Circle-To-Land Tactics

The circling maneuver varies widely, from almost a straight-in to a large visual segment.

By Wally Roberts

THE CIRCLING MANEUVER IS one of the more demanding aspects of instrument flying. This is especially true when the ceiling is near MDA, the visibility is near minimums, and there's turbulence with rain or snow thrown into the mix.

In my article "Circling and the Visual Segment" (January 1996 *IFRR*), I discussed the technical aspects of circling approach design. This article will review the fundamentals and provide a more technique-oriented perspective than the previous article.

Fundamentals

Figure 1 (below right) is from the AIM and shows how the circling maneuvering area is constructed. At an airport with all five approach categories, the radii and tangents must be calculated five times with larger dimensions for each approach category. The minimum obstacle clearance within each approach category circling maneuvering area is 300 feet.

Also, the height above airport (HAA) of the MDA cannot be less than: Cat A – 350 feet, Cats B and C – 450 feet, and Cats D and E – 550 feet. These minimum HAAs for circling are just that: *minimums*. Neither the minimum circling HAAs nor the lateral areas protected by the table in Figure 1 are conservative. Instead, they are biased toward operational necessity with the presumption of a high degree of pilot skill and airport familiarity. ICAO international circling areas are much larger than those provided by the FAA, which should give you additional pause about the FAA's circling criteria and philosophies.

FAR 91.175(e)(2) requires you to keep an identifiable part of the airport in distinct view, except when banking temporarily blocks the view. Further, FAR 91.175(c) comes into play once you're satisfied it's time to leave MDA because you're "in the slot" for the landing runway.

Those high MDAs

The FAA view of circling really only covers circling MDAs to perhaps a few hundred feet higher than the standard 350/450/550. Once the MDA reaches a height where you must depart MDA much before rolling out on a final within the distance limitations of your approach category (1.3 nm for Category A), then you should think twice about circling at such an airport unless you know where every big brick pile is located.

If you depart the circling MDA on downwind or base, the FAA takes a walk at that point. Only where you get into the final approach area of the landing runway is there any offer of obstacle protection below MDA. If the landing runway has a VASI or PAPI, you're in good shape once you're within 10 degrees of the extended runway centerline. Also, if the runway has approach lights and straight-in minimums on a different IAP of three-quarters of a mile or less, you're in good shape. (However, chances are you would have flown the straight-in approach in this case, right?)

CIRCLING APPROACH AREA RADII

Approach Category	Radius (Miles)
A	1.3
B	1.5
C	1.7
D	2.3
E	4.5

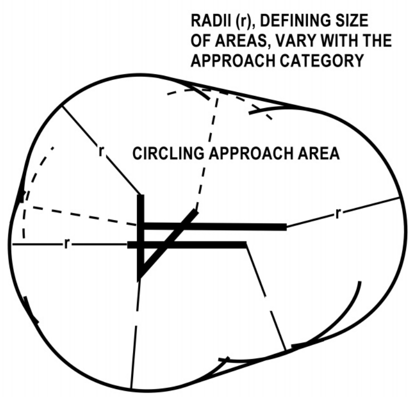

Figure 1. Circling approach protected airspace varies by aircraft category. The HAA must be at least 350 feet for Cat A, 450 feet for B & C, and 550 feet for D & E.

If the landing runway has neither VASI/PAPI nor approach lights with one-half or three-quarter mile straight-in minimums, then you're on your own. Once you're 300 feet below MDA there could be anything sticking up, even to the runway threshold. This is where a local pilot's knowledge equates to a big edge over the hapless itinerant.

AIM view of circling

AIM 5-4-18f. states: "Circling Minimums: In some busy terminal areas, ATC may not allow circling and circling minimums will not be published. Published circling minimums provide obstacle clearance when pilots remain within the appropriate area of protection. Pilots should remain at or above the circling altitude until the aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers.

"Circling may require maneuvers at low altitude, at low airspeed, and in marginal weather conditions. Pilots must use sound judgment, have an in depth knowledge of their capabilities, and fully understand the aircraft performance to determine the exact circling maneuver since weather, unique airport design, and the aircraft position, altitude, and airspeed must all be considered. The following basic rules apply:

"1. Maneuver the shortest path to the base or downwind leg, as appropriate, considering existing weather conditions. There is no restriction from passing over the airport or other runways.

"2. It should be recognized that circling maneuvers may be made while VFR or other flying is in progress at the airport. Standard left turns or specific instruction from the controller for maneuvering must be considered when circling to land.

"3. At airports without a control tower, it may be desirable to fly over the airport to observe wind and turn indicators and other traffic which may be on the runway or flying in the vicinity of the airport."

Be careful out there

This AIM guidance basically says, "you all better be careful out there." Subparagraphs 1 and 3 are seemingly contradictory. If you keep in mind that subparagraph 1 is focused on towered airports, whereas subparagraph 3 is not, it becomes clearer what the FAA is trying to say.

Circling at a busy, non-tower airport in marginal weather is fraught with the hazard potential of a midair collision, in addition to the substantial hazard of exposure to controlled flight into terrain during marginal or minimal conditions. When weather conditions permit, never use the circling MDA when a higher traffic pattern altitude will suffice.

Only where you need to operate at the *minimum* descent altitude for circling should you operate below pattern altitude. The circling MDA is different than a straight-in MDA in that it becomes an operational altitude for a sometimes lengthy visual circuit of the airport, with precious little margin for error. Are you satisfied your skills permit a sustained visual circuit around the airport at only 350 - 450 feet agl, and with some terrain or other obstacle whizzing by only 300 feet below you? With all this taking place at night, in strong winds, and perhaps rain or snow with one-mile visibility? The MDA is just that; you cannot go below it under any circumstances until you're in a position to make a normal descent to landing—hopefully on, or near, final.

Restricted sector

Where there are really high obstacles on only one side of the airport, the circling minimums will often be annotated with a restriction, such as "Circling not authorized west of Runway 18-36." These notes are easy to miss. The FAA has no responsibility for obstacles that exist in such a restricted sector. You have no business circling at an airport unless the reasons for application of such a note for that airport is obvious to you.

Keep in mind the excluded sector might be defined by the extended runway centerline of the runway to which you're circling. Assume, especially at night, that a brick wall rising to infinity is just to the restricted side of runway centerline. Slightly undershooting your turn to final is the best bet at such an airport.

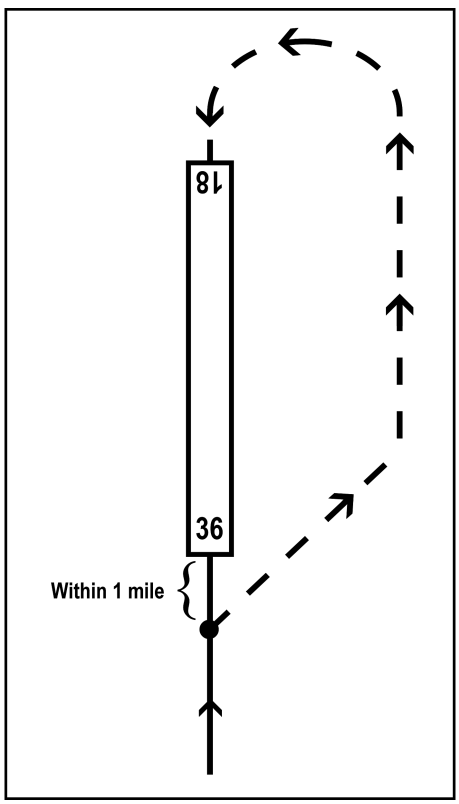

Figure 2. "Classic" circle-to-land scenario with electronic guidance to Runway 36, followed by circling maneuver to Runway 18. In this situation, don't depart the electronic final approach guidance until within one mile of the approach end of the runway served by the IAP.

Classic circle-to-land

Figure 2 (below left) illustrates the "classic" circle-to-land maneuver where the landing runway is the reciprocal of the runway to which the IAP leads. Single-pilot operations dictate circling so the critical part of the airport is to your left. If a restricted sector note forces you to circle with the critical part of the airport to your right, that is a very loud hint you shouldn't be circling at all, unless you know the lay of the land so well that peeks out the right side will keep you both safe and legal.

In Figure 2, I recommend against departing the electronic final approach guidance until within one mile of the approach end of the runway served by the IAP. This assures adequate visual reference and initial containment within the circling maneuvering area. The broken line is the visual flight track and should remain well within the distance specified for your approach category in Figure 1. Ideally, you shouldn't leave MDA until rolling out on the landing runway's final leg.

Lined up, but too steep

Figure 3 (page 12) is the profile view and minimums for the LOC-DME (BACK CRS)-B at Medford, OR (MFR). On this IAP, the localizer is perfectly lined up with the runway, but the descent gradient is too steep for TERPs straight-in minimums. For straight-in minimums, the final approach course must be aligned within

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30 degrees of the runway *and* the final segment descent gradient must not exceed 400 feet per mile to touchdown. With circling minimums, however, the FAA only calculates the 400-foot-per-mile limitation to MDA, which leaves the pilot hanging to figure out what's needed to get from MDA to landing.

I believe the FAA should chart the descent gradient on such potentially dangerous and misleading procedures. In the example illustrated in Figure 3, that big blank box to the left of the circling minimums could (should) state, to the effect, "Descent gradient from D9.0 IMFR LOC to Runway 32 touchdown is 645 feet per mile (6.1 degrees)." Nonetheless, you can make such a calculation as part of your preflight familiarization with the airport.

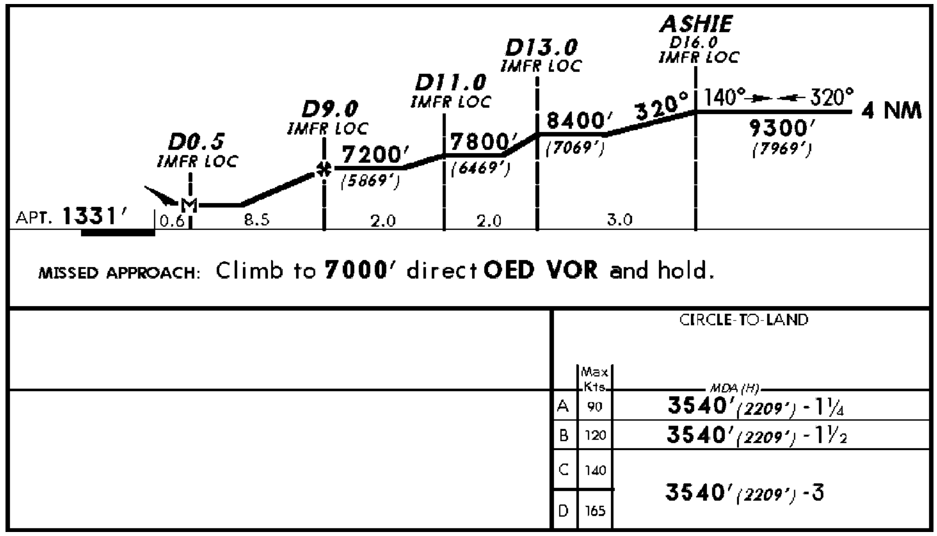

Figure 3. The LOC-DME (BACK CRS)-B at Medford, OR. The localizer is aligned within 30 degrees of the runway, yet this IAP has circling-only minimums because of the steep descent gradient. You'd be much more aware and prepared if the chart noted: "Descent gradient from D9.0 IMFR LOC to Runway 32 touchdown is 645 feet per mile (6.1 degrees)."

The 800 pound gorilla

Both FAA experts and industry pilot representatives authored the TERPs instrument approach criteria. Safety and efficiency influenced the latter group for pilots. The FAA experts (mostly pilots) were sometimes for pilots, but more often for operational "flexibility." Then, after the fact, the FAA 800-pound gorilla (ATC "metal movers") placed its spin on the situation when necessary for "the service." A classic example is illustrated in Figure 3, which is a lined-up, but steep, circling-only IAP.

MFR is a part-time Class D airport. The AIM has something to say about such approaches at towered airports:

(5-4-18d.) "Straight-in Minimums: Are shown on the IAP when the final approach course is within 30 degrees of the runway alignment and a normal descent can be made from the IFR altitude shown on the IAP to the runway surface. When either the normal rate of descent or the runway alignment factor of 30 degrees is exceeded, a straight-in minimum is not published and a circling minimum applies. The fact that a straight-in minimum is not published does not preclude pilots from landing straight in if they have the active runway in sight and have sufficient time to make a normal approach for landing. Under such conditions and when ATC has cleared them for landing on that runway, pilots are not expected to circle even though only circling minimums are published. If they desire to circle, they should advise ATC."

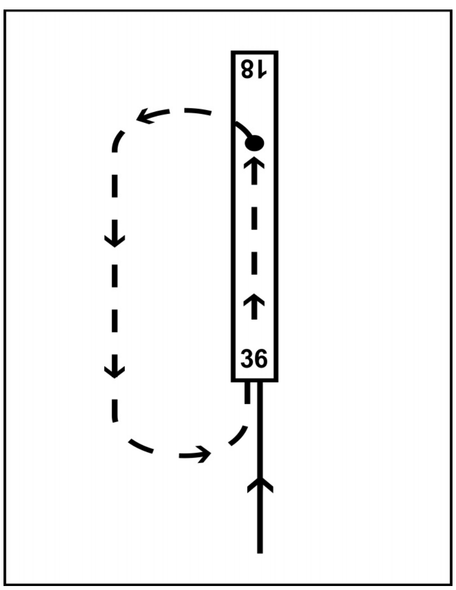

Figure 4. For a circling approach where the electronic final is aligned with the runway, fly down the runway at MDA until it's about to disappear under the nose, then enter the close-in circle-to-land maneuver.

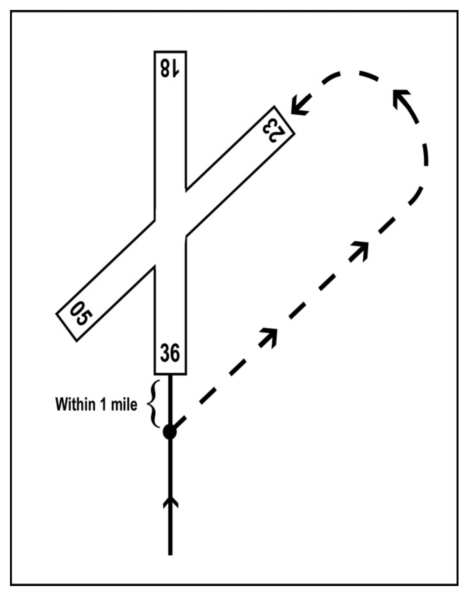

Figure 5. Because the intersection of Runway 23 with the IAP runway is sufficiently down-field, you can break off the electronic final in a manner similar to the "classic" circle-to-land in Figure 2.

If you're not comfortable landing straight in with an IAP like the MFR example, the burden is upon you to advise the tower as early as possible.

Circling to land straight-in

Figure 4 (page 12) is the method I recommend for handling a situation like the MFR IAP, where you aren't comfortable landing straight-in. The first reaction of both pilots and controllers is to "do a 360 on final" rather than what I've illustrated. A 360-degree turn on final is fine on a clear VFR day. That's not the type of day with which this article is concerned, however. I'm assuming night or day with precip, bumps, gusty winds, etc. When you *really* need to circle at MFR, Figure 4 is the way to do it. Fly down the runway at MDA until it's about to disappear under the nose, then enter the close-in circle-to-land maneuver.

Variations on the theme

Figures 5 and 6 show more complex airport configurations. In Figure 5 (page 12), you want to circle to intersecting Runway 23. Because the intersection of Runway 23 with the IAP runway is sufficiently downfield, you can break off the electronic final in a manner similar to the "classic" circle-to-land to Runway 18.

In Figure 6 (on right), however, Runway 29 intersects your IAP runway too close in order to break-off and enter left circling. If you attempt to directly enter left downwind for Runway 29, you would either be forced to depart the electronic guidance at a point where visual cues might be marginal, or you might unwittingly depart the circling maneuvering area protected airspace, or you might end up atop Runway 29 with no place to go. My recommended maneuver in Figure 6, although a bit more complex at first glance, will keep you where you want to be.

Beware the dangers

There are many variations on the themes of Figures 5 and 6. The game plan is best figured out over a cup of coffee. A good principle to keep in mind is this: circling at an unfamiliar airport is a form of IFR Russian Roulette.

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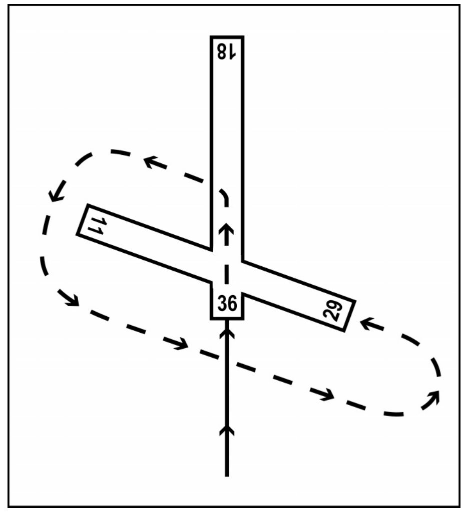

Figure 6. You want to land on Runway 29, but it's too close to break-off and enter left circling. In this situation, fly down the runway until crossing Runway 11/29 and circle to the left in order to keep the runway visible at all times.