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.

Handing Over for the Future

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 to the European Community, ready for certification and its expanded use.

The development under ESA has involved numerous industrial partners and it is as 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.

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.
Even though the ownership of EGNOs has now been transferred to ESA and its role and its design and procurement agent through a Delegated Agreement signed by Mr. Matthias Rust, 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 Evolution Programme.

These projects are to be considered for the definition of the next evolutions of EGNOs (EGNOs V). They address a range of topics including technology obsolescence, emergence of new global and regional navigation systems, new 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 (SPED). It will allow for performing Mission and System Evolution Engineering tests, as well as demonstrations (e.g. coverage extension to other areas). Moreover, SPED mission includes supporting the qualification of new EGNOs system releases (even allowing fast replay capability). SPED allows performing all these tests and experiments by experimenting real EGNOs performances.

In preparation for a world with increasing number of space-based navigation system, ESA has commenced the Multi-Constellation Regional System (MRS) project, which is a concept to provide SBAS services and regional integrity considering the future GNSS constellations, through multi-constellation, multi-frequency and multi-broadcast concept. It includes combined GPS, Galileo, GLONASS measurements from new generation RIMs, new processing capabilities at the Centre 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 SBAS services and regional integrity for all navigation signals broadcast by these constellations.

Another progression for EGNOs is the development of “Operational Reference for all navigation signals broadcast by these constellations”.

For further infrastructure upgrades include the new generation Navigation Land Earth Stations (NELS). In the EGNOs system there are two uplink stations per GEO. This will allow EGNOs to uplink the signal for the new L3 domain. The EGNOs evolutions projects help to ensure the continued improvement of Europe’s GNSS in an ever changing environment.

EUROCONTROL was one of the founding partners for EGNOs. It 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 CND organisation, is the Focal Point for RNAV Approaches and a Chairman of the RNAV Advisory Group, which is the body that looks after RNAV users.

I am confident that EGNOs will be a significant development for the aviation community. It has been a long road and we are now at the point where EGNOs will be used operationally and I am sure that we will find many users. Having an independent monitoring system for GPS, which is already widely used, means that EGNOs will be a first significant impact although largely invisible to users. Operationally the benefits of EGNOs will support the ICAO objective to provide vertical guidance as well as allow improved operational applications of satellite navigation in aviation. Our Multi-constellation project the preparatory work for new, non-EGNOs, non-Navigation Operations and Infrastructure organisation (EONI), and the GNS P-2 contribution to the future Multi-region System (MRS) project. We have also looked at a number of lessons about working together to put such a service in place.

Headingley 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 Sates, Norwegian Mapping Authority and Noris Helicopter.

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 along the north 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. The SBAS data was used in conjunction with 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 in 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 both the dynamic and the static modes, 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. Ahead of the planned user adoption of EGNOs a number of factors would be required to allow EGNOs to be adopted as an Air Navigation Service as soon as it is my impression that progress that is being made with the French National Supervisory Authority (NASA) – the national aviation regulation 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 an independent signal-in-space monitoring through the EGNOs Data Collection network. Here are providing results of the performance that would be experienced by a minimum equipped aircraft adding more confidence to where it is at 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 all navigation service providers as a basis on 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-Instrument Approach (NIA) 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 that 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 benefits will be much greater. These aircraft do not have barometric VNAV capabilities and it would be expensive to install. In this case it is likely that the SBAS service that will provide the vertical guidance and allow these aircraft to fly Approach Procedures with Vertical guidance (APV). The installation of SBAS on such aircraft will be much less of a 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 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 the technical development. We have been providing 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 been involved in setting up the ICAO institutions and working in conjunction with the European Commission and in particular the European GNSS. We have set up the RNAV Preparation Task Force to coordinate the implementation of APV in Europe which meets three or four times per month. We have been involved in setting up the ICAO institutions and working in conjunction with the European Commission and the CND organisation, is the Focal Point for RNAV Approaches and a Chairman of the RNAV Advisory Group, which is the body that looks after RNAV users. EUROCONTROL has supported 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 in the same way. For the adoption of the Single European Sky legislation by the European Commission and many discussions and discussions have been required to allow EGNOs to be adopted as an Air Navigation Service. Now clear it is my impression that progress that is being made with the French CND organisation, is the Focal Point for RNAV Approaches and a Chairman of the RNAV Advisory Group, which is the body that looks after RNAV users.

EUROCONTROL Clearing the Hurdles for EGNOs

A business jet landing the type of airspace user likely to gain the greatest benefits from EGNOs
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 its 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

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

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

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

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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.

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.

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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.