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FAA Satellite Navigation Product Teams

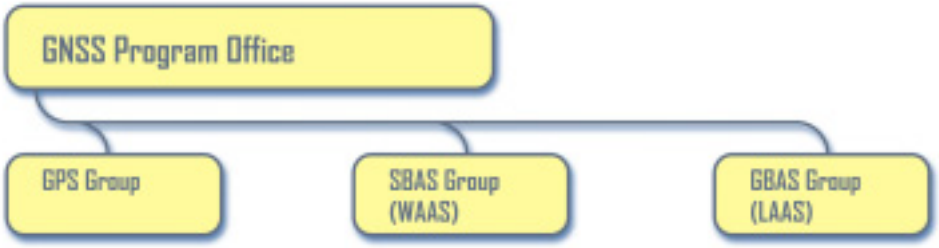
SatNav News

Management Changes within FAA SATNAV Programs

by Mary Ann Davis FAA GPS TAC

Dan Hanlon, who served as the Wide Area Augmentation System (WAAS) program manager for the last several years has moved on to support the Federal Aviation Administration (FAA) in an international position in Singapore. During his time as the WAAS program manager, Dan managed activities leading to WAAS commissioning, directed follow-on efforts for WAAS system enhancements, and worked closely with the operational community to help accelerate the realization of WAAS benefits to users. Dan's achievements and leadership during his tenure established an indelible legacy that set the standard for outstanding performance. Dan's last day as program manager on the WAAS program was January 27, 2006. His departure triggers a series of management shifts within the FAA satellite navigation programs.

Most significant of these shifts is the regrouping of the FAA's satellite navigation programs under one Global Navigation Satellite System (GNSS) program office. Under this new GNSS program office, there will be three groups: Global Positioning System (GPS); Satellite-Based Augmentation System (SBAS) – which includes the WAAS project; and the Ground-Based Augmentation System (GBAS) – which includes the Local Area Augmentation System (LAAS) project.



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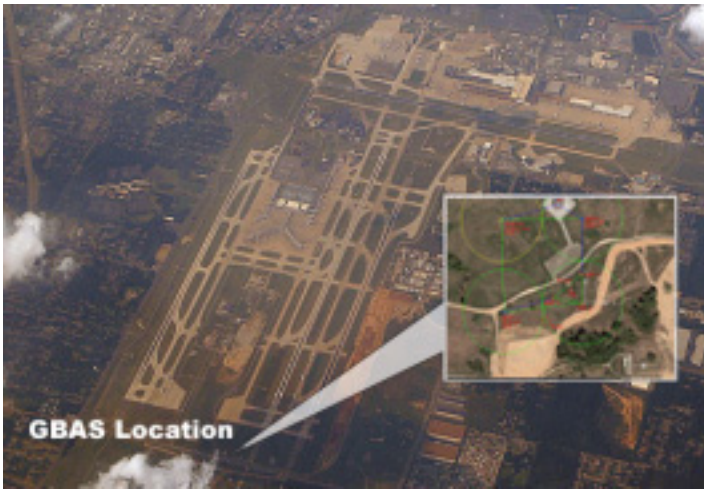
The **SATNAV News** is produced by the Navigation Services (ATO-W) branch of the Federal Aviation Administration (FAA). This newsletter provides information on the Wide Area Augmentation System (WAAS) and the Local Area Augmentation System (LAAS), and initiatives associated with the implementation of satellite navigation into the National Airspace System (NAS).

New, Lower LPV Minimums Announced

In a major step that expands the benefits of satellite navigation for aviation users, the Federal Aviation Administration has announced lower Localizer Performance with Vertical Guidance (LPV) approach minima through the use of the Wide Area Augmentation System (WAAS). WAAS is now approved to provide guidance down to 200 feet above an airport's surface for these vertically-guided instrument approaches.

For more information on this announcement, please visit our website at http://gps.faa.gov.

Leo Eldredge has moved into the role of GNSS Program Manager. Leo has been an integral part of FAA satellite navigation projects since joining the FAA in 1995. Until recently, Leo has served as the FAA's Ground Based Augmentation System (GBAS) manager where he was responsible for all program planning and execution for the FAA's LAAS program. From 1993 to 2003, he served in various positions on the WAAS program until he ended his tenure there as the Engineering Manager and Leader for the WAAS Integrity & Performance Panel (WIPP). The WIPP was the tiger team tasked to resolve technical issues linked to compliance with system safety and integrity requirements. Before joining the FAA in 1993, Leo served 20 years with the United States Air Force. His extensive aviation and satellite navigation experience, technical knowledge, and management skills will serve him well in this new role as GNSS Program Manager.



Aerial view of Memphis (MEM) Airport and LAAS Prototype (GBAS) Location

LAAS Integrity Work Progressing Toward Operational Trials

by Dieter Guenter, FAA GPS TAC

While the Local Area Augementation System (LAAS) remains a research & development (R&D) project, the FAA continues to make progress by working the integrity risks with Honeywell and the LAAS Integrity Panel (LIP). By September 2006, the FAA's Ground Based Augmentation System (GBAS) group expects to complete the integrity analysis and implement an approved set of integrity monitoring algorithms in a LAAS prototype at Memphis, Tennessee. Flight testing using both FAA William J. Hughes Technical Center and FEDEX aircraft will validate technical and operational performance of this prototype facility. The next step will be to upgrade the Memphis prototype facility to host all functions required to demonstrate compliance with Category-I Standards and Recommended Practices (SARPs) requirements. In order to do this, the processing architecture will be upgraded and a complete set of prototype software functions integrated at Memphis and a new facility installed at the William J. Hughes Technical Center in New Jersey by December 2007. The FAA is also coordinating with other service providers interested to fund development, test, and regulatory approval activities.

In February, the FAA and Airservices Australia signed a memorandum of cooperation as a first step toward establishing an international cooperative development effort to obtain approval for the Honeywell Inc. Category-I LAAS. If funding is approved, Airservices would complete the development of the Honeywell LAAS, including the LIP-approved integrity algorithms, for their system in Sydney. FAA would install the certifiable software at Memphis and proceed with regulatory approval for Category-I instrument meteorological conditions (IMC) operations in 2008. Other service providers - for example, Spain, and Germany - also have LAAS prototypes and have shown interest in approving those systems as well.

Airservices Australia has a GBAS prototype installed at Sydney International Airport and a Qantas Boeing 737-800 has successfully completed initial GLS (Global Navigation Satellite System Landing System) flight testing. These flight trials, GBAS siting experiences, and lessons learned will also be part of the international information exchange.

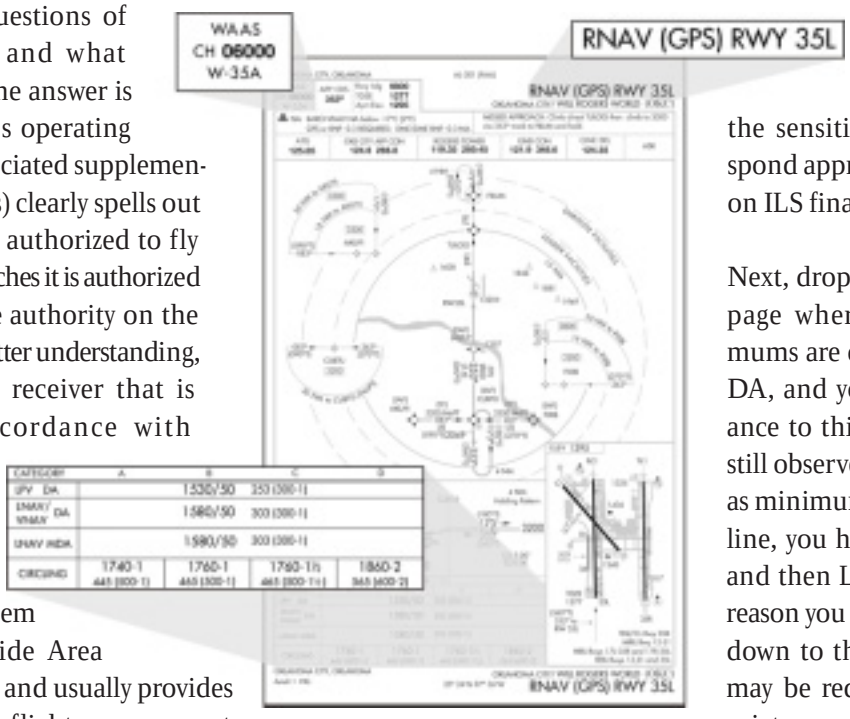
Flying an LPV Approach

by Larry Oliver, FAA GPS TAC

There are now more than 300 LPV approaches throughout the United States, and there will likely be another 300 added this year. Unfortunately, there is still some confusion about what an LPV approach is, and who can use it.

LPV stands for "localizer performance with vertical guidance," and it offers an ILS-like capability without requiring any additional equipment on the airfield. It uses the GPS signal, enhanced by the Wide Area Augmentation System, which in turn provides a capability to fly an LPV approach down to as low as 200' with the appropriate airport infrastructure. Not all airports will receive the advantage of the minimum altitude, however, because each approach must consider obstructions and other factors in determining minimums.

Regarding the basic questions of who can fly an LPV and what equipment is needed, the answer is as always. Your pilot's operating handbook (and any associated supplemental pilot/flight manuals) clearly spells out whether your aircraft is authorized to fly in IMC, and what approaches it is authorized to fly. It is the ultimate authority on the matter, but to promote better understanding, you must have a GPS receiver that is manufactured in accordance with TSO-C145 or C-146. TSO-C145 is entitled "Airborne Navigation Sensors Using the Global Positioning System Augmented by the Wide Area Augmentation System," and usually provides navigation outputs to a flight management system or navigator. TSO-C146 is "Stand-alone Airborne Navigation Equipment Using the Global Positioning System Augmented by the Wide Area Augmentation System." This is a complete sensor/navigator system that typically is found on aircraft without distributed navigation systems like FMS.



To be legal to fly an LPV approach with either system, it must have an airworthiness approval for installations such as a Supplemental Type Certificate. Typically the last instruction in an STC is to incorporate the system operating handbook, by reference, as part of the pilots operating handbook.

So much for the technicalities! On to flying an LPV approach. If you look at a terminal procedures booklet and find an RNAV(GPS) approach, you will notice a few differences. In the upper left corner is a block that says "WAAS," and it contains a 5-digit channel number. This channel has nothing to do with receiving the WAAS signal. It is a means to select the correct approach. Think of it as a page number that pulls up the correct "page" from your system. Not all WAAS receivers use the approach channel number to identify the appropriate procedure. Some use an airport menu that selects the appropriate runway and then procedure. Once you have the correct "page," your aircraft will look like it is receiving an ILS. On final approach you'll receive a glide slope indicator, and the sensitivity of the CDI will correspond approximately as your CDI does on ILS final.

Next, drop down to the bottom of the page where the category and minimums are displayed. There is an LPV DA, and you can fly the vertical guidance to this minimum, but you must still observe any other restrictions such as minimum altitudes. Below the LPV line, you have LNAV/VNAV minima and then LNAV minima. If for some reason you lose WAAS, you can fly GPS down to the LNAV minimums. You may be required to reload the appropriate approach procedure due to most WAAS receivers not having a "fail down" capability.

If you have not used a certified GPS before, you will note that distances are displayed to the next action point, and not from a transmitter. This makes life simple, as you no longer have to fly and do subtraction at the same time.

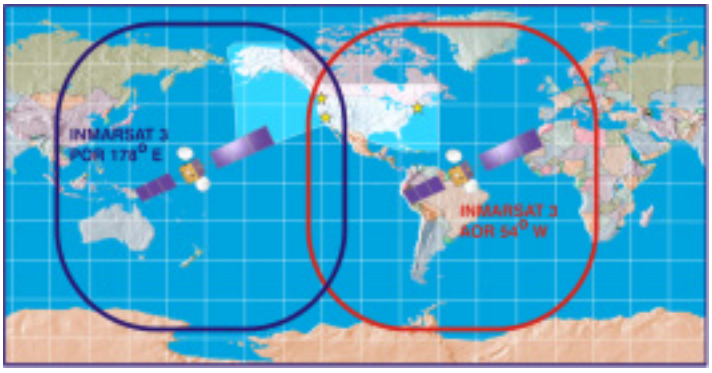
Some additional good news. Several years ago when GPS was first used, requirements for the destination and alternate (under IMC) were quite rigorous. Pilots had to perform a predictive RAIM check and forecast, and had to have a non-GPS approach capability at their alternate. With WAAS, the RAIM check is accomplished by checking WAAS NOTAMS, and you can use the LNAV minimum line for planning purposes at your alternate. Upon arrival at your alternate, you may use the lowest line of minima available and supported by your avionics.

Enhanced WAAS Satellite Coverage in 2006

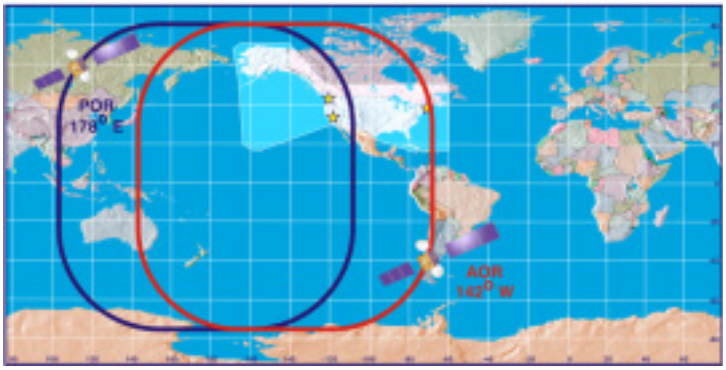
by Mary Ann Davis, FAA GPS TAC

In the last couple of years, the FAA has been busy tackling satellite planning and procurement challenges – work which has been transparent to the users. This year, users will begin to see the results of these activities and the associated benefits.

Since WAAS commissioning in 2003, WAAS has used two INMARSAT geostationary satellites (GEO) to broadcast the WAAS signal. The leases for these satellites are expiring and new satellites are coming on line. Steps will begin this year leading to the transition away from these INMARSAT GEOs and toward the future WAAS GEO configuration. As a result of these steps, WAAS users will be enjoying a higher level of WAAS availability by the end of 2006.

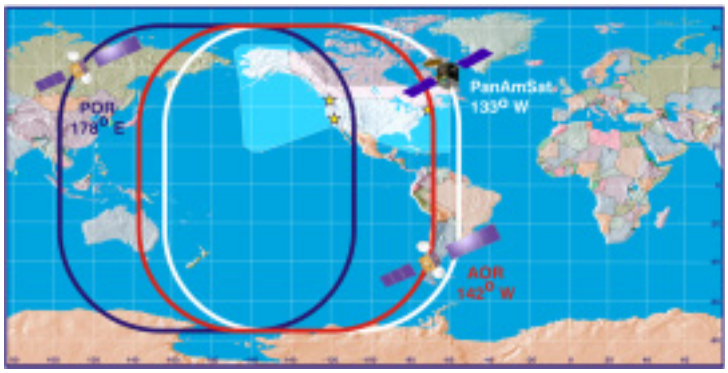


WAAS Inmarsat GEO Coverage
prior to February 2006



WAAS Inmarsat GEO Coverage to begin by April 2006

There are two major WAAS GEO activities that will occur this year – both of which will have an impact on users. The first will be the move of the INMARSAT AOR-W satellite. On February1st, INMARSAT began moving its AOR-W satellite to the west. As the satellite moves west, so will footprint of its broadcast. The move will take approximately 60 days and AOR-W will be in its new position in April.



WAAS GEO Coverage to begin by Fall 2006

The second activity to take place this year will be the debut of the WAAS-certified broadcast from the new PanAmSat satellite. The PanAmSat was launched in October of last year. Since then, steps have been underway to prepare it for WAAS service. Final testing and integration activities will take place this spring and summer to certify the PanAmSat's broadcast as a part of WAAS. The PanAmSat broadcast footprint will be in view of all users within the U.S. Both the move of INMARSAT's AOR-W satellite and the debut of the PanAmSat WAAS broadcast will be growth steps for WAAS.

As with any growth process, there will be some bumps along the way. As the AOR-W satellite moves west, so will its area of coverage. As a result, from mid-March to approximately late September, there will be a few areas in the extreme Northeast of the U.S. that will fall outside of the coverage area of WAAS. This is a temporary situation and full service will be restored in the affected area when the PanAmSat becomes operational in the fall. (For more details on the temporary impact of this situation to users, please select the "WAAS GEO Moving to New Location" link from the front page of our website at http://gps.faa.gov.) When both of these satellite activities are complete – the AOR-W move and the debut of the PanAmSat WAAS broadcast – the net result will be better service availability for the users.

In the past, both Alaska and the eastern two-thirds of the U.S. have only been within the broadcast footprint of one WAAS satellite. As a result, both of these expansive areas were vulnerable to a loss of WAAS service if one of the two WAAS satellites failed for any period of time. In its new location, the AOR-W satellite footprint will now cover all of Alaska. Additionally, the new PanAmSat broadcast will also cover all of Alaska. Alaska will gain double redundant coverage. The benefit is similar in the eastern two-thirds of the U.S. where the new PanAmSat broadcast will add a second layer of WAAS coverage. By the end of the year, the majority of all WAAS users within the U.S. will now be in view of at least two WAAS satellites, and in some cases in view of three WAAS satellites.

The improved WAAS GEO constellation that will be in place by the end of 2006 is only one of the many enhancements in store for WAAS users. WAAS has been providing valuable benefits since it was commissioned in 2003 and it just keeps getting better!

International WAAS Reference Station Update

by Wally Peterson, FAA GPS TAC

The WAAS team successfully completed all of the international installations planned for 2005 on schedule. Installations were completed in Mexico (Merida and Puerto Vallarta) in October. This brings the total number of international wide-area reference stations (WRS) to five, including the earlier installations in Canada (Gander and Goose Bay) and in Mexico (Mexico City). The five international WRS sites that were installed in 2005 are planned for integration into the WAAS in the summer of 2007.

In total, the pre-planned improvements to the WAAS include integration of four new WRS sites in Alaska, five new WRS sites in Mexico, and four new WRS sites in Canada.

Preparations are already underway for the installation of the last four international WRS facilities. NAV CANADA completed the site surveys for Winnipeg and Iqualuit earlier in 2005. In December, Raytheon and the FAA completed site surveys in Tapachula and San Jose Del Cabo, the new sites planned for Mexico. Installation for the sites in Mexico is planned for June and July 2006. Installation will be completed at Winnipeg, Canada in May 2006 and in Iqualuit, Canada in August 2006. These last four international WRS installations will be integrated into the WAAS in early 2008.

Incidentally, the next integration of WRS installations will be in August of 2006 of the four new Alaska sites which were installed in December 2004.

New Survey Criteria Speeds Process to LPV

by Tim Roe, FAA GPS TAC

One of the largest hurdles to implementing Localizer Performance with Vertical Guidance (LPV) instrument approaches is having or obtaining the appropriate level of aeronautical survey to support the design. There are many different levels or types of surveys, each traditionally supporting a single function. I'm sure you've heard or seen the acronyms ANAPC, ANALPV, PIR, D, C, BV, or CGR - each of these relates to a specific type of survey and each type has different specifications and accuracies. Most of the nation's airports have survey data for use in planning and airport development, but

these surveys do not meet the requirements for use in the design of a procedure. It is possible to develop an instrument procedure using only planning and development quality survey data but the approach minimums will be higher than necessary to account for the inaccuracy of the available data.

Working tirelessly with Aviation System Standards, Flight Standards and the Aeronautical Survey Program of the National Geodetic Survey, the WAAS program has developed and is utilizing a LPV survey specification called ANALPV. This specification is much shorter than the traditional ANAPC type survey and has a less stringent accuracy requirement to allow the use of aerial imagery to collect some of the data. By using aerial imagery, the process of collecting the obstacle data is reduced, meaning more survey data faster. This new specification is currently being tested at seven locations and the initial results are encouraging.

The WAAS NAS Implementation team is working diligently with other FAA groups and NGS to ensure the greatest numbers of surveys are available for use to provide the lowest possible minima to as many airports as possible. This work is not only in the area of survey specifications, but in the development of new tools to support the collection of aeronautical data such as the Aeronautical Data Collection Analysis Tool (ADCAT), a joint development effort of the FAA and NGS. This work will continue this year as the WAAS program funnels more money (approximately $5 million) into the collection of appropriate surveys to meet the ever- growing need for these highly beneficial, vertically-guided instrument procedures.

WAAS Government-Industry Partnership Announced

by Mary Ann Davis, FAA GPS TAC

On March 6, 2006, the FAA Office of Acquisitions released a Request for Information (RFI) / Market Survey soliciting industry input and interest in establishing a government-industry partnership(s) to expediate the development, integration and certification of LPV-capable WAAS avionics (for both fixed wing and vertical flight). More information on this announcement can be found at:

http://www.asu.faa.gov/faaco/index.cfm?ref=4650

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