WAAS'olgy 101

Understanding WAAS and the alphabet soup of WAAS-enabled GPS Navigation!

By: Matt Johnson

What Is WAAS?

If you haven't heard of WAAS or Wide Area Augmentation System, it's, probably fair to say you have been living in a cave. After all, the FAA "certified" WAAS in 2003. Or if you have heard of WAAS but don't know the in's and out's because of the intimidation of learning something new - fear no more!

Let's get it straight from the beginning by looking at WAAS (conceptually of course) as "Enhanced GPS." WAAS-based instrument approaches are quickly changing the way aircraft are flown and YOU need to know the basics. Note that I said "aircraft" and not "airplane," which means that this includes your faster than light instrument training helicopter. The beauty of this is that WAAS-enabled GPS receivers can be used for navigation from TAKEOFF through CAT I precision approaches. Without boring you to tears let's take a quick look at WAAS from the "hardware" perspective. The WAAS system utilizes a series of 38 ground based receiver sites throughout the United States. Each site receives GPS signals from all satellites in view. After collecting information from the GPS satellites the site then transmits the collected data to a "WAAS Master Station."

This is where part 1 of the "magic" occurs. At the WAAS Master Site, GPS errors are analyzed and a correction message is then transmitted to two geo-stationary satellites. Stay with me! We're almost there! Part 2 of the "magic" occurs when the geostationary satellites then re-transmit the "corrected message" to your helicopter's WAAS-enabled receiver, like the Garmin 430W found in most newer helicopter instrument panels. The WAAS-enabled receiver applies corrections and displays navigation information based on the information received from the geostationary satellite and the basic GPS satellites.

There you have it! The basics of WAAS! I can hear you asking, but why? Why all of the juggling of signals back and forth? Here is "one" of the answers that you should take to heart; with traditional GPS receivers we can have an error of around 25 meters (horizontally) however, the corrected WAAS position calculation is usually within 2 or 3 meters! Another huge benefit to WAAS utilization is the money that can be saved. Because traditional approaches utilizing ILS/Localizer components can cost the FAA, on the average, over $100,000/year in maintenance to maintain, it doesn't take a math major to figure out how WAAS can lead to a massive amount of savings.

GPS & WAAS Approaches

With the advent of WAAS and the ever growing progression of its use and availability comes a new set of terms we need to be familiar with. Don't be intimidated! The most novice of instrument students will recall that we have two "traditional" Standard Instrument Approach types; Precision and Non-Precision.

Thankfully we now have a third "type" of approach – the "approach with vertical guidance (APV for short). WAAS has improved GPS to the point of having landing minimums equivalent to Category I minimums, i.e. as low as 200 feet AGL. So, if this "newer" type of approach has vertical guidance isn't it classified as a "precision" approach? The answer is "officially"- NO. "Officially" these types

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of WAAS-based approaches are classified as APV's because it does not meet the ICAO and FAA precision approach definitions which mostly apply to localizer and glide-slope transmitters. The powers-to-be within the two organizations reached an agreement that both the FAA and IACO would adopt the term "APV."

The development of these WAAS-based approaches brought us even more terms to be found on certain instrument approach charts. You will see "RNAV (GPS)" on charts today. A common response to this is "why not a WAAS only chart" – here's why, again it was and is a money issue. The publishing of RNAV (GPS) charts allows chart makers to publish GPS and WAAS-based approaches on the SAME chart with the differences in approach types found in the minima section. This has saved on doubling the size of our instrument approach books! To determine what "types" of approaches are available at a particular airport, i.e. GPS or WAAS-based approaches, you must look to the minima section to determine whether it is a "traditional" GPS or WAAS-based approach. You will learn about the various GPS and WAAS-based approaches below.

Let's take a look at the "L-phabet" of GPS and WAAS approaches. Fortunately, they made it somewhat easy for us because all of these approaches begin with an "L." How thoughtful of them!

GPS & WAAS-Based Approaches
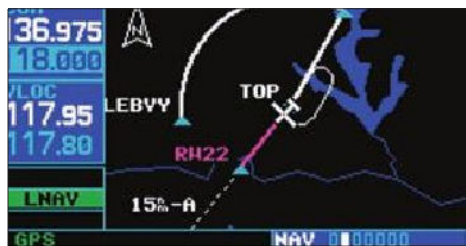
LNAV- This stands for "lateral naviga-

tion" and is the early pioneer if you will, of basic GPS approaches. These approaches provide lateral guidance ONLY and as you may recall, are flown to an MDA as opposed to a DA. Although these approaches pre-date the advent of WAAS, they can be flown with WAAS receivers.

LNAV/VNAV

This stands for "lateral navigation / vertical navigation." This type of approach is an approach with vertical guidance (APV) if you read it in the sense of IACO terms and standards. It is flown to a DA as opposed to an MDA but it is NOT a WAAS approach.

LNAV/VNAV approaches were available before the WAAS platform was certified. The reason it may seem new to you is that in the past, only aircraft equipped with Flight management systems and cer-

tified baro-VNAV systems could use the associated minimums of an LNAV/VNAV approach. Now, thankfully to WAAS; these approaches can also be flown using WAAS-enabled receivers. So this is an approach that you can "train for" and practice in your faster than light training helicopter.

LNAV+V- Guess what? There are NO LNAV+V minimums! So, you will USE the LNAV MINIMUMS LINE!

You WILL see LNAV+V on your moving map display of some Garmin products. Certain WAAS-enabled Garmin GPS receivers will, at times, provide you with an artificially created "advisory glide path" from the Final Approach Fix (FAF) to the touchdown area. Again, you will not see this on approach charts! It is simply a way for GPS equipment manufactures to assist us with a "stabilized approach." My fixed-wing brethren tell me the advent of this technology can eliminate the "dive and drive" descent to the MDA and can therefore provide us with

a "predictable" rate of descent on the artificial glide path. Neat stuff but it is important to remember that LNAV+V won't get you any lower than LNAV minimums.

LPV

This stands for "Localizer Performance with Vertical guidance." The LPV is strictly a WAAS approach -meaning if you don't have a WAAS-enabled receiver in your aircraft don't expect to see LPV annunciation on a "traditional" GPS screen. LPV approaches almost always give you the lowest possible minimums you can get using WAAS.

This WAAS approach provides vertical guidance to as low as 200 feet AGL and is, as you guessed it – flown to a DA rather than an MDA. The LPV approach essentially uses the same criteria as an ILS system with the main difference being that ILS systems use ground based transmitters whereas LPV's are based upon the WAAS system positioning signal, i.e. "Enhanced GPS" that we talked about in

the beginning. This technology will allow nearly every runway end or heliport to be a candidate for an LPV approach. At last report the FAA projection plan calls for an additional 500 GPS-based approaches during the year 2009 with most of them being LPV approaches.

What's New

LP- This stands for "Localizer Performance" and is starting to show up on Instrument Approach Charts more and more throughout 2009. This WAAS only type of approach, like a localizer approach, provides accurate lateral guidance but NO vertical guidance. The approach uses

WAAS performance with improved lateral accuracy that will allow minimums as low as 300 feet AGL. The creation of LP's and the associated LP "minima" were brought about to provide extreme lateral accuracy in areas where a vertical glide path (regular LPV) would not be possible due to terrain or obstacle issues that result in an unacceptable DA.

Conclusion

As you can see it is important to stay current both inside and outside of the helicopter cockpit to maintain a culture of "technology safety." Save some money, time and frustration and take advantage of free GPS simulators available for download from www.Garmin.com. Program in various airports and then sit in your recliner with your laptop, approach plates in hand, and fly all of the various GPS and WAAS approaches right there in your chair.

The intent of this article was to make you aware of what is available. I strongly encourage you take a deeper look into the world of WAAS and what it can offer you. For those knowledge-seeking sponges out there, I would be remiss if I did not mention a new book on the market: "GPS and WAAS Instrument Flying Handbook" by Max Trescott which can be ordered at www.maxtrescott.com or by calling 800-247-6553.

It truly is the most thorough and complete instrument flying book I have laid my hands on. Had I only had this book when I was preparing for my instrument and CFI-I check rides, I am certain I would have less gray hair as well as my instructor! ▌

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