

Where To Start The Missed Approach

Knowing the location of the MAP is important to understanding obstacle clearance protection.

By Wally Roberts

In "ESTABLISHING VISIBILITY MINIMUMS" (June *IFRR*), I discussed how visibility minimums for instrument approaches are determined. This article will focus on operating in the visual segment of an instrument approach, including the decision to miss the approach after entering the visual segment. For the purposes of our discussion, assume the weather isn't conducive to either canceling IFR or a visual approach. Further, assume that a contact approach isn't legal, or doesn't seem like a good option.

The visual segment

I defined a specific "visual segment" in my previous article, in which the FAA must determine certain obstacle free slopes in order to approve straight-in visibility minimums of either 3/4- or 1/2-mile. From both an operational and a regulatory standpoint, the pilot isn't constrained to limit the visual segment portion of an instrument approach to this criteria-specific area. In an operational sense, the visual segment could vary from a relatively small area in the case of a 200-1/2 ILS, to a very large area when, for example, circling from an approach to Runway 36, clockwise, for a long circle-to-land on Runway 27. Also, when the weather is well above MDA or DH, and/or the visibility is well above minimums, the pilot can elect to begin the visual segment prior to its mandatory point of beginning.

What is the visual segment's mandatory point of beginning? Well, it certainly isn't later than the missed approach point (MAP). But, it could be earlier, depending on where the MAP is located, and whether you're flying for hire. Also, your type of aircraft and the runway length enter into the equation, especially for not-for-hire operations.

Where's the MAP?

Because the visual segment cannot ever begin beyond the MAP, and sometimes must begin before, it's important to understand the concepts used to establish an MAP. With precision approaches (ILS, MLS, or PAR), this is a no-brainer: the MAP is always at DH. For non-precision approaches, it's more complex. Except

where either a VOR or NDB is located on the airport, the criteria prefer that the MAP be at the runway threshold for approaches with straight-in minimums, and at the first point a runway is encountered for circling-only approaches.

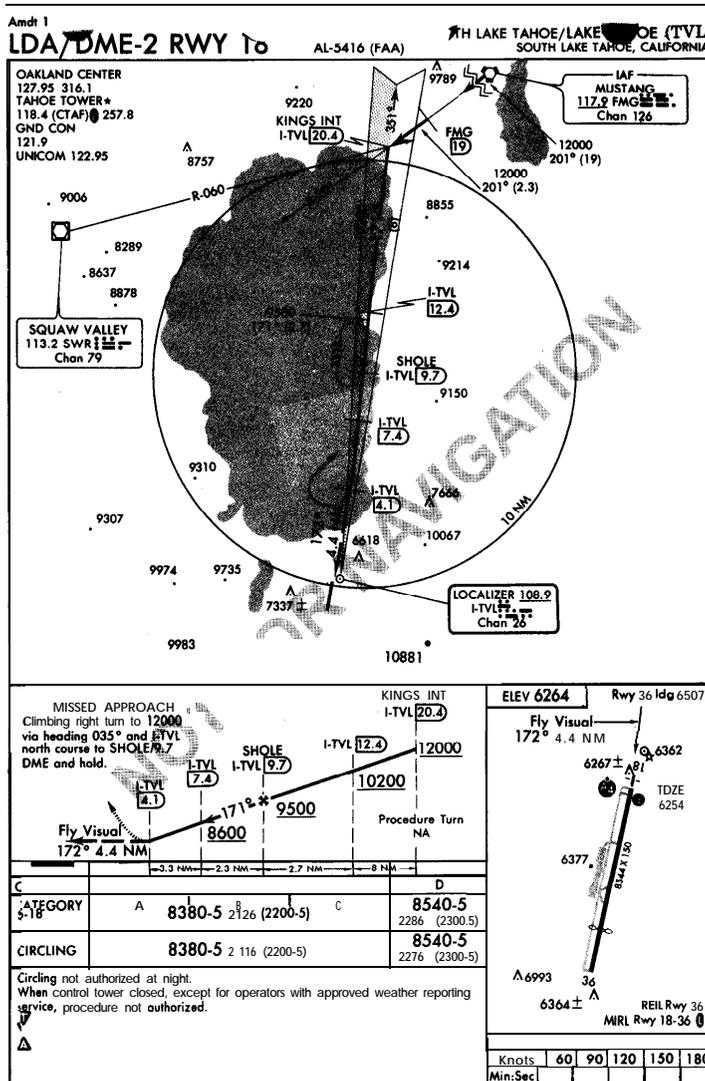
When either an NDB or VOR is located on the airport ("on-airport facility"), the navaid itself becomes the MAP, except where DME is a required part of the procedure. When DME is required with an on-airport navaid, a DME fix will mark the MAP in the same manner as with an off-airport VOR/DME approach. Localizer,

LDA, and SDF approaches have MAP considerations identical to off-airport VOR or NDB, e.g., either timing from the FAF, or a DME fix. GPS non-precision approaches have a special waypoint to mark the MAP.

The MAP and the 40:1 slope

Although the criteria prefer that a non-precision MAP be at the runway threshold, it's often located well before the threshold in order to satisfy the missed approach criteria. These criteria require that the missed approach segment be free of obstacles

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The 40:1 slope for the missed approach procedure starts at the MAP which for this procedure is 4.4 nm out. Miss the approach after this point, and you'll be below the obstacle clearance plane.

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along a 40:1 slope from the base of the required obstacle clearance (ROC) surface at the MAP until reaching a floor 1,000 feet below the missed approach level-off altitude. This is an international standard to which the FAA virtually always adheres.

There is only one public procedure exception for Category I procedures: the ILS Runway 8 at Burbank, CA. This procedure has a climb gradient specified for the missed approach procedure. In addition, there are a few mountain airports with special ILS instrument approach procedures that specify a climb gradient, but these require that the operator guarantee to the FAA that its aircraft will comply with the specified climb gradient in the event of a missed approach from DH.

Performance box

At an airport where the MDA or DH has an unusually high HAT or the MAP is well before the runway ("early" MAP), the aircraft falls well below the 40:1 missed approach surface as flight proceeds below the MDA/DH or beyond the MAP. Where an approach has both an early MAP and high MDA/DH, the airplane can get into a real performance box if a missed approach becomes necessary, late in the visual portion of the approach.

A classic example is the LDA/DME-2 at South Lake Tahoe (TVL), CA (page 5). The MAP is 4.4 miles from the runway threshold, and the Category A, B, and C MDA is 2,126 feet above the touchdown zone elevation. The missed approach 40:1 surface begins at the MDA of 8,380 feet, minus the required obstacle clearance of 250 feet, or at 8,130 feet. The 40:1 surface, and its associated protected airspace, are valid only when a turn is begun at the MAP. So, the airplane that misses at 100 feet agl, on short final, is almost 1,800 feet too low, and 4.4 miles too late, as far as standard missed approach protection is concerned.

Granted, most airports don't have such extreme circumstances, but there are lesser degrees of the TVL theme at many locations throughout both the western and eastern mountain areas of the U.S.

The late MAP

More typical is the dilemma created when descent is delayed until the MAP. In the case of an approach such as the VOR RWY 14 to Marysville, CA (on right), it's

way too late to land straight-in at the on-airport VOR MAP. In fact, at most non-precision straight-in MAPs, which are at the runway threshold, it's too late to land straight-in if descent isn't begun well before the MAP. If the operation is for hire, FAR 91.175(c)(1) requires that a normal descent be made to a landing within the touchdown zone (first 3,000 feet of the runway).

For the non-commercial operator, the descent still must be at a "normal rate," but the landing can be made beyond the touchdown zone, if that can be done safely. What constitutes a normal rate isn't defined for non-commercial operations, and is certainly different for a Cessna 182 than for a B-747.

The question occasionally arises: if it appears that descent for a straight-in landing can't be made in time, is it okay to climb to the circling MDA prior to the MAP, then circle-to-land at the MAP (assuming no ATC restrictions)? In theory, the answer is yes. But, in practical terms, the pilot is likely stuck at the straight-in MDA because of a lack of adequate visual reference, so climbing to the circling MDA is unlikely to be of much practical value.

Reduced or minimum visibility

One of the weakest areas of general aviation training is exposure to the visual segment during either actual or simulated minimum conditions. Popping the hood off at 200 feet on a CAVU day (or even a 2-mile visibility day) is a far cry from a "WOXO" day or night, with an RVR of 2400. And, a real WOXO RVR 2400 day is quite different than a WOXO RVR 2400 night. Then, there is the matter of an ex-

tended circle-to-land maneuver with the weather reported at 400-1, with precip, scud, and a hefty low-level wind thrown in for good measure.

The airlines routinely provide training in such demanding visual segment maneuvers with state-of-the-art flight simulators. Unfortunately, realistic flight simulation, with wrap-around visuals, isn't usually available to most general aviation pilots. So, actual experience is best obtained gradually with an experienced pro riding shotgun.

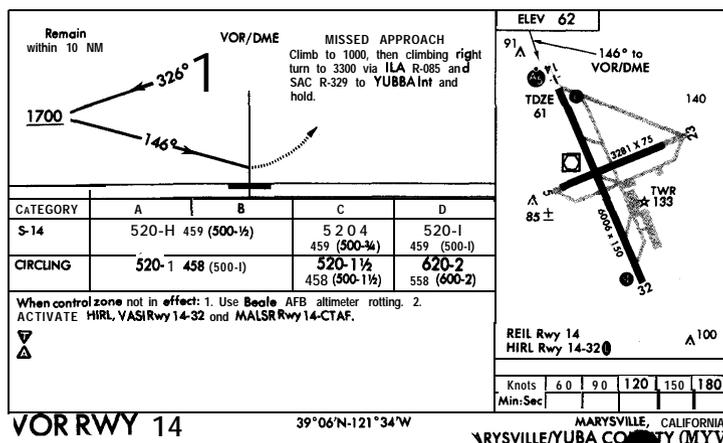
Circling to a missed approach

Paragraph 5-58 of the AIM contains good information about missing the approach during a circle-to-land maneuver. Add to that, however, the complexities of flying back to the MAP at a place like TVL. Also, Paragraph 5-57(d) of the AIM admonishes the pilot that ATC at a controlled airport will usually expect you to land straight-in out of a circling-only approach procedure. It's up to you to decide as early as possible whether a straight-in landing is feasible.

Refer to the VOR/DME-C at Medford, OR (page 7). Although the final approach radial is almost perfectly aligned with Runway 32, there are no straight-in minimums because of excessive descent gradient requirements. So, the pilot must decide whether it's safe to land straight-in, given the variables of aircraft descent requirements, and at what position on final that visual cues permit descending below the MDA.

Those required visual cues

FAR 91.175(c)(3) sets forth a list of run-
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When the MAP is at the airport, don't even think about landing straight-in if you happen to see the field from overhead.

way-specific visual cues that must be present in order to descend below the MDA or continue the approach below DH. With the exception of an approach light system (ALS), all the other items ensure that the runway environment, per se, is in sight. The (ALS) exception permits descending to as low as 100 feet without seeing one of the visual cues associated with the runway itself. This is tricky stuff, because extensive research has proven that approach lights provide no vertical guidance.

The ALS exception was written with a standard, unrestricted ILS system in mind, although it certainly pertains to any instrument approach. With an unrestricted ILS, the glideslope is useable to at least 100 feet, and with a CAT II or III system the glideslope plays well to 50 feet. But, there are some CAT I ILS systems where the glideslope falls apart shortly below DH, and following it could take you right into the approach lights.

When to circle

The decision to descend below the MDA on a straight-in approach is relatively straight-forward. What isn't so obvious is when it's okay to depart the electronic final approach, but remaining (or above) at the MDA, for a circle-to-land. FAR 9 1.175(e)(2) requires a missed approach during the circle-to-land maneuver unless "an identifiable part of the airport" is continuously in sight (excepting wing blocking during turns). So, presumably, "an identifiable part of the airport" must be sighted prior to departing the approach procedure's electronic guidance for the circle-to-land maneuver.

Obstacle alligators

Of course, the circle-to-land cannot be done below the circling MDA until at least one of the runway-specific cues associated with the landing runway is in view, and the aircraft is in a position to make a normal descent to landing. And, don't forget the obstacle "alligators" that can be present just 300 feet below the circling MDA at an unfamiliar airport. Also, at a controlled airport, don't ever let the controller talk you into "extending downwind," or "I'll call your base leg" when circling-to-land during IFR conditions. The obstacle-protected circling area can easily be breached unless the aircraft is kept reasonably close-in.

DH dilemma

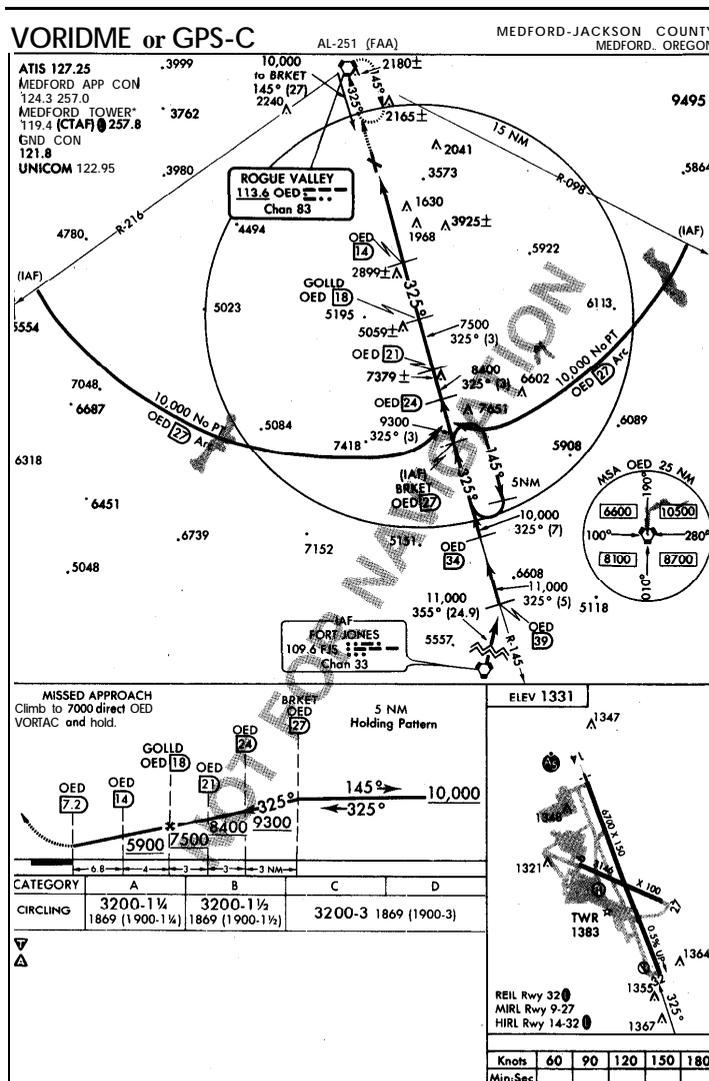
When descending on an electronic

glideslope to DH, the FAR simply says that approach cannot be continued below DH unless one or more of the runway-specific visual cues (or ALS) is sighted. Most single-pilot operators view this as looking up from the panel at DH and making the decision to either continue visually or miss the approach. While this is certainly practical, it isn't what the "head-shed" has in mind. The subject is sorely lacking in FAA directives for general aviation, but it's covered quite well in FAA directives to air carrier inspectors. The visual assessment must be completed not later than DH. The aircraft is permitted to descend through DH without the required visual cues, but only to the extent required to transition to the missed approach climb. Granted, it's an honor system for the single-pilot operator!

The missed approach climb

Finally, what about missed approach climb performance? As discussed, a standard 40:1 slope is provided from the bottom of the ROC at MDA or DH. But, climbing at just a 40:1 gives no pad at all at a location where obstacles might progressively get higher, but just beneath the 40:1 slope. So, at an unfamiliar airport, at least, the missed approach should be a maximum performance climb maneuver.

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Even though the final approach course is within 30 degrees of the runway, straight-in minimums aren't authorized due to the steep descent gradient.