

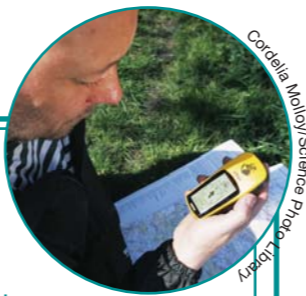
Some Examples of GNSS Applications include...

Telecommunications

Timing signals provided by the atomic clocks aboard each GNSS satellite are fundamental to the operation of digital telecommunication networks. The timing signals are used to control the flow of data packets through the network – without them, mobile phones would not work! The integration of GNSS receivers into mobile phones is bringing a multitude of new location-based services to consumers – from direction finding and real-time traffic information to the location of shops, restaurants and cinemas. Such services are expected to generate important new revenue streams for mobile operators and service providers.

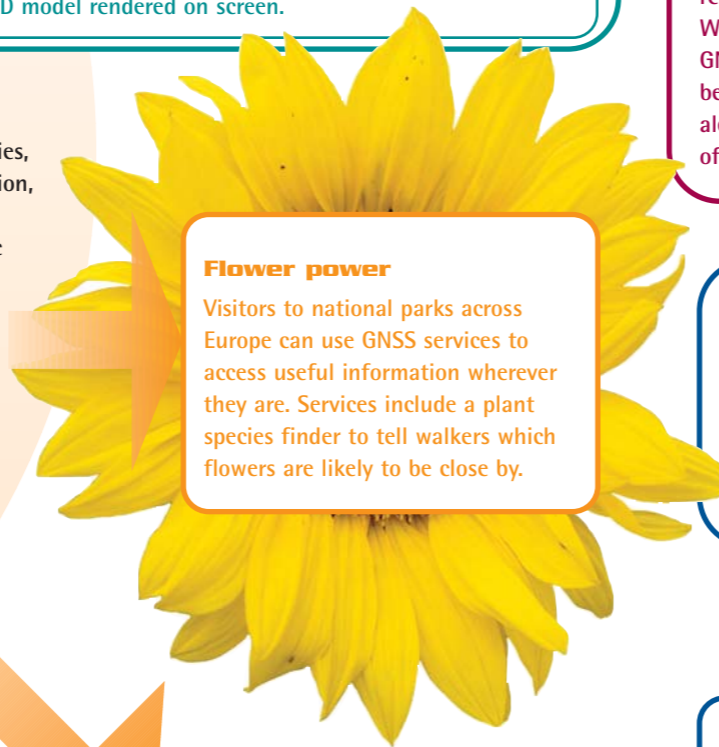
Lost in the city?

City University and the mobile phone company 3 are developing new software tools to help users of 3G phones orientate themselves and navigate within urban environments. By combining real and virtual worlds into an 'augmented reality' an enhanced representation of a local scene is created. This produces a more intuitive navigation tool. Using position data from GNSS and an electronic compass for orientation, the phone can be aligned with its surroundings and a 3D model rendered on screen.



Transport

Transport is the natural home of satellite navigation-based technologies, and each mode of transport has its own characteristic needs for position, velocity and time data. On the road, GNSS-enabled systems not only provide in-vehicle navigation but are also being used to reduce traffic congestion and track and manage fleets of vehicles. At sea and in the air, accurate and reliable information on the position and routes of aircraft and marine vessels enables safe and efficient management of traffic. Fishermen also use GNSS to find fish stocks, and many sailors now carry GNSS-enabled emergency beacons which can transmit their location to rescue services from anywhere on the globe. On the railway network, GNSS is able to offer improved cargo management, real-time track surveying and enhanced passenger information services. And as position accuracy and reliability continue to improve, it is possible to imagine a future where GNSS is an integral part of the control systems of pilot-less vehicles. Even the humble pedestrian can benefit from street navigation tools provided directly to their mobile phones.



Flower power

Visitors to national parks across Europe can use GNSS services to access useful information wherever they are. Services include a plant species finder to tell walkers which flowers are likely to be close by.

Berthing supertankers

Bringing a supertanker into a loading jetty can be a very delicate process and small errors can lead to significant damage to vessel and shore facilities. The UK and Irish General Lighthouse Authorities provide GNSS services to assist the tugs that control the movement of the ships as they are manoeuvred into shore.



Philippe Pailly/Eurimages/Science Photo Library

Where's the nearest taxi?

Finding the nearest taxi in London couldn't be easier. Taxis are using GNSS receivers and a radio link to continuously tell their dispatch office where they are. Using a fleet management system supplied by LogicaCMG, the dispatcher at the Computer Cab company can immediately allocate the nearest available taxi to customers.



Civil Protection

In major disasters such as earthquakes, floods, landslides and forest fires, traditional transport and communications infrastructures may be unusable. Successful relief operations rely on the co-ordination of real-time information of local geography, hazards, and alternative sources of power and water. GNSS navigation and location data, integrated with pre-disaster information and satellite imaging, is vital to the co-ordination effort.

Tracking offenders

As prison populations rise, governments are looking for alternative sentencing schemes. Accurate tracking of convicted offenders allows location-based sentences to be applied; offenders can be restricted to, or excluded from, defined locations. Wearable non-removable tags containing a GNSS receiver and a communications device can be used to monitor an offender's location and alert law enforcement agencies when the terms of their sentence are breached.



Offenders - we know where you are

Nottingham Scientific Ltd is working with a European consortium to develop a GNSS-based tracking system for offenders given non-custodial sentences. The key feature of the system is a guaranteed quality of service that provides position data reliable enough to meet the stringent requirements of justice systems across Europe.

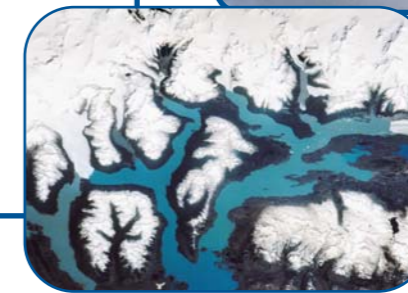
Civil Engineering

When GNSS is combined with ground-based systems, position can be determined to the centimetre, and even millimetre, level. This highly accurate position information is used in the surveying, building and monitoring of vital civil structures such as dams and bridges. Historic structures are also tracked for movement over time, and in earthquake zones, structural movements can be monitored for safety and to provide additional seismic data.



Land management and environmental monitoring

GNSS technologies have an important and wide ranging role in helping to understand and protect the natural environment. Knowledge of position and time enables us to monitor landslips, sea-level changes, and water heights in rivers and lakes. Dangerous goods can be tracked as they are transported to ensure their safe passage from one location to another. The combination of GNSS with earth observation data and the passage of GNSS signals through the atmosphere gives us new methods for weather forecasting and climate studies. And in the animal world, GNSS is being applied to track the movements of wild animals to help us preserve their habitats.



Weather forecasting

Scientists at the University of Nottingham have spent many years exploring how GNSS may be used as an environmental sensor, and have turned their knowledge of GNSS signals on its head. By understanding how water vapour affects the signals, they can aid weather forecasting by providing the UK Meteorological Office with critical data on the amount of water vapour in the atmosphere.

**Satellite Navigation in Transport and Logistics
A Pinpoint Faraday, Institute of Logistics and Transport,
and Royal Institute of Navigation Event**

Institute of Physics, London: 16 March 2004

This event will describe how satellite navigation systems work and explain current and future capabilities. Case studies will be presented of systems in use providing practical solutions in transport infrastructure, navigation and routing, logistics and fleet management.

For further details, please contact Paula Knee on 020 8943 6329 or e-mail at paula.knee@npl.co.uk

The 8th European Navigation Conference: "Merging Science and Applications"

The Netherlands Institute of Navigation, Rotterdam: 17-19 May 2004.

Scientists, engineers, manufacturers, service providers and users from the navigation/positioning and timing community are invited to the largest port in the world to learn about GNSS developments and see the latest products and services at the exhibition.

For further details, please contact the Netherlands Institute of Navigation at www.enc-gnss2004.com or Telephone: + 31 10 498 7518



FORTHCOMING NPL EVENTS

10 - 11 March 2004

Lead-free workshops

Contact: Roger Hughes

Tel: 020 8943 6164

E-mail: roger.hughes@npl.co.uk

11 - 12 March 2004

**Reliable Numerical
Computing Course**

Contact: Jan Kane

Tel: 020 8943 7100

E-mail: cmssc_training@npl.co.uk

15 - 16 March 2004

**10th UK Monte Carlo User
Group Meeting (MCNEG
2004)**

Contact: David Shipley

Tel: 020 8943 6252

E-mail: david.shipley@npl.co.uk

16 - 19 March 2004

**NPL Underwater
Acoustics/Corrosion
at Oceanology
International 2004**

Contact: Anne-Lise Christmas

Tel: 020 8943 7107

E-mail: anne-lise.christmas@npl.co.uk

18 March 2004

**Weighing & Density Group,
Annual Meeting**

Contact: Melanie Williams

Tel: 020 8943 6121

E-mail: melanie.williams@npl.co.uk

31 March 2004

**Structural Health
Monitoring: Advances in
Design, Evaluation and
Applications**

Contact: The Photonics Cluster Team

Tel: 0121 260 6333

E-mail: info@photonicscluster-uk.org

15 April 2004

**NPL Voltage and Current
Workshop**

Contact: Sara Fletcher

Tel: 020 8943 6827

E-mail: electromagnetic@npl.co.uk

21 April 2004

**Time and Frequency
Club Meeting**

Contact: Karen Hood

Tel: 020 8943 6582

E-mail: time@npl.co.uk

27 - 28 April 2004

**AMUM 2004 Conference:
Advanced Metrology for
Ultrasound in Medicine**

Contact: Adam Shaw

Tel: 020 8943 6581

E-mail: adam.shaw@npl.co.uk

27 - 29 April 2004

**Temperature Measurement
and Calibration Course**

Contact: Kerry Tottman

Tel: 020 8943 6684

E-mail: kerry.tottman@npl.co.uk

06 May 2004

**FoTON UK meeting,
Multimode Fibres**

Contact: Sara Fletcher

Tel: 020 8943 6827

E-mail: electromagnetic@npl.co.uk

26 May 2004

**Ionising Radiation
Metrology Forum**

Contact: Clare Lee

Tel: 020 8943 6208

E-mail: clare.lee@npl.co.uk

For further NPL events please go to www.npl.co.uk/news-and-events/

FURTHER INFORMATION

For additional copies of this newsletter, or for more information on any aspect of NPL's work and the range of services available from the Laboratory, call the NPL Helpline:

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Location, Location, Location...

Applications of Global Navigation Satellite Systems

Locating a restaurant in Paris on a 3D map, landing a pilot-less aircraft at Heathrow or even using your mobile phone to find a taxi in the middle of London...

these are just some of the products and services being developed using Global Navigation Satellite Systems (GNSS). The

forthcoming European system, Galileo, and enhancements to the Global Positioning System (GPS), will improve the accuracy and availability of satellite navigation and location services and open up countless new applications. To encourage the development of new GNSS technologies, the UK's Department of Trade and Industry set up the Pinpoint Faraday Partnership. Pinpoint aims to bring businesses and universities together to carry out the research required to bring new GNSS applications to market. The National Physical Laboratory manages Pinpoint on behalf of its members in industry and universities.

Scientific Challenges for the 21st Century

Current and emerging GNSS applications bring new technical challenges. Many users require more accurate and reliable position, velocity and time data than currently available from GPS. Even with the additional satellites of Galileo, improved performance will only be achieved through improved receiver design and better knowledge of the sources of error. GNSS-based devices must also work in all environments, especially indoors, and this means the relatively weak GNSS signals need to be enhanced or combined with other local positioning technologies. And for GNSS to become truly useful it must be embedded in devices with other sensors and functions, and have communication capabilities to transfer the information to where it is needed. This requires GNSS receiver chips that are smaller, cheaper and faster than ever before.

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NEWS FROM THE

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METROMNIA

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