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ITS from Research to Deployment: Global Thinking and Local Action–A Case Study Analysis

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ITS FROM RESEARCH TO DEPLOYMENT: GLOBAL THINKING AND LOCAL ACTION – A Case Study Analysis

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Abstract

This research project explored institutional and organizational factors contributing to successful deployment of Intelligent Transportation Systems (ITS). The researchers conducted a comprehensive internet /literature search on the status of ITS programs in Europe and the U.S., interviewed principals involved in ITS deployment both at the policy and project levels, and from the public and private sectors, and developed four case studies of successful ITS deployment. Results from the internet/literature search and responses from the survey/interviews were analyzed to identify critical institutional and organizational factors for successful deployment and operation of ITS systems/services. The methodology allowed for both a top-down (programs and policies) and bottom-up (project experiences) review and analysis.

Executive Summary

Deployment of Intelligent Transportation Systems (ITS) has three primary aspects not found in traditional transportation solutions: 1) advanced technology insertion, interoperability and maintenance; 2) system approaches at the planning, operational and service connectivity levels; and 3) private industry products and services linked to public infrastructure and services. All three have institutional (across agencies and sectors) and organizational (within a transportation agency) ramifications. To better understand what these are and how they can be effectively addressed, the researchers conducted a comprehensive internet /literature search on the status of ITS programs in Europe and the U.S., interviewed principals involved in ITS deployment both at the policy and project levels, and from the public and private sectors, and developed four case studies of successful ITS deployment.

Five institutional/organizational aspects were investigated:

- Planning and Funding ("programming") Processes
- Decision Support Tools (ITS architecture, benefit-cost methods, performance standards/measures, etc.)
- Deployment Agency Characteristics (structure and competencies)
- Partnership Arrangements (public-public)
- Incorporation of Private Sector Mobility Products/Services

To capture specific project experiences, four ITS application areas were addressed: 1) traffic management; 2) traffic safety; 3) transit services; and 4) integration of multiple ITS services. Projects that represented successful deployments of each were identified and one of each application selected for the case study development. To address varying political and institutional environments, the researchers selected case studies that spanned both the U.S. and Europe, and national (including the European Union or EU), state and regional efforts. The case studies selected were:

Traffic Management:	SIRIUS/IPER - Ile de France/Paris
Traffic Safety	Digital Tachograph for Commercial Trucks - EU
Transit	Le Pilote/Loreiv – Marseilles
Integrated ITS	IMAJINE – Los Angeles

Key findings include a commonality of institutional and organizational environments and issues between Europe and the United States, significant gaps between national public policy objectives and local political realities, ITS deployment successes in spite of traditional transportation planning and resource allocation processes, some organizational innovations that have been effective, very limited success in cooperative ITS public/private sector efforts, and significantly different approaches to ITS research programs between Europe and the U.S.

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Introduction and Project Overview

This project explores the critical institutional and organizational factors contributing to successful deployment of Intelligent Transportation Systems (ITS). ITS deployment has three primary aspects not found in traditional transportation solutions: 1) advanced technology insertion, interoperability and maintenance; 2) system approaches at the planning, operational and service connectivity levels; and 3) private industry products and services linked to public infrastructure and services. All three have institutional (across agencies and sectors) and organizational (within a transportation agency) ramifications. To better understand what these are and how they can be effectively addressed, the researchers conducted a comprehensive internet /literature search on the status of ITS programs in Europe and the U.S., interviewed principals involved in ITS deployment both at the policy and project levels, and from the public and private sectors, and developed four case studies of successful ITS deployment.

METHODOLOGY

Analytical Framework and Survey Instruments

Five institutional/organizational aspects were investigated:

- Planning and Financial ("programming") Processes, incl. O&M
- Decision Support Tools (ITS architecture, benefit-cost methods, performance standards/measures, etc.)
- Deployment Agency Characteristics (structure and competencies)
- Partnership Arrangements (public-public)
- Incorporation of Private Sector Mobility Products/Services

Reflecting this framework, two survey instruments were developed: one that formed the basis for higher -level program and policy discussions with officials within the Ministere de L'equipement du Logement et des Transports (French transport and housing ministry); and a detailed questionnaire to be completed by principals involved in the case study projects and programs cited below. See Appendices C and D for these.

Summary of ITS Deployment Programs and Policies

The internet/literature review and interviews formed the basis of the summaries of ITS programs and policies in Europe and the U.S. included in this report. A supplement on ITS activities in Japan was added as a result of a visit to Japan by the INRETS researcher concurrent with this project. The purpose of these summaries is to construct (and contrast) the current framework for ITS deployment within which institutional and organizational issues must be addressed.

Case Studies

To capture specific project experiences, four ITS application areas were addressed: 1) traffic management; 2) traffic safety; 3) transit services; and 4) integration of multiple ITS services. Projects that represented successful deployments of each were identified and one of each application selected for the case study development. To address varying political and institutional environments, the researchers selected case studies that spanned both the U.S. and Europe, and national (i.e., EU), state and regional efforts. The case studies selected were:

- Traffic Management: SIRIUS/IPER –Ile de France/Paris
- Traffic Safety Digital Tachograph for Trucks – EU
- Transit Le Pilote/Loreiv – Marseilles
- Integrated ITS IMAJINE – Los Angeles

Analysis and Findings

Results from the internet/literature search and responses from the survey/interviews were analyzed to identify critical institutional and organizational factors for successful deployment and operation of ITS systems/services. The methodology allowed for both a top-down (programs and policies) and bottom-up (project experiences) review and analysis.

European Union Policy and Programs

The authorities and roles in transportation of the European Union's governing bodies have evolved, and continue to evolve, over the forty-five years since the Treaty of Rome (1957), which established the European Community (EC) and called for a common EC transport policy. This original mandate went unfulfilled, as the EC's Council of Ministers did not implement such a policy. The Treaty of Maastricht (1991), which established the European Union (EU), further delineated authorities and provided for the fiscal and institutional mechanisms to carry out policies. A European Commission was established to co-function with the Council of Ministers in an executive role and with the European Parliament on legislation, with the Commission having the proactive role of placing issues/proposals on the agenda and providing the bulk of the staffing of the EU. Importantly, this treaty also incorporated the concept of a trans-European transport network and infrastructure, which could be supported (at least partially) with EU funding.

The current EU role in transportation, therefore, is emerging to be somewhat similar to that of the U.S. federal government – establishing policy directions and encouraging policy implementation through funding support that preserves regional/local discretion and flexibility. The level of flexibility, however, may be higher and reflected in the fact that, while the Treaty of Maastricht allows for majority decision-making among Member States, in practice unanimous decisions are the norm. Also, the challenges in "harmonizing" policies, programs and systems across what are sovereign nations, with different languages and cultures, would seem more daunting than those faced in the U.S.

EU TRANSPORT POLICY

The first European common transport policy was published in 1992. This called for opening up transportation markets, reregulating and deregulating surface, air and marine transport. Claiming achievement of this objective in all but the rail sector (excluding the high-speed passenger rail system), the European Commission adopted in September 2001 a new set of common policies in the white paper entitled "European Transport Policy for 2010: Time to Decide". The white paper (a formal policy/action plan in EU context) addresses growth challenges, reconciliation of ever-increasing mobility demand with sustainable development, and improving safety. Major initiatives include: a "rebalancing" of modal shares (for both people and goods); congestion and bottleneck reduction; interoperability of transport systems across and within the Member States; putting the users at the center of transport policies (as to safety, costs and intermodality); "rationalizing" urban transport (energy diversification); and managing the globalization of transport (enhancing EU global role and competitiveness). Pricing and technology strategies have significant roles in these policy initiatives, with Intelligent Transportation Systems (ITS) being highlighted in one of four "annexes" (appendices) to the white paper.

A related initiative – the "e-Europe 2002 Action Plan" – was adopted in June 2000 by the Heads of State and Government to be implemented by Member States and industry. No additional funding was provided; instead the intent is to "pledge" Member States' funding, and influence industry contributions, for transport and research in support of EU policy objectives. Among the Plan's stated aims is to facilitate ITS deployment by accelerating research and development and removing barriers to private mobility service provision. Initial implementation targets are set for 2002 with the thinking that EU global competitiveness in transportation technology could be lost if immediate actions were not taken. Specific 2002 targets are:

- 50 percent of Europe's major cities and towns provided with traffic and travel information services;

- 50 percent of Europe's major motorways to be equipped with traffic monitoring and management systems;

- All new vehicles sold in Europe to be equipped with more effective active safety systems;

- All of Europe's mobile phone users to be provided access to location determination for emergency calls and with full multilingual assistance and emergency services; and

- Legislative initiatives to be undertaken to promote the "Single European Sky" (for air traffic control), mobile communications for rail/maritime information and control systems and for Galileo (the EU's planned, high-accuracy global positioning system for civil use, featuring pay-for-service and third generation GPS bandwidth).

An assessment of Europe's progress toward e-Europe strategic goals is ongoing, including "benchmarking" of major IT areas (e.g., internet access in EU households, pupils per PC, etc.). However, it is not clear if there will be a quantitative assessment of progress toward, or achievement of, the specific ITS targets above.

An "e-Safety" initiative, anticipated in late 2002, will focus on active and cooperative vehicle/highway safety systems for car, bus, truck, and rail modes. These will combine vehicle control technologies with vehicle-center- roadside communications for navigation, hazard warnings and even automated speed control. EU research funding under the 6th Framework (see below) would be provided. The bus/truck industry is expected to support this initiative, with auto manufacturers participating but not committed to control commands from outside of the vehicle (e.g., for speed control). The European auto makers are still reluctant to deploy automatic speed control for cars considering that the German market would not accept such restrictions. New heavy trucks already have factory-installed electronic speed limitation features.

ITS DEPLOYMENT INITIATIVES AND PRODUCTS: 1995-2000

EU funding contributions for road ITS deployment totaled about 125 million euros from 1995-2000. While a number of activities were funded, primary focus was placed on matching mainstream funds (of Member States) to establish a trans-European network of major road corridors, including traffic management systems and travel information services for both goods and passenger movements. Another significant activity, aimed at urban areas within Member States, was the ITS City Pioneers program launched in 1998.

Trans-European Transport Network (TENT-T)

Even to those comfortable with the use of acronyms for concepts and programs, EU project names can be daunting and confusing (even amusing – e.g., FANTASIE, UTOPIA and OPIUM). Practically every ITS-related deployment and research project funded by the EU since the early 1990's have been assigned an acronym. Five such projects formed, and still form, the core of EU efforts to establish an integrated network on the trans-European road network (the highway portion of the TEN-T). All have similar ITS applications – traffic/system monitoring infrastructure, pre-trip and in-trip information, coordinated (cross-border) traffic management and incident response planning, and control centers upgrades/networking. Three (ARTS, CENTRICO, SERTI) have an integrated electronic fee/toll payment application. All are manifestations of a notable event under the EU's first common transport policy – the adoption by the Parliament and Council of Ministers in 1996 of guidelines for the development of the TEN-T.

The five are distinguished mostly by the geographical areas covered and the special needs/environments of those areas (e.g., weather info in VIKING):

ARTS	Southwest Europe: Atlantic coasts of France/Spain/ Portugal
CENTRICO	Central Europe: Benelux/Germany/France/Netherlands/UK
CORVETTE	Alpine: Austria/Germany/Italy/Switzerland
SERTI	Southern Europe: France/Germany/Italy/Spain
VIKING	Northern Europe: Germany/Denmark/Scandinavia

Together with related research projects (see "ITS RESEARCH & DEVELOPMENT PROGRAMS IN THE EU" below), accomplishments claimed for these EU-supported projects in this first stage (through 2000) of ITS deployment include:

- Cross-border user surveys of TENT-T functional needs;
- Definition of cross-border traffic management schemes which allow for rerouting on European corridors during major road blockage events;
- Installation of traffic monitoring/data collection infrastructure;

- Establishment of a European network of traffic management centers using the DATEX specification for information exchange (developed in R&D and other projects);

- Transnational route information (via Internet and other media); and

- Definition of interoperability for electronic toll collection.

These projects are to continue into the EU's next funding cycle under the new TEMPO program (see EU PROGRAMS for 2001-06).

One of the more interesting strategic aspects of the TEN-T development effort is that it is a visible and significant case of applying ITS approaches to create a major highway network where only disjointed elements exist. While "concrete" elements are necessary, they are not seen as sufficient to provide effective system capacities commensurate with the EU's economic and social needs/goals. The outcome by mid-decade of this initiative should be particularly enlightening to the system performance/management dialogue now taking place in California and the U.S. It seems clear even now, however, that European officials and many in the Member States have accepted ITS-enhanced operational approaches as an attractive policy to help "build" capacity and expand mobility options within a growth environment. It should be noted that the EU funds are provided only on a matching basis, and that the deployment initiatives are left to individual Member State budgets.

ITS City Pioneers Program (1997-99)

The ITS City Pioneers Consortium was headed up by ERTICO (ITS America's counterpart in Europe) and included a number of government and industry partners. This EU-funded program promoted the promise of ITS technology applications and developed guidelines for deployment in urban and peripheral areas. These guidelines took the form of three copyrighted documents published by ERTICO in 1998.

The first was a general overview of ITS with a number of ITS "success stories" highlighted, including:

- Residential area access control system, using electronic permits and roadside readers, developed for the 1992 Barcelona Olympics for residents and workers in the city center;

- Central Oslo cordon system for electronic toll collection (priced for transport revenue generation not demand reduction):

- Flexible routing/demand responsive transit, with automated vehicle location (AVL), for suburban/rural service in Flanders;

- Personal security system for Paris metro trains and buses packaging a security control center, emergency response software, bus/train AVL, video surveillance for stations, and alert devices for drivers/agents and users; and

- Real-time traffic and traveler information in the British Midlands.

The second was an ITS Planning Handbook which included general and specific advice on planning issues, including a step-by-step method and checklist for ITS deployment plan development. Individual country planning environments and previous experience were discussed with specific case examples highlighted. Finally, an "ITS Toolbox" document detailed individual ITS technology applications and packages and provided guidance to urban planners on tool selection and integration.

The outreach portion of this initiative was launched at a press conference/executive forum in Stockholm in September 1998. Since then ERTICO has led ITS public awareness efforts in Europe.

ITS DEPLOYMENT: THE EU PROGRAM FOR 2001-06

The EU's new transport investment program, the Multi-annual Indicative* Program (MIP), is designed to carry out the objectives of the common transport policy discussed above and to stimulate ITS deployment across surface, air and marine modes. Within the MIP, the program specifically dedicated to road ITS deployment, TEMPO, initially increases funding to 190 million (from the previous 125 million) euros over the five-year period. As before, half of this funding is provided by the EU Commission's Directorate General for Energy and Transport and half by Member States. This funding contributes to a total budget of 1.2 billion euros over the same period for the five core (road) TENT-T projects (continued under TEMPO) and a new similar project for the United Kingdom and the Republic of Ireland – STREETWISE. Essentially the same set of ITS road applications included in these projects (and discussed above) are identified as the priority applications under TEMPO.

The Commission has specified a list of measures /user services eligible for funding under the MIP - actions within the same application domains of the six projects, plus project management and "horizontal issues" activities including those addressing coordinated planning, technical interoperability, system architecture, organizational issues, enforcement, human factors, and evaluation . It is not clear at this time how many projects will be funded beyond the core six, or how much more EU funding will be made available beyond the 190 million euros.

In addition to funding, the EU Commission plays a key role in "harmonization" of regulations, particularly in the freight sector, and is incorporating ITS applications for this purpose. To illuminate this aspect of ITS deployment, a case study is included below for the "digital tachograph" which facilitates enforcement of truck driving regulations.

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* Indicative relates to the Commission's ability to make "indicative" decisions on future year budgets, thereby providing more consistent support for medium and long-term projects.

Recently, EU governing bodies have made some significant decisions to help launch the next stage of ITS deployment in Europe:

- Go forward with the Galileo (very accurate) global positioning system (more than 3 billion euros) to support ITS applications across modes;

- Issue recommendations promoting the development of a legal and business framework for the participation of the private sector in deploying advanced traffic and travel information services; and

- Approve funding of 17.5 billion euros for the next EU Research and Development Framework Program (6th Framework) for 2002 to 2006, of which one billion is expected to go to surface transport and 200 million euros to ITS-related research.

ITS RESEARCH & DEVELOPMENT PROGRAMS IN THE EU

The European Community launched its 1st Framework Program for research and development in 1984, funding it at 3.7 billion ECU ($4.8 billion). This effort helped define a common strategy for science and technology to support European industrial competitiveness, a theme that has been at the core of the first five programs. Working together, essentially building an integrated Europe, has also been a core theme (now embodied in the "single ITS market" objective in the new MIP deployment program). Quality of life in the new information society is a theme that came to the forefront, as did sustainable growth, in the 5th Framework Program (1999 to 2002, funded at 15 billion euros). Science and technology areas covered under these programs include energy, advanced materials, biotechnology, agricultural and industrial technologies, environmental and marine sciences, telecommunications and information technology, and socio-economic aspects.

Since the "Drive 1" program under the 2nd Framework, ITS research and development has been supported by EC/EU funding. Its evolution has paralleled those in the U.S. in that earlier "scoping" efforts have matured to support more defined and complex ITS applications in both trans-European TENT-T and urban/rural environments. Application packaging, systems integration, human factors and institutional/organizational aspects have all received emphasis in the most recent Framework Programs.

Unofficial results of the "Transport" subprogram projects under the 4th Framework have been summarized by a consortium report (2001) associated with the Directorate General for Energy and Transport (5th Framework results will become available sometime in 2002). Transport subcategories included: strategic, rail, integrated transport, air, urban, waterborne and road. "Key results" relevant (but not exclusively) to road ITS include:

- Galileo: requirements investigated for multimodal transport, findings that it will be economically beneficial to end users, and preferred options identified for public-private partnerships in its design, building and operation;

- Field tests have shown the benefits of integrated urban traffic management for controlling congestion and pollution (specifically citing Turin with a 20 percent travel time reduction and 3 percent shift to public transport and referencing the DIRECT and INCOME Framework projects); and

- Internet-based communication interfaces successfully piloted for intermodal freight and operator/supplier/customer information exchange;

The report, which does not represent the official EU position, goes on to cite policy research, focusing on pricing strategies, compatible and comprehensive payment systems, and policy decision-support with a modular system architecture for related information systems. Human and organizational factors, automated incident detection with variable speed limits, urban traffic/(transit) fleet management coordination and innovative rural (low-density) transit strategies are also cited. Suggested priorities for future research include much of the above and puts forward a vision of seamless, door-to-door transport for people and goods.

Importantly, ITS survived as 5th Framework Program philosophy differed radically from previous programs (as characterized by the European Commission), shifting from “performance for its own sake” to “social and economic problems which face society today”. Resources were to be “concentrated on carefully targeted priorities”. ITS research was funded under “Systems and Services for the Citizen” and “Sustainable Mobility and Intermodality” - two of 23 “key” actions. An appraisal in late 2001 by the advisory group for the latter action area sheds light on the role of ITS within this broader context and outlines process issues and research priorities. Recommendations included:

- Network research activities, balance short-term and long-term research, accepting risk for targeted actions on long-term problem solving, and issue focused call for proposals that can integrate tasks from different areas and contribute to a more effective system approach;

- Take system approach to transport, equipping each mode to serve functions for which it is best suited and promote synergies between modes;

- For policy research, a well-organized and continual dissemination/ exploitation strategy, in cooperation with national/regional/local agencies, should be a high priority, and these same agencies should set targets to implement EU policy objectives;

- Research priorities:
  - first order: economical, fast and secure access to reliable and consistent data on transport demand and vehicle flows; and refinement of forecasting tools

- second order: translating common transport policy objectives to national/regional targets; and analysis/dissemination of best practices; and harmonized evaluation methods; and support for interoperability and standardization
- third order: medium to long-term measures/innovations beyond the 2010 time period of the transport policy.

These priorities are further developed and detailed in the report including optimal, efficient use of transport (to be determined from performance measurement and analysis), multi-modal transport, safety and security, driver assistance technologies, human factors, infrastructure, environment, new propulsion systems, and "supply chain management". The use of advanced information and communication technologies are cited across the areas (including for demand management).

The 5th Framework does in fact incorporate several transportation decision-support projects, and the recommendations for networking of research and multidisciplinary integration of tasks will be implemented in the proposed 6th Framework "virtual centers of excellence" and "integrated project" (see next page) elements. The high-level topic areas for the 6th Framework Program are genomics/biotechnology, information society, intelligent materials/new production processes, aeronautics and space, food safety/health, sustainable development/global change, citizens and governance in the European knowledge-based society, and a "catch-all" - anticipating the EU's scientific and technological needs. ITS research will primarily be funded under the "information society" and "sustainable growth" topics.

ITS research under the Framework Programs tends to focus on real-world problems and projects. For example, INFOTEN and other projects have helped develop/refine the DATEX information exchange specification now in use on TENT-T road corridors. The process is set up to promote partnerships and entertain funding proposals down to the local/regional level provided that more than one Member State is involved. Also, EU R&D contractors are required to submit a "Technological Implementation Plan" that discusses project results and outlines the plan that project partners will use to apply the results and encourage others to do so (however, this requirement is not uniformly enforced across the topic areas). Framework Programs now include an "Innovation and SMEs" (small and medium enterprises) element for business to participate in EU research and to promote best practices.

The 6th Framework, in addition to the innovative "virtual center" network, will add a new approach for research management and product development. For large, complex efforts (over 10 million euros) an "integrated project " mechanism will be introduced which will have one prime contractor (public, private or association) that will be responsible to the EU for product delivery. This will be implemented in both technology development (e.g., for systems integration) and societal (e.g., policy, regulations, standards) efforts. ERTICO and EUCAR (a consortium of automakers – see PRIVATE SECTOR ACTIVITIES) are expected to develop ITS integrated project proposals for 6th Framework funding. It is hoped that the integrated project process will accelerate product development and deployment and create critical-mass consensus on related societal/ institutional issues.

ITS Deployment within EU Member States

As in the U.S., surface transport systems are designed, implemented and operated by “state” (national), regional and local agencies. ITS, therefore, is actually deployed within the EU’s Member States. Two will be discussed here - France and the United Kingdom (UK).

ITS DEPLOYMENT IN FRANCE

The French government’s latest national transport master plan, adopted in July 2001, includes as main objectives optimum use of existing infrastructure, encouraging the use of environmentally friendly modes through information and pricing strategies, and safety. These translated into four priority action items:

- Lead and coordinate multimodal information activities in France;
- Interface state traffic management with local and transit operations;
- Integrate transit and highway fare payment, ultimately with parking/other; and
- Automate data exchange in the freight sector for efficiency/enforcement.

The French transport ministry developed a Strategic Road Management Plan (SDER) in 1997. This addresses three areas: road maintenance, traffic management and travel assistance. Safety is a function and policy objective incorporated into each of these. The SDER identifies six operational levels from urban expressways in the largest metropolitan areas to strategic motorways (including the extensive private toll road system) to national roads that provide only local access. Within this scheme each of the 95 “departments” (equivalent to Caltrans districts) develops its own operational plans and organizational structures based on local needs and conditions, and often coordinate with other departments such as on major trans-European TENT-T corridors.

In fact, the ministry originally gave highest priority under SDER to developing advanced traffic management systems in these corridors and on peripheral motorways around the larger metropolitan areas. Much of this has already been accomplished, including SIRIUS in Paris (one of the ITS case studies cited below), Coraly in Lyon and Marius in Marseilles; five others are on-line in smaller cities and more planned for the future. As with California, France plans to have an advanced traffic management system functioning in every medium-to-large metropolitan area. These state centers will exchange information with those of local operators (using the DATEX specification); and feed information directly to motorists through variable message signs and in-vehicle radios (using the RDS-TMC European standard), to a parallel system of regional traffic information centers (involving other ministries including the police), and through private traveler information services.

In 2002, the transport ministry updated priorities and objectives to align them with the new master plan. These included:

- New software for decision support;
- Better traffic management procedures and definition of network priorities;
- Traffic data collection/dissemination - new budget program called SDIR; and
- Local districts participation and partnership with police/toll roads/media.

The Paris-Lyon-Marseilles corridor was designated as a test bed for SDIR and the data collection network for this given high budget priority.

Public transportation applications of ITS typically fall to regional/local agencies in France. One such effort in Marseilles ("LePilot/Loreiv") is the subject of a ITS case study here (others are listed in Appendix B). However, the state does support ITS for public transport through its various policies and programs outlined above and broad multi-modal ITS research at the National Institute for Research into Transport and Transport Security (INRETS) and the French Road Public Works Research Institute (LCPC) as well as universities and engineering schools. France has an aggressive, nationwide program for interoperable fare payment systems and smart cards addressing transit, freight and inter/ multimodal applications as well as interfacing with non-transport services in the longer term (see Appendix B). Also, the PREDIT research program, involving four ministries of the national government, has focused on broader transport, quality of life and energy/environmental issues, and the integration of these for sustainable mobility. The new program announced for 2002-06 will investigate innovative and integrated public transport, urban goods movement, shifting demographics and demand, and land use/town planning interactions with transportation. This new phase of PREDIT will also facilitate cooperative research between France and other EU countries such as Germany.

Three other items of note regarding ITS deployment in France at the national level: 1) the minor projects portion of the road safety and operations administration budget, where the ITS deployment program resides, was merged with the construction and maintenance administration budget (ITS and signals retrofitting projects under 1.5 million euros "mainstreamed" from one perspective); 2) an extensive private toll road (intercity) system has been constructed that extensively incorporates ITS for both basic functions (e.g., toll collection) and value-added services (e.g., in-vehicle information – see PRIVATE SECTOR section); and 3) with EU funding, France is developing a comprehensive national ITS architecture called ACTIF (building on the Framework project KAREN which first defined a European functional ITS architecture).

ITS DEPLOYMENT IN THE UK

The most recent master plan for transportation in the UK - "Transport 2010" – was published in 2000 by the Department of the Environment, Transport and the Regions. This plan seems to stress new highway construction and capital transit/rail expansion more than that of France, citing "decades of under-investment" (in

relation to other EU countries). Of the £180 billion investment outlined for the ten-year period, £121 billion will be in capital investment (road, transit and rail), cited as a 50-75 percent increase in real terms over investment in the previous decade. This plan emphasizes delivery of the capital program through public-private partnerships. Also cited is that many local level decisions will be required. Among the ten-year targets set for this plan - a 5 percent reduction in congestion from current levels across England, with more in major cities.

One general theme that should have direct relevance to ITS deployment is integration of systems, modes and services. While physical integration is highlighted, electronic connectivity (e.g., information exchange) is incorporated under this designation. Among the ITS applications cited are new technology for better traffic management, smart cards, guided buses and real-time information. An effort called "Transport Direct" is focused on providing public transportation user information and transactional services on a national scale via the Internet by 2003. Building on previous research, the Department of Transport launched in 2001 the demonstration phase of an "Urban Traffic Management and Control" initiative to support local traffic functions and promote open, standard communication protocols.

Independent assessment of progress toward the Plan's objectives is provided to the national government by the Commission for Integrated Transport. In its annual report issued in September 2001, and again in an update in May 2002, the Commission cited a number of issues and made recommendation relevant (but not exclusively) to system performance/management and ITS deployment, including:

- Benchmark performance of UK transport systems (vs. other EU);
- Short-term, small-scale and local improvements tend to be undervalued in appraisal methods – this deficiency should be corrected;
- Balance capital investment and traffic management strategies;
- Promote seamless journeys to make public transport competitive, including integrated ticketing, information and better auto- to-transit interfaces;
- Look at transit "club car" services (e.g., internet/fax), that cannot be provided in private autos, noting that info services will be added here too; and
- Bolster demand management efforts – take bus priority measures and consider "equitable" pricing that will offset the divergence of transit vs. car users costs over the next ten years.

The last item needs some further explanation. First, light rail is cited as a possible "major success story" so bus priority is framed as an additional significant option, not a competitor. Also, transit costs are expected to increase, at least partly due to labor costs, and car user costs projected decrease by 20 percent (also noted is the national government's recent decision to freeze fuel taxes). Noting that Transport 2010 targets assumed pricing actions by 20 local authorities, the Commission asks (in the update) if the national government is ready to support such actions.

Finally, the Commission is investigating “best practices” in Europe (and will do five major case studies). It has initially identified three themes that support effective integrated transport policy delivery in Europe:

- Integrated institutional and funding arrangements;
- Public transport coordination, quality and affordability; and
- Balanced use of street space (typically, separate bus/tram lanes).

On the first item, the UK is cited for having a weaker regional planning process than mainland Europe, with current institutional arrangements being a barrier to realization of Transport 2010 objectives. Also, a “Multi-modal Study (MMS)” process to deliver integrated solutions in the UK is also cited as being potentially counter-productive (in terms of modal balance) because of gaps between the process and funding allocations. For the second bullet above, integrated public transport management structures are cited as critical.

As with France, the UK supports a broad research agenda related to ITS, including traffic modeling, decision-support, vehicle technology (truck safety and “vehicle-of-the-future”), traveler information/travel behavior and other “telematics” items. Some of these are linked to EU Framework programs.

Private Sector Activities in Europe

TRAVELER INFORMATION MARKETS

To date, attempts to provide traffic information through paying, customized service on dedicated in-car devices have met with no real commercial success. National transport agencies in many EU Member States actively supported the launch of dedicated radio receivers (RDS) equipped with a special Traffic Management Channel able to transmit traffic information available on an FM subchannel. The electronic suppliers and auto manufacturers agreed on European "RDS-TMC" standards but the anticipated subscription market did not materialize. Today in-car navigation devices with RDS-TMC are offered as an option on new vehicles. The traffic information is provided free to the option purchaser. The automakers pay a one-time fee to the traffic information providers who aggregate the traffic data supplied by public sector agencies. There have been about 2 million RDS-TMC equipped navigation devices sold in Germany alone and about 20,000 in France since the mid-1990's. This is explained by the structure of local markets. The market for luxury vehicles is much more developed in Germany. Most of these cars (Mercedes 500, BMW 700. Etc) are equipped with route guidance devices. On the other hand, traffic updates and alert overrides are provided on 107.7 FM throughout the French national and toll road systems and can be received on the RDS radios now standard on European cars. There is a simmering interest in this field by the European telecommunications industry who might package value-added services to the automated emergency location feature being developed for cell phones.

EUCAR CONSORTIUM

Europe's major automakers, including Ford, Opel (GM) and Daimler-Chrysler, have formed the European Council for Automotive R&D (EUCAR). This industry consortium facilitates and coordinates pre-competitive research and development on enabling technology and systems integration. ITS-related items that they address include vehicle information systems, human/vehicle interface and advanced vehicle control. The consortium is proposing to participate in the 6th Framework Program through the integrated project process. Specific topics for EUCAR proposals are not known at this time, but areas that have been discussed provide a good working definition of the integrated project approach: "telematics" (i.e., ITS applications) under the Framework's IT society topic would be combined with light weight vehicles under the intelligent materials topic and vehicle emissions technology under the sustainable development topic. A complex and flexible management structure within EUCAR would oversee the entire effort. At this time it seems that EUCAR is proposing a new PROMETHEUS-type program under the European e-Safety and 6th Framework umbrella.

General Observations on ITS Deployment in Europe

- EU political environments in regard to transportation, while differing in detail, are comparable to those of the U.S., with “federal” (EU), “state” (national) and regional/local issues, policies, roles and authorities similar.

- There is a consistent theme across policy and planning documents of the need for quality information on system condition and use, and related collection systems, for investment decision support and policy development.

- For transit, there is also a consistent theme of developing seamless, door-to-door services to be competitive with the private vehicle, with ITS applications playing a key role, and often within a “livable cities” framework.

- As in the U.S., ITS is recognized as an integrated framework and technology toolbox more at the EU level and among leading Member States than at lower levels of government; at the same time, individual ITS technology applications (by any name) seem more integrated into mainstream, including “green”, initiatives than in the U.S. (e.g., bus rapid transit operations within overall “livable cities” schemes).

- ITS architecture development in Europe is lagging U.S. efforts, with France’s ACTIF apparently leading the way (but with no clear path at this time to an EU architecture beyond KAREN); related standards development and implementation, however, may be more advanced in some cases (e.g., RDS-TMC and DATEX).

- The EU has undertaken a substantial ITS deployment initiative to realize a core policy mission – integration of the disparate national systems into a pan-European transportation network (TENT-T) to “build” capacity. While portions are already operational, work continues into the next round of TENT-T deployment funding.

- The EU is about to undertake a major strategic initiative – the Galileo global positioning system – which will support more accurate and expanded ITS services requiring locational information.

- European efforts to supply real-time traffic information to private information service providers have been substantial but have not resulted in a viable pay-for-services market (data gaps and quality may have contributed to this as well as competition from free governmental services); at the same time, France’s private toll road operators do utilize intensive management for maintaining level of service and provide value-added information services on their system, in part to maintain customers and attract users from non-toll national highways.

- The EU and leading Member States continue to support ITS research and refine mechanisms for promoting research-to-deployment; mechanisms that seems particularly effective in supporting ITS deployment are the Framework Programs' process of entertaining proposals by operating agencies down to the regional/local level (provided more than one Member State is involved), and their support for the involvement of small and medium-sized enterprises as well as large corporations.

ITS Policy and Programs in the U.S.

EFFORTS TO DATE

Focused ITS efforts were launched in the U.S. under the federal Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. This act provided funding and direction for ITS research, development, field testing, demonstration and planning. Under ISTEA a national ITS system architecture and standards development effort was initiated, numerous ITS field operational tests were conducted by local/regional/state, academic and private sector partners, four major "ITS priority corridor showcase" efforts funded (supplemented later by five "ITS model deployment" sites), early deployment planning established, and an automated highway system development and demonstration program mandated. ITS America, an association comprised of the broad public-private ITS partnership, became an official advisory group to the U.S. Department of Transportation (USDOT). Many state chapters of ITS America were founded including the California Alliance for Advanced Transportation Systems (CAATS). Recognizing the cross-cutting nature of ITS applications, USDOT established a Joint Program Office to coordinate ITS activities among its modal administrations and to manage the national ITS effort. ISTEA, therefore, provided the foundation for establishing a critical mass of ITS interest and activity. While many of the efforts in the early to mid 1990's were experimental, many (e.g., the Southern California ITS Priority Corridor cited in the IMAJINE case study below) continue today as evolving, broad and substantial ITS deployment efforts. The national ITS system architecture was completed in 1996, with updates and revisions continuing as are related standards development activities.

The subsequent federal surface transportation act – TEA21, enacted in 1997 – continued the national ITS program, putting additional emphasis on ITS deployment. Funding guidelines were adjusted to allow use of mainstream funds for ITS infrastructure. "Mainstreaming" ITS – bringing it into the regular transportation planning and programming (funding) process – became a core principal of USDOT policy. In TEA21, the U.S. Congress directed the Secretary of Transportation to establish guidelines for ensuring conformity with national architecture and standards for ITS-related projects involving federal funding (the Federal Highway and Transit Administrations have recently adopted rules and policies on ITS regional architectures). In place of field operational tests, an ITS deployment category was established and funded at about $115 billion per year. Unfortunately, being one of the few transportation funding sources which did not offset Congressional "earmarks" with concomitant reductions in district mainstream allocations, this ITS fund has become a source of "pork barreling" with Congress earmarking all available funds every year.

Federal support for ITS research and development has narrowed under TEA21. The automated highway system program was eliminated some five years prematurely (given national consortium plans), replaced in one sense with an Intelligent Vehicle Initiative (IVI) with a focus on shorter-term, vehicle-based safety systems. Other ITS research, outside of federal institutions and labs, receives no

dedicated funding. States can allocate their regular research ("SP&R") funds to ITS, and some federal research initiatives include ITS elements. However, there is no federal equivalent to IVI for the other ITS application areas.

ANTICPATING THE 2003 FEDERAL ACT: CURRENT THINKING

A key realization that has emerged with experience in ITS deployment is its link to system operations, management and performance. In this context ITS is seen as the tool box (technologies) and framework (architecture) to enable multimodal, multijurisdictional systems management for maximum performance and safety. This systems, operations-centric, outcomes approach is in contrast to the incremental, capital projects, outputs approach which has essentially shaped transportation planning and programming, and transport organizations, over the recent decades. At the core of the current ITS policy discussion/ debate, therefore, is the need for systems-level processes, outcomes/performance-based decisions, and operations-oriented transport agencies. Also of high interest are mechanisms for better utilizing private market ITS products and services.

The USDOT Joint Program Office, with ITS America and a number of professional associations, has launched a "national dialogue on operations" to address some of these issues. The proceedings of an October 2001 "summit" held in Maryland on this topic, with participation by the core associations involved in the dialogue, put forward a number of general themes, including:

- Increase focus on operations at all levels of government in response to customer needs;
- Define transport operations in a way meaningful to the public, officials and professionals, and foster great awareness of its value;
- Develop information infrastructure to support performance-based decision making, and put increased focus on safety, reliability and security;
- Create linkages between traditional capital planning processes and planning for operations;
- Support and assist homeland security initiatives;
- Facilitate accelerated evolution of cultural change within transport agencies that support operations;
- Enhance interagency coordination and cooperation; and
- Continue funding and support for operations programs/policies at the federal level, and greater participation at state/regional/local levels.

A number of legislative and non-legislative options, and some potential “next steps”, were identified. The extent of the support for these should become apparent as position papers for TEA21 reauthorization are adopted by the individual associations.

ITS America, in its January 2002 “National ITS Program Plan: a Ten-Year Vision”, devotes an entire section (“enabling theme 1”) to establishing a “culture of transportation management and operations” in transport agencies and among decision makers. Culture changes called for include:

- From an engineering-dominated environment to multidisciplinary staffing;
- From fragmented jurisdictions to high levels of cooperation;
- From focus on construction to a focus on reliability and information;
- From independent vehicles and infrastructure to new levels of coupling;
- From a modal focus to a multimodal approach; and
- From arms-length public and private sectors to new forms of cooperation.

Recommendations are put forward to accomplish these changes.

Finally, the events of September 11 and the resultant national priority given to homeland security have caused the ITS community in the U.S. to stress the relevance and potential benefits of ITS deployment for this purpose.

General Observations on ITS Deployment in the U.S.

- Past federal support has created substantial ITS activity and momentum across the U.S., and this support is expected to continue in the next surface transportation act, likely tied to homeland security initiatives at least in part (a bipartisan ITS Caucus has been formed in Congress).

- The early development, adoption and codification (for conformity) of a national ITS architecture should facilitate cooperative and interoperable system deployments across modes and jurisdictions and between public infrastructure and private products/services.

- As within Europe, private ITS markets are still evolving with viable, sustainable business models elusive to date; however, there seems more optimism in the U.S. for realizing ITS market potentials.

- ITS mainstreaming efforts have been beneficial in both incorporating ITS into mainstream planning and programming processes, and in exposing the shortcomings of these processes for systems, operations and performance-based approaches.

- Transport agency organizational structures and cultures have been identified as inappropriate for the challenges and policy objectives ahead.

- The focus on, and discussions around, these shortcomings by USDOT, ITS America and the professional associations are encouraging, as are the somewhat general recommendations from these. However, specific actions and legislative recommendations will need to be developed; and the degree of support for such initiatives from many key stakeholder groups is unknown pending adoption of formal position papers on reauthorization.

- One of the points of contention is whether to establish a separate, substantial funding category for operations/ITS or to continue the “mainstreaming” policy of the current national program. Note that system maintenance issues arise under either scenario.

- Dedicated federal funding for cooperative ITS research and innovation is restricted to a very narrow area (IVI); research funding for other ITS applications excludes key partners whose participation could facilitate the transition from research to deployment. This is in stark contrast to EU Framework programs and processes.

CASE STUDIES

1. SIRIUS/IPER (Ile de France/Paris)

This project/program has been identified as a successful application of advanced traffic management and information services.

Project/Program Overview

SIRIUS (Système d'Information pour un Réseau Intelligible aux Usagers) was initiated in 1986, and the eastern part of SIRIUS went in operation in early 1990. The process to equip the rest of the western part of the Ile de France (Paris regional) network has been lengthy, but the system is expected to be fully operational in 2002.

The SIRIUS system incorporates real-time system condition data collection and advanced traffic management on the state motorways and, with the City of Paris' "IPER" system, on surface arterials and the Boulevard Peripherique (ring motorway). Traffic management includes real-time signal control (through the City's "Surf 2000" system), limited ramp metering, incident identification and coordinated response, and information exchange between state and local operators. Additionally, real-time traffic information is made available to motorists via changeable message signs (including incident alerts and link travel time estimates on alternative routes and at motorway ramps), and through the internet by www.sytadin.equipement.gouv.fr.

Participants

French transport ministry ("state") and City of Paris

Benefits

An independent technical, socio-economical evaluation study conducted in 1994 shows that the SIRUS "eastern implementation" is a success when considering:

- Time savings due to congestion information on changeable message signs: 1.5 to 2 percent of VMT are diverted from the congested network
- Gains for drivers who remained on the network while congestion was posted on the signs estimated between 47 M€ to 65 M€ per year
- Gains for drivers who diverted estimated between 2 M€ to 5 M€/ year
- Benefits for automatic incident detection due to SIRIUS technologies can be estimated at 1.5 M€ per year
- Energy savings are in the order of 0.5 M€ per year

The impact on comfort and safety is not yet evaluated, but there is a very strong positive feedback from the driving population through different panel surveys conducted over two years. The SIRIUS evaluation shows a return on investment of "110 to 185 percent" while traditional new infrastructure solutions in the same region have a return of "40 to 60 percent".

Unique and/or Interesting Aspects

- Special multi-department (district) regional entity (SIER) established within the French transport ministry to oversee SIRIUS for state operations.

- Agreements between state and local agencies for pre-defined, coordinated response to incidents.

- Link travel time estimates for alternative routes displayed on motorways and at motorway ramps via changeable message signs.

- City-controlled ring motorway and resultant interaction between "freeway" and surface arterial operators within the City of Paris.

Obstacles and Issues

Institutional/organizational issues and obstacles identified in an independent audit include:

- Implementation of the western portion lengthy with cost overruns
- Internal jurisdictional aspects of the project (between different administrations within the French transport ministry)were inefficient
- Human resources were not adequately available, and the project did not receive enough priority
- Cost-share ratios between locals and state were not proportional to the higher benefits of the locals
- Transport ministry rules for establishing the public partnership were not clear, and the private sector was hesitant to play an active role
- These obstacles have to be treated to successfully implement the state's ten-year project of real-time traffic information along the 20,000 km of national roads

The audit, however, seemed to recognize cost-effectiveness by inference in not recommending cessation of the SIRIUS program. In fact, the SIRIUS initiative has been expanded and implemented in Lyon (as Coraly), Marseilles (as Marius) and elsewhere with the experience of the first benefiting subsequent deployments.

2. LePilote/ Loreiv (Marseilles)

This program has been identified as a successful application of advanced public transportation systems, with multi-modal trip planning services.

Project/Program Overview

Loreiv is an advanced transit management program, internal to the primary bus/tram/metro operator in the Marseilles region – RTM. Le Pilot is a multi-modal trip planner with links to Loreiv. Some applications are still evolving but in use (even if manually). However, the decisions/funding commitments have already been made by the regional partners to have a fully functional and automated system in place by 2004.

Loreiv components include: automated vehicle location (GPS); location predictive software (using historical and real-time data); integrated electronic ticketing (now transitioning to contactless smart cards), with data links to fleet operations center for passenger counting and demand estimation features; links to the City of Marseilles traffic management center for bus probe data feeds and bus priority requests within overall signal network timing; "next bus" features and data feeds to Le Pilote for traveler information/trip planning. Loreiv was initiated as a driver security measure, and is now also being used for more effective transit management and demand response (e.g., assigning buses in real time to "overflow" routes and locations).

Le Pilote is under the direction of the Marseilles "urban community" a subregional grouping of locals authorized and enabled under a 1999 French law focused on urban planning and administration in major urban areas (similar to an MPO in the U.S.). Le Pilote receives data from several agencies, including the state's Marius traffic center, and provides automated trip planning services across modes – walking, bike, car, transit, intercity rail –with access through France Minitel and internet. Currently, about 7,000 requests per month are handed, with a strong growth curve on use.

Participants

RTM and other transit operators, City of Marseilles, Marseille Provence Metropole (urban community), SNCF – TER (intercity and commuter rail), and French transport ministry.

Benefits

No formal, independent evaluation has been conducted to date on either system. However, RTM management has indicated the following qualitative benefits for Loreiv:

- Improved driver security
- Reduced travel times for buses
- Better and more timely response to over-demand situations
- Improved customer service and satisfaction
- More efficient internal management (MIS functions)

Le Pilot benefits are measured currently in terms of customer use (increasing) and satisfaction (positive).

Unique and/or Interesting Aspects

- Perception of value by management of Loreiv to transit operations without any apparent conflict with capital expansion interests.

- Interaction between transit fleet and traffic operations centers, and perceived mutual benefit of bus priority and bus probe applications.

- Integrated fare payment and anticipated non-transport use of smart cards (e.g., movie tickets) when system is fully operational.

- Urban community structure that controls all transport funds in jurisdiction, with oversight from local officials.

- “Public service delegation” (to private contractors)for transit services that provides income-sharing incentives to grow transit base.

Obstacles and Issues

Institutional/organizational issues and obstacles identified include:

- Partnership among agencies is voluntary
- Human resources adequate now but longer range issue
- Proprietary systems and lack of open standards
- Support/ concern from union perspective on safety/efficiency aspects

3. Digital Tachograph for Commercial Trucks (EU)

This program has been identified as a successful ITS application for traffic safety (and illustrates a "regulatory" approach to deployment).

Project/Program Overview

The primary purpose of the tachograph is to monitor, for traffic safety purposes, the number of hours the vehicle is driven to ensure that drivers observe the rest periods stipulated by EU regulations and do not exceed daily driving times. Installation of the tachograph is required by national and international regulations in Europe (since the 1980's), and the version now in use records daily journey details on a paper disk. However, there have been concerns that the current system is not tamper-proof and that some drivers and the companies that employ them have not been abiding by the rules, which has led both to safety risks and to unfair competition. In addressing this problem, customer surveys have been made and a long decision-making process (approx. eight years) undertaken.

The result is, by no later than 2004, all new commercial vehicles in the European Union will have to be equipped with a digital tachograph. However, the technical specifications, the last of which were adopted in June 2002, will allow industry and public authorities to implement the digital tachograph before then. In the meantime, the European Commission is negotiating with all contracting parties of the UN Agreement AETR (European agreement on road transport) to determine a date for the mandatory introduction in non-EU countries. The AETR agreement mainly comprises Eastern European countries.

A digital tachograph - a kind of "black box" to be installed in interurban passenger buses, trucks, and tractor /trailers to monitor vehicle operations and driver performance - was created in a pilot project conducted under European Community and French ministry of transport auspices with the cooperation of a major electronics supplier (Thomson CSF). The electronic system will work with individual "smart cards" carrying personal data for each driver, which will be inserted in a dashboard slot at the start of each journey. Besides recording the driving times, both the smart card of the driver and the main memory of the device will continually register a range of operating data for each journey such as vehicle speed, mileage, and fuel consumption, all of which will be available for company and public authority use in case of accidents. At the end of each trip or on a daily/weekly basis, the on-board information would be downloaded, stored, and, if required, printed out by a central processing unit at company headquarters. The prototype system operates in a Windows environment.

Participants

EU, Member States, Eastern European (AETR) nations, tachograph firms and the commercial vehicle industry, manufacturers and operators.

Benefits

The technology development is mostly industry funded. Deployment costs will be borne by commercial transport companies. The European enforcement eliminates the market acceptance problem. The benefit at the European level is that "fair competitiveness" in the trucking industry is enabled by providing a technology that should limit fraud concerning the driving time of truck drivers across Europe. It will be a standard to monitor this driving time and no one country can apply a different tool or standard to control the situation.

Also, it is anticipated that the new, stricter control of driving time will reduce accidents due to driver fatigue.

Unique and/or Interesting Aspects

- Regulatory, mandated deployment of ITS technology.

- While the project was not formally linked with the architecture KAREN, linkage with ACTIF will be made in the near future.

- Funds came from EC research program for standardisation, with development funded by private companies.

- In France, as a Member State example, the internal organisation of the Land Transport Directorate (DTT), responsible for enforcement, is being adapted to use of this new ITS tool.

Obstacles and Issues

Institutional/organizational issues and obstacles identified include:

- Common information system at the European level is new for regulation enforcers, although common EU rules existed for the mechanical tachograph
- EU Member States working on the organisational issues for about two years; cited as difficult but interesting experience
- New competencies in project management and IT security have been hired within transport agencies

4. IMAJINE Case Study (Los Angeles)

This program has been identified as a successful effort in ITS applications integration and packaging.

Project/Program Overview

The IMAJINE Project brings together four existing local transportation management facilities in the Los Angeles region:

- Caltrans District 7 freeway management system
- Los Angeles County Metropolitan Transportation Authority (LAMTA) fixed-route bus operations center and database
- Access Service Incorporated (ASI) demand-based paratransit system
- City of Los Angeles South Gate arterial traffic signal control system

This project integrates freeway and arterial street operations in the southeast Los Angeles County along with the LAMTA bus operation database. This includes the synchronization of local and state signals, the adjustment of signal coordination to allow minimum delay in transit operations, and coordination of paratransit with fixed route bus operations.

The project successfully completed its final acceptance test in September 2001. This acceptance test incorporated the machines in each of the agencies, interfacing with the available legacy systems and the communications network. Also tested was the "1.0 Kernel" integration architecture/mechanism for interoperability of systems across modes and jurisdictions in Southern California (an element of the Southern California ITS Priority Corridor).

Participants

Caltrans, Los Angeles Metropolitan Transportation Authority, City of Los Angeles, ASI, and the Southern California Association of Governments and other Southern California ITS Priority Corridor participants.

Benefits

According to participant agency, IMAJINE has successfully demonstrated that legacy systems can be integrated for enhanced system management and service coordination. Bus priority application in "Rapid Bus" cited as reducing travel times by 30 percent.

Other benefits cited were facilitation in evolving new organizational relationships, including strengthening ties between ITS planners and implementers.

Formal evaluation in progress at Priority Corridor level by contractor. Contact Scott Cook at (619) 725 – 6561.

Unique and/or Interesting Aspects

- Integrates legacy systems under regional (priority corridor) architecture developed within national ITS architecture framework.
- Basis for expanded efforts across county through locally funded “Regional Integration of ITS (RIITS)” initiative, including development of a configuration management plan and projects funding evaluation criteria.
- Establishment of an ongoing Regional ITS Coordinating Committee.
- Formal evaluation that addresses multiple applications and synergies.
- Public domain interfaces developed for “plug and play” applications.
- Open ATIS design by one region used by another to avoid redundancy.
- Link to county ITS early deployment planning (federal program).
- Possible model for research/demonstration to deployment approaches.

Obstacles and Issues

Institutional/organizational issues and obstacles identified include:

- Partnership challenges vary by location and political environments
- Technology system operations/maintenance (O&M) funding not solved
- Gap between ITS benefits analysis and common regional performance measures and transportation models
- Technical support resource gap

General Observations from Case Studies

- Given the institutional/organizational issues focus of this research, the four ITS case studies presented are considered successful because they are beyond the research stage, in stable operation and delivering the services for which designed (even if additional functionality is planned). Benefits/ costs are not of primary interest; it is the "how" not the "why" that is the primary focus of this report.

- With the exception of the EU's regulatory action on the digital tachograph (which entailed a regulatory process), the success of every case studied came about in spite of, and not because of, traditional transportation planning and programming processes and organizational structures.

- In two cases, SIRIUS /IPER(Ile de France/Paris) and IMAJINE (Los Angeles), special organizational arrangements were established which facilitated regional and/or multijurisdictional ITS deployment and operations. In one case, Le Pilote (Marseilles), a new permanent regional governmental entity with transportation funding authority– the urban community – will likely facilitate such purposes.

- Almost all respondents cited resource gaps for both technical support (human resources and expertise) and technology system O&M (funding and expertise). Most projects used outside contractors for technical support.

- Many respondents cited that traditional capital project evaluation and funding mechanisms did not adequately capture ITS value or resource needs, particularly for O&M.

- Also cited was that the complex, systems nature of ITS confused both public and public officials as to value/needs.

- The value of ITS "mainstreaming" efforts to date were cited, but also the need for planning and funding tailored to ITS/system management (sometimes by the same respondent). One interpretation of these responses would be that both ITS mainstreaming and special system-level planning and funding for ITS is needed. This is in contrast to some current discussion (at least in California) on mainstreaming vs. dedicated funding as if the two were mutually exclusive options.

- With the exception of the EU's regulatory action on the digital tachograph, there was little evidence that these cutting-edge efforts have been able to find a viable mechanism for delivering private sector ITS products and services in coordination with public agencies. Only Japan (see supplement below) provides such an example.

- The top-down EU and national policies and programs for ITS (comprehensive and integrated vision, architectures, standards, etc) and the bottom-up local/regional projects studied (three of the four) present some interesting contrasts and synergies:

Contrasts:

- In spite of the ITS label and higher-level integrated visions and policies, each project needed to deal with local constraints and opportunities. The ITS vision is often fuzzy at the community level. It is noteworthy that both SIRIUS and Loreiv were initially "sold" as safety and security projects, with system performance aspects secondary at the outset.

- No clear rules for public/private participation in ITS deployment exist at the community level. While discussions in the global ITS arena focus on business models, the models seem less relevant to local practices where the political label is often paramount (e.g., safety and security) and determines the level of justification needed for a capturing support.

- Only Japan, if one goes beyond the four cases, offers a clear success story of private ITS products and services tied to public infrastructure and services. However, the transferability of this example to Europe and the U.S. is questionable.

Synergies:

- ITS architecture and standards contributed significantly in at least one case studied – IMAJINE – and to the development of the European TENT-T road network if one looks beyond the four specific cases.

- EU-funded research projects and products fed all three European cases studied.

- Several respondents indicated that they monitored the progress or results of other projects in designing and implementing their efforts. It would seem that "state-of-the-practice" information has been, and would continue to be, useful for local ITS practitioners.

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APPENDIX A

CONTACTS AND WEBSITES OF PROGRAMS CITED IN REPORT

EU POLICIES/MIP and FRENCH PROGRAMS

Numerous interviews with officials within the French transport ministry. Contact pconroy@path.berkeley.edu or ygnace@inrets.fr

TENT-T PROJECTS

Websites:
ARTS: www.arts-mip.org
CENTRICO: www.itsproj.com/centrico/index.html
CORVETTE: www.eu-corvette.com
SERI: www.sert-mip.org
VIKING: www.viking.ten-t.com
STREETWISE: www.streetwise.ten-t.com

ITS CITY PIONEERS

Barcelona, Oslo, Flanders, Paris and British Midlands outlined in text, plus a number of other ITS deployment, planning and organizational case studies. See Bibliography and contact ERTICO for updates:
p.kompfner@mail.ertico.com

UK PROGRAMS

Transport Direct: www.dtlr.gov.uk/transdirect/what/index.htm
Urban Traffic Management and Control (UTMC): www.utmc.dtlr.gov.uk/index.htm

EU FRAMEWORK RESEARCH PROGRAM RESULTS

Transport Research Program Knowledge Center
Website (nowww): “europa.eu.int/comm/transport/extra/home.html”

US PROGRAMS

National Operations Summit: Valerie Briggs (703) 917-2197.
ITS America: (202) 484-4847; www.itsa.org

APPENDIX B

SELECTED LISTING OF OTHER ITS-RELATED EFFORTS in EUROPE

TRANSIT

Rouen, France: Bus Rapid Transit

Tram-like bus operations with separate right-of-way, priority signaling and automated docking at stations. Contact: John Marino, MATRA Transport International, Maywood, NJ. (201) 843-6687.

Turino, Italy: Integrated Traffic/Transit Management

See p. 8 of *Intelligent Transport Systems: Results from the Transport Research Programme* referenced in Bibliography above.

Zurich, Switzerland: Transit, Technology and Livable Cities

Andrew Butler Nash and Ronald Sylvia, *Implementation of Zurich's Transit Priority Program*, Mineta Transportation Institute, San Jose State University, San Jose, CA, October 2001.

Munich, Germany: Transit, Technology and Livable Cities

Stephen Bernow et al, *Putting the Brakes on Urban Sprawl: Innovative Transportation Solutions from the U.S. and Europe*, Tellus Institute, Boston, MA, January 2000.

European Mobility Manager Network

Other transit innovation sites - Salzburg, Edinburgh, etc .

Website: www.epomm.org

TRB Transit Cooperative Research Program: International Studies

See reports of "missions" (tours) 1994 + (active project J-03) on website: "www4.nationalacademies.org/trb/crp.nsf/All+Projects/TCRP+J-03"

TRB Committee for an International Comparison of National Policies and Expectations Affecting Transit

Making Transit Work: Insights from Western Europe, Canada and the U.S., TRB Special Report 257, Transportation Research Board, National Academy of Sciences, Washington, D.C., 2001

HIGH-TECH CARPOOLING AND PARKING: "Tecapsy" Project

Website: www.tecapsy.com

ADVANCED TRAVELER INFORMATION SYSTEMS

Travelguide Consortium Newsletter: Contact: *Christian.Knoll@iao.fhg.de*

Sample Services:
www.viamichelin.com
www.citefutee.com
www.webraska.com
www.sytadin.equipement.gouv.fr

TRANSPORTATION MANAGEMENT SYSTEMS w/TRAVELER INFO

Websites:
www.coraly.com
www.infoten.com

PRIVATE INDUSTRY ASSOCIATION: EUCAR

Website: www.acea.be/eucarinternet

SYSTEM ARCHITECTURE

France ACTIF: www.its-actif.org

KAREN Case Study:
Job J. Klijnhout*, Bridges of Amsterdam: A Coordinated Development of ITS Architecture,* Netherlands Ministry of Transport, Public Works and Water Management, May 1999.

SMART CARDS

Given the scope and level of aggressiveness in pursuing integrated fare and smart card applications, both the French transport ministry and the RATP of the Ile-de-France (regional transit agency for greater Paris) are excellent sources for information and status on this topic (for France, throughout Europe and elsewhere).

RATP introduced electronic ticketing on its system in late 2001. "NAVIGO" is the result of a partnership between RATP and a French company to provide a secure read/write, contactless card based on an existing standard – "Calypso". Development costs were shared and the pass, which allows for non-transport applications, is available by license. The first stage of implementation targets over one million ticket holders for the Paris Metro and RER systems and is scheduled for completion by 2002. Ultimately, the pass will be on all passenger carriers in the Ile-de-France region. For more information, see article on website: www.itsinternational.com or contact pconroy@path.berkeley.edu

French national efforts are summarized by an October 2001 powerpoint presentation by Mr. J.F. Janin, director of the Mission for ITS within the French transport ministry, updated in April 2002 and available from Pat Conroy at pconroy@path.berkeley.edu.

GENERAL ITS

Laurent Meillaud, *Intelligent Mobility Guide*, Navtech and ERTICO, TIERS COM S.A.R.L., Mezy-sur-Seine, France, October 2000.

Contact: laurent.meillaud@wanadoo.fr

APPENDIX C

OUTLINE OF INTERVIEWS with French Transport Ministry Officials

- ITS DEPLOYMENT TO DATE
  - Results from Previous Projects (notable successes/other)
  - Lessons Learned
  - Role of Research (including EU "Framework") Programs
  - General State of ITS: Public Agencies
  - General State of ITS: Industry and Cooperative P/P

- CURRENT AND NEW ITS INITIATIVES
  - ITS Architecture (s) / Standards
  - ITS /TSM Approaches vs. Traditional Project Processes
  - System Performance / Measures / Data Sources
  - Multijurisdictional Issues
  - Mainstreaming ITS: Policy Issues/ Plans / Programs
  - Resource Allocations (initial investment and O&M) & "MIP"
  - Role of Research: the Proposed EU 6th Framework

- PRIVATE SECTOR PARTICIPATION

  - Incentives for Quick Application Development & Deployment
  - Links to Public Infrastructure / Operations
  - France's Opportunity to Apply Toll Road Operators' ITS Expertise to National Roads
  - Transit Privatization: UK and Elsewhere
  - Private Industry Perspectives

- FRANCE DOT

  - Marketing of ITS: External and Internal
  - Internal Changes: Process and Competencies
  - Specific Planning / Programming Initiatives

- ADVICE ON FOUR CASE STUDY AREAS:

  - Where to Look & Our Initial Thinking
  - Comments on *draft* Project-level Questionnaire

APPENDIX D

ITS CASE STUDY QUESTIONNAIRE
Institutional and Organizational Factors

INTRODUCTION

The application of advanced computing, communication, sensing and control technology to surface transportation has been an area of significant global interest and effort for more than a decade, no more so than in Western Europe and the United States (U.S.). Under the umbrella of Intelligent Transportation Systems (ITS), user services and service "packages" or "bundles" (mutually-supportive services such as traffic management and traveler/ driver information) have been defined, information needs/flows identified, many enabling technologies developed and tested, and ITS architectures and standards developed or in development. Transnational (European Union - EU), national and state/regional programs have tended to view ITS, not as a random mixture of technologies, but as an expanding technology toolbox and a structured framework for supporting mobility services which improve system productivity, connectivity and safety, and user convenience and comfort.

In addition to helping develop ITS technical elements and systems, research (both public and industry sponsored) continues to investigate the range of technical, human and institutional issues relevant to ITS application deployment and sustainability. Many initial ITS efforts have moved from the lab to real-world demonstration and deployment, some successfully and some not. In both cases, transportation institutional and organizational environments have often been a critical factor.

ITS implementation or deployment has three primary aspects not found in traditional transportation solutions: 1) advanced technology insertion, interoperability and maintenance; 2) system (often multijurisdictional) approaches at the planning, service connectivity and operational levels; and 3) private industry products and services linked to public infrastructure and services. All three have institutional (across agencies and sectors) and organizational (internal) implications. To better understand these, and how they can be effectively addressed, this research project will study cases of successful deployments across various ITS application areas and institutional environments in both the EU and the U.S. Your project/program has been identified as a successful application of

_____.

PROJECT/PROGRAM OVERVIEW

This section will contain a preliminary overview of the project or program, including purpose, elements, any teaming arrangements, time period and results/status, that the researchers will provide from their web sources.

The project/program respondents can then correct/update and identify better sources (if appropriate) as part of the questionnaire process, without having to provide the full overview (since respondents' time will be a factor in completing the detailed questionnaire below).

QUESTIONNAIRE

A. Focus of Project/Program

- Was this project/program designed specifically as an ITS demonstration/deployment, or as a service improvement/innovation using support technology?

- If the latter, were you aware anytime during the project/ program of ITS efforts in your nation/state/region (as discussed in the Introduction)? If so, did you try to incorporate ITS objectives into the project/program?

B. Planning and Funding Process

1. Was this project/program initially funded from special or dedicated sources (ITS or other), or did it emanate from a "mainstream" planning/funding process?

2. How is it currently funded?

3. How are the technical system operations and maintenance (O&M) handled – both as to funding (same budget as #2?) and technical support?

PLEASE BRIEFLY EXPLAIN any changes or special issues, including any shared funding/tech/service arrangements with partners.

C. Measures of Effectiveness/Success

1. What parameters/attributes did you or your team set up at the beginning of the project/program to measure/evaluate its effectiveness/success?

   Qualitative:
   -
   -
   -

   Quantitative:
   -
   -
   -

2. What weightings were assigned to these? Did these or the measures change over time?

3. Was there a formal evaluation plan/element? If no, do you know why not? If yes, PLEASE BRIEFLY EXPLAIN, including whether an independent evaluator was enlisted and, if so, whether the evaluator was from the public, private or academic sector.

4. Did you use a standard or existing Benefit-Cost methodology or did you develop one to specifically address ITS and/or related technology/ system management/ private sector applications? PLEASE BRIEFLY EXPLAIN, including data sources.

5. Did you use a (transportation) system performance measurement framework*? If yes, did you use an existing or develop your own framework? PLEASE BRIEFLY EXPLAIN, including specific measures and data sources.

6. Did you conduct user or customer surveys before (for design), during or after (acceptance/satisfaction) the project/ program's initiation? If yes, PLEASE BRIEFLY EXPLAIN.

7. Has any evaluation framework developed to address ITS (or related technology/ system management/ private sector) applications, including any performance measurement framework, been extended in this project's full deployment phase, to other projects/programs and/or to "mainstream" planning or funding processes? If yes, results so far? PLEASE BRIEFLY EXPLAIN.

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* Analytical methods/software which uses data feeds from the field (e.g., highway loops) to measure actual transportation system performance given measures as in #1 above (e.g., travel times before/after project).

D. ITS Architecture/Standards and Decision-Support Tools

Did your project/program employ:

1. Experiences ("lessons learned") from other, similar projects/ programs? If yes, PLEASE BRIEFLY EXPLAIN.

2. Specific ITS, technology or system management planning/analytical tools (models, etc)? If yes, PLEASE BRIEFLY EXPLAIN.

3. Other products or results from ITS research? If yes, PLEASE BRIEFLY EXPLAIN.

4. ITS architectural framework and / or standards? If yes, PLEASE BRIEFLY EXPLAIN, including sources and any regional tailoring required.

5. General observation on usefulness of these and any recommendations to improve. PLEASE BRIEFLY EXPLAIN.

E. Institutional/Partnerships

1. How new was this project/program's institutional arrangement given the traditional modes of the entities involved? PLEASE BRIEFLY EXPLAIN.

2. What were the most and least effective/satisfactory aspects of the teaming/coordination arrangements: among public entities? Between public and private entities (if applicable)? PLEASE BRIEFLY EXPLAIN.

3. What changes were made during or after the project/program to address problems? How well did these work? PLEASE BRIEFLY EXPLAIN.

4. Did your organization become more of a "team player" with other transport agencies because of this project/program? If yes, PLEASE BRIEFLY EXPLAIN.

F. Organizational (Internal) Aspects

1. Did the external partnership/coordination arrangements have any positive or negative impacts on internal organizational processes or competencies within your agency/organization? PLEASE LIST.

2. What internal organizational processes were undertaken before, during or after the project/program launch to better support ITS/ technology/system management goals and execution? Which have been effective? Others being considered? PLEASE LIST and EXPLAIN.

3. Given the nature of the technologies involved, what technical competency gaps were identified and how were these addressed within your agency/organization (new staff added, contractors hired, etc.)? PLEASE BRIEFLY EXPLAIN, including current status.

4. Has there been a change of resource allocations to ITS/system management as a result of this or other successful projects/programs? PLEASE BRIEFLY EXPLAIN.

G. Public and Political Support

1. Did your project/program include a public education ("outreach") element? PLEASE BRIEFLY EXPLAIN, including effectiveness and status.

2. What, if anything, was done to garner support from public officials/decision-makers (elected or appointed)? PLEASE BRIEFLY EXPLAIN, including effectiveness and status.

H. General Observations and Recommendations

1. Based on your experience, which existing EU, national and/or state/regional/local policies/programs/processes best support your ITS/system management/partnership efforts? PLEASE LIST.

2. What are the most significant policy/process barriers? PLEASE LIST.

3. What policy/process/funding changes, initiatives or incentives would you like to see and at what level of government:
   - to better support ITS/system management?
   - to better utilize private sector products/services?
   For both, PLEASE LIST with some indication of importance.

4. Observations/recommendations on ITS technology insertion (investment) and technology operations & maintenance needs/support? PLEASE BRIEFLY EXPLAIN.

5. Any other observations/recommendation relevant to this study?

SUPPLEMENT: Synthesis on the ITS Situation in Japan by Jean-Luc Ygnace, INRETS

- **Joint ITS promotion by four governmental bodies, industry, and academics**

In Japan there are four governmental bodies concerned with Intelligent Transport Systems (ITS): Ministry of Land, Infrastructure and Transport (MLIT); National Police Agency (NPA); Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPMHAPT); and Ministry of Economy, Trade and Industry (METI). These are involved in promoting ITS under the Strategic Headquarters for the Advanced Information and Telecommunications Network Society ("IT Strategic Headquarters") which is spearheading the information technology (IT) revolution in Japan. The decisions made by the former Advanced Information and Telecommunications Society Promotion Headquarters (set up in 1994), including the Promotion of ITS, are carried over to the IT Strategic Headquarters. In addition, the four governmental bodies collaborate with ITS Japan (former VERTIS), which is an industry-academic ITS promotion organization, and the ITS Standardization Committee (former ISO/TC 204 National Committee) that promotes international standardization of ITS.

- **ITS as a national project**

The "Basic Guidelines on the Promotion of an Advanced Information and Telecommunications Society", adopted in February 1995 by the Advanced Information and Telecommunications Society Promotion Headquarters (headed by the Prime Minister), outlines the approach of promoting ITS in Japan:

- Practical application and deployment -
  - ETC
  - Real time traffic info
  - Develop local bases for applying information and telecom technologies (roadside rest areas)
- R&D
- National architecture
- Assistance for international standardization activities

The five governmental bodies jointly prepared in July 1996 a "Comprehensive Plan for Intelligent Transport Systems (ITS) in Japan." This is a master plan that defines the functions and long-term vision for ITS in Japan, and outlines the targets for systematic development and deployment. User views were incorporated by marketing surveys.

- **Priority on ITS for creating an IT nation**

In Japan, ITS is considered as the key for creating an IT nation, and is being heavily promoted. Of note on this point:

Basic Law on the Formation of an Advanced Information and Telecommunications Network Society (IT Basic Law) (Enforced January 6, 2001)
The law outlines the philosophy and direction for measures to create an advanced information and telecommunications society.

e-Japan Strategy (January 22, 2001 decision of the IT Strategic Headquarters)
The e-Japan Strategy is a national strategy wh ich aims to transform Japan into one of the most advanced nations in IT technology within five years. One of the pillars of the strategy is to establish public transport systems which utilize advanced road traffic systems (e.g. ITS), are less affected by congestion and accidents, and allow the users to reach their destinations safely and comfortably with the optimum transportation means and within the shortest time. There are many measures gradually being implemented in urban districts. They mostly deal with bus arrival prediction systems and information kiosk terminals located in the stations. There are some experiments on demand responsive systems (Nakamura). Cell phones and internet are also new means to provide bus information (http://www2.okakoku-mlit/go/jp/BUSI/)

e-Japan Priority Policy Program (March 29, 2001 decision of the IT Strategic Headquarters)
In accordance with the IT Basic Law, the e -Japan Priority Policy Program specifies the measures for implementing the e-Japan Strategy and lays down priority actions to be taken by the Japanese Government:

• Improvement of Road Traffic Information Provision

• Vehicle Information and Communications System (VICS): Commencement of VICS services in most areas in Japan by 2002

VICS can be considered as one of the major ITS deployments in Japan. It gives optimal route guidance to users, taking into account congestion levels on the road network.

Information on road traffic conditions processed and edited by the VICS Center is sent out from beacons set up on roads, using infrared rays on main trunk roads and radio waves (quasl-microwaves) on expressways. The providing of the road traffic information needed by drivers becomes possible through the use of these beacons. Also, information on road traffic conditions covering wide areas is provided by FM multiplex broadcasts via FM radio waves. VICS service is an option for factory installed navigation devices

By 2002, nine million car navigation systems were deployed, almost half with VICS.

• Smart Cruise Systems: Promotion of research and development, and introduction to several expressways (e.g. Second Tomei and Meishin Expressways) by 2003

Functions include:

- Support for prevention of collisions with forward obstacles
- support for prevention of overshooting curves
- support for prevention of lane departure
- support for prevention of crossing collision
- support for prevention of pedestrian collision
- support for road surface condition

• Electronic Toll Collection (ETC): Introduction to major toll gates in the country by 2002 for general users, and commencement of a system within five years that restricts urban expressways to vehicles equipped with ETC devices.

• International Standardization: With the expectation that ITS will grow dramatically in the next five years, expedite the international standardization of related technologies through various activities (including proposals to the International Organization for Standardization (ISO) and the International Telecommunication Union (ITU) on the standardization of cruise assistance systems and Dedicated Short Range Communication (DSRC) systems), while strengthening the international competitiveness of Japan's ITS-related industry.

- **Observations on ITS in Japan**

TheITS deployment in Japan is lead by two driving forces which rely on the federal state action and on industry strategy. The ITS discussions between public and private sectors have been running for the last twenty years and are based on consensus arrangements where each party keep their own field of decision without interference.

In recent years one can point out several key decisions giving a very high importance to ITS as cited above. Others include:

- November 9, 1998 : VICS deployment is decided, and the orientation promotes testing and R&D of ITS systems like ETC, in-car safety devices.

- July 1999 : The federal government decides to expand the national coverage of infra red beacons and DSRC communication protocols. This is in parallel a great emphasis on international standardization process to help the national industrial sector involved in the deployment of the technology (national market).

- July 2000 : The federal government created the strategic headquarters (in a military sense) for the high tech society of information and telecommunications under the Prime Minister.

- December 2000 : Orientation law to put Japan in the forefront of information and telecommunications society. This law defines new strategic and financial procedures to achieve goals. The DOTS can have access to ITS supplemental funds as they relate to the deployment of the information society.

- **The Results**

The industry started to market autonomous in-car route guidance systems in early 1990's. Under the VICS deployment by the national government, the industry also developed real-time traffic information options for their route guidance systems. Today there are 9.5 million route guidance systems on the Japanese roads, with 4.5 millions of them having a VICS real-time info feed option.

The Japan example shows how the private sector initiated a market on its own, and how the public sector was able to capitalize on this existing market to offer added value (for user, society and industry) to existing systems and functions.