

# EGNOS NEWS

Volume 8, Issue 1, 2009

**ISSUE – THE SKY IS NOT THE LIMIT**

## Editorial

We are seeing important changes as EGNOS prepares for its introduction into aviation and beyond. This issue of EGNOS News invites you to examine some of the critical developments for EGNOS and the views of those laying the foundations in the aviation community.

In this issue we report on the news of the successful transfer of ownership of EGNOS to the European Commission and the continued role of ESA. As part of what this might mean for the future, we take a quick look at the various plans for EGNOS evolutions being developed by ESA in its continuing role as design agent.

One element of the future evolutions for EGNOS is an expansion of the existing reference station network to increase performance and geographic coverage. We report on the EPINOL project which has

established two new Ranging and Integrity Monitoring Stations (RIMS) off the coast of Norway and demonstrated the improvement in performance for maritime vessels in normal operation.

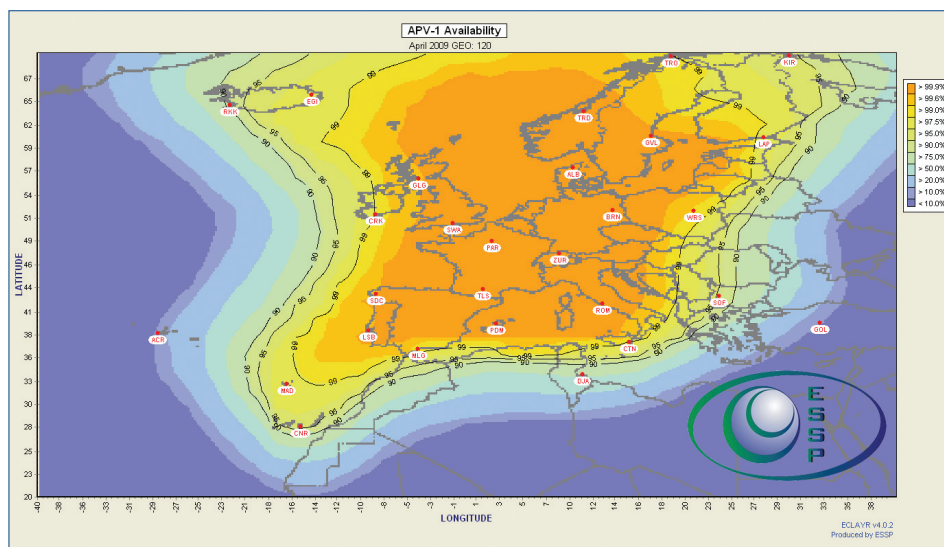
With the handover of EGNOS to the Commission we have taken another solid step towards the introduction of EGNOS in aviation. As one of the three founding partners of EGNOS, EUROCONTROL (the European Organisation for the Safety of Air Navigation) is a key actor in the introduction of EGNOS in aviation. EGNOS News interviews Rick Farnworth from EUROCONTROL on his views on the impact that EGNOS will make. His answers paint a picture of how EGNOS is likely to be used by the aviation community in the near future.

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As always, we very much look forward to receiving your comments and suggestions for anything you would like to hear about in future issues of EGNOS News.

## Handing Over for the Future



**EGNOS availability: EGNOS performance achieved in April 2009 for the handover**

On the 1st April this year a significant milestone for EGNOS was reached. The ownership of EGNOS was transferred from ESA to the European Community, represented by the European Commission (EC).

Over the last 12 years ESA has developed the system through its research programme. This was carried out under the aegis of a trilateral agreement between the EC, ESA and EUROCONTROL. This year EGNOS was

brought to the point where it could be handed the European Community, ready for certification and its expanded use.

The development under ESA has involved numerous industrial partners and it is an achievement to reach a position where it can be handed over for operations. In this new phase the Commission has become the owner of the entire system infrastructure on behalf of the European Community. The organisation European Satellite Services Provider (ESSP) SAS is currently under contract to the Commission to manage the operations and maintenance of the EGNOS system. This company based in Toulouse, France, was founded by seven air navigation service providers: Aena (Spain), DFS (Germany), DSNA (France), ENAV (Italy), NATS (UK), NAV Portugal and Skyguide (Switzerland).

Under the ownership of the Commission and operated by ESSP, the EGNOS signal remains available for operations on an “as is” and “as available” basis. Thus until certified, civil aviation users should not use the EGNOS SIS for safety critical purposes.

Even though the ownership of EGNOS has now been transferred, ESA will maintain its role of design and procurement agent through a Delegation Agreement signed by Mr Matthias Ruete, Director General of DG TREN, representing the Commission, and Mr Jean-Jacques Dordain, Director General of ESA.

This role follows on from ESA's responsibility for EGNOS development. Not wanting to stand still on the continuously evolving GNSS environment, ESA has commenced several concurrent projects addressing potential evolutions for EGNOS as part of its overall GNSS Evolutions Programme.

These projects are to be considered for the definition of the next evolutions of EGNOS (EGNOSV3). They address a range of topics including technology obsolescence, emergence of new global and regional navigation systems, more demanding user services and the availability of new technology.

One central part of the evolutions programme is the Support Platform for EGNOS Evolution

and Demonstration (SPEED). It will allow for performing Mission and System Evolutions Engineering tests, as well as demonstrations (e.g. coverage extension to other areas). Moreover, SPEED mission includes supporting the qualification of new EGNOS system releases (even allowing fast replay capability). SPEED allows performing all those tests and experiments by experiencing real EGNOS performances.

In preparation for a world with increasing number of space-based navigation systems ESA has commenced the Multi-constellation Regional System (MRS) project. It is a concept to provide SBAS services and regional integrity considering the future GNSS constellations, through a multi-constellation, multi-frequency and multi-broadcast concept. It includes combined GPS, Galileo, and GLONASS measurements from new generation RIMS, new processing capabilities at the Central Processing Facility (CPF), and provision of Galileo SBAS integrity. Since each constellation has its own reference for measurements and data (time and geodetic reference, correction and integrity data reference, etc...) it is of interest to create

a higher system layer / overlay (the MRS) to provide the user with a common / unique reference for all navigation signals broadcast by these constellations.

Another progression for EGNOS is the expansion of reference stations improving redundancy, performance and geographic coverage. EGNOS is using 34 RIMS in its current version 2.2. In the coming years, this number will increase to 38 RIMS (in the system version 2.3.1) and to 41 RIMS (in version 2.4 of the system). All reference stations are due to be replaced by the new RIMS which will have the capability of tracking more frequencies and signals from different constellations.

Further infrastructure upgrades include the new generation Navigation Land Earth Stations (NLES). In the EGNOS system there are two uplink stations per GEO. This will allow EGNOS to uplink the signal for the new L5 downlink.

The EGNOS evolutions projects help to ensure the continued improvement of Europe's GNSS in an ever changing environment.

## EUROCONTROL Clearing the Hurdles for EGNOS

EUROCONTROL was one of the founding partners for EGNOS and has been responsible for supporting its introduction into aviation. The organisation is responsible for the safety of air navigation in Europe and delivering benefits to airspace users and Air Navigation Service Providers (ANSPs) is at the core of its mission.

As we are increasingly close to the moment when airspace users can start using EGNOS for safety critical applications, we decided to interview one of the key figures at EUROCONTROL intimately involved with EGNOS to find out his view on how it was all going and what he expects for the future of EGNOS.

Rick Farnworth has been working for EUROCONTROL at the Experimental Centre south of Paris since 1996 and he has been involved in EGNOS since the very beginning. Initially as a Navigation Engineer within the GNSS Programme looking more at systems issues and recently more involved in operational applications of satellite navigation in aviation. He is currently a member of the Navigation Unit within the new CNSD organisation, is the Focal Point for RNAV Approach Issues and is Chairman of the RNAV Approach Task Force. Rick kindly took some time off from his day-to-day work to answer some of our questions.

1. Aviation has long been the target customer for EGNOS. Now that a certified EGNOS service for aviation users is hopefully just round the corner, do you feel that EGNOS will still be a significant development for the aviation community?

I am confident that EGNOS will be a significant development for the aviation community. It has been a long road but we are nearly at the point where EGNOS can be used operationally and I am sure that it will find many users. Having an independent monitoring system for GPS, which is already widely used in aviation, is the first significant impact although largely invisible to users. Operationally, the introduction of EGNOS will support the ICAO objective to provide vertical guidance on all instrument approach procedures and thus improve safety. As a multinational infrastructure project the participating ANSPs through the EGNOS Operations and Infrastructure Group (EOIG) have also learned a lot of valuable lessons about working together to put such a service in place.

2. Speaking of EGNOS certification, in what way is EUROCONTROL supporting the process, and what is your impression of the progress made so far?

That word "certification" has come up a lot over the years when talking about EGNOS, and not always to mean the same thing. Since the adoption of the Single European Sky legislation by the European Commission and many discussions amongst aviation regulatory experts the activities required to allow EGNOS to be adopted as an Air Navigation Service are now clear. It is my impression that progress is being made with the French



**A business jet landing: the type of airspace user likely to gain the greatest benefits from EGNOS**

National Supervisory Authority (NSA) –the national aviation regulator- in line with the objective to have an operational EGNOS service by mid 2010.

EUROCONTROL is contributing to the EGNOS certification in two main areas. The first is our independent signal-in-space monitoring through the EGNOS Data collection network. Here we are providing results of the performance that would be experienced by a minimum equipped aviation user as measured at various locations throughout the EGNOS service area. These results will be combined with those collected by other organisations such as ESA and the European Commission to build the technical file that will demonstrate EGNOS performance in support of the application for a certificate of compliance. Apart from system issues we are also developing the generic safety case for Approach Procedures with Vertical guidance (APV) using EGNOS. The aim of this safety case will be to build the necessary arguments to demonstrate that using EGNOS for such operations is safe. The generic safety case will be provided to air navigation service providers as a basis upon which they can develop their local safety cases.

3. In your opinion, for what type of operations or phases of flight will EGNOS provide the greatest benefits?

EGNOS will provide greatest benefits in the approach phase of flight. The replacement of Non-Precision Approach (NPA) procedures with RNAV approaches and in particular the addition of vertical guidance on such approaches is expected to bring a significant safety benefit. EGNOS will play a significant role in bringing this vertical guidance to a wide variety of airspace users.

4. Do you think there are any particular type of airspace user which are likely to benefit more significantly from EGNOS than others (or alternatively those for which the benefits are less clear)?

For the large modern air transport category aircraft, mainly produced by Airbus and Boeing it is more difficult to make the case for retrofitting with SBAS capability.

However, in the longer term I expect SBAS capability to be increasingly designed into new aircraft and thus the issues associated with the cost of installation will disappear.

For smaller aircraft such as those used in corporate and business aviation, general aviation and helicopters the benefit will be much greater. These aircraft do not have barometric VNAV capabilities and it would be expensive to install. SBAS is the solution that will provide the vertical guidance and allow these aircrafts to fly Approaches Procedures with Vertical guidance (APV). The installation of SBAS on such aircrafts will be a much lower cost than for transport category aircrafts and will bring an approach capability close to that provided by today's instrument landing systems (ILS) at airports without the ILS infrastructure.

5. EUROCONTROL has been deeply involved since the beginning of EGNOS as one of the members of the Tripartite Group established for its development. In what way has EUROCONTROL been supporting the introduction of EGNOS into aviation over the last few years, and how is this planned to continue in the future?

As you say, EUROCONTROL has been involved since the very beginning at many levels. In the past we have been involved in developing the Mission Requirements and contributing to system project reviews as well as our input to the signal-in-space validation. Our primary activities now are in support of the operational issues to do with introducing APV procedures using EGNOS. We have set up the RNAV Approach Task force to coordinate the implementation of APV in Europe which meets three or four times per year. We have identified all the issues that need to be addressed in order to implement APV procedures and are facilitating the work required for all these issues to be closed. As more and more ANSPs begin to implement APV procedures, it will be the role of EUROCONTROL to provide guidance and support based on experience with early implementation projects. There may also be a role for the continuation of the EGNOS data collection network to support the continuous

## Heading North



**KV Svalbard: During EPINOL it was Equipped with EGNOS while operating in Northerly waters**

Obtaining the performance levels in northern latitudes that EGNOS provides to the rest of its service area has always proved challenging due to the need for northerly located reference stations and visibility of the GEO satellites.

Based on the common interest of ESA and the Norwegian Space Centre to improve performance, the EGNOS performance in northern latitudes (EPINOL) project was launched in the spring of 2007. It was successfully completed in July 2009. The project user demonstrations were undertaken by a local

team of Kongsberg Seatex, Norwegian Mapping Authority and Norsk Helikopter.

The first phase of the project was to establish two new RIMS located on the Norwegian islands of Jan Mayen and Svalbard at 71 and 78 degrees North respectively. The expectation was that these stations would secure an improved EGNOS performance at high latitudes. The second phase of EPINOL aimed to verify and quantify this improved performance through User Demonstration Activities.

The verification work utilised data collected on two vessels and one helicopter in regular commercial traffic in the North Sea and Barents Sea. Data was continuously collected from April to December 2008. The vessel KV Svalbard was operating in most of the northern Norwegian waters as a vessel of the Norwegian Coast Guard, and the vessel Green Frost as a cargo ship were servicing harbours in the northern part of Norway including Svalbard.

For derivation of accuracy, reference trajectories for the vessels were calculated using accurate carrier phase data collected at the vessels. For the processing with EPINOL RIMS the real broadcasted EGNOS SBAS messages were used. For the processing without the EPINOL RIMS special SBAS data generated by the EGNOS Performance Assessment and Check-Out Facility (PACF) was used. This SBAS data was based on an EGNOS CPF processing carried out in a replay mode, where data from the RIMS stations at Jan Mayen and Svalbard were removed.

It was therefore possible to directly compare the EGNOS performance with and without the EPINOL RIMS under the exact same conditions (same receivers, same ionosphere, same data quality from other RIMS stations etc).

After the data analysis the largest improvement in performance was found for the area between mainland Norway and the island of Jan Mayen, where the dynamic data show improvement in availability of about 30 percent. The static data from the monitor station at Jan Mayen show the same level of improvement. The improvement in horizontal position accuracy is about 50 percent.

In general, the processing results reveal that when introducing the EPINOL RIMS, improvements in EGNOS performance are seen for data collected in both static and dynamic mode, especially in the area between 63° and 77° North in Norway. The improvements were more limited outside these latitudes.

The analysis undertaken with operational vessels has given a clear view of the performance of EGNOS in northern latitudes with and without the new EPINOL RIMS. The project also hinted at the benefits that could arise from test beds to play with system configurations and assess impact of RIMS configurations on end user performances. The SPEED project and its arctic version (Arctic Test Bed) could be a candidate for analysis of service extension and RIMS outages in the future.



monitoring of the EGNOS performance to ensure that compliance to the requirements is maintained.

6. What do you think are the greatest barriers and risks to gaining benefits from EGNOS in aviation in either the short or long term, and can we overcome them?

In the short term we need to encourage ANSPs to introduce APV procedures for both SBAS and Barometric and these solutions should be seen as complementary and not in competition with each other. We must be careful not to try and oversell the benefits of EGNOS as this will lead to even greater scepticism from our major

airspace users. The biggest hurdle we have to get over now is to remove the message type zero (a "Do not use" message broadcast by EGNOS) and get the first APV/SBAS procedures approved operationally. Once this ball is rolling the implementation in many European States will follow. There is a need for a clear vision for the future. The aviation community needs to know that EGNOS has a long term future and it needs to know how much the service is likely to cost in the longer term. It is important that any cost to the aviation community is proportional to the use made of the service when compared to the many other non aviation users. The role of EGNOS in the future multi-constellation GNSS environment needs to be clarified. When we

have GPS and Galileo with multiple frequencies as well as GLONASS, COMPASS and various other contributors to the future satellite navigation mix what is the role of EGNOS? This multi-constellation future is certainly going to pose a big challenge to standardisation organisations and we will need to work very hard together to overcome it.

So it looks as if there are exciting times ahead for EGNOS in aviation, but still some hard work for all concerned. As an early indicator of the future, it now appears that Airbus will equip its new A350 XWB's with SBAS receivers embedded in a multi-mode-receiver capable of using EGNOS in the future.

## Forthcoming Events

GNSS Vulnerabilities and Solutions Conference 2009  
Baška, Krk Island, Croatia  
2-5 September 2009

NavTech GPS Seminars  
ESTEC, Noordwijk, Netherlands  
8-11 September 2009  
<https://www.navtechgps.com>

Institute Of Navigation GNSS (ION GNSS)  
Savannah, Georgia  
22-25 September 2009  
<http://www.ion.org/meetings/gnss2009program.cfm>

Royal Institute of Navigation NAV09: Positioning and Location  
Locations throughout the UK  
10-25 November 2009  
<http://www.rin.org.uk/news-events/events/nav09-conference-exhibition-0>

International Global Navigation Satellite Systems Society (IGNSS)  
Queensland, Australia  
1-3 December 2009  
<http://www.ignss.org/?D=5>

Institute Of Navigation International Technical Meeting (ION ITM)  
San Diego, California  
25-27 January 2010  
<http://www.ion.org/meetings/itm2010cfa.cfm>

Munich Satellite Navigation Summit  
Munich, Germany  
9-11 March 2010  
<http://www.munich-satellite-navigation-summit.org/>

## Links and Contacts

ESA Navigation Web Page:  
<http://www.esa.int/navigation>

ESA EGNOS Web Page:  
<http://www.esa.int/EGNOS>

ESA EGNOS for Professionals Web Page:  
<http://www.esa.int/navigation/egnos-pro>

ESA EGNOS Real Time Performance Web Page:  
<http://www.esa.int/navigation/egnos-perfo>

ESA EGNOS Help Desk:  
[EGnos@esa.int](mailto:EGnos@esa.int)

EGNOS News:  
[EGNOS-News@esa.int](mailto:EGNOS-News@esa.int)

EGNOS Operations User Support:  
<http://www.asqf-gnss.com>

ESA Galileo Web Page:  
<http://www.esa.int/Galileo>

EC Galileo Web Page:  
[http://ec.europa.eu/dgs/energy\\_transport/galileo/index\\_en.htm](http://ec.europa.eu/dgs/energy_transport/galileo/index_en.htm)

European Satellite Services Provider:  
<http://www.essp.be>

FAA GPS Product Team:  
<http://gps.faa.gov>

GNSS Supervisory Authority:  
<http://www.gsa.europa.eu/>

## Help Us To Help You

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The Editorial Team welcomes your comments, inputs and suggestions for the next issue. Please send emails to [EGNOS-News@esa.int](mailto:EGNOS-News@esa.int).

## Disclaimer

The EGNOS system Signal in Space (SIS) is already available. The SIS is planned to be certified for safety critical usage in aviation by end of 2009. The EGNOS SIS (irrespective of either MT 0 or MT 0/2 is transmitted) is currently provided without any warranties regarding availability, continuity, accuracy, and reliability. The EGNOS SIS is provided on an "as is" and "as available" basis. Until further notice, messages associated with the EGNOS SIS are not certified for Civil Aviation or other safety critical purposes.

The use of the EGNOS SIS is therefore at the user's own risk. ESA expressly disclaims all warranties of any kind (whether express or implied), including, but not limited to

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### Note for Civil Aviation

The Certification process of the EGNOS SIS for Civil Aviation use is still under development. Until further notice, the EGNOS SIS is broadcasting a Type 0 or the equivalent Type 0/2 ("Do not Use") message as specified in ICAO SARPS. Despite the fact that the use of certified receivers by civil aviation users will automatically prevent the use of the EGNOS SIS as it is today, it is reminded here that **Civil Aviation Users should not use the EGNOS SIS for safety critical purposes before full EGNOS certification process is completed and that users should consult the relevant ICAO SARPS.**