

Navigating future for road charges

By Paul Rincon
BBC News science reporter

Motorists are already beginning to embrace the idea of satellite-navigation units in cars.

And in a few years, sat-nav will be doing far more than simply telling drivers how to get to their destination.

This week, the first test satellite in Europe's 3.4bn-euro (£2.3bn; \$4bn) Galileo satellite-navigation system blasted off on a Soyuz rocket from Baikonur Cosmodrome in Kazakhstan.

The final global network of 30 Galileo satellites is crucial to providing the high volumes of time- and location-based data needed for new services such as advanced sat-nav, mobile location data, natural disaster surveillance and air traffic control.

Powerful applications are expected on the roads; the Galileo network would allow a vehicle's exact movements to be tracked, presenting new possibilities for road-user charging and tolling.

The precision and availability of the Galileo signal would facilitate the application of charges according to the distance travelled by a vehicle, along with other parameters.

"For example, you might want to vary the charge according to speed, or whether someone is travelling through a city centre," Hans-Peter Marchlewski, general counsellor for the Galileo Joint Undertaking, told the BBC News website.

Tax collection

The time signal produced by Galileo would also allow different charges for driving at different times of the day.

"This we are able to do without any support from bridges or ground stations. You can do everything with the [Galileo] signal," explained Mr Marchlewski.

Each motorist would, of course, need to carry a satellite-linked "smart box" in their car, but Galileo-based systems would also dispense with much of the roadside infrastructure to collect tolls and charges.

There have been quite significant studies which show that revenue-neutral road-user charging would give you quite significant gains in congestion reduction
Prof Mike McDonald, University of Southampton

Galileo sat-nav could potentially form the basis for general "pay-as-you-go" road pricing proposed for the UK as a replacement for road tax and petrol duty.

However, transport policy expert Professor Stephen Glaister, from Imperial College London, says that "tag and beacon" systems are also under consideration.

These employ two-way communication between a roadside beacon and the vehicle.

They are used in a distance-related charging scheme for heavy goods vehicles in Austria and a congestion charging scheme underway in Trondheim, Norway.

The American Global Positioning System (GPS) is used for distance-related heavy-goods-vehicle charging in Germany.

Busy roads

These current schemes reveal pros and cons for sat-nav and beacon-based systems in road-user charging.

"As you pass the beacon you have a more solid communication link, allowing you to pass information both ways. The satellite system has some problems with continuous communication when you get shadowing by buildings," Professor Mike McDonald, director of the Transport Research Group at the University of Southampton, told the BBC News website.

"With satellite navigation, you don't get a totally continuous signal but you get a much better understanding of where the vehicles are and how they are being driven."

SAT-NAV AND ROAD SAFETY

'Smart box' would automatically transmit location of vehicle

Emergency request could be triggered at airbag inflation
Message might contain details of passengers, e.g. in coaches
Real-time traffic data would guide others away from scene
Future systems could warn of road dangers and take control of vehicle, e.g. limiting speed

With Galileo and GPS, the satellite signal can be supplemented where it drops out by ground stations, although these must have a line of sight with the vehicle.

European road users pay 330bn euros (£230bn; \$390bn) to governments through taxes each year. But along with its importance in raising revenue, road-user charging can play an important role in reducing congestion.

"In Brussels, we have the same transport situation as we have in London. In Germany, it is the same situation," lamented Mr Marchlewski. "Galileo will not reduce congestion directly, but it can be used for a more intelligent distribution of vehicles."

Professor McDonald adds: "There have been quite significant studies which show that revenue-neutral road-user charging would give you quite significant gains in congestion reduction."

By the same token, it could also be a powerful tool for tackling carbon emissions, say some experts. But environmentalists warn that shifting money away from fuel duty would remove the incentive for motorists to use greener vehicles.

Monthly bill

Currently, the UK is the only EU member state proposing pay-as-you-go charging. But this could change.

"As Galileo comes in it is quite likely to be acquired for road-user charging. The issues are political rather than technical," Professor McDonald commented.

...if you get a bill for a road you haven't driven on at a time of day you weren't there, what's the recourse for getting your money back?
UK's Automobile Association

Exactly how Galileo might be used in electronic fee collection (EFC) - a catch-all

term describing any toll or charge applied electronically - will in large part be left up to the individual member states, which will continue to set their own policies.

Some Galileo initiatives for the road sector are, however, being coordinated at the European level.

The European Commission is undertaking studies into the idea of equipping heavy goods vehicles and coaches with onboard terminals offering Galileo-based services, especially in EFC.

The system might work something like this: hauliers and coach operators would sign a contract with one or more operators to use the services offered through the onboard units.

The terminals would then be used to track the charges and tolls collected by vehicles on their travels. These would be issued to clients as a list of expenses much like a monthly credit card bill.

Emergency response

Initial versions of the terminals will need to work with three key technologies: Galileo, GPS and the microwave system used for tolling in France and Spain.

A spokeswoman for the AA motoring trust in the UK said there was still some way to go in working out exactly how such systems might work in practice.

THE GALILEO SAT-NAV FUTURE

Navigation for navigation's sake will not drive applications

Uptake pushed forward by services that add value to data

Huge potential for internet-linked services run off mobiles

E.g. finding a restaurant, and directing you to nearest ATM

Multimedia delivered to tourists' mobiles as they walk around

'Guardian angel' services will locate separated children

Possibilities are endless; mobile firms already brainstorming

Database and billing companies planning for large markets

"It's fine having a company process all the data from each country and tell you how much you owe; but if you get a bill for a road you haven't driven on at a time of day you weren't there, what's the recourse for getting your money back?"

In addition to EFC, the European Commission wants these units to be used for fleet and freight management and to launch emergency calls.

Drivers would use a small keyboard to enter certain parameters at the beginning of a journey, such as how many passengers were on a coach, or whether a lorry was carrying hazardous chemicals.

In the event of an accident, the terminal would launch an emergency call - perhaps triggered by the activation of airbags. The call would also send the information entered by the driver, allowing emergency services to adapt their response to the situation.

Using the Galileo signal, the terminal message would also pinpoint the precise location of the stricken vehicle.

Future vision

The price of one of these onboard units is currently estimated at 400 euros (£270; \$480), although it is hoped that this could drop to 100 euros by 2010.

Eventually, new trucks and coaches in Europe would be sold with the equipment already installed.

"If this system works for commercial vehicles, that same technology will be readily available for use in vehicle charging," says Mike McDonald.

Regardless of whether member states propose their own Galileo-based road-user charging schemes, onboard units offering Galileo-based services for ordinary motorists could be available by 2015.

These could offer route-guidance, incorporating up-to-date traffic information, but would also be enabled for insurance pay-as-you-drive schemes.

"There are drivers that would encourage people to buy systems in vehicles that have location-based data, communications and mapping," Professor McDonald explains.

"As they become universal, the incremental costs for putting in road-user charging and other applications will become very much lower."

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