

Flying DME Arcs With GPS

These procedures can be a snap, if you're familiar with the intricacies of your receiver.

By Harry Kraemer

FLYING A DME ARC IS EASY with GPS! At least, that's what the GPS manufacturers tell you. Using GPS to fly a DME arc considerably reduces your workload. You don't have to identify any nav aids or dial any radials along the approach. Once the approach is selected from the GPS database, you fly the CDI. There can be a few surprises, however, if you aren't familiar with how to fly an arc procedure with your GPS.

I'll discuss how to fly a DME arc procedure using the Bendix/King KLN-90B. Before I get into the details of flying an arc procedure, a brief review GPS overlay approaches is in order.

Overlay Approaches

DME arcs are found only on overlay approaches. An overlay instrument approach procedure (IAP) is an existing IAP that can be flown with GPS. A Phase III overlay approach will include "or GPS" in the title of the procedure. When using a Phase III procedure, neither the "traditional" avionics nor the applicable ground-based nav aid needs to be operational or monitored to fly the procedure.

Whenever you ask for an approach that can be flown with either GPS or a ground-based nav aid, e.g., "VOR or GPS RWY 8," the FAA recommends that you request the specific approach that you want to use. I recommend that you tell ATC when you intend to use GPS to fly an overlay approach procedure. This eliminates any confusion about which procedure you're flying.

An airport can have both a VOR/GPS overlay approach and a stand-alone GPS approach to the same runway. Each of these procedures is different (a stand-alone approach isn't part of an existing approach). A stand-alone GPS approach often has lower minimums than an overlay approach to

the same runway. Since approach-certified GPS receivers have become more popular and pilots have been flying GPS approaches, the FAA has decided that there will be only one GPS approach to a runway.

This policy started with the most recent GPS database revisions, where some approaches have "disappeared" from the database. The FAA is doing this to eliminate ATC confusion. Apparently, some controllers were getting confused about which approach the pilot was requesting.

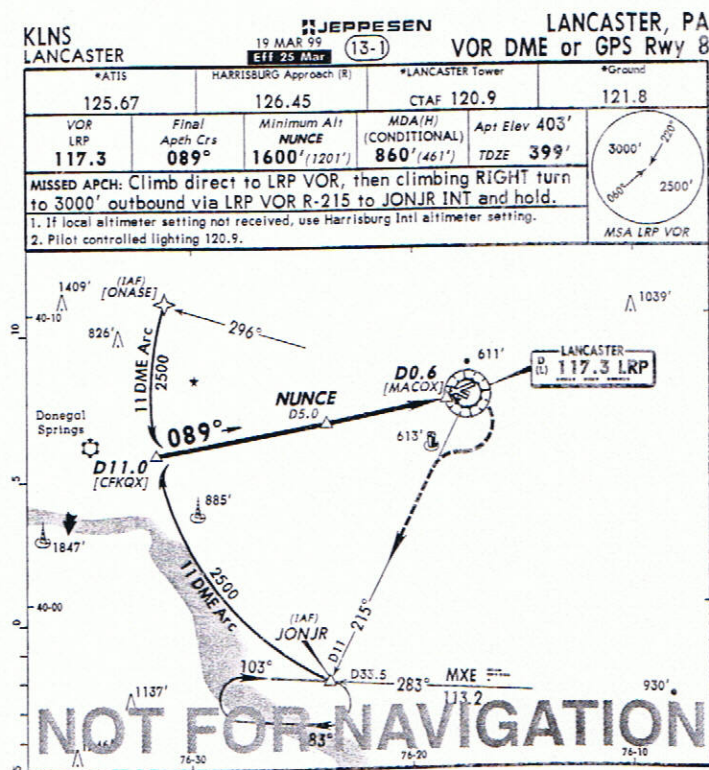
The DME arc procedure I'll review is the VOR/DME or GPS RWY 8 at Lancaster, Pennsylvania (see chart below). We'll use the KLN-90B in order to fly this approach with GPS. As we select and fly the approach, refer to the photos on page 7.

With the destination airport (KLNS)

as the active waypoint, you can access the available database approaches from the active or ACT page 8 on the receiver. Refer to the top receiver on page 7. It lists the three approaches at KLNS that are authorized for GPS use. We'll select the VOR/DME RWY 8. Once the approach has been selected, the next screen comes up and lists the available initial approach fixes (IAFs) from which you can start the approach. Our position is southwest of Lancaster, so we'll select JONJR as the IAF from which to start. (JONJR is also the missed approach holding point.)

Phantom Waypoints

The third display on page 7 shows what happened when we selected the IAF. Instead of JONJR in position 1, the display shows "D243K-i" as our first fix! The KLN-90B has calculated



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When using GPS to fly an overlay approach, tell ATC you want the GPS procedure to avoid a misunderstanding.

ON THE APPROACH

an intercept with the arc from our present position and has created a phantom waypoint that isn't listed on the chart.

Let's decipher the phantom "D243K-i" waypoint. The "D" indicates that the fix is a DME ARC. The "243" is our radial from LRP VOR. "K" is 11th letter of the alphabet, which indicates the fix is on the 11-mile arc. The "i" signifies this is an IAF.

The display now lists the fixes for the approach, in the order in which they are to be flown. Once the approach fixes have been loaded into the active flight plan, we turn to what Bendix/King refers to as the "Super" NAV 5 page (the fourth display on page 7). This page is an actual moving map that displays your position relative to the approach procedure.

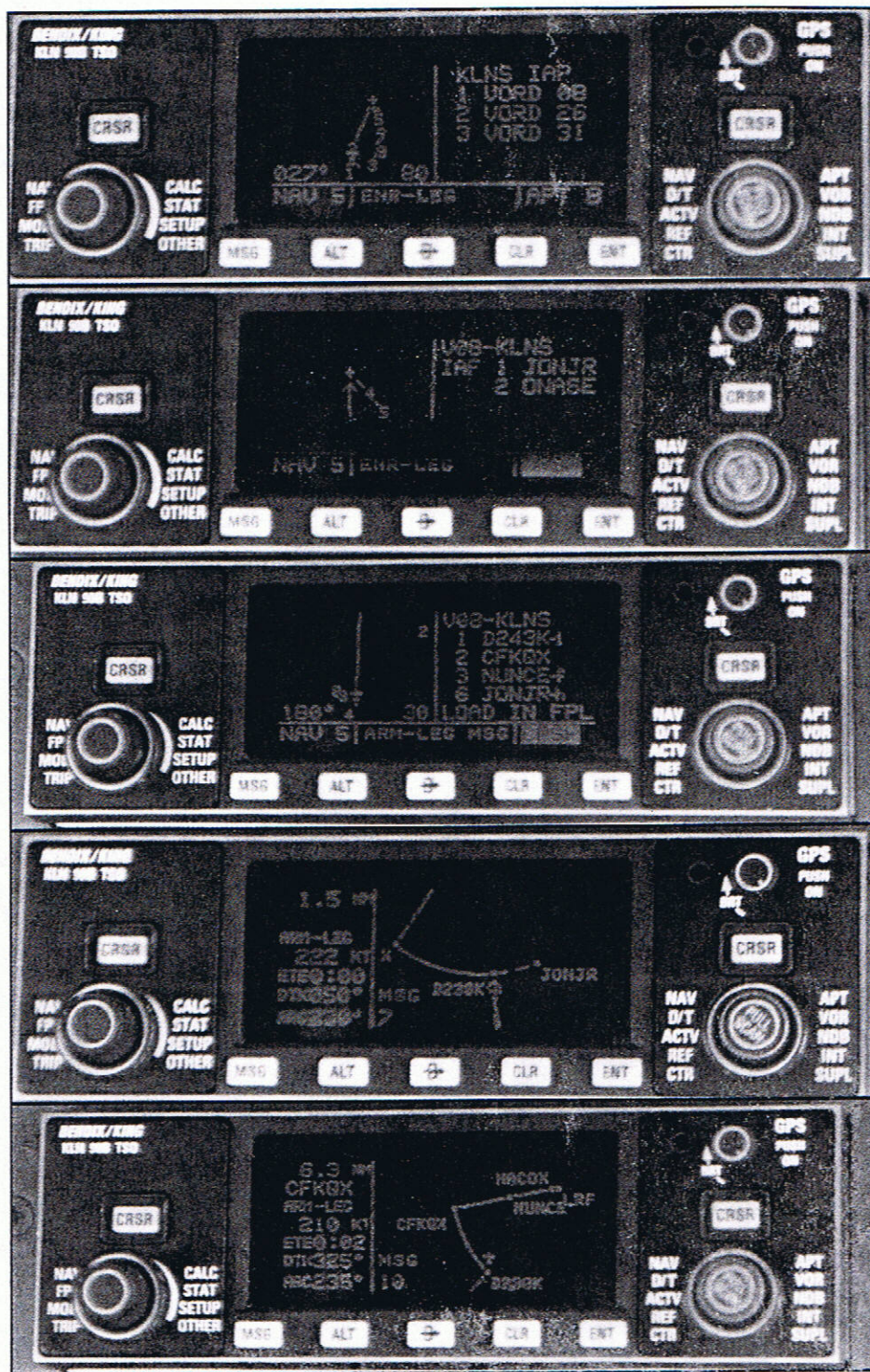
The display shows a line from our position to the intercept point on the arc, which is now the LRP R-230. Our distance from the point of intercept is 1.5 nm, and is shown on the upper left corner of the display. The map display also shows the arc, from JONJR to the final approach course.

The next display gives you the big picture of the arc, final approach course, and approach fixes. We've overshoot the arc here, as you can see by the fact that the little airplane on the display is north of the arc. We need to turn left to get on the arc.

The upper left corner of the display indicates we are 6.3 nm from CFKQX, the turn-point from the arc to the final approach course. The map display shows NUNCE (the final approach fix), MACOX (the missed approach fix), and LRP VOR.

In order to fly any instrument approach with GPS, the GPS receiver must be able to "drive" the CDI on a nav display. This means that the GPS signal will provide the normal "left-right" indications on your No. 1 VOR display or HSI (if installed). This makes flying an arc a breeze. Instead of turning the OBS 10 degrees and waiting for the CDI to center, then turn the OBS another 10 degrees, etc., simply keep the

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Starting at the top, the first display lists the approaches that can be flown using GPS at KLNS. Display No. 2 shows that the VOR/DME RWY 8 has been selected and lists the two IAFs that can be used. Although JONJR was selected, display No. 3 shows a phantom waypoint on the arc. This is the point at which the aircraft will intercept the arc based on its present heading. Display No. 4 is the "Super" NAV 5 page. It shows the point of intercept with the arc and another phantom waypoint, "D230K" which is the LRP R-230 on the 11-mile arc. Display No. 5 shows the IAP and fixes.

Recognizing Nav...

(continued from page 5)

the first officer asked, "Where's the missed approach point?" The captain responded, "200 feet." Instead, he should have responded with the decision altitude of 296 feet msl.

Operator's Guidelines

The training manual used by the Learjet operator had specific guidance about crew responsibilities while flying an instrument approach. The following responsibilities were listed for the captain:

- Sets navigational radios to the proper frequencies and bearings.
- Gives co-pilot the final approach briefing.

The following responsibilities were listed for the co-pilot:

- Reviews approach after captain gives the final briefing.
- Before-landing briefing to the passengers.
- On step-down approaches, calls out the next altitude after leaving the previous altitude. On ILS, calls glideslope intercept.
- Calls 1,000 feet to go to missed approach or MDA.
- Calls 500 feet to go and every 100 feet thereafter until reaching MDA or missed approach point.
- Calls missed approach point.
- Calls runway in sight.

First Impression Correct

After the first missed approach, the captain correctly assessed the situation when he said, "We can't do a trip like this." The lure of better weather at their ultimate destination, however, led him to believe they could somehow complete the trip. The crew had no business conducting an approach into low IFR once their avionics were known to be unreliable.

Approach Checklist

There are some important lessons here about having standard procedures for every instrument approach you fly. Following the aircraft checklist by it-

self isn't good enough: you need an instrument approach checklist as well (see guidelines in "Set for the Approach," page 5).

Use all the equipment on the panel to verify your position and altitude, and to maintain situational awareness. Use DME, GPS, Loran, etc., to do this. During an ILS, tune both nav receivers to the localizer and cross-check them during the approach. If you detect a discrepancy, ask ATC to help verify your situation when in radar contact and when time permits. Otherwise, go missed approach and get to a safe altitude where you can resolve your confusion.

Know the stabilized descent profile for your airplane. For example, a groundspeed of 90 knots requires a descent rate of slightly less than 500 fpm on a 3-degree glideslope. Anytime you have to significantly change your target descent rate should be a warning that something has changed. You need to find out why.

Observe Movement

Be suspicious when the glideslope indicator shows little or no movement, especially when it's centered or showing erratic "fly down" indications. Good situational awareness will help you detect a problem. Cross-check your altimeter at the outer marker. Monitor your distance from the airport to ensure your altitude makes sense.

The accident crew could have detected a problem, had they been attentive to their position and altitude. The approach they flew had DME. Even though the DME didn't count down to zero at the runway threshold, a check of distance and altitude would have yielded a discrepancy. The glideslope crossing altitude at the middle marker was 302 feet msl. The final radar return on the Learjet placed it at 400 feet msl, more than 2.0 nm from the runway.

A low approach in IMC isn't the time to be dealing with radio problems. Don't let your desire to complete the mission prevent you from making safe decisions.

Flying DME Arcs...

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CDI centered and you'll be on the arc. If your GPS has a moving map, you can monitor your progress as you fly the arc procedure.

Details Important

At the beginning of this article, I mentioned the importance of getting familiar with the intricacies of your GPS receiver. This is especially important when flying a DME arc. Using the KLNS procedure as an example, suppose ATC had instructed us to proceed to JONJR for the approach, instead of intercepting the arc from a different radial. This is a case where, "You can't get there from here," at least not that easily.

On the KLN-90B, you would press the DIRECT button and enter JONJR. After crossing JONJR and once outside of it, you would have to load the approach again and replace the existing approach. Then, the receiver will allow you to go the IAF on the chart. You can go the APT page 8 to have access to the approach (this is why I always have my destination airport in here) or scroll up on the FPL page to the top and change the approach there. The KLN 90B does not allow you to edit the approach on the FPL page.

Each Unit Different

Every manufacturer's GPS receiver operates differently when flying a DME arc approach. As a result of the lack of standardization in procedures and functions, the days of going from one plane to another and feeling comfortable with the navigation equipment are coming to an end. DME arcs are much easier when flown with a GPS, when you're fully familiar with the unit and its procedures. Get proficient and comfortable with your receiver in VFR conditions first, before attempting a GPS approach in IMC.

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