LANDING RWY 05		CIRCLE-TO-LAND		
DA(H) **1890′** (479′)		Not authorized South of airport		
	ALS out	Max Kts	MDA(H)	VIS
A	RVR 1500m	100	2100′ (689′)	1500m

DA Published — LSGG (GPS) VOR DME Rwy 05

Figure: Geneva VOR DME Rwy 05, from Jeppesen Airways Manual, LSGG, pg. 13-1.

The Swiss do not specifically mention CDFA on their approach plates or in the State Rules and Procedures pages, but a DA is listed on the non-precision approaches and the ICAO recommended technique should be employed. The Swiss do, however, specifically allow GPS overlays for specific approaches, including this one:

This approach can be flown almost like an RNAV (GPS) approach in the U.S. with the exception that 60' should be added to the published DA. Both PFDs can be set to LRN data with the SFD showing VOR or one PFD to VOR data. Unlike flying a U.S. RNAV (GPS) approach, the Swiss ATC pages specifically require the ground based navaids be operational and used as the primary means of navigation. I would have the ground based navaids in view on a display with a CDI, either the copilot's or the standby system. This way you can fly the approach using the APPR button, once again treating it like an ILS.

KLAF/LAF
PURDUE UNIVERSITY

JEPPESEN

16 SEP 11 (12-2)

LAFAYETTE, IND
RNAV (GPS) Rwy 28

ATIS (ASOS when Twr inop)	*GRISSOM Approach (R)	CHICAGO Center (R)	*LAFAYETTE Tower	*Ground
127.75	123.85	123.85 when App inop	CTAF 119.6	121.9

WAAS	Final Apch Crs	Minimum Alt	LPV DA(H) (CONDITIONAL)	Apt Elev 606′
Ch 82103 W-28A	280°	ILRAY 2300′ (1702′)	856′ (258′)	TDZE 598′

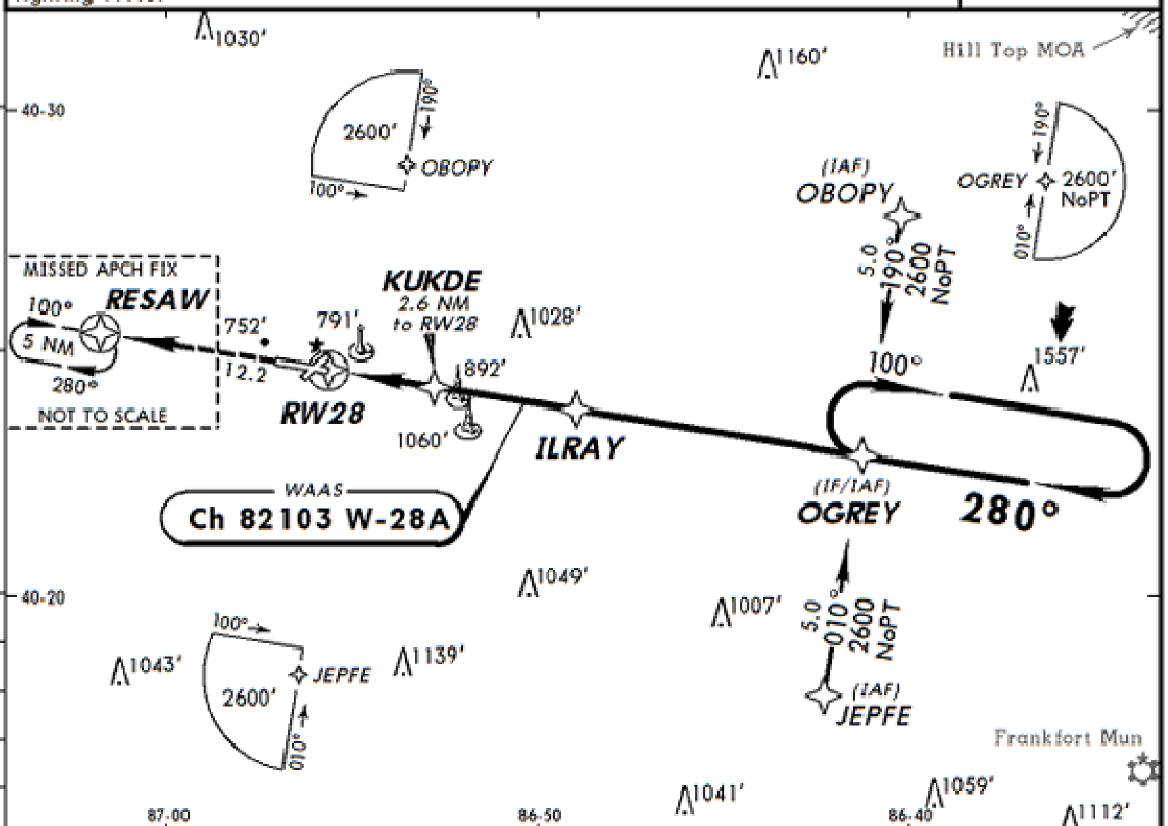
BRIEFING STRIP ™

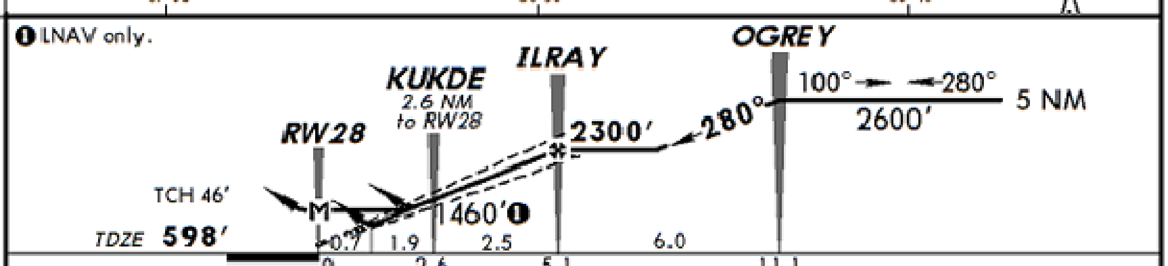
MISSED APCH: Climb to 2600′ direct RESAW and hold.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000′

1. Use local altimeter setting; if not received, use Vermilion County altimeter setting.
2. Baro-VNAV NA when using Vermilion County altimeter setting. 3. For uncompensated Baro-VNAV systems, LNAV/VNAV NA below -16°C (4°F) or above 47°C (116°F).
4. Visibility reduction by helicopters NA. 5. DME/DME RNP-0.3 NA. 6. Pilot controlled lighting 119.6.

TAA 30 NM IAF





Gnd speed-Kts	70	90	100	120	140	160
Glide Path Angle 3.00°	372	478	531	637	743	849
MAP at RW28						

REIL VASI-R

2600′ ↑ → D → RESAW

	STRAIGHT-IN LANDING RWY 28			CIRCLE-TO-LAND		
	1 LPV DA(H) 856′ (258′)	2 LNAV/VNAV DA(H) 1125′ (527′)	3 LNAV MDA(H) 1060′ (462′)	Max Kts	With Local Altimeter Setting MDA(H)	With Vermilion County Altimeter Setting MDA(H)
A	1	1¾	1	90	1160′ (554′) - 1	1260′ (654′) - 1
B				120		
C			1¼	140	1160′ (554′) - 1½	1260′ (654′) - 1½
D			1½	165	1320′ (714′) - 2¼	1420′ (814′) - 2¼

AMDT 2

MDA Published with GS — KLAF RNAV(GPS) Rwy 28

Figure: Purdue University RNAV(GPS) Rwy 28, from Jeppesen Airways Manual, KLAF, pg. 12-2.

This approach gives you several options, depending on aircraft capability and crew training:

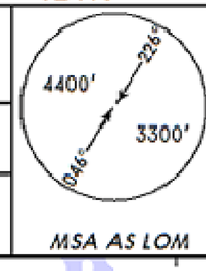
- If the aircraft and crew are LPV capable, the decision altitude of 856' would be used.
- If the aircraft and crew are LNAV/VNAV capable, the decision altitude of 1125' would be used.
- If the aircraft or crew were not VNAV capable, a DDA could be calculated (1060 + 60 = 1120' for an aircraft with a 60' pad), and the approach flown using CFDA techniques.

ATIS (ASOS when Twr Inop)	BOSTON Approach (R)	*NASHUA Tower	*Ground
125.1	124.9	CTAF 133.2	121.8

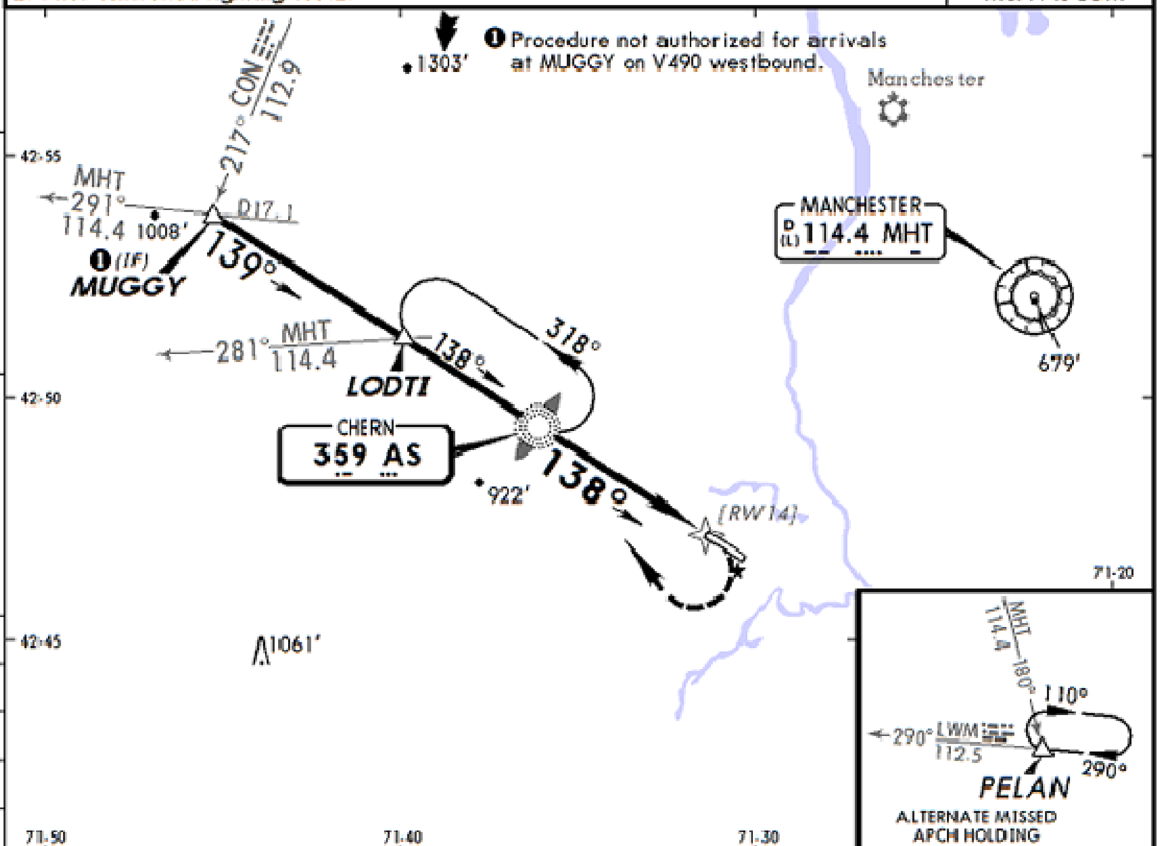
LOM AS	Final Apch Crs	Minimum Alt LOM	MDA(H) (CONDITIONAL)	Apt Elev 200′ / Rwy 14 200′
359	138°	1600′ (1400′)	880′ (680′)	

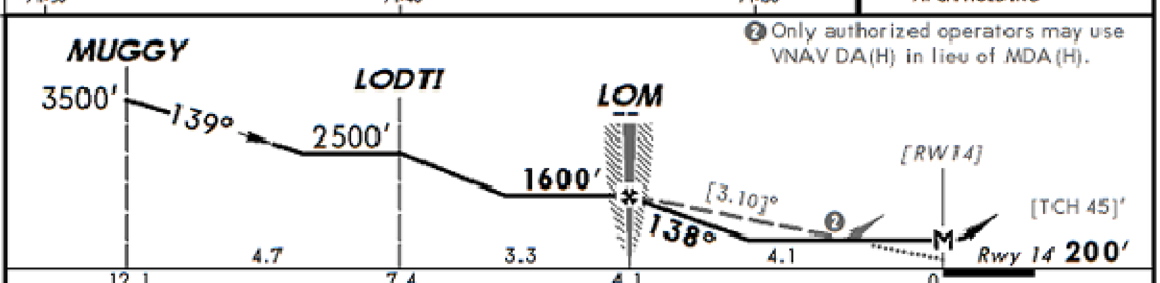
MISSED APCH: Climbing RIGHT turn to 3500′ direct AS LOM and hold. Continue climb-in-hold to 3500, or as directed by ATC.

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000′
1. Use local altimeter setting; if not received, use Manchester altimeter setting.
2. Pilot controlled lighting 133.2.



BRIEFING STRIP ™





Gnd speed-Kts	70	90	100	120	140	160
Descent angle [3.10°]	384	494	548	658	768	878
LOM to MAP 4.1	3:31	2:44	2:28	2:03	1:45	1:32

MALSR PAPI | 3500′ RT | D→ | AS 359

TERPS

STRAIGHT-IN LANDING RWY 14

	MDA(H) 880′(680′) With Local Altimeter Setting			MDA(H) 920′(720′) With Manchester Altimeter Setting		
		RAIL out	ALS out		RAIL out	ALS out
A B	3/4		1	3/4		1
C	1 1/2	1 3/4	1 7/8	1 5/8	1 3/4	2

CIRCLE-TO-LAND

Max Kts	With Local Altimeter Setting MDA(H)	With Manchester Altimeter Setting MDA(H)
90 / 120	880′(680′)-1	920′(720′)-1
140	880′(680′)-2	920′(720′)-2 1/8

MDA Published with VDA — KASH NDB Rwy 14

Figure: Nashua NDB Rwy 14, from Jeppesen Airways Manual, KASH, page 16-1.

Without C073 authorization, crews would have an MDA of 880' with a local altimeter setting, 920' without. They could elect to calculate a DDA and fly the approach using CFDA techniques. (A G450 would use 940' with the local altimeter setting, 980' without.)

"Only Authorized Operators" Approaches

With C073 authorization (OpSpec, MSpec, or LOA), crews can fly this approach using CDFA techniques down to the published MDA's, using them as DA's. (An authorized G450 would use 880' as a DA with the local altimeter setting, 920' without.) More about this: Procedures & Techniques / Vertical Navigation (VNAV).

PHTO/ITO
HILO INTL

JEPPESEN
31 JAN 14 (12-1) Eff 6 Feb

HILO, HAWAII
RNAV (GPS) Rwy 21

*ATIS	*HILO Approach (R)	HCF Center	*HILO Tower	*Ground
126.4	119.7	126.6 when HILO App inop.	CTAF 118.1	121.9

BRIEFING STRIP ™

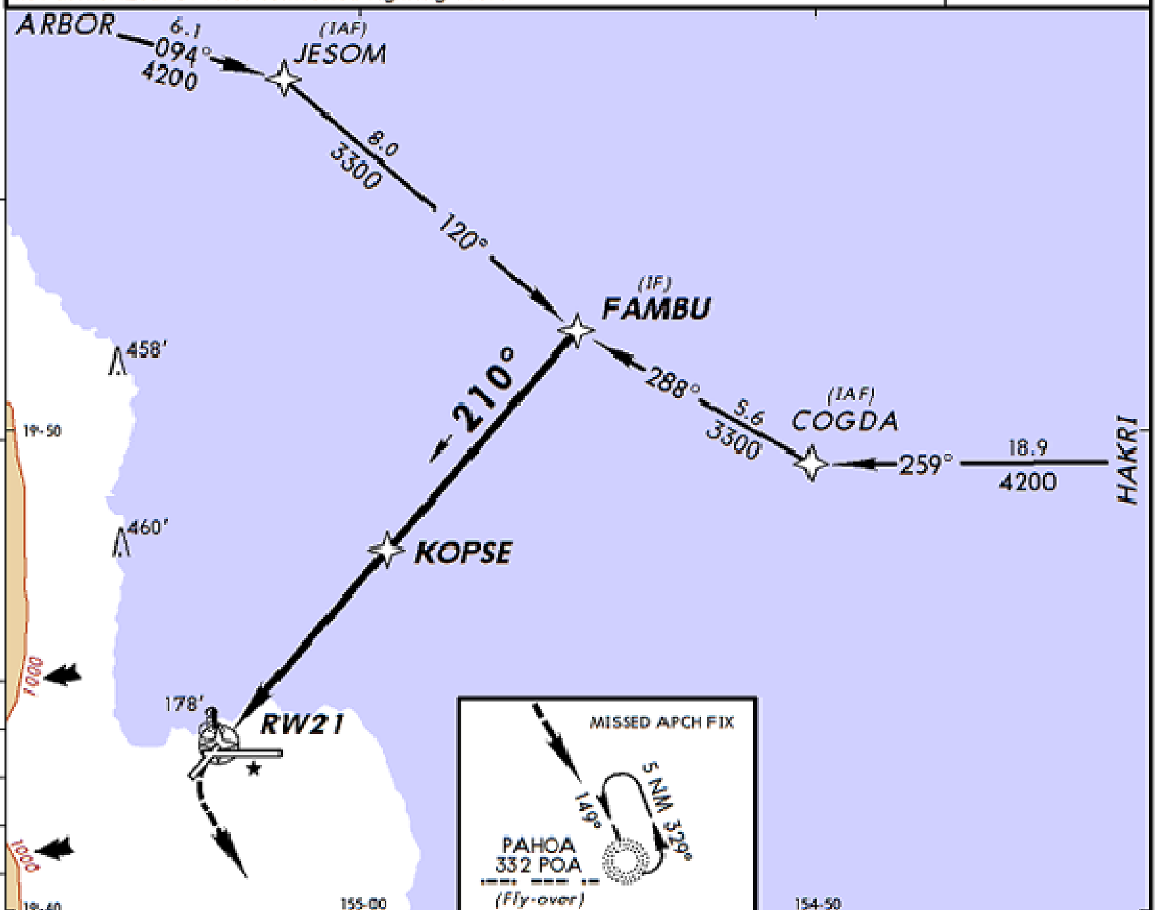
RNAV	Final Apch Crs	Minimum Alt KOPSE	LNAV MDA(H)	Apt Elev / TDZE
	210°	1800′ (1769′)	440′ (409′)	Apt Elev 38′ / TDZE 31′

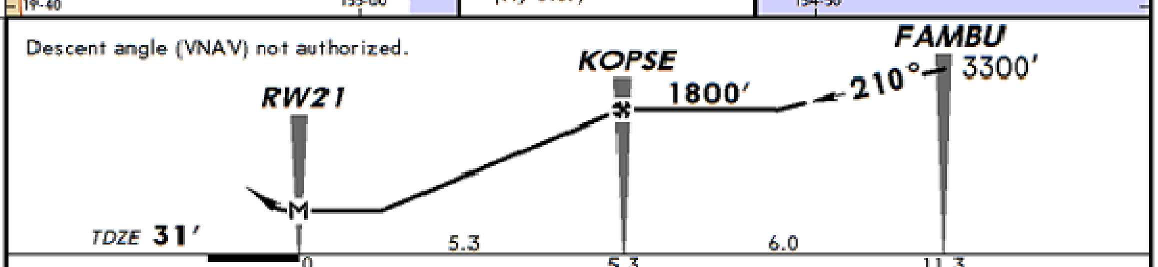
MISSED APCH: Climbing LEFT turn to 5000′ direct POA NDB and hold.

Alt Set: INCHES   Trans level: FL 180   Trans alt: 18000′

1. DME/DME RNP-0.30 not authorized. 2. Helicopter visibility reduction below 1 SM not authorized. 3. Pilot controlled lighting 118.1.

15,000′
MSA RW21





MAP at RW21

5000′ LT | POA NDB

STRAIGHT-IN LANDING RWY 21 LNAV MDA(H) 440′ (409′)	Max Kts	CIRCLE-TO-LAND Not Authorized South of Rwy 8-26 MDA(H)
A	90	500′ (462′) - 1
B: 1	120	
C: 1¼	140	500′ (462′) - 1½

CHANGES: ... AMEND 0A 6 FEB 2014

CFDA Not Advisable due to Obstacles — PHTO RNAV(GPS) Rwy 21

Figure: Hilo RNAV(GPS) Rwy 21, from Jeppesen Airways Manual, PHTO page 12-1.

There are at least three clues on the approach plate telling you a CFDA is not advisable:

1. There is no dotted gray line to the runway, which would indicate a vertical descent angle.

2. There is no glide path feather, which would indicate the VNAV glide slope portion of a LNAV/VNAV approach.

3. There is a warning in the profile view: "Descent angle (VNAV) not authorized.

Of course this begs the question: why?

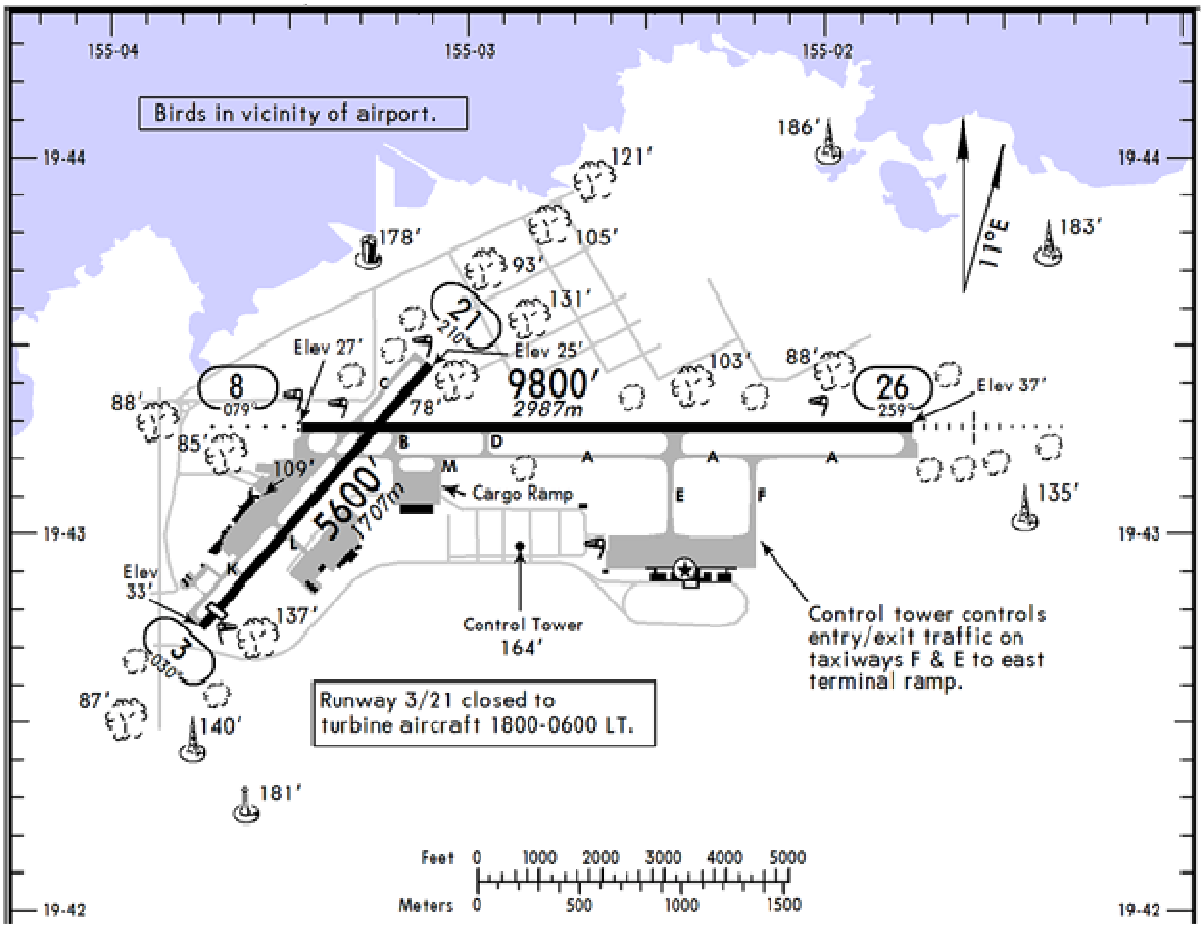


Figure: Hilo Airfield Diagram, from Jeppesen Airways Manual, PHTO page 11-1, extract.

Looking at the airfield diagram we see three obstacles within a mile of the approach end of the runway that will required visual maneuvering at the last moment.

KASE/ASE
-PITKIN CO/SARDY

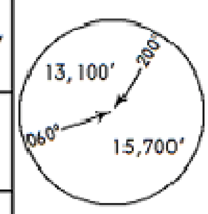
JEPPESEN
14 SEP 12 (11-1) Eff 20 Sep CAT A, B & C

ASPEN, COLO
LOC DME-E

ATIS (ASOS when Twr Inop)	*ASPEN Approach (R)	DENVER Center (R)	*ASPEN Tower	*Ground
120.4	123.8	125.35 when App inop.	CTAF 118.85	121.9

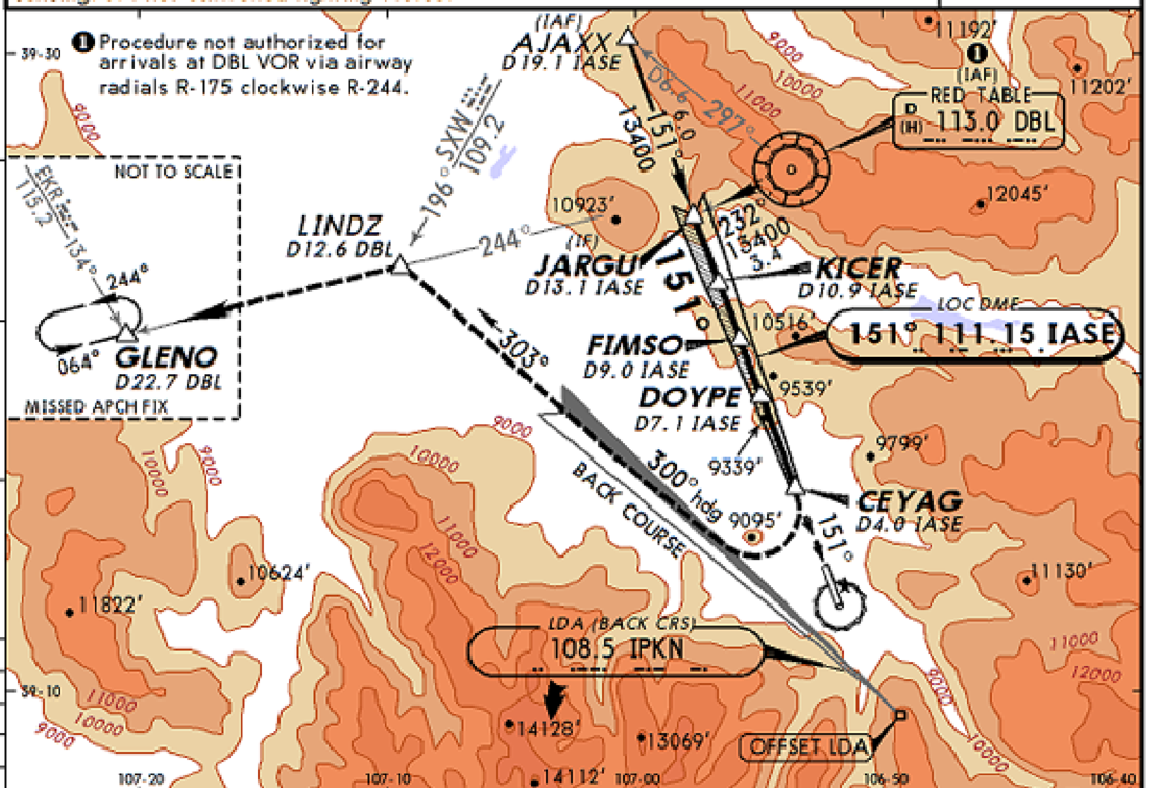
LOC IASE	Final Apch Crs	Minimum Alt DOYPE	MDA(H)	Apt Elev
111.15	151°	11700′ (3863′)	Refer to Minimums	7837′

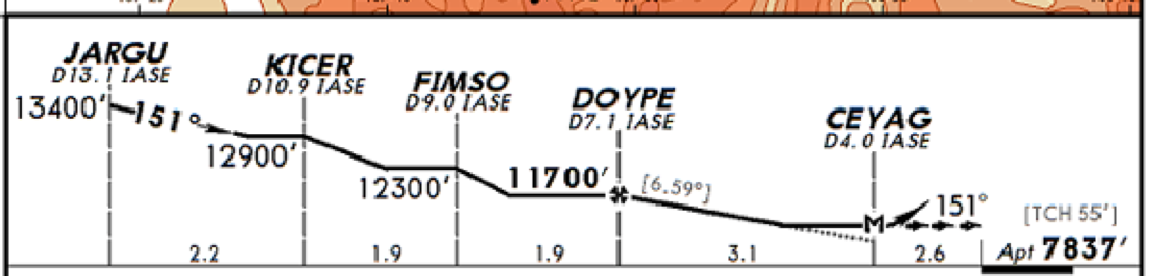
MISSED APCH: Climbing RIGHT turn to 14000′ on heading 300° and IPKN localizer NORTHWEST course (303°) to LINDZ/D12.6 DBL and on DBL VOR R-244 to GLENO/D22.7 DBL and hold.



Alt Set: INCHES Trans level: FL 180 Trans alt: 18000′

1. Dual VHF navigation receivers required. 2. Procedure not authorized at night. 3. VGSI and descent angles not coincident. 4. IPKN back course outbound is normal sensing. 5. Pilot controlled lighting 118.85.





Gnd Speed-Kts	70	90	100	120	140	160
Descent Angle [6.59°]	819	1053	1170	1404	1638	1872
MAP at CEYAG						

Lighting - Refer to Airport Chart

14000′ RT on 300° hdg and IPKN 108.5 NORTHWEST 303°

CIRCLE-TO-LAND

	Max Kts	DAY MDA(H)	NIGHT
A	90	9840′ (2003′)-3	NA
B	120	10020′ (2183′)-3	NA
C	140	10220′ (2383′)-3	NA
D		NA	NA

BRIEFING STRIP ™

AMEND 18, 20 SEP 2012

CFDA Not Advisable due to Excessive Descent Rate — KASE Loc DME-E

Figure: Aspen LOC DME-E, from Jeppesen Airways Manual, KASE page 11-1.

The approach contains the dotted gray line with a vertical descent angle given, 6.59°. The FAA version also has the requisite VDA depicted. Technically, you have what you need to fly this approach using a constant descent final approach, but it would be unwise. AC 120-108 suggests 3.77° is the maximum for a Category C aircraft. See: Vertical Path Angle — Limitations.

There are many problems with such and approach, to name just a few:

- Few aircraft can descend at such a steep angle and not accelerate, even when fully configured.
- The normal, flight tested, go around maneuver may not account for such an extreme change in flight path vector.
- If you manage to make it to the runway on speed, you may not have the energy required to flare from this angle.

The CFDA is meant to give you an unchanging flight path, laterally and vertically, from the final approach fix to the runway. Approaches like this are meant for low altitude maneuvering, making them unsuitable for CFDA techniques.

References

Advisory Circular 120-108, Continuous Descent Final Approach, 1/20/11, U.S. Department of Transportation

European Union Operations 1 (EU OPS 1), Subpart E, Section OPS 1.430, 20.9.2008. Official Journal of the European Union L 254/1.

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FAA-H-8083-15B, Instrument Flying Handbook, U.S. Department of Transportation, Flight Standards Service, 2012

FAA-H-8261-1A, Instrument Procedures Handbook, U.S. Department of Transportation, Flight Standards Branch, 2007

ICAO Doc 8168 - Aircraft Operations - Vol I - Flight Procedures, Amendment No. 3, Procedures for Air Navigation Services, International Civil Aviation Organization, 2006

Jeppesen Airways Manual

Eddie's Lawyer Advises:

Always remember that Eddie, when you get right down to it, is just a pilot. He tries to give you the facts from the source materials but maybe he got it wrong, maybe he is out of date. Sure, he warns you when he is giving you his personal techniques, but you should always follow your primary guidance (Aircraft manuals, government regulations, etc.) before listening to Eddie.