RNAV Revealed

On September, 15, 1904, when Orville Wright flew the first turn in a heavier-than-air powered machine, a new era of aeronautical navigation was born. Powered flight meant that terrestrial landmarks no longer served aviators who were flying farther, faster and higher than ever. Aeronautical navigation quickly evolved from signal fires, city names painted on water towers, concrete arrows in open fields and Captain Jeppesen's early pencil sketches to techniques like Four-Course-Range, VHF Omni-Directional Radio Range (VOR), Distance Measuring Equipment (DME), Instrument Landing System (ILS), Global Positioning System (GPS), Wide Area Augmentation System (WAAS) and, the latest chapter, Area Navigation (RNAV).

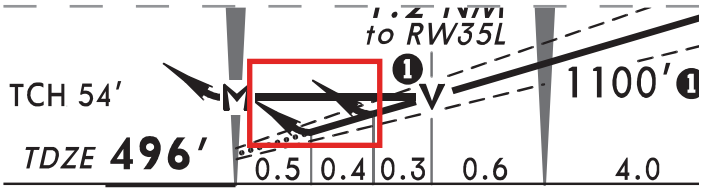
According to the International Civil Aviation Organization (ICAO) RNAV is *a method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced NAVAIDS, or within the limits of the capability of self-contained systems, or a combination of these capabilities.*

In short, it's a performance-based navigation structure used mostly with GPS, but it can also be flown as part of a larger system that includes some Flight Management Systems (FMS) or Barometric Vertical Navigation (BaroVNAV). The end result of this latest navigation evolution is savings—time, fuel, ATC congestion, engine hours and pilot workload—by creating more opportunities for point-to-point operations.

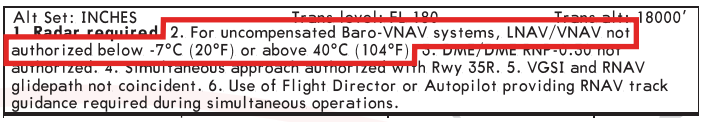
One Size Doesn't Fit All

Depending on your ratings, aircraft and navigation equipment, there is likely a level of RNAV service for you. RNAV comes in a number of different service levels to help extend the usefulness of current navigation equipment, yet offer the greatest possible precision for those want to invest in new technologies. Here is a brief overview of the different RNAV approach types and some charting tips to help you navigate each:

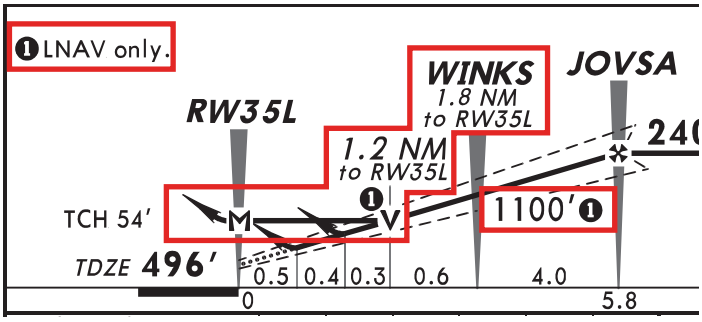
- **Localizer Performance with Vertical Guidance (LPV)** —LPV requires WAAS to fly, utilizes an FAS datablock to define the final segment, and is the most precise of the RNAV (GPS) approaches a GA pilot can fly. LPV provides a glideslope to fly much like an ILS with a DA. From a minimums perspective, its equivalent to a CAT 1 ILS approach, but it is technically a non-precision approach due to the language in the regulations. If you're using a Jeppesen chart for an LPV approach, you'll find some key information in the Briefing Strip™ including the WAAS channel (for those whose avionics won't auto-tune it) and typically the lowest minima for the approach. The WAAS channel is provided on the Plan View since your eyes will already be there reviewing the approach. In addition, the Profile View will provide the fly up arrow closest to the end of the runway (see illustration on top of next column) to help you visualize where you can expect to hit your decision altitude (DA).



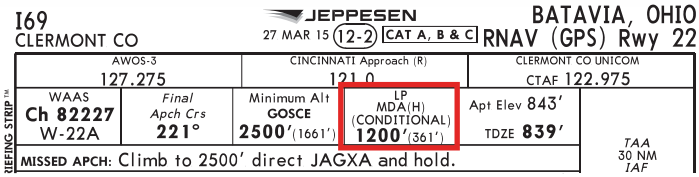
- **Lateral Guidance with Vertical Guidance (LNAV/VNAV)**—To fly an LNAV/VNAV approach, the next level down from an accuracy standpoint, you need to be WAAS or Baro-VNAV enabled. LNAV/VNAV still provides a vertical angle and a DA. The minima box will provide the same information as you might expect for standard approaches. Like LPV, you'll get the same WAAS and minima information listed. However, if you're going to fly a Baro-VNAV approach, it pays to double-check the notes section. Why? Say, for example, you're flying with an uncompensated Baro-VNAV system. If you're operating during extreme temperatures—hot or cold—there will be errors in your system. If you continue to fly it, your indicated altitude and actual altitudes will be different, which can impact obstacle clearance (see example below). Being slightly less precise, the fly up arrow for the decision altitude using LNAV/VNAV appears in the second position in the profile view.



- **Lateral Navigation (LNAV)**—This next level of service provides much limited benefits compared to the levels of service noted above. For starters, it's important to note that LNAV does not require WAAS due to the fact that it is lateral guidance/navigation only. This means the approach is less precise. It could also mean the likelihood of more notes to be considered when flying the approach. On a Jeppesen chart, be certain to check the notes section under the Briefing Strip™ as well as in minima listings. In addition, you can get an LNAV+V indication on your avionics. The "+V" provides an advisory vertical angle only (not to be confused with Vertical navigation since the levels of service is still only Lateral) which is only provided by certain avionics manufacturers for certain models. However LNAV+V is not considered a legal "level of service" as indicated by regulations. The fly out arrow for LNAV will be in the third position on the profile view (see below), at the Visual Descent Point (VDP), due to limited accuracy of the approach.



- **Localizer Performance without Vertical Guidance (LP)** —This approach provides WAAS lateral guidance only, which means tighter tolerances than an LNAV approach. This, in turn, means lower minima can be used on your approach. As with the other levels of service outlined above, WAAS frequencies are provided in the Briefing Strip™ and on the Plan View in a Jeppesen chart. But when planning for and/or shooting an LP approach, you may be more apt to find additional detail—highlighted by a word like "CONDITIONAL." In this example (see illustration in next column), conditional indicates that if you're using the local altimeter setting, then the minima for the LP approach can be used as stated in bold. However, if you have to use an alternate altimeter setting, your minima go up, making the LP approach conditional. An LP level of service is only designed when an LPV won't work due to obstacles limiting a vertical angle.



- **GBAS Landing System (GLS)**—GBAS stands for Ground-based Augmentation System. You may have heard of a GBAS/LAAS (Local Area Augmentation System) approach. GBAS Landing System (GLS) is the new name the FAA is assigning to what was once LAAS. It's worth noting that the reason GBAS and GLS are used together is that GBAS is the navigation system you're using on a GBAS/GLS approach, while the GLS is the actual procedure.

Data Makes the Difference

Data is the lifeblood of RNAV. Without complete and accurate data, RNAV breaks down. It's worth mentioning that hand-hacking your avionics for any procedure, or not keeping your databases up-to-date is illegal, and it is important to seek out proper training prior to flying an RNAV-type approach. RNAV was created to help pilots save time and money, while also giving more control over the decision-making that impacts every flight. The trade-off is an expectation that you operate to tighter tolerances than ever before, because the airspace you're operating in is getting more crowded. Put another way, RNAV, and the evolutions to follow, require both respect and reverence.

Though GPS has been around for over 20 years, it's still difficult to know the impact it will ultimately have on how you fly. RNAV may be only scratching the surface of how hardware, software and data integrate to change how we fly. Today's pilots are likely seeing RNAV through the same lenses generations of past pilots viewed "new" technologies like VOR, DME and ILS. One thing that has remained is the commitment of the pilot to safe operations. RNAV, and the advancements in aviation to follow, are possible because pilots always rise to the challenge to find new and better ways to operate, believe that the hard work and training to stay proficient is part of the joy of flying, and that there are partners, like Jeppesen, who they can trust to help them along the way.

Learn more by watching the recording of our RNAV Revealed webinar. And while you're there, check out recording of past *Chart Clinic Confidential* webinars as well as register for upcoming live webinar presentations!

Learn more