

SatNavNews

FAA Navigation Programs AJM-32



The *SatNav News* is produced by the Navigation Programs AJM-32 branch of the Federal Aviation Administration (FAA). This newsletter provides information on the Global Positioning System (GPS), the Wide Area Augmentation System (WAAS) and the Ground Based Augmentation System (GBAS).

Airbus Flying High with SBAS

The Airbus A350 XWB is the first wide-body aircraft embedding a Satellite Based Augmentation System (SBAS) navigation solution in its design.



SBAS enables the use of the Localizer Performance with Vertical (LPV) line of minimum found on RNAV(GPS) charts in the U.S. and on RNAV(GNSS) charts in Europe.

Jean-Christophe Lair, Airbus test pilot, and Frederic Belloir, Manager, Navigation Systems, at Airbus, shared their perspective on LPV capability in the Airbus A350 XWB.

Q. What led to the Airbus decision to add SBAS capability to the A350 XWB?
A. Airbus is looking at solutions to maximize airport accessibility for all its operators. For Airbus, this means including compatibility for all existing instrument approaches – ILS, GLS, RNAV, and RNP-AR. Providing the ability to fly SBAS/LPV approaches is a part of this approach.

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Tell Us Your WAAS Story

We're collecting testimonials about the benefits of Wide Area Augmentation System (WAAS) navigation from users. If you are a pilot, passenger, airport manager, controller, dispatcher, airline employee, or are involved in aviation in any capacity - whether you fly fixed-wing or vertical flight aircraft - we want to hear from you! Please send your stories and contact information to Amy Trevisan at: amy.ctr.trevisan@faa.gov

Q. How is the LPV capability integrated into the Airbus?

The Airbus A350 XWB includes a function called SLS (Satellite Landing System). This function supports SBAS or future enhanced GNSS applications.

Q. Has the addition of SBAS capability been beneficial?

A. Yes, the SLS function shows its value every day that we use it for approach. The benefits can apply to all categories of airports. LPV is an ideal back-up solution on main runways currently equipped with ILS (e.g. in case of failure or maintenance). It also allows for the creation of instrument approaches at many runways which do not currently have ILS approach capability.

(Editorial note: As of June 25, 2015, Europe has published 201 LPVs serving 128 airports. Source: EGNOS Bulletin, Issue 15 Q2 2015)

Q. What has been the feedback from pilots who flew the LPV on the Airbus?

A. The feedback has been excellent from both Airbus and European Aviation Safety Agency (EASA) pilots involved in the A350 certification. The SLS LPV signal observed during the A350 XWB test flights was just as good, and often better, than that of a Category I ILS.

Q. Is there a learning curve for pilots when it comes to using the LPV approaches?

A. Not really, LPV approaches with SLS function are part of xLS concept (another example of xLS is GLS, used for GBAS). ILS is the reference system for instrument approaches and the xLS concept aims at providing the pilot with a similar and consistent operational solution whatever the type of approach. So with SLS, LPV approaches are flown like ILS approaches and pilots feel immediately comfortable with this new function.

Q. Anything else to add?

A. Working on this project was an exciting and enjoyable experience. The A350 XWB, being a new program, provided the perfect opportunity to introduce the SBAS technology. We are indeed quite happy with the SBAS performance on our aircraft and trust it's going to bring real enhancements in the instrument approach domain.

(Acronyms in article above: XWB – Extra Wide Body; RNAV - Area Navigation; GPS - Global Positioning System; GNSS - Global Navigation Satellite System; ILS - Instrument Landing System; GLS - GBAS Landing System; GBAS – Ground Based Augmentation System; LPV - Localizer Performance with Vertical; RNP-AR - Required Navigation Performance – Authorization Required; SBAS - Satellite Based Augmentation System; EGNOS – European Geostationary Satellite Overlay System)

Related Article – [EGNOS Dream Now a Reality](http://gpsworld.com/egnos-dream-now-a-reality/); GPS World, June 29, 2015 - By Tim Reynolds - <http://gpsworld.com/egnos-dream-now-a-reality/>

Summer Aviation Events – A great time to interact with WAAS Users

On Saturday, June 6th, the FAA WAAS Team participated in the Aircraft Owners and Pilots Association (AOPA) Fly-In at Frederick Municipal Airport in Maryland. In July, members of NavPrograms team participated in the EAA AirVenture Oshkosh 2015, (pictured at right) which is a highlight of the year for many pilots and aviation enthusiasts. There was beautiful summer weather for both events.

At the FAA WAAS exhibits, we had the opportunity to meet and talk with many pilots who are WAAS enthusiasts- both current and future WAAS users.

The resounding enthusiasm for WAAS from both events can be summed up by this comment: "WAAS has really changed



the way General Aviation flies IFR. We can fly frequently during IFR conditions and feel comfortable and safe doing so." Further, one WAAS enthusiast noted he was happy to have the option for a WAAS LPV approach on a flight to an airport where the ILS was out of service. Another, one of the avionics representatives to whom we spoke, was very passionate about WAAS. We also talked with a student pilot who had just finished ground school the week before and was excited to use WAAS in the future. One visitor asked that we pass along their thanks to the FAA WAAS team for all their work to make WAAS a reality and to provide the benefits that they are enjoying today. "I LOVE WAAS !!!"; "I just can't say enough positive things about WAAS" and "I use WAAS when I fly IFR and also VFR." were some of the other comments that rounded out the day's conversations.

Events like the EAA events and the AOPA Fly-ins are critical for us to engage with our many WAAS users, and we really appreciated the multitude of pilots who stopped by to share their WAAS experience,

To read more about the event, please visit AOPA's page at <http://www.aopa.org/News-and-Video/All-News/2015/June/06/AOPA-Homecoming-draws-thousands-to-airport>.

To read more about the EAA AirVenture Oshkosh 2015, please visit EAA's webpage at: <http://www.eaa.org/en/airventure/eaa-airventure-news-and-multimedia/airventure-2015-videos>

- Jennifer Campbell, FAA AJM-32/NAVTAC

Increased use of GBAS reported at the 16th International GBAS Working Group

The 16th International Ground Based Augmentation System (GBAS) Working Group (IGWG) was hosted by the FAA at the William J Hughes Technical Centre (WJHTC) in Atlantic City, NJ, USA from June 1 to June 4, 2015. The meeting was co-chaired by the FAA and EUROCONTROL. The IGWG addresses relevant issues for the development and implementation of GBAS. It also provides a forum for the exchange of data and information, which can effectively be used by the participants in formulating their business strategies and implementation plans.

Highlights from the International GBAS working group meeting:

- About ninety-five (95) participants from fifteen (15) nations representing navigation service providers, airports, airlines, aircraft manufacturers, and aviation equipment manufacturers attended the meeting and working sessions.
- The trend towards greater interest in operational aspects continues, with more attendees at the operational than technical sessions.
- Use of GBAS by airlines continues to increase.

In her welcome, Shelley Yak, acting director of the FAA WJHTC, noted the progress made since the start of



GBAS activities at the WJHTC and the extent of analysis and testing capabilities at WJHTC. She also remarked on the importance of GBAS as an operational precision approach navigation aid, and on how we're gleaning experience in its use from the Newark and Houston installations.

The commitment to GBAS development and implementation by participants is clear. Delta Airlines provided an outlook of Delta GBAS fleet equipage and indicated a desire to employ GBAS at a number of US airports; Delta has sent a letter to SEATAC requesting the installation of a GBAS. Cathay Pacific provided experience in obtaining regulatory approval to fly GBAS without having any operational GBAS stations certified by their regulator. Airports and service providers continued to express plans to install GBAS at their airports, including the following notable locations in the USA (John F. Kennedy), Australia (Melbourne), with manufacturers reporting interest from other airports; United Kingdom (London Heathrow) and Dubai/UAE. Boeing and Airbus remain strongly committed to GLS and both manufacturers reported continued sales of GLS-equipped aircraft resulting in an increased percentage of aircraft with GBAS equipage.

Use of GBAS by airlines continues to increase. Qantas now flies over 90 GLS approaches into Sydney per day. Emirates and Cathay Pacific also use the Sydney station. While United Airlines still flies the most GLS approaches in the United States, averaging over 70 GLS operations per month, other airlines now have operational approval and fly GLS. Since the last IGWG, these include British Airways, Delta Airlines, Emirates, Lufthansa and Cathay Pacific. Frankfurt and Zurich now also have operational GBAS systems. A EUROCONTROL flight-plan analysis shows that GBAS equipage continues to increase, with over 5% of European approaches being flown with equipped aircraft up from 3% reported at the last IGWG. Other airports, notably those in Scandinavia, receive up to 30% traffic with GBAS capabilities. Russia approved the use of GBAS and published approaches, at Moscow Sheremetjevo. The first approved flight occurred in December 2014.

Honeywell also announced the anticipated approval of an update to the Honeywell SLS-4000. The Block-II update will improve operational availability and potentially enable new operations or operations in new locations.

The status reports of service provider plans, users and manufacturers were important and informative. Participants appreciated the possibility to get a concentrated overview of the worldwide state of the activities in a single day.

The trend toward operational aspects noticed during the last meetings continued. More than 2/3 of the participants attended the operational working sessions in this meeting. The presence of representatives of regulatory organizations and a large number of active pilots was noted as beneficial to the discussions.

The key value of the GBAS working group continues to reside in the parallel strings of technical and operational sessions, where data collection and evaluation, siting experience and interference mitigation, ionospheric activities, operational plans and future operations are not only exchanged but actively coordinated.

In the operational sessions (CAT I Post Approval Activities and GBAS Future Operations) all aspects of use of the GBAS signals were discussed. Several presenters underscored the need to go beyond ILS capabilities and rapidly exploit GBAS potential in new areas. The sessions included analytical and experimental assessment of several of the following concepts:

- Noise reduction through the use of a combination of steeper approach paths and displaced thresholds. GBAS can support both of these and each serves to decrease aircraft noise to the surrounding communities, with the potential to noise reduction of 1 to 3 dB or more.
- Improved RNP to GLS transitions that would enable shorter approach paths and ease transition from terminal to approach flight
- Extended service volume for GBAS to enable use of the GBAS signal farther from the airport. The session included an operational working group that identified the challenges that pilots have noticed with the current short GLS transition on approaches that currently use extended ILS service volumes.
- Special authorization to use the current Category-I approved GBAS to support operations during Category II minima.

The technical sessions (Data and Testing, Ionosphere, Siting, Interference and Ground Monitoring) focused on the transition to operations, with significant feedback experiences in monitoring, notably of the ionosphere, interference, overflights and tools used for GBAS performance assessment. The investigation in effects of ionospheric events remained an important subject, with intensive discussion of GBAS Approach Service Type D (GAST-D) ionospheric monitoring and the first results towards validation of a Europe-wide threat model. In several areas the work will be continued

between IGWG sessions to progress on the exchange of methods and experiences on more detailed subject matters. Single European Sky ATM Research SESAR reported significant progress on its technical and operational efforts with validation results from the GAST-D prototypes now having been recognized by ICAO and the intensifying of work on GBAS dual frequency and multi constellation architecture. The SESAR work now continues into 2016 with the two installed GBAS prototypes and concentrated on increasing coverage and robustness at large, complex airports. A new SESAR project on advanced procedures using GBAS has provided the first results. The next IGWG meeting will take place in April 2016 in Europe.

- Joseph Dennis and Dieter Guenter, FAA AJM-321/NAVTAAC

Satellite Navigation Approach Procedures Update

The tables shown here reflect the continuing growth of satellite-based approach procedures as compared to the inventory of instrument approach procedures based on conventional NAVAIDS. For more detailed information about satellite-based instrument approach procedures, please visit our GPS/WAAS Approach Procedures web page. http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/approaches/index.cfm

Satellite-based Approach Procedures			
	Procedures (Part 139 Airports)	Procedures (Non-Part 139 Airports)	Total Number of Procedures
RNAV (GPS) Approach LNAV Line of Minima	1,767	4,217	5,984
RNAV (GPS) Approach LNAV/VNAV Line of Minima	1,374	2,068	3,492
RNAV (GPS) Approach LPV Line of Minima	1,380	2,187	3,567
Non-ILS runway	53	1,610	2,414
ILS runway	1,387	577	1,142
RNAV (GPS) Approach LPVs w/200' HAT			930
RNAV (GPS) Approach LP Line of Minima	82	511	592
GPS Approach GPS Stand-Alone Procedures	11	93	104
GLS Approach	11	0	11

(Data as of September 17, 2015)

Instrument Approach Procedures (IAPs) Based on Conventional NAVAIDS	
ILS	1,284
ILS (CAT II)	153
ILS (CAT III)	118
NDB	694
VOR	1,233
VOR / DME	931

(Data as of August 20, 2015)

More information is available on the FAA Inventory Flight Procedures (IFP) Inventory Summary at https://www.faa.gov/air_traffic/flight_info/aeronav/procedures/ifp_inventory_summary/

Country	Airports – LPV procedures	# LPV Procedures
France	70	104
Switzerland	6	6
Guernsey	1	2
Germany	18	27
Italy	5	11
Spain	2	3
Finland	1	2
Austria	2	2
Czech Republic	4	8
Norway	7	14
Poland	2	4
United Kingdom	2	4
Sweden	2	3
Netherlands	2	3
Slovak republic	2	4
Denmark	1	2
Portugal	1	2
Total	128	201

The number of LPVs in Europe is also growing. The table to the left shows LPV procedures in Europe as of June 25, 2015, as included in the Quarter 2 EGNOS Bulletin. (Source: EGNOS Bulletin, Issue 15 Q2 2015)

Follow this link to the most recent Quarter 3 EGNOS Bulletin, Issue 16: http://egnos-user-support.essp-sas.eu/new_egnos_ops/content/quarterly-bulletin

On the Web

Where can you find FAA Satellite Navigation program information between editions of the SATNAV News? On our website, at <http://gps.faa.gov>, you can read about GPS, WAAS, and GBAS; browse an archive of past SATNAV News editions; and download a variety of fact sheets.



What's New?

Three-dimensional animations have been added to our GPS - How It Works web page and to our WAAS - How It Works web page. Please visit our website at <http://gps.faa.gov> to learn more.

- Mary Ann Davis, FAA AJM-321/NAVTAC