Towards Cooperative Systems for Road Transport

Paper prepared for the

Transport Clustering Meeting

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European Commission
Directorate-General “Information Society”
Directorate C “Miniaturisation, Embedded Systems and Societal Applications”
Unit C.5 “ICT for Transport and the Environment”
Introduction

The purpose of this paper is threefold:

- It describes the rationale for the Strategic Objective “eSafety - Cooperative Systems for Road Transport” in the IST Work programme 2005-2006.
- It informs about the details of the Strategic Objective in the IST Work programme 2005-2006 and the upcoming call 4.
- It presents an overview on ongoing activities in international and national programmes on cooperative systems in road transport.

Based upon the report of the consultation for the IST Work programme 2005-2006 performed in spring 2004 it is augmented by additional information to be used as a reference to transport research activities on cooperative systems for road transport.

Consulting the constituency

In spring 2004 three expert meetings were organised by Unit C.5 (ICT in Transport and the Environment) of DG Information Society. In these, experts in the field of transports telematics were invited to express their views on what should be the objectives and priorities in the area of cooperative telematics systems for improving the safety and management of road transport. This was intended to provide a basis of a contribution to the IST Work programme development for RTD projects in the Sixth Framework programme for 2005-2006.

Two meetings were held on February 19th 2004, the first involving selected experts from relevant public sector bodies with responsibility for the road infrastructure, while the second meeting involved experts connected with the vehicle industry. A third meeting on March 18th included a larger number of experts with the aim of refining issues raised at the previous meetings.

For the meetings some of the participants prepared their own position papers. These papers have been made available to the experts during the meetings. As far as the authors have agreed, they are available on the web at [ftp://ftp.cordis.lu/pub/ist/docs/dir_c/trans/list_contr_en.pdf].

Based on the contributions of the experts, Mr. Philip Bly prepared a report on the results of the expert meetings, which was published on the web in May 2004. The report can be consulted at [ftp://ftp.cordis.lu/pub/ist/docs/dir_c/trans/bly_report_en.pdf].

The views expressed in that report are those of the author and contributors and do not necessarily reflect the official European Commission’s view on the subject.

In parallel a web consultation process has been initiated on Programme level, and there were 49 responses to the invitation to comment from 46 different contributors. These comments are available at the following Internet address [ftp://ftp.cordis.lu/pub/ist/docs/dir_c/trans/web_cons_contr_en.pdf]. Other written comments on the report, which arrived on other channels, can be found at [ftp://ftp.cordis.lu/pub/ist/docs/dir_c/trans/list_comments_en.pdf].

05/11/2004
Cooperative Systems for Road Transport in the IST WP 2005-2006

Under the European Framework Research and Development Programmes projects have been funded which have developed and demonstrated traffic telematics systems aimed at making transport safer, more efficient and effective, and more environmentally friendly. Many of these systems were aimed at improving the transport infrastructure, while others were based in the vehicles themselves.

Mostly, the systems developed by these projects have operated as autonomous or stand-alone. They hold the great potential to improve road safety and efficiency. Nevertheless there are limitations, to what can be achieved by systems based solely on the road, or solely in the vehicle, e.g. dealing with far distance threats or anticipating road difficulties with time margins compatible to the driver response time.

This requires another class of systems whose intelligence is distributed between vehicles and roads. As the capacity and flexibility of information technology and communications increases, and costs decrease, it becomes feasible to develop co-operative systems in which the vehicles communicate with each other and the infrastructure. In this way co-operative systems will greatly increase the quality and reliability of information, support and protection available to road users, and the cost-effectiveness of applications.

The following definition of Co-operative Systems was agreed during the expert meetings:

"Road operators, infrastructure, vehicles, their drivers and other road users will co-operate to deliver the most efficient, safe, secure and comfortable journeys. The vehicle-vehicle and vehicle-infrastructure co-operative systems will contribute to these objectives beyond the improvements achievable with stand-alone systems."

Some few aspects of such systems have already been investigated in previous Framework Programme and recent projects, but it is sensible to make co-operative systems a stronger focus of R&D in the future, as vehicles are increasingly equipped with wireless communications and location detection, increased computing power, and a multifunctional Human Machine Interface.

Taking into account the results of the consultation process and the ongoing research initiatives the requirements for projects to be funded in the IST Work programme 2005-2006 under the Strategic Objective "eSafety – Cooperative systems for Road Transport" were developed and approved by the ISTC Committee as follows.
Strategic Objective “eSafety - Cooperative Systems for Road Transport”

- Technical Content

Objectives

To develop and demonstrate Cooperative systems for road transport that will make transport more efficient and effective, safer and more environmentally friendly. Co-operative Systems (as an extension to autonomous or stand-alone systems), in which the vehicles communicate with each other and the infrastructure, have the potential to greatly increase the quality and reliability of information available about the vehicles, their location and the road environment, enabling improved and new services for the road users.

Such systems will enhance the support available to drivers and other road users and will provide for:

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

Focus

1. Research on advanced communications concepts, open interoperable and scalable system architectures that allow easy upgrading, advanced sensor infrastructure, dependable software, robust positioning technologies and their integration into intelligent co-operative systems that support a range of core functions in the areas of road and vehicle safety as well as traffic management and control. In addition to this, RTD activities on active safety systems insofar as they contribute to increased performance of integrated safety systems. Instruments: IPs, NoEs, STREPs.

2. In support of the eSafety initiative, and as a prerequisite for diagnosis and evaluation of the most promising active safety technologies:

   - research in consistent accident causation analysis to gain a detailed knowledge about the real backgrounds of European traffic accidents using existing data sources. Instruments: STREP;
   - research to assess the potential impact and socio-economic cost/benefit, up to 2020, of stand-alone and co-operative intelligent vehicle safety systems in Europe. Instruments: STREP;
   - actions which will sustain the work of the eSafety Forum. Instruments: SSAs;

3. Support for international co-operation, training of professionals and users, dissemination and improvement of the participation by SMEs. Instruments: SSAs.
The proposals shall indicate how vehicles equipped with such systems will be used across Europe and internationally and how the proposed activities relate to initiatives launched in some Member States and world-wide, especially activities in the USA, Japan and emerging economies. Consortia have to ensure the involvement of all stakeholders, such as road operators, road authorities, service providers, automotive industry, original equipments suppliers, systems integrators, and communications providers. Societal, organisational and institutional matters that are linked to the new generation of Co-operative Systems have also to be addressed.

The previous text is not legally binding; the final text is expected to be published soon on the IST page on CORDIS.

- Call Information

The Call 4 is expected to be published in the Official Journal in November 2004 including the following information:

<table>
<thead>
<tr>
<th>Specific programme:</th>
<th>Integrating and Strengthening the European Research Area</th>
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</thead>
<tbody>
<tr>
<td>Thematic priority/domain:</td>
<td>Information Society Technologies (IST)</td>
</tr>
<tr>
<td>Call title:</td>
<td>IST Call 4</td>
</tr>
<tr>
<td>Call identifier:</td>
<td>FP6-2004-IST-4</td>
</tr>
<tr>
<td>Date of publication(^1):</td>
<td>16 November 2004</td>
</tr>
<tr>
<td>Closure date(s)(^2):</td>
<td>22 March 2005 at 17.00 (Brussels local time)</td>
</tr>
<tr>
<td>Total indicative budget(^3):</td>
<td>1120 million Euro</td>
</tr>
</tbody>
</table>

Areas and instruments

Proposals are invited to address the following objectives:

<table>
<thead>
<tr>
<th>Strategic Objectives 2005-06</th>
<th>Instruments</th>
<th>Ratio New(^4)</th>
<th>Indicative Budget(^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Traditional(^5) Instruments (%)</td>
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<td>...</td>
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<tr>
<td>2.4.12 eSafety – Co-operative Systems for Road Transport</td>
<td>IPs, NoEs, STREPs, SSAs</td>
<td>60/40</td>
<td>82</td>
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\(^1\) The Director-General responsible for the call may publish it up to one month prior to or after the envisaged date of publication.

\(^2\) Where the envisaged date of publication is anticipated or delayed (see footnote above), closure date(s) will be adjusted accordingly in the published call for proposals.

\(^3\) Any call budget information relating to 2005 is provided under the condition that the draft budget for that year is adopted, without adjustments, by the budgetary authority.

\(^4\) New Instruments: IPs and NoEs

\(^5\) Traditional instruments: STREPs, SSAs and CAs

\(^6\) The amount accounts for 90% of the budget pre-allocated to the Strategic Objectives.
Annex: Ongoing activities on Cooperative Systems in Road Transport

The contributions to the consultation process were complemented by a scan of transport research and other activities to identify those programmes which contribute to research on cooperative systems for road transport.

The scan covered Member States’ programmes and research activities in the United States of America and Japan.

1. Member States

Some of the Member States have their national transport research programmes which partly contribute to research on cooperative systems. The EU-funded ERA-NET Transport supports the research cooperation between different national activities.

1.1 Austria: IV2S and Telematics Master Plan

Austria supports transport research in the IV2S programme (Intelligent Transport Systems and Services) of the Austrian Transport Ministry (bmvIt). To reach its objectives such as demand-driven road traffic management, variable electronic fee collection, support for intermodality and incident management, cooperative systems are required. They will be based upon the Austrian ITS Architecture which is part of the Telematics Master Plan.

The Telematics Master Plan (Telematikrahmenplan) has been published on 15th October 2004 and defines recommendations for the implementation of intelligent transport systems in Austria for the next fifteen years. It covers all modes of transport and aims at efficiency, safety, quality and usability of the transport networks. It prioritises the foreseen actions into three clusters, each lasting for five years. The estimated overall investments sum up to 1.055 billion EURO for a period of fifteen years.

URL (Austria Telematics Cluster): http://www.attc.at
URL (Austrian Transport Ministry): http://www.bmvIt.gv.at

1.2 France: PREDIT / ARCOS

PREDIT is a programme for research, experimentation and innovation in land transport, started and implemented by the ministries in charge of research, transport, environment and industry, the ADEME and the ANVAR.

By stimulating cooperation between public and private sector, this programme aims at encouraging the creation of transportation systems that are economically and socially more effective, safer, more energy saving, and finally more respectful of mankind and environmentally-friendly.
ARCOS is a 3 year-project (2002-2004) funded in the PREDIT programme. It represents 26 million Euro, 450 person months per year and 58 teams from public and private sectors, who have worked together in close cooperation for three years.

Research has concentrated mainly on four principal road safety functions:

- controlling headways,
- collision avoidance,
- preventing vehicles from leaving the road or lane,
- warning other vehicles about incidents and accidents.

Four modes of operation were highlighted: perceptive (information are given automatically to the driver like speed or obstacle but he keeps total control of the vehicle), mutual control (cooperation between the driver and the vehicle, action are suggested to the driver or even constrained by the car itself), delegation (the driver asks the device to control automatically some functions or the infrastructure requires from the car some action like speed limit) and automatic.

Short, middle and long term targets for each function and each device were identified. Some are mature enough for industrialisation. As for longer term targets, potential for further research has been defined, and teams are ready to continue to work together to make research real products for the benefit of people safety.

The results are of equal importance from the human as the technical perspective. Experimental prototypes have been developed and the ability of drivers to adapt to new technical functionalities has been investigated. In addition social acceptance of the devices has been studied as well as the related legal aspects.


1.3 Germany: INVENT

The INVENT programme of the Federal Government in Germany addresses three areas:

- Driver assistance / active safety,
- Traffic management 2010,
- Traffic management in transport and logistics.

The driver assistance / active safety projects include research on vehicle–vehicle communication and infrastructure–vehicle communication for the implementation of cooperative systems which will warn of dangerous traffic situations and allow efficient traffic management e. g. in congested situations.

A budget of 15 million EURO is foreseen for funding these projects.

URL: http://www.invent-online.de
1.4 French-German cooperative research: DEUFRAKO

DEUFRAKO is a joint venture in the area of transport research between 'Mobilität und Verkehr', the transport research programme of the German Bundesministerium für Bildung und Forschung and 'PREDIT', its French counterpart, which is jointly managed by the French ministries for transport, research, industry and environment with the agencies for energy Management (ADEME) and Innovation (ANVAR).

Traffic telematics is one out of five areas of activities of DEUFRAKO.

URL: http://www.deufrako.org

1.5 Italy: ARTIST

The National ITS Architecture – ARTIST – has been launched on 11th March 2003. The aim of the architecture is to support the development of the ITS market in Italy by ensuring high quality deployments, the interoperability of ITS applications at national and European level, and also to promote integration of transport modes.

The Steering Committee of ARTIST is led by the Italian Ministry of Infrastructure and Transport, which has overall responsibility for the project.

ITS development is considered a major source of potential benefit for the optimisation of transportation activities and therefore has to be co-ordinated with the efforts currently being made to improve Italy’s transport infrastructure.

The need for a national reference Architecture for ITS was identified as a strategic priority in the National Transport Plan. In fact, the project has been funded and actively supported by the Italian Transport Ministry.

URL: http://www.its-artist.org

1.6 Netherlands: SUMMITS

The TNO organisation has started in 2003 a multi annual programme SUMMITS (Sustainable Mobility Methodology for Intelligent Transport Systems) lasting until 2006 for research to make cooperative road-vehicle systems safe, reliable and efficient.

The main aspects within SUMMITS are the design of functional concepts, information exchange, driver’s role and system reliability.

URL: http://www.vv.tno.nl

1.7 Sweden: Knowledge and Innovation within the Road Transport System

The Swedish National Road Administration (Vägverket) has published in September 2003 its Programme for Knowledge and Innovation within the Road Transport System which addresses nineteen so-called development areas. Some of them are directly linked to cooperative systems, such as “Better cooperation within the road transport sector” (DA 11), “More efficient road traffic management and road-user information” (DA 12) and “IT infrastructure within the SNRA to promote cooperation” (DA 14).
The programme aims at research, development and demonstration until 2013.

URL: http://www.vv.se

1.8 United Kingdom: CVHS study

The Department for Transport is undertaking a development study to identify and quantify the benefits and added value of co-operative vehicle highway systems (CVHS).

Many benefits have been predicted and claimed for systems that closely couple a vehicle and its infrastructure, e.g. improvements in road safety, network management, traffic enforcement, journey time reliability as well as new business opportunities.

A critical assessment is planned to test whether adaptation of CVHS techniques might reach these objectives, and if so to devise a strategy for realising these benefits.

The study is expected to be released during the first quarter of 2005.

URL (Department for Transport): http://www.dft.gov.uk

1.9 ERA-NET Transport

The ERA-NET TRANSPORT programme for the period 2004-2007 comprises eleven partners from nine European countries that aim at efficient trans-national research cooperation in the field of transport. ERA-NET TRANSPORT is financed through the European Union’s 6th Framework Programme with the aims to strengthen the European scientific base and to support the structuring of the European Research Area (ERA).

The purpose of ERA-NET TRANSPORT is to develop a European vision for transport research. Its objective is to promote cooperation between national transport research programmes by providing joint procedures, joint programming and joint project management models and guidelines. The programme aims to supply transport and research policy-makers with information about the future challenges and European research priorities.

URL: http://www.transport-era.net

2. eSafety Initiative

eSafety is a joint industry-public sector initiative aiming to reduce the number of accidents by using new Information and Communication Technologies. Advanced Information and Communication Technologies (ICTs) can contribute significantly to improving road safety, enabling sophisticated safety systems that improve road users’ chances of avoiding and surviving accidents.

In 2002 the Commission established an eSafety Working Group collecting together the full range of stakeholders, to agree on the actions needed for accelerating the research, development, deployment and use of ICT for improving road safety. On the
basis of the report of this Working Group, and other consultations, the Commission adopted in September 2003 a Communication on eSafety. The Communication presents the Commission’s recommendations to accelerate the development and deployment of ICT in road safety, in particular the wider, accelerated use of active safety systems called Intelligent Vehicle Safety Systems.

The establishment of the eSafety Forum in 2003 was one of the priority actions brought forward by the Commission Communication. The eSafety Forum, meeting twice per year is a joint platform involving all the road safety stakeholders. The general objective of the Forum is to promote and monitor the implementation of the recommendations of the eSafety Working Group and to support the development, deployment and use of the intelligent vehicle safety systems.

The eSafety Forum created several Working Groups focusing on priority topics that are important for the implementation of the recommendations of the eSafety Working Group, and are in line with the priority actions brought forward in the Commission Communication.

During 2004, nine eSafety Forum Working Groups have continued their tasks on priority topics, under the guidance of the eSafety Forum Steering Group. The Forum held two meetings in Brussels, one in March, and another in September 2004. The results of these Plenary Meetings as well as more information on the Working Groups are available on the eSafety websites:

URL: http://www.europa.eu.int/information_society/programmes/esafety/index_en.htm
URL: http://www.eScope.info

3. United States of America

Among the U.S. Department of Transportation and it’s agency for road transport, the Federal Highway Agency’s (FHWA) Intelligent Transport Systems programmes the initiatives on Cooperative Intersection Collision Avoidance Systems and on Vehicle Infrastructure Integration contribute to cooperative systems research.

URL: http://www.its.dot.gov
URL: http://www.fhwa.dot.gov

3.1 Cooperative Intersection Collision Avoidance Systems

The Cooperative Intersection Collision Avoidance Systems initiative aims to achieve deployment of intersection collision avoidance systems that can save lives and prevent injuries at 15% of the most hazardous signalized intersections nationally, with in-vehicle support in 50% of the vehicle fleet, by 2015.

It builds on research and operational tests conducted under US DOT’s Intelligent Vehicle Initiative. Vehicle Infrastructure Integration will provide the enabling communication capability necessary for cooperative crash avoidance systems, thus VII and this program is closely coordinated.

In partnership with the automotive manufacturers and State and local departments of transportation, this initiative pursues an optimized combination of autonomous-vehi-
cle, autonomous-infrastructure and cooperative communication systems that potentially address the full set of intersection crash problems, culminating in a series of coordinated field operational tests. The field operational tests will also help achieve a solid understanding of safety benefits and user acceptance.

Commercially deployable intersection collision avoidance systems will be developed.

URL: http://www.its.dot.gov/initiatives/initiative2.htm

3.2 Vehicle Infrastructure Integration (VII)

The Vehicle Infrastructure Integration (VII) initiative aims to achieve nationwide deployment of a communications infrastructure on the roadways and in all production vehicles and to enable a number of key safety and operational services that would take advantage of this capability.

VII makes use of the advanced vehicle safety systems developed under the IVI and the availability of radio spectrum at 5.9GHZ recently approved by the FCC for Dedicated Short Range Communications. The VII would enable deployment of advanced vehicle-vehicle and vehicle-infrastructure communications that could keep vehicles from leaving the road and enhance their safe movement through intersections.

It builds on the research and operational tests conducted under the Department's Intelligent Vehicle Initiative. Vehicle manufacturers would install the technology in all new vehicles, beginning at a particular model year, to achieve the safety and mobility benefits while, at the same time, the federal/state/local transportation agencies would facilitate installation of the roadside communications infrastructure.

Vehicles would serve as data collectors, transmitting traffic and road condition information from every major road within the transportation network. Access to this information will allow transportation agencies to implement active strategies to relieve congestion. In addition to these direct benefits to the travelling public and the operators of the transportation network, the automotive companies view VII as an opportunity to develop new businesses to serve their customers.

To determine the feasibility and an implementation strategy, a three-party consortium has been formed consisting of the seven vehicle manufacturers involved in the IVI, AASHTO and ten State departments of transportation and the USDOT.

URL: http://www.its.dot.gov/initiatives/initiative9.htm

4. Japan

Japan has been actively promoting the development and application of Intelligent Transport Systems that use advanced information and telecommunications technologies to link humans, roads, and vehicles. The Ministry of Land Infrastructure and Transport has been very active through the ITS policy and programme division of the road office.

The first "Comprehensive Plan for ITS in Japan" was formulated in 1996. Thereafter, a variety of services entered the market including vehicle information and communication systems (VICS) and electronic Toll Collection (ETC); and there was rapid growth in vehicle-mounted devices such as car navigation systems and ETC on-board units. The widespread adoption of car navigation systems began around 1994, and more
than 15 million units have already been shipped. One in five vehicles is equipped with a car navigation system, and these are becoming standard automotive equipment. VICS services first began in 1996, enhancing car navigation systems by adding real-time information. The nationwide deployment of VICS was completed in February 2004, and about 80% of all car navigation systems currently being sold are equipped with VICS features. ETC services first began in 2001, and this service has spread rapidly. Over 3 million vehicles are equipped with ETC on-board units as of June 2004.

Recently a new proposal called SMARTWAY has been presented. The goals of SMARTWAY are to improve the quality of mobility and transportation in order to realize a society of smart mobility by means of the following four goals: reversing the negative legacy of motorization including accidents, environmental burden, and congestion; ensuring the mobility of the elderly and disabled so that they can get around with confidence; developing affluent communities and lifestyles by promoting the use of expressways and public transportation in order to improve community vitality and bring a sense of affluence; and improving the business climate by ensuring the seamless flow of information and improving the efficiency of distribution.

SMARTWAY is strongly based on co-operative systems and it is designated as a national strategy to achieve these goals, and it is necessary to more strongly accelerate and promote efforts in these areas.

The Advanced Cruise Assist Highway System Research Association (AHSRA) is also very active and influential in developing and promoting co-operative systems.

AHSRA aims to develop the Advanced Cruise-Assist Highway Systems to achieve significant improvements in road traffic safety and efficiency by applying information technology (IT) to road infrastructure.

AHSRA was established in 1996, and worked to clarify the AHS concept and formulate the requirements. Systems were developed to realize those requirements, performed substantiation and evaluation, and also clarified the objectives for safety and reliability on the infrastructure side. This led to the development of applied systems for proving tests that are actually performed in different locations in Japan.

URL (Road office): www.mlit.go.jp/road/ITS
URL (AHSRA): www.ahsra.or.jp
URL (ITS Japan): http://www.its-jp.org