STAKEHOLDERS' CONTRIBUTION TO THE FORMATION OF THE FP7 WORK PROGRAMME ON ICT FOR MOBILITY

Document prepared by the eSafety Forum Working Group RTD

PURPOSE OF THIS DOCUMENT

This document has been prepared as a contribution to the FP7 Work programme on ICT for Mobility. It also has the purpose to harmonise and consolidate the views and wishes of the concerned road transport stakeholders on the priorities of R&D in the ICT domain.

The document mainly focuses on five areas identified as priorities for ICT for Mobility, namely:

- Mobility Services for People
- Mobility Services for Goods
- Intelligent Vehicle Systems
- Cooperative Systems
- Field Operational Tests

Major objectives of research in these areas are to further develop and deploy technologies, functions and services to enhance traffic safety, efficiency and reduce the impact on the environment. Additionally the commercial and competitiveness aspects of European Industry are dimensions to be recognised in the outlining of future strategies and in the selection of R&D topics.

For all of the five areas listed above, the European Commission, DG INFSO, organised targeted expert meetings to develop and formulate recommendations and priorities for R&D in FP7. This occurred during a series of five workshops that took place in April – May 2006. The eSafety Forum, through the Working Group RTD, has been engaged in a sixth workshop where the recommendations of the five areas where reported, discussed and set in relation with the objectives to improve road transport and European industrial competitiveness. Additionally also "horizontal" aspects like standards, common communication links, etc. were identified as issues belonging to the research agenda.

A version of this document will be made available at the web site of DG INFSO for a broad public consultation. The Working Group RTD (WG eRTD) of the eSafety Forum will evaluate comments and suggestions on improvements, during the autumn 2006. Thereafter the final version of this document will be issued as the WG eRTD's recommendation on FP7 Work programme for the ICT for Mobility challenge.

EXECUTIVE SUMMARY

The eSafety Forum, Working Group RTD (WG eRTD) has reviewed the recommendations on R&D in FP7 as reported from five expert workshops, arranged by DG INFSO, on the topics:

- Mobility Services for People
- Mobility Services for Goods
- Intelligent Vehicle Systems
- Cooperative Systems
- Field Operational Tests

With the aim to focus R&D in the ICT for mobility challenge, towards key societal concerns of traffic safety, efficiency and environmental compatibility as well as considering competitiveness of the European Industry, the WG eRTD has identified, for the five areas listed above and for related horizontal aspects, a set of R&D priorities for the initial phase of FP7. These are stated below in a short format. Additionally, R&D topics for the second and later phases of FP7 are outlined in the following pages of this document.

Recommendations on R&D Priorities for FP7 first call: (short version)

1. **Mobility Services for People**
   - System architecture for multi-service overlay networks
   - Geo referencing data systems and data mining technologies
   - Adaptable user interface and standardized format for mobility information
   - Always-on context awareness flexible, reliable and accessible systems
2. **Mobility Services for Goods**
   - Exploiting RFID and ICT platforms
   - Urban logistics, liable security, tracking and tracing
3. **Intelligent Vehicle Systems**
   - Vehicle environment perception systems
   - Vehicle architecture for data flow. Dependable vehicle infrastructure
   - Faster and smarter actuator performance
4. **Cooperative Systems**
   - System integration, configuration management, service monitoring
   - Simulation and testing for evaluation of concepts and systems
   - Communication V2V and V2I
   - Enhanced digital maps and positioning of sufficient accuracy
   - Large-scale pilot V2V and V2I applications demonstrations
5. **Field Operational Tests**
   - Methods and Procedures for planning, running and evaluating a FOT
   - Small scale, real FOT using technically mature ICT systems
6. **Horizontal Issues**
   - Methods and procedures to assess the safety and traffic impacts of ITS functions
   - Enhanced digital maps and position systems
   - Security functions and services embedded into the ICT – ITS system
   - Intelligent infrastructure; Network management, interoperability of systems, …
   - Road maps and business models for commercial deployment of ICT transport systems
   - ICT for cleaner mobility (optimum routes, flow optimisation, …)

CONTENT **PAGE**

BACKGROUND, CHALLENGES AND APPROACHES TO SOLUTIONS

Passengers and goods road transport, in urban, inter urban and rural areas, faces today several major challenges that may become even more severe in the future. Energy consumption and suitable fuels, environmental impact of air pollutants, noise emissions, safety and traffic congestions are issues of serious societal concern. The efficiency of the road network in Europe and the competitiveness of the European industry are additional dimensions to consider.

A holistic and integrated approach is required to find solutions for our road transport system. Such an approach embraces production and supply of energy/fuels, vehicles adapted to the services requested by the society and its individuals, road network and traffic management systems providing dynamically the framework conditions for a safe and efficient traffic environment.

In the domain of traffic safety, efficiency and driver assistance systems, ICT systems have a strong potential in addressing the challenges and contributing to solutions. One can foresee that ICT can also contribute to environmental and energy savings by providing means for better planning, monitoring and management of traffic and transport.

The following pages focus on the contribution of ICT to the future Road Transport System. In particular the major challenges of traffic safety and efficiency are addressed. But also of equal importance are the issues of driver support, concern for other road participants (vulnerable road users) and the impact on environment.

Major contributions to the above described challenges are found in the five areas:

- Mobility Services for People
- Mobility Services for Goods
- Intelligent Vehicle Systems
- Cooperative Systems
- Field Operational Tests

Additionally, several horizontal issues combining and complementing these five areas are necessary for an integrated and holistic approach to road traffic and transport.

On the following pages, the five areas and the horizontal issues are outlined and R&D priorities for these are recommended.

DESCRIPTION OF RESEARCH AREAS

MOBILITY SERVICES FOR PEOPLE

i) Introduction and Description

This chapter identifies key issues for "Mobility Services for People" with regards to ICT.

It should not be neglected that real implementation of mobility services require efficient transport systems, including related information flows, for both private and public use, and considering all "moving and mobile people", i.e. pedestrians, people with special needs, passengers and drivers inside and outside the vehicles.

ii) Challenges

Always-on services offering reliable information personalised to the users, which should provide a seamless user experience, irrespective of the terminal or the communication network.

Methods and procedures for sustainable and optimal mobility are a must. Amount of travelling, measured in distance, is increasing all the time (e.g. airborne travelling is estimated to triple during next ten years). Congestion problems are increasing. In order to improve our quality of life various technologies have to be developed to decrease pollution, noise and also traffic volume in general.

Adequate info-mobility services, including pre-trip, on-trip and post-trip information can help to cope with these problems contributing to a more efficient mobility. True real intermodality information has to be offered through the whole chain for private, public or combined transport modes.

The development of mobility services has as a by-product enabled various other services. Development of communication solutions for private, commercial and public transport vehicles have already started with higher available data transfer rates, availability of download capabilities and dedicated designed HMIs. More and more information about our environment is available with real-time updates. Entertainment possibilities are increasing remarkably with multimedia messaging, music downloading and content sharing.

There is a strong need to develop a harmonised, interoperable, pan-European mobility services, context aware, with reliable transport contents and wide availability to users and their interfaces to single and multi-modes of transports.

Seamless integration of Nomadic Devices into vehicle's HMI is a key feature for eSafety. Driver distraction needs to be minimised, high customer value is expected if data can be exchanged between home, car and portable use. It will be unavoidable that users carry their Nomadic Device into the vehicle; therefore integration according to ESoP will avoid uncontrollable use while driving.

iii) User Aspects

There are two different aspects involved: the users need to know about the services and to understand the services. Thus, both availability and capability knowledge (i.e. user friendliness) are needed.

Wide offering of mobility services is needed. One of the key issues to be solved is the functional coexistence of free of charge web content and marketable content with addi-

tional value. Furthermore, content must be trustable, relevant, complete and free from redundant and distracting information.

Focus should be on people and on urban situations. Emphasis is moving towards the users of the road systems because mobility services are more or less organised for interurban situations. But there is a great diversity from city to city. Furthermore, managing roads is changing towards managing traffic situations and preventing incidents, as well as managing dedicated traffic in urban areas.

One of the main requirements is a very well defined and managed customisation of service packages. This means that for the end user mainly two things matters: the applications available on his/her terminal and his/her possibility to access the content through them.

Public Transport information is not enough to attract people to use public transport – frequency, coverage, comfort and cost are critical factors. One solution could be logistics software to pool together statutory transport (health, elderly, education, etc) with commercially provided transport services. Another way could be to investigate how to make the whole area of public transport provision more reactive to network conditions, by for instance dovetailing real-time and predictive information with public transport operations.

iv) Applications and Services

Harmonised, interoperable pan-European mobility service with transport content and wide availability to users has to be developed. Challenges are to get content updating continuously with responsible, local parties involved, managing the wide variety of communication modes and access methods and giving reliable, relevant, complete and useful information to the user in the form and with devices wanted.

The mobility services have to be always-on and converged into a usable information toolbox. There should be no need for starting any additional applications, but making a quick change to the selection and using of services covering travelling and other activities of mobility. Straightforward management is needed for things like: how/when/where to go, options to travelling/transport, options in problematic situations, options for access and routes, information about the environment, locations etc. The mobility services should provide a seamless user experience to the customer.

The ordinary people commuting and travelling in their everyday environments as well as people in unknown environments and those with special needs have to be covered in order to make these mobility services a success. One of the main requirements is thus a very well defined and managed customisation of service packages for each and every person. This requires on one hand a selection of ready-made profile setups (like styles and themes in Windows for graphical UI) but also the possibility to have a totally personalised customisation. Context awareness, especially location awareness enables the mobility services to give efficiently selected, relevant information to the users without the need to ask for details for information filtering (like in Web services often). In this context, flexible access of external applications (e.g. those downloaded from service centres or running on nomadic devices) to the in-vehicle HMI is an important area including both technical and strategic issues, which need further research and studies.

These mobility services are made for end-users, users maintaining services (super-users, remote services) and user managing systems (administrative, fleets, roads, traffic management).

v) R&D Topics

- System architecture is needed for connecting various systems together in a multi service overlay networks
- Geo referencing data systems are a prerequisite issue
- User interface (single and multi-mode) and accessibility have to be developed
- HMI issues specific to "Mobility Services",
  including seamless integration of nomadic devices to vehicle HMI
- Journey planning and "through ticketing" systems
- Standardized format for mobility information
- More accurate positioning technologies or systems
- Personalised, context aware services
- High-rate data transfer capacities
- Address specific needs for themselves and as an incentive to innovation (accessibility) for elderly and disabled
- IPv6 use: Treat satellite based and IPv6 technologies impacts on these services
- Continuity of the services
- Connectivity / data exchange car / home / portable
- Safe in car use
- Data collection and data mining
- New ICT solutions to deliver better and cheaper public transport
- Certification procedures
- Business Models (PPP)

vi) Core Technologies

Key challenges in ICT area for Mobility services

- IPv6 (all devices with IP-address: can you call your car, can the service man do it?)
- high-rate data transfer capacities (OTA-updating, *over-the-air:* updating your car's music, videos, engine, digital maps, …)

Availability of content in the terminal depends on the existence of two main technical parts: first does the content exist and second can the content be properly accessed. In mobility services content is almost always based on digital maps, i.e. all information has to be georeferenced. This information includes road information, points of interest, traffic information, weather, public transport timetables and travel management information. More general information is related to entertainment and other information, like real-time web-cams and traffic cams. Data fusion methods, sensor systems and sensor networks are capable of creating huge amounts of data, which have to be filtered for various uses. European wide mobility services may be difficult to make because the availability of data varies from country to country. Interoperability must be ensured (standard interfaces, content formats/metadata, common protocols)

vii) Deployment Issues

In order to take the results of research activities more efficiently to the real market and to commercial use, development of business models and commercial exploitation activities have to be supported. Cooperative activities between public and private sector (PPPs) but also between private persons (private publishing, P2P) have to be established. A proper emphasis should be put on "product development" and commercialisation of services. Earlier projects have managed to make realisations of interesting mobility services, even easy to use services. After this prototype phase, competent actions rarely take place towards turning these prototypes into products for commercialised market entry.

Solutions for handling georeferencing of content, permanent and changing content, local, national or European level content have to be made. Data collection and processing are carried out in many ways. Content is gathered by commercial companies (news agencies, mapping companies), public authorities (traffic management, weather stations), drivers or travellers (fleet systems, ordinary drivers,). In order to make all the content usable commonly agreed transport related architecture definitions, including protocols, content formats and information exchange mechanisms have to be taken into use. Binding agreements are needed between the content and service providers on coverage, availability, continuity, correct formats and updating intervals.

In standardised interfaces there is a need for definition of minimum content set which is required and definition of proprietary additional manufacturer specific set which can be used if wanted, e.g. metadata definition in GIS information. Multilingual solution needs to be developed to enable true pan-European service.

Services related to public transport are often seen as services needing standardisation and certification. This is often true, but not in all cases. Certification may be needed with some types of mobility services, some activity on certification mechanisms exist in e.g. GST or Certecs. One of the challenges in the near future is how to qualify the future applications based on certified Galileo signals but with uncertified content.

MOBILITY SERVICES FOR GOODS

i) Introduction and Description

This chapter identifies key issues for Mobility Services for Goods with regards to ICT. It should not be overlooked that there remain many other significant issues, e.g. those described in the full report on the workshop on "Mobility Services for Goods" (see Appendix).

The core objective for Mobility Services for Goods is to develop seamless, efficient logistics chains across boundaries, modes and services, in order to meet customers' expectations at lowest cost and to address Europe's major societal challenges arising from the increasing demand for transport services.

ii) Challenges

The freight transport sector's actions have a high impact on the overall structure and performance of our transport networks. Freight transport counts for a high share of the load on our networks, and successful implementation of improvements will deliver immediate benefits.

Major challenges to be addressed include:

- Planning and optimising, monitoring and managing, the transport chains within and across modes and transfer points
- Exploiting the potential of radio frequency identification (RFID) for transport logistics with intelligent and value-added applications and services
- Enhancing transport security using ICT in local and cross border goods flows
- ICT solutions for network operators to cooperate with 'intelligent trucks' to guide lorries smoothly and safely within urban areas
- Achieving the potential of urban logistics and e-fulfilment
- Offering true best-service/lowest-cost multi-modal solutions.

iii) User Aspects

Due to the specific structure of the freight transport sector very diverse objectives and user aspects have to be considered:

- Shippers and receivers have different requirements and priorities. The systems and processes of the logistics actors must be enabled to work with this diversity.
- Costs and reliability of services are fundamental to the competitiveness of logistics actors.
- All actors are part of extensive and overlapping transport/logistics supply chains. They cannot determine the overall framework or technologies on their own.
- Full knowledge of options is fundamental to the competitiveness of multi-modal solutions.

iv) Applications and Services

The main application and service areas needed for Mobility Services for Goods are:

- Services for goods transport based on open best-service/lowest-cost principles supporting best choice of modes.
- Tracking and tracing of goods and vehicles across the transport logistics / supply chain to increase security and service performance.
- Advanced urban logistics services to enhance efficiency of pick-ups and deliveries of goods.
- e-fulfilment services capable to deal with the changing demand arising from the more and more widespread e-business services.
- Supply chain optimisation and management.

v) R&D Topics

The R&D topics aim at:

- Creating seamless efficient mobility service systems using ICT as an enabler
- Exploiting RFID and ICT platforms as critical component and architecture
- Offering real modal choices
- Urban logistics systems for delivery and pick-ups
- Achieving high levels of liable security and of adequate tracking and tracing
- Managing supply chains and logistics by supply chain event management
- Exploiting and demonstrating location-aware services including Galileo satellite based technologies.

The R&D activities should be clustered with the task to deliver reliable solutions, or explore new solutions, in a real organisational environment where the impacts are assessed.

vi) Core Technologies

Surveying the sector leads to the following prioritisation for technology development and demonstration:

Highest priority technologies and tools

- Concepts and tools for optimisation in the transport logistics chain at the planning stage to ensure end-to-end efficiency
- Practical tracking and tracing tools needed throughout the supply chain
- Tool development and demonstration for new 'least-cost / best-service routing services'
- Value-added applications which exploit the potential available through RFID and ICT in general
- Tool development and demonstration for practical application of urban logistics and e-fulfilment

Next priority technologies and tools

- ICT tools supporting transfer points and processes
- Further development of RFID technology, including low-cost RFID devices and Smart Tags with increased read/write range and speed and inter-tag communications
- Routing and navigation systems needed to meet the specific requirements of commercial vehicles (vans, trucks, buses), also taking into account issues relating to movement of hazardous goods.

vii) Deployment Issues

- A paradigm shift is on the rise in freight transport due to advanced information and communication technologies such as RFID: Objects (freight and vehicles) are more closely linked to their related information (in term of both descriptive as well as dynamic status information) than in the past. This will require new concepts, business models and operational products to be deployed.
- A strong focus is therefore needed on demonstration of robust, liable tools – this is a sector which is willing to invest, but which also demands proven products (or solutions).
- Multimodal services and skills are mostly derived today from a single mode with some extra capabilities. A new generation of truly multimodal systems and capabilities is needed and has to be developed and deployed.
- Security measures and functions throughout the supply chain aimed at combating terrorism and theft and to ensure the integrity of goods.

INTELLIGENT VEHICLE SYSTEMS

i) Introduction and Description

Future research and development of intelligent vehicles is a major cornerstone of the ICT for mobility challenge in FP7. The main focus is on the next generation of improved, new and cost-effective technologies, on common platforms integrating several applications, on the better understanding of driver behaviour, on HMI issues and on the ability to support autonomous and cooperative driving. One motivation for this development is to reduce the cost of these advanced information and safety systems so they can reach a wider and larger market penetration, including also medium and lower priced cars, to achieve substantial impact on safety and traffic efficiency.

ii) Challenges

The main challenge for the upcoming FP7 is the introduction of cost-effective sensors (including multi-usage and sensor fusion) and technologies for the intelligent vehicle and of advanced protective safety applications. These sensors, technologies and applications, should provide concepts for a new generation assisted driving platform, which integrate lateral and longitudinal control with collision mitigation concepts. Advanced driver assistance functions need to be developed not only for cars but also for commercial vehicles (vans, trucks, buses) and two-wheelers. Research should also concentrate on autonomous vehicle systems operating in dedicated environments or performing their specific manoeuvres.

Future vehicle systems need to be interoperable and their functionalities should support cooperative driving. Decision and control system must be adaptable to different driving situations and different driver capabilities Benchmarking activities should be considered for Active Safety, Advanced Driver Assistance Systems and Advanced Protective Safety Systems regarding aspects like technical reliability, safety benefits/risks, user acceptance, etc. Studies and research on legal issues related to these advanced and new systems should be continued and deepened.

iii) User Aspects

The increasing number of safety functions in the vehicles and their complex interaction motivates an increased focus on the user in terms of better understanding of the driver's needs and capabilities, and modelling of his behaviour.

As driver situation awareness is maintained through intuitive Human Machine Interaction, reliable monitoring and prediction of driver status and the comprehension of vehicle safety functions, especially due to the growing aging driver population, needs special attention. A concept for a new cockpit with special focus on HMI and enhanced driver situation awareness is recommended as future research topic. This should include ADAS warning and automation strategies, human factors issues related to drive-by-wire technologies etc, which has not been much covered in existing research. Another key issue is the development of a common platform to enable flexible HMI solutions for users with special needs.

iv) Applications and Services

Applications should concentrate on new generation driving support, emergency manoeuvres and collision mitigation through novel and intelligent actuation concepts. The development of new generation longitudinal and lateral control functions needs to keep the driver in the vehicle control loop as far as possible. The applications need to be integrated in one platform and managed through a new generation HMI and cockpit concept to support situation awareness and to avoid over-flow and saturation of information. For dedicated scenarios, autonomous driving support should be introduced. The quality of these applications needs to be ensured by formalised and commonly agreed procedures, as is the case with passive safety systems.

The safety and security systems in the vehicle must be dependable. Thus, the vehicle infrastructure must support the operation and availability of these systems, e.g. dependable power supply for safety and security critical systems.

v) R&D Topics

- Sensor development (improving existing sensors, new sensor concepts, multi-usage and sensor data fusion)
- Positioning systems (accurate and fast) and enriched digital maps
- Flexible vehicle systems architecture
- Dependable vehicle infrastructure (e.g. power to safety and security systems)
- HMI issues and future cockpit
- Description and modelling of driver behaviour and capabilities
- Effective actuators, in particular for passive and active safety functions
- Platform integration of several applications
- Development of foresighted and cooperative driving
- Autonomous vehicles capable of operating in dedicated environments

vi) Core Technologies

The work will speed up the development of integrated active safety functions and their further harmonisation and integration with passive safety systems. The focus is on enhanced and new sensors and sensor systems with more reliable perception of the driving environment able to deal with complex scenarios such as intersections, detection and recognition of vulnerable road users, adverse and night time driving conditions. Foresighted driving is based on precise vehicle positioning and enhanced digital maps where cooperation with road authorities is essential. The use of devices external to the vehicle and standard gateways are promoted to support the development of vehicle information and remote diagnostics functions. Research on transport security and vehicle data security will further contribute to safer, cleaner and more efficient mobility.

Enriching the digital maps with road geometry and other relevant data attributes supporting the vehicle control and the evaluation of Galileo as an additional “sensor” for advanced driver assistance, safety systems and efficient power train control are also addressed. Robust, open, flexible and safe vehicle architectures for reliable high-speed data flow in complex environments need to be developed. This work also includes the development of methods and processes for efficient cooperation between OEMs and suppliers.

Whenever assistance systems are integrated into a vehicles, performance fallback solutions must be provided if the systems fails or cannot react because of missing or non-interpretable data. Clear and intuitive warning or takeover request strategies must be developed alongside sensor and actor development.

vii) Deployment Issues

The Intelligent Car Initiative outlines several actions to support the deployment and take up of these systems in the market.

Examples of actions proposed which hold the potential to contribute to a faster deployment of Intelligent Vehicle Systems are:

- Raising awareness at different stakeholder levels
- Identification and implementation of incentives
- Establishment of a European Code of Practice for development and testing of Advanced Driver Assistance Systems
- Impact assessment and socio-economic cost/benefits analysis
- Establishment of an independent performance and conformance testing programme

COOPERATIVE SYSTEMS

i) Introduction and Description

Cooperative systems in road traffic use communication between vehicles and between vehicles and the road infrastructure. Significant benefits beyond those that will be delivered by separate vehicle and traffic management systems are available from vehicles co-operating through communicating with one another and with the road infrastructure itself.

ii) Challenges

One of the major challenges facing the transport system is how to retain flexibility and personal mobility and achieve significantly better efficiency whilst still delivering improvements in safety, environment and sustainability for everyone in the society. In order for cooperative systems to deliver their potential benefits they will have to function on the widest possible scale, both geographic and market. There has to be a shared vision and understanding among all relevant stakeholders about the nature of the way the services are delivered and where the cost and benefits will accrue. Wireless technology has the systemic problem that 100% system performance cannot be reached due to interference or shielding effects. Therefore safe fallback strategies (i.e. by supporting sensor systems like video, radar or ultrasound) must be developed.

Furthermore, a threshold problem exists whenever cooperative systems for traffic management or collision avoidance shall function. Research results on minimum deployment rates are currently only partly available.

Infrastructure needs to become more intelligent in order to maximize potential benefits of cooperative systems for network management purposes.

iii) User Aspects

Demonstrations are needed to show deployable services that use efficient technical solutions, real users and real market conditions. There is a need to understand the interaction between social cost-benefits, commercial return, affordability and policy drivers. For successful deployment it is necessary to educate users and operators in order to modify their behaviour in advance of services being deployed. Awareness needs to be raised with the investment decision makers and the users, i.e. operators and public.

A large scale demonstration (i.e. city/region wide) is needed in order to evaluate the potential impact of V2V and V2I applications, notably on network management.

iv) Applications and Services

Services are needed to maintain and manage cooperative systems, enabling information to be connected at the service centre level and applications and services to be delivered to large numbers of mobile individuals over wide geographic areas. There is a need for open, interoperable systems at both the vehicle or portable device and service or control centre ends of the chain. Applications can be local or road network based, individual or collective, or aimed at traffic safety and/or efficiency.

Cooperative systems may use different means of communication: vehicle-to-vehicle communication, sensors, roadside infrastructure, mobile phone networks or broadcast systems. A systematic analysis of multi-modal data exchange with respect to communication and system cost is required.

v) R&D Topics (First Call)

- Research and development into system integration, system configuration management, service monitoring.
- Study into a dedicated communication approach for V2V and V2I that addresses explicitly the need for low latency and high reliability, focusing on feasibility, potential technologies and benefits.
- Development of a roadmap which indicates how to migrate from where we are today to being able to deploy cooperative systems, based on realistic business models, environmental and energy considerations and impacts as well as socio-economic assessment.
- A clear goal of projects should be the commercialisation of the results of former projects on cooperative systems. Clear assumptions will be needed to test against before large scale pilot demonstrations will be started. These demonstrations must make use of existing devices to start the process of evaluation of the potential impacts of V2V and V2I applications. They should focus on commercially deployable services and communication technology with real users and market conditions.
- Development of common simulation tools and a common test bed, enabling cost-effective evaluation of concepts and systems, available to all EU actors.
- Accurate and timely positioning, giving attention to a standard approach to augmentation to cope with those situations where even the future enhanced GNSS services do not deliver sufficient accuracy, and ensuring that system security and integrity are not compromised.

vi) Core Technologies

The core technologies to be used and researched are system integration, communication technology and positioning technology. Simulation and observational tools enabling assessing the impacts ranging from the interaction between drivers and system through the HMI up to network wide effect on traffic and communications systems. Business modelling, road mapping and life cycle management tools are needed to support the development of a realistic road map.

vii) Deployment Issues

The systems architecture is a key factor and the major actors will need to devise and agree on such architecture. The challenge will be to create an environment where differing application business models can be supported through a common network and set of standard interfaces.

The scale of deployment of cooperative systems is such that there needs to be a harmonised approach to standards, testing and certification at the European level. A body is needed that can take decisions on the way to proceed in a rapid and open manner to ensure confidence for the investors in research.

The threshold problem of cooperative systems can only be overcome if a large proportion of vehicles will be equipped with the technology in rather short time. This means that deployment must include the volume segments of the car market.

FIELD OPERATIONAL TESTS (FOT)

i) Introduction and Description

Development of ICT functions and systems for road transport were initially to a large degree driven by technology interest and possibilities. Demonstrations have been used to test the technical and functional behaviour of the developed systems. However, these have often been restricted to controlled conditions and in limited scale due to the fact of availability of equipment as well as restrictions in operating experimental equipment in real traffic.

As a consequence there is still a great need to investigate the behaviour of the user in the real traffic environment when being equipped with new ICT systems for safety and efficiency as compared to the user's behaviour without the ICT systems. The short and long term effect of the use of such systems is also of great importance to assess as a justification of the systems.

Field Operational Tests (FOT) have during later years developed as a powerful tool to gain insight into how new functions and systems suit the user when operated in the real context under sufficiently long time to reach the "daily operational and behaviour level".
FOTs for ICT based traffic safety and efficiency functions and systems are viewed as very interesting for understanding the users ability to use these and to make cost/benefit assessments as well as to evaluate the impact on safety, traffic efficiency, environmental aspects and the behaviour of drivers and other road users. FOTs are also important in the technical development since they can provide valuable feedback regarding the performance and improvement of the technical system.

FOT activities have been used in the US where the DoT has supported several FOTs to evaluate on-board vehicle systems like for example the evaluation of driver assistance systems for trucks. In Japan, the OEMs often use the Japanese market for early evaluation of new systems, e.g. route guidance systems and vehicle to infrastructure communication based services.

In Europe it has been rather rare to make larger, long endurance tests of new equipment in ordinary traffic. Consequently there is a lack of knowledge, facts and data of European traffic system response to ICT based technologies and systems. As noted by the eSafety Forum, this lack of information also limits the scientifically based argumentation with administrations and politicians to provide and prepare for necessary decisions on investment and deployment schemes. Additionally the outcomes and experiences gained with the FOTs can be the basis for broadening the awareness among the public for these ICT systems.

ii) Challenges

Gain and extend knowledge, facts and real data on ICT based systems for driver support, safety and traffic efficiency as a basis for socio economic cost/benefit analysis, impact assessment on driver behaviour, safety and efficiency and development of business models for the market deployment of these systems. It is essential to ensure the transferability of the FOT results to the overall European and global conditions.

iii) User Aspects

In establishing FOTs several aspects need to be considered:

- Confidentiality and IPR issues needs to be guaranteed for the partners supplying the equipment, functions and services to be used in the FOT.
- The FOT should not be designed as an exercise to compare and grade different branded products. It should instead focus on assessing the functionality of the ICT system and its impact on driver, safety, etc.
- Experimental design of the FOT and evaluation of the collected data should be done by parties independent from the ones supplying the equipment.
- The FOT should be handled as one combined and integrated project embracing all aspects of the FOT in order to create the critical mass of needed data and maximise the investments. (Small projects for each of the FOT moments should be avoided).
- Experiences and results from FOT or similar trials done in EU Member States, US and Japan should be used in building future FOTs.
- Identification and, when missing, development of necessary and sufficient procedures, methods, assessment schemes, simulation methods, … to plan, implement and evaluate a high quality FOT.
- Experimental and trial set-up of the FOT must not influence or disturb the behaviour of the "ordinary" driver.

iv) Applications and Services

Not applicable since FOT is a "tool and approach" for impact assessment, (and not a "commercial" product).

v) R&D Topics

First Phase Priority

The methods and procedures for planning, running and evaluating a FOT need to be developed and verified. This includes experimental planning, pre-simulation of the FOT, techniques for measurements and registrations, methods for evaluation and conclusions, criteria for selection of statistically "ordinary drivers", …

Once the procedures and methods have been developed and verified (simulations using statistical approaches) a real FOT, in small scale should be conducted. In this "first" FOT a technically mature ICT system should be used.

Second Phase Priority

Once the procedures have been developed, and the complete chain of a FOT has been established, a full scale FOT should be conducted. It is recommended that this FOT address Cooperative Systems, including vehicle – infrastructure – traffic management, e.g. as under preparation by the FP6 projects Safespot and CVIS.

vi) Core Technologies

Required technologies to design perform and evaluate FOTs are likely of two kinds:

- The generic ones applicable and useful for most FOTs. These are the methods for planning, executing, recording and evaluation of statistically designed experiments.
- The ones unique for the particular FOT. These are in particular methods and equipment for surveillance and registration of the driver, vehicle, traffic environment, etc. to capture the necessary information for impact assessment of the ICT system under study.

vii) Deployment Issues

Successful deployments of FOTs require a clear definition of the objective, in particular the what safety, traffic efficiency and/or environmental aspects are under investigation, the pre-planned experimental design, preferably supported by simulations, the reasonably mature ICT system, the sufficiently large scale of experiments, considering number of test objects and the duration of the test, so that statistically significant conclusions can be made, and finally the methods for impact and cost/benefit evaluation.

It is recommended to have an evolutionary approach in building FOTs, starting with developing the methods, make a first smaller FOT on a mature autonomous system (e.g. Driver Information Systems) and then in the later phase make a more full size FOT on Cooperative Systems, (Vehicle – Vehicle – Infrastructure Communication based functions and services).

HORIZONTAL ISSUES

Additionally to the five specific areas described above there are also horizontal issues common to several applications or generic pre-requisite for successful deployment of functions and services. In the text below a non-exhaustive list of horizontal issues is presented.

Standards

- Development of methods and procedures to assess the impact of vehicle and infrastructure related ITS functions with a view to possibly developing certification procedures.
- European benchmark and trends of infrastructure-vehicle technologies aimed at traffic information and traffic management.

Support to policy initiatives

- Activities in support of the Intelligent Car Initiative and of the eSafety Forum should be envisaged in the form of targeted supportive actions.

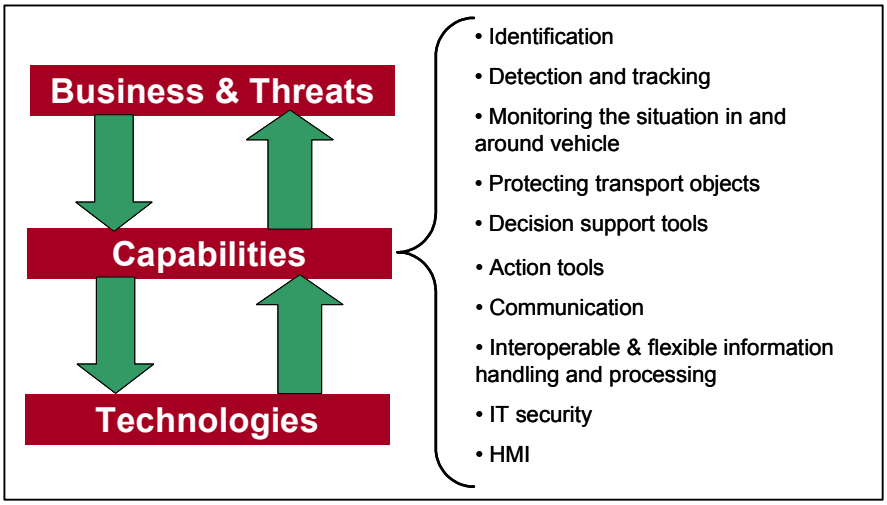
Communications

The recommendations of the eSafety Forum, WG Communication have to be retained.

Security

Due to growing terrorism in society the security field has raised an increasing attention during recent years. A specific segment of security is the transportation area, which has been shown to be a vulnerable target for terror, theft and crime acts. Driven by this increasing society focus, it is crucial to initiate research activities within this area.

Some wanted future capabilities for obtaining secure network-based vehicles are listed in the figure below:



Future ICT – ITS system should, by default, have the security functions and services embedded.

System Aspects

- Novel enhanced digital maps and positioning systems (accurate and fast) to support both intelligent vehicles, infrastructure and cooperative systems.
- Future vehicle information systems need to be interoperable and functionalities should support cooperative driving
- Cooperative vehicle and infrastructure system should make use of the autonomous vehicle and infrastructure systems under development and already available.

Intelligent infrastructure

In order to maximise the benefits of the new functions and services from the five research areas presented above, the infrastructure needs to become more intelligent, in terms of:

Network management

Making traffic management systems 'proactive' rather than 'adaptive', by predicting congestion and dampening incoming waves through metering, advice or other interventions, and by adopting a regional/cross regional approach to managing traffic. Thereby it is possible to get more out of existing technologies by adapting them to new environments and developing new processes.

Greater interoperability of systems through a single back office

R&D has historically tended to focus on frontline transport applications/services to the detriment of back office systems. Efficient back office systems are vital for improving network performance and service levels for the user. Indeed a single back office for all transport applications would provide a single point of contact and payment for all transport related transactions, within a city, across administrative boundaries within a region and why not across state borders. Technological developments within transport are creating a greater need for authorities to work more closely with other agencies, including the public transport operators, the police, the banks and credit card companies, car park operators, etc, which all have a stake in the delivery of transport services, be it through management, payment or enforcement. A common back office system is strongly motivated for these purposes.

Business Model

- New car insurance model based on the positioning system
- Business modelling and deployment aspects of cooperative systems should be handled within the general horizontal business model development for transport ICT systems

Deployment Aspects

- Legal issues of relevance to ITS and ADAS systems
- Road maps for deployment and partnership building for ICT and Cooperative Systems commercial market introduction

Education and Training

The research and deployment of an intelligent road – traffic - transport system (including drivers – vehicles – infrastructure and other road users) need to have very good trained and educated researchers, engineers and other capable staff.

One of the critical issues is also to prepare the next generation of focused research scientists for industry and academia. Special actions should be taken to fulfil this future need and the available FP7 instruments should be explored for this purpose. Development of relevant course material in automotive engineering, electrical engineering, information sciences, human factors, traffic and transport engineers should be encouraged.

R&D recommendations: First call of FP7

1. **Mobility Services for People**
   - System architecture is needed for connecting various systems together in a multi services overlay networks
   - Geo referencing data systems as a prerequisite issue
   - User interface and accessibility have to be developed
   - HMI issues specific to "Mobility Services"
   - Flexible access of external applications and nomadic devices to the "in-vehicle HMI".
   - Standardized format for mobility information
   - IPv6 use: IPv6 technologies' impacts on mobility services.

2. **Mobility Services for Goods**
   - Creating a seamless efficient mobility service system using ICT as an enable
   - Exploiting RFID and ICT platforms as critical component and architecture
   - Urban logistics supported by network management.
   - High level of liable security and of adequate tracking and tracing.

3. **Intelligent Vehicle Systems**
   - Development of vehicle environment perception systems
     Develop enhanced and new sensors and sensor systems with more reliable perception of the driving environment able to deal with complex scenarios and interactions such as intersections, perception of vulnerable road users, adverse and nighttime driving conditions. Research/define confidence levels of the different sensor data
   - Vehicle architecture for data flow
     Development of robust, open, flexible and safe vehicle architectures for reliable high-speed data flow in complex environments
   - Dependable vehicle infrastructure
     Dependable vehicle infrastructure for the operation of safety and security systems. Development methods and processes for efficient OEM - supplier cooperation
   - Development of faster and smarter actuator performance
     Enhanced x-by-wire actuators provide last moment intervention, collision mitigation and other vehicle dynamics functions

4. **Cooperative Systems**
   - Integrated systems
     Research and development into system integration, system configuration management, service monitoring
   - Road map for cooperative systems
     Development of a roadmap that indicates how to migrate from "where we are today" to "being able to deploy" cooperative systems
   - Demonstration
     Large-scale pilot demonstration, making use of existing devices to start the process of evaluation of the potential impacts of V2V and V2I applications
   - Simulation and testing
     Development of common simulation tools and a common test bed, enabling cost-effective evaluation of concepts and systems, available to all EU actors
   - Communication V2V and V2I
     Study into a dedicated communications approach for V2V and V2I that addresses explicitly the need for low latency and high reliability. Bandwith needs of each application must be defined and the impact of the application on safety correlated

- Positioning
  Accurate and timely positioning, giving attention to a standard approach to augmentation of future enhances GNSS services to deliver sufficient accuracy

5. **Field Operational Tests**
   - Methods and Procedures for FOT
     Development of methods and procedures for planning, running and evaluating a FOT, including (among others):
     - experimental and statistical planning, pre-simulation of the FOT,
     - techniques for measurements and registrations,
     - methods for evaluation and conclusions,
     - criteria for selection of statistically "ordinary drivers", length and size of test, …

   - Small scale, real FOT on technically mature ICT system
     Implementation of a small scale FOT in real traffic, using a mature ICT system.

6. **Horizontal Issues**
   - Legal issues of relevance to ITS and ADAS systems
   - Analysis and modelling of interactions between drivers in traffic and their effects of traffic safety, traffic flow and the possible changes by ADAS functions
   - Development of methods and procedures to assess the safety (and traffic) impacts of vehicle-infrastructure related ITS functions with a view to possibly developing "certification" procedures
   - Enhanced digital maps and position systems (accurate and dynamically fast) to support intelligent vehicle systems, infrastructure and cooperative systems
   - Security functions and services embedded into the ICT – ITS system
   - Development of road maps and business models for commercial deployment of autonomous and cooperative ICT based systems for road transport
   - Intelligent infrastructure for network management and interoperability of systems
   - ICT for cleaner mobility

R&D recommendations: Second and later calls of FP7

1. **Mobility Services for People**
   - Planning, optimisation and managing transport networks in an intermodal way
   - High-rate data transfer capacities
   - Address specific needs for themselves and as an incentive to innovation (accessibility) for elderly and disabled
   - IPv6 use: Treat satellite based and IPv6 technologies impacts on these services

2. **Mobility Services for Goods**
   - Managing supply chains and logistics through a supply chain event management
   - Achieving possibilities for real intermodality
   - Exploiting and demonstrate navigation technologies including Galileo satellite based

3. **Intelligent Vehicle Systems**
   - Development of integrated platforms based on enhanced sensor systems, evolvable and flexible system architectures with open software and hardware interfaces supporting multiple functions
   - Development of adaptable decision and control systems for different driving situations and variable driver capabilities, to extend the domain of operation and effectiveness support provided by the intelligent vehicle
   - Development of a concept for testing different Active Safety and Advanced Driver Assistance Systems
   - Development of autonomous vehicles capable of operating in dedicated environments or for given manoeuvres

4. **Cooperative Systems**

   Field trials and demonstrations in real traffic environment for testing and verifying cooperative systems technically at system level as well as proving their positive impact on traffic safety, efficiency and giving basis for cost/benefit assessment. Drivers – Vehicles – Infrastructure – Traffic and Goods Management should all be components, linked with communication systems, in these field trials. These field trials should be developed with a view to be extended into Field Operational Tests of cooperative systems.

5. **Field Operational Tests**

   A full scale FOT should be conducted addressing Cooperative Systems, including vehicle – infrastructure – traffic and goods management.

   The FOT should preferably make use of the field trials and tests done by the by the FP6 projects Safespot and CIVIS and their potential extension into FP7.

   One major reason for this FOT is to generate “Scientific Facts & Figures” for authorities, industries and investors engagement in the deployment of cooperative systems.

6. **Horizontal Issues**
   - The impact of “pervasive” location, computing and communications on traffic operations
   - New car insurance model based on the positioning system
   - European benchmark and trends of infrastructures-vehicle technology aimed at traffic information and traffic management

APPENDIX: Short reports from workshops arranged during April – May 2006

Mobility Services for People: 2006-06-08, Hannu Hakala, rapporteur

Challenges

Challenges of mobility services exist on many levels. On the user level the personal safety has to be assured. This is valid for all the moving or mobile people: pedestrians, passengers and drivers inside and outside the vehicles. Implementation of mobility requires efficient transport systems for both private and public transport side. Tools, background systems and solutions are needed for fluent travelling on crowded roads and streets. The overall solutions are needed for route planning, urban and inter-urban planning and multimodal systems, for private, public and combined transport modes.

Methods and procedures for sustainable mobility are a must. Amount of travelling is increasing all the time (e.g. airborne travelling is estimated to triple during next ten years). Congestion problems are increasing. In order to improve our quality of life various technologies have to be developed to decrease pollution, noise and also traffic in general.

As a by-product from the development of mobility services is the enablement of various other services. Development of communication solutions for cars and PT vehicles has already started with higher available data transfer rates and availability of download capabilities. More and more information about our environment is available with real-time updates. Entertainment possibilities are increasing remarkable with multimedia messaging, music downloading and content sharing (e.g. podcasting).

Key challenges in ICT area for mobility services can be expected from following main changes:

- IPv6 (all devices with IP-addresses: can you call your car, can the service man do it...)
- more accurate positioning (getting to lane or sub-line level: warning of being on left side of the lane ...)
- high-rate data transfer capacities (OTA-updating, *over-the-air:* updating your car's music, videos, engine sw?, digital maps....)

User aspects

Needs of users are generally understood, but still it seems that in many cases the developer of the services knows about the service needs and their realisation, but not exactly the end user. There are two different aspects involved: the users need to know about the services, but they need to understand the services, too; i.e. both availability and capability knowledge are needed.

In most of the project cases some of the user needs are covered well, but the wider selection of services is missing. This leads to a situation, where only some separate services exist with decent user need coverage, but not with a total service offering. (You get something, but you know something is missing.) Wide offering of mobility services is needed. One of the key issues to be solved is the functional coexistence of free of charge web content and more valued content with additional value.

Focus should be on people and on urban situations. Emphasis is moving towards the users of the roads. For road administrators, it is not about managing roads, but about managing traffic situations; their role is quickly changing from road operators towards traffic operators. What

goes through matters, not what exists. Mobility services are more or less organised in interurban situations, but urban situations vary from city to city.

Applications & services

A uniform, pan-European mobility service with transport content and wide availability to users has to be developed. Challenges are in getting content updating continuous with responsible, local parties involved, managing the wide variety of communication modes and access methods and giving reliable, relevant and useful information to the user in the form and with devices wanted.

The mobility services have to be always-on and converged into usable information tool box. No need for starting any additional applications, but making a quick change to the selection and using of services covering travelling and other activities of mobility. Straightforward management of things like: how/when/where to go, options to travelling/transport, options in problematic situations, options for access and routes, locations etc.

Both the ordinary people commuting and travelling in their everyday environments, people in unknown environments as well as people with special needs have to be covered in order to make these mobility services a success. One of the main requirements is thus a very well defined and managed customisation of service packages for each and every person. This requires on one hand a selection of ready made profile setups (like styles and themes in Windows for graphical UI) but also the possibility to have a totally personalised customisation. Context awareness, especially location awareness enables the mobility services to give efficiently selected, relevant information to the users without the need to ask for details for information filtering (like in Web services often).

Core technologies & tools

From user point of view the mobility services are based on applications running on their terminals. Services build up from the use of content through these applications. This means that for the end user only two things matters: are the applications available on his/her terminal and can he/she access the content through them. All the other parts are hidden from the user.

Availability of content in the terminal depends on the existence of two main technical parts, first does the content exist and second can the content be properly accessed. In mobility services content is almost always based on digital maps, i.e. all information has to be georeferenced. This information includes road information, points of interest, traffic information, weather, PT timetables and travel management information. More general information is related to entertainment and other information, like real-time web-cams and traffic cams. Data fusion methods, sensor systems and sensor networks are capable to create huge amounts of data, which has to be filtered for various uses. European wide mobility services may be difficult to make because the availability of countrywide data varies.

Functional infrastructure includes servers, communication means, interfaces and databases. System architecture (ref. to coop systems, Frame) is needed for connecting various systems together. Content for the databases can come from systems like traffic and transport management systems, road infrastructure systems or tolling systems. Today's situation is in many cases such that the user has to access each of these systems separately without having the possibility to use their content together (i.e. traffic situation or weather on one applications without the possibility to use the information on a navigator). Seamless service experience both on terminal application level and server content level is needed.

End users can access these mobility services with many kinds of terminals. Drivers and passengers of automobiles can access the services through vehicle systems. In buses, trains and on stations various kinds of info kiosks can be used to access services. Private travel-

lers/commuters can access the services with portable and home devices. Applications for these mobility services are made for end-users, users maintaining systems (super-users, remote services) and users managing systems (administrative, fleets, roads, traffic mgmt).

Horizontal issues

In order to take the results of research activities more efficiently to the real market and to commercial use, planning of business models and commercial exploitation activities has to be supported. Cooperative activities between public and private sector (PPPs) but also between private persons (private publishing, P2P) have to be established. A proper emphasis should be put on production and commercialisation of services. Earlier projects have managed to make realisations of interesting mobility services, even easy to use services. After this prototype phase seldom any competent actions take place towards turning these prototypes into products, which can be commercialised for market entry.

Solutions for handling georeferencing of content, permanent and changing content, local, national or European level content have to be made. Data collection and processing is done many ways. Content is gathered by commercial companies (news agencies, mapping companies), public authorities (traffic management, weather stations), drivers or travellers (fleet systems, ordinary drivers, whoever). In order to make all the content usable commonly agreed transport related architecture definitions, including protocols, content formats and information exchange mechanisms have to be taken into use. Binding agreements are needed between the content providers and service providers on coverage, availability, continuity, correct formats and updating intervals.

In standardised interfaces there is a need for definition of minimum content set which is required and definition of proprietary additional manufacturer specific set which can be used if wanted, e.g. metadata definition in GIS information. Multilingual solution needs to be developed to enable true pan-European service.

Services related to public transport are often seen as services needing standardisation and certification. They are vital, but not required in all cases. Certification may be needed with some types of mobility services, some activity on certification mechanisms exist in e.g. GST or Certex. One of the challenges in the near future is how to qualify the future applications based on certified Galileo signals but with uncertified content.

Pan-European multimodal, multilingual mobility service has to be evaluated in thorough user tests both on locally and abroad with a number of typical travel chains with all the relevant user devices. These tests do not necessitate any fixed field operational test site, but require availability of multi-channel access to country-wise content and service provision system with multilingual support.

Conclusions and recommendations

The user is in the focus point: users have to be aware of services, have to be easily able to purchase or use them as well as have to get wide enough service offering to be satisfying to the user. The user has to be able to rely on the service, its quality, repeatability and coverage.

Mobility services have special importance for people moving on the roads in urban environments. They must travel with ease and confidence for one place to another, knowing that they will get there, be there in time and without worries.

Recommendation: Need to develop a uniform, Pan-European mobility service with transport content and wide availability to users, which requires the development activities targeted to following areas:

1) Provision of transportation products that meet the mobility requirements of users in an attractive, reliable, efficient way
2) Content for customer-facing services, especially information and mobility-related e-services
3) Usable access mechanisms to the mobility-related services that are appropriate and acceptable to the diverse user segments

Mobility Services for Goods: 2006-06-09, Brendan Finn, rapporteur

This chapter identifies the key issues from the workshop "Mobility Services for Goods" brought forward to the Consolidated Report. It is stressed that these are key issues - it should not be overlooked that there remain many other significant issues, which are described in the main workshop report.

Challenges

The core objective for the theme "Mobility Services for Goods" is to develop seamless, efficient logistics chains across boundaries, modes and services, in order to meet customers' expectations at lowest cost.

The key challenges that face the sector are:

- Plan, optimise and manage supply chains within and across modes and transfer points
- Offer true best-service/lowest-cost multi-modal solutions
- Exploit the RFID and ICT platform with intelligent and value-added applications and services
- Achieve the potential of Urban Logistics and e-Fulfilment
- Achieve e-security in cross border goods flows

User Aspects

Primary user aspects to be considered are:

- All actors are part of extensive and overlapping supply/logistics chains. They cannot determine the overall framework or technologies
- Shippers and receivers have diverse requirements and priorities. The systems and processes of the logistics actors must be able to work with this diversity
- Cost and reliability are fundamental to the competitiveness of logistics actors
- Full knowledge of options is fundamental to the competitiveness of multi-modal solutions

Applications and Services

The main application and service areas needed for Mobility Services for Goods are:

- Supply chain optimisation and management
- Multi-modal mobility services for goods based on open best-service/lowest-cost principles
- Tracking and tracing of goods and vehicles across the logistics / supply chain
- Advanced urban logistics services
- e-fulfilment services

Core Technologies and Tools

Highest priority technologies and tools

- Concepts and tools for optimisation in the logistics chain at the planning stage to ensure end-to-end efficiencies
- Practical tracking and tracing tools are needed throughout the supply chain
- Develop and demonstrate tools for new service 'least-cost / best-service routing'
- Value-added applications which exploit information available through RFID and ICT
- Develop and demonstrate new tools for practical application of urban logistics and e-fulfilment

Next priority technologies and tools

- ICT tools to support transfer points and processes
- Further development of RFID, including low-cost RFID devices, increased read/write range and speed, inter-tag communications
- Routing and navigation systems need to meet the specific needs of commercial vehicles and HGVs, and also take into account issues relating to movement of hazardous goods

Horizontal Issues

- A paradigm-shift is required in Mobility Services for Goods. This will require new concepts, business models and operational products
- A strong focus is needed on demonstration of robust, reliable tools – this is a sector which is willing to invest, but which also demands proven product.
- Availability of information throughout the supply chain needs many support actions, ranging from harmonisation of forms and exchange protocols, to data integrity and completeness, to portals and concentrators of data.
- 'Multi-modal' services and skills are mostly derived from a single mode with some extra capability. A new generation of truly multi-modal systems and capabilities is needed.
- Security needs must be supported throughout the supply chain. This is not only security against terrorism, but also in relation to theft and integrity of goods.

Conclusions and Recommendations and Immediate Call Priorities

The immediate Call priorities are:

- Interoperability and harmonisation of both systems in the logistics chains and of documents exchanged between actors
- Getting ICT to work between functions and between actors
- Demonstrate technical reliability of chosen solutions
- Bring communications to a more trustworthy basis

Intelligent Vehicle Systems: 2006-06-08, Tapani Mäkinen, rapporteur

Challenges

The challenges of the upcoming FP concern the introduction of cost-effective intelligent vehicle Active Safety and advanced protective safety applications showing proven concepts of a new generation assisted driving in terms of lateral and longitudinal control and collision mitigation concepts integrated in one platform. Advanced driver assistance functions need to be developed also for two-wheelers. Prototypes of autonomous vehicle systems capable of operating on dedicated environments or for given manoeuvres need to be introduced as well. Autonomous driving faces also legal issues to be addressed in the upcoming work. Areas addressed to attain these goals include further development of integrated platforms based on enhanced sensor systems, evolvable and flexible system architectures with open software and hardware interfaces supporting multiple functions. Future vehicle information systems need to be interoperable and functionalities should support cooperative driving. The adaptability of the decision and control system to different driving situations and variable driver capabilities is enhanced in order to extend the domain of operation and effectiveness support provided by the intelligent vehicle. Due to a great number and diversity of applications, a concept for benchmarking different Active Safety, Advanced Driver Assistance Systems and advanced protective safety systems will be introduced.

User aspects

Due to multiple safety functions in vehicles, focus on user needs in terms of better understanding of driver behaviour and modelling of driver behaviour is ever more important. Driver situation awareness is maintained through intuitive Human Machine Interaction, reliable prediction of driver state and the comprehension of vehicle safety functions, for instance in view of the growing aging driver population, this needs special attention. A concept for a new cockpit with enhanced driver situation awareness will be introduced.

Application & services

The applications needed concern especially new generation driving support, emergency manoeuvres and eventually, the mitigation of collision through novel and intelligent actuation concepts. The principle in the development of new generation longitudinal and lateral control functions is to keep the driver in the vehicle control loop as far as possible. The applications need to be integrated in one platform and managed through a new generation HMI & cockpit concept in order to support the driver's situation awareness and to control the information over-flow. For dedicated scenarios, the autonomous driving support is introduced. Due to a number of different driver support applications, the quality of functionality need to be ensured through a formalised and commonly agreed benchmarking procedures as is the case with passive safety systems of cars.

Core technologies and tools

The work will speed up the development of integrated vehicle active safety functions and their improved harmonisation with passive safety systems. The focus is on enhanced and new sensors and sensor systems with more reliable perception of the driving environment able to deal with complex scenarios and interactions such as intersections, perception of vulnerable road users, adverse and night time driving conditions. Foresighted driving is focused on by precise vehicle positioning and enhanced digital maps in cooperation with road authorities. The use of vehicle external devices and standard gateways are promoted to support the development of vehicle information and diagnostics functions. Research on transportation security and vehicle data security issues further contribute to clean and safer travel and logistics.

These targets are met by means of enhanced situation analysis, classification and sensor data fusion technologies. New sensor technologies are combined. The intelligent use of several wavelength bands as well as completely new wavelength bands are explored. Multiple radar fusion techniques, advanced laser technology, further development of CMOS-Cameras and RFID-technology are used to improve the environment perception with a focus on cost-effective solutions. The potential of new enabling technologies are investigated, especially passive and active 3D obstacle detection methods for trajectory estimation, new optical materials for low-cost manufacture of detection optics, as well as associated signal processing are investigated. Enriching the digital maps with road geometry and other relevant data attributes supporting the vehicle control and the evaluation of Galileo as an additional "sensor" for advanced driver assistance, safety systems, and efficient powertrain control are also addressed.

Robust, open, flexible and safe vehicle architectures for reliable high speed data flow in complex environments need to be developed. This work also includes the advancement of development methods and processes for efficient cooperation between OEMs and suppliers.

Horizontal issues

Intelligent vehicle systems need to consider foresighted and cooperative driving as well. As horizontal issues, this means the considering vehicle positioning and digital maps with a enhanced list of attributes need in driver support, HMI supporting variable information and vehicle systems architecture supporting easy add-on of new applications. Furthermore, the integration of nomadic devices in vehicle systems needs a dedicated horizontal approach.

Conclusions & recommendations (priorities for first calls)

The work proposed builds on the activities carried out in previous Framework Programmes. The activities that need to be further supported are especially associated with keeping the driver better "in the loop" and also to promote the chances for survival in a crash. This means that the driver needs advance information of safety relevant traffic incidents beyond her/his field of vision, communication with the surrounding traffic and background systems, the information must be intuitively understood. In the event of an imminent crash, more advanced actuator performance and collision mitigation is needed. Work in these fields needs to elevated in order to realise the vision of safe, smart and clean vehicle. The work will speed up the development of *integrated* vehicle active safety functions and their improved harmonisation with passive safety systems.

The priorities for the first calls concern:

- Further developing vehicle environment perception systems with the focus on enhanced and new sensors and sensor systems with more reliable perception of the driving environment able to deal with complex scenarios and interactions such as intersections, perception of vulnerable road users, adverse and night time driving conditions.
- Better driver situation awareness through a new generation HMI (a horizontal priority too).
- Faster and smarter actuator performance by means of enhanced x-by-wire actuators for the last moment intervention, collision mitigation and other vehicle dynamics functions.
- As a first call horizontal issue, novel enhanced digital maps to support both intelligent vehicle systems and cooperative driving.
- Robust, open, flexible and safe vehicle architectures for reliable high speed data flow in complex environments need to be developed. This work also includes the advancement of development methods and processes for efficient cooperation between OEMs and suppliers.

Cooperative Systems: 2006-05-31, Neil Hoose, rapporteur

Challenges

One of the major challenges facing the transport system is how to retain flexibility and personal mobility and achieve significantly better efficiency whilst still delivering improvements in safety, environment and sustainability for all society. The capability to link vehicle to vehicle and vehicles to the traffic management system opens up new opportunities for the way the road transport system functions. Significant benefits beyond those that will be delivered by separate vehicle and traffic management systems are available from vehicles co-operating through communicating with one another and with the road infrastructure itself.

In order for co-operative systems to deliver their potential benefits they will have to function on the widest possible scale, both geographic and market. This means that there has to be a shared vision and understanding about the nature of the way the services are delivered and where the cost and benefits will accrue. There are still many research challenges in both the technology and tools that need to be addressed.

User Aspects

Demonstrations are needed to show deployable services that use efficient technical solutions, real users and real market conditions. Business case for different parts of road network may be stronger and there is need to understand the interaction between social cost-benefits, commercial return, affordability and policy drivers. The role of public awareness and the need for education about the potential of co-operative systems needs to be taken into account. For successful deployment it may be necessary to educate users and operators in order to modify their behaviour in advance of services being deployed. Awareness needs to be raised with the investment decision makers and the users, i.e. operators and public. The former need showcases, demonstrations and route maps whilst the latter need use of public media, test drive experiences and showcases.

Applications and Services

Services need to be “end to end” and there needs to be open, interoperable systems at both the vehicle or portable device and service or control centre ends of the chain. A huge amount of information and data needs to be connected at the service centre level if applications and services are to be delivered to large numbers of mobile individuals over wide geographic areas. Co-operative systems allow more distributed intelligence but create new challenges in terms of how to maintain and manage such systems.

Research needs to select “strong” applications that can be seen to make a difference and research should establish their “added value” beyond autonomous ways of delivering the outcomes. One strategy is to focus research on how co-operative systems can deliver a bundle of services that are readily marketable.

Core technologies and tools

There needs to be research that demonstrates the effectiveness of co-operative applications. This may be done using technologies that are in the market or very near to the market. At the same time, knowing that there are shortcomings in the available technology, work should be progressed on developing the communications, positioning and application techniques that will deliver a more “ideal” and unified solution.

Co-operative systems are large-scale systems and therefore are difficult and expensive to demonstrate. There is a need to create simulation tools that can be used to investigate the whole end-to-end services at a large scale and enable impacts to be evaluated. These impacts range

from the interaction between drivers and system through the HMI up to network wide effects on traffic and communications systems. It would be beneficial and potentially cost-effective to have a common simulation toolkit available for all EU actors. The challenge is to create a harmonised set of simulators that offers shared use and that can be linked to real test sites to allow validation of outputs. This need not only tools for V2V and V2I communications simulation but needs to have simulations that integrate the driver/user and models of the transport network.

Co-operative systems research should be informing and influencing the development of these next generation communications systems and standards. Techniques for managing the life cycle of the co-operative environment are required.

Horizontal Issues

The systems architecture is a clearly a key factor and the major actors will need to devise and agree such an architecture. A key challenge is how to create a common approach that can support very different application areas, for example safety and entertainment, at the same time in a single system. The need to deliver a bundle of services in a seamless manner also raises the challenge of meeting the business models of different sectors. The challenge will be to create an environment where differing application business models can be supported through a common network and set of standard interfaces.

The scale of deployment of co-operative systems is such that there needs to be a harmonised approach to standards, testing and certification at the European level. A body is needed that can take decisions on the way to proceed in a rapid and open manner so as to enable the investors in research to have confidence.

Priorities for First Call in FP7

Key challenges that will have to be met include, system integration, system configuration management, in service monitoring, scenario development based on realistic business models and environmental and energy considerations and impacts

There is a need for a clearer idea on how to migrate from where we are today to being able to deploy co-operative systems. This could be captured as some form of development route map.

There should be an Integrated Project in the form of a Large Scale Pilot demonstration. This could make use of existing devices to start the process of evaluation of the potential impacts of V2V and V2I applications. This pilot should focus on commercially deployable services with real users and market conditions.

There is a need to develop common simulation tools and a common test bed.

In the long term it may be beneficial to have a dedicated communications approach for V2V and V2I that addresses explicitly the need for low latency and high reliability. Work needs to be started to examine if the benefits of such an approach are realisable and on the potential technologies that could provide solutions.

Accurate and timely positioning in co-operative applications is crucial. There will have to be some form of augmentation to cope with those situations where even the future enhanced GNSS services do not deliver sufficient accuracy. There needs to be a standard approach to augmentation to ensure the requirements are completely fulfilled and system security and integrity are not compromised.

Field Operational Tests: 2006-06-01, Paul T. Kidd, rapporteur

Field Operational Tests (FOTs) are large-scale test programmes, using ordinary citizens as drivers, covering a wide range of driving conditions, undertaken over an extended period of time. They enable the collection of data that cannot be produced by conventional test and demonstration methods associated with RTD activities. The data collected from FOTs can then be used for socio-economic and technical evaluations, leading to concrete information concerning the costs and benefits of advanced ICT-based systems in vehicles, and their impacts on driver behaviour, traffic safety, the environment, and transport efficiency. FOTs can be undertaken, in principle, with any type of road vehicle fitted with relevant ICT-based systems: cars, trucks, buses, and coaches.

A significant element hindering wider uptake of ICT-based vehicle safety systems is lack of awareness, throughout society, of the potential benefits of these systems. Consequently, FOTs are seen as a way of radically transforming the present circumstances, by providing real and convincing data of the costs and benefits of advanced ICT-based safety systems in vehicles. The expectation is that once wide awareness is achieved, other barriers, such as legal liability frameworks, will be addressed, leading to a transformation whereby these advanced ICT-based safety systems will become normal features of all road vehicles. This is the strategic imperative lying behind the proposal to undertake FOTs within the ICT research programme of FP7.

There are various issues and challenges involved in undertaking FOTs. These arise from the various different interests and concerns of the stakeholders, and the current lack of experience in Europe of undertaking FOTs. However, although there are many challenges and as yet unresolved issues, the fact that FOTs have been successfully undertaken elsewhere demonstrates that none of the difficulties are insurmountable.

Given that FOT is an activity that has not previously been addressed at EU level within the ICT research programme, and is also something that the various stakeholders have little direct experience of, an evolutionary approach is considered to be highly desirable. In addition, before any FOTs are undertaken it is essential that careful preparatory work be undertaken, both in terms of dealing with generic issues, and also in relation to specific FOTs. Importantly, it is essential to learn from the experiences of FOTs already undertaken in the United States and at a national level in Europe.

It clear that a phased approach will be needed, starting with on-board systems that are in a ready state for testing, moving forward to the testing of cooperative systems, and integrated on-board systems, later in FP7. One challenge will be to identify systems that are in a suitable state for testing, and undertaking work that may be necessary to bring other more advanced systems, for example, cooperative systems, to a state where they too can be subject to FOTs. This however can only be done once research and development projects started in FP6 have been successfully concluded.

A further challenge will be ensuring cooperation with relevant agencies in the Member States, to gain support for FOT deployment.

The main recommendations are that FOTs should be implemented within the ICT programme of FP7, on the following basis:

- The aim should be to evaluate the functionality of advanced ICT-based vehicle safety and other systems, with respect to impact on road safety, traffic efficiency, environment, and driver behaviour. There should be no evaluation of competing systems.
- Increasing the awareness throughout society should be based on the results of the FOT assessments and not the FOTs themselves. Avoiding creating unrealistic expectations is important.
- Commercial confidentiality must be respected and conflicts between commercial stakeholders avoided.
- The scope and objectives of each FOT should be clearly defined.
- Calls should be based on defined road safety problems, rather than specific types of ICT-based vehicle safety systems. These road safety problems can be specified based on EU policy priorities, or accident data, or both.
- An evolutionary phased approach should be adopted based upon what is feasible to include in FOTs.
- Statistical relevance of FOT data has to be attained, and this will probably involve combining data sets from several FOTs.
- Independent parties should undertake assessment and analysis of FOT data.
- The starting point for FOTs should be preparatory work, followed by a simple FOT, to gain experience, using on-board systems that are in a ready state.
- Cooperative systems, and integrated on-board systems, should also be included in FOTs later in FP7.
- Integrated Projects should be used for FOTs and not STREPS, and these Integrated Projects should involve representatives from all stakeholders.
- The appropriate funding structure should be a 50% community contribution.

The first steps will be to undertake the necessary preparatory work, including:

- Documenting international FOT experiences and identifying good practices;
- Identifying all the relevant issues and concerns and developing appropriate solutions, etc.;
- Developing a harmonised European approach to FOTs;
- Preparing guidelines and criteria for selecting systems for FOTs;
- Preparing common facilities such as simulation tools and test tracks for pre-FOT activities;
- Defining standard data collection technologies and methods, data storage, and analysis techniques.

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