

## W.A.A.S.

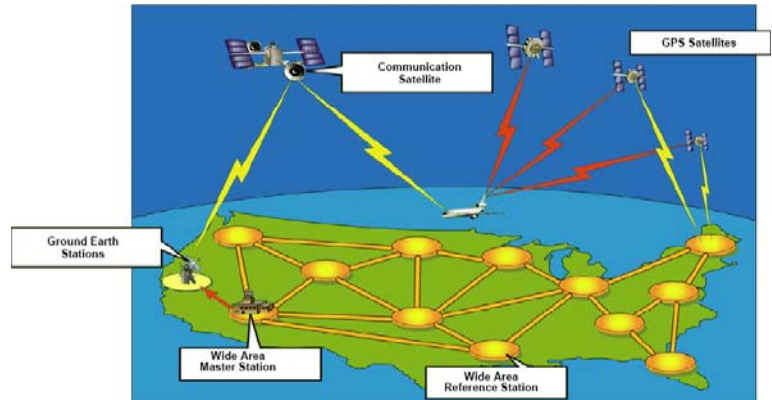
By Richard Bertoli, CSIP



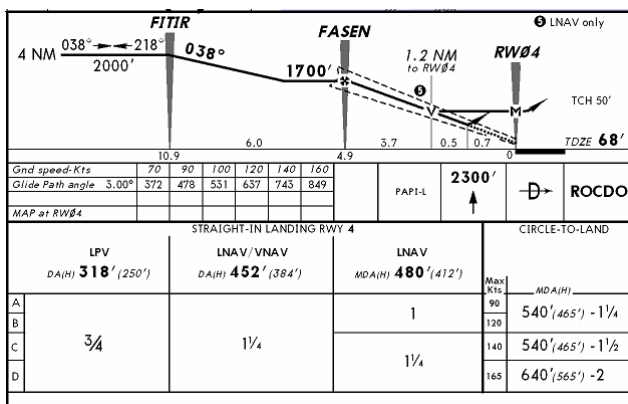
The Wide Area Augmentation System (WAAS) has been making headlines lately in aviation media, primarily because of the FAA certification of Garmin's ubiquitous GNS 400 and 500 series GPS navigation systems under TSO\* C146a. The approximately 75,000<sup>1</sup> Garmin units out there will need to "meet their maker" again, where circuit boards will be replaced, software upgraded and a new antenna will be installed in the aircraft. The end result of all this will allow "WAAS-ified" aircraft to be flown by well-trained, proficient pilots down to instrument approach minimums formerly reserved for ILS runways.

### What is WAAS?

Commissioned in July, 2003, it's basically a system of satellites and ground stations that provide GPS signal corrections, allowing for highly reliable position accuracy. A network of precisely surveyed ground reference stations is strategically positioned across the country including Alaska, Hawaii, and Puerto Rico to collect GPS satellite data. Using this information, a message is developed to correct any signal errors. These correction messages are then broadcast through communication satellites to aircraft GPS receivers. The WAAS broadcast message improves GPS signal accuracy from 20 meters to approximately 1.5 - 2 meters in both the horizontal and vertical dimensions, allowing more efficient arrival, enroute, and departure operations at low cost to an increased number of airports throughout the U.S. Further, the WAAS system was designed to the strictest of safety standards – users are notified within six seconds of any issuance of hazardously misleading information that would cause an error in the GPS position estimate. For an informative graphics presentation on how WAAS works click here: [http://www.freeflightsystems.com/waas\\_howitworks.htm](http://www.freeflightsystems.com/waas_howitworks.htm)



### A New Low



LNAV/VNAV (Lateral Nav / Vertical Nav) is an RNAV (GPS) approach procedure using vertical guidance displayed on the primary navigation instruments with typical minimums of a 350 foot decision height and 1½-mile visibility. Presently, over 900 LNAV/VNAV published procedures are available which WAAS capable aircraft can fly. In the fall of 2003, the FAA improved the precision approach capability provided by WAAS through terminal approach procedures (TERPS) optimization. This improvement took full advantage of the capabilities of the WAAS Signal-in-Space and provided a new approach procedure with vertical guidance called LPV (Localizer Performance with Vertical guidance). LPV provides more lateral precision over LNAV/VNAV resulting in lower

approach minima for most runways. LPV procedures have nominal minimums of a 250 foot decision height and 3/4

\* A Technical Standard Order (TSO) is a minimum performance standard issued by the Administrator for specified materials, parts, processes, and appliances used on civil aircraft.

<sup>1</sup> Garmin Press Release, November, 2006

mile visibility without proper lighting (½ mile visibility with proper lighting). Currently, there are over 600 LPV procedures published which can be flown by WAAS equipped aircraft.<sup>1</sup> The FAA is continuing to develop these procedures, adding many more each year. The first procedures that will allow operations down to 200 feet AGL will be published in 2007.

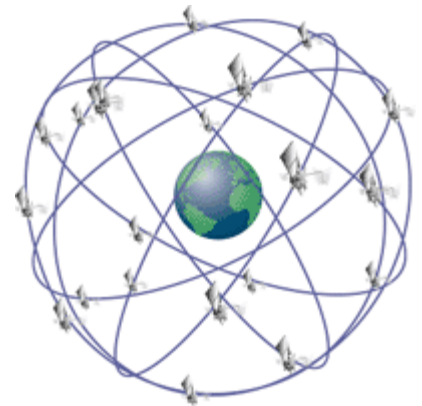
Pilots can fly the following minima with an appropriately certified WAAS receiver: LPV, LNAV/VNAV, and LNAV. Why would one fly LNAV/VNAV or LNAV minima if they could fly LPV? The reason is that some GPS and RNAV(GPS) approaches have LNAV/VNAV, but not LPV minima. Also, if the WAAS system has an outage, the pilot can still fly the LNAV portion. Think of flying the localizer-only approach when the ILS glideslope is out of service. LNAV/VNAV minima on RNAV approaches are used by some transport category aircraft equipped with Flight Management Systems (FMS) that do not include GPS receivers, but derive precise navigation from other sources.

## Benefits

- Upgraded units will feature: 5 Hz position updates, faster map redraws, fully coupled and guided procedure turns and holding patterns.<sup>1</sup>
- Potentially reduce the number of CFIT accidents by replacing the dive and drive approach with a stabilized glide path and vertical course guidance for nearly all GPS approaches.
- WAAS allows near-precision approach minima at airports without expensive ground-based landing systems, thereby saving money and expanding capacity.<sup>2</sup>
- Significant government cost savings due to the elimination of maintenance costs associated with older, more expensive ground-based navigation aids (to include NDBs, VORs, DMEs, and most Category 1 ILSs).
- Efficient use of airspace by more direct routing and reduced separation standards, which allow increased capacity in a given airspace without increased risk.
- Significant fuel savings / Reductions in flown miles (Direct Routes/Point to Point)<sup>3</sup>

## Are we there yet?

The question still remains about when flying an LPV approach in your Cirrus will become reality. Garmin claims that GNS 430/530 upgrades may begin in January 2007, but that the required software won't be available until an unspecified date in 1<sup>st</sup> quarter of 2007.<sup>1</sup> There is also the issue of how the WAAS upgraded Garmin will interface with the Avidyne PFD and S-Tec autopilot when flying a GPS approach with vertical guidance. To date, I have heard nothing definitive on this, but only conflicting reports. Once in place, standard operating procedures must be developed with compulsory training and practice. I wonder if pilots went through all this when the first VOR was commissioned back in '51. It's exciting to be on the cutting edge, but patience is not just a virtue here; it's a requirement.



## References

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<sup>1</sup> Garmin Press Release, November, 2006

<sup>2</sup> Flight Plan 2006-2010, FAA – 2006

<sup>3</sup> Lateral Precision Performance with Vertical Navigation, FAA - February, 2006