Q&A

09:40-11:00 EGNOS programme update

EGNOS programme status	EUSPA

Q: Will the UK remain a participating state on EGNOS?

A: UK is no longer a participating state to EGNOS.

Q: 99 % availability for LPV 200 was a good achievement for the period 2011- 2021. But now, as mentioned by Mr. Da Costa, aviation is moving to full PBN environment, and 99% is an ICAO specification for low use of EGNOS (15 min availability per day) not meeting full PBN aviation environment by 2030. When is EUSPA going to increase the objectives toward e.g. 99,9% LPV 200 availability?

A: EUSPA concurs with the need to increase the LPV-200 availability objective above 99%, up to 99.9%. The programme is currently engaged in a step-wise performance improvement plan, relying on 242B and 3.1 releases to improve the L1 GPS-only based LPV-200 service and then V3.2 and EGNOS Next to further improve performances of DFMC based LPV-200 services. The expected steps and schedule of performance improvements will be consolidated on the basis of the EGNOS V3 development reviews in the 2022-23 timeframe.

Q: 99% is a nice stable performance for LPV 200, but to achieve the goals explained by Mr. Da Costa in the introduction (full PBN environment), this is still a potential loss of coverage of 15 mins per day, therefore not acceptable by aviation. When will GSA accept this fact and propose a significant availability target increase?

A: See previous answer.

EGNOS services performance status	ESSP

Q: Is it possible to access to the detailed information on EGNOS performance like the maps and results you have presented in the slides?

A: Yes, the performance information, including monthly and yearly performance reports, daily maps and results, and real-time performance information can be found in the EGNOS User Support Website (https://egnos-user-support.essp-sas.eu/). This website represents the main source of information relative to the different EGNOS services status and performance. As part of this website the users have the opportunity to register to access additional contents subscribe to a notification system or receive information when new information is available.

Q: During the year 2020 some problems were reported linked to the use of GPS-III satellites by EGNOS due to the need of qualifying this new block of satellites. What is the status of this activity?

A: Today EGNOS is completely qualified for the use of GPS block-III satellites and so the users can compute the EGNOS position using all the GPS satellites operational with no limitations. When a new satellite is declared as operational by GPS, the configuration of the system is updated allowing the receivers to include them as part of the EGNOS solution.

Q: You have mentioned some figures relative to compliance with different commitments provided by EGNOS, are these commitments available to the users and how can I find them?

A: The commitments for the different services, Safety of Life, Open Service and EDAS can be found in the respective SDDs,

Service Definition Documents, which include the description of the services, conditions of use and the commitments for each of them. The Service Definition Documents can be found in the EGNOS User Support Website (https://egnos-user-support.essp-sas.eu/).

Q: Where can I find the historical performance for the different LPV or LPV200 procedures in Europe?

A: This information is available, in a monthly basis, as part of the EGNOS Monthly Performance report, available in the EGNOS User Support Website (https://egnos-user-support.essp-sas.eu/). In this document, in addition to the monthly performance for LPV and LPV200 procedures, the value of the overall availability and continuity figures computed since the publication of each procedure it can be found providing a clear view on the historical performance for each location.

EGNOS market and services strategy

Q: What are in your views the main market and business opportunities for EGNOS applications?

A: While EGNOS was born to support aviation approaches, we see growing opportunities for new users and applications not initially foreseen. This is the case of unmanned vehicles in the air, land and sea which can benefit from navigation integrity, and where the market forecast shows a big growth.

In maritime and rail, the Agency is working on development of new services which will also open the market to new users and applications beyond the ones we have seen so far.

Q: By EGNOS avionics for 38% of EU fleet, do you mean SBAS NAV capability or SBAS LPV capability? If it is SBAS NAV capability, what is the % for SBAS LPV capability?

A: It refers to SBAS LPV capability.

Q: Will these services be free of charge for European users/companies?

A: EGNOS services are provided free of charge to European users/companies. The support tools and documentation offered to users to ease the use of EGNOS are described in the EGNOS user support portal (https://egnos-user-support.essp-sas.eu/), and are also provided free of charge.

Q: Do you have some general comments about the market potential in autonomous maritime vehicles?

A: Autonomous maritime vehicles are getting more relevance, also to support reduction of pollution and traffic congestion. With this wide term, there are different applications and operations that should be considered and whose market potential is very relevant.

The International Maritime Organization (IMO) is working on the topic to ensure that operations are safe, secure and environmentally sound. They identify several degrees of autonomy, from ship with automatic processes under human supervision to fully autonomous vessels.

- Fully autonomous vessels will probably arrive first in domestic travels with the support of national authorities and will require the use of all the technologies and sensors available, including EU Space Data (GNSS, SBAS, Copernicus).
- The applications with high potential in short term may go from Seabed exploration vessels, Tug operations, small cargo vessels, small ferries.
- A specific area in Norway has been enabled for testing in Trondheim.

Accuracy and integrity are indeed the key performance aspects needed to ensure safe and efficient navigation and the

specific requirements for autonomous vessels are published in the EUSPA Report on Maritime and Inland Waterways User Needs and Requirements for Autonomous Vessels. A review of such navigation requirements, considering the latest developments in IMO, IALA and the different EC/EUSPA funded projects on MASS is ongoing. The integration of new EGNSS solutions as a precursor of autonomous vessels was explored in the Hull to Hull project, funded by the EC/EUSPA under the H2020 project.

Q: How about applications in the driver-less cars sector?

A: Initially, EGNOS integrity could potentially contribute to highly demanding applications in road transport. As a matter of fact, EGNOS is being implemented in the Cooperative ITS systems that will support the deployment of smart motorways for autonomous driving. They provide location corrections through vehicular communication at regional level in Europe.

In spite EGNOS is already enabled in almost every new car sold in Europe, there are basically two limitations for the automotive industry in order to valorise EGNOS in the autonomous driving system:

- the lack of continuous visibility of EGNOS satellites in urban areas, an issue particularly sensitive in safety-critical applications,
- the lack of global coverage of EGNOS, considering the automotive manufacturers are looking for scalable solutions operating in any part of the world.

Nonetheless, EC/EUSPA are trying to fill the integrity gap in the next EGNSS mission evolutions. In fact, two projects (ITHACA and ICHASE) are already investigating how a potential Galileo High Accuracy integrity service would contribute to the reliability of autonomous driving systems.

2020 user satisfaction results ESSP

Q: Where can I find the detailed results of the EGNOS User Satisfaction survey of previous years?

A: Apart from this presentation, that will be made available in the EGNOS User Support Website, the satisfaction results are published in the EGNOS User Support website every year. The results since 2014 can be found in the “Resources and Tools“ menu item under the “EGNOS User Satisfaction“ section.

Q: I saw in the presentation that you have launched the 2020 survey to more than 5.000 contacts, but how do you construct this list to be sure that it represents the EGNOS users community

A: ESSP is making use of the distributions list available from its interfaces as EGNOS service provider (prior the required authorizations in the corresponding Consent Forms when compiling the data) like for example the EGNOS helpdesk or the website, but has also a wide network of contacts with organizations and working groups that represent different user communities and market segments, which enables us to achieve a good level of representativeness considering that some individual answers may represent key organisations/stakeholders or user communities.

Q: How do you analyse or justify the decrease of the mark from 8.6 to 8.5 (from 2019 to 2020)?

A: Statistically speaking an increase or reduction in the overall score in 0.1 points in such a complex survey cannot be considered representative of any relevant trend. The more relevant conclusions are actually obtained from the different comments introduced by participants and from the analysis of the trends for each specific question, topic and market segment and of the statistical contribution of the different aspects to the overall score.

11:15-12:15 Successful EGNOS implementation stories in aviation

Hungary: PBN implementation status and plans	HungaroControl

Q: Why were these airports selected?

A: These are the civil aerodromes featuring in the Hungarian AIP, and we wanted to cover all of these, plus the three major military airports.

Q: Why are there no RNP AR approaches required in your country?

A: Terrain-wise Hungary can be considered as having a simple geography, there are no geographical challenges in approaching either of our aerodromes, and this is why RNP AR approaches are not required.

Q: Were there some particular challenges faced during implementation?

A: Regarding the obstacle databases we did face some issues. There was a mistake in some of the databases delivered, which had to be corrected by the supplier. This became particularly interesting as Innovation and Networks Executive Agency (INEA) funding was involved, having an impact on the necessary completion deadlines. Fortunately, the mistakes could be corrected and we even had the time for an independent company to cross check the data.

Q: Availability is okay, but what about continuity? Could you explain what mitigation strategies that need to be done?

A: Continuity is well known not to be in compliance with ICAO Annex 10 requirements, as already described in the SDD itself. This issue should be carefully covered in the correspondent safety case and the mitigation strategies would depend on the specific scenario. Nevertheless coordination among all the stakeholders at the required level is a must in all the cases.

Q: Will you be able to tell us which is the manufacturer you used for ground based equipment?

A: The beauty of using EGNOS is that no ground based equipment is needed since EGNOS is broadcast from the GEO satellites in space directly to the onboard receivers.

Q: Could you elaborate on the steps you found necessary as operational mitigations to enable the usage of EGNOS with the current signal performance not being satisfactory?

A: The EGNOS signal performance is indeed satisfactory enough, which undoubtedly is the reason why EGNOS based publications are on the rise all over Europe. Operational mitigations may be needed depending on the specific site in which an EGNOS based procedure is meant to be used, and should be carefully covered in the dedicated Safety Assessment, in coordination with the National Competent Authority.

The Norwegian Police air support unit using EGNOS at the National Emergency Response Centre at Taraldrud (ENTX - close to Oslo)	

Q: Is the minima of the approach at a decision height of 311 ft limited by the EGNOS supported PinS procedure?

A: No, the system minima for the LPV200 is 200 ft but due to terrain and obstacles in the approach sector the minima had to be raised to 311 ft for obstacle clearance.

Q: It seems that the heliport is located close to a highway, have the NW Police encountered disturbance of GPS signals during the approaches due to vehicles carrying GPS jammers?

A: No, we have not had any issues with this but we are familiar with the problem and it has been a problem in other places.

Q: Does the procedures allow for the pilots to proceed for landing according to the "proceed visually" or "proceed VFR" from minima to landing?

A: The airport is designed according to ICAO Annex 14 and the procedures are classified as "proceed visually" which is 800 m visibility for the heliport at Taraldrud.

Fokker perspective on SBAS: a demanded solution

Q: What is the status of developing LPV for the Boeing 737 NG and Boeing 757 aircraft?

A: For the B737NG the certification is almost done, we expect that it will be in-service at our launching customer in Q1 of next year. The next platform for which we will develop an LPV solution is the B757 solution and we will start with that in the beginning of next year.

Q: Are you planning to offer LPV on other aircraft platforms as well?

A: Certainly, obviously depending on market outlook but we already received requests to look at other platforms as well. As we did for instance with our ADSB-out solutions, we often see that customers would like to have one supplier for all of their different aircraft types. It can be sometimes very challenging to develop at the same time such a modification for different aircraft types, but we have developed our best practices to deal with that challenge.

Q: How much experience do you have with developing STC's?

A: For over 25 years now, we have developed many STC's. Not only relatively simple mods like ULD or EFB but also major mods like complete aircraft conversions and completions. Due to the fact that, next to our STC's, we still maintain the Type Certificates for the Fokker aircraft types, our capability range is quite extensive. That helps us with solving sometimes difficult integration issues. So, in total we have around 35 STC's and of which most of them have been validated by FAA and various other authorities as well.

Q: Why did you choose the CMA5024 hardware?

A: We believe that with the CMC CMA5024 hardware we can offer the most cost effective solution for our retrofit market with the lowest technical risks. We have a strong relationship with CMC which helps us with the development of modifications like LPV.

12:15-13:00 EGNOS Safety-of-Life service for aviation

EGNOS in aviation: service provision and implementation status

Q: During the presentation it is mentioned that EGNOS procedures can also be implemented in non-ATS scenarios, is it possible to implement an LPV in a non-instrument runway?

A: We have been working in coordination with EUSPA and EASA to publish some guidelines covering this case which have been published by the end of November on EUSPA's website. If you are interested, I invite you to check the guidelines and contact us if you need any support.

Q: What are the differences between the Agreement for a rotorcraft operator and the one for more conventional scenario, with an ANSP?

A: The EGNOS Safety of Life Service is the same for all the users, therefore, the EGNOS Working Agreement is essentially also the same. It is true that there are some slight differences in the EWA depending on the user in order to properly cover their particular needs, but the EWA as the tool used to guarantee the harmonization must be the same for all to also ensure fair

and equitable treatment.

Q: If I have SBAS onboard and I go to a different region of the world, is my receiver going to use the SBAS applicable to that area?

A: Yes, as long as the receiver is certified for SBAS and the SBAS system on the other area is certified against SBAS SARPS; for instance WAAS/EGNOS. You can see a good example of this interoperability feature on Finnair's article on the EGNOS Bulletin where they explained how did they perform a transcontinental flight using LPV approaches at both JFK (New York) and HEL (Helsinki) airports. The pilot mentioned it was seamless to him to change from EGNOS to WAAS and the approaches went smoothly and stable.

Q: As an Operator, how do I know if my aircraft are eligible for implementing LPV?

A: First of all you will need to check if there is some kind of EGNOS solution available in the market for your specific model. To do so you can check the STC/SB tool on our Website. Afterwards, we would recommend you to contact the corresponding solution holder to make sure your current configuration is eligible or whether you would need to implement any additional STC or SB. Sometimes implementing LPV requires using more than one STC.

Q: Do you have any estimate when the EGNOS continuity performance will be satisfactory and no longer require operational mitigations to be used within Europe?

A: EGNOS programme continues to work in order to improve the EGNOS continuity performance. We expect a significant improvement in continuity for V3.

EASA's activities towards EGNOS-based operations

EASA

Q: What is the requirement in the PBN rule regarding the implementation of approach procedures?

A: The relevant stakeholders (air navigation service providers/airport operators) are required to implement Required Navigation Performance (RNP) approach to three different minima:

- Lateral Navigation (LNAV);
- LNAV/Vertical Navigation (VNAV); and
- Localizer Performance with Vertical Guidance (LPV)

at all instrument runway ends, and they may also implement RNP Authorization Required (AR) if the previous cases would not be possible because orography or obstacles.

The deadlines are:

- 3 December 2020, for instrument runway ends not served by other precision approach, and
- 25 January 2024 in case of instrument runway ends already served by conventional PAs (e.g. ILS).

Q: Where can data about the current status of implementation of procedures be obtained?

A: Data on what has been planned to be implemented and what is actually being implemented can be obtained only from the approved transition plans and the aeronautical information publications (AIPs) of the respective States.

In addition, part of this data is available in the EUROCONTROL PBN Map Tool. This tool is also an aid to EASA in monitoring compliance with the regulatory requirements in the PBN IR, though the main artefacts for that discussion are the relevant

transition plans.

Q: What is EASA planning to do about EGNOS not fulfilling the ICAO requirements on continuity?

A: According to the ICAO Annex 10 Appendix D 3.4.3.4, the non-compliance in the continuity requirements do not prevent the publication of landing procedures provided that appropriate operational mitigations are in place. Then, in front of such non-compliance, there are two main lines of action:

- On one side, keeping both the organisations signatory of an EGNOS WA and the relevant National Supervisory Authorities (NSAs) informed about the up-to-date status of EGNOS performance. This is done via the EGNOS service documentation, starting with the SoL Service Definition Document (SDD). In this manner, appropriate operational mitigation actions are introduced (typically introduced at ATS level). Information exchange and coordination among competent authorities (i.e. EASA and the NSAs) is in place so this, among many other aspects, is appropriately taken care of during oversight.
- As well, ensuring that ESSP performs the root cause analysis and develops the associated mitigation actions in order to improve the continuity performances. As result of the combined effort of all involved stakeholders -among them ESSP, EUSPA and EASA- improvements in the continuity figures have occurred during the last years.

Q: Is PBN IR (EU) 2018/1048 applicable to PinS?

A: The PBN IR does not require the implementation of point-in-space departure and approach procedures. It does not consider heliports or other landing sites dedicated to helicopter-only operations. It only addresses runways located at aerodromes through requirements that, for instance, helicopters could also use for departures and approach procedures when flying procedures promulgated for Category A (CAT A) aeroplanes or more specific procedures applicable for helicopters-only operations to/from runways (CAT H).

14:00-14:45 EGNOS multimodal adoption I

Market status and adoption plan ESSP

Q: Is there any specific work stream to explore EGNOS benefits in regards to sustainable modes of transport?

A: Yes, we have been working in this line in several market segments. For instance, in geomatics, we have found initiatives that benefit from EGNOS for the location of Personal Mobility Vehicles.

Within aviation, we have made research to find how EGNOS can contribute to reduce emissions. The objective has been to assess the environmental impact reduction that EGNOS-based procedures in combination with other techniques can bring, if compared with conventional approaches. Several scenarios have been modeled and we have improved the environmental online tool that is available in the EGNOS User Support Website.

And also the online tools for agriculture provide estimations of reduced fuel consumption.

Q: In your first slide you provided figures for EGNOS compatible receivers in SOLAS and non-SOLAS vessels. Which is the difference between them?

A: SOLAS vessels are the ones subject to the International Convention for the Safety of Life At Sea, (merchant ships, large passenger ships or vessels involved in international trips). These kinds of vessels are the ones that could benefit the most

from the new Maritime Service that is under development.

Non-SOLAS vessels are not subject to that convention. Mostly recreational ships.

Q: You have mentioned that a high percentage of tractors are equipped with EGNOS. Which applications can benefit from EGNOS?

A: The main application that benefits from EGNOS is tractor guidance, especially for extensive crops in dry areas, such as dryland cereals, legumes and sunflowers. Tractor guidance allows farmers to be more precise when using a tractor to perform tasks in the field, such as fertilising, sowing or harvesting. However, EGNOS can be also of help in optimising other agriculture tasks that are done before or after the cropping campaign itself. For instance farm planning, field mapping, soil sampling, yield mapping or irrigation.

Q: Are driverless cars experiments supported by EGNOS?

A: Driverless cars use GNSS devices together with additional sensors to provide not only absolute positioning but also relative positioning with regard to other elements on the road. Those GNSS devices can take benefit of EGNOS corrections, although nowadays there is no specific service for this market segment.

Q: Are outcomes of cost benefit analysis in maritime available to public?

A: The CBAs carried out for maritime and inland waterways authorities are confidential, since these entities provide us with specific information on their infrastructure and costs. Any authority interested in understanding the economic benefits of using EGNOS as a source of GPS corrections can contact us through EGNOS-adoption@essp-sas.eu and we will be glad to give our support.

EDAS for added value applications

Q: How can I connect to EDAS and start using its data?

A: In order to request an EDAS account, you just have to fill the registration form available in the EDAS Service section.

After the verification of the provided data, the EGNOS Helpdesk will provide you with the configuration details necessary to activate the requested EDAS account. You will also have access to the User Information Package, where you will find all the required information (domain name, IP addresses, ports, etc.) required for establishing a connection and starting using the selected services.

Q: What accuracy levels can be achieved when applying EDAS corrections in smartphones?

A: This would strongly depend on the environment conditions. Note that smartphone antennas are subject to high multipath errors. Due to the unknown orientation of the smartphone, mobile devices use omnidirectional antennas, making them more sensitive to multipath effects.

Thus, in urban / harsh environments, where the position error is strongly affected by multipath, the application of code-based corrections like SBAS or DGPS does not provide a major added value.

However, in open-sky / rural conditions, the application of these corrections could increase the accuracy of the smartphone chipset position by 50%. For more information, refer to the results presented by ESSP last year in the ION GNSS conference.

Q: How can I know if my smartphone is using EGNOS?

A: As far as we know, there is no smartphone providing its position based on EGNOS corrections. For battery saving reasons,

the smartphones do not track the navigation message in a continuous manner. Thus, it is not possible to access the EGNOS message from the Signal In Space.

The only option available nowadays is to get the SBAS message from EDAS (SISNeT service) and for that reason, we have developed the ELFA library, to provide Android developers a module that will ease the integration of EDAS in their applications.

Q: Does EDAS provide Galileo measurements?

A: No, EDAS provides access to the information collected by the EGNOS RIMS. As of today, these stations track GPS and GLONASS (for RIMS type B) measurements. In the future, when running over EGNOS v3, EDAS will also provide Galileo data.

Q: When will EDAS be available in mobile phones?

A: Whether the EDAS services are used in smartphones depends on the existence of applications which apply the EDAS corrections in order to provide a more precise position. To ease the development of these applications, ESSP is currently developing a library to provide decoded EGNOS data from SISNeT and Ntrip protocols by means of the EDAS services. The objective of this library is to provide the users a tool to be integrated in their own Android applications. The library is expected to be published at the website in the next months.

Q: How do you recommend to connect to EDAS: by SISNET or NTRIP?

A: Firstly, it should be noted that SISNeT provides the EGNOS corrections by means of the messages provided by the GEO satellites, while Ntrip provides DGPS and RTK corrections.

On the other hand, if the protocol is not predefined by the receiver type, then the recommendation to use any of these services depends on the accuracy required and the receiver location.

The map with the EGNOS stations, which include the coverage for the EGNOS, DGPS and RTK solutions in relation to the areas where the end users are to be located can be found In the EGNOS User Support website. With an RTK solution, a centimetre level accuracy for locations closer than 50 km to a station can be obtained, while accuracies under 1 meter can be obtained using DGPS and EGNOS corrections.

Keeping this in mind, the election of SISNeT or Ntrip will depend on the receiver compatibility and the distance to a station

Please, check the coverage map at https://egnos-user-support.essp-sas.eu/new_egnos_ops/resources-tools/edas-dgnss-coverage-map.

Q: What are contained in the latency of EDAS? Please explain the start and end in the definition of this latency?

A: When applied to EDAS services, the latency is time elapsed since the transmission of the last bit of the navigation message from the space segment (EGNOS and GPS/GLONASS satellites) until the data leaves the EDAS system (formatted according to the corresponding service specification).

Q: Are there mobile phones EGNOS enabled?

A: In most cases, it is not possible to access the EGNOS navigation message from the Android GNSS raw measurement. Even though that there are several smartphones capable of tracking the EGNOS signals, the navigation message is not accessible since for battery saving reasons, the smartphones do not track the signal on a continuous manner. This not only affects the EGNOS message but also the navigation message of the different GNSS constellations. EDAS SISNeT is therefore the only

mechanism available to access the EGNOS SBAS message in smartphones.

How are European farmers working with FieldBee using EGNOS? FieldBee

Q: When do we need to use base station?

A: It depends on region, for example when in you region expensive subscription for NTRIP or you don't have good internet coverage you ca use base station in radio mode.

Q: How to upgrade tractor to autosteer?

A: Depends on tractor model we can provide specific kit, now we have specific installation kit for more than 700 different tractor models or generic kit which can be easily adjusted for you tractor model.

Installation is required basic engineering skills

Q: Is it possible to achieve high accuracy on smartphone for tractor navigation?

A: Depends on smartphone, environment condition and specific of operation.

Q: How RTK works with EGNOS?

A: EGNOS provide ionospheric correction. So without other services you can achieve pass 2 pass accuracy in 20-50cm.

Also after losing RTK system automatically switch to EGNOS for keeping decimeter accuracy after 60 sec.

Q: What are the problems encountered when using EGNOS in the tractor?

A: The problem may be in the additional position error. This happens if you are in the border area of EGNOS coverage (for example, Ukraine is partially covered by EGNOS, but in the eastern part of Ukraine it is required to disable the use of correction).

Without RTK on the territory of the EGNOS coverage area, the quality is only better compared to other regions.

Q: Which is the difference between sowing and cultivation? Is EGNOS feasible for these tasks?

A: The sowing operation requires high accuracy of +-2.5 cm, which is provided by the RTK.

It is important to note that EGNOS is just used to maintain high accuracy after the loss of the correction signal from the base station RTK. In this case, EGNOS correction will be useful.

The cultivation operation is performed with less accuracy, with EGNOS it is possible to perform the operation within one day.

15:00-16:10 EGNOS multimodal adoption II

Service development status in the maritime domain EUSPA

Q: Will Galileo corrections be distributed from IALA beacons?

A: If the standard RTCM v2.4 is approved then yes. Differential Galileo is already considered in shipborne receiver standards: IMO Res. MSC 233 and IEC 61108-3.

Q: Why can't maritime use the same protection level as aviation?

A: Today, the Protection Level methodology for aviation includes a model of multipath that over bounds the errors. For maritime, local errors due to multipath have been identified in several research projects for a limited number of vessels (e.g. SEASOLAS and MARGOT). These errors are larger than in aviation and depend on the class of vessel and on the navigation phase. Once Galileo is augmented by EGNOS (DFMC in the future EGNOS V3), and thus with an increased number of satellites contributing to the computation of the PL, the concept for maritime will be re-assessed for each phase of navigation, starting with coastal navigation, where HAL is 25m.

Q: Can SBAS be an enabler for autonomous vessels and unmanned operations?

A: Yes, SBAS DFMC together with RAIM will be an enabler for both autonomous vessels and unmanned operations. Two studies are running in parallel to assess the feasibility of an integrity service complementing EGNSS High Accuracy to enable autonomous operations in diverse sectors, including maritime.

Q: Will the Galileo high accuracy service be used in the maritime and is this a competitor to SBAS?

A: Yes and No.

Yes, Galileo High Accuracy Service will be used as well in maritime, providing increased accuracy down to 20cm in horizontal, with a receiver taking the corrections from E6 frequency or from Internet. This service is expected to be operational by 2023.

On the other hand, SBAS SF today is providing already an accuracy of 1m.

The two services are complementary and can be used in incremental steps by different type of vessels depending on the need of the operation (e.g. pilotage).

Q: Does EGNOS V3 expect an increase in accuracy?

A: Yes. EGNOS L1 service accuracy will improve thanks to the use of Galileo measurements for iono modelling (EGNOS V3.1). Once Galileo is augmented (EGNOS DFMC service – EGNOS V3.2) both availability and accuracy will be improved.

Q: Which kind of alert system you foresee in slide 7, it works in real time?

A: Already today, EGNOS broadcast via the EGNOS L1 SiS satellite alerts, iono alerts and do-not-use-SBAS alerts, which can be processed by the EGNOS-enabled receivers as specified in the "Guidelines for Manufacturers for the Implementation of SBAS in Shipborne Receivers" (expected to be published in 2022) and later as specified in the IEC SBAS standard (expected to be published in 2023).

Q: Will maritime service based on EGNOS V2 or EGNOS V3 services?

A: The SBAS Maritime service will be operational as of December 2023 using EGNOS V2 system, then it will be provided using EGNOS V3 when it will become operational in 2026. This is related to the incremental steps shown in the second slide of the presentation.

Q: Maritime service: how integrity of the EGNOS MSI service is ensured up to each maritime receiver?

A: EGNOS MSI Service will inform the mariner about plan and unplanned outages in the EGNOS system by other means different from the EGNOS-enabled rx, e.g. Navtex, SafetyNet. See http://www.hidro.gov.ar/ohi/S_53_JAN16_E.pdf for more detailed information.

Q: Under which conditions would the shipborne receiver manufacturer agree to standardise the user local error model?

A: According to the stakeholder consultation carried out in SEASOLAS project, user-level integrity would be a critical component needed to improve the situational awareness of the maritime users and eventually contribute to an overall reduction of maritime accidents, fatalities and injuries.

In addition, receiver manufacturers would agree to standardise the user local error model under the condition that only a minor upgrade would be needed in the GNSS receiver.

EUSPA is already involved, together with receiver manufacturers, in the SBAS shipborne receiver test standard under development within IEC and planned to be ready by mid-2023.

Q: Are outcomes of cost benefit analysis in maritime available to public?

A: H2020 SEASOLAS mission study assessed the CBA of an EGNSS service for maritime in 2017, the results are available in EUSPA website here: https://www.euspa.europa.eu/egnos-v3-maritime-safety-service#tab-resources.

EGNOS in the maritime domain

KONGSBERG

Q: Who can we contact to use the autonomous test area in Trondheim?

A: Information is available at: http://www.testsitetrd.no.

Q: Will SBAS be used for autonomous unmanned operations in the future?

A: SBAS will not be used a sole means of navigation by the maritime. It will be used together with other sensors, especially for autonomous operations. However, the improved accuracy and integrity that SBAS can provide is definitely a contributor to increased use of autonomy in many maritime applications. Many of the autonomous operations planned today will still require people onboard the vessel. It may take some time until we see unmanned operations.

EGNOS mission studies for rail (EGNSS-R project)

AIRBUS

Q: Can you provide more information with respect to the timeline (at least as foreseen by Airbus) for the proposed roadmap?

A: Entry-into-service: EGNOS L1 SiS pseudorange service in the short term (circa 2025), then EGNOS V3 2027-28 and mid-term EGNOS V3+ 2029-30.

Q: The presentation focuses on EGNOS but what about Galileo for rail usage?

A: In the frame of EGNSS-R the following Galileo services are considered:

- Galileo Open Service (OS) considered in the frame of EGNOS DFMC.
- Galileo Open Service Navigation Message Authentication (OSNMA) also considered. Galileo OSNMA is an authentication mechanism that allows GNSS receivers to verify the authenticity of GNSS information, making sure that the data they receive are indeed from Galileo and have not been modified in any way.

Q: What are the expected benefits for Rail operators of such roadmap?

A: A simultaneous study named CLUG in which Airbus is in charge of the architecture of a potential solution, is trying to provide some quantitative data by simulation. Integrity requirements from Rail operators not fully converged (depending on the type and the phases of mission), bottom up approach by prototyping is envisaged/engaged.

Q: What dissemination means is recommended in the frame of EGNSS-R?

A: The use of a trackside equipment as a GSM-relay is preferred to disseminate GNSS data to trains.

Q: Is EGNOS V2 or EGNOS V3.1 "usable" for rail versus railway integrity requirements?

A: TBD following Performances forecast + Cost Benefits Analysis.

Application of GNSS for optimization of freight wagon disposition at DB Cargo | DB Cargo

Q: What is the actual life duration of the terminals installed in wagons?

A: 6 years we put in in our demands and the average is now 3-4 years old, and we continuously monitor the battery life and it looks really good at the moment.

Q: What the average cost to retrofit or totally equip a single freight asset?

A: It is depending from different factors, so you can roughly estimate 300-500 EUR, but when you put additional sensors you can easily pay 1000-5000 EUR.

Q: Why do we need high precision positioning systems in rail freight transport where actually movement is bound to tracks?

A: Although freight cars have only limited degrees of freedom in their movement, it is of great interest to know the position of the individual cars as precisely as possible. This is because processes in train assembly and the search for individual wagons are helped by the assignment to a track and section. And today's systems can be checked with this information and corrected if necessary.

Q: What are the challenges in equipping freight wagons with telematics units?

A: In recent years, we have had to deal with two problems in particular: the availability of wagons for orderly equipment and the weather conditions, especially in winter with cold and darkness. The first showed us a classic Pareto situation, with now very high organizational hurdles to equip the last remaining wagons. The latter is due to the energy supply, which must be ensured stand-alone by means of solar panel and battery.

Q: With tens of thousands of wagons now under monitoring and resulting millions of data points per day, how do you want to improve rail transport in the future?

A: Over the next few years, we will not only continue to expand and refine existing dashboards. We will also use AI-based methods to continuously improve operations and thus offer customers an even better service. For example, we have just put an interface into operation to achieve automated detection of steps in the logistic chain from the combination of sensor data and asset systems. And precise localization data play an important role in this.

16:10-16:35 SBAS in the world

SBAS global status

Q: Is there extensive training required to SBAS approach procedures?

A: Flying SBAS procedures is similar to flying ILS procedures and requires minimal additional training.

Q: Why should someone equip with SBAS?

A: Access. In some countries, like the United States, there are more SBAS procedures than there are ILS procedures, with SBAS procedures available as overlays of existing ILS procedures. SBAS procedures are also extensively available in Europe. Other regions have active SBAS acquisition programs, and pilots can expect to see a large increase in SBAS procedures available worldwide in the next 2 to 5 years.