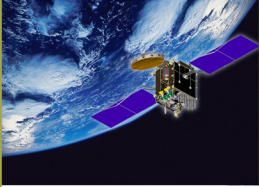







State of the GEOs

Current GEO satellites supporting WAAS			
			
Intelsat Galaxy 15 Launched: 10/2005 Operating: 133°W	Telesat Anik F1R Launched: 9/2005 Operating: 107.3°W	Eutelsat Satmex-9 Launched: 6/2016 Operating: 117 °W	SES SES-15 Launched: 5/2017 Operating: 129 °W <i>Operational: 6/2019</i>

For nearly fifteen years, Wide Area Augmentation System (WAAS) users have relied on geostationary satellites, or GEOs, to relay more accurate, available and reliable navigation information. What began with 2 satellites positioned at each coast of the United States has evolved to the current configuration of 3 operational satellites covering the northwestern most parts of Alaska to the northeastern most parts of Maine.

As of March 2018 the system has 3 operating satellites and one replacement satellite. The replacement satellite, SES-15, is planned to join the operational satellites in the summer of 2019 and will replace CRW at that time.

CRW, or Galaxy 15, launched in October 2005, and this WAAS transponder was placed in operation in September 2006. Intelsat owns and operates the satellite.

CRE, or Anik F1R, was launched in September 2005, and has broadcast WAAS corrections since September 2006. Telesat owns and operates the satellite.

Eutelsat 117 West B (former SatMex 9), was launched in June 2016 and integrated into the WAAS system on March 27, 2018. The satellite, operated by Eutelsat, is the replacement for AMR that was removed from WAAS in November of 2017. This GEO

provides triple-redundant coverage to the continental US and adds dual coverage benefits to the northwestern parts of Alaska, a community reliant on the benefits of WAAS.

GEO 6, or SES 15, was launched in May of 2017, and this WAAS transponder is scheduled for integration into WAAS in the summer of 2019. It is currently in the testing phase. GEO 6 will allow WAAS to retire the aging CRW WAAS transponder without affecting the performance of the WAAS system.

As the planned lifespan of each GEO is approximately 10-15 years, preparation has begun to acquire the next satellite in the system. Multiple indefinite delivery/indefinite quantity (IDIQ) contracts were awarded to procure GEO services in September of 2017 with a task order award to Leidos for GEO 7 in March 2018. Launch of the satellite, Intelsat Galaxy 30, is expected in the first half of 2020 with operational integration by late 2021.

Technology has advanced over the years with the geostationary satellites supporting WAAS. What once started as two satellites with a wide footprint across the United States is now a trio of complimentary GEOs providing unprecedented reliability. WAAS users from Alaska to Maine all have something they can depend on.

- Joseph Dennis, FAA AJM-32/NAVTAC

Talking about EGNOS with... Finnair

Reprint from EGNOS Bulletin, Issue 25 Q1 2018

Founded over 90 years ago as Finland's flag carrier, Finnair has conducted during the last years a significant restructuring program which has served the company to return to profit and start a massive recruitment program, among others. Today's Finnair fleet consists of over 60 aircraft, including eleven new Airbus A350 XWBs, the first of which was received in 2015. In this issue of the EGNOS Bulletin, we interview Finnair's Airbus Chief Pilot, Captain Marko Valtonen.

When did you first hear about EGNOS and LPVs?

I can't remember an exact date, but we have definitely paid more attention to these terms while preparing our A350 pilots' training programme, including exchanges with Airbus on the SLS function operation. Additionally, the terms became relevant during discussions with ESSP about our interest to see new LPVs deployed in Finnish airports.

As Fleet Chief Pilot, could you please let us know which are your roles within Finnair?

I am the Chief Pilot of A330 and A350 flight operations. Among many other things, I am responsible for the preparation and modification of the fleets' Operational Manuals (OMs) and Standard Operating Procedures (SOPs).

How many A350's do you currently operate, and how many do you plan to operate once all the orders are delivered?

We already operate 11 A350s. The next delivery will take place in December 2018. Our current plan foresees operating a fleet of 19 A350 aircraft.



The SLS option (SBAS Landing System, acronym selected by Airbus “for the A/C function supporting SBAS applications (LPV or LP)”) on the Airbus A350's is purchased as an option. What was the reason behind Finnair's decision to go for it?

I was not involved in the decision when the orders took place some years ago...but now I can say that selecting the SLS option was the

right decision, since we expect the A350's to remain in Finnair's fleet for quite a long time. The combined SLS/GLS capability guarantees that the aircraft will be able to cope with the requirements associated with the future ATM environment.

In which airports do you expect the SLS to be more beneficial? Why?

Our main base is Helsinki and for that reason we would appreciate having LPVs there. Behind this, we would prioritise London Heathrow, as we are flying there too. On the other hand, our American destinations (New York JFK, Chicago O'Hare and San Francisco) already have LPV procedures in place, in this case based on WAAS. As for the reasons we would appreciate LPVs in our current destinations, in today's scenario we consider LPV as the perfect back-up for ILS Cat II and III approaches. In tomorrow's scenario, and probably for other airlines already today, LPVs would be beneficial when landing at non-ILS runways.

According to our knowledge, Finnair flight crews have been, or are being trained, to make use of the SLS functionality? Have you received any feedback from the crews in relation with this functionality?

Our crews started the SLS/GLS training in July 2017 and it has gone very well. All our A350-only pilots have already passed their theoretical and practical training. Those A350 pilots who are flying SFF¹ (Single Fleet Flying) and operating A330 aircraft too, will receive their training soon too. We expect to complete all training by the end of June 2018.

How much and what type of training did the crews receive?

Both the SLS/GLS syllabus and practical training have already been implemented in the type rating course of all new A350 pilots, including CTR² (Common Type Rating) and CCQ³ (Cross-Crew Qualification) course.

The practical training in the simulator takes, together with the briefing, around 90 minutes, and it includes executing 4 SLS/GLS approaches. In some of these, contingency procedures are also put into practice, and we check how crews will judge the situations and apply the corresponding action, like executing go arounds, etc.

Has the Finnish Aviation Authority approved your crew training and amended operation manuals to be able to fly LPVs? If not, when do you expect to receive such approval?

The training is in place and therefore approved by our authority. The amendments to the Operational Manuals are still on-going. We expect to have them ready by the time all pilots will be trained, which shall occur by mid-2018.

Finally, as you certainly have SBAS sensors on-board...do your aircraft also include ADS-B Out capability?

Yes, ADS-B Out is a function we have in the A350's. Again, this feature allows us to cope with the ADS-B Out mandates emerging around the globe.

¹ Fly both aircraft under a single license endorsement

² Again, one license for A330 and A350

³ Abbreviated type rating course where only differences with respect to "base aircraft" are taught

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

Air New Zealand will use GLS as Primary Approach in Houston



After purchasing 13 Boeing 787-9 aircraft equipped with GBAS Landing System (GLS) capability, Air New Zealand (ANZ) has wasted no time putting this capability to good use as they debuted their GLS capability “down under” in Sydney and Melbourne, Australia. Additionally, ANZ has received FAA approval to fly GLS procedures in the United States. The U.S. currently has two public use GBAS sites, Newark, NJ and Houston, TX. Air New Zealand has their sights set on the GBAS at Houston George Bush Intercontinental Airport (IAH) in Houston, Texas. Flight Operations Management have instructed their pilots to use GLS as their primary CAT I landing aid versus CAT I ILS whenever possible.

The management team believe that the GLS approach preference over ILS will reduce the risk of false ILS LOC and ILS GS capture events that operators experience at airfields worldwide. Like other GLS capable air carriers, ANZ looks forward to the potential of flying CAT II type minima against the current CAT I GBAS. GBAS has limitless potential for multi-angled approaches and other benefits not achievable with current ground based navigation aids.

- Campbell Motley FAA AJM-32/NAVATAC

Did You Know . . .

The Federal Aviation Administration (FAA) Wide Area Augmentation System (WAAS) was commissioned in 2003. To date, there are over 4,500 Area Navigation (RNAV) Global Positioning System (GPS) approach procedures to Localizer Performance with Vertical (LPV) & Localizer Performance (LP) minima. The implication here is that aircraft equipped with WAAS can access over 4,500 runway ends in poor weather conditions to minimums as low as 200 feet. There are over twice as many RNAV (GPS) approach procedures with LPV/LP line of minima as there are Instrument Landing System (ILS) glide slopes in the U.S. National Airspace System¹. This is great news for WAAS and our stakeholders. However, after researching the internet and reading several third-party sites on the subject of WAAS there still seems to be significant ambiguity regarding WAAS and the capabilities it affords. The objective of this series of Q&A's is to provide some clarification for some of the noted and recurring misconceptions regarding WAAS and enhance situational awareness.

Our next set of questions in the series:

Q1 – *What is the lowest published LPV Minima?*

A1 – 200 feet above touchdown, with visibility minimums as low as ½ miles when the terrain and airport infrastructure support the lowest minima¹. The answer was already provided in the introductory paragraph – good catch!

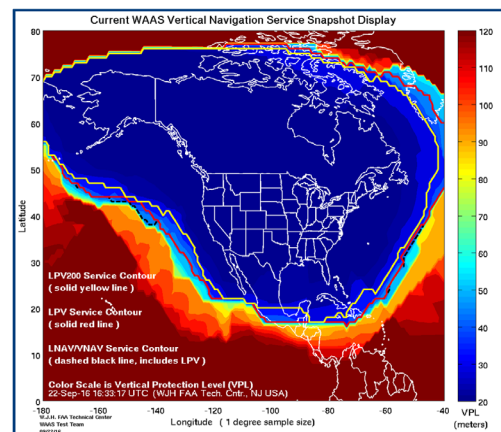
Q2 – *Is there an additional requirement to adjust the altimeter settings for extreme temperatures when executing Procedures with an RNAV (GPS) Rwy XX Approach to LPV/LP minima?*

A2 – **No.** RNAV (GPS) Approaches support all basic GPS approach functions and provide additional capabilities. One of the major improvements is the ability to generate glide path guidance, independent of ground equipment or barometric aiding. This eliminates several problems such as hot and cold temperature effects, incorrect altimeter setting, or lack of a local altimeter source².

Note: Temperature limitations do not apply to flying the LNAV/VNAV line of minima using approach certified WAAS receivers when LPV or LNAV/VNAV are annunciated to be available³.

Q3 – *What is the WAAS LPV coverage area?*

A3 – As of July 27, 2017 WAAS LPV services are depicted in blue, covering Alaska, Canada, the Continental United States and Northern Mexico, on the display⁴ to the right.



¹ Aeronautical Information Manual (AIM), 1-1-30, 4/27/2017
² Aeronautical Information Manual (AIM), Section 1-1-18 d.1 (page 1-1-32), 4/27/2017
³ Aeronautical Information Manual (AIM), 5-4-24, 11/10/2016
⁴ www.nstb.tc.faa.gov/rt_verticalprotectionlevel.htm

- Steve Mulloy, FAA AJM-32/NAVTAAC

Satellite-Based Augmentation System (SBAS) Interoperability Working Group (IWG)



The European Space Agency hosted the 33rd meeting of the SBAS IWG in Madrid, Spain from January 15-17, 2018. Participation was strong. The Federal Aviation Administration will host the 34th meeting of the SBAS IWG in Miami, Florida from September 24- 26, 2018.

WAAS LPV Game Changer

Wide Area Augmentation System (WAAS) Localizer Performance with Vertical guidance (LPV) procedures can be a game-changer in the lives of ordinary pilots. Ken Shaffer describes how the technology helps him stay close to his parents.

To hear Ken's story click link:
<https://www.facebook.com/FAA/videos/1853753917999555/>



Satellite Navigation Approach Procedures

WAAS LPVs

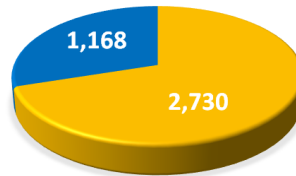
The table to the right reflects the continuing growth of satellite-based approach procedures. For more detailed information about satellite-based instrument approach procedures, please visit our GPS/WAAS Approach Procedures web page. http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/approaches/index.cfm

Satellite-based Approach Procedures			
RNAV (GPS) Approaches	ILS Runways	Non-ILS Runways	Total
LPV Line of Minima	1,168	2,730	3,898
<250' Decision Altitude			1,052
Exactly 200' Decision Altitude			1,004
LP Line of Minima	4	648	652
LNAV Line of Minima	1,217	4,805	6,022
LNAV/VNAV Line of Minima	1,146	2,640	3,786
GPS Stand-Alone Procedures	1	54	55
GLS Approach	11		11

(Data as of March 29, 2018)

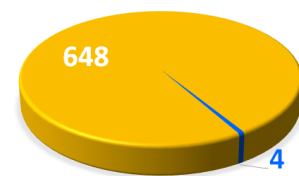
LPV UPDATE
3,898 TOTAL LPV'S PUBLISHED TO DATE

■ LPVs Published to non-ILS Runways:
■ LPVs Published to ILS Runways:



LP UPDATE
652 TOTAL LP'S PUBLISHED TO DATE

■ LPs Published to non-ILS Runways
■ LPs Published to ILS Runways



EGNOS LPVs

The number of LPVs in Europe is also growing. The table to the right shows LPV procedures in Europe as of February 1, 2018, as included in the EGNOS Bulletin Quarter 1 (Source: EGNOS Bulletin, Issue 25 Q1 2018)

Follow this link to the most recent EGNOS Bulletin Issue 25 Q1 2018: http://egnos-user-support.essp-sas.eu/new_egnos_ops/content/quarterly-bulletin

Country	Airports – SBAS APV procedures	# SBAS APV Procedures
Austria	2	2
Belgium	5	9
Croatia	1	1
Czech Republic	5	9
Denmark	4	8
Estonia	1	2
Finland	1	2
France	71	106
Germany	22	35
Guernsey	1	2
Hungary	0	0
Ireland	1	1
Italy	10	20
Netherlands	2	3
Norway	16	24
Poland	5	9
Portugal	2	3
Romania	1	2
Slovak Republic	2	4
Spain	3	6
Sweden	4	6
Switzerland	8	10
United Kingdom	14	31
Total	181	295

Canadian WAAS LPVs



Numbers provided by NAV CANADA as of March 29, 2018