JEPP'S BRIEFING

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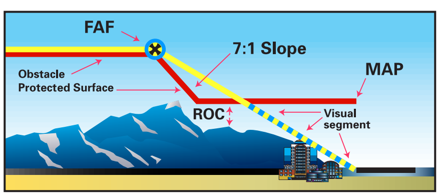
The Chart Clinic – Twenty Third in a Series

When you descend down to the minimum descent altitude (MDA), is it a "hard" altitude? Can you descend below the MDA while still in instrument conditions? What about the decision altitude (DA)? Is it legal to descend below the DA while executing a missed approach? Why is there a difference?

MDA Protection

As can be seen from the illustration, the MDA is protected starting at one mile after first receiving the FAF all the way to the missed approach point (MAP). Obstacles within the first mile after the FAF that fall below the 7:1 slope do not need to be considered in establishing the MDA. According to the TERPs criteria, the MDA is the lowest altitude to which descent shall be authorized in procedures not using a glideslope. Aircraft are not authorized to descend below the MDA until the runway environment is in sight and the aircraft is in a position to descend for a normal landing.



Because of the design of the MDA, the obstacle which controls the MDA could be close to the end of the runway and actually penetrate through a line which proceeds straight from the FAF to the end of the runway. This is the reason the MDA must be maintained all the way to the missed approach point (MAP) and a *descent below the MDA is not authorized* until visual conditions exist.

The MDA for straight-in landings can be as low as 250 feet and the MDA for approaches where only circling minimums exist can be as low as 350 feet for category A aircraft and higher for the other aircraft categories. The MDA typically is higher than the minimum because of obstacles, remote altimeter sources, and other factors such as excessively long final approach segments.

Constant Angle Non-Precision Approaches

In the Jeppesen NavData™ database for airborne systems such as GPS and FMS, there is a vertical navigation (VNAV) angle for virtually every non-precision approach procedure in the world. All of the descent angles are based on a series of rules which are written in the ARINC 424 specifications. The rules essentially state that a straight line will be drawn from 50 feet above the runway threshold back up to the altitude at the FAF. A calculation will then be made to determine the angle for the descent line. This is the method specified in both the TERPs criteria and the ARINC specs and is rounded to one hundredth of a degree. The descent angle will be at least 3.00°. If the computed descent angle is less than 3.00°, the angle will be raised to the minimum of 3°.

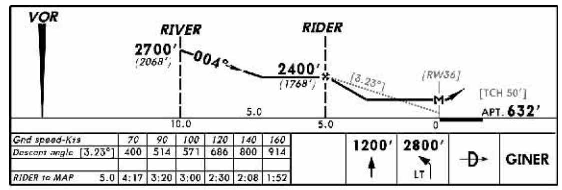
When flying this VNAV descent angle, you can fly a stabilized descent from the FAF to a landing. In order to display this new information, all the non-precision approach charts produced by Jeppesen will have a modified profile view and conversion table beginning in an early December 1999 revision. The first profile view illustration shows a sample of the new profile view.

Look at the profile view and note the dotted line from the RIDER intersection (FAF) to the runway threshold. The dotted line will always match the angle in the database. To show that the descent line is computed and in the database, the dotted line is shown in a gray color rather than the dark black lines used for the other profile view information. The computed descent angle is 3.23° and is included in brackets to show the database information.

Also included in the profile view is the threshold crossing height (TCH) which has a default value of 50 feet. The value may be other than 50 feet when it is determined to have a different requirement because of various government criteria. On this approach, the missed approach point is the threshold on runway 36. The identifier RW36 is shown in the profile view inside of brackets and in a gray color to depict the database identifier for the MAP.

The conversion table also shows the descent angle in brackets and in hundredths of a degree. The most valuable information for aircraft not equipped with VNAV is the descent rate in feet per minute at various ground speeds. Assuming a ground speed of 100 knots, a descent rate of 571 feet per minute should accomplish a stabilized descent from the FAF to the runway. Since it is virtually impossible to maintain a perfect ground speed while flying a final approach segment, it might be suggested to add a few feet per minute to the descent rate to ensure that you don't overshoot the runway threshold.

Using this procedure, you generally will reach your MDA at about the distance from the runway that is the same as the minimum visibility. In some cases, the visibility might be slightly different from the distance when reaching the MDA because of lighting or higher MDAs.



Descent Angles to Clear Stepdown Fixes

On many approaches, a straight line from the final approach fix down to the TCH is actually too low for a stepdown fix and will cross the stepdown fix below its minimum altitude. In these cases, the descent angle is calculated from the altitude at the TCH back up to the stepdown fix altitude. By FAA and ICAO Pans Ops criteria, the stepdown fix descent rate to the runway has to meet the same criteria as any other portion of the final approach segment. The optimum descent gradient on the final approach segment is 300 feet per mile (close to 3°) and cannot be steeper than 400 feet per mile (3.77°).

On the profile view that shows KENDO as the FAF, notice that there is a short level segment after the FAF. This means that the descent angle of 3.50° is not from the FAF, but was calculated between the stepdown fix and the runway threshold. To fly the 3.50° descent angle to the runway, the descent is delayed until 6.9 NM to RW29. This distance is shown in gray just after the FAF, and is marked by a small vertical line at the point of the delayed descent.

Using the MDA as a DA

There are many aircraft today that are equipped with vertical navigation equipment and are capable and authorized to fly the computed descent angle on non-precision approaches. Because of this capability and the airlines' desire to use more of the capability in their FMSs, the FAA issued a Joint flight Standards handbook bulletin for Air Transportation (HBAT) and General Aviation (HBGA). The Bulletin number is HBAT 99-08 and HBGA 99-12 and is applicable to operators under FAR 121, 125, 129, or 135.

The profile view with KENDO as the FAF shows a slightly different depiction of the descent angle. Instead of a dotted line, there is a dashed line from the FAF down to the MDA. Note that the dashed line stops at the MDA and is followed by a small arrow that curves up at the MDA. This shows that the MDA can be used as a DA(H).

Once the statement is made that *the MDA can be used as a DA(H)*, a lot of explaining is necessary. And a lot of conditions must be met.

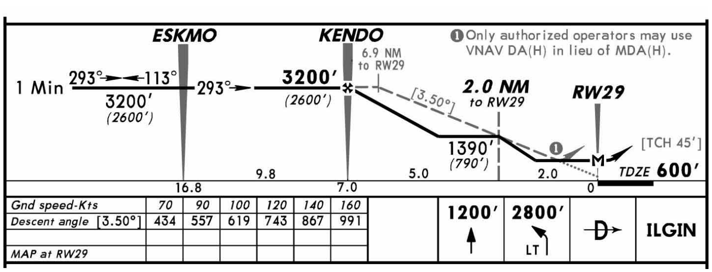
There is a small ball flag with the number "1" at the bottom of the dashed line. The ball flag refers to the note that states, "Only authorized operators may use VNAV DA(H) in lieu of MDA(H)." First, special approval from the FAA is necessary for each operator to gain this new benefit. And - the approval is only for certain airplanes used by the operator.

And the big "IF." The MDA may be used as a DA only if there has been a visual segment obstacle assessment made for the straight-in landing runway. The FAA has stated that there has been an obstacle assessment when the runway has a VASI or PAPI as a visual guidance system indicator, an electronic glideslope, or an RNAV approach published with a decision altitude.

Since an obstacle assessment has been made, the FAA has authorized the DA since it is assumed that a momentary descent will be made below the DA during the execution of a missed approach.

When there is a VDP, it should be at the point where the descent angle meets the MDA.

Most aviation authorities and industry leaders have recognized the safety benefits that will be gained by reducing the number of non-precision approaches that don't have vertical guidance. The addition of vertical guidance should help to reduce the number of CFIT (controlled flight into terrain) accidents. Recently, the NTSB has recommended that aircraft with onboard capabilities for vertical guidance should be required to use them during non-precision approaches. They have also recommended that within 10 years all non-precision approaches approved for air carriers should incorporate constant-angle descents with vertical guidance from onboard systems.



In the next article, we will begin the discussion of missed approaches.

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