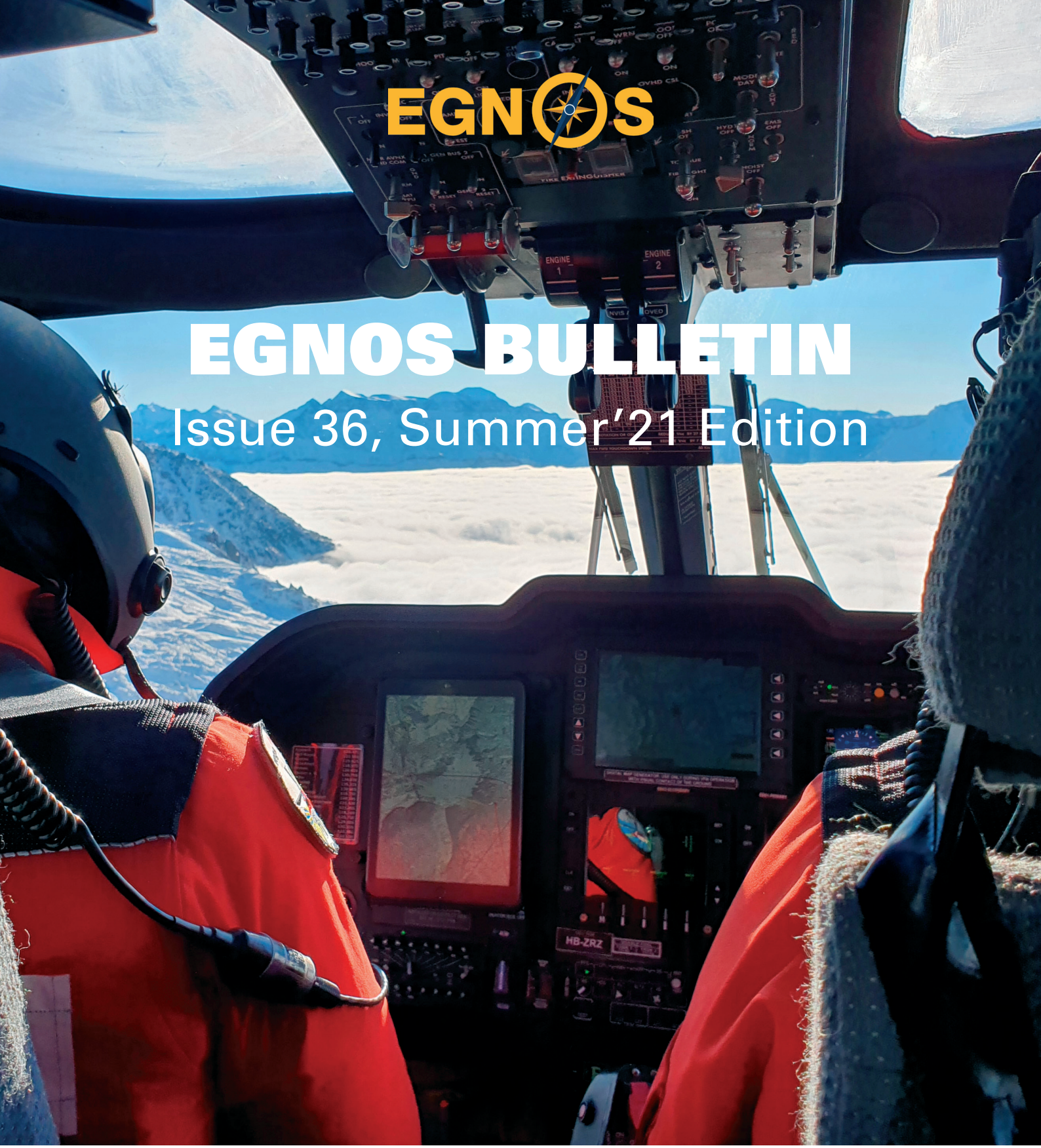
EGNOS

EGNOS BULLETIN

Issue 36, Summer'21 Edition



Credits: REGA

EUSPA
European Union Agency for the Space Programme

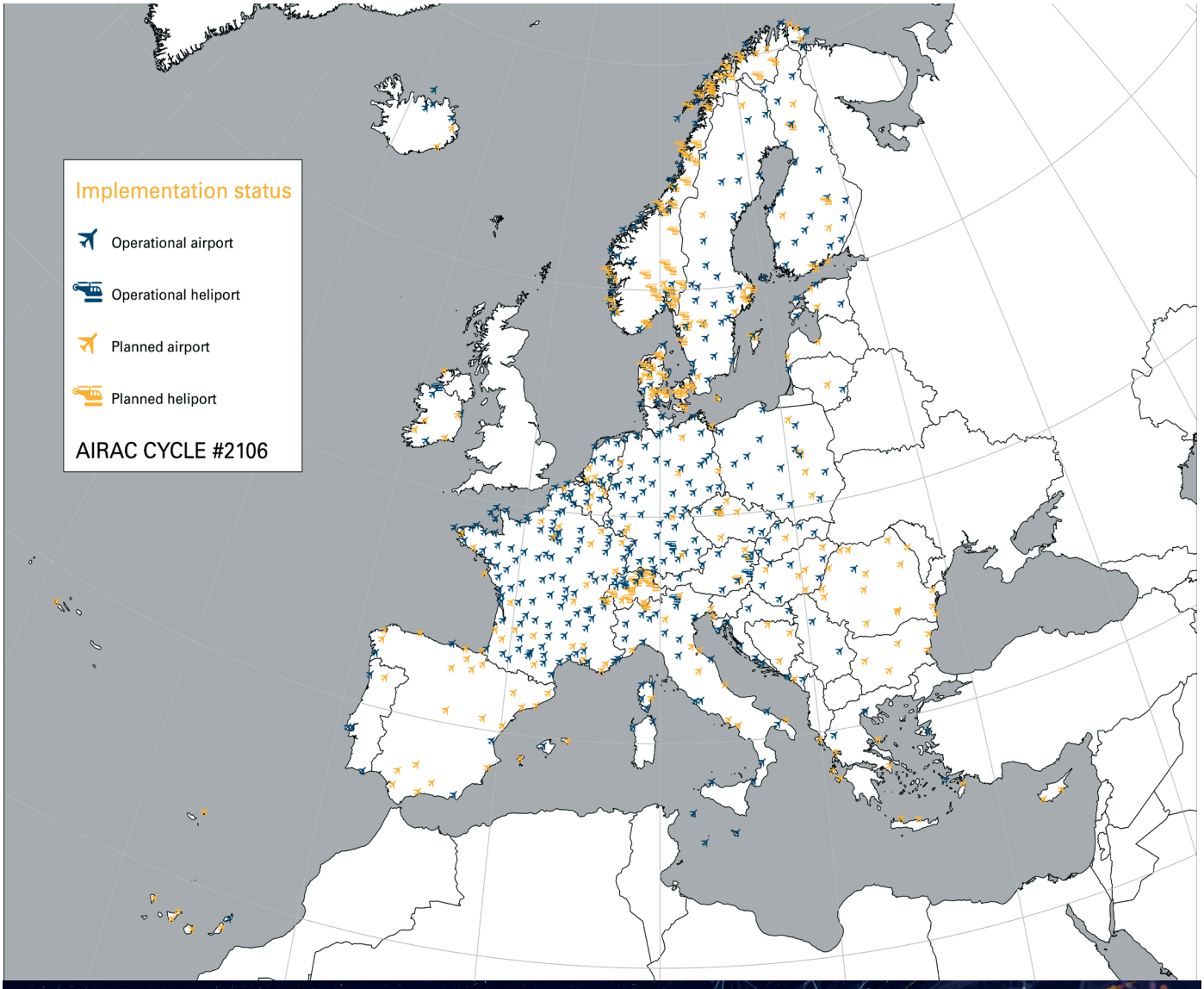
NAVIGATION MADE IN EUROPE

https://egnos-user-support.essp-sas.eu/

ESSP

https://www.essp-sas.eu/

EGNOS implementation



EGNOS Success Stories

WIDEROE

Credits: Wideroe/Kim Vanvik

The adoption of EGNOS in Wideroe's fleet has increased significantly since November 2019, when the first LPV test flights were performed on the DHC-8 Q400 aircraft (see the Success Story here). Today they operate a fleet of 10 DHC-8 Q400 aircraft, all of them equipped with LPV capability. "Wideroe considers that LPV has enormous potential due to its capabilities and accessibility". Initially, Wideroe experienced situations in which the aircraft would be slightly offset from the runway centerline on the short end. However, this anomaly was thoroughly investigated, and they discovered the autopilot gains had to be re-adjusted. When this setting was modified, the offset disappeared.

In addition, the future of the remaining 30 aircraft that constitute their complete operational fleet will be upgraded with SBAS-compatible FMS. The final decision on equipping LPV capability remains to be taken. Special attention has been given to the fleet dedicated to serving the demanding Public Service Obligation (PSO) network of STOLports (Short Take-Off and Landing) at several destinations located alongside the Norwegian coast with remarkably short runways.

Most of the STOLports are equipped with GLS - introduced as early as 2007 - and served by 23 DHC-8 100 and 3 DHC-8 Q200.

As LPV procedures are implemented at these destinations, Wideroe foresees that LPV, preferably LPV Cat I (LPV200), may replace GLS . Some of these destinations are located on the northern coast of Norway, beyond 71° North. However, the recent expansion of the EGNOS SoL Service commitment area to 72° North enables the publication of LPV procedures at all STOLports. Nevertheless, Wideroe is looking at a transition period in which GLS and LPV would co-exist.

> "Wideroe considers that LPV has enormous potential due to its capabilities and accessibility"

The PSO operations Wideroe is committed to providing are critical to coastal communities in Norway and account for 40% of its operations. As a result, and with LPV procedures currently published at 67% of their destinations, they have remained at the top of the list of airlines with more operations during most of the COVID crisis, despite the increasing number of travel restrictions enforced in Europe. Maintaining the bulk of these operations was a decision taken very early on by the Norwegian Government, who even provided financial support to some domestic routes.
Despite all these measures, operations fell by 25% to 35%. However, they are now slowly recovering and reaching "normal figures".

All Wideroe aircraft and crews have remained airworthy as they have operated an increased number of ad-hoc charter flights during the period. Although many flights were very short, they amounted to 350 per day while maintaining a consistently high safety standard in their operations. Moreover, Wideroe made production more flexible, enabling shorter planning timeframes to adjust to the market, which made it possible to reduce operating costs by the same percentage as the reduction in operations. The government even commissioned Wideroe to re-furbish a DHC-8 100 and equip it with two full-size incubators and seven seats. This aircraft was on standby 24 hours a day and could even serve Spitsbergen at 78º degrees North.

Credits: Wideroe

BABCOCK SCANDINAVIAN AIRAMBULANCE

Credits: Babcock

Babcock Scandinavian AirAmbulance has a division in Norway, operating 11 Beechcraft King Air 250 and one (soon to be two) Cessna C680A Latitude. They have their own CAMO Part-145 maintenance organisation and Approved Training Organisation with a Level D Flight Simulator. The fleet is engaged in daily air ambulance missions in Norway, including Svalbard and Jan-Mayen, as civilian air operators under contract by Air Ambulance Services of Norway. Their operational bases are Kirkenes, Alta, Tromso, Bodo, Bronnoysund, Ålesund, and Oslo. As part of their daily operation in Norway's mountainous terrain, 22 airports are classified under risk category B, and 14 airports are classified as critical-class C. The entire fleet is fully LPV capable with two independent FMS/GNSS/SBAS systems.

They started operations in Norway on 1 July 2019 with a completely new aircraft fleet. Most of the approximately 100 pilots came from the previous contractor. The integrated cockpit of their new aircraft fleet was slightly different, and the pilots were new to SBAS operations, including LPV approaches. With that in mind, they slowly started to adopt LPV approaches and soon experienced the transition between conventional and performance-based navigation.

Conventional thinking and transition to PBN

Babcock Scandinavian AirAmbulance's previous training and experience mainly used conventional air navigation (ILS/VOR/NDB). With PBN, a new ballgame emerged. Their experience says that, while it is considerably easier to navigate (using PBN) than conventional navigational aids with all systems operational, solving issues is significantly different when GNSS/SBAS systems are not operating as intended. The C680A was working flawlessly, while the B250s had some issues. It was then that the

> "LPV has been a «game-changer"

Credits: Babcock

EGNOS Helpdesk stepped in and provided expert guidance, solving the problems at hand.

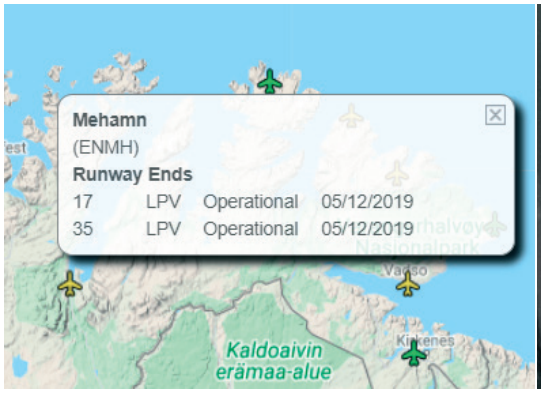
Babcock implemented several mitigation measures to address the issues. The first and most important was to adjust flight and theoretical pilot training by focusing on PBN and LPV. Secondly, weekly meetings were held with the manufacturer. The third measure consisted of an informal site (social media) where articles are posted, and people can comment and share experiences as they do in the office. The work has paid off, and problems are being solved. This is important for Babcock because LPV has been a "game-changer". At Ålesund, on the LPV Cat 1 approach to RWY06, the improved minima has been a significant step in getting the aircraft home, not to mention the increased capability at Molde and Kristiansund. At Harstad, the LPV has better performance than the ILS. The most important step is the increase in possibilities. At some airports with only conventional navaids available, aircraft have to make a demanding circle to land, whereas EGNOS capable aircraft can enjoy a safe straight-in landing with the LPV approach. Mehamn (lat. 71N), the northernmost LPV procedure, is an example of this.

> "At some airports with only conventional navaids available, aircraft have to make a demanding circle to land, whereas EGNOS capable aircraft can enjoy a safe straight-in landing with the LPV approach"

Coping with high latitudes when using GNSS/SBAS

The GNSS antennas are located on top of the aircraft. At higher latitudes, the geostationary EGNOS satellites are lower on the horizon. This implies that when the top of the aircraft is facing north, the GNSS antennas will be in the self-induced aircraft shadow of the EGNOS satellites. Since their aircraft is equipped with dual SBAS receivers, they placed the antennas slightly to the left and right of the roof. Therefore, during the eastbound left bank, they may temporarily lose the right-hand SBAS, and during the westbound right bank, they may temporarily lose the left-hand SBAS. From an operational viewpoint, this

Credits: Babcock



is important to know until a more permanent solution is found.

Conclusion

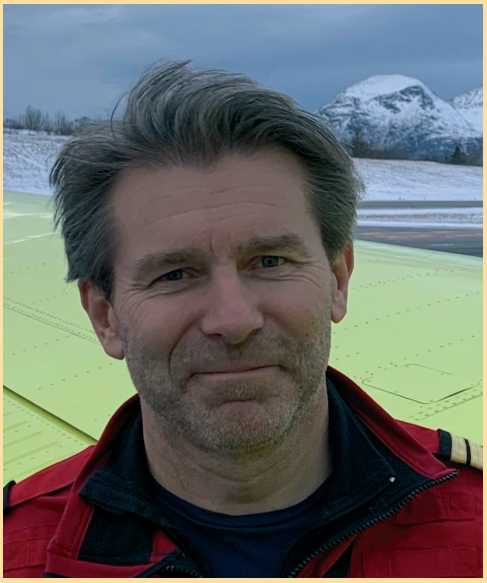
Babcock Scandinavian AirAmbulance has put a great effort into improving LPV operations, and it all starts with knowledge and training. They have committed managers, technicians, and pilots (such as Mads Andre Jarto), and their own Full Flight Simulator approved with SBAS capabilities.

The pilot's experience with EGNOS/LPV

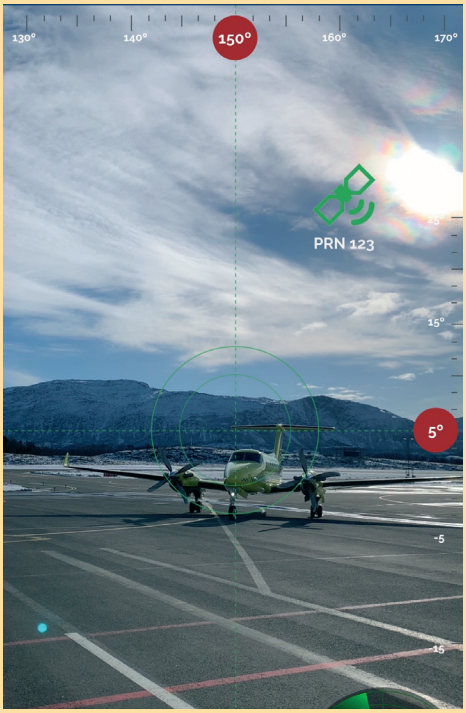
"I am engaged as a pilot in Babcock. I have been an ambulance pilot in Norway for 20 years and have formerly been engaged in several managing positions."

"In my effort to understand the PBN concept and related systems, I conclude that bringing people together is more important than ever, particularly when it comes to exchanging experience."

"The existence of EGNOS Helpdesk was crucial to get started working on our SBAS issues. Initially, our knowledge in the PBN concept was up to date, but when it comes to understanding the system, it was priceless to have a point of contact and experts available to help to get us started resolving the issues observed."



Credits: Babcock



Credits: Babcock

"I also make use of the EGNOS App. One of the greatest features is the satellite finder. To me, this was a huge step in accepting the system. I know the satellites are there, but to actually see them in the sky was all "bringing them down to earth". I call it "the lighthouse in the sky" or a "guardian angel."

"As an old school pilot, I know everything about using and navigating on raw data. The PBN concept is easier to navigate, and, despite the transition effort needed when coming from conventional navigation, most pilots are enthusiastic about the simplicity of navigation and its possibilities. The LPV with EGNOS is fully operationally, and now it's important that we, the users, use it at every opportunity and share our experience. This is the future, and we want to be a part of it!"

Mads Andre Jarto

AIRBALTIC

Credit: airBaltic

airBaltic is a Latvian-based airline that embraces the best of both worlds - traditional network airlines and ultra-low-cost carriers. In this case, geography is essential. Using Riga, the capital of Latvia, as their main hub, they connect the three Baltic countries with a total of 100 destinations through a Hub & Spoke model. In 2020, airBaltic celebrated its 25th anniversary with a fleet consisting of a single aircraft type, the emerging Airbus A220, the first airliner of its class featuring EGNOS & LPV capabilities as standard.

airBaltic is known worldwide for its innovation and punctuality. For several years, the airline has been recognised by OAG as the most punctual carrier in the world. Its fleet is one of the most modern and environmentally friendly in Europe and includes a full business class service and affordable economy class tickets. The A220 is very efficient for the type of routes flown and customers enjoy a wider seat width at 18.5 inches. When airBaltic first ordered the A220s in 2012, it was called the Bombardier C-Series, a clean-sheet design competing with offerings from market leaders Airbus A320 and Boeing B737. But airBaltic saw the potential of the longer-range A220-300 variant and became its global launch customer. EGNOS & LPV capabilities were part of the decision-making process because airBaltic had already planned LPV for the Dash-8 Q400.

> "We are proud to have successfully implemented this modernisation programme with the cooperation of the EU and the EU Agency for the Space Programme (EUSPA)"

airBaltic's initial agreement with Bombardier was for ten aircraft, but even before entry into service, the order had increased to 30 aircraft. The A220 quickly demonstrated an excellent operational and customer experience, saving fuel and exceeding the company's expectations. They received such positive feedback from their pilots, their technical staff, and their passengers, for instance, about the spacious and quiet cabin with superior interiors that, in 2018, airBaltic presented a new business strategy based on a unique fleet around the A220. As a result, they signed a new agreement with Airbus for another 20 planes, now rebranded as A220, plus 30 options.

EGNOS Bulletin asked airBaltic how it managed to get the A220s in the air so soon after purchasing them and turning around its fleet so quickly. airBaltic responded: "We had a very well-defined strategy. We decided to go for an all A220s fleet because it makes things easier for pilots, mechanics, crew training and, in addition to having important operational advantages, the customer response was amazing. The A220 was the most efficient and convenient plane for us to achieve the planned growth to double their passengers from 2019 to 2025. Having a single fleet makes it easier to introduce new fuel-saving initiatives too."

EGNOS is instrumental in fulfilling airBaltic's strategy, as it needs SBAS and LPV approaches to meet its responsibility of being a "HUB", as

Credit: airBaltic

the shorter routes are under a one-hour flight time to transport the passengers between the Baltic countries efficiently. It needs to increase availability, and EGNOS and LPV reduce the chances of not getting to the destination, "come rain or shine". airBaltic's Chief Operating Officer – COO-, is also a Captain and knows it well: he flew the first A220 from Montreal to Riga.

On the first implementation of EGNOS LPV in airBaltic, COO Pauls Cālītis: "As an innovative company, airBaltic is always striving to increase its efficiency and benefit from the most modern technology available. We are proud to have successfully implemented this modernisation programme with the cooperation of the EU and the EU Agency for the Space Programme (EUSPA) co-financing and having paved the way for other European airlines to follow in our footsteps."

During the early days of COVID, an airBaltic A220-300 made a 6-hour and 35-minute flight from Ürümqi Diwopu International Airport in China to Riga, carrying one million face masks and respirators. This was one the longest flights for airBaltic and, since then, several cargo flights have been airBaltic's contribution as part of the effort to combat the COVID pandemic to this very day.

In fact, this pandemic has shown the resilience of the A220, being one of the least-impacted aircraft both for operators, who kept more of them in service during the worst of times and are flying most of them now, and for the manufacturer, who, unparalleled, did not cut production but even increased it.

airBaltic has a strict commitment to reducing its environmental impact, and the A220 is an essential part of that strategy. The A220 was chosen in the first place also based on the reduction of emissions. According to an internal comparison with previously operated fleets, the A220 offers a 19% reduction in fuel & CO2 per seat compared to the Q400 and a 24% reduction per seat compared to the B737CL aircraft on similar routes with the same load factor. The company also benefits from the A220's EGNOS/LPV capabilities by training flight crews to use them to save more fuel and reduce CO2 as much as possible.

In fact, it is working to improve digitalisation with initiatives such as digital passenger lists instead of paper ones.

In 2020, sustainable aviation fuel accounted for 0.6% of the total amount used by the company. Constantly looking for new improvements is a steady job, because all things, even the smallest, add up and contribute to the final goal. EGNOS is a good example, as it contributes new possibilities for saving fuel and CO2. Today, 55% of airBaltic's destinations have LPV procedures in place, so the opportunities are only improving.

> "55% of air baltic's destinations have an LPV procedure in place"

EGNOS SUPPORTS FIGHT AGAINST COVID IN MULTI-PURPOSE DEVICES

Credits. FEDE atomizers

Pulverizadores Fede has been dedicated to developing, designing, and manufacturing air blast sprayers and trailed mist blowers for over fifty years, being specialists in the precision agriculture sector at an international level.

> "They use EGNOS because "it improves the positioning of their solutions, which involves precision spraying, traceability, technology proactivity"

With its R&D projects, in active collaboration with European research centres and universities, it promotes digitising the fields. Its goal is to make agriculture a more sustainable and environmentally-friendly activity and help agricultural companies achieve maximum profitability by offering healthy products to fruit and vegetable consumers.

It has been using EGNOS since 2019. It is automatically configured in H3O technology (Healthy crop, Healthy environment, Healthy finances through Optimization) and the SCG system (Specialty Crops Gateway), leading agronomic management tools in the high-value crop sector.

H3O technology is incorporated into the spraying equipment, forming part of their Smartomiser, an intelligent atomiser connected to a digital platform to manage treatments. Following the instructions from this platform, the device performs precision spraying according to the vegetable mass and records the treatment data for subsequent visualisation and analysis on a map, allowing actual traceability of the treatments. On the other hand, the SCG is a device installed on the tractor that allows recording all the tasks carried out on a map to provide valuable integrated information for tracking fieldwork and its costs.

Dr Lars T. Berger, Chief Technology Officer, explains they use EGNOS because "it improves the positioning of their solutions, which involves precision spraying, traceability, technology proactivity, as well as data collection for

Credits. FEDE atomizers

visualization and analysis. The value of these digitisation solutions relies on the precision and integration of the IoT (Internet of Things) applied to the tasks carried out in the field".

Thanks to the precision provided by EGNOS, machinery guidance and treatment monitoring are improved. It makes it possible to carry out Zone Spray treatments to automatically adapt spraying parameters to the density of plants in the area of each field to be treated. It entails a significant reduction in the environmental impact due to the decrease in the amount of agricultural chemicals sprayed, improving Agri-Food safety and savings in production costs.

Users of Pulverizadores Fede experienced a high level of satisfaction with the H3O and SCG technology and, as Mr Berger expressed: "part of this success is thanks to the benefits provided by EGNOS" which is currently present in more than 400 devices. Some of the equipment has been used during the pandemic to disinfect public spaces against COVID-19. EGNOS enabled precise disinfectant spraying, which was then visualised and analysed on a digital platform to ensure optimal disinfection.

> "Part of this success is thanks to the benefits provided by EGNOS" which is currently present in more than 400 devices"

EGNOS service solutions have been developed in the FieldCompanion Project, which has received funding from the Eurostars-2 Programme and co-funding from the CDTI and Horizon 2020 Programme.

EGNOS CONTRIBUTION TO INFOMAR SURVEYS

Credits: Infomar

INFOMAR is Ireland's national marine mapping programme, a joint programme funded by the Department of Environment, Climate and Communication between the Geological Survey of Ireland and the Marine Institute, whose objective is to map the physical, chemical, Hand biological features of Ireland's seabed.

> "EGNOS has replaced beacon DGPS sources and reduced the number and range of equipment required on our vessels"

INFOMAR surveys primarily collect bathymetry data using multibeam echosounders. The surveys are performed as part of an ongoing effort (over 20 years) to map Ireland's seabed and are currently set to continue until 2026. Surveys are conducted throughout the year, with the greatest effort during summer, when weather conditions are most favourable. They also collect 'backscatter' information from these instruments, enabling them to infer the types of seabed encountered. Additionally, several of the vessels used are fitted with sub-bottom Profilers, geophysical instruments that provide information on the composition and structure of the sub-seafloor. Where required, seabed samples and other measurements are taken.

EGNOS has been utilised on INFOMAR vessels since 2011 when receiving hardware capable of decoding the signals. According to David Hardy, Geologist with the Geological Survey Ireland, "EGNOS has replaced beacon DGPS sources and reduced the number and range of equipment required on our vessels; therefore, it reduced system complexity and potential points of failure". The aim of the surveys is to provide a modern, high-quality baseline dataset. The data are then post-processed and made available to a wide range of users; who use them for hydrographic products, environmental studies, fisheries, renewable energy, oil exploration, marine tourism, aquaculture, regulatory & educational purposes. All data is available free of charge and can be commonly accessed through their website.

> "EGNOS is of significant value to our work and a very clear benefit to us"

All coastal vessels operated by the Geological Survey of Ireland use EGNOS to support real-time navigation within Irish waters, up to 30nm offshore. EGNOS corrections are received, decoded, and applied to improve positional accuracy significantly beyond stand-alone GNSS. Following the acquisition, additional post-processing is performed to improve the navigation solution further, but this is primarily driven by their need to use the Inertial Navigation System (INS) height readings to correct tidal effects (requiring accuracy of <10cm).

Vessel positioning is achieved with Applanix POS MV systems, which utilise Trimble GNSS receivers with an integrated ability to decode and use EGNOS signals. Stand-alone terrestrial GNSS systems from Leica and Trimble are used to support operations.

Mr Hardy emphasizes the advantages of EGNOS since "it is of significant value to our work and a very clear benefit to us. The improved positional quality it provides (beyond bare GNSS) supports the efficiency and safety of our operations. The increased positional certainty allows us to improve our line-keeping and sonar coverage efficiency throughout operations. The improved positioning accuracy also allows us to operate in areas of critical depths with confidence".

EGNOS IN SYNERGY WITH COPERNICUS HELPS IMPROVING DRAINAGE SYSTEMS AND VARIABLE RATE FERTILIZATION

Credits: Credits: GRAP, University of Lleida

Figure 1. Veris 3100 Soil EC Surveyor of the University of Lleida with GNSS and EGNOS receiver

Using in situ sensors and satellite remote sensing, it is possible to obtain information on soil anomalies, enabling farmers to take corrective actions in the field. This information is given through a pre-set field map that allows farmers to identify, in a user-friendly way, which areas need a specific treatment.

Measuring apparent electrical conductivity (ECa) with sensors in the field is a very useful means used in precision agriculture to obtain a pre-set field map since ECa reflects the combination of different parameters that affect soils, such as the combination of the salts content, textural components, clay mineralogy, cation exchange capacity, moisture content, depth, etc. Therefore, ECa allows monitoring the spatial variability of soil properties at a plot scale.

The AgroICT & Precision Agriculture Research Group (GRAP) of the University of Lleida/ Agrotecnio-CERCA Center is applying a technology that measures soil ECa using a device that georeferences the measurements using EGNOS together with Sentinel-2 images (Copernicus Programme) to identify drainage problems in some parts of the field and, therefore, understand the causes of crop development and yield variability.

The existing sensors to measure ECa differ according to the method used. The following is an application of a galvanic contact sensor named Veris 3100 Soil EC Surveyor (Veris Technologies Inc.). The system is connected to a GNSS receiver and performs continuous on-the-go measurements at a rate of 1 point/s, so that an ECa survey can have sample densities between 200-900 points/ha, depending on the travel speed of the sensor and the distance between paths. Each measured point has latitude, longitude, altitude, and ECa information. These measurements are interpolated using geostatistical methods (kriging), resulting in an accurate ECa map, which relates to soil properties and crop vigour or yield, providing valuable information for in-field zoning of soil variability.

EGNOS contributes to georeference ECa measurements, allowing to obtain an improved ECa map thanks to the sub-metric geolocation of sampled points. Therefore, the ECa map is very useful information for identifying saline soils and areas to extend the drainage network to improve soil conditions.

Satellite-derived information was taken with Sentinel-2 (Copernicus) providing soil and crop

Credits: Credits: GRAP, University of Lleida

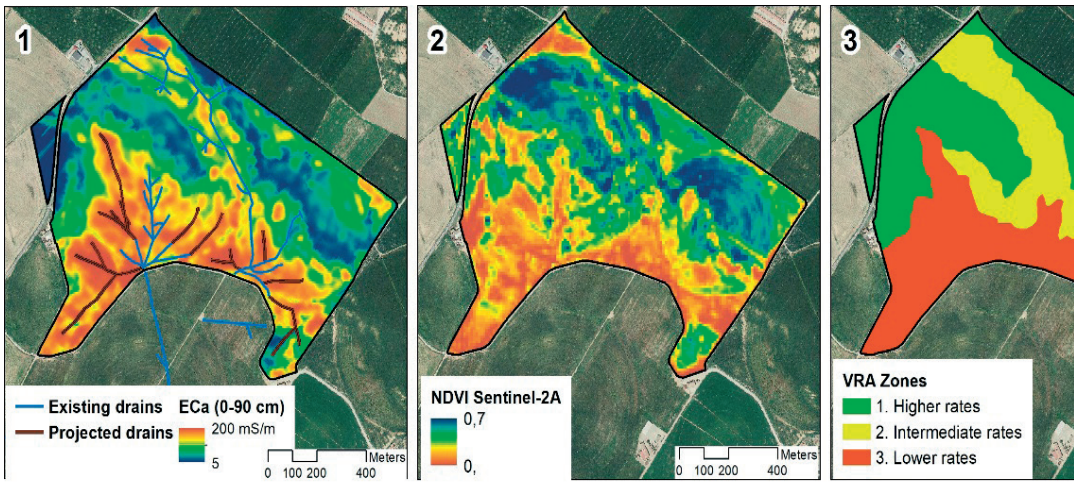


Figure 2. 1: ECa map and existing drainage network. 2: Sentinel-2 NDVI map showing the development stage of fields in the middle of the previous season's crop. 3: Variable-Rate-Application zones derived from 1 and 2 for variable seeding and fertilising of the next season.

conditions indicators, such as the Normalized Difference Vegetation Index (NDVI).

The figure above shows the map of apparent soil electrical conductivity (ECa) taken, using EGNOS to georeference those points and the NDVI derived by Sentinel-2 images in an agricultural crop field (maize):

On the one hand, from the ECa map (Fig. 2.1), high ECa values (above 100 mS/m) are interpreted as corresponding to saline soils with limited drainage, while low ECa values corresponded to soils with loam sand texture and frequent gravel content.

> "Thanks to the ECa map improved with EGNOS and the information derived from Sentinel-2, it has been possible to increase the cost-benefit ratio of agricultural crops"

On the other hand, the NDVI map (Fig. 2.2) confirmed the findings of the ECa survey: the crop in saline and poorly drained soils developed much less than in areas with moderate to low ECa. José Antonio Martínez Casasnovas from GRAP says: "If the drainage systems had not been improved and organic modifications had been made, crop development and yields in the high ECa value areas would not have improved. Thanks to the ECa map improved with EGNOS and the information derived from Sentinel-2, it has been possible to increase the cost-benefit ratio of agricultural crops".

In this particular case, this site-specific management, made possible thanks toby the usinge of both European programs, EGNOS as a georeference source and Copernicus images for NDVI, allowed the farmer to increase the cost-benefit ratio by 11% compared to the traditional uniform management.

Did you know...?

EGNSS-Copernicus synergies by EUSPA

The EU Agency for the Space Programme (EUSPA) is responsible for promoting user adoption, particularly fostering synergies between GNSS and Earth Observation. The European Space programme, Galileo, EGNOS, and Copernicus, is helping to protect the environment by driving innovation and enabling solutions that increase efficiency across a wide range of sectors, with agriculture, in particular, helping to reduce the environmental footprint.

IEC Standardisation for SBAS L1 Maritime Receivers

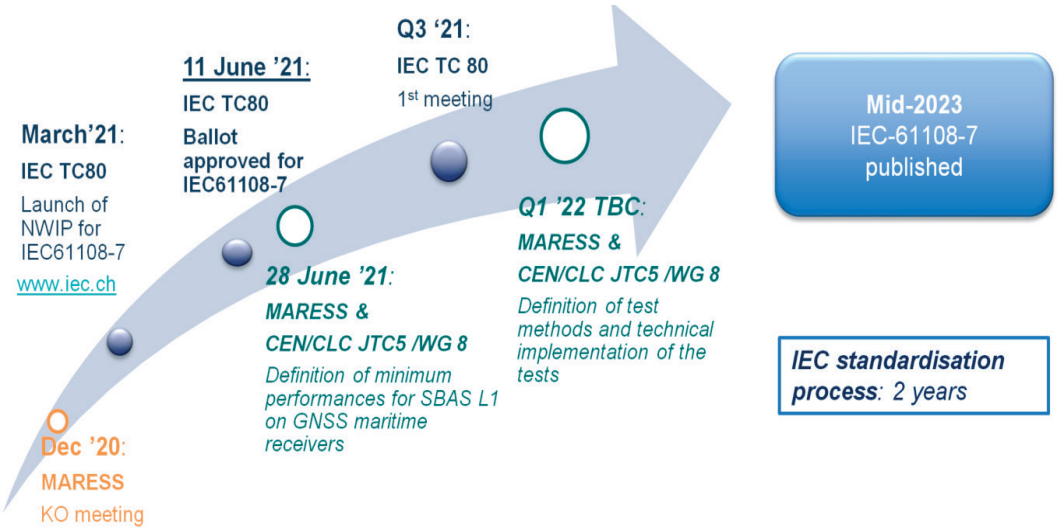


Figure: Tentative plan for the standardisation process

To ensure safe use of SBAS by all shipborne receivers, an IEC[1] 61108 standard for SBAS L1 maritime receiver equipment should be published. IEC 61108 is a collection of IEC standards for «Maritime navigation and radio-communication equipment and systems - Global navigation satellite systems (GNSS)».

A new IEC 61108 standard is planned to be developed to include the minimum performance of SBAS L1 maritime GNSS receivers that receiver equipment must meet to be compliant with the IMO[2] Resolution A.1046 (27) operational requirements for harbour entrances, harbour approaches and coastal waters, along with the test methods and required test results.

At this point, two initiatives are currently working to support this standardisation process:

- Firstly, the EU Agency for the Space Program (EUSPA) and the European Commission (EC) have launched the MARESS (Maritime Receiver SBAS Standardisation) Project, where ESSP, BNAE, CEREMA, and the Gustave Eiffel University are working during 2021 on the production of technical documentation to support IEC standardisation.
- Secondly, CEN, the European Standardisation Committee, through its Technical Committee 5 dedicated to Space, has created Working Group 8 (CEN/CLC JTC5 /WG 8) of the SBAS receiver performance for maritime applications in September 2020. This group will present the results of the MARESS project to reach a common agreement on the draft of IEC-61108 Part 7 for SBAS L1 receiver equipment, to be submitted to IEC Technical Committee 80 (Maritime navigation and radiocommunication equipment and systems).

The ballot for the New Work Item Proposal IEC 61108-7 standard closed in June 2021, approving the start of the IEC standardisation process within IEC TC-80, which may take about two years. The target is to publish the IEC 61108-7 standard "Maritime navigation and radiocommunication equipment and systems – SBAS L1 Receiver equipment" by mid-2023.

[1] *IEC (International Electrotechnical Commission)*
[2] *IMO (International Maritime Organization*

Talking About EGNOS with...Rega

In this EGNOS Bulletin edition, we are going to talk about EGNOS with Heinz Leibundgut (Nominated Person Flight Operations Helicopter and Member of the Management Board) from Swiss Air-Rescue Rega, a well-known air operator inside the EGNOS/LPV community. Rega is a Swiss non-profit organisation that provides expert assistance by air by transporting medical care to the casualty and help in emergencies.

Credits: Rega

H125 training helicopter | AgustaWestland Da Vinci | Airbus Helicopters H145

Credits: Rega

Heinz, introduce Rega's mission and history to our readers.

"Rega is a non-profit private organisation that guarantees an around-the-clock assistance service to the Swiss population. Our missions are characterised by our highly qualified, professional members of staff and the very best equipment available in the fields of rescue, medical, and flight technology. Our highly skilled crews result from an enormous effort in training and the use of state-of-the-art technology. We are financed by means of private funding, which enables us to operate independently in the service of our patients. 3,6 million donors are the ones that keep Rega working by providing a yearly donation. This is very important for us. All the community accept Rega as an air rescue service that has to be there due to the special topography Switzerland has. People in distress need to be able to go to a faraway hospital in case of need. And Rega has become an identity sign in Switzerland; pupils at school are taught about Rega, and the donations are made every year, so it is a service that is very anchored."

How is Rega organised in terms of flight operations? What are your routes and helicopter bases?

"In Switzerland, Rega operates 12 helicopter bases, as well as a partner base in Geneva. Since August 2019, it also has a training base in Grenchen, in Canton Solothurn. Our helicopter bases are distributed throughout the country in such a way that we can fly to any location within Rega's operational area within 15 minutes. Everything is controlled in Rega's Operations Centre, where the flight coordinators answer emergency calls around the clock and coordinate more than 17,000 missions every year, both at home and abroad."

What about your fleet and capabilities?

"Our fleet is composed of 19 rotorcraft and 3 Challenger CL-650 ambulance aircraft. Among the 19 helicopters, there are 7 Airbus Helicopters H145, 11 Augusta Westland AW109Da Vinci, and a single Airbus Helicopters H125, used for training purposes. When we order new rotorcraft, we want to have the best and more advanced equipment on -board for our critical missions, so we chose the best possible solution on the market. And that is a long- term decision because we want them to be used for many years, so we have to design our requirements carefully –usually, the equipment gets lighter if the configuration is properly arranged, and that is a demanding issue for our missions-.

Credits: Rega

Credits: Rega

In today's world, the requirement to perform EGNOS navigation with modern helicopters is the standard. At the time we bought the AW109DaVinci, this was not yet the case. The AW109Da Vinci helicopters were not EGNOS/LPV equipped from the production line.

> "We have been using EGNOS for our IFR operations since 2011, and all our rotorcraft fleet is perfectly equipped for that purpose"

In the year 2010, Rega participated in the Helicopters Deploy GNSS in Europe (HEDGE) Working Package 4 to demonstrate the benefits of EGNOS LPV for Helicopter Emergency Medical Services. The flight demonstration performed by Rega in collaboration with AgustaWestland, Hickok Associates Inc, Cobham/Chelton, Pildo Labs, EASA, and ESSP allowed validating the first Helicopter LPV PinS (Point-in-Space) approach in Europe to a HEMS pad located at the Hospital in Interlaken, Switzerland.

The LPV approach was designed by Hickok Association. As the helicopter ICAO-APV criteria were still under development at the IFPP level, Eurocontrol/EASA permitted the use of design criteria approved by the FAA. The procedure was created by Hickock Associates – an FAA-approved designer."

Rega has been related to EGNOS and LPV since the very beginnings of its use in aviation. Could you briefly tell us about your experience with EGNOS in rotorcraft operations?

"We have been using EGNOS for our IFR operations since 2011, and all our rotorcraft fleet is perfectly equipped for that purpose. In addition, the EGNOS-based procedures we fly belong to Rega, and they are designed according to PANS OPS criteria but configured and tailored so that it suits the requirements of our operations. Not every aircraft can fly these procedures, and this is a crucial point, so fleet and flight procedures must be synchronised. Often, it is an operational problem, as the procedure has to be designed in such a way that it fits into the mountainous landscape and achieves an interesting approach altitude.

We noticed that, in an operational area such as Switzerland, we needed to reach lower approach heights than the actual ones. Correspondingly, in 2014 Rega took part in the PROuD (PBN Rotorcraft Procedures under Demonstration), a SESAR joint undertaken project.

The PROuD purpose was intended to demonstrate improvements in rotorcraft operations, particularly for HEMS (Helicopter Emergency Medical

Services) and SAR (Search and Rescue), through the implementation of Performance Based Navigation (PBN) procedures for approach, departure and Low Level IFR Routes (LLR) in European scenarios, challenging for weather conditions, visibility limitations or geographical configuration. As demonstrated in the former ProuD project, and now confirmed in Rega's internal Advanced Rotorcraft IFR Operation in Switzerland (ARIOS) project, today's helicopters, supported by the digital autopilot and the help of EGNOS, can fly RNP AR 0.1 procedures within the required tolerance."

Any feedback from the pilots?

"They are very happy with the procedures. It could happen that the weather turns ugly, and they cannot land or take off. In that case, the pilot cannot do anything but wait while they fight for the patients' life. Imagine the pilot having to communicate to the doctor that they cannot go to the closest hospital just because they have a cloud (which is pretty common). That cannot happen, and thanks to these EGNOS-based procedures, all the stakeholders work in harmony to prevent this situation. Pilots need to be able to safely fly their patients to where they need to be. That is why we have very strict policies to comply with their motto "mission first, safety always.

That is why they train pilots and HEMS Crew Members twice a year. We have access to the Rega AW109SP FFS, certified for RNP-AR 0.3, and the H145 FFS in Cologne Hangelarand. That is also the reason why they do many training hours in the simulator, to be able to have the task automated. In summary, our final goal is to allow patients to arrive at the hospital on time without compromising the safety of the patient."

What news is Rega bringing to our readers in this Bulletin's edition?

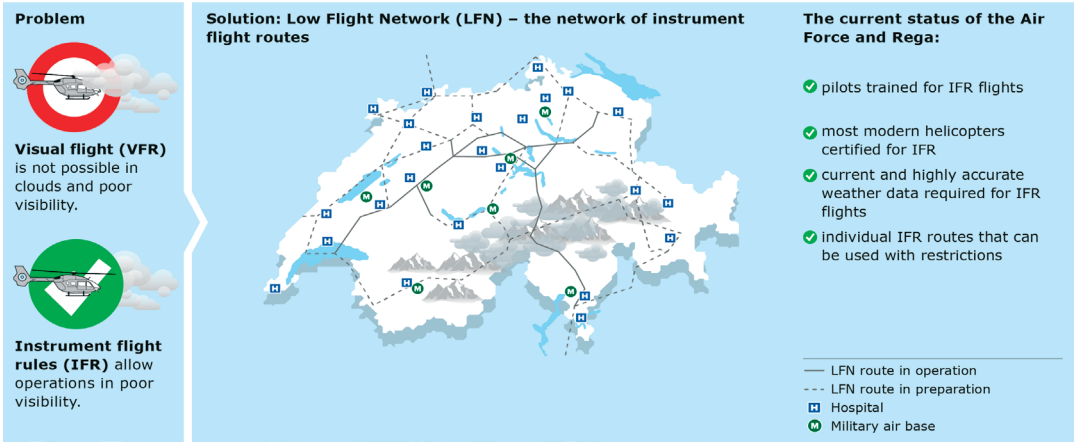
"There are two state-of-the-art projects related to EGNOS ongoing inside Rega. One is the creation of a national network of IFR routes and subsequent approach and departure procedures –the national Low-Flight-Network (nLFN)- and another one comprises a pilot project for the use of EGNOS in RNP 0.1 AR procedures at two locations in Switzerland."

> "Thanks to these EGNOS-based procedures, all the stakeholders work in harmony to prevent this situation"

In addition to the necessary navigation performance (RNP_AR), we expect the AW169 "IceBirde" in 2023, which will be equipped with a de-icing system that will allow Rega a further step in the direction of air rescue as weather-independent as possible."

The Low Flight Network

"Poor visibility is still the most common reason for a Rega crew being unable to embark on a mission or having to abort one that is already underway. To be able to help even more people in distress in the future, for many years Rega has been pursuing its vision of all-weather air rescue. We collaborated with the Swiss Air Force and the Skyguide air navigation service to develop the so-called Low Flight Network (LFN), which enables us to perform rescue missions in almost any weather. The Low Flight Network is designed for establishing a practical, efficient, and quick connection between all critical landing points for air rescue throughout the country, including hospital landing areas, military airfields, and Rega



Credits: Rega

Credits: Rega

bases. This network brings the possibility to safely be able to fly in poor visibility conditions, making use of this "sky highway" that is optimised for this kind of operations. Since the end of 2020, the Low Flight Network is considered a critical infrastructure in Switzerland, so the development of this LFN has become a critical issue at a national level. Both chambers of the Swiss parliament were in favour of the further expansion and operation of the Low Flight Network, becoming the responsibility of the federal government, which will now push forward the implementation of LLRs."

> "To be able to fly in fog and falling snow, including, for example, the LLR and PinS/LPV procedures based on EGNOS"

Pilot project on RNP AR 0.1

"We needed an RNP0.1 navigation specification to reduce the decision altitude to avoid icing conditions as much as possible, so we had to implement an RNP AR procedure, and it will use the EGNOS system. Working together with the helicopter manufacturer, we have performed several flights tests already. Now, we need to have a certified aircraft. This task is managed by Leonardo Helicopters. To get the aircraft certified for RNP 0.1 AR procedures, we need to have approved RNP 0.1 AR procedures implemented before the aircraft can be certified. On the other side, the publication of such procedures is difficult without having a certified helicopter. It's some sort of the classic 'chicken and egg problem'."

Finally, please, add any topic you would like to discuss.

"Every year, bad weather prevents around 600 people in Switzerland from receiving emergency assistance by air. Rega wants to change this situation and, in the future, help even more people in distress. It has therefore launched a series of measures that will enable its helicopters also to be able to fly in fog and falling snow, including, for example, the LLR and PinS/LPV procedures based on EGNOS."

Did you know...?

What is up with the LPs?

If you are interested in understanding why sometimes it is not possible to implement an LPV in a given location instead of an LP, do not miss the clear explanation given in FAA SatNav News, Winter 2021 issue, page 12.

EGNOS for rotorcraft operations

EGNOS enhances vertical precision and integrity, improving safety, accessibility and efficiency for operators, pilots and helipads across Europe.
When bad visibility conditions do not allow flights under Visual Flight Rules (VFR) to operate, EGNOS brings the possibility to fly under Instrumental Flight Rules (IFR) without the need of implementing ground infrastructure. This is a key factor at zones in which helicopter operations take relevance, such as hospital landing areas or low visibility airspace above difficult-to-access terrain.
There are two main rotorcraft services enabled by EGNOS: Point-in-Space (PinS) approach procedures and operations with RNP 0.3 Navigation Specification.

Point-In-Space (PinS) approach

A Point-in-Space (PinS) approach is an operation designed for helicopters that provides them with horizontal and vertical guidance to a designated point in space –and not directly to the landing area- at which the pilot must decide whether enough visual references from the landing area are obtained or not. In case they are, the helicopter should complete this final segment of the operation visually. If visual references are not obtained, the rotorcraft should perform an instrument missed approach.

The final visual segment from the PinS to the Final Approach and Take Off (FATO) point can be performed as:

i. **"Proceed VFR":** Before or at the time of reaching the PinS point, and when the visual reference is obtained, the pilot switches from IFR to VFR. Thus, the see and avoid principle has to be applied, and there is no procedure-related obstacle clearance. Consequently, the visual segment is flown under the same requirements as every other VFR flight. Thereby, it requires Visual Meteorological Conditions (VMC) to be met.

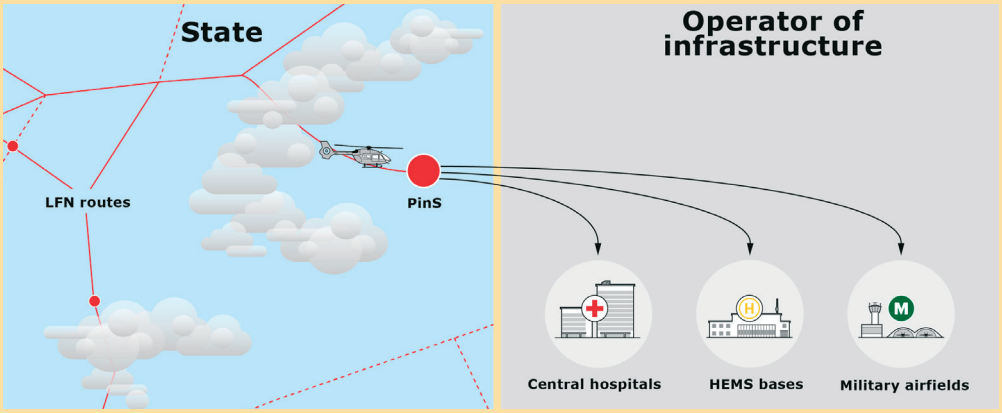
ii. **"Proceed visually":** Before or at the time of reaching the PinS point, the pilot gets visual reference. The final segment is manoeuvred visually under IFR from the PinS to the FATO, including an obstacle clearance for this segment. Therefore, VMC are not needed.

RNP 0.3 routes

The RNP 0.3 specification refers to the level of performance required for a specific block of airspace of ± 0.3 NM (Nautical Miles) for at least 95% of the flight time. It allows a helicopter to fly a specific path between two 3D-defined points in space.

Credits: Rega

The aircraft must have both airworthiness and operational approval for RNP 0.3. A typical RNP-compliant installation would at least consist of FMS (Flight Management System) equipment with GNSS sensor meeting ETSO-C146 (SBAS).



Credits: Rega

EGNOS services highlights

SERVICE BASELINE DOCUMENTATION

NEW SOL SDD V3.4 PUBLICATION

NEW SOL

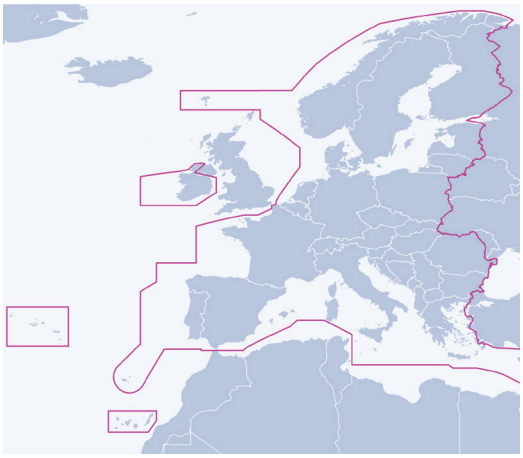
Service Definition Document, Issue 3.4

The new version of the Service Definition Document (SDD) for the EGNOS Safety of Life service (SoL) was released on 4 May 2021. The EGNOS SoL service supports safety-critical operations in the aviation domain, such as Approaches with Vertical Guidance (APV-I) and Category I precision approaches.

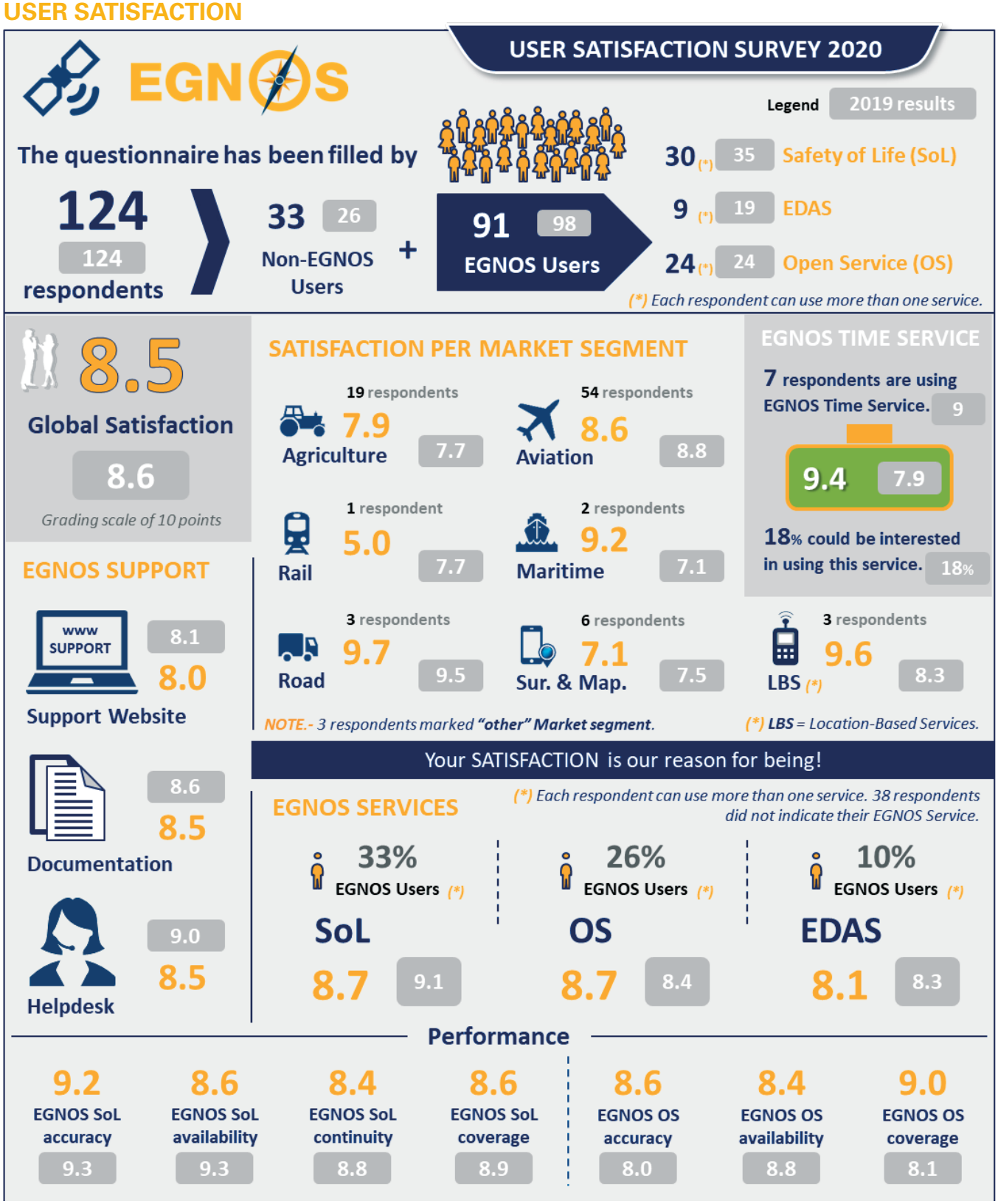
In this version, the SoL service region actively pursued by the EGNOS Programme (the magenta inner area) has been updated, following the withdrawal of the United Kingdom (UK) from the European Union (EU). This region includes EU member states and third countries that have an agreement with the EU for the use of the EGNOS SoL service. Beyond this region, the EGNOS SoL Service for non-EU areas is not ensured in the absence of EGNOS Working Agreements (EWAs), which will be the case in the UK, as EWAs with UK Air Navigation Service Providers (ANSPs) will be terminated on 25 June 2021.

In this release, a new continuity risk level, <2.0x10-4, has also been introduced within the performance commitment maps for APV-I and LPV-200 service levels. This new level, between <1.0x10-4 and <5.0x10-4 values (already presented in the former SoL SDD version), provides more accurate geographical information on the minimum continuity performances expected for the two EGNOS SoL service levels.

In addition to the above, the SoL SDD contains updated information on the EGNOS SoL service and system status. Also, the text encompasses information of interest to aviation users: conditions of use, information for ANSP on EGNOS Working Agreements, and the relationship of Performance Based Navigation (PBN) specifications with all EGNOS SoL Service Levels.



USER SATISFACTION



EGNOS HELPDESK

We are pleased to remind EGNOS users about the availability of our Helpdesk service, allowing to submit any kind of question related to EGNOS or to report any experienced issue.

We will be pleased to hear from you!

Our pull of experts is ready to quickly provide support on:

- Troubleshooting assistance
- EDAS Registrations management
- Answering general and technical EGNOS questions (about Usage, Architecture, Documentation, Performance, Coverage area, etc.)

The EGNOS Helpdesk interacts with users every day, providing a customized helpdesk experience focused on each type of user and delivering the fastest resolution time possible.

During **2020**, our users rated the service with **9.1** and, so far, in **2021** we are at **9.2**!

But we don't want to settle for this. Our team looks forward to continuously improving the service and support the EGNOS Helpdesk provides to the EGNOS community.

Let's answer your questions!

What are our users asking?

- Am I inside the EGNOS coverage area?
- How can I know if a drone can use EGNOS?
- What is EDAS?
- What can I obtain with EDAS?
- Is my receiver compatible with EGNOS?
- Where can I get HPL, HPE, VPL and VPE historical data?
- How could EGNOS help users in the maritime sector?

Use the channel you prefer to contact the EGNOS Helpdesk...

... via online form: available at the EGNOS User Support Website and the EGNOS app (**Android** and **iOS** versions), send us an email or give us a call.

EGNOS Helpdesk 24/7

+34 911 236 555 | egnos-helpdesk@essp-sas.eu | online form

What's going on...

in aviation.

NARROW-BODY AIRCRAFT GETS THROUGH COVID-19 CRISIS

Although there seems to be light at the end of the tunnel, the aviation market is still struggling with the COVID-19 crisis in 2021. Vaccination is accelerating rapidly, and we can say that the aviation economy is slowly starting to recover, but let's be cautious. A few short-range flights were the only ones that remained operational during the worst stage of the pandemic, and it is these flights that are positioned at the forefront of the pandemic recovery, supporting the first wave of tourist and business travel in 2021.

And that is one of the characteristics of this crisis, which was analysed in-depth in EGNOS Bulletin Issue 34 "Autumn'20 edition". Those airline market segments that are usually related to narrow-body aircraft, such as regional and business aviation, were less affected compared to mainline airlines, whose fleet is made up of wider aircraft units.

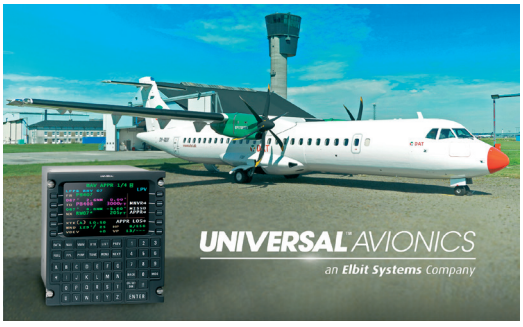
As an example, we can read news, articles, and studies concluding that, Embraer seems to maintain, not cancel, and even increase its orders during these trying times compared to wider commercial aircraft manufacturers. Furthermore, the new generation of E-jets E2 is succeeding within European aviation. Given the importance of reducing environmental impact, the fuel efficiency that characterises these jets, combined with their attractiveness for regional and business aviation, make this new generation a robust market today. With rumours about the introduction of all-electric planes in regional aviation, the horizon in the near future for the narrow-body aircraft market looks brighter than ever.

UNIVERSAL SOLUTIONS FOR LPV

Universal Avionics –UA- has introduced two new STCs that implement LPV capabilities for ATR regional aircraft using UA solutions. One of them, the EASA STC 10072190 REV. 1, developed by DOA AEROTEC CONCEPT in France, applies to the ATR42/72, models 100, 200, 300, and 400, and is a dual FMS UNS-1Lw installation for Automatic Dependent Surveillance–Broadcast (ADS-B) out and compliance with PBN RNAV & RNP specifications, including LPV.

The other, the EASA STC 10075588, developed by DOA 365 AEROSPACE DDS LIMITED in Ireland, applies to other models of the ATR42/72, prior to the current 600 model, and introduces the ADS-B Out and Single UNS-1Lw Flight Management System, including the Localizer Performance with Vertical Guidance (LPV) Monitor.

UA presented the latter in a user-case focused webinar event last March 2021 (on-demand replay available here). The LPV vertically coupled with ADS-B out compliance solution provided commonality for a mixed fleet of ATR42 and 72 200/500 types and models with minimal impact on crew training and workload thanks to a common FMS for all flight phases.



Credits: Universal Avionics

UA invited the EGNOS Adoption Team to give a quick update on the implementation of EGNOS in Europe and highlight the interoperability of different SBAS worldwide, with real examples of EGNOS and WAAS.

You can easily search the SBAS & LPV available STC and SB solutions for any aircraft, including the two mentioned above, with this free tool at the EGNOS User Support Website.

in aviation.

CALL4GRANTS

Accelerating the adoption of EGNOS in transport

From 30 March until 19 July 2021, a proposal can be submitted to apply for funding to implement EGNOS-based operations in civil aviation, inland waterways, and rail. All details are available at this link, together with answers to questions raised by participants in the information webinar organised by EUSPA on 23 April.

Credits: EUSPA

in agriculture.

FAST PLATFORM FOR CAP USING COPERNICUS

EU technologies (such as Copernicus and EGNOS) enable more efficient and sustainable management of farming activities, contributing to the Farm to Fork (F2F) strategy. In particular, the EU Commission is working with Member States to apply precise and sustainable fertiliser techniques to be included in CAP strategic plans. This is the case of the agricultural sustainability tool for nutrient management (FaST) based on space data (Copernicus, EGNSS) that will make agriculture, environment, and sustainability capacities available.

Did you know...?

ERGO (Panel of Experts in Rail for EGNSS Operational use)

Did you know that a working group of rail experts has been created to assist the EUSPA in consolidating and validating an EGNSS-based Safety Service concept tailored to the rail community and in line with the ERTMS standards? The panel is called ERGO (Panel of Experts in Rail for EGNSS Operational use).

Did you know...?

Greener Aviation

Aviation is taking decisive steps to align with the European Green Deal, an ambitious package to make the EU the first climate-neutral society by 2050. Next-Gen "greener" aircraft are being developed, and aircraft operators are showing interest in them. These planes go beyond fossil fuel and Sustainable Aviation Fuels. Some are pure electric battery designs, the 9-seat Tecnam P-Volt, endorsed by Wideroe, and Finnair's 19-seat Heart Aerospace ES-19. Airbus is moving ahead with new ZEROe aircraft using a combination of hydrogen (H2) fuel cells and H2 hybrid propulsion for 100-200 seats and 1000-2000 nm, which could fly by 2035.

in rail.

RAILTECH

RailTech Europe 2021 was conceived to showcase the latest innovations that will shape the future railways and was the perfect platform to do so. With more than 8,000 unique visitors from over 90 different nationalities, RailTech Europe 2021 reinforced itself as one of the largest railway events worldwide. Over three days, visitors to this digital event were hosted by more than 100 speakers on three different stages packed with content and live networking.

The first day on the main stage was devoted to covering the European Year of Rail, an initiative of the European Commission to highlight the benefits of rail as a sustainable, smart, and safe mode of transport.

The second day, which focused on Digital Railway, covered the challenges of ERTMS, digitalisation, and new technologies. In this section, the GSA (new EUSPA) and the ESSP jointly gave a presentation on "Precise and reliable train localisation thanks to EGNOS," addressing various aspects of the use of EGNOS in safety and non-safety applications in the rail market segment.

Finally, Smart Infrastructure was the hot topic of the last day, with a special focus on predictive maintenance to enhance capacity and increase railway infrastructure efficiency.

If you were unable to attend, you still have the opportunity to access all the sessions through this link.

Credits: Railtech

in maritime.

SEGRA PROJECT

ESSP is participating with Kongsberg in the development of guidelines for shipborne manufacturers for the implementation of SBAS Double Frequency Multi-Constellation (DFMC) open service within the SEGRA project, which will include augmentation to GPS and Galileo constellations for L1 and L5 frequencies. These guidelines will include the minimum receiver requirements for SBAS DFMC processing, along with the required testing to validate the safe use of SBAS for maritime applications.

Kongsberg is a Norwegian technology enterprise that delivers systems for positioning, surveying, navigation, and automation to merchant vessels and offshore installations. Kongsberg, who is leading SEGRA project, will develop and install firmware in a shipborne receiver to process SBAS DFMC messages in line with these guidelines, being validated according to the test specification defined within this project.

Kongsberg shipborne receiver

Credits: Kongsberg

Upcoming Events

WORLD ATM CONGRESS 2021

26 - 28 Oct

A new edition of the World ATM Congress, the most important Air Navigation Services Providers (ANSPs) congress globally, will be held once again in Madrid from 26-28 October 2021.
Operated by CANSO BV in association with the Air Traffic Control Association (ATCA), the event provides an excellent opportunity for worldwide ANSPs and the ATM Industry to meet. Visitors will have the chance to tour the exhibition and enjoy a large number of free conferences.

EGNOS will be present at Stand 1141

World ATM Congress

Did you know...?

EGNOS configuration update and GPS III
On 9 April, the EGNOS configuration change was successfully completed to include PRN14 (SVN 77), the fourth GPS satellite in the Block III family, launched by the United States at the end of 2020, as part of the GPS modernization plan. This change ensures that all EGNOS users will be able to obtain SBAS correction for the entire GPS constellation in Europe and will increase the robustness of the system, mainly in regions located at the border of the Service area. With this change, EGNOS demonstrates once again its commitment to delivering a high-quality service in Europe.

https://egnos-user-support.essp-sas.eu

EGNOS applications. Developers platform. Business support.
Information on historical and real-time EGNOS performance. EGNOS Signal in Space (SIS) status. Forecast on SIS availability and EGNOS performance. EDAS information and registration. EGNOS adoption material and tools.

For questions & information

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EUSPA European Union Agency for the Space Programme

ESSP

NAVIGATION MADE IN EUROPE