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ICT Research
The policy perspective

ICT and transport
The road to safer, smarter driving

European Commission
Information Society and Media

Index

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ICT Results is an online editorial service established on behalf of the Information Society and Media Directorate-General.

The service's main aim is to:
- raise the visibility of ICT-funded research results
- support projects' access to markets and encourage uptake of innovations
- raise awareness of European ICT programmes and activities

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Driving forward innovative road travel

In this report produced for the publication series ICT Research: The policy perspective, we examine how information and communications technology, or ICT, is driving forward a new era of 'accident-free' road travel. ICT is making travelling safer, cleaner and more efficient.

Road transportation is a bedrock of the European economy, important for the mobility of citizens and goods. About half of all freight is carried by road, along with four out of every five travellers.

Yet our reliance on the road system comes at a cost. Each year, about 40,000 people die on Europe's roads; accidents cost the European economy in the region of €200 billion. Road congestion in the EU could soon amount to an estimated 1% of its GDP, adding €100 billion to the bill.

Despite a growing awareness that alternatives to road transport may be safer and less damaging to the environment, road transport continues to increase. There are now some 300 million drivers on Europe's roads. Quite simply, travelling and transporting by road is convenient. People are not in a hurry to switch their cars and lorries for bicycles and trains.

In 2001, the European Commission published a transport policy white paper, *European Transport Policy for 2010: Time to Decide*. Setting out the Commission's vision of the future of transportation, the white paper aimed to strike a balance between economic development, on the one hand, and the demands by citizens for safe, efficient and environmentally friendly transport, on the other.

In the paper, the Commission emphasised that the actions resulting from such policies should ensure that road traffic continues to flow smoothly and reduce the risk of accidents.

As traffic densities rise (increases of 26% in vehicle-kilometres covered and the equivalent of 38% in goods transport are forecast for the first decade of this century), the Commission recognises that ICT has a central role to play in meeting its goals.

Congestion, accident rates and fuel consumption can all be reduced by using ICT to develop Intelligent Transport Systems (ITS) – 'smart' cars and an 'intelligent' road network – with relevant information being exchanged between drivers, vehicles and road features, such as traffic lights, intersections and tunnels.

As part of the i2010 EU policy framework for the information society and media, the Commission, therefore, launched its flagship Intelligent Car Initiative (iCar) in February 2006. This initiative aims to remove bottlenecks in rolling out ITS and to speed up the development of environmentally friendly, efficient and safer road transport for Europe.

Cleaner, greener

Congestion currently costs the EU about €50 billion per year and this figure could rise rapidly if no action is taken to ease the pressure on the road network. Member States will need to take a variety of different measures to address the problems of high traffic densities. Legislation, public awareness campaigns and investment in alternative public transport networks are just some of the options available to keep vehicle numbers down.

Meanwhile, ITS can help to keep traffic moving, especially when densities get high in zones prone to congestion or accidents. For example, a combination of sensor networks and wireless communication between road infrastructure and vehicles can turn dangerous junctions into intelligent intersections that monitor and automatically manage traffic. With real-time traffic information being delivered to control centres, operators can actively manage traffic and keep it moving. Short-range communication can also allow a group of vehicles to exchange information by automatically forming ad hoc communications clusters, and to network with the infrastructure (traffic lights, for example) so as to coordinate movements in the most efficient manner. Studies suggest that these systems could reduce congestion by as much as 40%.

Simply by lowering congestion and encouraging more efficient driving behaviour, fuel consumption could be reduced tangibly. Next-generation navigation systems that integrate geo-location data with other sources of traffic information – for instance, the location of free parking spaces – could also help drivers find more direct routes to their destinations. One study found that driving distances could be reduced by 18% through such technologies.

Prevention technologies put safety first

After the environment, where significant progress has already been accomplished, road safety is the major societal issue for this decade. The cost of road-related collisions, injuries and fatalities has a tremendous impact on citizens' quality of life; the personal, social and economic consequences of traffic accidents cannot be underestimated.

Recognising the importance of making our roads safer for travel, the 2001 transport policy white paper set an ambitious target to halve road fatalities by 2010, saving tens of thousands of European lives each year. The European Road Safety Action Programme (RSAP) set out various measures to achieve this target highlighting that the responsibility is shared among all stakeholders – road users, the private sector, regions, Member States and the EU. RSAP exploits a number of EU instruments, including legislation where necessary, to take action in a number of domains including user behaviour, infrastructure, vehicle safety, and the study of road accidents.

Over the past 15 years passive systems, such as airbags, protective bodywork structures and sophisticated seatbelts, have effectively helped to shave the number of road fatalities. But further safety improvements will only be achieved if accidents can be prevented in the first place. Studies show that more than nine in every ten accidents are caused by human error; it is therefore clear that ITS – which can help people make better decisions or even make decisions for them – has a central part to play.

Adaptive cruise control, for example, helps drivers maintain sufficient distance between vehicles. Estimates show that 4,000 accidents could be avoided if just 3% of European cars were fitted with the technology. Electronic stability control, which prevents skidding, can reduce the number of car accidents with fatalities by about 10%.

Such onboard ICT technologies are all examples of advanced driver assistance systems (ADAS), also known as intelligent vehicle safety systems (IVSS). They offer an extra set of eyes and ears for a driver. Intelligent vehicles integrate data from external monitoring devices and internal sensors to reduce a driver's workload and anticipate dangers. Indeed, combining all of the information to hand, including much that is unavailable to the driver, the intelligent car could take split-second control of a vehicle in an emergency to avoid or mitigate the effects of a collision.

eSafety is the first pillar of iCar and the European Union's most important link with industry and decision-makers outside the EU institutions. It draws together the European Commission, representatives of the automotive industry, road operators and other stakeholders. The aims of eSafety are to accelerate the development, deployment and use of IVSS. eSafety is the main driving force in the development and deployment of intelligent ICT solutions for accident prevention and mitigation.

eSafety has driven the adoption of eCall, a pan-European in-vehicle emergency call system. Fourteen Member States and many more organisations have now signed a Memorandum of Understanding, making a commitment to implement the system. It is estimated that 2,500 lives could be saved in the EU annually, and 15% of serious injuries mitigated, if all European cars were equipped with eCall.

Driving research

Many of the research topics addressed under the EU's Fifth and Sixth Framework Programmes for research (FP5 and FP6) are in the pipeline for commercial rollout. eCall is one of the applications demonstrating the social benefits these systems

SEVENTH FRAMEWORK PROGRAMME

can provide to society. However, still more research and development is needed to push the boundaries of vehicle- and infrastructure-based solutions for greener, smoother and safer travelling on European roads.

Several of the 'challenges' outlined in the €9 billion ICT arm of the Seventh Framework Programme (FP7), the EU's current round of research funding, encompass transportation issues. For example, car-to-car and car-to-road communications rely on pervasive and secure networks (Challenge 1), often established in an ad hoc manner when suitably equipped vehicles encounter each other.

Research projects categorised under Challenge 2 of FP7's ICT Work Programme focus on cognitive systems and interactivity between ICT networks and components, while those listed under Challenge 3 tackle the extensive research agenda for the improvement and wider uptake of embedded micro-technologies. Embedded systems are already widely used in modern road vehicles. eSafety tools, such as ADAS, would make even greater use of this technology.

Projects under Challenge 6 look specifically at ICT research and development for mobility, environmental sustainability and energy efficiency. Such projects seek targeted solutions to the problems of increasing congestion, fuel consumption, pollution from emissions, and traffic accidents.

The prioritisation of ICT research on transport issues is guided by a set of strategic research agendas outlined by the Commission. During 2006, the eSafety Forum developed the Strategic Research Agenda for iCar. The latest version of its recommendations for forthcoming R&D under the FP7 ICT Work Programme was published in December 2007 (Strategic Research Agenda – ICT for Mobility).

While the eSafety Forum introduced a number of new priorities for 2009-2010, the group also suggests that "research should continue to address Intelligent Vehicle Safety Systems, Cooperative Systems and Mobility Services".

Central unlocking

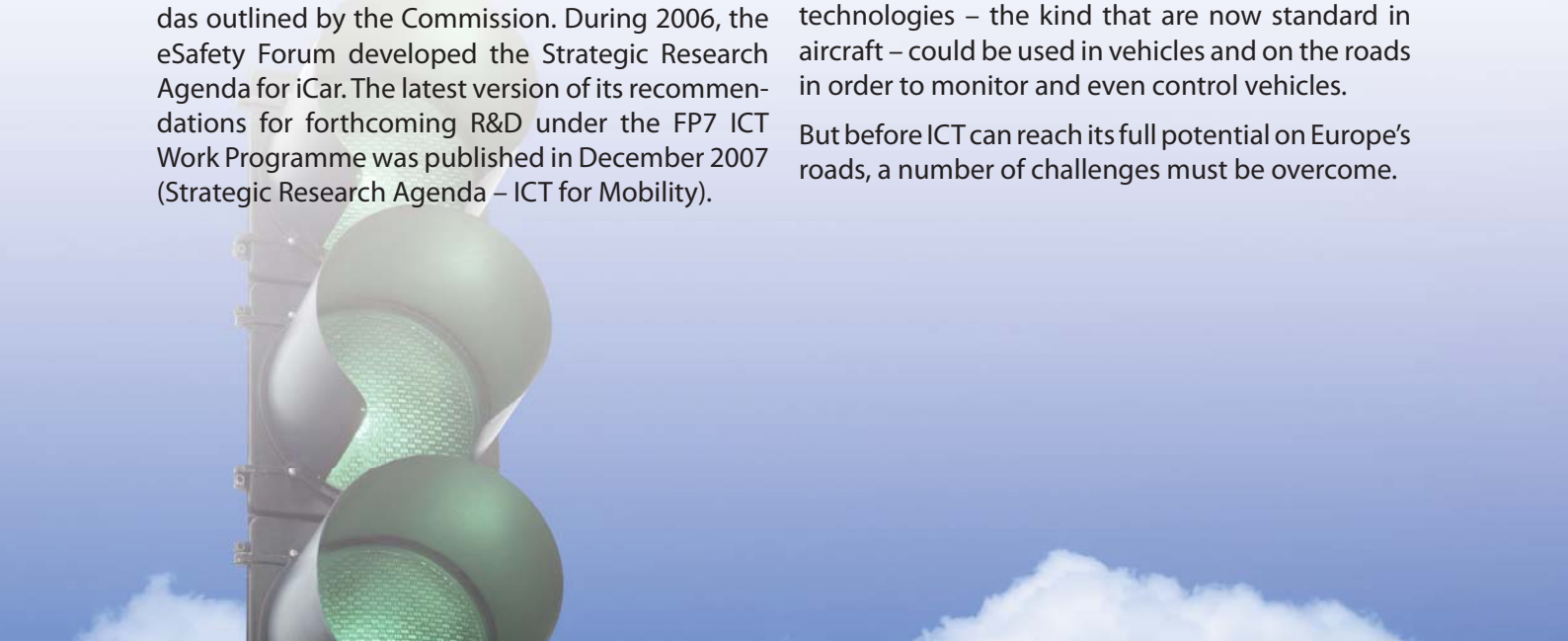
iCar is not just driving an agenda for ITS research. With an eye on the need for competitive, commercial products, the initiative is also about supporting the market for intelligent solutions to problems on the road.

In partnership with industry bodies, Member States, service providers and car-markers, iCar aims to build consensus within the automotive sector on how the development and implementation of intelligent transport systems should progress.

On the consumer side, iCar is looking at ways to increase awareness and stimulate consumer demand for new technologies. Using a mix of policy, research and communications instruments, the initiative will accelerate the deployment of intelligent vehicle systems on European and international markets, for example by supporting technical solutions which ensure interoperability across national borders.

Indeed, through such initiatives as iCar, ICT is given a far greater role in a new era for road transport. Citizens and the economy will benefit from the power of intelligent transport systems and services. Sophisticated data collection, processing and fusion technologies – the kind that are now standard in aircraft – could be used in vehicles and on the roads in order to monitor and even control vehicles.

But before ICT can reach its full potential on Europe's roads, a number of challenges must be overcome.



Meeting the challenges

A wide range of EU policies and initiatives emphasising the importance of an efficient transport system has been adopted. The smooth running of the road network will allow citizens ease- and freedom of movement and will ensure that society is not crippled by congestion, traffic accidents and environmental degradation. Above all, citizens on the road should be as protected as possible from injury and loss of life.

Driver assistance

To the experienced driver, controlling a vehicle safely on the roads seems easy. Yet it is a complex and intense activity. Brain and body must rapidly and continuously process and respond to visual information, along with sounds and the 'feel' of the vehicle. ICT in the form of networks of sensors, microchips and electromechanical components can extend and enhance the information available to the driver, as well as the driver's room for reaction.

The FP7 ICT Work Programme (2007-2008) placed significant emphasis on the development of technologies for the 'intelligent car'. Onboard ICT could offer a higher degree of accident prevention through improved sensing, hazard detection and driver warning. Indeed, smart cars could independently activate safety systems to make up for driver error.

ICT research and development focuses on sensor networks and data fusion, integrated with cognitive processing able to predict accidents and driver behaviour. The aim is to prevent crashes from happening or to mitigate their consequences, if the collision is unavoidable. Research into advanced driver assistance systems (ADAS) aims to improve their performance and, especially, their reliability so that drivers will quickly adopt and trust the new technologies.

Co-operative systems

ADAS technology is mostly 'driver-centric': it focuses on driver support to protect the vehicle from collisions. Using satellite navigation, dynamic route guidance technology can advise the driver on the best route to a destination. On top of ADAS and route guidance, even more efficient and safer traffic flows can be achieved by coordinating vehicles through wireless vehicle-to-vehicle information exchange.

There are numerous challenges to overcome before such co-operative systems become widespread. The technology powering co-operative systems must be foolproof, and the ad hoc networking and data processing behind the concept must be fast, secure and reliable. To this end, large-scale test programmes must fully assess the efficiency, quality, robustness and user-friendliness of these systems. In parallel, industry standards must be developed

to ensure that different makes and models of vehicles and the road infrastructure all 'talk' the same language.

Location-based services

The increasing capabilities of wireless technology open the door to a wealth of mobile and location-based services for drivers. Over the past few years the cost of satellite navigation systems has dropped significantly, bringing this technology into the hands of businesses and consumers.

The 2001 transport white paper called for the creation of an independent satellite navigation system. Europe's answer is GALILEO, a global navigation satellite system being developed by the European Union and the European Space Agency to provide accurate, guaranteed global positioning services under civilian control. Full operation is scheduled for 2013. The system will consist of 30 satellites and deliver real-time positioning down to the metre range, which is unprecedented for a publicly available system.

Intelligent transport systems will profit from this pinpointing technology, but further research is needed to ensure that location-based services will appeal to end-users. EU-funded projects will work to develop user-friendly services that integrate satellite positioning from low-cost satellite signal receivers and other positioning technologies which are 'always-on' and context-aware. The information they supply should be personalised, reliable and seamless – not dependent on the terminal, hardware or the communication network.

Supporting commercialisation

Intelligent cars and 'traffic-aware' infrastructure will remain little more than concepts unless the ICT technologies behind them receive widespread support and adoption within the automotive industry, from road operators and consumers.

It is important that manufacturers agree on common standards to ensure systems' performance and interoperability, on the home and the global markets. To generate maximum societal benefits, co-operative systems require a significant number of equally equipped vehicles on the road. Research and development is therefore required to ensure that onboard ICT technology is affordable, so that smart technology becomes a standard feature in vehicles.

Knowing the customer is also important. Drivers in one country can have quite different preferences from those in another country. Researchers must find out what kinds of features different groups of users want and ensure that the new technologies meet consumers' demands.

On the road to reducing accidents

Even the most experienced drivers are prone to error, or can be the victim of another driver's mistake. The EU is battling to reduce accident rates in a bid to save lives and keep traffic moving. Along with Member States effort to enforce safe traffic behaviour, EU-funded research projects are developing advanced driver assistance systems (ADAS) that integrate sensor, cognitive and 'actuation' technologies that can alert drivers about potential collisions on the road – and actively help avoid them.

Studies show that at least 93% of accidents are caused by human error, so the case for increased driver assistance is clear.

A vehicle's dashboard is the simplest form of a driver assistance system. At the very least, it tells drivers their speed, fuel supply, engine temperature and the status of various vehicle components, such as lights. This information is essential for the driver. The brain assimilates it, along with what the driver can see, hear and feel.

Advances in ICT have widened the scope for ADAS, which can take some of the strain away from drivers, or provide information that they currently do not have. For example, infrared sensors may be able to detect obstacles in fog.

Built with powerful onboard decision-support and cognitive functions, future ADAS technology will make cars really intelligent. In emergencies, the ADAS may take control of the vehicle, perhaps by adjusting engine speeds, by applying brakes, by pretensing seatbelts, or by guiding a vehicle through a skid so as to avoid or mitigate a collision.

Adaptive cruise control (ACC), for example, can prevent rear-end collisions. Estimates show that as many as 4,000 accidents could be avoided if as few as 3% of European cars were fitted with ACC (SEiSS Study – Socio Economic impact intelligent Safety Systems). It is estimated that hypo-vigilance systems, which can sense driver drowsiness, could play an important role in helping prevent up to 30% of fatal crashes on motorways and 9% of all fatal accidents.

Driver assistance at a glance

Drivers have to take in, process and react to a huge amount of information. Often it is just too much. ICT can partly ease the drivers' burden by detecting problems and reacting in emergencies to make the driving experience safer.

As technological progress goes on in ICT, ADAS become better performing and affordable. Advancement in ADAS remain a priority under the current Seventh Framework Programme. Calls for research proposals are based on the European Commission's relevant two-yearly work programmes that take into account research agendas, such as those approved by the eSafety Forum or drawn up by the European Road Transport Research Advisory Council (ERTRAC). Bodies like the eSafety Forum and ERTRAC help create the necessary co-operative links between industry and researchers. The partnerships bring together business leaders and policy-makers so that the overall vision for safer road travel in Europe can be realised through an integrated programme of action supported by all players.

Alongside the extensive ICT research programme into driver assistance, the Commission is working to adapt the regulatory environment. For example, work is underway to harmonise EU rules governing the use of short-range radar. It is also inviting European standardisation bodies to develop standards and technical specifications to ensure the technologies developed are interoperable, for example.

The eSafety Forum has also endorsed a European Code of Practice for the development and testing of ADAS, as drawn up by RESPONSE, a partly EU-funded sub-project of the PReVENT Integrated Project. This code should help to accelerate the uptake of ADAS and help manufacturers navigate the complex legal aspects coming with these technologies.

Projects in action

SEE
LOCUST
EDEL
SAVE-U
WATCH-OVER
SAFE-TUNNEL
PEIT
SPARC
HAVE-IT
AIDE

A system developed by European researchers has doubled airline pilots' ability to detect obstacles, and in road tests has boosted automobile drivers' vision by up to 400%. The **SEE** project developed two types of sensors, one using the short-wave infrared band and another the long wave. Combining complementary data from the two cameras, the system produces a more accurate image than either sensor could produce on its own.

SEE researchers conducted tests on cars driven in foggy conditions. "It was really effective at detecting a person or an animal on the side of the road," says Pierre-Albert Breton of Thales Avionics, a SEE partner. The sensors can help drivers 'see' pedestrians or cyclists in poor visibility conditions. BMW, one of the project's eight partners, is exploring low-cost applications of the system.

Meanwhile, the **LOCUST** project has created a computer vision system for collision detection that is expected to be more effective and cheaper than existing technologies.

The software algorithms are based on analogies of the vision system of locusts. "Locusts and flies have unique vision systems that we have emulated and expanded upon to create sensors that can detect objects around vehicles", explains project coordinator Angel Rodríguez-Vázquez of the Seville Microelectronics Institute.

To design the system, the project built on studies conducted by a team of neurobiologists at the University of Newcastle-upon-Tyne, a project partner. The LOCUST system is the first to be based on "intelligent vision", which unlike radar can identify multi-dimensional objects, making it more effective. It is also expected to be considerably cheaper to use commercially.

The **EDEL** project has designed and developed different technological solutions for future onboard night vision systems. The different solutions can be compared on a cost benefit basis and will offer the market modular solutions that will allow carmakers to select the most suitable ones for their vehicles. The system uses a CMOS sensor to prevent drivers being dazzled by the light of oncoming vehicles. The scene in front of the car is 'illuminated' by near-infrared laser diode arrays installed in a new headlight unit. A camera captures the images in front of the vehicle for further processing and continuously monitors images from the road scene ahead. The image data is transmitted to an image-processing module and eventually to the windscreen, which features an infrared transparent area. A carefully designed, user-friendly human-machine interface then displays the relevant information.

Every year in the European Union there are about 9,000 deaths and 200,000 injured victims in road accidents that involve pedestrians or cyclists colliding with a car. Hoping to improve on these grim statistics, researchers involved in another project have developed a cutting-edge sensing system that could ultimately help to save the lives of vulnerable road users.

A prototype vehicle incorporating the **SAVE-U** system has been successfully tested in the United Kingdom. Installed on the car are one video camera and one infrared camera, along with a radar device. The system calculates in a fraction of a second the movement of pedestrians within the 'capture zone', which can be any space up to 30 metres away from the vehicle. From that point on, the car's onboard cameras track pedestrians' movements. This information is correlated with data received from the radar network, such as distance to objects and their speed. SAVE-U can thus identify any pedestrian or cyclist coming within the trajectory of the vehicle and after analysing the situation, warn the driver or apply automatic braking if there is a risk of collision.

SAVE-U's work continues in a project called **WATCH-OVER** which aims to improve the detection parameters by an order of magnitude and to integrate a communication link between the vulnerable road user and the vehicle. This helps in situations where the road user cannot be 'seen' by the vehicle, for example when a pedestrian steps on the roadway.

ICT does not just help drivers with better information from outside. Sensor technology can also keep an eye on the status of the vehicle's mechanics. This monitoring is particularly important for goods vehicles. One research project is focusing on how smart technology can reduce the number of incidents in tunnels, which can be particularly dangerous or can cause enormous disruption on European roads.

Researchers involved with the successful **SAFE-TUNNEL** project equipped two trucks with preventive diagnosis devices, tele-control and a human-machine interface. Tests were conducted along an alpine stretch of the A32 connecting Italy and France, and involved three long tunnels. The system uses onboard prognostics to detect existing or imminent faults in vehicles and sends the information to a control centre. The tunnel operator can then prohibit tunnel access to vehicles with problems, either by sending a message to the driver, or by controlling a barrier.

The control centre can also recommend speed and safety distances to drivers. An onboard radar system measures the distance to the vehicle ahead and could be used to control engines and brakes to maintain a recommended speed and distance. And thermal cameras at the tollgate detect overheated trucks and bar them from entering the tunnel.

As in SEE, researchers in the **PEIT** project are using airline technologies to introduce 'drive-by-wire' in European automobiles. "Giving the driver a virtual assistant [who is] able to indicate and prevent mistakes enhances the potential to reduce the number of vehicle accidents significantly," says PEIT project leader Ansgar Maisch of DaimlerChrysler. "Such future assistant systems could be capable of preventing the driver from getting into critical situations by detecting obstacles [on] the road or driving at too high a speed [towards] a road bend for example, and [taking] action to ensure the vehicle's safety."

Research in the PEIT project has focused on a failsafe electronic control unit (ECU) that serves as a platform for future driver assistant systems. This central ECU, which is similar to the system used on the Airbus A380 aircraft, coordinates the management of the whole powertrain (the engine and transmission, including steering, braking, engine, gearbox, and power) in such a manner that a given command coming from the driver is safely executed.

The PEIT system would not just react to driver error after the fact, but predict from a variety of inputs (e.g. a positioning system, weather and traffic conditions) the safest vehicle position, trajectory and speed for present road conditions.

The promising results of PEIT led to a follow-up project called **SPARC**. The SPARC system merges a set of motion vectors coming from the human-machine interface – from the driver, on the one hand, and from the vehicle's ADAS, on the other. The project's goal was to compute one secure motion vector out of this information and implemented by the powertrain using an architecture based on PEIT.

SPARC has the potential to warn, stabilise, and mitigate accidents. It can hinder unwanted movements, and ultimately help drivers control the vehicle.

SPARC researchers have produced a platform that can be fitted to vehicles of all types and sizes. By building a demonstration heavy goods vehicle and a small passenger car the researchers have proven that the system is scalable.

The work of PEIT and SPARC continues in the current EU research programme FP7 within the Integrated Project HAVE-IT.

The main objective of **HAVE-IT** is to develop a next-generation ADAS which optimises how easy-to-handle tasks are allocated between the driver and a highly automated vehicle. One basic idea is to define different levels of automated driving which can be selected according to the needs of the driver, their state of alertness and the driving conditions. For example, if the system detects that the driver is sleepy, the ADAS may switch the car into a high mode of automation.

HAVE-IT will build on a safe vehicle architecture that tolerates failure and includes the advanced redundancy management developed in SPARC, but adapting it to suit the needs of highly automated vehicle applications.

Whenever the new technologies and applications are introduced into a vehicle, the central point of reference must always be the driver. The effects of ADAS could become counter productive if the system is confronted with unexpected driver behaviour.

The main objective of the **AIDE** Integrated Project therefore was to better understand how ADAS and nomadic devices could be safely and efficiently integrated into the driving environment. The project developed methodologies and human-machine-interface technologies to improve this integration. AIDE developed an adaptive driver-vehicle interface that integrates innovative concepts and technologies which maximise efficiency and thus the safety benefits of ADAS, and minimise workload and driver distractions coming from in-vehicle systems and nomadic devices. The AIDE concept was tested and validated in different types of vehicles: a city car, a luxury saloon and a heavy truck.

More information:

SEE: http://cordis.europa.eu/fetch?ACTION=D&CALLER=PROJ_IST&RCN=63617 (fact sheet on CORDIS)
LOCUST: www.imse.cnm.es/locust
EDEL: www.crfproject-eu.org (please click on EDEL)
SAVE-U: http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=69&CAT=PROJ&QUERY=011b0dd97dd6:6da2:2d7c897f&RCN=61499 (fact sheet on CORDIS)
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SEiSS Study: http://ec.europa.eu/information_society/activities/esafety/research_activ/research_activ_fp6

eSafety website: http://ec.europa.eu/esafety
eSafetySupport website: www.esafetysupport.org

FP7 ICT Work Programme: http://cordis.europa.eu/fp7/ict

Plotting a common course

In a move towards a new model of driver assistance technologies, several European projects are exploring how vehicles can use ICT to interact with one another, and with the road infrastructure. By sharing information, drivers will have more knowledge at hand, and smart vehicles can make better decisions on the safest and most efficient way they each must navigate in a particular location.

Most drivers would welcome advanced driver assistance systems in their vehicles. Who could reject the idea of blind spot monitoring or rear-end collision warnings? And even should the car take over control, if the technology successfully prevents fatal accidents, few people would complain.

Exchanging information with other cars or the infrastructure complements the onboard sensor information and therefore extends the "safety horizon" and contributes to safer and more comfortable driving. If, for instance, two cars are approaching a junction and heading for a crash, most ADAS technology would apply the brakes on both cars, perhaps turning a potentially fatal accident into a minor prang. However, co-operation between vehicles might result in one car accelerating to clear the junction while the other brakes, thereby avoiding a collision altogether.

The European Commission and numerous other European bodies recognise the enormous potential for co-operative systems on the roads. The FP7 ICT Work Programme (2007-2008) states that: "[By] combining technologies, such as accurate positioning and improved sensor networking, research is expected to lead towards 'zero-accident' scenarios[…]. An increasing number of vehicles with ICT-links to the transport infrastructure will make it possible to optimise traffic management across a wide geographical area."

In addition, the eSafety Forum recognised the potential in its Strategic Research Agenda *ICT for Mobility* for forthcoming research and development projects targeting ICT and mobility under FP7 funding. Recognising that co-operative systems should have benefits in terms of safety and efficiency, the eSafety Forum places significant emphasis on the need for more R&D in this field. The Forum called for the development of adaptive, intelligent co-operative systems that automatically adjust to the traffic situation at any moment in time. An information infrastructure for smart mobility and adaptive co-operative systems are necessary prerequisites to make this vision happen.

Co-operative systems also require a radio spectrum for short-range, low-latency communications. Industry has asked for a band in the 5.9 GHz range. The Commission supports industry's request, and has adopted, on 5 August 2008, a Decision on the harmonised use of radio spectrum in the 5895-5905 MHz frequency band for safety related applications of Intelligent Transport systems (C(2008) 4145).

Possible applications for co-operative systems include real-time traffic management, for example by using data from smart vehicles to feed into control centres which can set variable message signs to inform and instruct drivers in ways that improve traffic flows.

At an intersection, traffic lights could transmit their status to vehicles. The onboard vehicle safety system could inform drivers on the optimum speed to minimise fuel consumption and arrive at the intersection when the light is green. Further co-operation could be achieved by programming the traffic lights to process data from all of the vehicles approaching the junction and adapt their cycle to optimise overall traffic flow. Studies and large-scale field trials will also be required to evaluate the impact of such systems, especially on accident rates.

Co-operative systems at a glance

An innovative way to avoid accidents and get traffic flowing efficiently is for vehicles to co-operate with each other or the infrastructure while they are on the road. Wireless networking between vehicles and the road infrastructure will provide drivers with information about hazards on their way, even if the latter are still out of sight.


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Projects in action

REPOSIT
Com2React
WILLWARN
INTERSAFE

Emerging wireless technologies for vehicle-to-vehicle and vehicle-to-infrastructure (e.g. to traffic control centres) communication promise to reduce fatal roadway accidents by providing early warnings to motorists. As well as improving road safety, such technologies will also help optimise the flow of traffic and enable drivers to take greater control of their vehicles. Several EU-funded projects are showing how it can be done.

The **REPOSIT** project developed a new concept to prevent accidents through integrating existing collision avoidance systems, vehicle-to-vehicle communication and relative GPS positioning.

The system knows its own position, speed and trajectory, and also those of neighbouring and oncoming vehicles, and it uses this information to predict where these will be in a few seconds' time. If the data predicts a collision is about to occur, the system warns the driver.

"So far, we've got predictions about one to three seconds ahead of a collision… but anything from two seconds up gives drivers time to react. It works better at medium-to-high speeds, above 50km/h," says Jose Ignacio Herrero Zarzosa, coordinator of the REPOSIT project.

High-performance, satellite-based systems can locate a car to an accuracy of within a metre, but even with poor GPS technology, REPOSIT has managed to increase warning times by up to 1.5 seconds in a simulator, not too far from the useful minimum of two seconds. Zarzosa believes the system can do even better, with further work using vehicles' available sensors.

New technology from the **Com2React** project will allow a group of vehicles to exchange data automatically with each other and with traffic control centres. The Com2React researchers have developed a system to help inform drivers of poor weather or road conditions immediately ahead, for example. The information allows drivers to choose alternate routes, easing congestion and cutting down on accidents, says Chanan Gabay, Com2React's project coordinator.

Being able to share such data is a crucial component of any future automated road traffic management system that aims to provide drivers with 'live' information en route. Com2React software also creates a virtual traffic control sub-centre, which temporarily forms to manage a moving group of vehicles in close proximity. The software assigns the role of the virtual control centre automatically to one of the vehicles in the group according to rules embedded in the Com2React software.

The sub-centre obtains and processes data acquired by the group of vehicles and rapidly provides the driver with instructions related to local traffic and safety situations. The software also transmits selective data to a regional control centre and receives current traffic information to

distribute to the vehicles. The updated 'common knowledge' is then processed by each vehicle's software, allowing drivers to make informed decisions.

The concept works as information processed through the virtual sub-centre can be better directed to the relevant vehicles, avoiding information overload, says Gabay. "Local communication is much faster than remote communication and can, therefore, enable an immediate reaction to sudden events," he adds.

A prototype system, tested in Munich and Paris, proved that it works. The team is looking to bring down the cost of the system to about €100 a vehicle to increase its appeal to vehicle manufacturers and encourage mass take-up.

The **WILLWARN** system, developed as part of the large-scale PReVENT Integrated Project, acts in a similar fashion. It can detect potential road hazards using data from various in-vehicle systems, such as anti-lock braking systems (ABS) and electronic stability control (ESC), and can inform other vehicles about these hazards via WLAN-based communication. On the one hand, WILLWARN maps nearby vehicles, and on the other it can send or receive information about upcoming road conditions.

Another PReVENT sub-project, **INTERSAFE**, used vehicle-to-infrastructure communication as a part of the application which aims at reducing the number of accidents at cross-roads. Accidents at intersections happen when drivers perform inappropriate manoeuvres, fail to anticipate other drivers' actions, or overlook road signs and signals. The INTERSAFE driver warning was based on the relative position of vehicles within the intersection, prediction of their paths and communication with traffic lights

More information:

REPOSIT: www.ist-reposit.org
Com2React: www.com2react-project.org
WILLWARN (on PReVENT site): www.prevent-ip.org/willwarn
INTERSAFE (on PReVENT site): www.prevent-ip.org/intersafe

ICT and smart vehicles stories on ICT Results:
http://cordis.europa.eu/ictresults/index.cfm?section=press&tpl=search&browsescope=browse&EditorialThemes=616

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eSafety website: http://ec.europa.eu/esafety
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FP7 ICT Work Programme: http://cordis.europa.eu/fp7/ict

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Tuned-up satellite navigation and more

Mobile phones are a ubiquitous technology. Now that global positioning is affordable for use in consumer electronics, European researchers are working to develop traffic-related services targeted at mobile phone users.

In the past few years, satellite navigation on the road has passed from an expensive luxury to a mainstream technology. Drivers are getting used to the idea that they can pinpoint their location anywhere on Europe's roads.

The affordability of global positioning systems opened up opportunities for providing drivers with specific services related to where they are. For example, the navigation system can warn drivers as they approach a dangerous intersection or the last motorway exit before a tailback.

The EU has dedicated a budget of €3.4 billion to fund the GALILEO satellite navigation system. This network of 30 satellites will compete with and complement the US-run GPS network and the Russian GLANOSS system. Thanks to the satellite signals, the positioning device will be able to calculate its position to an accuracy of within one metre. At this level of accuracy, it should be possible to use global positioning not only for vehicle navigation, but also for real-time traffic management and advanced onboard driver assistance systems.

At your service

One important transport application of these satellite developments is the location-based service eCall. Built into vehicles, eCall is the pan-European emergency call system. In the event of a serious accident, it calls the nearest emergency service using the European emergency number 112, and delivers crucial information about the accident: its location, the time of the incident, a description of the vehicle involved etc. At the moment, the location of the accident is mostly provided by GPS, although in the future eCall could tap into the GALILEO network.

Location-based technology at a glance

Numerous European projects are exploiting global positioning technology in a bid to provide drivers with personalised services appropriate for specific locations on the road network.

The immediate eCall alert to the rescue services and the exact knowledge of the accident scene's location will translate into 50% less reaction time in rural and 40% in built-up areas. Studies suggest that eSafety will annually save about 2,500 lives in EU Member States, and lead to considerably less severe injuries in 15% of all accidents involving bodily harm.

In a September 2007 statement on the EU's Intelligent Car Initiative, Viviane Reding, Commissioner for the Information Society and Media, said: "If we are serious about saving lives on European roads, then all […] Member States should set a deadline to make eCall […] standard equipment in all new cars."

The European Parliament has given its full support to eCall, asking all stakeholders to take the necessary actions immediately for implementing it. European standardisation organisations ETSI and CEN29 are aiming to complete in 2008 the standards needed for the rollout of eCall in 2010.

The Commission has started negotiations with the European Automobile Manufacturers' Association (ACEA) and its Japanese (JAMA) and Korean (KAMA) counterparts, on the voluntary inclusion of the eCall device as a standard option for all new vehicles starting from September 2010. The Commission will report on the outcome of these negotiations in late 2008 or early 2009 to the European Parliament and the Council. New regulations on the implementation of eCall may also be required.

Projects in action

E-MERGE
AIDER
GST RESCUE
ActMAP
FeeDMAP

Not all of the smart technology has to be mounted into vehicles. Several European projects are looking at roadside or global positioning technologies that could provide location-specific information, such as alerts about hazards ahead, to onboard safety systems.

Project **E-MERGE**, for example, developed prototypes and demonstrated the eCall concept. Proof of concept was established in Sweden, Germany, Spain, Italy and the UK. Private service providers, such as roadside assistance, were also alerted in the demonstrations to test the efficacy of an integrated call response.

Working on vehicle accident scenarios, the **AIDER** project used mechanical and biomedical sensors, as well as cameras, to monitor the onboard pre- and post-crash environment, transmitting the information wirelessly to a control centre. The system dramatically accelerates and improves the response of emergency services.

"During trials, we found that the system reduces the response time of emergency services by approximately 30% and also increases the effectiveness of their response," says Silvia Zangherati, the project coordinator.

Meanwhile, **GST's** sub-project **RESCUE** (see next section for more on GST) takes this work further by accurately assessing the type of emergency and resources required for an appropriate response to a critical incident. RESCUE investigated the emergency call chain – including so-called 'blue corridors', and vehicle-to-vehicle communications systems that use virtual 'coning' to warn other road users of the oncoming emergency vehicle, as well as accurate satellite navigation – so that emergency services can reach the scene quickly and safely. Exchange of information between the rescue units and control rooms (police, hospitals and others involved) is also enhanced thanks to the work undertaken by the RESCUE researchers.

Navigation to and from emergency scenes is helped by the use of accurate, 'real-time' digital maps. The **ActMAP** project investigated and developed a means for incremental online updates of a vehicle's digital map database. Real-time map content must include static (i.e. road closed for summer repairs) and dynamic (i.e. spontaneous traffic jam) location-based information.

As its name suggests, the **FeedMAP** project is studying the commercial and technical feasibility of a so-called 'map deviation feedback' system. To improve the flow of map-user feedback, the FeedMAP concept uses all vehicles equipped with a digital map for deviation detection, i.e. to check if the maps are indeed accurate and complete.

The project is developing a framework that detects map anomalies – when cars come across a faulty map attribute – and quickly updates the maps of all other vehicles. The framework uses a standardised mechanism for delivering incremental map updates, as developed in the ActMAP project. It can be used to detect different kinds of changes in the road network, but also 'live' reports and verification of on-road events, such as traffic jams or accidents.

More information

E-MERGE: www.ertico.com/en/activities/activities/e-merge.htm
AIDER: www.crfproject-eu.org (please click on Aider)
RESCUE: www.ertico.com/en/activities/safety/gst_rescue.htm
ActMAP: www.ertico.com/en/activities/activities/actmap.htm
FeedMAP: www.ertico.com/en/activities/safety/feedmap_01.htm

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Website of the Commission's Intelligent Car Initiative:
http://ec.europa.eu/intelligentcar

eSafety website: http://ec.europa.eu/esafety
eSafetySupport website: www.esafetysupport.org

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Fuelling take-up of advanced vehicle technology

Without wide adoption by vehicle manufacturers, road operators, consumers, and so on, intelligent transport systems will struggle to make European road transport safer, greener and more efficient. The EU is therefore at the forefront of efforts to stimulate the market. Policy actions target industry for agreements on standards for interoperability, consumers for increasing awareness and demand, and manufacturers for developing cheaper components and affordable applications.

Given the considerable effort and expenditure going into the development of smart transport technologies (ITS), it is likely that, within a decade, vehicles could have the capability to communicate with one another, predict the driver's next move and even 'chat' to traffic lights. But while the underlying technology is advancing apace, the market may not be ready. A concerted effort is required to encourage uptake of technologies by manufacturers and road operators, as well as acceptance by drivers.

In April 2008, the Transport Committee of the European Parliament reported that take-up of intelligent car technologies remains very low, given their potential. The technologies need to get cheaper, and should be better publicised, committee members said.

The EU's Intelligent Car Initiative is working with all stakeholders to remove bottlenecks in the rollout of these life-saving technologies. Its activities use a mixture of policy, research and communications instruments to ensure interoperability across EU countries, and to support ICT-based research in this area. The initiative also targets efforts to raise awareness among consumers and decision-makers of the potential benefits and availability of ICT-based solutions.

Supporting commercialisation at a glance

Industry standards and coordinated research activities are the only ways in which a critical mass of vehicles and infrastructure can become 'intelligence-enabled' over the next decade. The interoperability of ICT solutions between vehicles, infrastructure and other mobile devices is key to Europe's vision of smarter and safer driving.

Standards support safety

The work of the eSafety joint initiative to promote eCall (see previous section) demonstrates how the European Commission is working with Member States, public bodies and industry stakeholders to overcome some of the barriers to the take-up of potentially life-saving technology. eCall's Memorandum of Understanding is that the system should work in any Member State and be based on the single pan-European emergency call number 112. Fourteen Member States and three Associated States have now (July 2008) signed this Memorandum, along with more than 50 organisations and companies, including insurers, carmakers, vehicle parts manufacturers, mobile telecoms providers and digital mapping providers.

An important lesson learned from the success of eCall is that standardisation of technologies is a critical task. Co-operative ITS rely on wireless networking between vehicles, devices and road infrastructure, irrespective of their manufacturer or country of origin. It is imperative that data and decisions are effectively communicated to all users within a network; different technologies must 'speak' a common language. Without standards, interoperability would be all but impossible, and intelligent systems would not achieve the critical mass to prevent accidents and fatalities.

Harmonisation also has a role to play in stimulating the market, as seen in the establishment of the pan-European emergency number 112. Harmonisation

is also required for many of the advanced driver assistance systems (ADAS) which rely on short-range radar to detect objects in the road. It would be dangerous if safety systems on which drivers have come to rely were to stop working suddenly, or become illegal, just because the vehicle has crossed a national border. The European Commission recognises that these systems should use common frequency bands and it is working to harmonise radio regulation across Member States to make this possible.

Paying the price

In its 2006 Strategic Research Agenda the eSafety Forum suggested that, for widespread deployment of ADAS and ICT/ITS systems into small- and medium-class vehicles, the systems need to be highly integrated and reliable, and the cost of installing them reduced.

EU Framework Programme-funded research has focused on the need for low-cost technologies. The smartest car and the most intelligent infrastructure has little impact if their implementation costs are prohibitively high. In the competitive automotive market, where sales margins on cars are tight, new technologies will struggle to be accepted if the costs are not kept down. Consumers are unlikely to pay extra for what they perceive as unproven technology with minimal benefit. An ADAS, for example, should ideally cost just a few hundred euros. A higher price would mean a higher risk of failure in the market.

For this reason, an important aspect of ITS research to date, and a focus of the EU's iCar initiative, has been an emphasis on affordable ITS solutions. Furthermore, the eSafety Forum has explored the possibility of Member States introducing incentive schemes to help consumers meet the additional cost of vehicles with advanced safety functions. The Commission is currently investigating schemes such as tax incentives at the national level within the framework of the ITS deployment roadmap.

Steering consumer demand

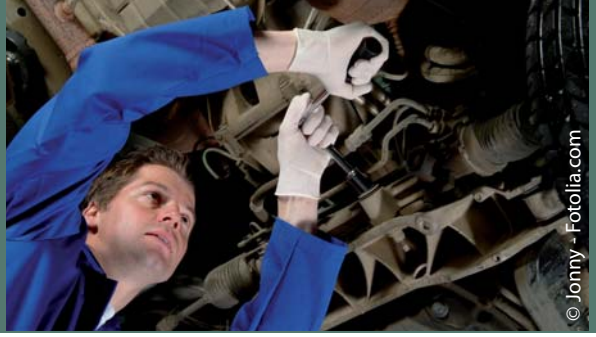
While the cost of ITS must be competitively priced, demand for smart transportation technologies also stems from effective communication strategies. iCar is involved in a number of consumer- and industry-focused awareness and dissemination campaigns.

One of the main drivers for these campaigns is eSafetyAware, a communication platform partly funded by the European Commission which actively assists transport stakeholders in their efforts to increase public awareness of the enormous potential of intelligent vehicle safety systems. Electronic stability control (ESC) technology is the first to benefit from such a public awareness campaign. While the technology is already installed in about 40% of all new cars, the aim of the campaign is to increase consumer demand. A recent study found that 4,000 lives could be saved and 100,000 accidents avoided each year if all European cars had ESC.

In another bid to communicate with the public, the Commission launched an intelligent car website in September 2007. It aimed at the public to promote the full range of ICT-based technologies for road vehicles, including driver assistance systems, co-operative systems and location-based services.

The Commission recognises it has to do all it can to foster the right conditions for the effective development, commercialisation and consumer uptake of technologies that make vehicles safer, smarter and greener.

"Technology can save lives, improve road transport and protect the environment," said Viviane Reding, EU Commissioner for the Information Society and Media, at the iCar event in Versailles in September 2007. "The EU must spread this good news among consumers and continue to put pressure on stakeholders to ensure Europeans benefit from these winning technologies sooner rather than later".



Projects in action

EASIS
AUTOSAR
ATESST
GST

Traditionally in engineering, the more complex a system or design, the greater the risk of breakdown or failure. But by 'nature', intelligent vehicle safety systems (IVSS), which is another term for advanced driver assistance systems (ADAS), have to be complex to accommodate all of the safety factors that may come into play on the road, such as speed, steering, braking and other parameters.

For example, in the past a wheel speed sensor would be slaved to the ABS braking system. Using IVSS all components would now be part of a network, so they are available for a host of other applications, such as ensuring a car or truck is observing local speed limits. This integrated approach, once safely implemented in a standardised electronic architecture, reduces development time and the costs of a new application. What is more, this electronic architecture can also improve dependability by designing it into the in-car infrastructure from the start.

The goal of the **EASIS** project was to develop a safe and dependable electronic architecture for in-vehicle safety systems, and give recommendations to the automotive industry's design and engineering process. It was not a simple task.

EASIS designed an approach to application development, called the EASIS Engineering Process (EEP), that is specifically tailored for the processes required to design complex IVSS. EEP focuses on the dependability of hardware and software design and ensures that engineers eliminate or mitigate all possible errors and failures. EEP adheres to agreed industry standards and thus provides common services upon which future, dependable applications can be built.

The team verified its results in two demonstrations. In one, they showed the effectiveness of a firewall developed for telematics systems – it is vital that the safety of a car cannot be compromised by malicious communication. The project also used a hardware simulator to demonstrate the overall dependability of an IVSS system. Both cases showed the effectiveness of the EASIS approach, and the work has caught the interest of the European carmakers and suppliers.

Meanwhile, the development partnership **AUTOSAR** is dealing with the standardisation of software architecture for automotive applications. It is used by many component suppliers and is on its way to becoming a *de facto* international standard. Also in common usage are off-the-shelf unified modelling language 2 (UML2) modelling tools that are not specific to the auto-industry.

"But this is still not enough," says **ATESST** project coordinator Henrik Lönn. "We have developed an industry specific system which works with these other standards and dictates what part of the system is performing what function, and makes sure the different components will work together."

ATESST has developed an architecture description language (EAST-ADL) aimed at improving methodology to handle component failures and avoid design flaws. Even with IVSS, the more electronic systems are added to vehicles, the more they contribute to vehicle breakdowns and recalls. Electronics failure rates will reach unacceptable levels if no preventative action plan is put in place, suggests Lönn.

EAST-ADL2 enables the computer to model systems. Instead of an old-fashioned text file, a supplier can now provide a computer model of his system to the manufacturer who can then immediately integrate it into the overall design.

"[This] gives the manufacturer a complete picture at a much earlier point in proceedings than is possible at the moment," says Lönn. "You don't have to wait for all the electronics and software to be ready and assembled, but can do your analysis at a much earlier stage."

With a holistic view available much earlier than was previously possible, problems at the later phases of integration – when failure is both common and costly – are avoided and the chance of design errors, which are felt by car buyers, is minimised. EAST-ADL2 will also help manufacturers conform with the new ISO26262 standard that controls how improvements are made to all of the safety aspects of vehicles.

Integrated Project **GST** worked on standardisation at a different level: it developed an open and standardised framework architecture for a wide range of telematics applications (see also GST RESCUE in the previous section). The novelty is the existence of a common mechanism for the installation, updating and removal of services and applications. Standards are necessary for the key interfaces which allow the complexity and diversity of the supporting technologies to be hidden.

GST developed, tested and validated open telematics services, control centres, middleware and in-vehicle integrated platforms at different test sites. It also addressed relevant operational and business aspects for market introduction of open telematics.

More information

EASIS: www.easis-online.org
AUTOSAR: www.autosar.org
ATESST: www.atesst.org
GST: www.gstforum.org

ICT and smart vehicles stories on ICT Results: http://cordis.europa.eu/ictresults/index.cfm?section=press&tpl=search&browsescope=browse&EditorialThemes=616

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eSafety website: http://ec.europa.eu/esafety
eSafetySupport website: www.esafetysupport.org

FP7 ICT Work Programme: http://cordis.europa.eu/fp7/ict

Prediction, prevention and avoidance of accidents

Integrated Project PReVENT was set up to develop and demonstrate preventative applications and technologies for road safety.

PReVENT's consortium consisted of more than 50 members representing carmakers, suppliers, research institutes and public bodies. Co-funded by the European Commission, the project represented the largest single ICT project under the Union's Sixth Framework Programme.

PReVENT at a glance

The PReVENT Integrated Project brought parts of Europe's research efforts to develop ICT-based automotive safety systems under a single umbrella.

Active and preventative safety systems will inform the driver as early as possible if there is a danger and actively assist, or ultimately intervene, if the driver does not respond to the information, in order to avoid an accident or mitigate its consequences.

Projects in action

SASPENCE
LATERALSAFE
APALACI
COMPOSE
MAPS&ADAS
PreVAL

Suddenly, a truck exits from a side road directly into your path. Your car issues a warning, starts applying the brakes and attempts to take evasive action. Realising impact is unavoidable, in-car safety systems increase tension on the safety belts and arm the airbag, timing its release to the second before impact. European vehicle and road research is taking just this holistic approach to ICT-based automotive safety systems.

PReVENT had a total budget of €59 million. Its more than 50 partners pursued a broad, but highly complementary programme of research. A dozen subprojects focused on specific road-safety issues, but all projects supported and fed into each other.

PReVENT studied relatively cheap, even simple, technologies – such as parking sensors and existing satellite navigation – that can be retooled to improve traffic safety. But as part of its broad and deep approach to car safety, sub-projects also delved into more complex experimental and medium- to long-term systems, innovations that could appear in five to ten years.

A handful of PReVENT's sub-projects were working on a theoretical construct known as the 'uncrashable' car. But the construct could become far more of a reality than anyone expected.

Of course, it is impossible to stop all car collisions, but technology could be pushed to make it increasingly unlikely and mitigate crashes when they do occur.

For example, **SASPENCE** looked at safe driving distances and speed, while **LATERALSAFE** finally brought active sensing to the blind spot. All have their role in the uncrashable car, as do many others within PREVENT.

But two sub-projects, **APALACI** and **COMPOSE**, took the construct a step further by developing ways to track the speed and trajectories of surrounding vehicles and other road users in real time. If one vehicle suddenly stops, or a pedestrian suddenly steps out

into the road, the technologies swing into action to calculate the implications.

APALACI developed an advanced pre-crash mitigation system built round the recognition and registration of other motorists and cyclists. In the APALACI system, sensors monitor the street or road immediately around the vehicle and collect as much information about a collision as possible, before it even starts to take place.

The system uses this data to decide on the ideal safety reaction strategy. Such strategies could include controlled braking manoeuvres, the controlled activation of seatbelts or the pre-arming of airbag systems. The car's systems can react far faster than the driver, cutting speed by crucial amounts to ensure unavoidable accidents are less severe.

APALACI also developed a so-called 'Start Inhibit System' for trucks. The system surveys the blind spot immediately in front of a truck and helps protect pedestrians, cyclists, or children by preventing dangerous manoeuvres.

The APALACI system uses laser sensors, radar, software decision assistance and a variety of other technologies to achieve the project's goals.

COMPOSE, meanwhile, aimed more specifically to keep others, as well as the driver, safe. The system developed by the project can apply the brakes if a pedestrian steps into the road, or can extend the bumper and raise the bonnet to help protect the vehicle's occupants.

Tiny differences have a huge impact on car safety. Dropping speed by 1 km/h can reduce accidents that result in injury by 3%, while braking fractions of a second sooner is enough to reduce the resulting damage dramatically.

The COMPOSE systems were tested in a BMW passenger car and a Volvo truck, and found to have appreciably improved safety. But, for all their potential, these systems remain, for now, as future technologies.

Evaluating the impact of potential technologies – whether they really do warn drivers in a clear and timely manner, and whether they can prevent accidents – is a crucial area of research. Evaluation can help prevent expensive mistakes, and can also help identify the most cost-effective technologies with the greatest possible impact.

The 'horizontal' sub-project **MAPS&ADAS** developed, tested and validated safety enhanced digital maps to be used by the driver and the in-vehicle advanced ADAS, as well as a standard interface to the ADAS applications.

To reduce costs, this project integrated existing resources in new ways to increase functionality. For example, the onboard computer scans the maps for the 'speed profile' of the road ahead, the rights of way and other related data, thus virtually extending the driver's horizon.

"The analysis of many situations can be dramatically improved by an awareness of the location," says Matthias Schulze, coordinator of PReVENT and senior manager ITS & services at Daimler AG.

Another evaluation task was the work of sub-project **PReVAL**. It aimed at developing a pre-production evaluation platform for ADAS. The researchers examined driver behaviour and preferences, the impact of the human-machine interface, and assessed the potential real-world impact of the explored technologies.

In developing a methodology, PReVAL researchers observed all of a system's aspects in a holistic manner. The first part of the methodology estimated the technical reliability of a new system. The second part looked at its effect on driver behaviour and performance, while the third evaluated the impact on traffic safety. The project found that it is vitally important to eliminate false alarms. If the system alerts the driver in a no-risk situation, the driver will begin to ignore the warnings.

All warnings must also be unambiguous. Does the warning relate to an imminent head-on collision or another car in the blind spot? Failure to get it right could make cars less safe, not more. The system must be as intuitive to use as when indicating a right or left turn. It must be integrated in a seamless, natural way that does not interfere with the driving experience.

The task was an immensely difficult one, because PReVAL had to start more or less from scratch. "Right now, there is an independent, international standard for crash-test performance, called EuroNCAP, but no such standard exists for ADAS," explains Maxime Flament, PReVENT's second coordinator. "PReVAL contributes to fill[ing] that gap."

PReVAL went beyond the consortium to draw on expertise from other leading European projects in the field, such as **APROSYS**, **AIDE** and **eIMPACT**.

More information

PReVENT: www.prevent-ip.org
SASPENCE: www.prevent-ip.org/saspence
LATERALSAFE: www.prevent-ip.org/lateralsafe
APALACI : www.prevent-ip.org/apalaci
COMPOSE : www.prevent-ip.org/compose
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