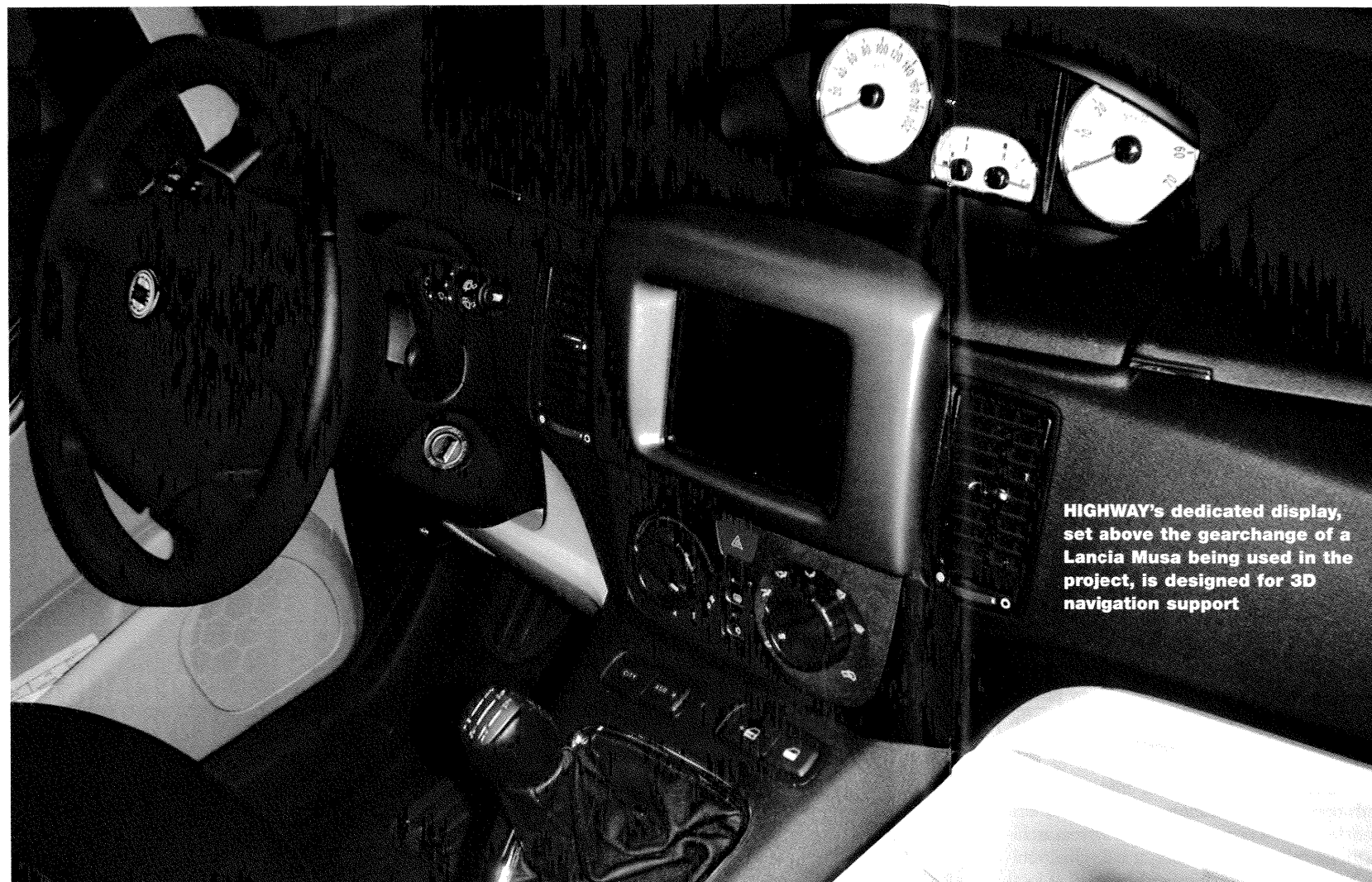


A number of EU-funded projects focussing on safety, also have important implications for traffic management. *ITS Solutions* investigates some promising practical initiatives.



## The next technology jump

The impressive progress seen in information and communication technologies (ICT) from the early 1980s has been a key driver for the development of in-car electronics. Today, these account for some 20% of the value of the car, and their importance is expected to grow further.

As active safety devices and driver assistance systems appear on the market, European research is already looking forward to the next technology jump. This will provide the platform for new cooperative approaches to both overall road safety and network performance using advanced traffic management systems (ATMS).

EC support for ATMS is evident in projects supported under the IST stream of its Sixth Research and Technological Development (R&TD) Framework Programme (FP6). Among these is the 33-month HIGHWAY (Breakthrough Intelligent maps & Geographical tools for the context aware delivery of e-safety & added-value services), which started in April 2004.

HIGHWAY is developing innovative combinations of smart real-time maps, UMTS 3G mobile technology, positioning systems and intelligent agent technology, 2D/3D spatial tools and speech synthesis/voice recognition interfaces. The aim is to equip drivers with responsive eSafety services, at-the-point-of-need interacting with multimedia information sources, and value-added location-based services (LBS).

Future HIGHWAY-type maps will deliver flows of up-to-date navigational information enriched with safety-relevant data, including speed limits, to feed on-board intelligent speed adaptation (ISA) units, and dynamic traffic or weather conditions information for human and, possibly, non-human use. In the latter case, the maps will act as additional sensors for on-board advanced driver assistance systems (ADAS).

The main aim is to deliver the benefits of traffic management and control information directly into vehicles. Notably, HIGHWAY-type maps could help drivers facing critical driving situations resulting from

the road topography.

Examples could include automatic triggering of safety mechanisms, or delaying of incoming phone calls, in response to map information – eg on the radius of a curve in the road ahead, or speed limits – or to an incident alert.

The project has already identified user requirements and undertaken the definition of a system architecture for open, integrated and secure, geographic, multimedia and multimodal service deliver. It has subsequently carried out the specification and implementation of a set of networked, multimodal and interoperable tools.

These are designed to acquire, manage and deliver map-based, multimedia information from distributed sources (eg vehicles, the infrastructure and user profiles), exploiting broadband wireless technology (UMTS, Wi-Fi) technology, intelligent distributed agents and XML-based languages. HIGHWAY is currently planning extensive demonstrations of innovative, intelligent services targeted at car drivers.

By enabling machine-machine interaction as well as human consumption of information, it aims to create an entire new generation of intelligent services. These could include real-time 2D and – highly innovatively – 3D map delivery, as

well as time-variable information and route guidance.

The 3D maps will be designed for easy integration into vehicle navigation systems.

Key HIGHWAY features will include:

- eSafety services, eg remote diagnostics, emergency services and roadside assistance;
- Routing and navigation information, weather advisory services, road construction alerts, and route determination for turn-by-turn travel guidance;
- Intelligent yellow pages using time-variant information, eg on less-congested routes to specific destinations, or detailed itineraries taking account of current weather conditions; and
- Advanced urban area traffic management.

The project partners, based mainly in Italy and Finland, will test the HIGHWAY approach at two pilot sites, one in either country, from September 2006. The city of Turin, in Italy, will demonstrate urban services both in-vehicle and on personal digital assistants (PDAs), with 3D navigation under test in the historic centre. The Finnish site, a stretch of the country's E8 motorway, will test interurban services, including traffic information and intelligent yellow pages.

### Further along the highway

In late 2004, the EC launched a further FP6 Call for new research proposals. It was looking for ones aimed at developing and demonstrating co-operative systems (CS) designed to make road transport safer and more efficient and environmentally friendly.

As an extension to autonomous or stand-alone systems, CS – in which vehicles communicate continuously with each other and with the infrastructure – have the potential greatly to increase the quality and reliability of available information about vehicles, their location and the road environment. The result should be to enable the emergence of new and improved services for all road users, as part of a worldwide wave of research into vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications.

From the research proposals it received, the EC retained 22 projects to share €91 million of funding. These had all started work by early 2006, with early results due for presentation at the 2006 ITS World Congress in London.

One key feature of CS is their ability, by establishing communication channels between a vehicle and its environment, to extend its range of external sensing. This offers new perspectives in dealing with network management and overall transport system performance, as well as safety. Among the 22, a number relate specifically to traffic management.

### CVIS – Cooperative vehicle-infrastructure systems

Within the CVIS integrated project and its family of sub-projects, two aim directly at increasing urban traffic safety and efficiency: COoperative MOonitoring (COMO) and COoperative URban Applications (CURB). COMO is developing

specifications and prototypes for the collection, integration and delivery of extended real-time information on individual and collective vehicle movements, as well as on the state of the road network. It has three major objectives.

First, the encouragement of cooperative applications through a communication interface that enables them to access monitoring data anywhere and at any time, so capturing information from networks of eg probe vehicles and infrastructural sensors. This will be available for use by application-oriented CVIS subprojects concerned with the urban (CURB), inter-urban (CINT) and fleet and freight (CF&F) sectors.

CF&F (Cooperative Freight & Fleet applications) is focusing on three applications:

- Hazardous goods management;
- Priority booking and assignment of spaces for vehicles in delivery zones and motorway rest areas; and
- Coordination of freight vehicle access to environmentally-sensitive areas.

CINT (Cooperative INTER-urban applications) is developing concepts and a toolkit for vehicle-infrastructure cooperation in the areas of:

- Enhanced driver awareness (EDA);
- Cooperative travellers' assistance (CTA); and
- Cooperative urban applications (CURB).

COMO's second aim is to develop a standardised interface providing raw (or nearly raw) data, gathered by vehicles and a local sensor infrastructure, that a qualified service provider can then use for specific purposes.

Its third is to develop the distributed algorithms for data fusion needed to deliver the COMO service to individual applications, based on the data delivered by the standardised interface. The plan is to develop these data fusion methods in close cooperation with the application-oriented sub-projects in order to meet their specific requirements.

COMO is also cooperating with the DEPLOYment eNablers (DEPN) sub-project to establish an operational business case that addresses all relevant non-technical issues. In its coordinating role, DEPN is working to ensure that CVIS core technologies gain the widest possible acceptance, by addressing the issues of:

- Openness and interoperability;
- Safe, secure and fault-tolerant design;
- Utility, usability and user acceptance;
- Costs, benefits and business models;
- Risks and liability;
- CVIS as a policy tool; and
- Deployment road-maps.

### CURB and COMM

CURB (Cooperative URban applications) plans to encourage more efficient use of the urban road network and improve individual mobility. It involves the development and implementation of modules for use with all the control levels of urban traffic management system – from strategic to tactical – using four applications:

- Cooperative network management. This aims at optimising area traffic management by

making use of information on characteristics such as vehicle/driver destinations and individualised route guidance.

- Cooperative area routing. Intersection controllers will signal momentary disturbances in traffic flow in their area of control, and give individual, destination-based and appropriate rerouting advice to approaching vehicles.
- Cooperative local traffic control. This envisages enhanced local intersection traffic control acting cooperatively with approaching vehicles, giving control and traffic state-related information to their drivers, and creating green waves using speed recommendations for drivers and data exchange with neighbouring intersections.
- Dynamic bus lanes. Shared use of fixed bus lanes will allow their use by CVIS-equipped private vehicles when there are no priority vehicles already in occupation. The bus will move along the lane in a 'protected block', which will signal to other nearby vehicles when they need to leave the lane to make way for the bus, and can enter it once the bus has passed.

A key objective is to develop open interfaces between CVIS components, and with the proprietary environment (installed base) and open source modules that future application developers will be able to use. These are defined for road-side applications in the FOAM (Framework for Open Application Management) environment.

FOAM is developing specifications for an open software execution environment which will act as a gateway for both in-vehicle and infrastructure-based services. This will allow the downloading, starting, stopping, upgrading and discontinuation of CVIS-based telematics applications during the life cycles of both service applications and equipment.

Another sub-project, POMA (POsitioning and MApping), is developing specifications and prototypes for positioning, mapping and location-referencing modules that will enable new and improved capability for cooperative applications.

The COMM (COMMunications Technologies) sub-project is developing a CVIS communication system based on new international standards for hybrid mobile networking. This will ensure an 'always-on', transparent connection between a vehicle, and the infrastructure and other vehicles.

#### COVER

COVER (Semantic-driven COoperative VEHICLE infRAstructure systems for advanced eSAfety applications) is setting the scene for the creation of next-generation intelligent cooperative systems. Its focus is on the integration of semantic technologies, intelligent agents, in-car and infrastructure-based sensor data, multi-channel communication technologies, and context-aware and multimodal (voice/graphics) interfaces.

As with HIGHWAY, the partners come mainly from Italy and Finland, so again there



**The E18 (Helsinki-Turku) motorway in Finland equipped with a weather-controlled speed limit system and variable slippery-condition warning sign, a good example of ICT deployment in traffic management and road safety. Developed by HIGHWAY consortium member Tieliikennelaitos (the Finnish Road Enterprise).**

are going to be two different sites, one in either country. The Finnish site will, again, be on the E18 (using mainly professional truck drivers); the Italian one on a stretch of the Turin-Florence expressway (using non-professional ones).

One feature will be a dedicated, unobtrusive, in-vehicle display which will access navigation features and create 3D representations of key landmarks (to be tested in the historic core of Turin). COVER is also concerned with the development of applications such as intelligent speed adaptation (ISA) – in static, temporary and dynamic speed limit environments.

#### MORYNE

Finally, the urban-focused MORYNE (EnhanceMent of public transpORT efficienCY through the use of mobile seNsor nEtworks) is investigating ways of using buses as elements in a network of mobile sensors. These will gather traffic information, communicate with the infrastructure, and allow the development of more effective cooperation between traffic and public transport management systems.

The system will involve bus-borne sensor data being processed locally and in real-time to generate information for transmission to a public traffic management centre (PTMC), using reliable and cost-efficient radio communications. The PTMC will make the information collected available to a city's road-based traffic management centre (TMC), where it will contribute to a comprehensive and up-to-date picture of the overall traffic situation. It will also generate announcements for broadcasting to PT vehicles and fixed points, eg message panels at bus stations.

Key stages involve the setting up of an in-laboratory demonstrator, and field testing with the

Berlin Transport Authority (BVG). MORYNE expects the system to encourage more efficient use of the urban road infrastructure by providing more accurate information on actual traffic conditions and specific local situations.

It also envisages the development of new capabilities for data transfer, interconnection with open communication networks, and efficient location. A purpose-designed system architecture, intelligent processing at individual vehicle level and a hierarchical organisation at local and regional levels will ensure scalability and the ability to deliver timely information.

Core functions being implemented and tested include, apart from traffic management and control, fleet management, real-time information delivery, obstacle detection, surrounding scene analysis, and assessment of driving conditions. In terms of public transport performance, buses will benefit from the overall improvements in traffic performance that they themselves have helped to deliver.

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[http://europa.eu.int/information\\_society/activities/esafety/index\\_en.htm](http://europa.eu.int/information_society/activities/esafety/index_en.htm)

[http://europa.eu.int/information\\_society/activities/esafety/research\\_activities/index\\_en.htm](http://europa.eu.int/information_society/activities/esafety/research_activities/index_en.htm)

[www.ist-highway.org](http://www.ist-highway.org)

[www.cvis-project.org](http://www.cvis-project.org)

[www.ist-cover.org](http://www.ist-cover.org)

[www.fp6-moryne.org](http://www.fp6-moryne.org)