EU Hitachi Science & Technology *forum*

Transportation and IT, Impact on European Society

SUMMARY REPORT

14-16 May 2004, Stockholm

HITACHI
Inspire the Next

Contents

It is my privilege to introduce the summary of the proceedings of the 7th EU Hitachi Science & Technology Forum on "Transportation and IT, Impact on European Society", held in Stockholm, Sweden from 14th to 16th May, 2004.

Since 1998, Hitachi has been hosting the EU Hitachi Science & Technology Forum in recognition of our responsibility to contribute to the public policy debate in Europe. The base of Hitachi's corporate philosophy has always been to contribute to society through science and technology, and in this respect, I believe that the forum has proven to be a unique platform for experts to exchange ideas on how innovation can help solve some of the problems we all face as Europeans. Through the continuation of this programme over the past seven years, I believe that we have been successful in stimulating the debate on finding solutions to improve the quality of our lives.

This summary reflects the conclusions reached by the forum members after three days of intense discussions led by distinguished policy makers, academics, scientists and business experts. The conclusions reflect the views of many European citizens when addressing transportation related societal issues, and suggest possible solutions that might be helpful to those in charge of transportation policy in the European Union. It is our sincere wish that the proceedings help readers to gain insight on the issue of European transportation and to learn what technology and policy measures can and are being taken.

In concluding, my sincere thanks to all speakers, moderators, forum fellows and members who made this meeting so successful, and also to Mr. Mike Sharpe who has so skillfully summarized the abundance of ideas in putting together these proceedings.

Michiharu Nakamura

Michiharu Nakamura, Ph.D.
Executive Vice President & Executive Officer
President, Research & Development Group
Hitachi, Ltd.

What is the
EU Hitachi Science & Technology Forum?

left to right:

Mr. Per Eriksson
Mr. Yasushi Fukunaga

Prof. Phil Goodwin
Mr. Norikiyo Koide

Mr. Hiroaki Nakanishi
Prof. Karl-L. Bång

Since its creation in 1910, Hitachi has kept its founder's commitment to contribute to society through technology. Once more, this longstanding commitment has been demonstrated by the setting up of the EU Hitachi Science & Technology Forum in 1998.

The core participants of this Forum are European scientists, engineers and business persons who have participated in long-term internships in the Hitachi's laboratories, plants or business groups in Japan. The Forum was designed to meet two objectives. Firstly, it provides a platform where these Hitachi alumni can address and discuss societal issues related to science and technology in the daily life of European citizens to contribute to the public policy debate. Secondly, it provides a yearly occasion for all European Hitachi alumni to meet friends and colleagues.

In 1998, the Forum concept was successfully tested with the working theme: "R&D in SMEs, comparison between the EU and Japan". The meeting started on Friday evening and closed on Sunday afternoon, with large breaks giving free time to the participants. This format has been kept ever since. The 1999 Forum discussed societal issues related to "Information technology and its benefits to society". To allow Forum members greater involvement in the organisation of the event, a working group was created appointed for one year. With this development, the Forum was to be run by its members, on topics selected by its members, for the benefit of its members.

In September 1999 a newsletter, European Connextion, was launched as a link between Forum members and Hitachi and as a tool to promote the Forum proceedings. In 2000, the Forum was held in Ireland, following France and Germany, with members coming from across the EU. The theme "Electronic commerce and its impact on society" was covered by scientists, specialists in social sciences and consumers' representatives who all vastly broadened the debate.

In 2001, the 4th Forum took place in Brussels where the theme was "Life sciences and their impact on European society". A further innovation, introduced at the request of Forum members, was a presentation on current Hitachi R&D developments in life sciences. Several Hitachi executives from the EU and Japan attended the Forum and answered questions related to Hitachi's activities. The full proceedings of the meeting were published and widely distributed. The 2002 Forum was organised in Hungary focusing on "Water Issues and their impact on European Society". In addition to the scientific discussions, the location provided an excellent opportunity to discuss the latest developments in relation to EU enlargement. In 2003, the Forum met in Antwerp around the theme "Energy and its Implications for European Society".

The Forum requires the support of experts who have a keen interest in European societal issues, who will be interested in contributing to the overall success of the EU Hitachi Science & Technology Forum through a strong personal commitment. These individuals make the Forum Fellowship. The Forum Fellows are: Mr. Mark Cantley (Advisor, DG Research, European Commission), Dr. Dolf Gielen (Energy Technology Division, International Energy Agency), Mr. Pierre Longin (President, Longin & Associés, Brussels), Dr. Florian Schmitz (Partner, Clifford Chance, Frankfurt) and Mr. Robert Verrue (Director General, DG Taxation and Customs Union, European Commission). The chairman of the Forum Fellows is Dr. Michiharu Nakamura (Executive Vice President and Executive Officer, President, Research & Development Group, Hitachi, Ltd.)

Hitachi, with the active participation of Forum members is committed to contribute to European Society by helping to shape policies which will improve the daily life of their fellow European citizens. In this respect, the EU Hitachi Science & Technology Forum wants to clearly bring the benefits of new technologies to all Europeans.

Transportation and IT,
Impact on European Society

Executive Summary

The 7th EU Hitachi Science & Technology Forum brought together over 100 scientists, engineers, executives, policy-makers and others around the theme "Transportation and IT, Impact on European Society". The Forum addressed the role of information and communication technology (ICT) in transport from three perspectives: safety, security and efficiency.

Transport is a key issue in a policy context. According to the International Energy Agency (IEA), passenger transport in the European Union (EU) will increase by 50% by 2050, and freight transport by 125%. Growth worldwide will be even higher. Energy use in the transportation sector will increase by 130% globally and by 30% in Europe. As well as the obvious benefits, transport impacts on society through congestion, environmental pollution and accidents, the costs of which are not reflected in overall costs of transportation services.

In terms of safety, a variety of safety-related IT innovations are already on the market. These provide warning information to the driver or are able to assume control over vehicle functions in an emergency. Next generation systems will be able to look "further ahead" on the road to inform drivers sooner about potential hazards. Examples include systems able to warn of curves, improve vision in night driving, warn of approaching emergency vehicles, and activate pre-crash safety systems. Improvements to the road environment also offer opportunities to enhance safety. Security has become a much more significant issue in a transport context, as both people and goods travel more. Security impacts the cost/efficiency of transport systems and inevitably there is a trade-off between the two. We are seeing a change of paradigm here, with a shift from a reactive to a pro-active approach. At the same time, we have to ensure any measures taken are proportionate to the risks involved. Technologies such as radio frequency identification (RFID) and location monitoring offer potential solutions but also

raise issues in relation to privacy, trust and liability. From an efficiency perspective, politicians generally see the development and implementation of ICT as a means to reduce the need to invest in expensive new road network infrastructure. This view has its limitations, however. Current networks are already approaching their full capacity and ICT appears to offer only marginal improvements. In reality, the technologies are likely to be applied in a way that enables us to manage demand for transport better rather than simply maximising traffic flow. In public transport, ICT will improve quality of service, a key to increasing demand.

The Forum called for the mandatory installation of preventative crash technologies on all new vehicles to reduce the number of automotive fatalities. The Forum believes that European Union legislation may be needed to encourage car manufacturers to improve automotive safety features, if customers are unwilling to pay for technologically advanced safety solutions as optional extras. Regulatory environments will also need to be updated to take account of security, privacy and liability issues arising as a result of the application of new technologies, if the benefits are to be maximised. In addition, the aspect of human behaviour must be taken into account as the societal issues involved in today's transportation occur from human acts of hazardous driving or unnecessary use/mis-use of transportation technologies. The Forum called for European governments to work more closely with car manufacturers, including research into user acceptance and attitudes to the new technologies.

Introduction

Over 100 participants attended the 7th EU Hitachi Science & Technology Forum held in Stockholm, Sweden from 14th -16th May 2004, where they discussed the theme "Transportation and IT, Impact on European Society". As usual, the gathering attracted a diverse range of scientists, engineers, executives, policy-makers and others. Dr. Spyros Konidaris, of DG Information Society, European Commission, served as Forum General

Moderator, drawing linkages between the presentations and encouraging participants to engage in a constructive analysis of the issues.
Mr. Norikiyo Koide, General Manager of Hitachi Corporate Office, Europe, welcomed participants to Stockholm. He expressed his appreciation to the guest speakers for agreeing to participate in the meeting and to Dr. Konidaris for agreeing to act as moderator. He also welcomed Hitachi interns from Japan and a variety of other guests from industry and government.

Opening the Forum, Mr. Hiroaki Nakanishi, Senior Vice President, Hitachi, Ltd. and Chief Executive for Europe, reiterated that the Forum was based on Hitachi's principle of commitment to society. Participants would find it a different experience as it is a meeting designed to encourage participants to reflect on issues facing European society and in so doing contribute to the wider policy debate. Transport is an important issue worldwide, and is also a key focus for Hitachi's own research and development (R&D) activities.

Mr. Nakanishi thanked the Swedish National Road Administration for the afternoon's visit to the Stockholm Traffic Control Centre, which had provided the opportunity to see state-of-the-art applications of information technology in the city's road traffic management. Stockholm is widely acknowledged as a leader in transportation and there could be no better place to discuss transport issues.

Per Eriksson, Director-General of VINNOVA, the Swedish Agency for Innovation Systems, welcomed the Forum on behalf of the Swedish hosts. We are all travelling more, Mr. Eriksson said, and hence making greater demands on transport infrastructure and on our environment. He was impressed by the commitment of Japanese companies to building their societies as well as their businesses. Europe had much to learn from this model.

Sweden is relatively strong in R&D, explained Mr. Eriksson, committing around 4% of GDP. VINNOVA has a special interest in the topic of the Forum, since around 30% of its research relates to transport and a further 30% to information and communication technologies (ICT). Interaction is a key issue in the knowledge economy, and VINNOVA places special emphasis on encouraging "the Triple Helix" – interactions between policy-makers, research institutes and industry. The Agency is mission-oriented and works closely with the Swedish car industry on various programmes related to intelligent transport systems (ITS).

Can IT Solve The Transport Problem?

Prof. Phil Goodwin, Professor of Transport Policy and Director ESRC Transport Studies Unit, University College London

Prof. Phil Goodwin delivered the Forum's keynote speech. Launching his presentation, Prof. Goodwin said the title should perhaps be phrased in another way: Can technology provide extra effective transport capacity to allow us to travel more, at higher speeds, safely? His proposition was that the way in which advanced information technology (IT) will impact on transport is radically different from what was expected, because of fundamental changes, still to be completed, in the policy context.

There is a strong relationship between growth in incomes and growth in car-based mobility, but it is no longer feasible to seek to provide enough road capacity fully to keep pace with unrestricted traffic growth. Therefore on current trends, congestion will increase, in intensity, duration and geographical spread. The supply of road space will not be matched to the demand, so demand management will provide the key policy context.

One can imagine, Prof. Goodwin continued, a dream role for IT which would use real-time information allowing exact tracking of traffic movements and congestion hot-spots, real-time (fast) external feedback and traffic control systems, and real-time (very fast) in-vehicle detection and automatic collision avoidance. The intended outcome of these technologies would be to maximise traffic flow, and increase safety without the need to reduce speed or compromise freedom of movement and action.

But any system continually operating close to its maximum capacity, and subject to random variation, is inherently unstable, Prof. Goodwin contended. The "predict and provide" approach leads to a vicious circle of self-fulling predictions. It is no longer feasible – if it ever was – to match road capacity to unrestricted traffic growth. If we cannot manage supply, we have to find better ways to manage demand. Prof. Goodwin cited many examples where demand management had been applied successfully, one being the London congestion charge.

The technology will evolve in new directions

because of this new demand-led policy agenda. As a result there will be an unintended and unexpected market dynamic in which technologies introduced for one purpose will evolve a different function. For instance, vehicle-centred, two-way communication set to provide information to drivers about traffic conditions, route advice etc., is likely to evolve into a platform for implementing road-user charging. Vehicle crash avoidance systems set up to enable drivers to travel faster, with closer headways, will evolve into use for "automatic traffic calming" (i.e. instead of speed-humps in home zones). Real-time urban traffic control using integrated traffic signals to maximise traffic throughput, augmented by vehicle detection to distinguish buses, lorries, cyclists etc., will be used to reallocate capacity away from maximum flow, so as to enhance selective vehicle priority measures. In conclusion, Prof. Goodwin noted that the way technology is applied to transport depends on the wider policy context, which is changing fundamentally for reasons of economic efficiency, environmental protection, and quality of life. The dream – technology for capacity and speed – is mistaken. It will be replaced by technology for management and quality.

Recent R&D Achievements in Transportation Technologies

Mr. Yasushi Fukunaga, General Manager, Hitachi Research Laboratory, Hitachi Ltd.

Mr. Fukunaga explained that intelligent transportation systems (ITS) represents the convergence of two extremely important lines of Hitachi technology – transportation systems and information technology. He illustrated this by numerous examples. In the area of propulsion systems, Hitachi is applying simulation technology developed for the nuclear and gas turbine industries to model combustion processes and improve fuel efficiency of automotive engines. The company is also developing advanced motors and motor control technologies for both cars and railways and is actively involved in advanced battery technologies.

A further area is control network systems, where Hitachi's advanced "x-by-wire" technology is being applied into the next generation of trains and cars.

In information systems, Hitachi has major interests in transport telematic systems and in February 2004 integrated its IT and automotive teams to establish a Telematics Business Center.
In conclusion, Mr. Fukunaga noted that electric and electronic technologies are becoming more important for transportation systems to meet market needs in terms of environment, security and safety. Hitachi is committed to contributing next generation solutions for global markets based on its high technology products.

Transportation in the World and the EU: a bird's eye view

Dr. Dolf Gielen, Energy Technology Policy Division, International Energy Agency

Dr. Gielen's presentation set the scene for the morning discussion, providing an overview of the transportation sector and its key policy challenges. His presentation provided a wealth of quantitative data together with some qualitative ideas on the future impact of information systems within the transport sector.

Over the last decade, passenger transport in Europe (EU15) has been growing at the same rate as GDP, while freight transport has been growing much faster than GDP. Around 82% of European passenger transportation is accounted for by road vehicles and the use of passenger cars has more than doubled in the last thirty years; only passenger air transportation has shown stronger growth. Truck freight transport and short distance sea shipping has almost tripled over the last thirty years, while other transport modes have remained constant. The switch to home deliveries, the relative decline of transportation costs, and the increasing value of goods transported are all factors that contribute to the rapid growth of road freight transportation. These trends clearly indicate that road transport is the key transport issue. Transport is also important from an economics perspective. Overall, it accounts for around 20% of GDP and has implications in terms of the economic activity in vehicle manufacturing, investment in transport infrastructure, costs of vehicle fuels, and fuel taxation. Overall, figures suggest the costs for society considerably outweigh the benefits. Internalising these costs, to take account of factors such as congestion, environmental damage, remains a key policy challenge.

Turning to the future, Dr. Gielen noted that growth in transportation will be much higher at a global level than in Europe. Recent work by the IEA projects worldwide growth of 150% in passenger transport and 200% in freight transport by 2050, versus projections for Europe of 50% and 125% respectively. Energy use in the transportation sector will grow by 130% globally and by 30% in Europe. There will be no conventional fuel switch, Dr. Gielen argued, and as conventional oil reserves decline dependency on OPEC will increase significantly. Pollution emissions such as NOx and particulate matter decline dramatically due to better engines, better fuels and end-of-pipe technology, but CO_2 emissions increase in line with energy use. The number of deaths from road accidents keeps increasing, as safety measures are offset by increased transportation activity.
The use of ICT systems could contribute in a number of areas: increased comfort and economic efficiency; increased energy efficiency and environmental benefits; and improvements in safety and security. Key applications will include: better engine management systems; improved logistics and goods tracking systems (based on radio frequency identification (RFID)); road payment systems, and advanced driver assistance systems (ADAS).

THEME I: SAFETY
Future Vehicle Safety

Dr. Ralf G. Herrtwich, Director Telematic & E-Business, Daimler Chrysler AG, Research & Technology

Road accidents remain a major concern, accounting for 127,000 deaths a year in Europe alone and a further 2.4 million are injured. Dr. Herrtwich's presentation focused on the shift in vehicle safety research from passive to active safety systems. In the automotive sector, most innovations are now IT related: some analysts put the figure as high as 70% over the last 20 years. Onboard safety systems has been a major area of development. In the current generation, software systems evaluate sensor input about the vehicle environment and provide warning information to the driver or take over vehicle functions in an emergency. So far, the sensors used are largely based on radar or vision and cover the immediate vehicle surroundings well.

The next step is to look "further ahead" on the road to inform drivers sooner about potential haz-

ards. Map and communication technologies will be key building blocks here and will find their way into advanced driver assistance systems. Maps and communication are just two sides of the same coin, Dr. Herrtwich said, since all relevant information in the telematics horizon is location-based. How quickly information changes determines how it should be communicated into the vehicle. Hence, one major trend in active vehicle safety is to augment onboard systems with offboard information. Dedicated short range communication (DSRC), a variation of the IEEE 802.11 wireless LAN standard, is the leading contender for the communication technology, both vehicle-to-vehicle and infrastructure-to-vehicle.
There are many potential applications. For instance, vehicles in a traffic jam could communicate information about a hazard back to other vehicles so that it reaches upcoming vehicles faster. Emergency vehicles could send out a warning message to warn other road users in the vicinity. And traffic lights could communicate with vehicles by sending out information on their timing and phase to prevent red light violations and potential accidents. The audience much appreciated a series of videos which served to demonstrate Dr. Herrtwich's points very clearly.
Finally, Dr. Herrtwich turned to deployment: how can we ensure the fast and effective deployment of these technologies given that consumers tend not to place a high value on safety? One solution, he suggested, could be to sell the technology on the back of applications that consumers will pay for such as in-car entertainment. Safety is a long and winding road, he concluded, and the first step to make may not be the most obvious one.

Road Traffic Safety
Mr. Torbjörn Biding, Program Director, Swedish National Road Administration

The starting point for Mr. Biding's presentation was Vision Zero, a Swedish initiative which envisages that no-one should be killed or seriously injured in road traffic accidents. It forms the basis for road traffic safety initiatives in Sweden and has resulted in changes in road safety policy and methods of working with road safety issues. The spirit of Vision Zero is that roads, streets and vehicles are increasingly adapted to the limitations of human beings and that the responsibility for safety is shared between the designers and users of the road transport system. Offering road users information on how the system can be improved provides individuals with an opportunity to choose the safest alternatives. Improved consumer informa-

tion about safe traffic solutions increases consumer pressure on the market and speeds up developments in the field.

Cars, roads and traffic systems are still largely designed independently of each other. This must change, Mr. Biding argued. It not, it will become necessary to drastically reduce speed limits to ensure road safety. For higher speeds to be maintained, the traffic environment must be adapted to the levels of crash protection afforded by current vehicle technology. It is possible to maintain current speed levels and reduce the link between speed and traffic fatalities. The greatest opportunity to achieve this lies in improving and combining the safety characteristics of both the road environment and vehicles.

To test these ideas, during the period 1998 – 2002 the Swedish National Road Authority, national and municipal authorities and car manufacturers co-operated in a large-scale field trial entitled Intelligent Speed Adaptation (ISA). The results were impressive. Road safety was improved without any increase in travel times in built-up areas. There was also a noticeable positive effect on other traffic and a substantial reduction in speed violations. The systems attained a high level of acceptance from users and even the automotive industry, which was highly sceptical at first, is now interested in the system. However, the trial suggests that to maximise the benefits ISA should be mandatory in urban areas.

Concluding, Mr. Biding stressed again that the design of the road transport system must be based on human limitations; it must accommodate mistakes and misjudgements. The interface between the driver, the vehicle and the road must be improved. Co-operation between the car industry and road authorities is needed to develop effective, integrated solutions. To help achieve this, the Swedish authorities are working with industrial partners in Intelligent Vehicle Safety Systems (IVSS), a new US$80 programme focusing on emerging technologies and applications. The programme will lay the foundation for, and help introduce, new safety solutions within vehicle and roadside systems.

Identification Technologies in Transport Systems

Mr. Ioannis Maghiros, Project Leader Cybersecurity, Institute of Prospective Technological Studies, European Commission

Mr. Maghiros began by observing that security was becoming a much more significant issue in a transport context. People are travelling more while international trade too is increasing. With enlargement, the EU is expanding its border but also has to police "internal borders" such as airports and container ports. Security impacts the cost/efficiency of transport systems and inevitably there is a trade-off between the two. We need to change our approach to security, so as to be pro-active rather than reactive. At the same time, we have to ensure any measures taken are proportionate to the risks involved.

A number of technologies are available to enhance security, ranging from monitoring (CCTV) to scanning (x-ray), sensing (CO2), communication (GSM/GPRS), identification (RFID) and positioning (GPS). Two technologies that, when combined, are particularly promising are radio frequency identification (RFID) and location monitoring (satellite and terrestrial systems).

Electronic tagging technology based on RFID enables objects to be identified automatically and remotely. It provides dynamic labelling capabilities at very low cost enhancing the flexibility of the supply chain as well as providing a basis for other applications. Unattended bulk identification allows hidden monitoring of objects and people so as to combat fraud and crime. Location monitoring technologies may be used by emergency services or for data mining, profiling and surveillance. By combining monitoring information with location information, they enable goods or people to be tracked with pinpoint accuracy.

Summarising, Mr. Maghiros reiterated that enhancing the security of transportation systems is mandatory in the current climate, since the cost of doing nothing may become huge. The cost/efficiency of new security technology solutions still needs to be proven and privacy protection needs to be addressed. Some security measures lead to productivity enhancements that are beneficial for

the overall system – faster if safer. Extensive collaboration between all actors, rich information sharing and procedural and physical security are key elements in the chain. However, there should be a balance between centralisation and fragmentation. We need to design systems so as to facilitate their "fail safe" capacity, and thus include disaster recovery plans as an integral part of the design. Finally, we need to define measures that limit or contain the consequences of disasters; here the insurance industry could help design and implement them.

Transport Surveillance and Information

Mr. Georg Linde, Clifford Chance

Mr. Linde's presentation focused on a number of areas where the use of location data is currently hotly disputed. The presentation explored the advantages and disadvantages of each of the upcoming new technologies for society and briefly examined the current and likely future regulatory framework for these applications.

The first area was "convenience services" such as m-commerce, location tracking and navigation. M-commerce is one of the most widely awaited applications for 2G and 3G mobile telecommunications. The technology permits localisation of the customer to an accuracy of 100-200 metres through the mobile telephone, and with GPS is even more accurate. This brings benefits in terms of customisation of services, but many would see the highly detailed profiles that the operators are able to build up as a downside.

A mass of data is already collected in this way. However, location data is effectively personal data and under the EU regulatory framework (Data Protection Directive 1995 and Privacy & Electronic Communications Directive 2002) practically no use of location data is allowed except on an anonymised basis. Thus, operators will need to obtain users consent to use this information if it is to drive m-commerce.

A second area is what Mr. Linde described as "the transparent customer". This relates to the use of RFID in situations such as supermarkets, airports and border crossings, and information gathered through customer loyalty schemes. Such technologies offer speed and convenience. But again is this at the expense of giving away too

much personal data, Mr. Linde asked?

The third scenario was "Big Brother": surveillance and the use of location data for investigation purposes. The general acceptance of surveillance in the movement of people and goods is worrying, Mr. Linde claimed. In most EU countries there are practically no restrictions on how such data can be collected (e.g. through public CCTV systems), although eavesdropping and access to location data is generally restricted. As so often, the legal framework lags behind the technology. The key issue is storage rather than access, said Mr. Linde. Defining whether certain data should be stored in the first place takes us a good way towards a policy of acceptable use.

Efficient Road Traffic Management and Operation

Prof. Karl-Lennart Bång, Department of Infrastructure, Division of Transportation and Logistics, Royal Institute of Technology (KTH)

Opening his presentation, Prof. Bång noted that politicians generally see the development and implementation of ITS as a means to reduce the need to invest in expensive new road network infrastructure. Today, a rapid technological development of ITS is taking place with governments, automotive and IT industries and telecom service providers as the main actors.

Three types of customers can be identified. Firstly, road authorities invest in surveillance and IT systems for road traffic management (RTM) and driver information systems with the capability to control, warn and guide the drivers. Secondly, car owners purchase and use in-car equipment provided by automotive industries for intelligent cruise control, navigation and warning systems for car malfunctions, lateral positions etc. Thirdly, individuals make use of their mobile phones to access, inform and debit services developed and provided by IT industries and telecom operators.

Prof. Bång then detailed the use of ITS for road traffic management, focusing on the need for RTM, RTM system architecture and current RTM applications. Current applications include incident detection and management systems, control and

warning systems for roads and interchanges, and network control and information. Participants had had the opportunity to see much of this in action the previous day during their visit to the Stockholm Traffic Management Centre, which Prof. Bång had organised.

At present most ITS applications that have reached a high market penetration focus on providing information to the drivers, enabling them to drive in a safer and more efficient manner. The impact of such systems on efficiency and safety is difficult to evaluate in spite of major research efforts. In future, we might see more systems that relieve the drivers of the driving task. The ultimate solution would be fully automated vehicles operating on reserved carriageways. This opens the possibility to electronically link cars closely together like wagons in a train, with obvious potential for major capacity increases and safety benefits. Concluding, Prof. Bång emphasised that the realisation of the full potential of ITS for road traffic management requires action at many levels. Further internationally coordinated and interdisciplinary research is needed. Much work remains to be done on international standards and guidelines for design, development, testing and evaluation of ITS components and applications. Implementation strategies should be experimented with, based on user acceptance surveys, willingness to pay and system impacts. And greater emphasis is needed on long-term strategies and evaluation of system impacts.

Quality of Service in Transport

Mr. Patrick Labia, Head of Division & Mr. Nicolas Gauthier, Urban Public Transport Division, Land Transportation Administration, French Ministry for Infrastructure, Transport and Housing

Presenting on behalf of the joint authors, Mr. Gauthier explained that France has invested heavily in its urban public transport systems over the last 30 years and developed a dynamic national policy. This has led to two very different situations. On the one hand, the Paris Ile-de-France region, the largest urban area in France, has a very dense but ancient network, with a powerful institutional organisation and integrated fares policy. Overall the quality of service is quite poor in the capital region. In most of the other urban areas, recent and modern networks have been developed, with

good quality of service but as yet the level of network integration is poor.

Moving on to the second element of his presentation, Mr. Gauthier noted that mobility trends over the last 10 years are quite worrying. Usage, measured in terms of the number of trips per kilometre has decreased by 16%, while costs have risen and revenues have fallen. The net result has been that public subsidies have increased by 44%, making the French network one of the most expensive. Despite this, however, the modal share of public transport is stable.

Massive investment in infrastructure is not enough to stop this trend and prevent the share of public transport falling even further. The system needs to be rebuilt around a different model – one based on service rather than infrastructure. Customers are looking for qualitative benefits (comfort, accessibility, safety …) as well as just quantity (whether the buses run). Technology will play a key role in delivering this improved quality of service. One important innovation here is "Navigo", a personalised smartcard using contactless technology. To reduce the cost of the system, the current social policy also needs to be rethought.

Finally, added Mr. Gauthier, a global mobility policy is needed in place of the current infrastructures policy. This should take account of aspects such as multi- and intermodality, the urban environment, quality of service, accessibility and reliability.

WORKING SESSIONS

Working Session I: Safety

Moderator: Mr. Torbjörn Biding, Swedish National Road Administration

Mr. Biding gave a short introduction to the discussion within Working Group I and Dr. Anthony Morton-Blake presented its conclusions. The group had received two presentations on Hitachi's recent work in this field from Mr. Yoshiyuki Sasada and Mr. Yoichi Sugita.

The group welcomed the latest safety innovations but asked how easy it would be to implement them? There appeared to be a dichotomy of interest here. On the one hand, there is the safety authority (usually government) which has to legislate on safety. On the other hand, the car manufacturer has responsibility for implementing the technologies. But they also have to satisfy their customers and safety features tend to be low in

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Dr. Spyros Konidaris with other speakers Mr. Torbjörn Biding

Working session on Efficiency

Working Session on Safety Mr. Ioannis Maghiros, Dr. Ryo Imura

Working Session on Security

the list of customers' concerns. So it comes down to who pays for the new features.

The group had a number of suggestions for improving public consciousness of safety issues. Governments should legislate for safety measures and over-ride commercial concerns. We should make full use of technology to enable us to drive at safe distances and warn us of hazards. Differential road tolls could be considered so as to encourage more freight to be transported by rail. Governments could offer tax discounts to cars fitted with specified safety devices; similarly with insurance companies. Finally, we need a strong education message: motorists who fail to fit safety devices should be castigated and made "social outcasts", in the way drunk drivers have been.

Working Session II: Security

Moderator: Mr. Ioannis Maghiros, Institute for Prospective Technological Studies, European Commission

To launch the debate, the group had heard a presentation from Dr. Ryo Imura of Hitachi's Mu-Solutions Division, on the latest developments in the field. Mr. Niek Ijzinga acted as rapporteur. The group agreed that recent events together with technological developments had put a firm focus on security. The EU is reshaping its borders and the cost and efficiency of security measures is influencing people's mobility – and hence economic prosperity. Emerging identification technologies are at the centre of the debate, in particular in relation to privacy.

Radio frequency identification devices (RFID) – as developed by Hitachi - are a promising development here. This technology has many potential applications in transport. For example it could be used to identify and track containers and their contents. Biometrics is another promising area. Amsterdam airport already uses an iris scanning system. However, biometrics raises the risk of privacy abuse because biometric data is, by definition, highly personal information.

Turning to societal factors, the group stressed the importance of trust in human behaviour. Laws can go some way towards providing this but trust also has to be built into the technologies themselves. For instance, any data collected on passengers

ought to be destroyed after the journey, rather than stored for some undefined purpose, and consumers need to know this will be the case. The group concluded that security technology and trust have to keep pace with the increased use of transport. The cost of security is hard to calculate – and in many ways open-ended – and we have to remember that accepting risk is also an option. Finally, privacy is a major issue influencing security in transport and will become even more so as new technologies are implemented.

Working Session III: Efficiency

Moderator: Prof. Karl-L Bång, Royal Institute of Technology (KTH)

To set the scene, the group heard a presentation by Dr. Takayoshi Yokota of Hitachi Research Laboratory on recent developments in intelligent transport systems (e.g. real time traffic information, toll systems, safety assistance systems, and traffic control systems). Mr. Amaury Catlin acted as rapporteur.
Traffic congestion represents an economic loss of 92 billion in Japan; other speakers had quoted similar figures for Europe. The issue is primarily one of information. People don't have the information to enable them to use the road capacity effectively, for example by altering their travel plans in response to traffic congestion. The group felt the key problem was that nobody wants to pay for the cost of improving this information.
The answer, the group suggested, lay not in a single solution but in a combination of solutions, both technical and non-technical. On the technical side, better use could be made of ITS solutions such as those described by Dr. Yokota, as well as simulators and "smart" infrastructure that is able to communicate with the vehicle. However, the group felt ITS would be less effective in congested urban areas. On the "human side", we have to change behaviours. Driving is a highly personal activity: people cherish the freedom to drive and the fun it provides, and often see their cars as an extension of their personal space. Such habits will be difficult to break.
In summary, the group was pessimistic as to whether ITS could replace infrastructure investments in fighting congestion. This is clearly a multi-dimensional issue where IT solutions need to go hand-in-hand with changes in human behaviour.

left to right

Mr. Nicolas Gauthier
Dr. Dolf Gielen
Mr. Ioannis Maghiros

During the General Q & A Session

Dr. Ralf G. Herrtwich
Mr. Georg Linde

Panel Discussion

The Forum concluded with a panel debate involving all of the speakers, at which participants were invited to raise questions on any aspects of the agenda. The participants used the opportunity to home in on the key issues that had arisen during the meeting.

One questioner was concerned about public acceptance. Will the public accept the innovations we have been discussing? In reply, Dr. Herrtwich stressed that we are not looking for full automation. This is still in the far future, if attainable at all. However, experience has shown that customers are keen on innovations where they are introduced. For instance, navigation systems have quickly caught on in premium sectors of the market and as prices fall penetration will increase in other sectors too. Mr. Gauthier noted that automation is accepted in public transport, since it tends to result in more reliable and efficient services. Many participants were exercised by questions of economics. Is congestion really a damage: how can we measure it effectively? Can we really expect to continue to have free road access? And in the discussion on subsidies, who is subsidising who? On the first point, Prof. Bång explained that congestion is costed on the basis of the value of revealed time – in other words what people are prepared to pay in order to avoid a specific outcome, in this case spending time in a traffic jam. This is a well established field of research. Mr. Gauthier stressed that such figures are only estimates and also time is only one measure – environmental pollution and related health impacts should also be taken into account.

Regarding subsidies, Prof. Bång said the issue could be looked at in several ways. Firstly, general taxpayers and non-users subsidise transport users. Secondly, one mode of transport tends to subsidise another, since charging structures are not the same. Roads are a good case in point: paying according to usage is fairer but is hugely unpopular politically.

Related to economics, one participant wondered what were the implications of transport's dependence on oil and what measures were being taken to overcome this? Dr. Gielen said many measures were potentially available. Improved energy efficiency (i.e. more efficient engines) could make a major impact, as could hybrid vehicles and biofuels. In the longer term, fuels cells could make a significant contribution but would require widespread structural changes as we shift to a "hydrogen economy". Modal shifts (i.e. from one mode of transport to another) and ICT (the main issue for the Forum) could also help reduce oil dependence.

Security was another concern. Does increase in dependence on IT make us more vulnerable, one participant asked? The dependability of IT is a huge issue, conceded Mr. Maghiros. We need to follow the airline's approach and build in redundancy. Dr. Herrtwich said security often comes as an afterthought. Technology should only be introduced when it is ready – rather than when regulators specify – otherwise projects get squeezed. Mr. Linde said consumer pressure had a key role in improving the reliability of security features. Finally, there was the issue of driver behaviour. Will new devices encourage drivers to change their behaviour, so that they drive less safely? Dr. Herrtwich thought not. Developments such as anti-lock braking systems and electronic stability control operate in the background and drivers do not tend to rely on them to compensate for poor driving behaviour.

During the General Q & A Session

Prof. Karl-L Bång (left), Dr. Spyros Konidaris

Working group 2004-2005:
Thanh Lam Nguyen, James Mitchell, Marco Morgandi, Ingeborg Schütz, Martijn Anthonissen,Ronald Hanson, (not in photo) Estelle Molin-Lutz

Closing of the Forum

Dr. Michiharu Nakamura, Executive Vice President and Executive Officer, President, Research & Development Group Hitachi, Ltd.

Closing the three-day meeting, Dr. Nakamura said the Forum had provided stimulating and thoughtful discussion. Participants had addressed a diverse range of issues and had debated them at some depth.
The automotive industry had brought dramatic changes over the last 100 years, Dr. Nakamura said. There had been obvious benefits but also problems, in particular environmental issues, traffic congestion and road safety. "Second generation" vehicles will take much greater account of these externalities and we can expect the social context of the automobile to change as a result. Hitachi is addressing many aspects of efficiency, safety and security and has a strong commitment to improving the next generation of motor vehicles.
Dr. Nakamura thanked Forum members, and especially those in the Working Group, for their enthusiasm and commitment. He acknowledged the expertise of the speakers and moderators. Special thanks were due to the Forum General Moderator, Dr. Spyros Konidaris of the European Commission, who had provided extensive support for the Forum over many months. He also acknowledged the support of the Forum's Swedish hosts, VINNOVA and KTH. Finally, he expressed thanks to Hitachi colleagues for the organisation of the Forum.

Speakers

From left to right: Mr. Yasushi Fukunaga, Dr. Dolf Gielen, Dr. Ralf G. Herrtwich, Mr. Torbjörn Biding, Mr. Ioannis Maghiros, Dr. Spyros Konidaris, Prof. Karl-L. Bång, Mr. Nicolas Gauthier, Mr. Patrick Labia

Prof. Karl-L. Bång	Department of Infrastructure, Division of Transportation and Logistics, Royal Institute of Technology (KTH)
Mr. Torbjörn Biding	Director of IVSS Program, Swedish National Road Administration
Mr. Yasushi Fukunaga	General Manager, Hitachi Research Laboratory, Hitachi Ltd.
Mr. Nicolas Gauthier	Urban Public Transport Division, Land Transportation Administration, French Ministry for Infrastructure, Transport and Housing
Dr. Dolf Gielen	Energy Technology Policy Division, International Energy Agency
Prof. Phil Goodwin	Professor of Transport Policy and Director ESRC Transport Studies Unit, University College London
Dr. Ralf G. Herrtwich	Director Telematic & E-Business, Daimler Chrysler AG, Research & Technology
Mr. Patrick Labia	Head of Division, Urban Public Transport Division, French Ministry for Infrastructure, Transport and Housing
Mr. Georg Linde	Clifford Chance
Mr. Ioannis Maghiros	Project Leader Cybersecurity, Institute of Prospective Technological Studies, European Commission

Working Group for the May 2005 Forum on Urbanisation, Athens

The working group was set up in 1999 to give the Forum members the opportunity to become more personally involved in the selection of the Forum topics, and subsequently in shaping the Forum agenda.

The current working group consists of the following members:

Martijn Anthonissen	The Netherlands
Ronald Hanson	The Netherlands
James Mitchell	United Kingdom
Estelle Molin-Lutz	France
Marco Morgandi	Italy
Thanh Lam Nguyen	France
Ingeborg Schütz	Germany

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