The Precision of Non-Precision Approaches

The painless way to do without the crutch of ILS crosspointers

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■■ There is a strange misnomer in IFR flying called the "non-precision approach." The term seems to suggest that there's something sloppy about an IFR approach that doesn't incorporate an electronic glideslope.

In practice, the opposite is true. The non-precision approach is often more demanding and requires more precision and technique than the ILS or so-called precision approach.

Accident statistics seem to bear this out. Considerably more fatalities result from non-precision approaches than from ILS approaches. This is not because the VOR, ADF or LOC approach is inherently more dangerous than the ILS. Every IFR approach—irrespective of the type navaid used—is a safe procedure as long as the pilot is capable of complying with the dictates of the approach plate.

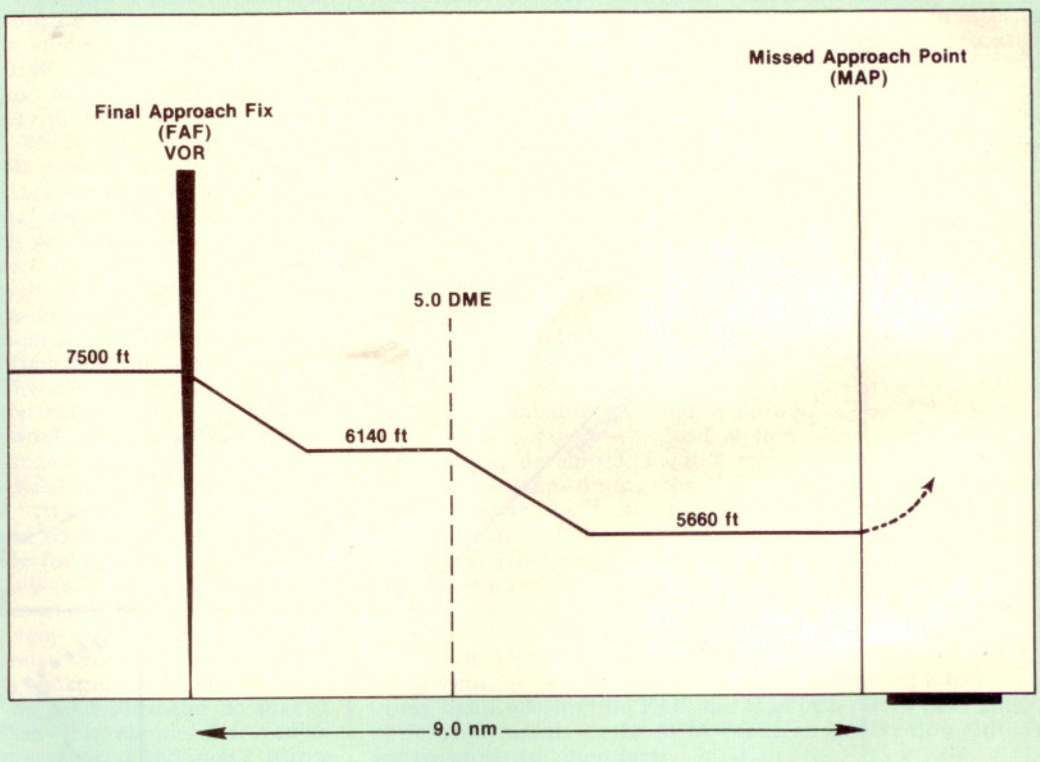
The non-precision approach is the most difficult because it requires a pilot to devise his own glideslope and use judgement to establish a visual slot, techniques that require more skill and IFR discipline than chasing perpendicular needles. Time and again, I have observed professional pilots shooting near-perfect ILS approaches only to find that these same pilots invariably have more difficulty with VOR approaches, for example.

The reasons for this are numerous and lead to the purpose of this article—to offer suggestions that can simplify the demands of a non-precision approach.

Pre-solo pilots are taught that good landings result from good approaches. So it is that the quality of an IFR approach is related to the time spent on planning for the procedure, an activity best performed while enroute to the destination airport.

After reviewing and becoming familiar with the approach plate, check for notations that warn of unusual conditions. Often, these notes go unnoticed.

The Detroit (Metro Wayne) VOR Runway 9 approach plate, for example, contains this interesting caution: "Brightly lighted street in town 1½ nm short of runway may easily be confused for Runway 9." An often overlooked notation on the



Ground Speed—Knots	60	80	100	120
VOR to MAP 9.0	9:00	6:45	5:24	4:30

Figure 1

Hayward (Calif.) VOR-A plate says, "Final approach course aligned 1,150 feet left of approach end Rwy 28L." And finally, this word of caution from the Santa Ynez (Calif.) VOR-A plate: "Turbulence and downdrafts in vicinity of GVO VOR."

Searching for and studying such notes can eliminate undesirable and dangerous surprises during an IFR approach.

The mental gymnastics of computing the time required to fly from the final approach fix (FAF) to the missed approach point (MAP) should also be accomplished while enroute. Unfortunately, this chore is usually left until the last minute, a practice that can result in dangerous error.

Assume, for example, that a pilot is preparing to shoot a VOR Runway 8 approach to Albuquerque (Figure 1). He quickly scans the bottom of the plate and notes that 6 minutes and 45 seconds are required to fly from the VOR to the missed approach point (based on an approach speed of 80 knots). Sounds simple enough, but such simplicity incorporates considerable error.

This approach calls for passing over the VOR at 7,500 feet and descending to an MDA of 5,660 feet, which means that the average altitude during the approach is roughly 6,500 feet. A quick spin of the computer reveals that 80 knots of indicated airspeed is equivalent to a true airspeed of more than 90 knots.

Now consider that even though the wind at the surface may be calm, the wind over the VOR could be a westerly tailwind of 10 or 20 knots which increases ground speed to more than 100 knots.

It is the ground speed, not the indicated approach speed, that must be used to enter the "time to MAP" table at the bottom of the plate. At 100 knots (GS), the time required to fly the 9-nm final approach course is 5:24 not 6:45 as calculated earlier. Without realizing it, the pilot in this example will fly beyond the missed approach point for almost a minute and a half, a potentially lethal error.

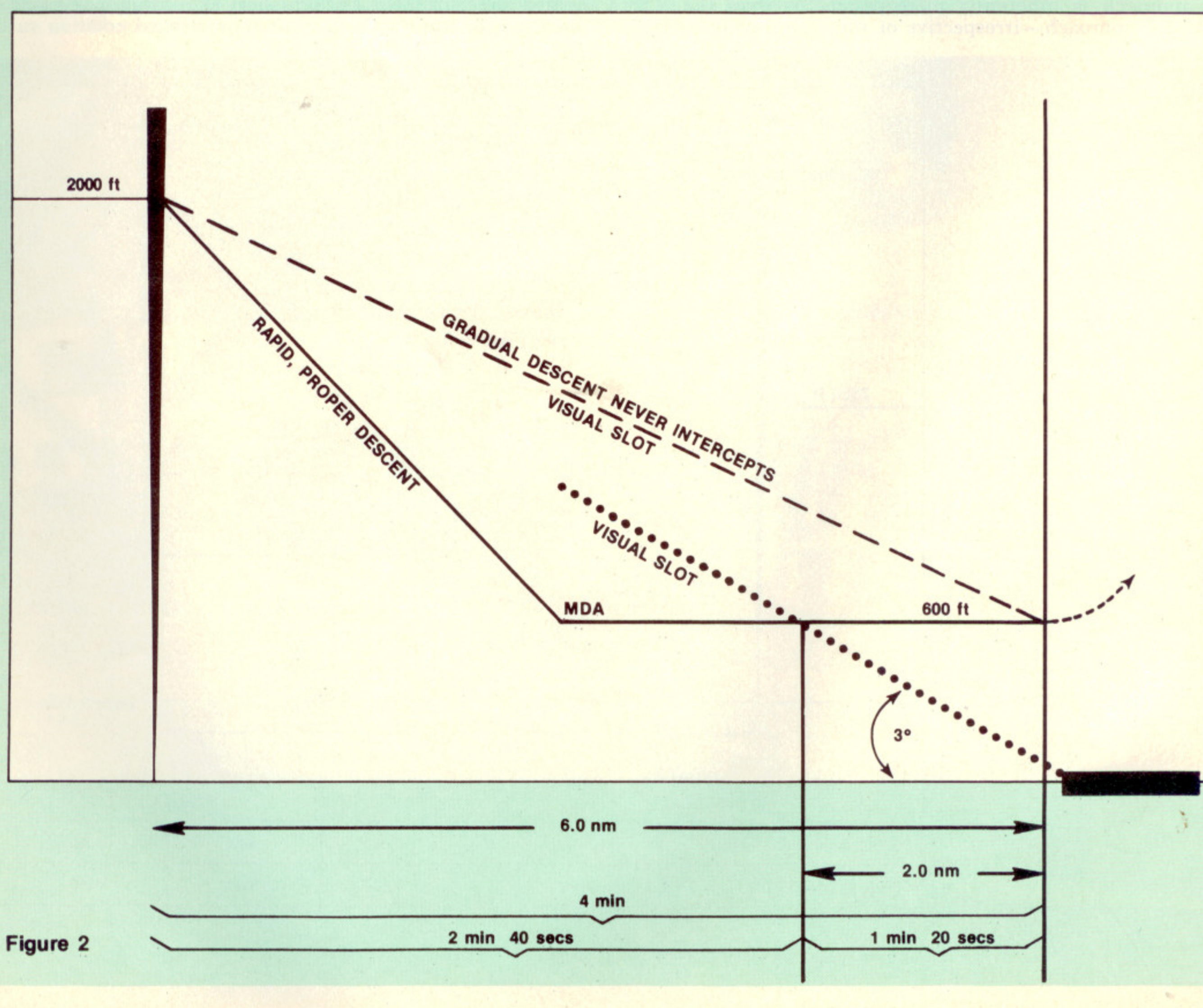


Figure 2

Conversely, failure to consider the effects of a headwind could result in flying an abbreviated final approach course. During conditions of minimum visibility, this would require having to execute a pullup before getting close enough to the airport to establish visual contact.

Assume that a pilot considers all factors and determines that his average ground speed on final will be 73 knots. After consulting the table, he determines that it is necessary to interpolate between 60 knots (9:00) and 80 knots (6:45). The actual time required, therefore, is 7:32, a number easier to determine in your living room than while flying solo in the clouds.

Fortunately, there is a clever way to eliminate the need for laborious interpolation. In this case, for example, simply increase approach speed by 7 knots to arrive at a planned ground speed of 80 knots and read the time required directly from the table. Adjusting approach speed is simpler than juggling numbers and prevents mathematical errors from ruining an otherwise good approach.

With respect to timing the final approach course, do not use a conventional clock with a sweep-second hand because this adds unnecessary hardship.

Assume, for example, that the clock indicates 12:57:33 when passing over the VOR at the beginning of a 6:46 final approach course. Quickly now, at what time should the pullup be executed? The answer is 1:04:19. But a pilot should not be bothered with such exercises during this critical phase of an IFR approach. Instead, use a stopwatch and fly the approach until the watch indicates 6:46.

There's an even simpler method to use, a technique that doesn't require having to remember the specific time required to fly from the FAF to the MAP. While enroute, subtract the determined time (6:46) from 10 minutes which results in 3:14. Then start the stopwatch and hit the stop button at precisely 3:14. When over the final approach fix, start timing again. When the missed approach point is reached 6 minutes and 46 seconds later, the stopwatch will indicate 10 minutes.

If such a technique is employed prior to every timed approach, the stopwatch will always indicate 10 minutes when the missed approach point is reached. This relieves the pilot of having to remember a specific time interval, one that varies from one approach to another. The effect is that of reducing all timed approaches to a common denominator. It would be marvelous if some manufacturer would develop a "backwards" stopwatch so the MAP is always at zero, for instance.

Another number that is often hard to keep in mind is the minimum descent altitude (MDA). It is usually an odd figure such as 1,620 feet or 770 feet. And since it is often necessary to fly low and slow at this altitude for up to several minutes, it is a number that is vital to a pilot's health and well-being. But there's no need to commit this number to memory either.

Before your next IFR flight, visit a stationery store and buy a box of small, red, self-adhesive arrows. Prior to an IFR approach, peel off the protective backing from one of these markers. Then place the arrow on your altimeter so that it points directly at the MDA. With this simple act, you've eliminated something else to remember. (And don't worry about removing these markers; they peel off easily.)

This technique is used by virtually every air carrier pilot. But instead of using stickers, he uses a mechanical "bug" built in to his altimeter. Frankly, I don't understand why every IFR aircraft doesn't have an altimeter (and airspeed indicator) with these extremely helpful devices.

By employing these suggestions, a pilot is relieved of having to memorize a string of unrelated numbers and is less encumbered during final approach. His mind is free to concentrate on the demands of his instruments.

There is another item to be covered during the planning stage. Glance at the circling MDA even when planning to execute a straight-in approach. Occasionally, the circling MDA is the same as the straight-in MDA. When such is the case, a pilot who establishes visual contact with the runway from too high an altitude to land straight-in has the option to circle and land (should he so desire).

Conversely, if the circling MDA is higher than the straight-in MDA, a pilot has no such option when flying at the lower minimum descent altitude.

But here's a tip. Assume that the straight-in MDA is 500 feet and the circling MDA is 600 feet. A pilot makes a straight-in approach and descends to 500 feet. He spots the airport, but is too high to land straight-in. He is also 100 feet below circling minimums. Is a missed approach necessary? Perhaps not. If the pilot can climb to the higher, circling MDA *prior* to reaching the missed-approach point and can *still see the airport* at this higher altitude, he is then in a legal and safe position from which to commence a circling approach.

Fortunately, most of the preceding considerations are unnecessary during an ILS approach; the glideslope needle solves many of the problems associated with non-precision approaches, but not always.

Should a pilot encounter a glideslope failure (either the transmitter or receiver), he is suddenly compelled to either abandon the ILS or continue by executing a non-precision LOC approach. The latter, of course, requires preparation. It is extremely difficult to convert from a precision to a non-precision approach without first having become familiar with the MDA and the time required to fly from the outer marker to the missed approach point.

The prepared pilot will, prior to executing an ILS, become acquainted with the "glideslope out" requirements and begin timing his approach when passing the outer marker—just in case.

It should be obvious by now that the success or failure of a non-precision approach often hinges on the quality of preparation.

When approaching the final approach fix, airspeed, altitude and heading should be stabilized. The pilot should spend a moment reviewing what must be done once the FAF is crossed for this is probably the busiest portion of an IFR approach. To simplify a pilot's workload at this point, a system of five Ts has been developed. Each T represents a required action.

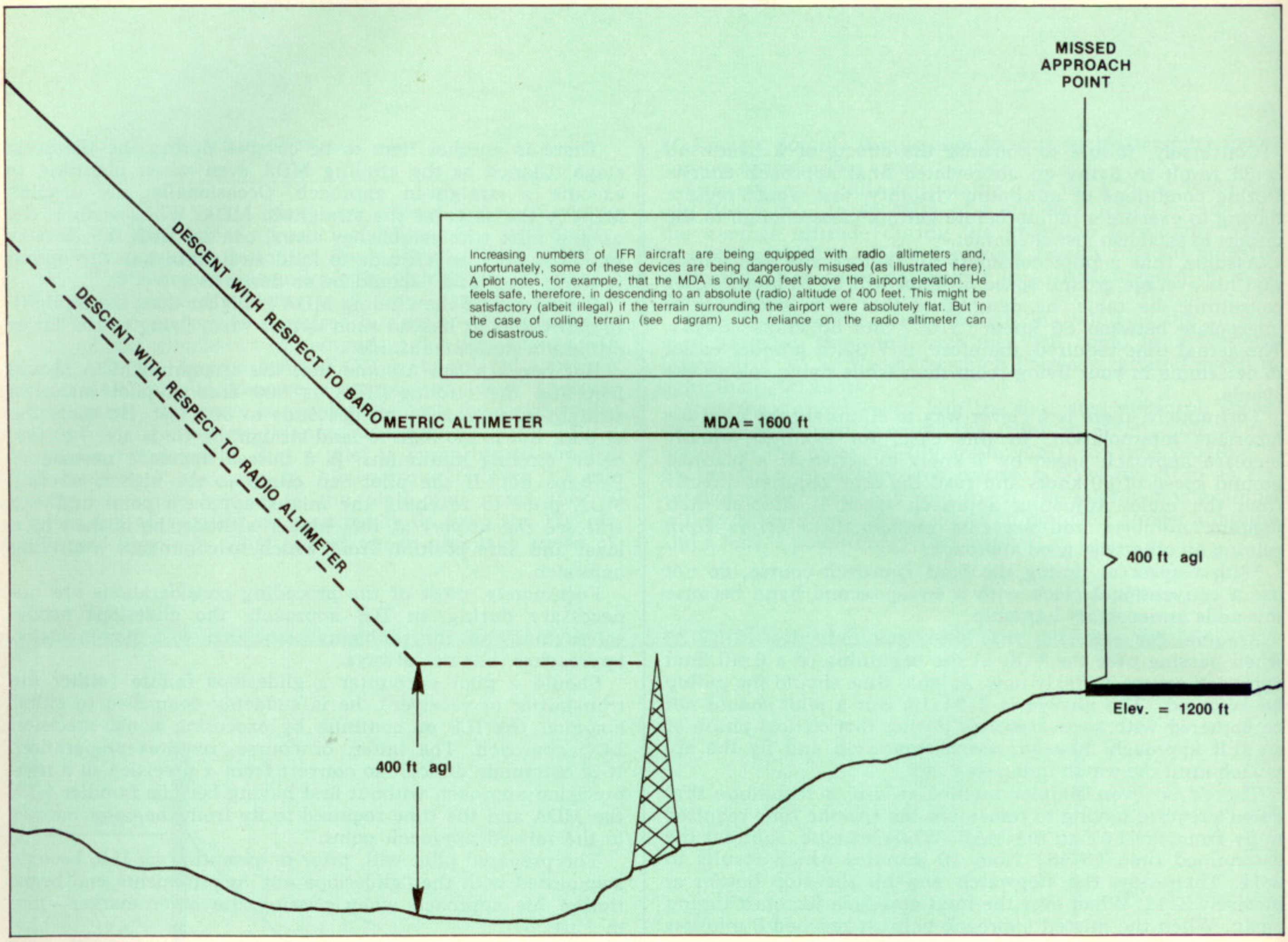
1. Time. Begin timing the final approach segment when directly above the final approach fix. This step comes first because timing must commence at the FAF and no later.

2. Turn. Turn the aircraft to the new course (if a dog-leg turn is required at the FAF). This must be done as soon as possible to remain within the obstruction-free approach corridor.

3. Tuck. This is a cute term used to describe the beginning of descent. It is not mandatory that the descent begin precisely upon passing the FAF, but it is in a pilot's best interest to descend rapidly to the MDA (or to an intervening altitude) for reasons explained later.

4. Twist. Twist or rotate the OBS to the desired radial and make whatever final corrections are necessary to bracket and track the final approach course.

5. Talk. This has the least priority because communicating with a tower controller has little to do with a successful IFR approach. Although approach control will usually ask a pilot to contact the tower when passing the FAF, don't be intimidated into conversation before the first four of the five Ts have been attended to. FAA should revise its procedures so that—during IFR conditions—approach control can issue



NON-PRECISION APPROACHES continued

landing clearance to a pilot before he reaches the final approach fix. The final moments of an IFR approach are not the time for talking.

Once the tower is contacted, however, always ask for the latest altimeter setting because this can be significantly different from the setting obtained earlier from ATC or an outdated ATIS broadcast. Remember, each error of .01 inches represents 10 feet on the altimeter.

A pilot who can remember his five Ts (time, turn, tuck, twist and talk) has an organized method of getting lots done in minimal time. The system also helps to prevent forgetting an important step.

The method of descending to MDA is a source of controversy. Many pilots descend so as to reach the MDA just prior to the missed approach point. This results in a relaxed, gradual descent, but is illogical during minimal weather conditions.

Figure 2 is the profile view of a typical VOR approach. The pilot must pass over the VOR at 2,000 feet and then descend to a 600-foot MDA. The distance between the VOR and the missed-approach point is 6 nm which, at a groundspeed of 90 knots, for example, requires four minutes.

Quite obviously, if the pilot breaks out of the 600-foot overcast immediately prior to reaching the missed-approach point, he will be too high to continue and be forced to execute a pullup.

Proper planning dictates that a pilot level off at the MDA *prior* to intercepting a 3° approach slot (the dotted line in the diagram) from which point a normal, visual descent to the runway can be executed.

The problem, therefore, is to determine how soon one must arrive at the MDA in order to intercept such a slot. The solution is not difficult.

A 3° slot simply means descending 300 feet during every nautical mile of flight. To be in a normal visual slot when approaching the example airport, therefore, it is necessary to level off at the 600-foot MDA when at least 2 nm before the MAP.

At a ground speed of 90 knots, 2 nm requires a flying time of 80 seconds. This means that it is necessary to arrive at the MDA, in this case, at least 80 seconds (1:20) prior to reaching the missed-approach point. Since it will take 4:00 to fly from the FAF to the MAP, a pilot should plan to be at the MDA at least 2:40 (4:00 − 1:20) after passing the final approach fix.

The suggestions offered here cannot be found in FAA manuals. Instead, they represent a gathering of techniques developed by professionals whose survival depends on the precise execution of non-precision approaches. □