Galileo and EGNOS

playing a key role in Europe’s global monitoring programme
The European satellite navigation programmes, Galileo and EGNOS, will be important partners in Europe’s GMES programme (Global Monitoring for Environment and Security), providing critical data for building the most complete picture ever of our complex world.

Galileo is Europe’s independent global navigation satellite system. Fully interoperable with America’s GPS and Russia’s GLONASS, it is set to become a new cornerstone of tomorrow’s worldwide navigation systems. EGNOS (European Geostationary Navigation Overlay Service) is Europe’s ‘pre-Galileo’ system, already providing augmentation signals suitable for safety critical applications such as flying aircraft or navigating ships through narrow channels.

Another major European initiative will use data from Galileo and EGNOS to provide a clearer vision of the environment and human activities: the GMES programme will gather data received most notably from space-based Earth observation (EO) satellites, but also from ground-based monitoring systems, allowing authorities, businesses and citizens to examine and better understand the state of our world and its evolution. In addition to environmental data, GMES can provide important security-related information for law enforcement, humanitarian and crisis management operations.

GMES is an ongoing initiative, currently delivering an initial set of ready services, to be followed by a fuller range of services that will transform the way we see the planet. Crucial to its success is the full exploitation of data and information provided by satellite navigation and positioning systems such as Galileo and EGNOS.
Managing the oceans and seas

The EU-funded MARUSE project has already demonstrated how innovative systems such as Galileo can support the delivery of reliable, efficient and cost-effective navigation services for the benefit and safety of mariners. In a recent demonstration in Oban, Scotland, project partners placed both virtual and real emergency buoys over a simulated shipwreck.

Another EU-funded project, MARGAL is aimed at demonstrating the use of differential corrections and integrity alarms to provide even more accurate and reliable waterborne navigation, ultimately contributing to harmonised and seamless positioning services from the high seas to inland waterways.

This is precisely the kind of service that will form a key part of the wider GMES system, delivering detailed positioning information, which, together with the full range of environmental and security-related Earth Observation data, will give us a clearer picture than ever of the Earth’s oceans and waterways.

Services based on improved Galileo signals will also include fleet management and detailed mapping, allowing rapid response to maritime emergencies and security threats. Sea-based industries such as fishing will also see more effective information exchange between vessels and stations, improved fishing capabilities and improved navigation aids for fishermen. GMES and Galileo will also be crucial tools in detection, monitoring and cleanup of oil and other toxic spills.

Environment

Improved EGNOS and Galileo services will be used to track pollutants, dangerous goods and natural hazards such as icebergs, to map the oceans, study tides, currents and sea levels – all crucial elements of the GMES initiative. State-of-the-art satellite positioning will help monitor the atmosphere, water vapour for weather forecasting and climate studies, and the ionosphere for radio communications, space science and even earthquake prediction. Along these lines, the EU-funded GEO6 project is working to foster possible novel applications of European GNSS signals within the scientific community for use in monitoring the Earth’s atmosphere and the oceans.

Allowing transporters to calculate more direct and more efficient routes will cut down on fuel consumption and pollutant emissions, while the movements of wild animals, including large sea mammals and endangered species, can be tracked to help preserve their habitats.

One EU project working in this area is the BEAR initiative, aimed at developing improved wildlife tracking and management techniques. BEAR partners are working on improved tracking algorithms which may have general application in a variety of difficult environments. The GSA (European GNSS Authority) says improvements in animal tracking can have direct commercial benefits as well; knowledge of the behaviour of whales off the Atlantic coast, for example, or bears in Romania, can have applications in both animal conservation and eco-tourism sectors.
### Energy

The design, construction and operation of energy networks for electricity, oil and gas require accurate localisation and timing systems. Power grids must be continuously monitored to ensure efficient operation. When a power line breaks or a weakness appears in the grid, it is vital that monitoring instruments are synchronised with maximum accuracy. The improvements in existing navigation services represented by Galileo and EGNOS will offer new possibilities for energy transport and distribution. Once again, this is exactly the kind of crucial information that will form the backbone of future GMES services.

Similarly, in the oil and gas sector, marine seismic exploration will increasingly benefit from Galileo services to seismic acquisition vessels and seismic streamer and gun arrays. High-resolution surveys of new sites and identification of geomorphologic or geophysical risks will also increase the safety of drilling activities.

The EU-funded GIGA project is a prime example of work being carried out in this area. GIGA is analysing, demonstrating and disseminating a wide variety of positive impacts of EGNOS and Galileo for high precision positioning applications in the area of energy exploitation and supply.

### Management of land resources

Europe has a notable history of natural disasters, such as earthquakes, landslides, floods and volcanic activity. Over nearly 50 years, geodesists and surveyors developed deformation-monitoring techniques based on traditional land surveying equipment, such as theodolites, electronic distance meters (EDMs) and levels.

Since the 1980s, these traditional techniques have been replaced by satellite positioning technologies. The emergence of Galileo and EGNOS will contribute substantially to the accuracy and reliability of satellite measurements, thereby improving land deformation monitoring. Moreover, the availability of Galileo and EGNOS signals with an increased number of monitoring points will provide wider spatial coverage.

On a related front, the EU-funded MONITOR project is demonstrating the use of European GNSS for environmental and civil engineering monitoring, showing, through pilot projects, the added benefits of EGNOS and Galileo. Project partners are developing a new operational centre for environmental and assets monitoring, analysing the barriers to wider penetration of GNSS within the land survey and civil engineering markets and proposing enablers to overcome these barriers, covering needed technology advances, strategies for market penetration and a comprehensive regulatory framework.
Agriculture

The agricultural community has long been a key target beneficiary of GMES services. By integrating Galileo and EGNOS with EO monitoring technologies, farmers large and small will benefit from more efficient distribution and dilution of agricultural chemicals and fertilisers, improving parcel yield thanks to customised treatment and more efficient property management.

Partners in the EU-funded FIELDFACT project are already working to promote the use of GNSS in the agricultural community through the demonstration of innovative EGNOS and Galileo applications.

With the active engagement of a range of stakeholders, FIELDFACT is developing a useful and simple GNSS application for small farmers as well as a higher-end demonstrator that collects and integrates land and crop positioning data with other farm management data to reduce the administrative workload for large farms and co-operatives.

FIELDFACT will promote these applications and other GNSS opportunities through professional networks, stimulating the development of a spatial data infrastructure (SDI) for useful content collection and sharing.

Emergency response

Improved management of emergency situations has been another key aim of the GMES initiative, making it heavily reliant on GNSS-derived data. Dedicated GNSS positioning devices available for tourists or hikers, amusement park and museum visitors, even shoppers within large shopping centres, will provide higher than ever security levels, allowing the location of stolen property, or lost pets or individuals, enabling more crime prevention and life-saving search and rescue operations.

Crucially, Galileo services will include a global Search and Rescue (SAR) function, based on the operational Cospass-Sarsat system. Galileo satellites will be equipped with special transponders able to transfer distress signals from user transmitters to a rescue coordination centre.

A key example of EU-funded work in this area is the SPESS project, now developing innovative EGNOS-based applications and services for ‘special events’ management, with a major focus on security, safety and emergency operations. Special events can include sporting events, meetings and concerts where large numbers of people come together in a defined area for a brief period. This kind of concentration of thousands of individuals can place unusual stress on infrastructure and services.

Meanwhile, the VASER project is looking for new strategies in disaster management. VASER partners are bringing together EGNOS and Galileo navigation technologies and the most advanced visualisation technologies such as those more typically associated with GMES, to support a disaster mission control centre. Tasks include the provision of important information to field teams regarding their location and the location of hazards, victims, and means of support.
Humanitarian aid

Future humanitarian aid operations will be heavily dependant on Galileo and EGNOS, telecommunications, and Earth Observation or GMES technologies. The combination of these and other tools make possible a set of applications and procedural improvements that will drastically change operations in this domain.

GNSS is already being used extensively in emergency management and law enforcement, but much less in the field of humanitarian aid. The EU-backed HARM-LESS project is a collaborative effort by the European Commission, the GNSS industry, and technology experts, with the objective of promoting the use of the European navigation satellite systems in humanitarian aid and relief activities.

Global security

Today, space is a strategic area of growing importance for security. Europe is currently considering a number of new potential security-related space capabilities, including a space situational awareness capability enabling detection of debris and other dangerous objects in space, reducing the risk of European satellites colliding or being destroyed, and early warning satellites capable of detecting ballistic missile launches, allowing monitoring of compliance with non-proliferation treaties and, if necessary, giving early warning of attack.

On the ground, the GMES initiative already encompasses a vital security dimension: civil protection and planning agencies are major users of observation systems permitting the evaluation and prevention of catastrophes or disasters, whether of human or natural origin.

Galileo and EGNOS will be major contributors to GMES security-related services. The encrypted Galileo Public Regulated Service (PRS) and Safety of Life Service (SoL) will provide unprecedented accuracy, extreme robustness against jamming and reliable detection of problems within 10 seconds. These services will cater for security authorities, including the police and military, and safety-critical transport applications, from air-traffic control to automated aircraft landing.

The EU-funded MENTORE project is aiming to define a roadmap for GNSS technologies and services in the tracking-and-tracing-regulated markets. The tracking and control of radioactive fissile materials is a case in point, ensuring the protection of both citizens and the environment. MENTORE partners say current remote tracking and tracing systems use available GPS signals, but EGNOS and Galileo will feature enhanced performance and deliver new services such as advanced signal authentication.
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