

# SatNav Velue 79 Spring/Summer Edition

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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).

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## What is an LPV and how does it affect me?

Many folks hear a lot about LPVs, but they hardly ever get to see one!!

So, what is an LPV? It is a vertically and horizontally guided instrument approach that can allow aircraft to fly a stable approach at night and/or in poor weather conditions. An LPV is equivalent to the Instrument Landing System (ILS) Category I but is flown using the Wide Area Augmentation System (WAAS) in the US, Canada, and Mexico (and in other counties.)

Safety must be the top priority. A stable approach, particularly at night or in bad weather, greatly reduces accidents. A study I contributed to in the late 1990s showed that the rate of Controlled Flight Into Terrain (CFIT) accidents was reduced to one-eighth with a vertical and horizontal guided approach. Prioritizing these strategies is crucial for aviation safety.

When a runway is equipped with an ILS, aircraft can achieve a stable approach. However, it's important to recognize that installing ILS equipment requires significant construction efforts, clearing of areas, and specialized equipment. Moreover, each runway that needs vertical guidance must have its own dedicated ILS installation. Atlanta (ATL) has 10 ILSs, Denver (DEN) has 12 ILSs, and Chicago O'Hare (ORD) has 16 ILSs—plus well over a thousand ILSs in the rest of the USA. Each of these is six figures for installation, maintenance, checking, and electricity.

Smaller airports typically have only one or no ILS systems. If the wind is blowing from the wrong direction, or if the ILS equipment is malfunctioning or not installed, there will be no vertical guidance available.

The WAAS allows the development of LPV approaches at many locations in Alaska, Canada, the continental United States (CONUS), and most of Mexico, without requiring navigation equipment at airports. The Federal Aviation Administration (FAA) has published 4,184 LPV approaches, including 1,178 for ILS runways. These LPVs enable stabilized approaches in low-visibility and nighttime conditions, even when ILS is unavailable. Canada and Europe have also implemented numerous LPVs for their runways.

Some runways have terrain or obstacles that hinder the development of an LPV. In many cases, only an LP or LNAV approach can be developed for the runway. These approaches do not have vertical guidance—only lateral--and usually must be done in better weather conditions, but they still provide guidance to the runway. The FAA has 749 LPs.

Another concern with LPVs is the sun. When the sun erupts and releases a burst of particles, it can disrupt the upper atmosphere, causing LPV availability issues. Solar eruptions occur periodically, and 2025 is predicted to be a year of maximum solar activity. However, even with

Money is a significant factor! Upgrading my airplane with WAAS avionics was expensive, but the investment has paid off. I now enjoy the safety and weather advantages of LPV, as well as LP and LNAV approaches, at nearly all instrument runways across the USA. Additionally, my avionics enable me to transmit WAAS position data for Automatic Dependent Surveillance-Broadcast (ADS-B). This adds safety for visual and instrument operations.

WAAS has FAA costs, but the benefits in safety and capability really make up for the money. Also, as noted above, aircraft can use WAAS to transmit ADS-B position.

For those unfamiliar with an LPV approach, here is an example from Oshkosh, WI (OSH), the home of the Experimental Aircraft Association (EAA). This is also the first LPV published in the USA, which occurred in 2003.

-Vince Massimini, NAVTACII/DSc, CFI, CFII



## "LPVs enable stabilized approaches in low-visibility and nighttime conditions, even when ILS is unavailable ,



Oshkosh, Wisconsin (OSH) - RNAV (GPS) RWY 36 Approach (click **here** to view chart)

## Cargolux prepares for the future with LPV capability on new B777-8F

Reprint from EGNOS BULLETIN Issue 42, Autumn '24 Edition

As one of the world's largest freighter airlines, Luxembourg-based Cargolux is preparing for the future with an ambitious fleet transition. Starting in 2027, the airline will begin retiring its flagship Boeing 747s and integrate the Boeing 777-8F into its fleet. The aim is to improve operational efficiency, sustainability and performance. In a forward-thinking decision, Cargolux has chosen to equip all its new aircraft with LPV (Localizer Performance with Vertical guidance) capability, a commitment to adopting the latest precision navigation technology. This strategic shift represents a key milestone in the airline's long-term growth and modernisation strategy.



The idea of integrating LPV capability into Cargolux's new fleet emerged a few years ago during the Aerospace TechWeek in Munich. This industry event brought together aviation experts, and it was there that Cargolux began to consider the benefits of LPV technology seriously. Discussions with ESSP during the event allowed Cargolux to understand the future potential of LPV in improving operational efficiency, reducing reliance on ground-based infrastructure, and enhancing approach accuracy. This meeting served as one of the catalysts for Cargolux's decision to adopt LPV as part of its long-term fleet modernisation strategy.

To support the airline's decision-making process, ESSP conducted a comprehensive study assessing the potential impact of LPV integration on Cargolux's daily operations at its European and North American destinations. The study revealed that 85% of Cargolux's destinations in these regions already have at least one LPV approach procedure in place, while 99% of its flights land at airports with at least one published LPV procedure. These results were pivotal in demonstrating the feasibility and operational benefits of adopting LPV technology.

For this article, ESSP had the opportunity to speak with Captain Christophe Klees, an experienced aviation professional with 19 years at Cargolux, to discuss the reasons behind the airline's decision to adopt LPV.

Captain Klees, who began his career as a First Officer at Luxair in 2000, joined Cargolux in 2005 and by 2016 was a Boeing 747 Captain and the Chief Technical Pilot. He is currently the Deputy Nominated Person for flight operations at Cargolux and is responsible for overseeing the entry into service of the Boeing 777-8F. According to Captain Klees, the decision to equip the new fleet with LPV capability was driven by a forward-looking approach. By implementing LPV, they aim to stay ahead of the curve, anticipate the decommissioning of ILS systems and eventually perform CAT-I LPV approaches using EGNOS.

(( .... with LPV, we are taking a step forward in both safety and operational reliability. The more tools we have in the cockpit, the better equipped we are to ensure smooth, precise and safe landings. )) When asked about the main reasons behind the company's decision to equip the new aircraft with LPV capability, Captain Klees pointed to the European Commission's PBN IR mandate, as he foresees it could lead to airdromes phasing out ILS CAT I approaches for normal operations. He also emphasised that LPV will play a pivotal role in the future of RNP approaches. Additional factors identified by the company were improved fuel efficiency through constant descent approaches and the ability to select closer alternates during the pre-flight phase, which will allow the airline to carry less fuel on board.

As for the challenges the company may face during the transition to LPV, Captain Klees mentioned that the process should be very smooth, as these approaches closely resemble other PBN approaches. The company's pilots are already trained in PBN principles and familiar with these types of operations. This aligns with the original objective of LPV approaches, which are designed to mimic ILS CAT I approaches, using satellite-based signals to provide vertical and lateral guidance without relying on barometric measurements.

Captain Klees hopes that, over time, LPV will become the preferred approach method for pilots. Initially, the transition may be slower as experienced pilots are more accustomed to using ILS. However, once they become familiar with the new technology, Captain Klees believes that pilots will find LPV approaches to be very comfortable and more stable. In addition, as of June 6, 2030, operators will no longer be able to use ILS CAT I approaches except in the event of contingency.

Cargolux strongly supports LPV and encourages other companies to incorporate this capability, especially in newer aircraft, by selecting it as an option from the manufacturing line.

As Captain Klees stated: "with LPV, we are taking a step forward in both safety and operational reliability. The more tools we have in the cockpit, the better equipped we are to ensure smooth, precise and safe landings"

### EGNOS reaches milestone of 1,000 approach procedures: A testimony to your commitment to safety and efficiency

Reprint from the European Union Agency for the Space Programme (EUSPA) (http://www.euspa.europa.eu), December 13, 2024



**EGNOS** has reached an impressive milestone with 1,000 approach procedures now utilising its Satellite-Based Augmentation System (SBAS). This achievement highlights EGNOS's vital role in transforming aviation safety, accessibility, and sustainability across Europe.

#### Supporting safety in aviation

The integration of EGNOS has introduced Localiser Performance with Vertical Guidance (LPV) procedures, a significant advancement in navigation technology. LPV approaches are praised for their precision and safety. As a representative from NetJets remarked, "LPV with EGNOS provided a big leap forward in terms of the minima and level of safety provided by GNSS approaches, without the need for additional ground infrastructure."

Unlike standard GNSS approaches, LPV procedures are unaffected by low temperatures or incorrect altimetre settings, offering greater accuracy and reliability. They also enable smaller aerodromes to achieve approach minima comparable to an Instrument Landing System (ILS) without the need for costly installations. Additionally, LPV maintains operational continuity at larger airports when an ILS is inoperative. "LPV gives a greater degree of accuracy when compared to a standard GNSS approach, giving lower minima. It also improves safety as the glidepath is not affected by low temperature or incorrect altimeter settings, which can impact standard GNSS approaches."

#### **Building for the Future**

As the adoption of EGNOS expands, operators are aligning their fleets with this cutting-edge technology. An Air France spokesperson noted, "Every new unit must have SBAS implemented so that LPV procedures can be performed." This commitment ensures that airlines are equipped to maximise the benefits of EGNOS-enabled approaches, from improved precision to enhanced operational efficiency.

The growing number of LPV procedures also reflects a shift in how the aviation industry values this technology. An Air Nostrum representative recalled the early days of EGNOS adoption, stating, "Now, with around 1,000 EGNOS-based procedures, it is easy to find the usefulness of an LPV-equipped aircraft, but back then, it was a gamble at the time." They added, "With the increase in LPV procedures available at European airports in the latest years, they have been benefitting from the advantages of LPV in the recent years."

#### A More Sustainable Aviation Sector

In addition to its operational benefits, EGNOS contributes significantly to environmental sustainability. By ensuring greater flight path visibility, EGNOS

"By enhancing safety and efficiency in the aviation sector, we are helping to create a more reliable and sustainable future for all stakeholders involved )) procedures reduce fuel consumption and carbon emissions. According to some estimates, optimised flight routes and shortened flying times can save at least 100 kg of CO2 per flight, while landing using a continuous descent into an airport can save at least 150kg of CO2 per flight.

#### **Transforming Aviation**

The growing adoption of EGNOS and LPV procedures has made cutting-edge navigation technology more accessible and sustainable for large and small aerodromes alike.

As EGNOS surpasses 1,000 procedures, its role in shaping the future of European aviation is undeniable. With proven benefits for safety, sustainability, and operational resilience, EGNOS continues to be a cornerstone of modern aviation.

"At EUSPA, we are proud to have contributed to these significant advancements. By enhancing safety and efficiency in the aviation sector, we are helping to create a more reliable and sustainable future for all stakeholders involved," confirmed Jean Marc Piéplu, EUSPA Head of EGNOS Exploitation Department.



WAAS is a nighty accurate satellite based navigation system developed for civil aviation that augments the basic service provided by GPS through improved accuracy, integrity and availability for all Performance Based Navigation (PBN) operations and vertically guided approaches.

This storyboard demonstrates how WAAS operates within the National Air Space (NAS).

## How EU Space helps aviation reduce its environmental impact

## Thanks to EGNOS and Copernicus, aviation is flying towards a more sustainable future

Reprint from the European Union Agency for the Space Programme (EUSPA) (http://www.euspa.europa.eu), August 1, 2024



Image: imaginima/iStock/Getty Images Plus/Getty Images

While many of us look to paint the town red this summer, climate activists decided to paint a jet orange.

On 20 June 2024, after illegally gaining entry to London Stansted Airport, two Just Stop Oil protesters proceeded to spray several private jets with orange coloured paint. Earlier in the year, climate protestors conducted 'days of actions' at such airports as Paris Charles de Gaulle, London Heathrow, Madrid Barajas, Frankfurt and Amsterdam Schiphol.

While there is no denying that aviation does have a rather large carbon footprint, actions like these tend to paint over all the things the industry is doing to become more sustainable.

One of those things is the use of EGNOS to implement Performance Based Navigation (PBN) procedures.

An alternative to ground-based Instrument Landing System (ILS) navigational aids, EGNOSenabled approaches, called localiser performance with vertical guidance (LPV), utilise geostationary satellites and a network of ground stations to receive, analyse and augment GNSS signals. In doing so, it enables aircraft approaches that are operationally equivalent to ILS CAT I, providing lateral and vertical guidance without the need for visual contact with the ground until a decision height of only 200 feet above the runway as minimum.

Interesting, but what does this have to do with sustainability?

Turns out, quite a bit.

#### Business aviation leads the way

When an aircraft comes in for landing, most airports require that it make their approach step-by-step, levelling off at each stage – a process that results in more fuel being burned and more emissions being released.

EGNOS-based approaches, on the other hand, allow for a smooth, continuous glide path approach that is significantly quieter and more fuel efficient.

"From an ecological standpoint, EGNOS helps reduce noise pollution for airport residents by allowing the development of LPV approaches with increased glide slopes and runway threshold shifts on longer runways," says an European Business Aviation Association (EBAA) spokesperson. "This, combined with the use of geometric altitude, helps aircraft avoid level offs, thereby reducing both noise and fuel consumption."

According to the EBAA, business aviation has been a pioneer in the use of EGNOS, and most new business aircraft are already EGNOS-equipped. "Increasing EGNOS penetration not only brings real benefits to aviation, but also to the European economy and the environment," adds the spokesperson.

With sustainability being one of the EBAA's top priorities, increasing the adoption of EGNOS-based approaches remains key to enhancing business aviation's operational efficiency and further reducing its environmental impact. "By leveraging EGNOS, business aviation can significantly enhance flight efficiency, safety, and sustainability, all of which align with our broader goal of reducing aviation's carbon footprint," explains the EBAA spokesperson.

#### Everyone benefits from flying with EGNOS

But it's not just business aviation that stands to benefit from flying with EGNOS. Thanks to its lower decision height, EGNOS can help all pilots better evaluate visibility conditions, which in many cases means being able to avoid having to circle or divert – two manoeuvres that also burn a lot of fuel.

According to some estimates, optimised flight routes and shortened flying times can save at least 100 kg of CO2 per flight, while landing using a continuous descent into an airport can save at least 150kg of CO2 per flight.

"Minimising diversions and aborted landings mean less fuel consumption, making EGNOS a win-win solution for both the environment and the airlines," notes EUSPA Executive Director Rodrigo da Costa.

But it's also a win for passengers. For instance, airports are using EGNOS to help increase capacity and efficiency, mainly by preventing delays and diversions – welcomed news for anyone getting ready to take-off for their summer holidays!

There's even a tool that allows airports and operators to assess their environmental impact when using EGNOS. You can access the EBCAST tool here (registration required).

#### **Combating contrails with Copernicus**

But EGNOS isn't the only component of the EU Space Programme working to make aviation more sustainable – Copernicus can help too.

For instance, aviation's climate impact is not limited to CO2. It also contributes to climate change through such non-CO2 emissions as contrails, those white, line-shaped clouds that form behind a jet. It is estimated that contrails make up 60% of aviation's overall climate impact and account for 2% of all human-caused climate change.

But instead of ignoring the issue, the aviation industry is proactively working to both better understand how contrails impact the climate and to mitigate the risk. Here, companies like SATAVIA are leveraging the power of Earth Observation data to monitor contrail formation and to help airlines avoid those areas most likely to contribute to contrail formation.

Copernicus, and the Copernicus Atmosphere Monitoring Service in particular, can also be used to monitor emissions. In fact, EUSPA, through its Copernicus Demonstrators, recently funded a project working to use Copernicus data to build



This graphic reflects the continued growth of satellite-based LPV/LPs approach procedures. For more detailed information please visit: http://www.faa.gov/about/ office\_org/ headquarters\_offices/ato/service\_units/techops/navservices/gnss/ approaches/index.cfm Minimising diversions and aborted landings mean less fuel consumption, making EGNOS a win-win solution for both the environment and the airlines ))

a better way of monitoring air quality at airports and within the communities that surround them.

#### Taking off towards a more sustainable future

Although climate activists are correct in highlighting aviation's environmental impact, the facts paint a bigger picture. Part of that picture is that EU Space – and EGNOS and Copernicus in particular – are key enablers of aviation's ongoing efforts to reduce its environmental footprint.

"There's still a long way to go, but together these programmes help aircraft fly the safest, most direct, fuel-efficient routes, resulting in reduced flight times and less emissions," concludes da Costa.

Add this to the continued investments in more fuel-efficient aircraft, use of sustainable aviation fuels, development of efficient propulsion systems, and design of aerodynamic aircraft made from lighter materials and it's clear that instead of flying away from its environmental challenge, aviation is taking off towards a more sustainable future.

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## WAAS is Working

## A Video Series demonstrating the benefits of WAAS

**Featuring:** Horizon Air, the Goodyear Blimp, MedStar, Miss Virginia, Floatplanes in Alaska, Mid Atlantic Angel Flight, Airports and Northern Air Cargo





### LPVs Internationally



Performance de la construcción d

Canadian WAAS LPVs provided by NAV CANADA as of April 17, 2025 (click for map)

. . . 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 Cornell Walker at: cornell.ctr.walker@faa.gov