Mastering GPS Approaches

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GPS approaches come in a variety of flavors, however all GPS approaches share some common features. In every case you follow a series of waypoints—arbitrary points in space—through a final approach fix and then aim to a missed approach point, which are also waypoints. Primary guidance is still from a course deviation needle; although the nature of GPS navigators is that most also show your position on a moving map.

GPS approaches might have no vertical guidance and reach an MDA, or they might have vertical guidance similar to a glideslope down to a Decision Altitude. Only GPS navigators certified for WAAS provide vertical guidance on approaches.

Within those two general groups, there are a few variations. Start with the simplest one: LNAV or lateral navigation. These approaches offer horizontal approach navigation without vertical guidance. They are non-precision approaches to a minimum decision altitude and are your only option without WAAS. If you have an IFR-certified WAAS GPS, you may be able to fly Localizer Performance, or LP approaches. These are akin to localizer-only approaches, with greater lateral precision than the LNAV approach but still not vertical guidance.

For GA, there are two GPS approach types with approved vertical guidance on the final approach segment, similar to an ILS. (There are some others for transport category aircraft, but we'll skip those for this discussion.) One is the Lateral Navigation/Vertical Navigation or LNAV/VNAV. This is laterally similar to an LNAV approach, but usually offers lower minimums by virtue of limiting where you descend.

The system that provides the greatest precision and therefore the lowest minimums is the Localizer Performance with Vertical Guidance or LPV approach. LPV approaches provide an approach similar to a Category 1 ILS.

Some WAAS navigators also offer an LNAV+V option. This is advisory vertical guidance on an LNAV-only approach. This advisory glideslope doesn’t guarantee obstacle clearance. Instead, it provides guidance for a stabilized approach and meets minimum decision altitude at the appropriate visual descent point. You’ll never see LNAV+V minimums on an approach plate because this is unofficial, helpful guidance only. It’s still an LNAV approach to an LNAV MDA.

As in our discussion of ILS approaches, you need to know the power settings and pitch attitudes for straight and level at about 110-120 knots with gear up if you have retractable gear. If you fly a lower performance fixed gear airplane you might want something like 90 knots. You also need power and pitch combinations for a 500
FPM descent and a 750 FPM descent with the gear down and whatever flap setting you choose from the final approach fix to the minimum descent altitude and yet one more combination for level flight gear down and approach flaps.

With these power settings and configurations, you can easily maneuver your airplane in the airport area and fly any GPS approach. Use these numbers every time and each approach will be the same rather than each one being a new adventure.

The first step in any approach is to get the ATIS or airport weather as soon as possible to determine which approach is in use, or which you want to request from ATC.

Naturally, you want to select an approach that will allow you to land straight in if possible. But, you also need to consider the ceiling and visibility. If the straight in approach has minimums which are above the published ceiling, that approach is not of much use. You may have to accept a crosswind to get the approach that will get you low enough minimums to land. This is where WAAS pays off, because while almost all GPS approaches have an option to fly to LNAV-only minimums, they are usually the highest minimums. Generally speaking a circling approach would be my last choice unless the ceiling and visibility are well above minimums.

Some GPS units automatically zoom in on the map as the airplane approaches a waypoint. This feature can be changed in the system set up if desired. I prefer to manually scale down as I approach the final approach fix, but either way, ensure the range gives you an accurate picture of your relation to the fixes. In fact, it’s best to be consistent on where you set the range for approach, so you get a feel for what a certain distance on the screen means for your aircraft performance.

If radar service is available ATC will usually give you vectors to the final approach course. However, because GPS-equipped aircraft can navigate from any point in space to any point in space, controllers are more likely to clear you direct to an initial or intermediate approach fix with GPS than any other kind of approach. This can be a bit of a trap if you’re not ready for it.

Here are two tips that will help. If you’re cleared to a fix you don’t already have loaded into your navigator, ask for a vector to that fix to get you going in the right direction while you do the button pushing. Don’t accept the direct before you have the fix loaded.

Second, when you do see your course approaching that fix, be sure you can make the turn onto final without overshooting the inbound course.
The initial approach fix, or certainly the intermediate fix, is a good place to be at the published altitude and at your level flight 110 to 120 knot configuration or 90 knots for lower performance aircraft.

On most units, the approach can be loaded into the flight plan any time prior to beginning the approach. I typically do that early in the flight based upon the approach I expect. If after getting the weather I need to change it, I do. But, I like to get as much done as possible prior to getting in the airport area.

The system for loading an approach varies widely, so you must know your specific device. You should know these steps by heart, because someday you'll need to do a fast reload of an approach to comply with an ATC clearance, or deal with a runway change.

When loading the approach, you will be asked to select an initial approach fix or vectors. It's usually best to load the approach from the initial fix best aligned with your arrival. You can always activate a vector version, or a final leg later on.

It’s important after loading the approach to scroll down through the waypoints and compare them to the approach chart. As a side tip: If the GPS put a hold in your flight plan and you don’t need it, as when you know you’ll get vectors or your current arrival angle makes the hold unnecessary, you can usually delete it when you scroll through to verify the approach fixes.

In a radar environment, as soon as I change over to Approach and the controller says turn to heading ABC for radar vectors for GPS approach to runway XY, that’s my reminder to activate vectors to final, or a facsimile thereof. On many GPS units, activating vectors-to-final extends the course line outward from the final approach fix. While this is common procedure, on some systems it eliminates the step down fixes preceding the final approach fix. If you wish to keep these fixes available, you will need to learn how to activate a particular leg of the approach. On almost all GPS navigators, activating the leg ending at the final approach fix works best. It’s well worth your time to learn this trick because it can save a lot of mental math when ATC tells you to maintain an altitude to a fix that is no longer in your flight plan or on your map.

On every approach it’s important that you confirm that the proper data is being displayed on your course deviation needle. It is my practice prior to an approach to perform a little three step check. I confirm approach waypoints are correct; CDI source selector switch is set to the right source, such as the localizer or the GPS navigator; and check that the approach mode annunciation is as expected.

This is a good place to talk about the GPS mode annunciator. Your system must be in the proper approach mode prior to passing the final approach fix or you may not make the approach. For non-WAAS units, this is usually a simple annunciation of “approach” as opposed to “terminal” or “enroute.” If you have a WAAS unit, the annunciation shows the level of approach you may utilize. For example, you may see LPV, LNAV/VNAV or LNAV. These messages determine your lowest...
minimums, so it’s essential to confirm it prior to passing the final approach fix. If your unit is not in the proper mode you will not have the required accuracy to safely execute the approach.

The mode annunciator is the GPS equivalent of a nav flag on a traditional VOR or ILS approach. It must stay lit through the approach. If it changes and shows you’ve lost GPS position, standard procedure is usually to execute a missed approach. However, you should review all the annunciations and actions for your specific GPS navigator.

As with any approach, once I’m cleared to intercept the final approach course, I focus on that item alone so I don’t miss the needle coming alive. This is where always having a consistent zoom setting on the map really helps, because you develop an intuitive feeling for how far you are from the final approach fix as shown on the moving map. Some GPS units have the ability to show the digital distance left or right of course. Learning how to display this information can help with situation awareness.

Now that we have turned inbound, it is time to track the final approach course. Depending upon your unit, your current track over the ground should appear somewhere on the screen. It pays to learn to use this feature as it makes tracking that needle a much easier job.

After turning inbound simply fly the published course for a few seconds, and then look at your GPS track. If it matches the published course, there is no wind correction needed for now. If it’s off by, say ten degrees, turn ten degrees to correct your path and use five degree bracketing from then on, checking GPS track periodically for the rest of the approach. This system sure beats the system I previously used which is called, “chasing the needle”.

As with any approach, it’s important to be stabilized prior to the final fix. If you are not stabilized prior to the final fix, either go around or ask ATC for a delaying vector and set it up again. Un-stabilized approaches inside the final fix have been a contributing factor in many approach accidents.

How you descend after the final approach fix depends upon the type of approach you are doing. If you are doing a GPS LPV or LNAV/VNAV with approved vertical guidance, use the same technique you do on an ILS. That is lower the gear and use your 500 foot per minute descent configuration while bracketing the glideslope indication using the vertical speed indicator.

If you are doing a GPS LNAV or LP approach with no vertical guidance you may descend directly down for each step-down and the final MDA. If you have a WAAS unit that offers an advisory glideslope such as LNAV+V, you can use it or ignore it. I prefer to use the advisory glideslope to stabilize the approach but others will argue for a more aggressive descent to MDA. Remember, in either case, you must use your barometric altimeter to comply with any step down fixes and you must see the required visual references prior to descending below MDA.
If you are making an approach without vertical guidance, use the non-precision approach pitch and power settings you derived for a gear down 750 foot per minute descent, initially after crossing the final fix. A common error is not getting down to MDA quick enough to break out of the clouds soon enough to make a stabilized visual approach. There is nothing worse than to make a low instrument approach, see the runway, but not be able to land on it. To prevent that problem, I like to start with at least a 750 feet per minute descent rate and as I approach minimum descent altitude I reduce the rate of descent which makes the level off easier. Now, is time to use that pitch/power configuration that will hold level flight with the gear down, you can set that as you approach MDA and you should have no trouble holding MDA while looking for the runway environment.

You may also not descend below MDA until in a position to make a normal approach and landing. If things are not going well getting in position to land, take aggressively safe action and go around.

If you can land, you don’t need to worry about the GPS any further. As you reach the Missed Approach Point, the GPS will suspend sequencing of GPS waypoints and not bother you any further.

If you do need to go around, this is a good time to remember that the first step on all missed approaches is to climb, so be sure you get a stabilized climb going right away. Don’t let programing the GPS or tuning radios distract you from the primary job of flying the airplane and climbing away from danger.

The missed approach is part of the GPS procedure, so the GPS navigator is ready to help you fly the route. Most modern IFR-capable GPS units can be unsuspended for guidance on the missed as soon as you pass the missed approach point and are ready for guidance, but some require you comply with published climbs on the approach plate first. Know your device and always follow the procedure on the plate, or what ATC has issued as alternate instructions, rather than blindly following the GPS.

One final note on GPS approaches: Most GPS navigators have non-GPS approaches, such as ILS approaches in their databases. Even though you can’t fly the final segment of the approach with the GPS, you can use it to get established on the final approach course, locate waypoints, and fly the missed approach. This makes it a good habit to use the GPS on every approach.

So the secret to mastering GPS approaches is to know your equipment, its operation and limitations and know how to make your airplane perform the three or four steps necessary to complete the approach. It also takes practice, particularly on operating the GPS navigator itself.
In summary, here are my tips for mastering GPS approaches:

1. Everything that applies to regular approaches still applies: Know your pitch and power settings, slow down early, listen to ATC, and fly a stabilized approach.
2. Know how to set up your GPS equipment, including loading a different approach on short notice.
3. Always verify the waypoints loaded with the GPS approach match what you’re expecting from the approach plate.
4. Use your GPS track information to nail the heading that holds your final approach course.
5. Note the approach annunciation prior to the FAF, and the minimums you’ll fly to.
6. Un-suspend the GPS when you’re ready for guidance to the missed approach point from your current altitude.
7. Practice regularly with your GPS. Button-pushing skills weaken even faster than an instrument scan.
8. Don’t try to salvage an approach. It’s just not worth it.