esa ESTB NEWS

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Editorial

This, ESTB News's first anniversary, is a good time to remind ourselves of the significant advances made on European satellite navigation during the last year: the recent EGNOS Critical Design Review (CDR) concluded that the system is sound and in a very good stage of definition; the ESTB is being consolidated, and operations having been secured until at least mid-2003; and the EU and ESA Member States have agreed on an approach and funding for the development of Galileo that includes EGNOS operations.

In this issue you can read an interview conducted with Nicolas de Ledinghen, EGNOS programme manager at Alcatel Space Industries. We report on a successful curved-approach trial at Nice with exciting safety and environmental benefits, and present ESA's SISNeT product that promises to improve the availability of EGNOS data in urban environments. Other articles give the latest news from Brussels, describe how the ESTB will shortly be delivering sub-meter accuracy, and present answers to frequently asked questions.

EGNOS CDR Successful

Editor, Sally Basker, interviews Nicolas de Ledinghen, EGNOS programme manager at Alcatel Space, following the successful EGNOS critical design review.

Q *How important was the recent EGNOS Critical Design Review to Alcatel and its industry partners?*

A This has been a very important milestone for us. 75 independent assessors checked systems, sub-systems, and the implementation plans and confirmed their competence and consistency. EGNOS is in good shape and it should deliver a level of service beyond expectation.

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SISNeT: Enhancing EGNOS for Land-Mobile Users

SISNet allows users to access the EGNOS signal-in-space over the Internet in real-time, improving the availability of EGNOS data in urban and other challenging environments.

EGNOS will broadcast through three geostationary (GEO) satellites, and the user has to maintain contact with at least one of them. This is fine for many users (e.g. aviation and maritime), but others (e.g. land mobile) may experience service outages in, say, urban canyons. This is particularly significant because ESA has shown that an EGNOS solution is more robust in these environments with higher mask angles, and that using the WAD corrections can deliver 10m accuracy (95%) with a high level of availability.

Consequently, ESA is pursuing activities that aim to exploit fully the potential of EGNOS by investigating complementary transmission link options for EGNOS. SISNeT (**S**ignal **I**n **S**pace through the

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Silence is Golden: EGNOS Demonstrates Potential Environmental Benefits for City Airports

EUROCONTROL conducted flight trials at Nice in September 2001 that demonstrated how EGNOS could facilitate curved approaches, improving safety and reducing aircraft noise for local inhabitants.

Today, aircraft have a choice when approaching Nice airport: they either choose a visual approach along the Cap d'Antibes peninsula followed by a sharp unguided turn - a complex manoeuvre; or, under poor visibility, they choose an ILS Cat-I approach straight over the peninsula - raising many noise complaints from local residents. Hence, EUROCONTROL considered this to be an ideal opportunity to test an EGNOS-based curved approach with vertical guidance as part of its operational validation activities.

Working together with the French DGAC, they designed a bespoke curved approach procedure for Nice based on draft and existing design criteria (See Page 3). There are curves in this that can only be flown by aircraft with state-of-the-art Flight Management Systems (FMS), and vertical guidance is required all along the approach path from a high

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NLR's Cessna Citation II Research Aircraft

EGNOS CDR Successful: *(continued from front cover)*

Nicolas de Ledinghen, EGNOS Programme Manager at Alcatel

Q *How confident are you that EGNOS will not suffer from the same problems as the WAAS?*

A We have learned from their experience, and there are subtle differences between EGNOS and WAAS. Our incremental design process has accounted for all potential failure events including ionospheric behaviour. As a result, we are confident that EGNOS will deliver a high quality service even in the worst-case scenario.

Q *How have you designed and built safety into the system so that it can support safety-related aviation applications?*

A Safety is a priority design goal, and has been integrated in the design. We have merged the best space and aviation experience and standards in an integrated system engineering approach. Furthermore, independent safety working groups have conducted periodic audits.

Q *How can users be sure that their EGNOS receivers will work with the equivalent US and Japanese systems?*

A EGNOS meets the international standards for satellite-based augmentation systems. Manufacturers are developing receivers for the global market, hence ensuring interoperability.

Q *Can the EGNOS core service area be extended, and are there any plans so to do?*

A Coverage extension is built into the design either by adding RIMS or by sharing infrastructure and computing with adjacent EGNOS-like systems. There is a lot of interest although formal plans do not yet exist. We hope to progress this further.

Q *How have you accounted for user requirements in the EGNOS system?*

A We have designed EGNOS to meet system and operational requirements than can be traced back to user requirements, and have optimised operational man/machine interfaces during discussions with air traffic service providers. Future users are participating in reviews, and there is useful feedback from user trials.

Q *ESA's ESTB is an EGNOS prototype. How important is the ESTB for industry?*

A The ESTB has had a key role in the development process, helping us to shape the design, tune algorithms, and assess real-time issues using real data. It is also helping us to prepare the market for EGNOS applications and procedures.

Q *What are the key steps before the system is declared operational?*

A There are five key steps before 2004: subsystem deliveries are ongoing and system integration started in early May; the first RIMS will be deployed in Q4 2002; the Factory Qualification Review will take place in early 2003; the first true EGNOS signal-in-space will be available in the middle of 2003; and the Operational Readiness Review is in early 2004.

Q *What has industry learned from the EGNOS development, and how do you think users are going to benefit?*

A We have learned a lot about developing large distributed systems with primary criteria that include failure tolerance and quality of service (i.e. integrity). Working with large teams has forced us to be rigorous with the interfaces … although there was early pain, there has also been great gain. Users will benefit from an excellent quality of service that can be used by many applications.

Q *What is the future for EGNOS following the recent ESA and EU decisions to move ahead with Galileo?*

A Galileo, when operational, will extend the benefits of EGNOS. EGNOS will continue to enhance GPS, and this is fully consistent with Europe's unified satellite navigation strategy that foresees the integration of EGNOS into Galileo. EGNOS will help to open up the markets for GNSS applications in Europe.

Q *EGNOS will be operational in early 2004. How confident are you in that date?*

A We are very confident that EGNOS will be operational in 2004. This relies on industry remaining dedicated and working diligently to meet remaining key milestones.

Behind the Scenes: Achieving Sub-Metre Accuracy With the ESTB

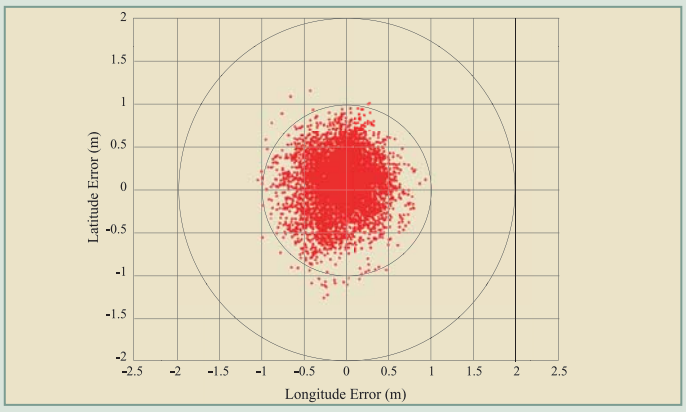
The ESTB team is always looking to improve its service, and the latest enhancements are providing sub-metre accuracy today.

A further software upgrade should be operational by July 2002. This will improve system availability to 95%, provide WAD corrections for the GEOs themselves, and meet the latest RTCA DO229B standard.

CNES and GMV experts, in support of ESA's ESTB, have carried out two subtle system modifications:

- The ESTB reference station co-ordinates have been improved; and
- The GPS inter-frequency biases (Tgd) are updated more frequently in the control processing facility.

Preliminary results from Toulouse show that the position error is now less than one meter with horizontal and vertical standard deviations of 0.7 m and 0.9 m respectively. Integrity has also been improved, with the availability of APV2 increased from 80% to 95%. Further tests are ongoing to confirm these new performance statistics. Performances analysis results from users are welcome at ESTB@esa.int.



ESTB Position Solution Showing Sub-Metre Accuracy

Silence is Golden: *(continued from front cover)*

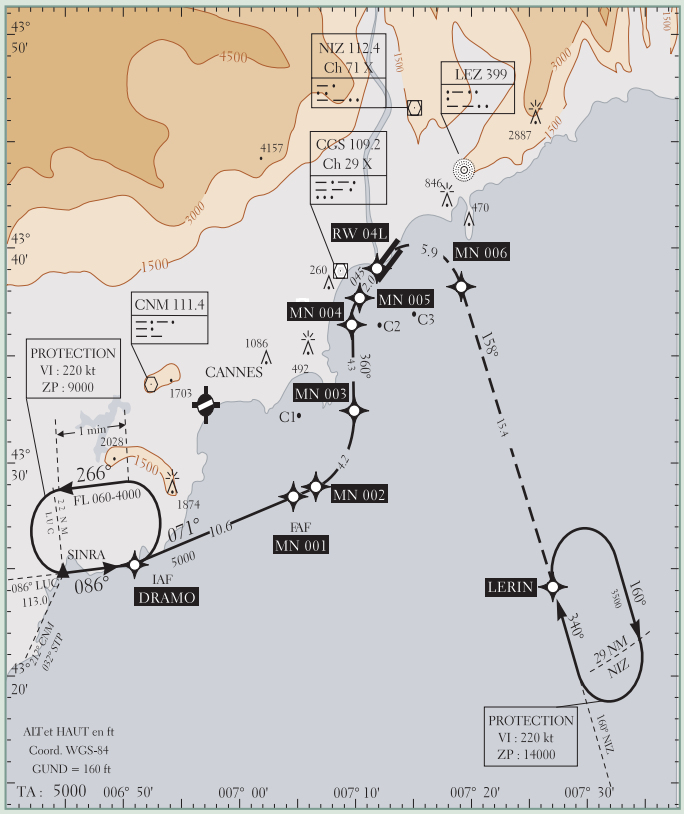
integrity navigation aid such as EGNOS.

This approach was tested initially using a commercial transport aircraft simulator. Two scenarios were studied: firstly, GPS alone with baro-altimeter to capture the ILS that is then used to land the aircraft; and secondly, EGNOS for the complete procedure. During the tests, it quickly became apparent that the former was not possible because the final straight approach was too short to acquire the ILS. Only a navigation aid providing continuous guidance along the approach would allow the Nice procedure to be flown.

The flight-tests took place on 26th and 27th September 2001 using NLR's Cessna Citation II research aircraft. EGNOS was investigated in two different ways: firstly by applying the ESTB position and integrity data to support flying curved approach procedures; and secondly, by providing ILS look-alike ESTB guidance to fly the standard straight-in approach to Nice over the Cap d'Antibes.

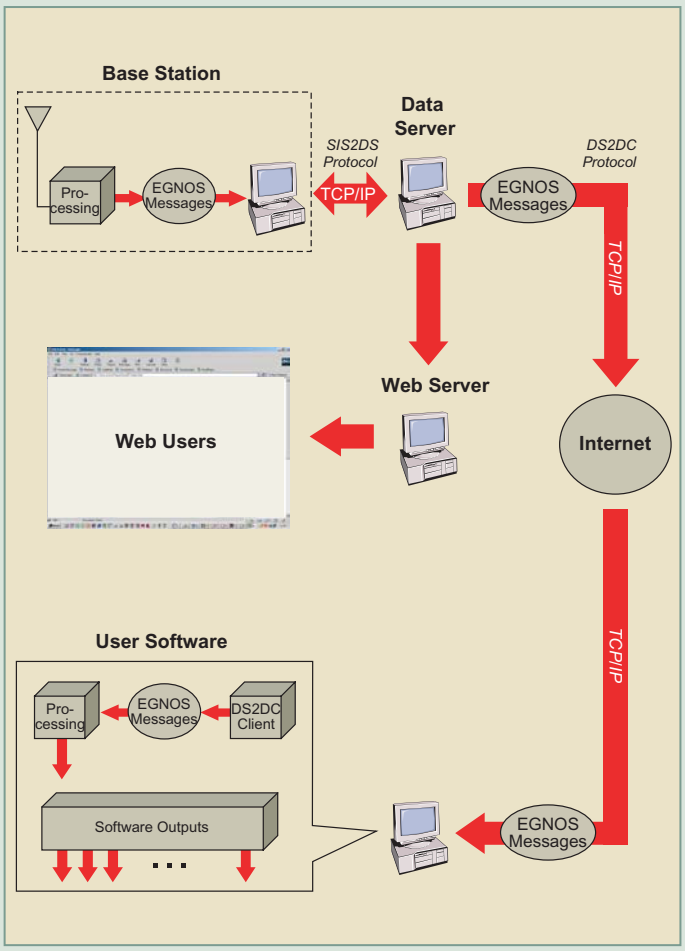
The results were processed using real-time kinematic GPS as the truth. From these, it was concluded that the ESTB met the demanding integrity and accuracy requirements for APV II precision approach. Most importantly, the pilots themselves were very complimentary … "Basically it was easy to fly the curved approaches using guidance from the ESTB … in general we were very impressed with the guidance from the ESTB system".

EGNOS will facilitate such curved approaches, bringing benefits to pilots and the environment. When EGNOS is fully operational in 2004 it should be possible for suitably equipped aircraft to choose a controlled curved-approach, improving safety and reducing aircraft noise for local inhabitants.



Experimental Curved Approach Procedure for Nice Airport

SISNeT: Enhancing EGNOS for Land-Mobile Users: *(continued from front cover)*



SISNeT System Architecture

inter**NeT**) is an internal ESA project that aims to provide access to the ESTB messages over the Internet.

The SISNeT concept is illustrated opposite and comprises a Base Station, Data Server, Web Server and the User Applications. The Base Station can acquire the EGNOS messages either from an EGNOS receiver or from the ESTB Central Processing Facility. These are provided in real-time to the Data Server that implements all the extra services provided by SISNeT to users (e.g. text messages) and transmits these to a large number of connected users.

ESA has published a comprehensive SISNeT User Interface Document for those interested in developing SISNeT User Applications. The data rate is very small, typically 500 bit/s, and hence there is plenty of scope for embedding SISNeT on Personal data Assistants (PDAs) and other devices aimed at the land mobile market.

ESA has recently developed SISNeT applications to demonstrate the power of this new technology including: real-time monitoring of the ESTB performance and SIS status over the World Wide Web (www.esa.int/estb). ESA has also placed a number of contracts to develop EGNOS-SISNeT receivers and to demonstrate its potential including: the development of an integrated SISNeT receiver based on a GPS receiver and a GSM/GPRS modem; the development of a handheld SISNeT receiver based on an iPAQ PDA (see overleaf); and demonstrations of SISNeT receivers in cars and buses.

The real benefits of SISNeT are clear:

- The EGNOS signal is available even if GEOs are not visible;
- The SISNeT data rate is less than 1 kbps, and hence can be accessed using GSM/GPRS;

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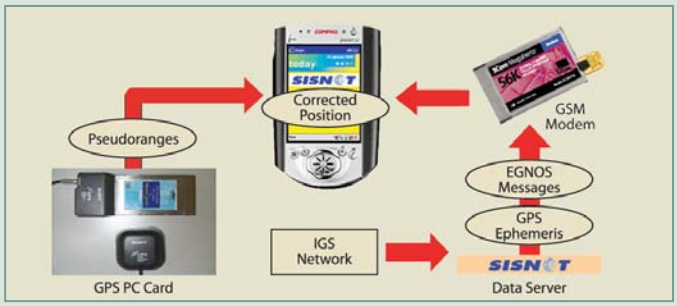
SISNeT: Enhancing EGNOS for Land-Mobile Users: *(continued from page 3)*

- You no longer need an EGNOS receiver to obtain the EGNOS data - only a connection to the Internet is required; and
- Pedestrian or land-mobile users will benefit from improved performance at higher mask angles in urban environments.

A SISNeT account can be requested by sending an email message to SISNeT@esa.int. Each account consists of a username, password and the IP address/port of the SISNeT Data Server.



SISNeT User Concept

News from Brussels

On 26th March 2002, the EU Council of Transport Ministers agreed on an approach and funding for the development of the Galileo system. On the same day the Ministers adopted a regulation for the establishment of the Galileo Joint Undertaking whose founder members are the European Community, represented by the European Commission, and the European Space Agency.

The Joint Undertaking will be in charge of the overall management for the development phase and for the preparation of the deployment and operations phase. It will also oversee the integration of EGNOS into Galileo. Finally, it will conclude an agreement with ESA to develop the Galileo space and ground segments.

Frequently Asked Questions

Q1: What are the different ESTB transmission modes?
A1: A set of ESTB broadcasting modes have been defined that indicate the messages and functions being broadcast. These vary from "internal test", when only test messages are broadcast, to "GIC/WAD corrections & ranging", when all possible data are provided. Further information is given in the ESTB User Interface Document at www.esa.int/estb. Real-time information on the current mode can also be obtained at the same address.

Q2: Why can't I receive the ESTB signal with my WAAS receiver?
A2: EGNOS and WAAS signals adhere to the same international standards, and receivers will track both systems when fully operational. However, in the current test-phase, each system transmits a different test-warning message. Both are allowed, but some receiver manufacturers have only implemented one of them. Several receivers can receive both EGNOS and WAAS. The ESTB Helpdesk (ESTB@esa.int) has more details

Links and Contacts

ESA Navigation Web Page:
www.esa.int/navigation

ESA EGNOS Web Page:
www.esa.int/EGNOS

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

ESA ESTB Help Desk:
ESTB@esa.int

SISNeT Administrator:
SISNET@esa.int

ESTB News:
ESTB-News@esa.int

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

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

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

FAA GPS Product Team:
gps.faa.gov

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

Forthcoming Events

GNSS2002, Copenhagen, Denmark, 27-30 May 2002
www.gnss2002.com

Farnborough International 2002, Farnborough, UK, 22-28 July 2002 www.farnborough.com

ION GPS 2002, Portland, Oregon, USA, 25-27 September 2002
www.ion.org

NAVSAT 2002, Nice, France,12-15 November 2002
www.navsat-show.com

Help Us to Help You

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