

Global reach

Fiammetta Diani from the European GNSS Agency analyzes the use, potential, and applications of GNSS in projects co-funded by the EC

Images courtesy of CoVeL, European Space Agency & Siemens

The road transport sector is currently facing major challenges, particularly the ongoing demands to increase safety and reduce congestion and pollution. The use of Global Navigation Satellite Systems (GNSS) is a powerful tool for improving road transport. Not only do such systems help drivers to get where they want to go more quickly and efficiently, they also enable fairer (and more automated) road-pricing schemes to be deployed.

Within this sector, three major drivers are emerging. The first is a positive market trend in terms of GNSS penetration in vehicles is being challenged by the associated price decrease of the devices. This price erosion can be compensated for by creating innovative solutions and new services. The second trend is that the current EU regulatory framework is having a positive impact on GNSS adoption. Reliable and accurate positioning, as offered by EGNOS and Galileo, is considered a key enabler for many ITS services and GNSS will be a key technology of the European Electronic Tolling Service (EETS). It is also expected to be embedded in the new generation of digital tachograph devices. Thirdly, as these new European GNSS join the market (EGNOS has been operational since October 2009 and Galileo looks set to arrive in the next few years) and early R&D results become available, the whole issue of GNSS is kept in the limelight, with the industry discussing these results at various events throughout Europe and beyond.

According to the *GNSS Market Monitoring* report, recently published by the European GNSS Agency, the road transport sector is the leading GNSS segment, accounting for more than 50% of market share. The penetration of receivers in road vehicles – today at 30% – will exceed 80% over the next decade. However, after

Europeans will refine the accuracy of GNSS through EGNOS, the precursor of the Galileo constellation

a period of fast growth, market saturation and competition in the form of smartphones equipped with free navigation capabilities have resulted in a slowdown in the car-based navigation market. Smartphones are now taking the lead in front of personal navigation devices (PNDs).

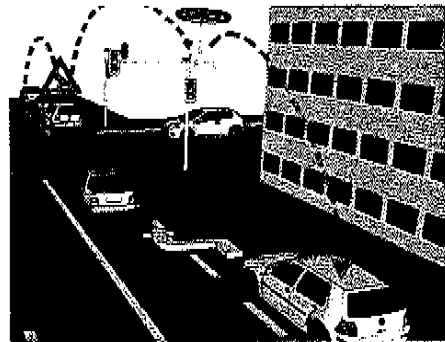
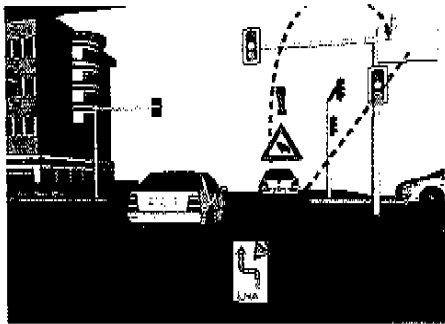
Price erosion has been high, driven by declining costs and strong competition. Vendors are using innovation as a differentiator, resulting in 'converged' products with both communication and multimedia functionalities. Some PND vendors are also tapping into new distribution channels, including car dealerships and smartphone application stores.

Services based on cooperative systems, such as advanced services for safety, driver assistance and active traffic management – as well as new information and entertainment services – will provide an important additional source of growth.

Regulations enabling opportunities

The ITS Directive, in force in Europe since July 2010, is opening up new possibilities for a safe, smart and green transport system, which is boosting attention and investment in the sector. Accurate and reliable

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positioning is a key technology for ITS deployment. As an example, in the ITS Directive, EGNOS and Galileo are addressed as key enablers for ITS applications and services for which accurate and guaranteed timing and positioning services are required. Particular focus is given to the tracking and tracing of freight along its journey and across modes of transport. Another major application of Galileo for roads will be its inclusion in future digital tachograph devices.

With the new EETS decision adopted in 2009 after intensive discussions with toll chargers and service providers, GNSS can become a core technology to realize a unique, Europe-wide tolling service.

Early results from EU research

The European Commission is co-funding a portfolio of 15 R&D projects related to EGNOS and Galileo for ITS applications, under the Seventh Framework Programme. Some of them are already providing interesting technical results. An almost complete overview will be provided at the forthcoming ITS in Europe event in Lyon, but it's possible to anticipate some of the more interesting results now.

The SCUTUM (from the Latin for 'shield') project is applying EGNOS for the provision of reliable and guaranteed positional information for the transport of dangerous goods. As a result of a location server that is exploiting the EGNOS integrity signal and applying advanced techniques to mitigate the multipath local effects, SCUTUM provides the position and a circle of



The European Union GNSS projects demonstrate a significant improvement of accuracy and a surprising availability level of EGNOS signal in different European areas

Figure 1 The aim of the CoVeL project is to develop and commercialize the Lane Navigation Assistant (LNA) - an in-vehicle device which will enable lane-level navigation and lane-level traffic management especially in urban areas

Figure 2 Satellite-based tolling is one of the most frequently used systems today, offering high flexibility in terms of choice and extension of toll route

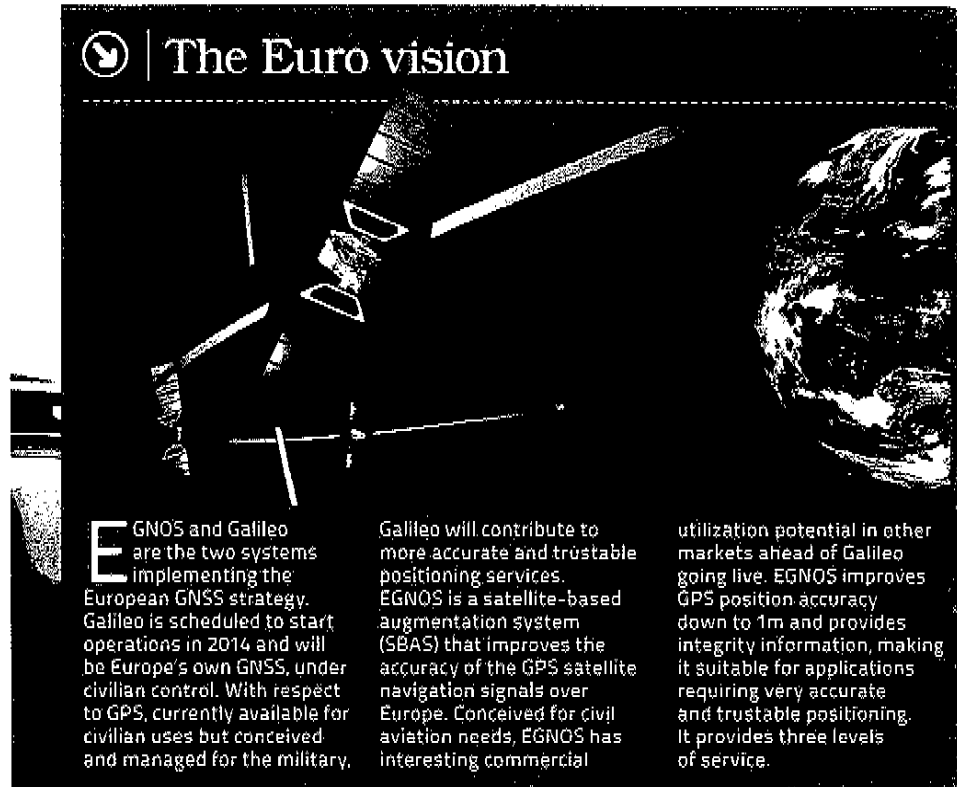
confidence that is around 8-9m in diameter. The user can be sure that the vehicle is within that circle. The main user is currently Eni, an Italian company ranked among the top oil and gas companies worldwide, which started to use the service in operational conditions, and is expected to implement it across all of its fleet. Italian and French transport ministries are actively involved in SCUTUM, as they are highly interested in having a confidence level in the tracing path of dangerous goods transport. The R&D phase is almost complete and the service will be ready for commercialization at the end of 2011.

The GINA project developed an advanced GNSS-only road pricing solution, applying geo-fencing based on position integrity. Two trials have been performed - an exhaustive one, assessing the performance of the system, and an end-to-end one, involving 100 final users. An incredibly large amount of data has been collected and independently analyzed. The analysis confirmed that GNSS is a reliable tool for different road user charging (RUC) schemes and that the technology proposed by GINA allows distance-based charging with good performance in a simple, affordable solution. Therefore, EGNOS and other GNSS-centered techniques (e.g. Receiver Autonomous Integrity Monitoring) can be used to improve performance and reliability. GINA technology is now available to be integrated in innovative RUC systems. The GINA



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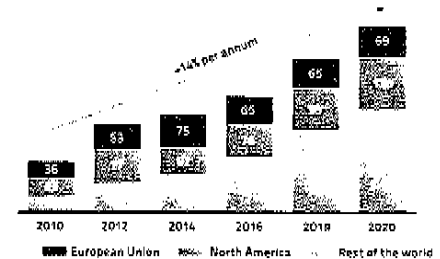
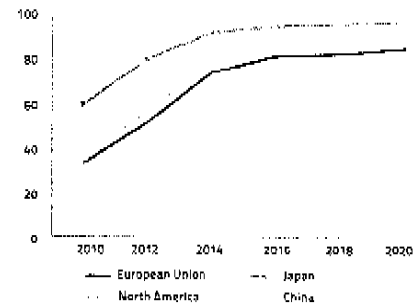
The Euro vision



EGNOS and Galileo are the two systems implementing the European GNSS strategy. Galileo is scheduled to start operations in 2014 and will be Europe's own GNSS, under civilian control. With respect to GPS, currently available for civilian uses but conceived and managed for the military,

Galileo will contribute to more accurate and trustable positioning services. EGNOS is a satellite-based augmentation system (SBAS) that improves the accuracy of the GPS satellite navigation signals over Europe. Conceived for civil aviation needs, EGNOS has interesting commercial

utilization potential in other markets ahead of Galileo going live. EGNOS improves GPS position accuracy down to 1m and provides integrity information, making it suitable for applications requiring very accurate and trustable positioning. It provides three levels of service.



with respect to market deployment, GSC identified the key differentiators of Galileo and EGNOS for a number of critical potential mass-market applications, including the interoperable road charging applications, and it demonstrated how these differentiators could become enablers for the market industrialization. Two leading road pricing service/technology providers took part and had the opportunity to directly trial EGNOS, with support of GNSS specialists. Among other achievements, GSC has demonstrated a relevant improvement of accuracy in extra-urban scenarios and a surprising availability level of EGNOS signal in different European areas.

Focus on EGNOS

The EC, Directorate General for Enterprise and Industry, is currently driving the EGNOS to Road project, involving key users such as a leading toll charger, a Tier 1 automotive manufacturer and a capital city traffic manager. The aim is to assess the EGNOS added value for road applications, with a focus on road pricing, tracking and tracing, and urban mobility. The project is running a field trial on a new motorway and in a challenging urban scenario. On top of the technical evaluation, EGNOS to Road will deliver a business and legal analysis of what EGNOS – and in future, some Galileo differentiators – could bring. The results will be available next summer and a preview will be presented at the upcoming ASECIAP Study Days event in Brussels.

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The top graph shows GNSS penetration in the road sector shown in percentages; the one below shows shipments of GNSS devices in the road sector, including smartphones used as PND (source GNSS Market Report). GNSS solutions are a powerful tool for improving road transport

project also developed a business plan for a potential EETS provider entering the market. The positive and encouraging business model will be presented at the ITS in Europe event.

In another example, the CoVeL project is developing a lane positioning assistant (LPA). The LPA provides a vehicle position with a higher level of accuracy than the GNSS mass-market receiver currently in use for navigation systems. Lane-level vehicle position enables a series of possible applications, including lane pre-choice or wrong-way driver warning. The output from the LPA is the vehicle position with lane accuracy using satellite positioning as its primary source, data that is augmented by EGNOS correction information. Advanced algorithms for relative positioning and group map-matching are currently under development, and it is expected that a demonstration will occur in Bordeaux in November 2011.

The GSC project, currently in its final phase, went beyond the demonstration of the 'multiple services platform' technical feasibility. In fact, it is providing analysis and recommendations