INSTRUMENT READINGS™

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USING GPS TO ASSIST OTHER IFR OPERATIONS

If your airplane has an IFR-certified GPS, you will probably use it for most navigational purposes. However, there are some operations for which it will not have a primary role. But for those cases, even if you only have a VFR GPS, whether panel-mounted, portable, or handheld general-purpose, the GPS can still fulfill a valuable supporting role under IFR.

Examples where your IFR GPS cannot be the primary navigational instrument are flying an ILS or a VOR-only approach. Some GPSs have ILS procedures in their database, but they are to be used only for situational awareness and not for navigation. Some VOR or NDB procedures might be in the database, but are not to be flown with GPS unless they are true GPS overlay approaches, signified by the words "OR GPS" in the procedure title. On these non-GPS procedures, the units will not perform the required RAIM checks and will not switch to 0.3 nm sensitivity on the final approach segment.

VOR Radials and Airways

Even tracking a VOR radial in OBS mode is not a proper use of some IFR GPS units. The reason is that VOR radials do not necessarily correspond with the magnetic course of the radial number. For example, Rocket VORTAC (RQZ) has its radials aligned to a magnetic variation of two degrees east (see the A/FD). Current magnetic variation in the RQZ area is approximately two degrees west. If you fly the 360 radial of RQZ outbound with a VOR receiver, assuming no errors, you will be flying a course of 002 true, which is a magnetic course of 004, for a difference of four degrees between the radial number and the actual magnetic course. GPS receivers are programmed with a model of magnetic variation versus location, and use that to convert navigational information to magnetic references, which is what is normally used by pilots. However, these models may differ from the magnetic variation you determine from a navigational chart or other reference. One or even two degrees of difference can be expected. In addition to these models, some units include (and use) the magnetic variation for the actual alignment of the VOR facility; other units do not. If your unit uses the actual VOR variation, it is fine to fly a radial in OBS mode. Otherwise, it is not, unless you adjust for it yourself. I have seen six degrees of difference. If you are following an obstacle departure procedure through mountainous terrain, you don't need these kinds of errors. So use a VOR receiver for a VOR operation, unless you are sure that your GPS unit accounts for VOR alignment.

Examples of IFR GPSs that do not use facility variation are Apollo GX-50/60 and Northstar M3. Some that do use facility variation are Garmin 430/530, CNX80, and GNS-480.

Some GPSs have airways in their database, and those units are fine for flying airways, but may not be OK for flying VOR radials. The difference is that the GPS computes the course from VOR to VOR using lat/long, and does not use radial numbers. Even when flying VOR-VOR direct off airways, the GPS is still fine to use because it uses the VOR lat/longs from its database and does not rely on radials

Even though we can't use our GPSs as our primary navigation along localizers or VOR radials, we can still use them to help us fly those things. One way they can help is by display of a moving map that graphically shows the airplane in relation to the procedure or radial. At a glance you can see the airplane's heading and displacement relative to the procedure track. You have to be careful, though; sometimes these displays become quite cluttered and you don't want to get on the wrong line. Another way the GPS can help is by numerically displaying your actual ground track. And if you are using VOR navigation along airways, the GPS (VFR or IFR) is a great aid to keep up with your progress along the airway; it will display your distance from the VOR or an airway intersection, avoiding the need for using VOR cross-radials.

Wind Correction

"N1234, five miles from DEBAY, turn left heading 200 join the localizer, maintain 2900 until established on the localizer, cleared ILS Runway 18L approach."

So you turn to 200 and watch the CDI. It is pegged to the right. You fly some more. Still pegged to the right. You fly some more. Then you hear the marker beacon receiver announcing the outer marker. But the CDI is still pegged. What's going on? So you call the missed approach and go around for another try.

This time you set up the GPS numeric display to show your actual ground track. It doesn't matter what waypoint it is set to, all you need is the numeric readout of your ground track (TRK). So you are on a base leg vector for the ILS, just like before, and you get the same instructions and clearance. You turn to 200, the CDI is pegged to the right. After a couple of seconds of stable flight, you look at the GPS and the ground track shows 182. Huh? You will never intercept like that, flying parallel to the localizer course. What is wrong? Two possibilities. Your DG is not set properly is one. You need to quickly check it (this should be a standard part of your procedure on base or earlier). If it is OK, then the problem is wind from the west, and a bad vector that didn't account for it. You are going to need a twenty or thirty degree turn to the west to intercept. Opinions vary as how to handle this. Some say that you should just shut up and go ahead and make the turn, since the controller said to join the localizer, and it will be necessary to turn more west in order to comply with that instruction. Others say that you should fly your assigned heading, call the controller, explain the problem and request a vector to the new heading. I tend to be in the former camp, especially if the frequency is busy.

Looking at this example a little more, what the GPS showed you is the amount of wind correction required. Your DG showed heading 200, the GPS showed track 180, so you need 20 degrees west. After intercepting, you turn left to 200, which is 20 degrees west of the desired course. That will be close to correct. Then on this new heading, let things settle down, then read the GPS track again. The difference between the DG heading and the GPS track is the wind correction required. You get it directly, no bracketing required. Once you turn to the wind

corrected heading, the GPS should show the ground track equal to the desired course. You now have your reference heading.

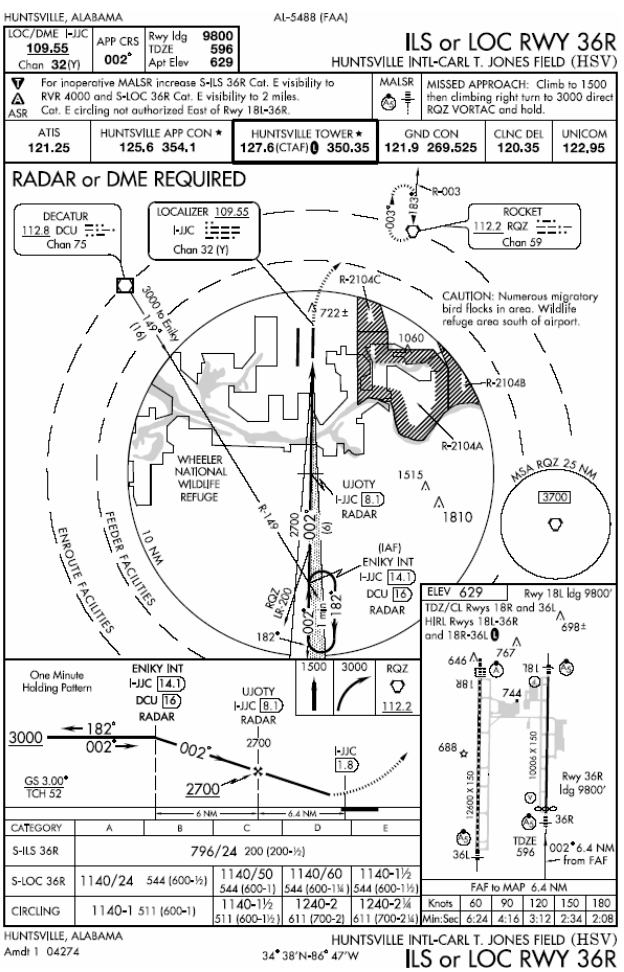
Obtaining the wind correction directly like this saves a lot of pilot workload when tracking localizers and VORs. But once you get established, fly using your DG as usual with your normal scan, only occasionally referring to the GPS to make sure the wind hasn't changed. Don't fly the GPS TRK readout; it is not located properly in your normal scan and is disruptive to your scan. Also, it is somewhat slow responding, making discrete updates once per second and with some filtering applied.

This technique also applies when navigating with the GPS. You turn to the heading equal to the desired course, let it settle down, look at the GPS track, subtract the two numbers to get the wind correction angle, then add that to your heading. It is easier to do than to say. You still fly the DG, not the GPS. The CDI and GPS TRK provide feedback that you use to make changes on your DG heading.

As I said earlier, this works even with a $100 hiker's handheld GPS. No aviation database is required. Just be sure to set the readout to magnetic degrees.

Localizer DME

The KHSV ILS or LOC RWY 36R approach provides for identifying ENIKY, UJOTY and the localizer MAP using DME. If you don't have a real DME, then you can substitute IFR GPS for the DME. The DME source is given as the localizer I-JJC, thus your GPS database must have localizer DME waypoints. Not all do. If yours does, then just dial in I-JJC as the active waypoint and read DME information that directly compares to the distances shown on the chart. If yours does not, then you have to use some other method.



Sayeth the AIM: "*An alternative, until all DME sources are in the database, is using a named DME fix as the active waypoint to identify unnamed DME fixes on the same course and from the same DME source as the active waypoint"*. Under this provision, you can put UJOTY in your GPS as the active waypoint, and identify it directly. You can identify ENIKY as 6.0 nm before UJOTY, and the localizer MAP by 6.4 nm past UJOTY. Note that an alternate DME reference waypoint must be on the same course as the fixes you are trying to identify. This rules out the airport reference point and on-field

navaids as DME reference points (unless the navaid is the specified DME source).

As a sidenote to this approach, since we have it before us, note the thin black line just to the left of the hold-in-lieu-of-PT racetrack pattern at ENIKY, marked RQZ LR-200. Although we are all familiar with lead radials used on DME arc approach segments, this is a less common usage of lead radials. It is for use by an aircraft flying the feeder route from DCU on DCU R-149; it alerts the pilot that s/he is almost to the IAF. I'm a little puzzled as to why this lead radial is shown; lead radials are required for turns more than 90 degrees, and must provide at least two miles of lead. Since the course reversal is a required maneuver for an arrival along the feeder route, and the feeder route makes a perfect teardrop entry into the holding pattern, no turn is required to intercept another course.

Procedure designers have some flexibility under the directives and policies and can apply some judgment as to including things that are not actually required. Or, a flight inspection pilot could have recommended it after seeing how the approach flew. S/he might have thought the localizer came up too fast with too little warning, so recommended the lead radial. Who knows? But it's an interesting little feature. For whatever reason it was put on the chart, it was added in a recent revision. Lead radials on feeder routes now appear on all the KHSV ILS charts.

As long as we are digressing to examine interesting details of the new charts, also notice that the glideslope altitude at the localizer nonprecision FAF is the same as the minimum altitude for the localizer approach at that point. In other words, the precision FAF and the nonprecision FAF are now collocated. In the past, the glide slope at the NPA FAF was usually somewhat lower than the minimum localizer altitude at the localizer FAF. Now the FAA is adjusting the approaches to collocate the precision and nonprecision FAFs; this usually requires moving the nonprecision FAF farther out from the airport. You will find this on all the new ILS or LOC approaches at HSV.

Distance for Radio Calls

On an approach into an uncontrolled field, you will receive your communications release at some point, usually at the FAF. Then you switch to the CTAF and make self-announcements to traffic at the destination field. *Please* do not make calls such as "Redstone traffic, N1234X, ARVES inbound on the NDB 17 approach, Redstone." (You do practice NDB approaches, don't you?) Student pilots and VFR pilots will have no idea what you are talking about, where you are, and where to look for you. Use a call like "Redstone traffic, N1234X five miles north straight-in runway 17, Redstone." Then make a similar call at two miles or so. If the tower is open, it may be useful to include your distance in your initial call to the tower. In either case, you can use the GPS distance to the airport reference point in your call. Since the GPS is not being used for navigation, you can use a VFR GPS for this purpose, if the database is correct for the airport. It usually will be unless the airport is undergoing runway work like replacing, adding or removing a runway, or significantly lengthening one. Even then, the airport reference point is not likely to move enough to cause significant error for the purpose of making CTAF radio calls.

Obstacle Departure Procedure

Some ODPs use a Visual Climb Over Airport (VCOA) procedure, as discussed in an earlier installment of *Instrument Readings*. The Visual Climb Area (VCA), within which you circle-

climb while visually avoiding obstacles, is usually centered on the airport reference point, which you must remain within a specified distance of. So you can set your GPS to the ARP (Direct-To the airport is one way) and use the distance readout to keep you safely within the VCA.

Wind Determination

Many GPS units include an E-6B-like function to calculate actual wind speed and direction. You enter your true airspeed and heading, the GPS knows your ground speed and ground track, and it computes the wind. Knowing the wind is useful for making pilot reports and, more importantly, evaluating your fuel situation. Knowing actual vs forecast wind allows you to refigure your fuel consumption and determine whether you need to start acting on Plan B. This is not an IFR-specific function, but it does assist IFR flight. You need to remain aware of whether you have sufficient fuel to make your destination and alternate and maintain your required reserve after 45 minutes of additional cruise.

Navigating Direct

If you are on an IFR flight plan and have a VFR-only GPS, you can employ a few tricks to improve your routing. We all know that, using VOR navigation, you are allowed to navigate off-route only within the service volume of the VORs, which generally means within 40 nm. Say that you filed an airways flight plan, but you would like to eliminate a big dogleg in the path by flying direct from a certain point on an airway to a distant VOR, say 100 nm away, that is on the filed route. What you do, when you get to the point where you want to go offroute direct to the VOR, is to punch in Direct To XYZ VOR on the GPS, look at the bearing to the VOR indicated on the GPS (say it's 024), and call up ATC with "Memphis Center, N1234X, request vector heading 024 then when able direct XYZ VOR." I have never been refused. Technically, you are legally navigating by radar vectors until you can receive the VOR, and then using VOR navigation; all you are using the VFR GPS for is situational awareness, and monitoring your navigation. If you don't file /G, ATC will not assign you a navigational task that requires GPS. But, if you put "VFR GPS" in the Remarks section of the flight plan, the controller sees that and knows what you are doing and knows that you won't deviate from the direct path to the VOR. When I have used this trick, I have always had the "VFR GPS" comment on my flight plan, and that may be why I have not been refused the request. I have even had a controller send me direct to an intersection, asking if I could use my VFR GPS to get me there. Now that wasn't quite right, and legally I should not have accepted the instruction, but it worked for all of us. I asked for an initial vector to get me started while setting up the GPS. It could have been made legal by making the clearance a little different: "…fly heading 123 join V234…". Both accomplish the same thing (it wasn't very far) so I had no problem with it. Don't try this kind of thing without a current database.

For an off-airways routing, your altitude must be above the Center's Minimum Instrument Altitude (MIA) or the TRACON's Minimum Vectoring Altitude (MVA) and must be consistent with direction of flight. If you are above the OROCA (MORA for Jepp) shown on the enroute chart, you should be OK for minimum altitude.

Coming attractions…

The next installment of *Instrument Readings* will examine Visual Descent Points (VDPs) and related issues.

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