

Editorial

Welcome to another issue of the EGNOS newsletter—keeping you up to date with EGNOS activities and giving a glimpse to the future.

In this issue, we concentrate on EGNOS in aviation, particularly looking forward to the operational use of EGNOS for safety critical applications. Ongoing flight trials are continuing to demonstrate the potential benefits of EGNOS to the aviation community. In parallel, considerable work is underway to overcome the barriers for operational use of EGNOS by airspace users.

We first report on the recent Growing Galileo conference where it was reinforced that EGNOS full deployment is planned by 2008, and intended to be fully certified for aviation by 2009. We also touch on some of the other positive messages from EGNOS users at the event.

In preparing for EGNOS operational use in aviation, it is necessary to undertake a multi-faceted certification process. In this issue we provide an overview of the process, main actors and some of the key activities being performed.

As an example of the exciting potential of EGNOS in aviation, we then take a detailed look at recent helicopter flight trials carried out in Switzerland to support emergency medical services.

Finally, we give a quick taste of potential EGNOS aviation applications. We review a sample of the large number of EGNOS trials and demonstrations on the ground, in the air and coming down to land.

As always, we very much look forward to receiving your comments and any suggestions you have for future issues.



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A Growing Future For EGNOS

At the recent Growing Galileo conference on 14th and 15th November in Brussels there were many positive messages for EGNOS.

The GNSS Supervisory Authority (GSA) hosted event was intended to launch GNSS activities under Framework Programme (FP) 7 and inform participants about technologies and applications from FP6.

EGNOS was highlighted as a key area in both previous and forthcoming research programmes— reinforcing EGNOS as a key part of future European GNSS.

Possible forthcoming areas of research for EGNOS primarily discussed included (amongst others):

- Accelerating EGNOS adoption in aviation.
- Innovative road applications.

- Consumer applications in mass market LBS.

EGNOS also drew significant attention from participants with integrity requirements proving to be a hot topic for past and future programmes.

The bright future for EGNOS was reinforced with a positive message delivered by Ugo Celestino, transport applications officer at the GSA. He stressed that the GSA will facilitate the accelerated adoption of EGNOS in aviation by:

- Reassuring the aviation community about EGNOS long term service provision commitment.
- Ensuring EGNOS full deployment by 2008.
- Completing the certification process by 2009.
- Continuing to improve EGNOS performance.
- Ongoing interaction with all aviation community members.



The Growing Galileo Conference

Not surprisingly, Growing Galileo was well received by EGNOS users at the event who expressed great expectations from EGNOS in the near future and beyond.

Rescued By EGNOS



The Eurocopter EC-155 (skytalk-skyguide's internal publication, December 2007)

In June this year the GIANT (GNSS introduction in the aviation sector) project effectively applied EGNOS to support Helicopter Emergency Medical Services (HEMS). Trials conducted in Lausanne, Switzerland, demonstrated that EGNOS can make helicopter operations safer and better for the environment.

Keeping helicopters available during an emergency

In topographically challenging environments like Switzerland, safely accessing hospitals after an evacuation in the mountains can be difficult, especially during the winter months and in bad weather, when deep valleys are often shrouded in fog. The Swiss HEMS agency (REGA) has long advocated the improvement of operations in these conditions to increase the availability and safety of helicopter medical services in an emergency. Together with REGA, GIANT partner Skyguide sought to investigate and validate the operational benefits of EGNOS for HEMS.

Trials for new approaches

For the Lausanne trials, Skyguide designed 6° and 9° approach angles, using the future 'Approach with Vertical Guidance' (APV) criteria, to be performed by helicopters landing on HEMS pads located within a city. In total, 26 of the steep (standard is 3°) APV approaches were flown for the first time with the support of EGNOS.

The flight trials were based at the helipad of the Blécherette aerodrome in Lausanne and were operated by Eurocopter. The approaches were flown to the helipads located on the roof of the University Hospital of Lausanne (CHUV). A Eurocopter EC-155 experimental HTT (Hélicoptère Tous Temps) was used, equipped with a CMC-GPS/EGNOS receiver.

In a first step, the quality of the EGNOS navigation system was investigated. The position accuracy was found to be 1.2 m, both horizontally and vertically. This considerably exceeds the ICAO APV-I requirements of 16 m horizontally and 20 m vertically. EGNOS navigation was available 100% of the time (ICAO requirement: 99.999%).

In a second step, all 26 approaches were investigated as to how precise the pilot was able to follow the desired flight path in the final approach segment. This accuracy was found to be 20-40m horizontally as well as vertically. An example of some of the 9° final approaches (black) in relation to the desired path (red) are shown in the figure. Successful approaches were not landed in most cases, resulting in the deviation seen at CHUV.

Feedback from the test pilots indicated that despite the steep final slopes, the approaches are

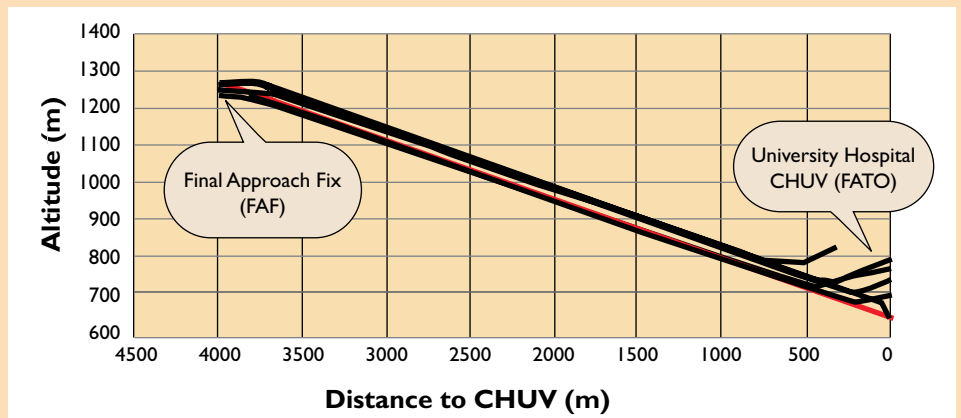
easy to fly thanks to GPS/EGNOS 3D guidance and should be well adapted to real helicopter operations. The 9° slope also provides the greatest benefits as it provides the best noise abatement for the population below the approach path.

EGNOS benefits validated

The GIANT trial demonstrates that EGNOS offers new interesting possibilities for helicopter navigation. Significantly, the creation of Instrument Flight Rules (IFR) approaches for Helicopter Emergency Medical Services operations allowing increased availability during emergencies and reduced noise abatement.

GIANT Partners say the results of the Swiss flight trials provide further evidence of the value of EGNOS for the improvement of aviation safety and efficiency throughout Europe.

GIANT is a 6th FP project coordinated by INECO, a leading engineering and consulting company in Spain and managed by the GSA supported by EUROCONTROL acting as technical manager. Future activities undertaken by GIANT will also include aircraft and helicopter trials, notably helicopters flying to North Sea oil rigs



Approach flight path with slope angle 9° (skytalk - skyguide's internal publication, December 2007)

En-Route To Certification

For EGNOS to provide Safety of Life services to aviation it must first be certified – but what does this mean in practice?

The aviation domain is widely recognised as having one of the most stringent regulatory frameworks for navigation services. Furthermore, aviation applications create many demanding navigation requirements. Therefore certifying EGNOS for aviation is not only challenging, but also overcomes major hurdles which may be met when providing safety of life service to other domains in the future.

In aviation, certification can appear a complex process and this is no exception for EGNOS. It is a key process to ensure safety, interoperability and effective operation of the airspace.

As such, certification touches on many areas of EGNOS including user equipment on-board, service provision, system design, operations and procedures.

There has been much progress on these areas, and work is ongoing to accelerate towards a situation where a fully certified EGNOS shall provide navigation services for the benefit of airspace users throughout Europe.

The certification responsibilities

This multi-faceted, Europe-wide process for EGNOS requires the involvement of a number of actors and certification bodies:

- GSA: coordinates the certification process;
- European Space Agency (ESA): EGNOS design authority and in charge of procuring the system development and operations.
- European Organisation for the Safety of Air Navigation (EUROCONTROL): provides support to the operational introduction of EGNOS into civil aviation.
- ICAO: Issues international standards for aviation.
- National supervisory authority (NSA): responsible

What do we mean by certification?

The demonstration and authorisation that the EGNOS system, service provision and equipment, are acceptable in order that EGNOS can be made available for safety critical operations by airspace users.

to deliver certificates for service providers under the Single European Sky regulation.

- Air Navigation Service Providers (ANSPs): national responsible for air traffic service provision.
- European Aviation Safety Agency (EASA): certification body for receiver equipment.
- EGNOS Service provider: responsible to operate the system and provide Safety of Life services

EGNOS certification process and evidence

	Regulation	Evidence	Certifying Body
System Certification	Compliance with SES interoperability regulation 552/2004 essential requirements	Technical file and declaration to be issued. Main part of technical file is an EGNOS Safety Case demonstrating compliance to ICAO SARPS.	Submitted to NSA in charge
Service Provider Certification	Compliance with SES service regulation 550/2004 & 2096/2005 requirements for Communication Navigation & Surveillance providers (CN&S)	Demonstration of compliance with regulatory requirements Work based on qualification exercise managed by ESA	Application to NSA in charge
Operational Approval for EGNOS Applications	National regulations	Application safety cases for specific operation and airspace prepared by national Air Navigation Service Providers (ANSPs)	Submitted by each ANSP to national regulators (NSA)
Receiver Certification	Technical Standard Orders and Minimum Operational Performance Standards (MOPS) for Satellite Based Augmentation System (SBAS) receivers	Demonstration of compliance to standards through aviation to certification body	EASA provides type approval after submission of design documents by manufactures

The certification process

Let's now dig down to the details of the planned process for certifying EGNOS.

EGNOS requires certification on a number of different levels:

- Demonstrating that the system is fit for purpose (meets ICAO SARPS).
- Certifying an EGNOS service provider.
- Certifying EGNOS equipment.
- Authorising the operational use of EGNOS applications for civil aviation.

The approach for the first two levels is to follow the framework established by the EC Single European Sky (SES) - specifically regulation for service provision and interoperability. EGNOS receiver equipment however, must meet the applicable international receiver standards.

As the table shows, for each level of certification solid evidence needs to be presented to the

appropriate authority.

This material is currently under development in a cooperative effort between responsible organisations. The material is mainly focused on the EGNOS safety case and service provider certification, detailed here after.

An EGNOS safety case

The central argument presented by the safety case is that EGNOS is compliant to the detailed technical civil aviation specifications presented in the ICAO Standards and Recommended Practices (SARPS). It will ensure that a user with a receiver which is compliant with the technical standards can achieve a positioning integrity and continuity performance as defined within the ICAO performance standards.

EGNOS as a Navigation Service Provider

To be certified as a Navigation Service Provider requires the demonstration of compliance with the many requirements placed on providers through the SES regulation. The EGNOS service provider will

need to demonstrate to the NSA in charge that it meets a set of common requirements covering:

- Technical and operational competence and suitability;
- Adequate safety and quality management systems.
- Security.
- Reporting systems.
- Quality of services.
- Appropriate liability and insurance cover
- Organisation structure
- Prevention of conflicts of interest.
- Human resources plans.

Looking towards a fully certified EGNOS

With EGNOS full deployment planned by 2008 work is well underway on EGNOS certification—notably the issuing of in-work versions of the EGNOS Safety Case.

The planned certification process is due to be complete by 2009, enabling EGNOS to offer safety of life service to the aviation community. The information presented in this article was prepared in cooperation with Eric Chatre, GSA.



Safety critical operations: a controlled landing

Fly With EGNOS



Air Nostrum Dash-8 aircraft

With aviation applications driving certification, we take a look at a select few of the large number of EGNOS flight trials and demonstrations undertaken or planned.

GIANT flight trials: results

In the frame of the GIANT project, EGNOS flight trials have been successfully conducted in Valencia in October 2006. The trials were coordinated by Aena -the Spanish Air Navigation Service Provider- and the major Spanish regional airline Air Nostrum. In this issue, we provide an update on the results.

The trials consisted of a number of LPV (Localiser Performance with Vertical Guidance) approaches to a non-ILS-equipped runway at Valencia airport. The EGNOS enabled LPV approaches were

successfully completed resulting in several potential benefits over the old procedures. The advantages are derived from:

- Vertical guidance – reduced risk of Controlled Flight Into Terrain (CFIT).
- Reduced pilot workload.
- Potential reduction in engine noise and fuel burn.
- Lower minima (when the pilot must see the runway) allowing increased accessibility in bad weather.

The Valencia LPV flight trial was the first in Europe to be conducted by a regional airline using the EGNOS signal and has shown that tangible operational benefits can be obtained.

Further flight trials demonstrating the benefits of using EGNOS for LPV approaches are planned during 2008 using a CRJ-200, and what is a major leap forward, with GNSS integrated avionics.

EGNOS in Africa

Over the past years several flight trials have taken place across Africa using the AFI System Test Bed (ASTB) enabling EGNOS to extend into Africa.

Flight trials and demonstrations were performed in Dakar in 2003 and at airports in Nigeria, Cameroon, Gabon, and Equatorial Guinea. The trials culminated in a West-to-East flight across the widest part of Africa, from Dakar to Mombasa, in May 2005.

Using the EGNOS test bed signal continuously, the ATR42 test aircraft of ASECNA (Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar) successfully navigated the 7000km route executing a series of APV (Approach with Vertical guidance) approaches to airports.

The successful flight trials highlighted the capabilities provided by the planned operational extension of EGNOS for Africa. This operational EGNOS extension is called the Interregional Satellite based system over Africa-India region (ISA).

The EGNOS flight trial successfully showed that the EGNOS navigation performance met the requirements for APV and supported the ICAO decision to



ASECNA plane on runway after landing using EGNOS

implement an operational ISA based on EGNOS.

The trials were undertaken as part of the 6FP Programme for Development and Demonstration of Applications for Galileo and EGNOS (ProDDAGE), currently managed by GSA and supported by ESA.

Airport surface movement

Under conditions of reduced visibility (rain, snow, fog etc) safe surface movement of aircraft and ground vehicles around congested airport aprons

becomes increasingly difficult. This can become the limiting factor on airport operations.

Testing carried out at a Portuguese airport in June 2005 has shown the benefits from improved situational awareness for airport surface movements (and therefore safety) through use of a low cost Airport Surface Movement Guidance and Control System (A-SMGCS) based on EGNOS.

Part of ESA's GNSS for Airports Movements Monitoring and Alert (GAMMA) initiative, this project demonstrated the use of a low cost A-SMGCS which

relied on the EGNOS Signal In Space (SIS) to provide the required level of accuracy and integrity (in terms of the upper bound on position error). Carried out at Portugal's Francisco Sa Carneiro Porto Airport, it demonstrated the feasibility of EGNOS to support the functionality and the new services provided (guidance, surveillance and control for surface movement).

Frequently Asked Questions

Q1 – When will EGNOS be certified for aviation?

A1 – Following full deployment planned for 2008, the certification process is planned to be complete by 2009.

Q2 – Can EGNOS be used for safety critical applications in aviation today?

A2 – Not yet... civil aviation users should not use the EGNOS SIS for safety critical purposes until the certification process is complete.



Q3 – Will there be more EGNOS flight trials in the future?

A3 – Yes. EGNOS trials for both fixed wing aircraft and helicopters in a range of operations are ongoing.

Q4 – How will the EGNOS Signal in Space (SIS) change once certification is complete?

A4 – Primarily, by the removal of Message Type 0 (MT0) "Do not Use" as specified in ICAO SARPS.

Forthcoming Events

Institute Of Navigation National Technical Meetings (ION NTM 2008), San Diego, California, 28-30 January 2008
<http://www.ion.org/meetings/>

Munich Satellite Navigation Summit 2008, Munich, Germany, 19-21 February 2008
<http://www.munich-satellite-navigation-summit.org/>

European Navigation Conference (ENC-GNSS 2008), Toulouse, France, 23-25 April 2008
<http://www.toulousespaceshow.eu/enc-gnss08/>

IEEE/ION Position Location and Navigation Symposium, (PLANS 2008) Monterey, California, 6-8 May 2008
<http://www.plansconference.org/>

Institute Of Navigation (ION GNSS 2008) Savannah, Georgia, 16-19 September 2008
<http://www.ion.org/meetings/>

Satellite Navigation User Equipment Technology workshop (NAVITEC 2008), Noordwijk, the Netherlands, December 2008

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

ESA RIMS Entities Assistance Desk:
Egnos-read@esa.int

EGNOS News:
Egnos-News@esa.int

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

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

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

EC Galileo Web Page:
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>

USCG Navigation Center GPS Page:
<http://www.navcen.uscg.gov/gps/default.htm>

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.

Disclaimer

The EGNOS system is under development and a Signal in Space (SIS) is already available. A stable SIS is expected to be made throughout 2008 and certified for safety critical usage 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 the

implied warranties of fitness for a particular purpose. ESA makes no warranty that the EGNOS SIS messages will meet the requirements of users. No advice or information, whether oral or written, obtained by a user from ESA shall create any warranty. By using the EGNOS SIS, the user agrees that ESA shall not be liable for any direct, indirect, incidental, special or consequential damages, including but not limited to, damages for interruption of business, loss of profits, goodwill or other intangible losses, resulting from the use of, misuse of or the inability to use the EGNOS SIS.

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.**