

# What's up with WAAS?

**There's a bright new star in the GPS constellation and pretty soon every 'bright' pilot is going to want to use it.**

BY DALE SMITH

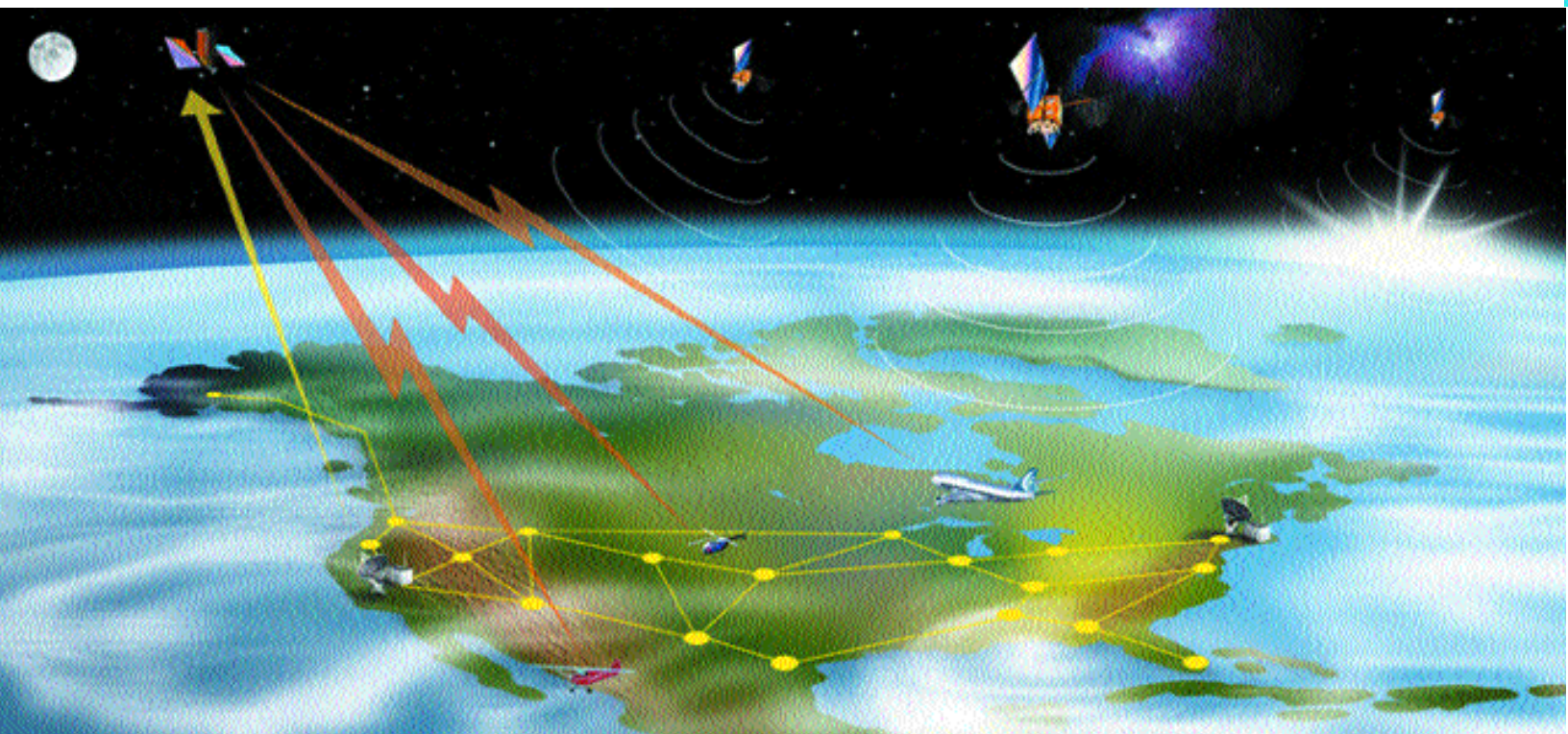
**Y**ou probably didn't notice it—I know I didn't—but at 12:01 a.m. on Thursday, July 10, 2003 the world of aviation navigation had a whole new look. That's when the FAA flipped the switch and the much-anticipated Wide Area Augmentation System (WAAS) came to life.

OK, so you've heard about WAAS, but what is it? And why should you be excited that it's finally here?

WAAS is going to be a lot of things, but quite simply, it is the next-generation of GPS. Wait you say! What's wrong with this generation of GPS? Well, nothing is 'wrong' with the GPS system that we've all come to know and rely so much on. But it's just not capable of doing what we really need it to do.

"Basically we had been using the ground-based navigation network for decades, and it was working well," explained Daniel Salvano, director of the FAA's Office of Communication, Navigation and Surveillance Systems. "Then the DOD (Department of Defense) launched the GPS system and as it became real we looked at it and said it was good, but not good enough.

"GPS was not designed to be a navigation tool for general aviation," he added. "The military only looked at it as a better way to deliver ammunition on targets. For navigation, we had much more critical parameters to look at: the accuracy of the solution; the availability of the signal; the continuity; and the integrity."



“The GPS in wide use out there in aviation is really limited in its ability to be used as a primary navigation source because of its lack of signal integrity,” explained Sam Seery, director of marketing for UPS Aviation Technologies. “The WAAS augmentation system that the FAA has been working so hard on basically plugs the integrity ‘hole’ and the new TSO improves the performance and criticality so GPS WAAS can now be used for our primary means of vertical guidance.

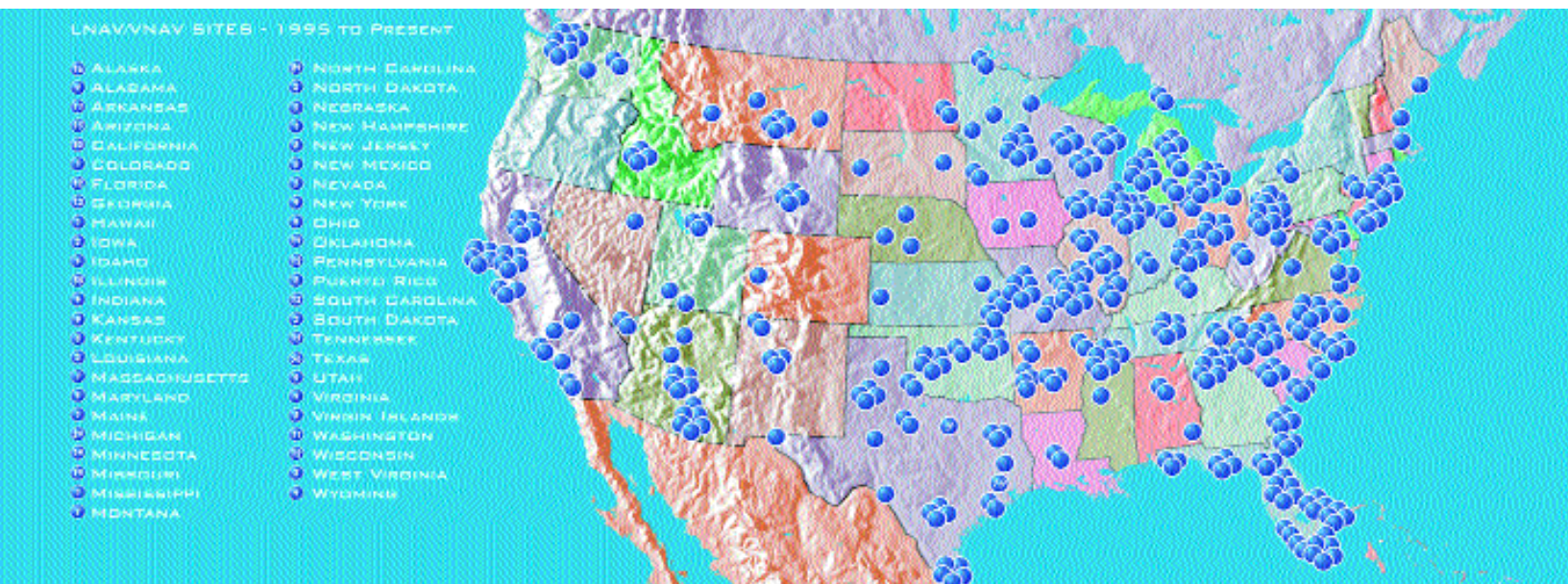
ties at all the runway ends of an airport without the need to invest large sums in a ground-based system,” Salvano said. That’s one of the big motivators behind the FAA spending years and loads of money developing WAAS: spending a lot today will save them a lot more in the future.

“ILS has been around for decades,” he continued, “but it requires a big investment at every airport. A typical ILS installation will run you between \$150 and \$180 thousand for the hardware, and upwards of a million dollars

## How WAAS works.

So how does this marvel of airborne navigation work you ask? It’s really a rather elegant system, both in its simplicity and its sophistication. The first thing to remember is that it is an ‘augmentation’ of information that is already available from the existing GPS network.

WAAS uses the same GPS satellite constellation that is currently in orbit over the United States to get its basic data. The augmentation comes from 25 WAAS ground ‘reference stations’



“What we have now is a system that gives us very precise aircraft position in three-dimensions,” he continued. “The critical part, and the part that was missing from the first-generation of GPS, being the vertical navigation capability.”

And with that ability to provide precise vertical navigation, WAAS will permit the creation of precision approaches into airports with no current ILS capabilities—pretty cool, huh?

## WAAS is like an ILS without the ‘S.’

“Simply, what WAAS will do is to give you precision approach capabili-

ties or more for the installation. That’s just for one end of a runway. The cost for multiple ends and multiple runways is enormous. And we haven’t touched on the maintenance and upkeep.”

Because it is satellite-based, WAAS does all this without all the ground-work. And because it requires no fixed equipment on site, it opens the door to creating precision approaches to hundreds, if not thousands more airports around the country.

“This will give pilots a great deal of access and flexibility in their schedules,” Salvano said. “You can go into a non-ILS airport that has an approved WAAS approach in very marginal weather.”

that are precisely located in a line across the continental United States (CONUS) and in parts of southern Alaska. “We know within inches exactly where the stations are,” Salvano explained. And that pinpoint positioning is key to making WAAS work.

In fact, that’s how the system augments the GPS satellites’ positioning signals. The GPS satellites transmit a signal saying “I’m here”—it’s classic ranging. By measuring the time it takes the signal to get to the receiver and comparing it to other satellites saying, “I’m here too,” you can figure out where the receiver is.

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## Precision approaches. WAAS style.

As we heard before, the beauty of WAAS is that it permits the creation of approved precision approaches into hundreds of airports that don't, and probably never would, have offered them. Opening all these destinations up to pilots who would have had to bypass them when the weather got ugly.

But, the operative word here is 'approved.' Although the guidance information is there, you just can't go off and fly an IFR approach into any airport in the country—at least not yet anyway. "One of the things we've done in parallel with the WAAS development has been to create and publish new LNAV (Lateral Navigation), LNAV/VNAV (Lateral Navigation/Vertical Navigation, and LPV (right now LPV doesn't really have an official definition—the FAA is still working it out with ICAO, but LPV is the approach with the lowest minimums), approaches," Salvano said. "Right now we have nearly 600 WAAS approaches covering 300 airports and we're adding more as quickly as we can."

"WAAS is a huge next-step in our navigation system. We've gone from VOR to VOR navigation, to LORAN, to C129 as our supplemental Nav source, to today having the C146 (GPS/WAAS) boxes as our primary navigation source and for precision approaches," added Craig Hudson, sales manager for UPS Aviation Technologies. "With WAAS you have a much safer feeling—that 'sweaty palm' feel can be subsided with the knowledge that you now have additional satellites and a whole network watching over your position as you progress towards your destination."

"You'll know that there'll be an airport below you when you break out," he continued. "And not a bunch of rocks and trees."

Salvano went on to explain that when it was commissioned, the WAAS system had the capability to deliver accuracy to that of a Category 1 precision approach—but the ability for pilots to use it is totally dependent on what the avionics manufacturers offer in their new WAAS certified boxes.

"Our first Gamma One application for the WAAS engine is our new CNX80 multifunction unit," Seery said. "G-1 allows the unit to be used for primary navigation during all phases of flight—with the exception of precision approaches."

"Soon we will be offering both Gamma Two and Three together in an upgrade," Hudson added. "G-2 will be certified for LNAV/VNAV approaches and will enable vertical guidance into about 800 airports in the U.S. G-3 is the LPV approach approval. It is a lateral precision approach with horizontal guidance. These are very precise. Nearly as precise as an ILS approach—you get basically 200 feet and one-half mile with an ILS and the LPV gives you 250 feet and three-quarters of a mile." Pretty darn good considering the signal is coming from hundreds of miles up in space.

## Safer flying through WAAS.

"It's a huge benefit to pilots," Seery explained. "You will have highly accurate, dependable precision approaches to literally thousands of airports. That alone will dramatically improve both the capability and safety of GA pilots." But for WAAS, precision approaches are just the beginning of its safety enhancing benefits.

"First and foremost we wanted to include WAAS in our equipment as part of our ADS-B (Automatic Dependent Surveillance –Broadcast). It's a traffic awareness system that also provides a bunch of other tools including aircraft spacing and situational awareness," he continued. "It's not only a benefit in the air but also on the

ground. It's very accurate position information can help reduce runway incursions."

"It will also make approaches into airports that have ILS's safer," he added. "There's nothing worse than shooting a GPS run into your final approach fix and trying to make the switch over to the ILS only to find the ILS is out or something. With WAAS you can fly the approach all the way down to the D.H. (decision height) without having to switch in the middle."

## Can WAAS augment the avionics business?

At the time this story is written only two companies, UPS Aviation Technologies and Chelton Flight Systems, have WAAS boxes certified—but they won't be alone for long. As the system matures and more and more approaches get their approval, pilots will want to have this capability in their cockpits. And the manufacturers and FAA both see this as a much-needed shot-in-the-arm for the avionics business.

"Dealers can sell this as the true next-step in technology," Seery said. "It is the future of area navigation. C129 equipment is not outdated, but it is definitely on the way out. I don't see why any manufacturer would build a C129 box. From here on out, they should all be derivatives of C146 WAAS technology."

"Phil Boyer of AOPA (Aircraft Owners and Pilots Association) was at our official commissioning and he said basically that he believed that once it became real—the prices of equipment would come down," Hudson said. "He said the benefits are there and he believes that once pilots see the benefits from a safety and capability perspective, they will start equipping."

Sure, just like the original GPS receivers WAAS will be good for business. But UPS Aviation Technologies

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sees it as a bit more than that. "The goal of introducing our CNX 80 was to create a safer and more confident pilot," he concluded. "We wanted to help simplify some of the things that C129 made complex." Well, according to all reports, once you fly your first WAAS approach you'll never go back again. **Q**

*(Editor's note: At press time, Garmin International had just announced plans to purchase UPS Aviation Technologies.)*