> Foreword

Mobility is essential to the functioning of European society but presents major problems in terms of congestion, safety and environmental impact. Traffic congestion now affects 10% of our major road network and costs an estimated €50 billion per year, or 0.5% of EU GDP. Road transport accounts for more than one-quarter of the EU's total energy consumption, and still there are around 1.3 million accidents and 41,000 fatalities on EU roads each year. Europe's estimated 300 million car drivers would like their driving to be made easier with fewer delays, and less chance of getting injured.

The Intelligent Car initiative is an attempt to move towards a new paradigm, one where cars don't crash anymore, and traffic congestion is drastically reduced. Part of the i2010 strategy to boost Europe's digital economy, the Intelligent Car initiative is an answer to the need of citizens, industry and the Member States to find common European solutions and to improve the take-up of intelligent systems based on information and communication technologies (ICT).

Intelligent systems can help solve many of Europe's road transport problems. They can support drivers to avoid accidents, and even call the emergency services automatically in the event of a crash. They can also be used in electronic traffic management systems or the optimising of engine performance, thus improving energy efficiency and reducing pollution. And with the help of ICT, good progress is being made towards the 2001 EU goal of halving road deaths by 2010.

But citizens and policy-makers cannot be expected to invest in or to promote car safety technology unless its benefits are clear. Hence, as well as further research, the Intelligent Car Initiative focuses on strengthening industry and policy efforts to make intelligence through ICT known to wider audiences of consumers and motorists and an integral part of all vehicles built in Europe.

This brochure provides an insight into the contributions that ICT research and deployment programmes are already making to our policy objectives in this field. Such actions are an essential part of our drive towards an inclusive, knowledge-based economy and society.

Viviane Reding

European Commissioner for Information Society and Media

> Introduction: Smarter, Safer, Cleaner Cars

Driving is central to our daily life. We rely on it for getting to work, going on holidays, keeping in touch with our friends, and having our goods delivered. Yet driving also brings problems, such as congestion and environmental impact, and our lives could change in an instant or even end because of a road accident. Europe's 300 million drivers want their driving to be easier with less trouble, less delay, and, above all, less chance of getting injured.

Information and communication technologies (ICT), which enable the building of intelligent vehicles and infrastructures, offer new advanced solutions to today's transport problems. These intelligent systems can assist the driver in the driving functions, thus preventing, avoiding or mitigating accidents. They can provide drivers with real time information about the road network, thus avoiding congestion. And they can optimise a journey or the engine performance, thus improving overall energy efficiency. There is clear evidence that investments in such technologies bring major social and economic benefits.

The pollution of the environment, traffic safety and congestion are truly European problems affecting all 25 Member States: common European solutions need to be found. Moreover, although many intelligent systems based on ICT are already available and more are under development, their take-up in the market is very slow. Action is needed to enable European citizens to benefit more from these technologies.

The Commission's Intelligent Car Initiative is a comprehensive answer to the need of citizens, industry and the Member States to find common solutions to Europe's mobility problems and to improve the take-up of ICT in road transport. In the long run, it aims to move towards a new situation, where cars don't crash anymore, and traffic congestion is reduced. As one of the flagship projects of the i2010 programme to boost Europe's digital economy, the Intelligent Car Initiative provides a further push towards smarter, safer and cleaner vehicles. The Initiative builds on efforts under the Information Society Technology (IST) Research Programmes, where over €400M has been invested in intelligent car related research over the last eight years.

The Initiative has three main objectives. Firstly, with the help of the eSafety Forum it will coordinate and promote the work of relevant stakeholders, such as industry, service providers and Member States. Secondly, it will support ICT-based research and development in the area of smarter, cleaner and safer vehicles as well as facilitate the take-up and use of research results. Thirdly, it will create awareness among consumers and decision makers of ICT-based solutions to stimulate user's demand for these systems and create socio-economic acceptance.

> Setting the Scene: Sustainable Mobility for Europe

Challenges for Road Transport

European society depends heavily on mobility. Yet transport entails severe problems, such as congestion of road networks and urban areas, harmful effects on the environment and public health, waste of energy and, above all, accidents which cause fatalities, injuries and material damage.

In the EU, congestion costs amount to €50 billion per year, or 0.5% of Community GDP, a figure which could double by 2010. The number of cars per thousand persons has increased from 232 in 1975 to 460 in 2002. The overall distance travelled by road vehicles has tripled in the last 30 years and, in the last decade, the volume of road freight grew by 35% contributing to 7,500 km or 10% of the major networks being affected daily by traffic jams.

Concerning energy efficiency and emissions, in 2002 the transport sector consumed 338 million tonnes oil equivalent (MToe), representing 31% of the total energy consumption in the EU. Road transport consumed 281 MToe, or 26% of the overall energy consumed. Road transport's CO_2 emissions account for 835 million tonnes per year, representing 85% of the total transport emissions. Investigations show that up to 50% of fuel consumption is caused by congested traffic situations and non-optimal driving behaviour.

Of all transport problems, safety is the one with the most serious impact on our daily lives. It also has a high impact in socio-economic terms. With its "White Paper" of September 2001, the European Commission set the target to halve road fatalities by 2010. Although the situation has improved considerably, every year there are still over 40,000 fatalities on EU roads, with about 1.3 million accidents and a cost of around €200 billion per year, representing 2% of the EU GDP.

Research indicates that human error is involved in over 90% of accidents, and in almost three-quarters of cases human error is solely to blame. As an example, a recent study concluded that if we have an accident when driving at a speed of 50 km/h and we could brake half a second earlier, we could reduce the crash energy by 50%. But an analysis of German accidents showed that 39% of passenger vehicles and 26% of trucks do not activate brakes before a collision, and some 40% do not brake effectively, underlining our limits as drivers.

The Potential of Intelligent Cars

Information and communication technologies (ICT) provide new intelligent solutions that contribute to solving the key societal challenges posed by road transport.

"Intelligent" systems can help drivers to avoid accidents, and can even call the emergency services automatically in the event of a crash. They can also be used in electronic traffic management systems or to optimise engine performance, thus improving energy efficiency and reducing pollution. With the help of ICT, good progress is being made towards the EU goal of halving road deaths by 2010.

Intelligent Vehicle Systems address the interaction between the driver, the vehicle and the road environment in an integrated approach, where the autonomous on-board systems are complemented with vehicle-to-vehicle and vehicle-to-infrastructure co-operative technologies and improved traffic network management.

What Causes Accidents?

Overall, road safety has been improving in industrialised countries over the last 30 years, showing that political willingness and the application of countermeasures produce results. For example, according to one recent report between 1980 to 2000, in three of the countries with the best road safety records, fatality trends had decreased dramatically, due to:

- Passive safety measures: 15% to 20%
- Safety belt wearing: 15% to 20%
- Drink-driving countermeasures: 15% to 20%
- Specific measures for vulnerable road users: 30% to 40%
- Actions targeting the Infrastructure: 5% to 10%
- Education / training / communication: 7% to 18%.

Despite these fatality reductions, road safety remains a major societal concern. Although car manufacturers in particular have gone to great efforts to improve their vehicles' passive and active safety over the past 15 years, road safety research shows that existing measures are reaching a ceiling in most countries, and experts agree that preventive and active safety should now be brought to the fore.

The EU's TRACE project aims to update the knowledge achieved so far about the causes of road accidents and will evaluate the effectiveness of technology-based traffic safety countermeasures.

Statistical analysis of road accidents is being undertaken from three research angles: road users, pre-accident driving situations, and risk factors. This will enable the nature and the magnitude of the safety problems to be identified, by means of descriptive statistics (at a European or pan-European level), and an in-depth analysis of accident causation issues to be prepared.

This is being backed up by work on methodologies, covering epidemiological and statistical issues concerning accident causation and risk analysis. Similarly, work on how to handle the human factors in accident causation and the evaluation of the safety benefits of technology is also well advanced. Here a psychological model is used to highlight and describe the source of human errors prior to a crash.

Finally, a comprehensive list of existing and forthcoming safety functions is being compiled, which will allow researchers to identify the most promising safety functions for future systems.

www.trace-project.org

> Building Intelligent Cars

Systems for Intelligent Cars

The term "Intelligent Cars" refers to a wide range of ICT-based stand-alone or co-operative systems, including infrastructure systems.

Certain of these systems are already in use, including anti-lock braking systems (ABS), and electronic stability programme (ESP) systems which help the driver maintain control of the vehicle in critical driving situations. A variety of newer systems are under development or being introduced into the market. eCall – which was pioneered also under previous European research programmes – automatically triggers an emergency call if the vehicle is involved in a serious accident. Other systems on the horizon include braking assistance, lane departure warning, collision avoidance and active pedestrian protection.

There is clear evidence that investments in such technologies bring major social and economic benefits. For instance, according to the SEISS study (see box), if all vehicles were equipped with eCall by 2010 fatalities in the EU could be reduced by between 5% and 15%. As well as reducing the human toll, such measures would save up to €22 billion social costs per year. Moreover, eCall could reduce congestion times between 10% and 20% with additional cost savings of between €2 to 4 billion.

Night vision is one of many, new intelligent systems to support drivers

Among other systems:

- **Adaptive cruise control** (ACC), which helps keep distance from the car ahead thus avoiding rear-end collisions, could save up to 4,000 accidents in 2010, even if only 3% of the vehicles were equipped.
- **Lateral support systems** (lane departure warning and lane change assistant) could save 1,500 accidents in 2010 given a penetration rate of only 0.6%, while a penetration rate of 7% in 2020 would lead to 14,000 fewer accidents.
- '**Hypovigilance systems**' for sleepy drivers could play an important role in avoiding 30% of fatal crashes on motorways and 9% of all fatal accidents.
- Other systems like "speed alert", "alcohol-lock" and "charging systems" can also have, under certain circumstances, an important impact on cleaner, safer and more efficient transport.

Solutions are not only focused on-board vehicles: improved software and real-time traffic data in urban traffic control centres could lead to better traffic management and achieve a reduction of up to 40% in traffic standstill and congestion, thus resulting in considerable energy savings. Solutions exist and they are getting better, cheaper and more reliable.

Market Take-up of Intelligent Vehicle Systems

Despite their potential, most intelligent systems are not yet on the market, and when they are large-scale deployment has taken a very long period of time due to severe problems. Safety innovations tend to start from the top end of the market, in luxury cars, and take a long time to 'trickle down' to the mass market. More than 20 years after the introduction of ABS, for instance, some cars still lack it. ESP systems took 10 years to achieve a market penetration of 40% in new cars in Germany. And ACC still has a very low penetration rate more than 25 years since its introduction.

There are many reasons for this slow take-up. Legal and institutional barriers, the extremely competitive situation of the automotive sector, the relatively high cost of intelligent systems and the consequent lack of customer demand all contribute. Most of all, there is a lack of information throughout society about the use and potential benefits of these systems.

A recent survey by EuroTest, a European motorists' organisation, showed that only half the drivers surveyed were familiar with existing basic in-vehicle technologies providing active and passive safety. Only 50% of them, for example, knew the features of the anti-lock braking system that is now fitted in almost all new vehicles.

A Call to Action

These are European problems and need European solutions. Bottlenecks to market implementation need to be removed, product demand needs to be stimulated, and consensus needs to be built among key players.

Advanced cruise control systems use radar to help drivers maintain a safe distance

The European Union has a particular role in ensuring interoperability and harmonising technical solutions through a comprehensive European approach.
In addition to standardisation, public authorities have a special function in the implementation of the appropriate infrastructures, including intelligent features that make the most of co-operative systems currently being developed. They also play a role in targeted actions enabling the wider deployment of intelligent transport systems.

Further action in research and development is also needed, to build upon the major investments in intelligent vehicle technologies made under previous European Research Programmes. It is also important to maintain European industry competitiveness towards Japan and the US where similar research programmes exist.

Assessing the Impact of Intelligent Vehicle Systems

With so many different types of intelligent safety systems available, and so many variables in how systems are used, we need to be able to assess their impacts and benefits.

The **SEISS** study analysed the socio-economic effects of intelligent safety systems in road vehicles. A survey of current approaches was undertaken to assess the impact of new safety functions, and a methodology was developed to assess the potential impact of intelligent safety systems in Europe. Factors influencing socio-economic benefits were identified, such as improved journey times, reduced congestion, infrastructure and operating costs, environmental impacts, medical care costs, etc. The project resulted in estimates of expected benefits and costs for a range of market deployment scenarios.

Building on this work, a follow-on project, **eIMPACT**, is assessing the socio-economic effects of Intelligent Vehicle Systems (IVS) to determine their future market prospects. It is identifying the most promising stand-alone and co-operative IVS technologies; developing scenarios for IVS for the period 2010 – 2020; and assessing the impact of IVS on traffic safety and efficiency in these scenarios. Policies to enable the implementation of IVS are also being addressed.

The output will be an assessment of the socio-economic impact including a picture of the costs and benefits for the stakeholders and the macroeconomic effects. These results will contribute directly to policy development at European and national levels, and will be actively disseminated through workshops, conferences, newsletters and brochures.

SEISS: www.vdivde-it.de/seiss/ eIMPACT: www.eimpact.info

> Intelligent Stand-alone Systems for Vehicle Safety

In-vehicle systems help drivers to avoid or mitigate an accident through sensing the nature and significance of the danger, while taking the driver's state into account. Depending on the significance and timing of the threat, these on-board eSafety systems will:

- *Inform* the driver as early as possible
- *Warn* him or her if there is no driver reaction to the information, and
- *Actively assist or ultimately intervene* in order to avert the accident or mitigate its consequences.

Preventive safety applications also help drivers to:

- Maintain a safe speed
- Keep a safe distance
- Drive within the lane
- Avoid overtaking in critical situations
- Safely pass intersections
- Avoid crashes with vulnerable road users
- And at a last resort, reduce the severity of an accident if it still occurs.

The following are examples of autonomous on-board systems arising from recent European research. Several of the current subprojects of the **PReVENT** project (see box opposite) are concerned with in-vehicle systems. Further examples of co-operative systems, based on vehicle-to-vehicle or vehicle-to-infrastructure communication, are presented on pages 10-11.

Radar detection can warn drivers of problems ahead

Waking Up to Sleepy Drivers

Over recent years, a major focus of traffic research has been driver fatigue as one of the most important causes of road accidents. Between 10-20% of all accidents are related to so-called 'hypo-vigilant' driver states. Furthermore, accidents related to driver hypo-vigilance are more serious than other types of accidents, since sleepy drivers often do not take evasive action prior to a collision. The introduction of various advanced driver assistance systems (ADAS) in the coming years could exacerbate this situation, as drivers become tired or stressed by prolonged periods of monotonous driving conditions.

The AWAKE system aims to detect drowsiness and warn the driver in time. Among other functions, the system monitors the driver's eye-blinking rate, the force on the steering wheel and the vehicle's position in relation to the road lane and the surrounding vehicles. A variety of sensors (radar, cameras) inside and outside the vehicle detect the driver's possible drowsiness. The driver is then alerted through a series of acoustic and visual warnings.

If widely deployed **AWAKE** is expected to significantly reduce traffic accidents caused by drowsy drivers. Three prototypes have been developed within the project, one for city-cars (Fiat Stilo), one for luxury-cars (Mercedes S-Class) and one for heavy vehicles (Mercedes Actros). These are currently being tested to assess the full impact of the system on driver behaviour.

Watching Over Pedestrians

Every year, approximately 150,000 pedestrians are injured and 6,000 killed EU-wide in traffic accidents. Passive safety features at the vehicle front can provide only limited benefit in case of a crash. Hence, driver assistance systems to detect pedestrians and other vulnerable road users are a focus for significant research effort.

One such system combines 24GHz radar sensors for detection with a video-based approach for recognition. It has learned what pedestrians look like from a database of tens of thousands of images, using machine-learning techniques based on shape and texture features. An assessment module determines the risk of the traffic situation, based on relative position and velocity of the pedestrian with respect to the vehicle. The driver is alerted through an acoustic alarm, possibly followed by automatic vehicle braking.

Cars equipped with this system are being tested by Volkswagen and DaimlerChrysler, and are able to detect pedestrians at a range of 5-25m, up to 4m lateral to the vehicle. Research activities are supported by the EU projects PROTECTOR (2000-2002), SAVE-U (2002-2005) and WATCH-OVER (2006-2008).

Hands-Free Motoring around Town

The development and adoption of small electric, fully automated vehicles was addressed in the IST-project **CyberCars**. They are able to run autonomously without a driver on city streets at low speed (up to 30 km/h at the moment), while avoiding fixed and mobile obstacles. Dual mode versions of these vehicles are foreseen for private use, which also allow for manual driving in normal traffic. For a fee, users would have access rights, and the clean fuel vehicles would be parked automatically and their speed controlled, improving the mobility and quality of life in urban areas.

For such systems to address high demands, more cooperation between vehicles is needed. This is the focus of a follow-on project **CyberCars2**, based on vehicle-to-vehicle and vehicle-to-infrastructure communications and vehicle coordination. It will address in particular the cooperation between vehicles running at close range (platooning) and at intersections (merging, crossing).

A CyberCars driverless vehicle

A Safer User Interface for Road Transport

With increasingly sophisticated in-vehicle communication systems it could be easy to become overloaded with information when driving. Managing the driver's information needs, **COMUNICAR** designed, developed and tested an in-vehicle, multimedia Human Machine Interface (HMI) that holds the potential to improve both safety and driving comfort.

COMUNICAR's multimedia HMI design covers both the instrument panel and the display located in the middle of the cockpit. The interface integrates for the first time a broad range of messages, including the mandatory and traditional vehicle information such as the speedometer, rpm counter and warnings. It also manages innovative driver functions, such as frontal and lateral collision warnings from eSafety systems as well as telematic services for navigation, traffic information, phone and message facilities, and the entertainment system.

Project results of COMUNICAR are one of the main building blocks for **AIDE**, a current Integrated Project focusing on the design and development of an adaptive and integrated HMI.

Mobilising European Efforts for Preventive Safety

PReVENT is a European automotive industry activity, co-funded by the European Commission, to contribute to road safety by developing and demonstrating preventive safety applications and technologies. PReVENT has over 50 partners, comprising industry (12 car manufacturers and 16 parts suppliers), public authorities, research institutes, universities and other public and private bodies. Its total budget is €55 million, of which the Commission is contributing €29.8 million. PReVENT embraces sub-projects working on stand-alone systems as well as sub-projects conducting research into co-operative systems.

PReVENT envisions the early availability of advanced, next generation preventive and active safety applications and enabling technologies and an accelerated deployment on European roads. To this end, it is developing, demonstrating, testing and evaluating a wide range of preventive safety applications and systems. It is also building consensus and co-operation between stakeholders to ensure their earliest possible implementation in Europe.

Activities are structured around a number of sub-projects undertaking research into:

- safe speed and safe following
- lateral support
- intersection safety and
- vulnerable road users and collision mitigation.

For instance, SASPENCE is developing an innovative system to help drivers keep a safe distance while driving. SAFELANE develops a lane keeping support system that operates safely and reliably in a wide range of adverse road and driving situations. LATERAL SAFE introduces a cluster of safety applications contributing to the prevention of lateral/rear related accidents and assisting the driver in adverse or low visibility conditions and blind spot areas. And the APALACI and COMPOSE sub-projects address complementary aspects in the field of collision mitigation and vulnerable road users.

In addition, PReVENT is sponsoring a series of 'horizontal activities' to remove barriers to market introduction. These include elaboration of a non-technical "Code of Practice" for development and testing of advanced driver assistance systems (ADAS) (sub-project RESPONSE 3); work to reduce the costs and complexity of map-based ADAS safety applications (sub-project MAPS&ADAS); and creation of a network of excellence on sensor data fusion, a key technology for all eSafety applications (sub-project ProFusion).

PReVENT will enable European industry to further strengthen its position by introducing leading edge technologies while helping to reduce road accidents.

PReVENT: www.prevent-ip.org

> Co-operative Systems for Road Traffic Safety

While stand-alone driver assistance systems can have positive effects in terms of safety and traffic management, these benefits would be magnified many times if individual vehicles were able to communicate with each other or with the road infrastructure.

Hence, over recent years the emphasis in intelligent vehicle research has turned, as an extension of autonomous or stand-alone systems, to co-operative systems, in which the vehicles communicate with each other and/or with the infrastructure. Such co-operative systems have the potential to greatly increase the quality and reliability of information available about the vehicles, their location and the road environment, enabling improved and new services for the road users. This, in turn, will lead to:

- Greater transport efficiency, by making better use of the capacity of the available infrastructure and by managing varying demands;
- Increased safety, by improving the quality and reliability of information used by ADAS and allowing the implementation of advanced safety applications.

The following are examples of co-operative systems arising from European research.

Inter-Vehicle Communications to Save Lives

Emerging wireless technologies for vehicle-to-vehicle communication promise to dramatically reduce fatal roadway accidents by providing early warnings to motorists. As well as improving road safety, such technologies will also help optimise traffic flow and enable drivers to take greater control of their vehicles.

Developed under the **CarTALK 2000** project, the idea is for information sensed from the vehicle's environment and information about manoeuvres to be transmitted from one car to other cars in the vicinity. This allows early reactions like braking if some vehicles in front have had to use emergency braking, and so helps prevent rear-end collisions.

The CarTALK vehicle communication system

The data exchange between vehicles is made possible by ad-hoc networks. These short-distance connections are spontaneously created between the vehicles as the need arises and can organise themselves without the help of any external infrastructure.

Other scenarios where such technology might be useful are if a vehicle encounters a critical situation such as congestion, fog, ice or an accident. It can pass the relevant information on to all affected road users in the immediate vicinity of the danger spot. Traffic approaching from further away is given ample warning and can respond to the situation.

CarTALK 2000 actively addressed market introduction strategies performing cost benefit analyses and addressing legal aspects.

Security on the Road

A prerequisite for the successful deployment of vehicular communications is to make the systems secure. For example, it is essential to make sure that critical information cannot be modified by a hacker, and to protect the privacy of the drivers and passengers. The specific operational environment (moving vehicles, sporadic connectivity, etc.) makes the problem very novel and challenging.

The **SEVECOM** project addresses security of the future vehicle commmunication networks, including both the security and privacy of inter-vehicular communication and of the vehicle-infrastructure communication. It has set out to define the security architecture of such networks, as well as to propose a roadmap for integration of security functions in these networks.

With the goal of enhancing the immunity of future road safety applications against a wide range of security threats, SEVECOM focuses on communications specific to road traffic. Three major aspects are being examined:

- Threats, such as bogus information, denial of service or identity cheating.
- Requirements, like authentication, availability, and privacy.
- Operational properties, including network scale, privacy, cost and trust.

A European Market for Vehicle Telematics

For co-operative systems to reach their true potential we need an environment in which innovative telematics services can be developed and delivered cost-effectively, and hence become more attractive for both manufacturers and consumers. The best way to ensure this is to create an open and standardised end-to-end architecture for automotive telematics services.

GST, Global System for Telematics, is a major initiative mobilising more than 50 key stakeholders in the European telematics industry. It will provide the building blocks to carry out the transition from closed to open systems, which is seen as the key to bringing telematics functionality to all new vehicles and unlocking the market for online services.

With an open environment the range of services that will become available to manufacturers and consumers will increase. Drivers and occupants will be able to rely on their on-board integrated telematics system to access a dynamic offer of online safety, efficiency- and comfort-enhancing services wherever they drive in Europe. They will be able to access their portfolio of services throughout Europe using the same vehicle terminal.

GST has three service-oriented sub-projects: Rescue which is continuing the work of E-MERGE on emergency services; Safety Channel for provision of priority safety information to road users; and Enhanced Floating Car Data. These are complemented by four technology-oriented sub-projects working on open systems architecture, security, payment and certification.

Research for Co-operative Safety Systems

Other research projects concerned with co-operative systems as part of the current portfolio in ICT for Transport include:

- **COM2REACT**, which aims to establish and test a new local-area traffic control concept based on vehicle-to-vehicle (V2V) and vehicle-to-centre (V2C) communication. It uses a virtual traffic control sub-centre to control a moving group of vehicles in close proximity.
- **CVIS**, which focuses on design, development and testing of new technologies to allow vehicles to communicate with each other and with the nearby roadside infrastructure.
- **SAFESPOT**, which aims to use both the infrastructure and the vehicles as sources (and destinations) of safety-related information, so as to expand the "safety margin" within which a potential accident is detected.
- **WILLWARN** (Wireless Local Danger Warning), one of the PReVENT subprojects, is developing a system that passes information between cars, so extending the driver's horizon and warning the driver of dangerous situations ahead.
- **INTERSAFE**, another PReVENT subproject, which is developing systems to improve safety at intersections based on vehicle-based sensors and infrastructure-to-vehicle communications.

> Location-based Systems for Road Safety

Location-based applications are of particular interest in the context of road transport. Already, the eCall pan-European in-vehicle emergency system is able to communicate the exact location of a crashed vehicle to the emergency services (see box opposite). There is also increasing interest in using location-based and digital map information in combination with advanced driver assistance systems (ADAS).

The aim here is to use an on-board map as a sensor, in much the same way as a radar sensor is used to track obstacles or other vehicles. Map-based sensors allow the vehicle's safety systems to look ahead, i.e. to where the car will be in a couple of seconds. The information derived from the map can then be used either directly by the vehicle's ADAS, or in combination with information from other sensors to improve detection or response.

The starting point for the development of map-based safety applications has generally been the maps produced for navigation applications. These navigation maps come close to the requirements of the safety applications under development. However, some additional measures are required to fully meet these requirements. Both control and advice applications need additional and higher quality map content than traditional navigation maps, whether used as a primary or secondary sensor. The extra map content required by safety applications is referred to as the "eSafety attributes".

A European approach to map-based ADAS is being led by the eSafety Working Group on Digital Maps. Its objectives are threefold. Firstly, it is working to define a business model for public-private partnerships to ensure availability of eSafety attributes in digital maps. Secondly, it is defining requirements for an eSafety digital map database which, in addition to roadmap data, contains agreed safety attributes for ADAS purposes. Thirdly, it promotes public/private cooperation to collect, maintain, certify and distribute the eSafety attributes so as to integrate them into the digital roadmap database.

Maps for eSafety

MAPS&ADAS developed, tested and validated appropriate methods to gather, certify and maintain safety content to enable the provision of ADAS maps. It is one of the horizontal subprojects of **PReVENT**, a large-scale European eSafety research project under FP6. The work involved the development and validation of a standard interface, called ADAS Horizon, between map data sources and ADAS / navigation applications.

By allowing ADAS applications to access safety-enhanced digital maps, ADAS Horizon extends the driver's view at least 500 to 1000 metres ahead. MAPS&ADAS proved the concept in two applications developed previously:

- ACC (Active Cruise Control) to validate the ADAS interface;
- Driver Warning System (HotSpot and Speed Alert) to assess the safety impact of ADAS maps.

In addition, other PReVENT applications will use the ADAS Horizon interface and use the ADAS maps in their respective test sites.

The results of the project confirm the potential benefits of using digital maps as a predictive sensor to enable or enhance ADAS applications. The system has received strong support from the ADASIS Forum, a self-funded industry initiative managed by ERTICO to coordinate developments in this area.

Also concerned with smart real-time maps for intelligent vehicle services (IVS) is **HIGHWAY**. Its 3D maps will provide users with up-to-date information enriched with safety relevant data. For instance, speed limit data will be fed to speed limit units, and dynamic data like relevant traffic or weather information will be accessible for the driver and the in-vehicle safety systems. HIGHWAY maps will also help drivers facing critical driving situations, for example by delaying incoming phone calls or triggering safety mechanisms based on map information like the radius of the curve ahead or speed limits, or an accident ahead. In addition to decreasing the probability of accidents, HIGHWAY services will save customers time and money by being better informed.

On-Call to the Emergency Services

eCall is an in-vehicle safety system that builds on the single European emergency number 112 and its location-enhanced version E112.

When a car senses a major impact in an accident, its eCall device automatically calls the nearest emergency centre using 112. This call transmits the vehicles' exact geographic location. An emergency call can also be generated manually by vehicle occupants by pushing a button in the car. The fact that the rescue services immediately get the accurate location data drastically cuts their response time, allowing them to reach the scene of the accident much quicker.

Much of the development work was done under the Framework Programme 5 project E-MERGE during 2002 – 2004.
E-MERGE determined the functional architecture for sending information - together with the 112 voice call - directly to the emergency services in case of a vehicle incident. This information includes details about where and when the accident occurred, vehicle identification, and information about the severity of the crash. Prototypes were developed and the eCall concept was demonstrated with the emergency services in a number of European countries.

eCall is a high priority in European eSafety policy. The European Commission is working with Member States to ensure the full-scale roll-out across Europe by 2009, by which time eCall devices will be fitted into all new cars. Achieving this, however, will require substantial work to upgrade emergency centres to receive E112 calls.

eCall is also a focus under GST, an FP6 Integrated Project dealing with the next generation of telematic support services for road transport (see page 11). The sub-project GST RESCUE is looking at how to improve the information flow and operation of emergency services so that emergency vehicles reach an incident scene rapidly and safely.

> Bringing It All Together: The Intelligent Car Initiative

The Commission's Communication on the Intelligent Car, published in February 2006, sets out Europe's future strategy for development of cars that are smarter, safer and cleaner. It shows how industry, Member States and citizens can work together to solve road transport problems and improve the take-up of ICT in transport.

The Communication presents the i2010 Intelligent Car Initiative as a framework for policy actions in this area. The Initiative comprises three complementary pillars: the eSafety Forum, research under the IST programme, and awareness-raising actions.

Coordination of Road Transport Stakeholders

The Intelligent Car Initiative aims to improve coordination between all road transport stakeholders, principally car manufacturers, road operators, telecom companies and transport service providers. Through coordination efforts, a mutually agreed approach to and implementation of activities leading to smarter, safer and greener road traffic is being sought.

These coordination activities build on the **eSafety Forum**, which is the driving force behind European efforts on eSafety. It aims at removing the bottlenecks preventing intelligent vehicle systems from penetrating the market. The Forum carries out its mission through consensus building among its participants as well as policy recommendations to the European Union and its Member States.

The Forum was established in 2003. Nowadays, it consists of more than 150 members representing all main parties interested in road safety. The Forum is the essential link to decision makers. It also ensures liaison with other activities such as Cars21, an expert group set up to advise the Commission on the future policy and regulatory framework for the European automotive industry, and the European Road Safety Action Programme. For the discussion of specific topics, the Forum has so far established 13 industry-led working groups, and has produced a number of valuable reports.

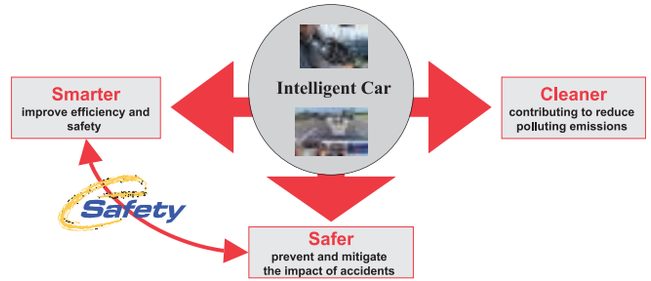
Research in Smarter, Safer and Cleaner Vehicles

The long-term objective of the Intelligent Car Initiative, a smarter, safer and greener road transportation system, needs sustained research efforts. As its second pillar, the Initiative will therefore foster co-operative research in intelligent vehicle systems. It will also help facilitate the take-up of research results. The Initiative's scientific activities will be part of the 7th Framework Programme, drawing of course on results achieved under Framework Programmes 5 and 6.

Specifically, the Initiative will support research and development in the following areas:

- The next generation of driver assistance systems, aiming among other things at enhanced performance, greater reliability and higher security;
- Co-operative systems based on vehicle-to-vehicle and vehicle-to-infrastructure communication to move from basic conceptual models towards integrated systems and applications;
- Real time traveller and traffic information and intermodal transport;
- A set of field operational tests in real-world environments to assess the impact of eSafety systems on driver behaviour and driving dynamics.

In addition, a number of studies to investigate the needs for independent conformance testing and performance assessment methods will be tendered.



[1]The Communication can be downloaded in almost all official languages from the following web site:
http://www.cc.cec/home/dgserv/sg/sgvista/i/sgv2/repo/repo.cfm?institution=COMM&doc_to_browse=COM/2006/0059

Awareness-raising Activities

Consumer research shows that the low market uptake and penetration of eSafety technologies is partly due to the fact that consumers, drivers and policy-makers know too little about the benefits of these systems, and about the way they function. Active information dissemination to wide audiences is therefore the third field of activity of the Intelligent Car Initiative.

Demonstrators at the Intelligent Car Initiative launch in Brussels, February 2006

To stimulate demand among drivers, activities here will include regular technology demonstration events and targeted TV programmes. In addition, the eSafety Forum is proposing an 'eSafety Communication Platform' (see box) as a unified branding for eSafety systems, to improve stakeholders' communications with end-users.

Branding eSafety: The eSafety Communication Platform

Consumer studies show that safety matters when consumers choose a new vehicle. However, communication on eSafety systems is often too technical and complex, containing a plethora of different abbreviations, some of which even refer to the same technology. Consumers need clear, simple messages so as to avoid being overloaded with technical details.

Branding eSafety is one way to support effective campaigning on eSafety systems. An "eSafety brand" makes it possible to connect a logo to the general concept of eSafety systems, and frequent use of this brand name will create a positive recognition Such a general brand will also make it possible to include new eSafety devices when they arrive on the market.

To proceed in this direction, the eSafety Forum has recommended the creation of a Communication Platform for eSafety, following the example of EuroNCAP, EuroTest, EuroTAP, EuroRAP and others. The Platform should have a broad participation of stakeholders, including car manufacturers, system suppliers, digital map producers, automobile clubs, Member State and local road authorities, insurers, media, car dealers and road safety institutes.

The Platform will work closely with communication and campaign managers, media and marketing experts, and representatives of user groups. Its work will focus on three main pillars: media, marketing and the policy framework. The eSafety Support office in Brussels will provide a secretariat to launch the Platform after which an independent structure will be established.

The Platform will be financed through a combination of membership fees, sponsorship from EU Member States and institutions, and private sponsorships.

eSafety Forum: www.esafetysupport.org

> Projects List

PROJECT ACRONYM	PROJECT TITLE	PROJECT WEBSITE	PAGE
AIDE	Adaptive Integrated Driver–vehicle Interface	www.aide-eu.org	9
AWAKE	System for Effective Assessment of Driver Vigilance and Warning According to Traffic Risk Estimation	www.awake-eu.org	8
CarTALK 2000	Safe and Comfortable Driving Based on Inter-vehicle Communication	www.cartalk2000.net	10
COM2REACT	Cooperative Communication System To Realise Enhanced Safety and Efficiency In European Road Transport	www.com2react-project.org	11
COMUNICAR	Communication Multimedia Unit Inside Car	www.crfproject-eu.org	9
CVIS	Cooperative Vehicle-Infrastructure Systems	www.cvis-project.org	11
CyberCars2	CyberCars2	http://www-c.inria.fr:9098/cybercars2	9
eIMPACT	Socio-economic Impact Assessment of stand-alone and co-operative intelligent vehicle safety systems (IVSS) in Europe	www.eimpact.info	7
E-MERGE	European In-Vehicle Emergency Call	http://www.ertico.com/en/activities/activities/e-merge.htm	13
eSafety Support	Support for the eSafety Forum	www.esafetysupport.org	14
GST	Global System for Telematics enabling On-line Safety Services	www.gstproject.org	11,13
HIGHWAY	Breakthrough Intelligent Maps & Geographic Tools for the Context Aware Delivery of eSafety & Value-Added Services	www.ist-highway.org	12
PREeVENT	Preventive Safety (Active Safety integrated project in EUCAR Integrated Safety Programme)	www.prevent-ip.org	9, 11, 12
SAFESPOT	Co-operative Systems for Road Safety "Smart Vehicles on Smart Roads"	www.safespot-eu.org	11
SEISS	Exploratory Study on the Potential Socio-Economic Impact of the Introduction of Intelligent Safety Systems in Road Vehicles	www.vdivde-it.de/seiss	7
SEVECOM	Secure Vehicle Communication	www.sevecom.org	10
TRACE	Traffic Accident Causation in Europe	www.trace-project.org	5
WATCH-OVER	Vehicle-to-vulnerable Road User Cooperative Communication and Sensing Technologies to Improve Transport Safety	www.watchover-eu.org	8

As additional information, the fact sheets of all projects mentioned above can easily be found via a search function on the following web site: http://cordis.europa.eu/ist/projects/projects.htm