esa

EGNOS NEWS

Volume 4, Issue 1, 2004

Editorial

Welcome to our new look EGNOS News heralding the transition from EGNOS System Test Bed to EGNOS. These are exciting times for all of us as we are approaching the end of the EGNOS development phase. In "Countdown to EGNOS" we are giving you an important update on the deployment status and initial performance, as well as giving you a feel for the plans for Operational Readiness Review and operations. One of ESA's great successes has been bringing the Artemis satellite on-line following its launch malfunction. Even better news for us, however, are the results of the first performance tests that we have been conducting for EGNOS. EGNOS promises to deliver real operational benefits for users.

In this issue we are also bringing you news of two interesting EGNOS applications. The first, Active Road Management Assisted by Satellite (ARMAS) aims to improve safety, increase traffic management and provide an electronic fee collection mechanism. It is currently being tested in Lisbon. The second, Common Agriculture Policy (CAP) fraud monitoring is using EGNOS to measure field areas.

We are looking forward to hearing what you are planning to do with EGNOS at the GNSS2004 conference. Please contact us at the EGNOS helpdesk – we are always interested to see how we can improve the service.

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Countdown to EGNOS

The countdown to EGNOS is progressing well. In this article we present the deployment status, give you early performance results, talk about the route to the Operational Readiness Review (ORR) and conclude by looking ahead to EGNOS operations.

Deployment Status

The deployment of the EGNOS infrastructure is moving swiftly. At the time of writing:

- all the Master Control Centres (MCC) have been deployed;
- five of the six Navigation Land Earth Stations (NLES) have been deployed with Torrejon due for completion shortly;
- 30 of the 34 RIMS have been deployed with only Golbasi, El Daba, Nouakchott and Bangalore pending; and
- both support facilities have been deployed.

Finally, all three EGNOS Geostationary satellites' transmissions (Inmarsat, IOR-W, AOR-E, and ESA's Artemis satellites) have been tested successfully during this period. This remarkable effort will allow EGNOS to deliver its SIS-2 performance in June/July – a major final step before the Operational Readiness Review (ORR).

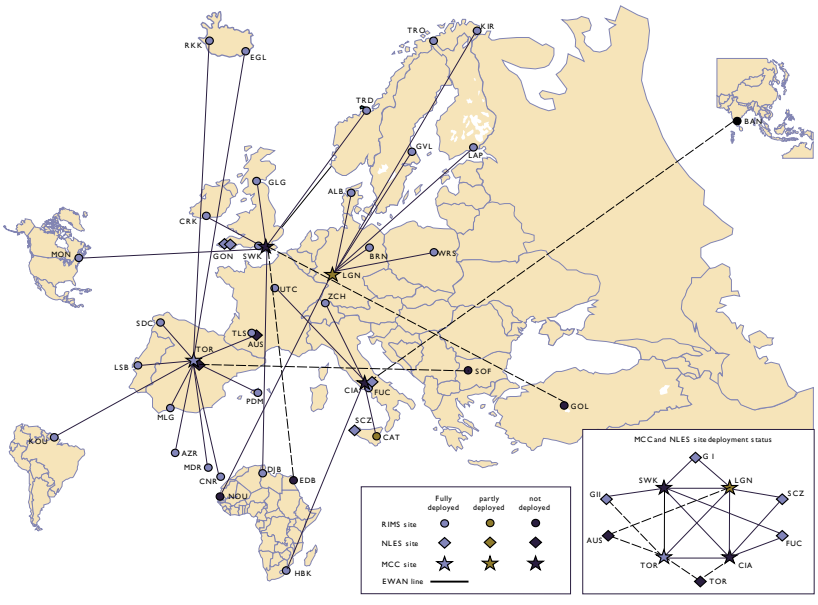
Performance

Our first EGNOS performance results based on SIS-1 (16 RIMS, 1 MCC, 1 NLES and 1 GEO) are very encouraging.

Together with our IMAGE (Independent Monitoring Assessment of GNSS signal-in-space Emission) partners, we have measured accuracies of 1-2m (95%) horizontal, and 1-2 m (95%) vertical. These are far better the 7.7 m (95%) specified and are a testament to all who have been involved in the EGNOS development.

With this limited SIS-1 RIMS configuration, we have also measured APV performance in the centre of Europe, already very similar to those obtained with the operational US Wide Area Augmentation System (WAAS).

Most recently (April 23, 2004) we have also measured EGNOS performance with up to 28 RIMS. The results are excellent with accuracies better than 1m in several sites and APV availabilities of the order of 100%, while at the same time we measured very comfortable safety margins.
Our next step in June/July 2004 is to assess long-term performance using the complete SIS-2 configuration. We are expecting to consolidate and improve on the current encouraging results and to realise the final performance that we are expecting from the operational EGNOS system.



Deployed Infrastructure - April 2004

Countdown to EGNOS (continued from page 1)

Moving to ORR

The EGNOS Factory Qualification Review (FQR) and Operational Readiness Review (ORR) are the final milestones in the EGNOS development programme.

ESA's FQR Review Board started in January 2004, and is expected to be concluded by the end of May 2004.

Our next challenge is the ORR comprising:

- the final system functional and operational requirements verification; verifying operator readiness to initiate Initial Operations; and checking that system releases and MCC/PACF platforms are available for operations; and
- the final Performance Qualification for Verification of System Navigation performance requirements.

The EGNOS ORR is expected to be concluded by the third quarter of 2004.

Operations

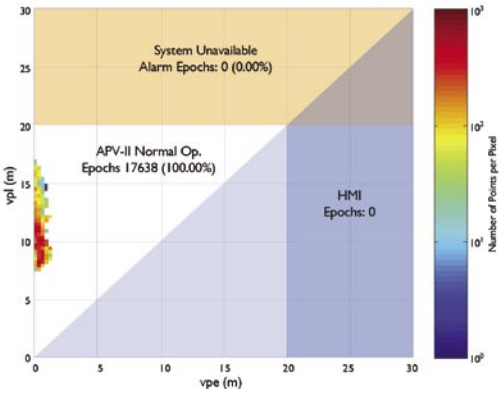
This brings us to the operations phase where our objectives are:

- to initiate and stabilise operations of the GS (Ground Segment) and SF (Support Facilities);
- to qualify operations of the GS and SF; and
- to arrive at the Operations Qualification Review(OQR) +1 day with an operationally-qualified system providing safety-of-life services.

To do this, we have a three-step approach based around:

- an Operations Preparation Phase where we initiate operations and exercise the system. This on-going activity is contracted to the European Satellite Service Provider (ESSP) and will be concluded in June 2004;
- an Initial Operations Phase, where we stabilise and optimise operations. This activity is planned to start after the EGNOS Operational Readiness review; and
- an Operations Qualification Phase (OQP) where we qualify operations leading to the Operations approval, at a level compatible with the provision of safety of life operations for long-term EGNOS performance testing.

EGNOS APV-II Performance with 28 RIMS (Paris, 23 April 2004)



Artemis - a success story

EGNOS will rely on the Artemis (Advanced Relay and Technology Mission) Technology satellite at 21.5°E to broadcast its signal to users.

Artemis was launched on 12 July 2001, but you probably remember that launcher malfunctions left it stranded a long way from its intended position in geostationary orbit.

Faced with a potential catastrophe, ESA and industry specialists responded vigorously with a series of innovative control procedures to rescue the spacecraft. They used Artemis' groundbreaking ion propulsion system together with innovative use of its chemical thrusters to place the satellite in geostationary orbit over an eleven month period.

In-orbit testing of Artemis's navigation payload took place at ESA sites in Redu, Belgium, during Feb/March 2003. We assessed and verified all the specified satellite navigation performance parameters including EIRP (Effective Isotropic Radiated Power) and EIRP stability, group delay and group delay stability at both Ku and GPS L1 frequencies. We were delighted to confirm that all measured parameters were well within the original specifications.

Our next step was to integrate Artemis with its EGNOS uplink station (NLES). This started in October 2003 when ARTEMIS was connected to the EGNOS NLES at Scanzano, Italy to broadcast an EGNOS-like SBAS RTCA MOPS standardized signal. The first transmission was a real success. After verification of the RF characteristics of the complete transmission chain, the first signal EGNOS messages were uplinked to the satellite. The NLES went into active tracking mode within a few minutes and no abnormal behaviour was noticed. In fact, the levels of the downlink signals were even better than specified.

In April this year we obtained our first end-to-end EGNOS performance results with the EGNOS signal and messages transmitted through the ARTEMIS GEO.

News from Brussels

The Galileo Joint Undertaking is responsible for the Galileo-related activities within the Sixth Framework Programme (6FP) in co-ordination with the EC. The first activities were let earlier this year following the 1st call.

The launch of the 2nd call is foreseen for the 2nd half of May and the Information Day will take place in Brussels on 2nd June.

The call will be focused on three areas:

- user segment;
- mission implementation; and
- innovation and international initiatives.

Further information is available at www.galileoju.com

The pre-selection Phase of the GALILEO Concession was completed the GALILEO Joint Undertaking on 9 February 2004 with the decision to pre-select three bidders.

One consortium comprises Eutelsat SA, Hispasat SA, and Logica CMG, the second, named iNavsat, comprises EADS Space, Inmarsat Ventures plc, Thales SA and the third consists of Alcatel Participations SA, Finmeccanica and Vinci Concessions SA.

The next Phase of the Concession commenced with the delivery of the Tender Documentation to the short-listed bidders on April 15th. This phase will result in the identification of a preferred bidder by the GALILEO Joint Undertaking, in September 2004. Negotiations will take place with the Preferred Bidder to agree and sign a concession Contract by the end of 2005.

Galileo Joint Undertaking 6FP 1st Call Activities

	Activities	Budget (M Euro)	Financing Level	Comments
A	User Receiver Prelim. Development	3.8	100%	• Core technologies • Basis for the 2nd call
B	Galileo Local Component Develop.	3.8	100%	• Building blocks • Input for 2nd call
C	Introduction of Galileo Services using EGNOS	4.7	50%	• Close to the market • Service implementation
D	Application Market Development	1.7	100%	• Service type contract
E	Mission Implementation	4.9	100%	• Service contract on key technical fields: • Services/standard/ frequency

Road management in Lisbon

Today, real-time active road management tests are being conducted on the Vasco Da Gama Bridge in Lisbon with real benefits for all of us.

The European Commission's White Paper "European Transport Policy for 2010: Time to Decide" gives two reasons for pursuing Active Road Management Assisted by Satellite (ARMAS): the human tragedy of road accidents and the need for infrastructure charging.

The White Paper provides horrifying road accident statistics: each year in Europe, 40 000 people die and 1 700 000 are injured in road accidents. Moreover, the statistics show that one in three Europeans will become road accident victims during the course of their lifetime. Europe is looking at ways to improve these statistics and road traffic surveillance using satellite technology is one candidate.

The White Paper concludes that one of the main reasons for the imbalance in the current transport system is that the transport modes do not always pay the costs for which they are responsible. Infrastructure charging is not a panacea but, together with the support of other instruments, it is a solution to the problem of financing major transport infrastructure.

ARMAS has been developed by ESA in partnership with the Portuguese companies Skysoft and INOV and with the support of Auto-Estradas do Atlântico and Lusoponte. It aims to transform the transport infrastructure by:

- improving safety;
- increasing dynamic traffic management capabilities; and
- providing electronic fee collection mechanisms.

During ARMAS Phase 1, we wanted to assess the feasibility of an Intelligent Car Navigation System based on satellite navigation and cellular network technologies, with three aims:

- to improve the safety of car navigation by an order of magnitude;
- to make dynamic traffic management an attractive and realistic proposition;
- and provide a competitive solution for tolling based on satellite positioning.

We have been conducting real-time tests on the Vasco Da Gama Bridge in Lisbon, one of the longest bridges in Europe. A receiver located inside the vehicle calculates its position in real time and enables information to be exchanged with a regional control centre.

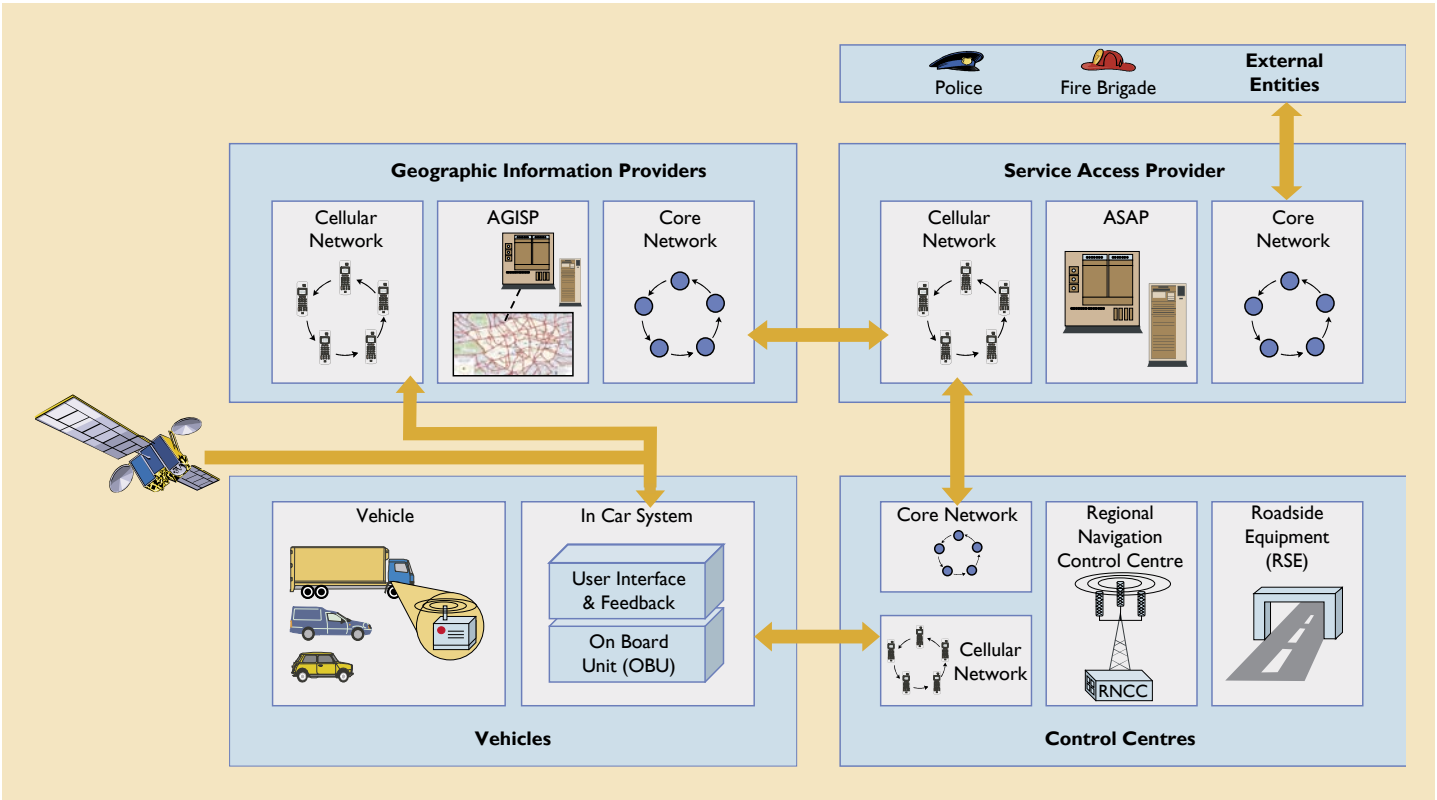
At the end of ARMAS Phase I we have identified three firm benefits:

- *virtual tolling* - which saves time and potentially puts an end to the dangerous traffic queues that occur at toll booths;
- *vehicle reporting* - where a vehicle can report problems that might occur while travelling. An SOS alarm can be sent in an emergency, allowing the control centre to send assistance immediately and alerting nearby motorists to slow down; and
- *situational awareness* - warning messages can be used to notify drivers of hazards ahead (tailbacks, lane changes, accidents etc). This is one example of real-time traffic management that should help accident prevention. ARMAS could later be applied to all road networks.

EGNOS is important for the success of ARMAS. Its position and timing accuracy significantly improves on that provided by GPS. Its system availability and integrity is key for applications like virtual tolling with its associated charging and revenue collection mechanisms. EGNOS will be certified against international standards and this will provide a firm foundation for systems like ARMAS that need to develop safety cases. Finally, EGNOS will provide a single seamless service over Europe, meaning that a system like ARMAS can be developed to target the whole of Europe rather than a specific country or region.

We are now looking forward to ARMAS Phase II. This aims to demonstrate the application of ARMAS to Electronic Fee Collection based on satellite positioning for highways and urban areas. Our goals include:

- implementing an ARMAS test-bed for advanced Intelligent Transport Systems (ITS) applications; and
- investigating the critical issues related to the successful introduction of Virtual Tolling using the test-bed, focusing on topics like reliability, integrity and fraud robustness.



ARMAS Architecture

Monitoring CAP Fraud

The European Agricultural Guidance and Guarantee Fund (EAGGF), set up for the financing of the Common Agricultural Policy (CAP) consumes a large part of the general budget of the European Union (close to 43 billion Euros in 2004). Hence, there is a need to control irregularities in the payment of amounts for the financing of the CAP, to recover amounts lost and to determine the nature of fraudulent practices and their financial effects.

The fraud monitoring activity involves carrying out on-the-spot-checks of agricultural areas (parcels) that have been declared for EC CAP funding, in order to verify their compliance with the terms under which aid has been granted. An independent inspection is required both to verify agricultural parcel boundaries and to verify eligibility for CAP funding. On the spot inspections are carried out for at least 5% of applications made each year.

The check consists of two parts: a preliminary verification of all declared agricultural parcels against map data, and a physical inspection of a sample of at least half the total areas to verify the crops, their quality and the precise size of the parcels. Non-eligible areas such as roads, ditches, buildings, woodland and permanent crops are excluded from the measurements.

The European Commission's Joint Research Centre at Ispra in Italy has acted as a focal point for much of the fraud monitoring activities. Its MARS (Monitoring Agriculture with Remote Sensing) activities provide technical support expertise for the implementation, management and follow-up of the CAP. The JRC has been actively assessing the deployment of satellite navigation techniques including EGNOS for CAP fraud monitoring. Both EGNOS and GALILEO are expected to improve accuracy and reliability.

The best practice relies on the application of tolerances to the assessment of the difference between the declared and measured areas of the agricultural parcel in the process of an on-the-spot check.

Tolerances can be expressed in two ways: either as a perimeter "buffer", or as a percentage of the measured parcel area. The former method is advised as being more appropriate for reliable and efficient measurement for GPS-based techniques. The tolerance requirement for GPS is up to 1.25m times the perimeter of the parcel; with EGNOS it is expected that measurement accuracy can be increased to reduce the tolerance considerably.

GPS and DGPS are already proving themselves in this environment. Early validation tests of SBAS (EGNOS) enabled systems have now started to show results of up to a five-fold improvement in technical tolerance, giving an indication of performance expected when EGNOS becomes fully operational.

Frequently Asked Questions

Q1 – EGNOS vertical accuracy is specified as 7.6 meters. How well will EGNOS perform when fully operational?

A1 – The good news is that the early EGNOS performance with the SIS-1 configuration is exceeding our expectations with accuracies of 1meter horizontal and 1-2 meters vertical being achieved.

Q2 - Will EGNOS services be offered outside Europe in the short term?

A2 - Yes, there are initiatives envisaging the development and demonstration of EGNOS services in 2005 over the broad Mediterranean region including most of the North African and Mediterranean countries.

Forthcoming Events

ENC-GNSS 2004, Rotterdam, The Netherlands, 16-19 May 2004, www.enc-gnss2004.com

ION 60th Annual Meeting, Dayton, Ohio, USA, 7-9 June 2004, www.ion.org

EURAN 2004, Munich, Germany, 22-23 June 2004, www.dgon.de

Farnborough International 2004, Farnborough, UK, 19-25 July 2004, www.farnborough.com

ION GNSS 2004, Long Beach, California, USA, 21-24 September 2004, www.ion.org

NAV 04/AIS 04, London, UK, 9-11 November 2004, www.rin.org.uk

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 ESTB Web Page: http://www.esa.int/ESTB

ESA ESTB Help Desk: ESTB@esa.int

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

EGNOS News: EGNOS- News@esa.int

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

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

EC Galileo Web Page: http://www.europa.eu.int/comm/energy_transport/en/gal_en.html

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

USCG Navigation Center GPS Page: http://www.navcen.uscg.mil/gps/

Galileo Joint Undertaking www.galileoju.com

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Stop Press

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