& CDI Sensitivities GPS APPROACHES

DO YOU KNOW WHAT YOUR CDI IS TELLING YOU? AS MORE HELICOPTER OPERATORS TAKE ADVANTAGE OF GPS APPROACHES, A CLEAR UNDERSTANDING OF CDI SENSITIVITIES IS ESSENTIAL.

by Matt Johnson

The guidance you receive on a GPS approach will depend on whether your GPS is WAAS-capable. **Skip Robinson Photo**

Do you know what your CDI is telling you?

For those of you who have had the pleasure of "chasing the needle" on a non-precision GPS approach, you are hopefully familiar with the varying levels of sensitivity seen on your course deviation indicator (CDI) throughout the various stages of the approach. What you may not realize is that CDI sensitivity varies between older, "traditional" GPS receivers and new WAAS (Wide Area Augmentation System) capable receivers. That means which type of receiver you are using can have an important impact on how you fly the approach.

THE RECAP

The typical CDI has four "dots," or marks, to the left and right of center. If you were flying on a VOR radial, each dot would represent a two-degree "angular" deviation — that is, a deviation of two degrees off the desired radial. (Recall that VOR — very high frequency [VHF] omnidirectional radio range — stations emit 360 radials, one for each degree of magnetic direction from the station.) The outside of the center circle actually represents the first two degrees of angular deviation, so "full-scale" deviation on either side of the center is 10 degrees.

When flying a non-precision GPS approach, however, the deflection of the CDI reflects a linear, fixed-distance deviation, as opposed to an angular deviation. In other words, each dot represents a certain distance off the desired course. The beauty of this is that the CDI's sensitivity remains fixed throughout any particular portion of the approach. This is a huge benefit over the angular deviation seen on VOR and instrument landing system (ILS) approaches: when dealing with angular deviation, the distance between any two radials becomes smaller and smaller as the radials converge at the station, which then makes the CDI extremely sensitive.

LEVELS OF SENSITIVITY

In considering non-precision GPS approaches with a non-WAAS-capable receiver, we must concern ourselves with three distinct levels of sensitivities.

The first level of sensitivity is found in the "en route" mode. The en route mode is automatically selected by the GPS receiver any time you are more than 30 miles from the destination airport. With each dot amounting to one nautical mile of fixed deviation in this mode, a full-scale deflection of the CDI would therefore represent five nautical miles left or right of the desired course. (Note that I said "destination" airport, but the same is also true when a "departure" airport is active in the receiver, such as when a published departure procedure is active in the receiver.)

When we find ourselves within 30 miles of the destination airport, the GPS will automatically ramp-down to "terminal" mode. In terminal mode, the fixed deviation is one-

fifth of that found in the en route mode. In terminal mode, the full-scale deflection is plus or minus one nautical mile, thereby making each dot a fixed-distance deviation of a mere plus or minus 0.2 nautical miles.

The third level of sensitivity is the "approach" level. In the approach mode, full-scale deflection of the CDI left or right represents just 0.3 nautical miles left or right of the centerline. This level of sensitivity should occur when you are at a point of two nautical miles prior to the final approach fix, or FAF (note that the receiver begins to gradually scale down to the approach level of sensitivity beginning two nautical miles before the FAF).

The approach mode is maintained until you reach the MAP (missed approach point), at which time the GPS receiver returns to the terminal mode (the second/intermediate level of sensitivity), enabling the sensitivity level of plus or minus one nautical mile for the full-scale deflection of the CDI.

OLD VS. NEW

It is important to note some differences between the older or "traditional" GPS receivers and newer WAAS-capable GPS receivers. The differences are several, but, for the purposes of this article, we'll concern ourselves with the area of CDI sensitivities.

First of all, the non-WAAS or traditional receiver was first certified under United States Federal Aviation Administration technical standard order TSO-C129a, while the newer WAAS-capable receivers are certified under TSO-C146a. As part of this newer TSO, the WAAS-capable GPS receiver has a CDI sensitivity of plus or minus two nautical miles in the en route mode, compared to the plus or minus five nautical miles that is found in non-WAAS capable receivers.

Additionally, while flying GPS precision approaches — more technically phrased "APV," for approaches with vertical guidance — you will note some sensitivity differences. As an example, the CDI sensitivity for an LPV (localizer performance with vertical guidance) approach is also plus or minus one nautical mile for the terminal or intermediate portion of an approach. However, at two nautical miles prior to the FAF, the sensitivity begins a smooth change to either plus or minus 0.3 nautical miles or two degrees — whichever is *less*. Obviously, during this two-degrees-of-deviation portion, the CDI is acting in an angular fashion, not to the previously mentioned fixed or linear fashion.

The purpose here is to achieve the sensitivity of an ILS. Thankfully, the CDI sensitivity or "scaling" will change back to linear as you near the runway. This scaling-back function avoids the oversensitive actions often seen with ILS signals near the runway. Technically speaking, the sensitivity of an LPV approach is always plus or minus 350 feet at the runway threshold. Simple math dictates this to be a mere 70 feet of deviation for each dot of deflection on the CDI — which is rather impressive, in my opinion!

In addition, as opposed to indicating "APR" for the approach mode found in traditional receivers, a WAAS-capable GPS receiver will actually indicate the level of the approach that is approved, e.g. LNAV (lateral navigation)/VNAV (vertical navigation) or LPV.

IN SUMMARY

It goes without saying that knowing where you are at all times while flying is paramount. It is the key to situational awareness, and, by extension, survival. Knowing the differences between older traditional GPS receivers and new WAAS-capable receivers is also of great importance: understanding the sensitivity of your particular CDI in the various phases of a GPS approach enhances your overall awareness of exactly where you are. Having little respect for "flying the needle" at full deflection can have dire consequences.

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