

GPS, Pilots & ATC

A recent incident reveals many of us need to come up the learning curve before flying GPS approaches.

By Russ Lawton

A FLIGHT INSTRUCTOR FRIEND and I went out recently to get some proficiency shooting GPS approaches. Our experience revealed neither we nor the controller who handled us were proficient with the subtle differences in these new non-precision approaches.

The airplane we flew was equipped with a Bendix/King KLN-90B (an IFR approach-certified GPS receiver). We filed from Gaithersburg, MD (our home field) to Pennridge Airport (about 30 miles north of Philadelphia, PA). Our plan was to shoot a GPS standalone approach and return to our local area for more approaches.

The flight northbound was uneventful. When handed off to Philly Approach, we told the controller we wanted the GPS Runway 26 procedure at Pennridge (on right) and asked to begin the approach at METRO (one of the initial approach fixes for the procedure). "I doubt we'll be able to approve that," replied the controller, "The fix is in New York's airspace and I don't think they'll release it."

Moments later we were told, "Unable METRO." We then asked for Yardley VOR to start the approach. That also was "unable." Then we were cleared direct ABBYS at 4,000 feet. A short while later, it was "cleared direct OXBOB [the final approach fix], maintain at or above 3,000, report OXBOB outbound."

We were arriving from the south, which meant a considerable turn at OXBOB. We would also cross the fix above the crossing altitude of 2,100 feet. I asked my friend Harry, "What do you think the controller expects us to do at OXBOB?"

"Well, he told us to report OXBOB outbound, so he must be expecting us to go out and do a course reversal."

This procedure doesn't have a course reversal, however, there is a missed ap-

proach holding pattern at OXBOB. Harry thought better of it and asked the controller whether to turn left or right at OXBOB. As you might expect, the controller wanted us to turn left. Harry told him we couldn't do that because of our altitude and the angle at which we would cross the fix.

"Approach clearance canceled," replied the controller, "Do you want to pick up your clearance back to Gaithersburg?"

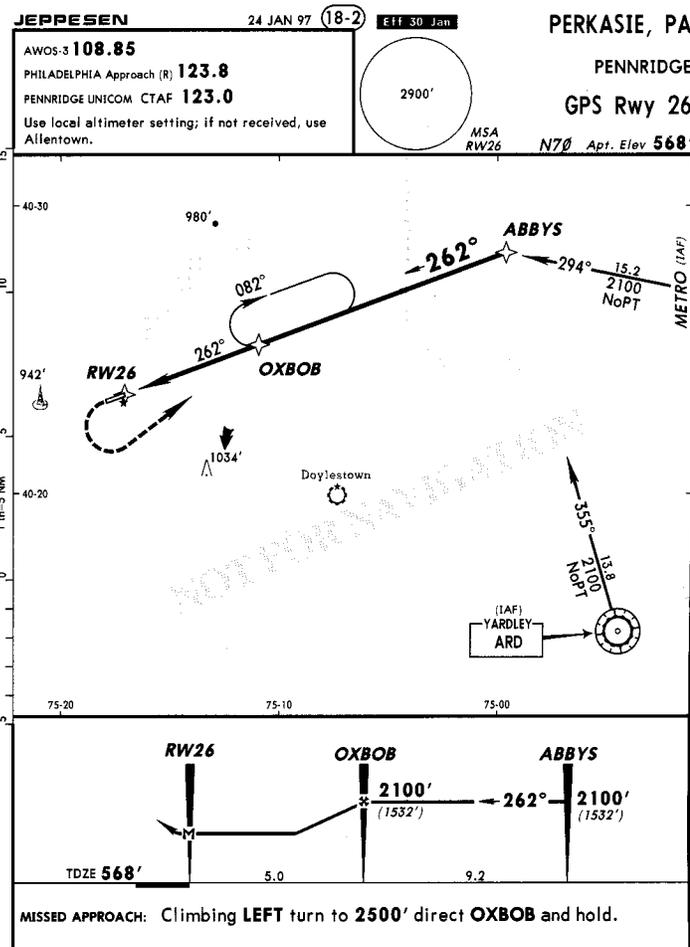
"How about the GPS to Runway 8," we asked. He then vectored us for the approach and everything worked well.

After we had returned to the home-drome, Harry and I reflected on the fact that a few mistakes had been made on both sides of the microphone. Later, I

called Wally Roberts and reflected on the flight. Wally gave me a severe tongue-lashing for allowing a controller to clear me direct to the final approach fix. Since I believe others could learn from this experience, I asked Wally to write a post-mortem on our flight, which he does with critical review on the next page.

Up the Learning Curve

I've since discussed my experience with other pilots who fly IFR with approach-approved receivers and have found others who have encountered similar problems. It appears at least some pilots and controllers have a long way to go up the learning curve on GPS stand-alone approaches.



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GPS Approaches: Design & ATC

A lot of rough spots are showing up as GPS standalones proliferate.

By Wally Roberts

THE SCENARIO ENCOUNTERED by Russ and his friend brings to light a series of problems with the design, charting and ATC clearances surrounding some new GPS standalone approaches. There are some old and new lessons for all instrument pilots to be gleaned from a close review of the instrument approach procedures at Pennridge Airport.

Cardinal Rule

The entire thrust of the circumstances surrounding the arrival and ATC clearance/handling/mishandling/confusion during the Pennridge flight focuses again on a cardinal rule for flying all approaches (except only ASR and PAR approaches): *The approach must begin from over the initial approach fix (IAF) appropriate to your route of flight, or ATC must vector you to the final approach course to intercept the approach course prior to the final approach fix (FAF) and*

at an altitude compatible with the approach procedure.

The only exception to this fundamental rule is when no IAF exists for the approach procedure. There are only two circumstances in which there will be no IAF (charting errors notwithstanding): (1) The approach routing begins at an intermediate fix, which is not a fix on an airway, in which case the approach chart will be marked "radar required" and ATC will provide appropriate vectors to the final approach course 100 percent of the time; (2) The intermediate fix lies along an airway and the descent gradient from the airway's MEA to the FAF is compatible with TERPs and the course alignments are also compatible with TERPs.

Airspace Constraints

Pennridge Airport's airspace is controlled by Philadelphia Approach Control, but it's on the cusp of New York Center airspace. Although the Jeppesen approach charts for this airport show the "(R)" symbol for radar coverage,

the radar coverage in this area is far less robust than at the primary airport for Philadelphia Approach Control.

Approach procedures are supposed to be designed to satisfy airspace requirements, in addition to their primary purpose to provide a safe, efficient and relatively easy procedure to descend from the en route structure to a position from which a safe landing can be made in marginal VMC conditions below the minimum descent altitude (MDA) or decision altitude (DA).

Within the FAA bureaucracy, the many organizational facets don't always meld as they should. An approach shouldn't be designed, for instance, where a required IAF isn't within the controller's airspace of responsibility. Or if the IAF lies in an adjacent ATC facility's airspace, then inter-facility agreements should make the IAF accessible.

The Scenario

Our two pilots on the Pennridge flight
(continued on next page)

It's Up to You to Do it Right

The strong suit of any RNAV system (which includes GPS) is the ability to fly point-to-point from any waypoint (fix) to any other waypoint. The Achilles' tendon of this capability is the temptation to bypass the required segments of an approach procedure by just truckin' directly to the FAF. It's your responsibility as pilot-in-command to not let this occur. Don't count on non-pilot, non-TERPs-trained controllers to always get it right. They want to move traffic and will sometimes innovate around their own directives to keep the traffic moving. It's up to you to do it right, both for safety and legality.

It's fine to do all that point-to-point

nav when en route. In the final analysis, it's the pilot's burden to assure he/she isn't less than 1,000 feet (2,000 feet in mountainous areas) above any obstacle within four miles of the aircraft. If ATC initiates an off-route point-to-point clearance, they can substitute their MIA/MVA chart for the absolute 1,000/2,000-foot clearance, but there won't be a significant difference.

Once you descend below the minimum en route altitude, however, all kinds of "ramp downs" of airspace occur for approach procedures, which are simply far too complex for either pilots or controllers to assess. There are both issues of laterally overshooting protected airspace in a large turn, and de-

scendent gradient issues that can accumulate and really bite on short final in marginal VMC conditions below MDA. Thus, the seemingly arbitrary rules that require either the vector to final or routing over the IAF are for good and valid safety reasons.

The terminal arrival area (TAA) charting concept for GPS approaches will help greatly, once it comes online. Keep in mind, however, the TAA sector is effectively a sector initial approach segment or, where the sector doesn't line up for "NoPT," it's effectively a sector feeder route. So the cardinal rule I cited at the beginning of the article is fully alive and well in the TAA chart.

GPS Approaches...

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requested the GPS Runway 26 approach and requested a clearance to METRO IAF to begin the approach. The Philly Approach controller said he was “unable METRO” and also denied a follow-up request to start the approach at Yardley.

At this point, the only remaining legal/safety option was for a vector to the final approach course in accordance with the ground rules set forth in the ATC Handbook. For reasons unknown to me, the FAA never placed OXBOB on Philly Approach’s radar video map. Therefore, the controller wasn’t allowed to provide vectors to final. This should have been the end of that approach, for it was simply not legally accessible.

If both pilots had the cardinal rule of this article firmly in mind, they wouldn’t have gone arm-in-arm down the primrose path with the clueless controller.

Both controllers and pilots tend to be innovative, however, which is sometimes good and sometimes not so good. The pilots entered what I call “twilight zone” negotiations by then requesting direct ABBYS for the approach (a no-no). The controller came back with “cleared direct OXBOB” (a major no-no).

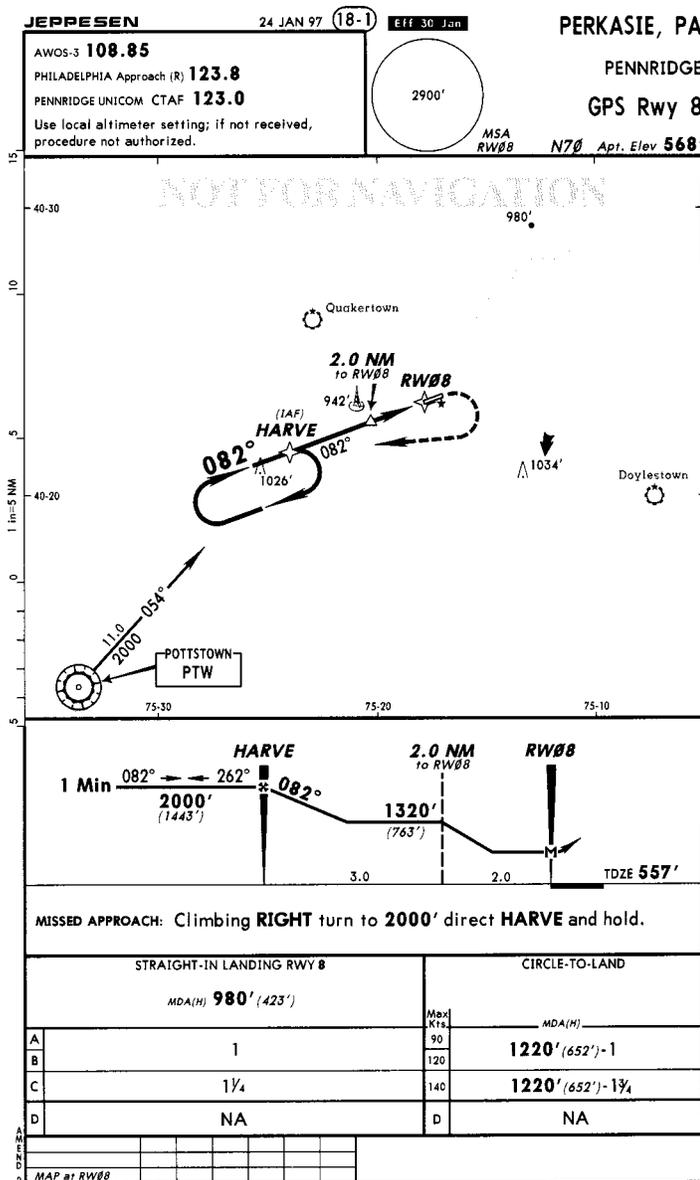
This placed the aircraft at an altitude and position from which both a breach of containment of the narrow lateral airspace at the FAF was a possibility, and a significant final approach course stabilization and descent gradient problem. Further, the critical approach mode capture feature of the GPS receiver would be compromised if a turn straight in from the FAF were made.

Each pilot had a differing view of what to do upon arriving at OXBOB. A discussion ensued. The pilot flying

said he was going to go outbound at OXBOB and do a course reversal. The other pilot said he sensed the controller was expecting a straight-in from over the FAF. They inquired and confirmed the controller expected them to go straight-in.

By this time, everyone involved was so far removed from the music sheet

that it was all being winged (no pun intended). As you’ll note on the chart, there’s no course reversal authorized at OXBOB; only a missed approach holding pattern. At this location, that might work as a course reversal from a practical standpoint, but it isn’t “codified” and could bite hard somewhere else. Going outbound could have cor



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The only feeder route for this procedure is from PTW to HARVE. When proceeding via this route, you must execute the published course reversal at HARVE. The VOR procedure to this runway (see chart page 13) has a “NoPT” route from PTW. Since the airspace has already been evaluated, it wouldn’t be difficult to have a straight-in route for the GPS procedure as well.

ON THE APPROACH

created a separation conflict, because the controller's improvised "music" was beating to a different tune than one of the two pilot's ad hoc tune.

If both pilots had the cardinal rule of this article firmly in mind, they wouldn't have gone arm-in-arm down the primrose path with the clueless controller. Further, if the controller had been properly trained on his guiding handbook, he should have known the only two choices were to route the aircraft over an IAF or provide an approved vector. There were no other options, period. Pilots ideally shouldn't have to compensate for lack of controller standardization, but that isn't always the real world. Be nice about it, but don't let yourself get drawn into "twilight zone" negotiations with ATC.

The pilots figured out in time how convoluted the situation had become, so they requested the GPS Runway 8 approach. Apparently airspace at this airport is configured more optimally for this approach, because the controller gave them a proper vector to the final approach course.

Staying Out of the Weeds

Many pilots have difficulty reconciling the cardinal rule I set forth at the beginning of this article and which I have stated to various degrees in previous articles. Nonetheless, there are numerous statistics about airplanes making "dive bomber" descents on an IMC final or losing it as they stagger back and forth through the final approach centerline chasing the needles at the wrong place and time.

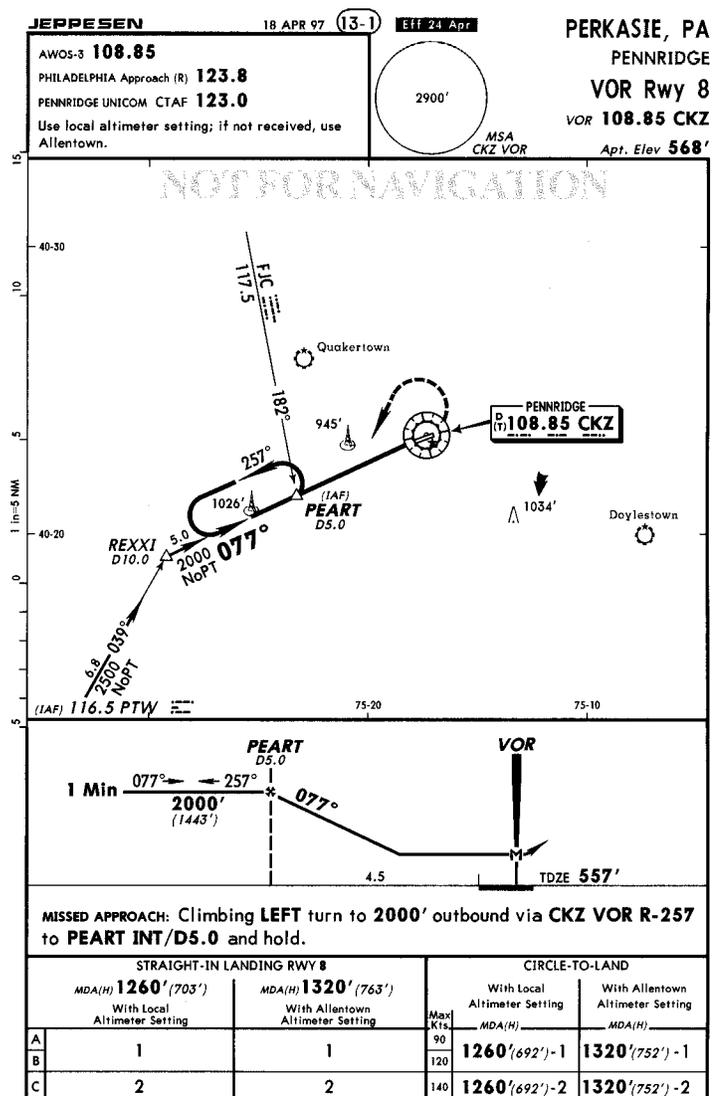
With GPS and the new ILS criteria, the final approach protected airspace is smaller than what we're used to with VOR and NDB. The final approach segment for the GPS Runway 8 at Pennridge is about one-half as wide as the VOR Runway 8 final approach segment. The 940-plus-foot tower and hill is too close for either VOR or GPS final width requirements, so a step-down fix is needed to clear the tower. There will be other locations, however, where a similar tower might be inside the VOR approach's final segment, but outside a

GPS approach's final segment for the same runway.

Chart Glitches

In the process of preparing for this article, I carefully reviewed the instrument approaches into Pennridge. On the GPS Runway 26, both initial approach segments (METRO-ABBYS and ARD-ABBYS) are marked "NoPT," yet there is no published course reversal on the chart. This is incorrect charting convention because

a route marked "NoPT" implies entry into the approach procedure from some directions requires a course reversal. All routes into an approach without a course reversal must meet "NoPT" alignment and descent gradient requirements. Therefore, "NoPT" should never be charted on an approach chart without a course reversal (holding pattern or bold-type holding pattern). I contacted the FAA about this charting error and was told it would soon be
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This procedure would have lower minimums if a DME step-down fix was placed inside the FAF, similar to the GPS Rwy 8 procedure shown on page 12. The FAA is presently evaluating the feasibility of adding a step-down fix and lower minimums. The 945-foot tower north of the final approach course is a determining factor.

GPS Approaches...

(continued from page 13)

corrected.

Refer to the GPS Runway 8 approach chart (page 12). Note the terminal route from PTW isn't marked "NoPT," so a course reversal is required at HARVE for every non-radar arrival. This doesn't take advantage of the flexibility afforded by GPS. On the other hand, the VOR Runway 8 (page 13) approach procedure has a dog-leg off PTW to a NoPT-qualified intermediate fix. This is far better design and the GPS approach should have followed suit. I believe this is an example of an overloaded FAA procedures staff having to blindly follow a headquarters bureaucratic mandate to crank out 500 GPS approaches "no matter what." We all lose something in the process. The FAA has also agreed to fix this terminal route to look more like the VOR approach's initial approach segment from PTW.

Finally, I pointed out to the FAA that the VOR Runway 8 approach could have significantly lower minimums for DME-equipped aircraft if a DME step-down fix were located at the approximate same location as the 2.0 nm along-track-distance (ATD) or step-down fix on the GPS Runway 8 procedure. This step-down fix clears the 940-foot (+/-) hill with tower left of final approach centerline. The FAA has also agreed to look into establishing such a fix.

Get Involved

I've pointed out these little charting glitches to emphasize that approach charts aren't necessarily 100 percent correct and/or optimal. This is why I remind all instrument pilots to be active participants in helping the FAA produce the best possible product. Your point of contact should be your FAA regional Flight Procedures Office (FPO).

Wally Roberts is a retired airline captain, former chairman of the ALPA TERPs committee and an active CFII in San Clemente, CA. Visit Wally's web site: www.terps.com