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March 21, 2002

FILED ELECTRONICALLY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
445 12th Street, SW
Room TW-A325
Washington, DC 20554

Re: *Ex Parte* Notice in WT Docket No. 01-90: Rules for the 5.850-5.925 GHz Band and Revisions to Part 90 of the Commission's Rules

Dear Acting Secretary Caton:

Pursuant to Section 1.1206 of the Commission's Rules, 47 C.F.R. § 1.1206, notice is hereby given in WT Docket No. 01-90 regarding an *ex parte* meeting on March 20, 2002 between representatives of the Intelligent Transportation Society of America ("ITS America") and the Wireless Telecommunications Bureau's Public Safety and Private Wireless Division. The meeting was held at the FCC.

At the invitation of the Public Safety and Private Wireless Division, Paul Najarian, Director of Telecommunications for ITS America, and Robert Kelly and Mark Johnson of Squire, Sanders & Dempsey L.L.P., counsel to ITS America, gave a presentation on the federal Intelligent Transportation Systems ("ITS") program, the role in the federal ITS program of the 5.850-5.925 GHz band ("5.9 GHz band") for DSRC-based ITS services, and a proposed band plan and licensing and service rules for the 5.9 GHz band.

Representing the Private Wireless and Public Safety Division were John Borkowski, Assistant Division Chief; Peter Daronco, Deputy Chief of the Policy and Rules Branch; Gerardo Mejia, Electronics Engineer; Ramona Melson, Deputy Bureau Chief (Legal); John Schauble, Chief of the Policy and Rules Branch; Scot Stone, Deputy Chief of the Policy and Rules Branch; Nancy Zaczek, Attorney-Advisor in the Policy and Rules Branch; and Herb Zeiler, Deputy Bureau Chief (Technical).

Enclosed with this letter are copies of the presentation materials used at the meeting by Messrs. Najarian, Kelly and Johnson, including:

- "Intelligent Transportation Systems: FCC Briefing" (presentation slides)
- "Delivering the Future of Transportation: The National Intelligent Transportation Systems Program Plan: A Ten-Year Vision" (brochure)
- "DSRC Spectrum: Issues for Licensing and Service Rules" (presentation slides)
- Mercedes-Benz USA: "DriveBy InfoFueling – Telematics beyond the Anytime Anywhere Paradigm" (White Paper accompanying CD video shown during meeting)

Please do not hesitate to contact me if there are any questions about this submission. As indicated below, copies of this notice will be distributed via email to the representatives of the Public Safety and Wireless Division who attended the meeting.

Sincerely,

Mark D. Johnson

Enclosures

Copy: John Borkowski, via email
Peter Daronco, via email
Gerardo Mejia, via email
Ramona Melson, via email
John Schauble, via email
Scot Stone, via email
Nancy Zaczek, via email
Herb Zeiler, via email

Intelligent Transportation Systems

FCC Briefing
March 20, 2002

ITS America

ITS

- Intelligent Transportation Systems employ the power of existing and emerging advanced information, telecommunications, electronics, and other technologies to solve surface transportation problems
- Integrated Telecommunications and Transportation

ITS America

Legislative History

- **ISTEA (Intermodal Surface Transportation Efficiency Act) -- enacted Dec. 1991**
  - **6 years (Dec. 1991 - Sept. 1997); $155 billion authorized**
  - **Completed Interstate Highway System**
  - **Established the IVHS (Intelligent Vehicle Highway System) Program and IVHS America**
  - **ITS National Architecture Completed June 1996**
- **TEA-21 (Transportation Efficiency Act for the 21st Century) -- enacted June 1998**
  - **6 years (Jun. 98 - Sept. 03)**
  - **Many Deployments Underway**
  - **Requested FCC to complete spectrum allocation for Dedicated Short Range Communications**

ITS America

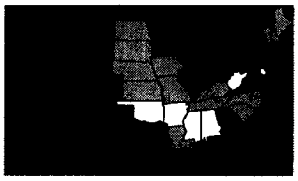
ITS America History and Organization

- **Began Operations in 1991**
- **Multiple roles**
  - Federal Advisory Committee to DOT (Society 501(c3))
  - Scientific and education association
  - Public - Private Partnership
  - Consensus Building Organization
- **Governed by a volunteer Board of Directors**
  - Coordinating Council
    - 24+ Technical committees and task forces
  - State Chapters Council
  - International Council

ITS America

ITS America History and Organization (cont'd)

- **22 State chapters representing 32 states**
- **An organization of organizations**
  - Membership open to any organization
  - 1000 + members
    - Private Sector - 57%
    - Public Sector - 26%
      - includes 37 State DOTs
    - Academic Institutions - 9%
    - Associations - 8%
- **Professional Staff - 48**
  - Includes 3 international fellows



Forming Chapters
- The Carolinas
- The Dakotas
- Heartland
- Louisiana
- Kentucky
- Rhode Island
- Northern New England
- Tennessee

ITS America

Program Evolution

- **National Program Plan, completed March 1995**
  - → **Jointly developed by ITS America and USDOT**
  - → **Short-term "blueprint" of activities to develop, test, and deploy ITS User Services (initially 29 User Services)**
- **National Architecture, Completed June 1996**
  - → **Dynamic process; Additional User Services added (currently 32)**
- **10-Year Research Agenda, Completed Jan. 2002**
  - → **Focuses on Re-authorization (FY 04 and beyond)**

ITS America

User Services Concept

- Define types of services and benefits users will receive
  - Based on needs identified by users and stakeholders
  - Provides a laundry list of options
- Shifts focus from Technology-Push to User-Pull
- Services vary in maturity
- Phased-in Deployment of services will help attain ITS Program goals
- National ITS Architecture must accommodate all User Services
  - Current Version of ITS Architecture (v. 4.0) accommodates all 32 User Services

ITS America

User Service Bundles

1 Travel and Transportation Management
2 Travel Demand Management
3 Public Transportation Operations
4 Electronic Payment
5 Commercial Vehicle Operations
6 Emergency Management
7 Advanced Vehicle Control and Safety Systems

ITS America

1 - Travel and Transportation Management

1.1 En-Route Driver Information
1.2 Route Guidance
1.3 Traveler Services Information
1.4 Traffic Control
1.5 Incident Management
1.6 Emissions Testing and Mitigation
1.7 Highway-Rail Intersection

ITS America

2 - Travel Demand Management

2.1 Pre-Trip Travel Information
2.2 Ride Matching and Reservation
2.3 Demand Management and Operations

ITS America

3 - Public Transportation Operations

3.1 Public Transportation Management
3.2 En-Route Transit Information
3.3 Personalized Public Transit
3.4 Public Travel Security

ITS America

4 - Electronic Payment

4.1 Electronic Payment Services

ITS America

5 - Commercial Vehicle Operations

5.1 Commercial Vehicle Electronic Clearance
5.2 Automated Roadside Safety Inspection
5.3 On-Board Safety Monitoring
5.4 Commercial Vehicle Administrative Processes
5.5 Hazardous Materials Incident Response
5.6 Commercial Fleet Management

ITS America

6 - Emergency Management

6.1 Emergency Notification and Personal Security
6.2 Emergency Vehicle Management

ITS America

7 - Advanced Vehicle Control and Safety Systems

7.1 Longitudinal Collision Avoidance
7.2 Lateral Collision Avoidance
7.3 Intersection Collision Avoidance
7.4 Vision Enhancement for Crash Avoidance
7.5 Safety Readiness
7.6 Pre-Crash Restraint Deployment
7.7 Automated Highway System

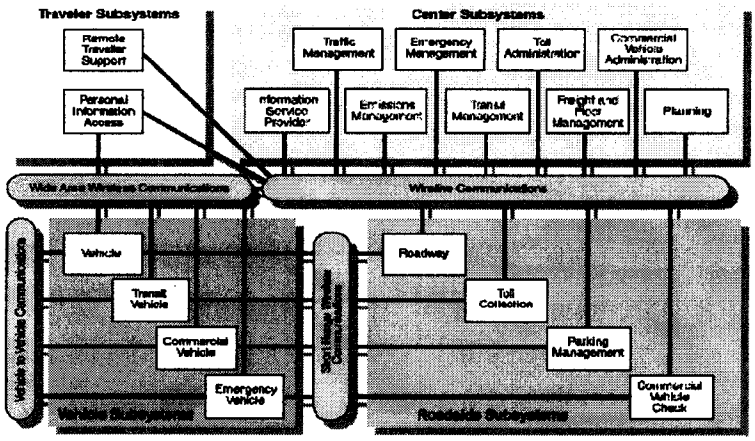
ITS America

Why Do We Need an ITS Architecture?

- **Promote National Interoperability (Statutory Rqmt.)**
  - Regional and International compatibility
  - Compatibility among different user services
  - Consensus agreements basis for standards
- **Accelerate the ITS markets**
- **Framework for the Public - Private Partnership**
  - Ensure public funds are wisely spent
  - Resolves compliance issues for use (or match) of public funds
  - Private products / public infrastructure
  - Benefits and costs understood
  - Avoid proprietary systems

ITS America

System Architecture Diagram



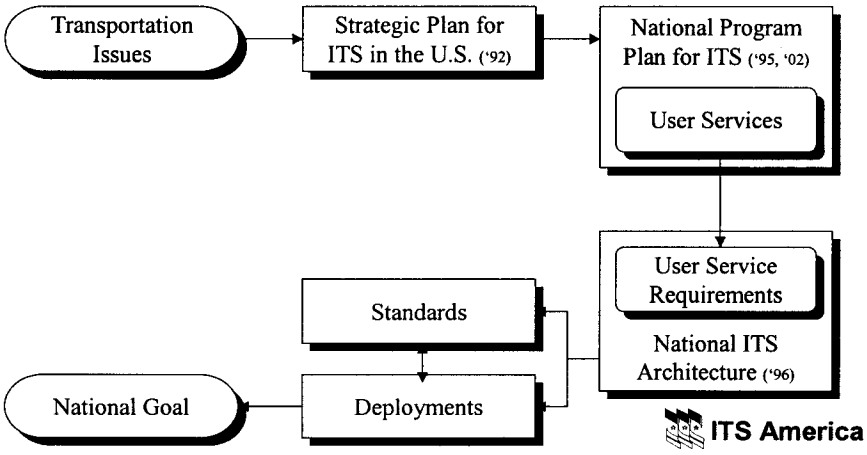
ITS America

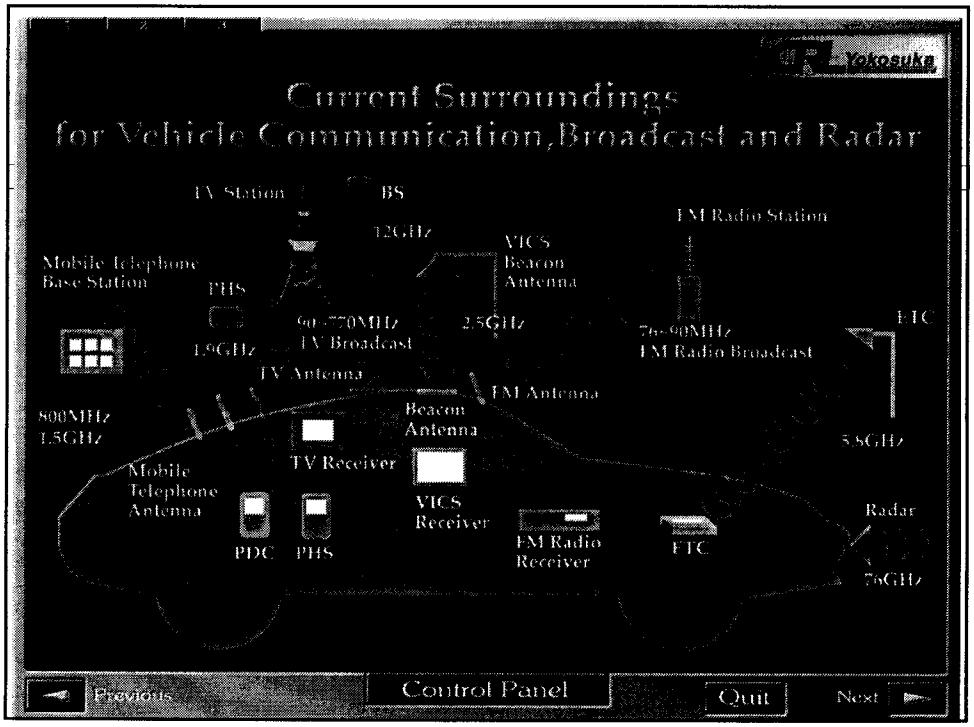
National Architecture Content

- Defines all the Physical, Logical and Institutional interface requirements between the Sub-Systems or User Services
- Provides a tool to develop User Service Requirements
- Identifies the data exchange and message sets at the interface level
- Identifies standards needed at the interface and user service level; e.g. standards requirements document
- Provides market packages for each User Service

ITS America

Deployment and Program Plan





ITS Telecommunications Policy

- Maximize the use of existing and emerging technologies
  - Do not re-invent the wheel
- ITS are a set of applications that can be piggy-backed on existing radiocommunication services or telecommunications networks
- ITS America advocates:
  - the use of the 5850 - 5925 Mhz band for DSRC, as endorsed by the PSWAC
  - the accelerated deployment of E-911
  - allocation of spectrum for vehicle radar systems (above 40 GHz)

ITS America

Regulatory Activities

- **Designation of ITS Radio Services, under Part 90**
- **Location Monitoring Services (LMS)**
- **220 MHz**
- **Above 40 GHz (76-77 GHz allocated for collision avoidance radar)**
- **E-911**
- **Telematics (including AMPS)**
- **Right-of-way issues (Section 256 of the Telecom. Act of 1996)**
- **Allocation of '511' for traveler information (July 21, 2000)**
- **Various issues through the LMCC**

ITS America

2002 Strategic Projects

Telecommunications-Related:

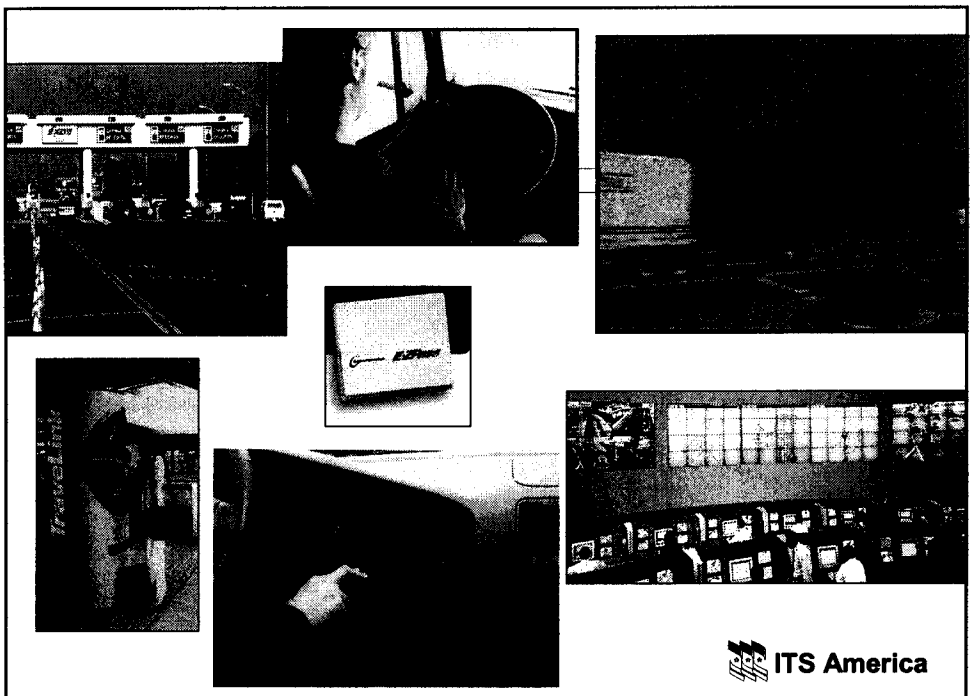
- **Homeland Security**
- **ITS Public Safety Program and E-911**
  - **Integration of ITS Technologies into Public Safety**
- **Implementation of 511 Telephone Number for Traveler Information**
- **DSRC 5.9 GHz Implementation**
- **International/National Standards and Interoperability**
- **10-year Research Agenda and Program Plan**
- **Other Emerging Telecommunications Technologies**

ITS America

Other Telecom Issues/Interests

- **3G Systems - W-CDMA; GPRS**
- **World Radio Communications (WRC - 03) Agenda Items**
  - Spectrum for Public Protection Disaster Relief
  - Band Sharing Between GPS and Mobile Satellite Services
  - Band Sharing Between MSS and Land Mobile Systems below 1 GHz
- **Completion of Nationwide Differential GPS**
- **Digital Audio Broadcast (DAB) Standard**
  - **Deployment of RDS-TMC in the US**
- **Emerging Technologies and Applications (Adaptive Antenna, SDR, UWB, Satellite Radio, VoIP..)**
- **Telematics (in general)**

ITS America



ITS America

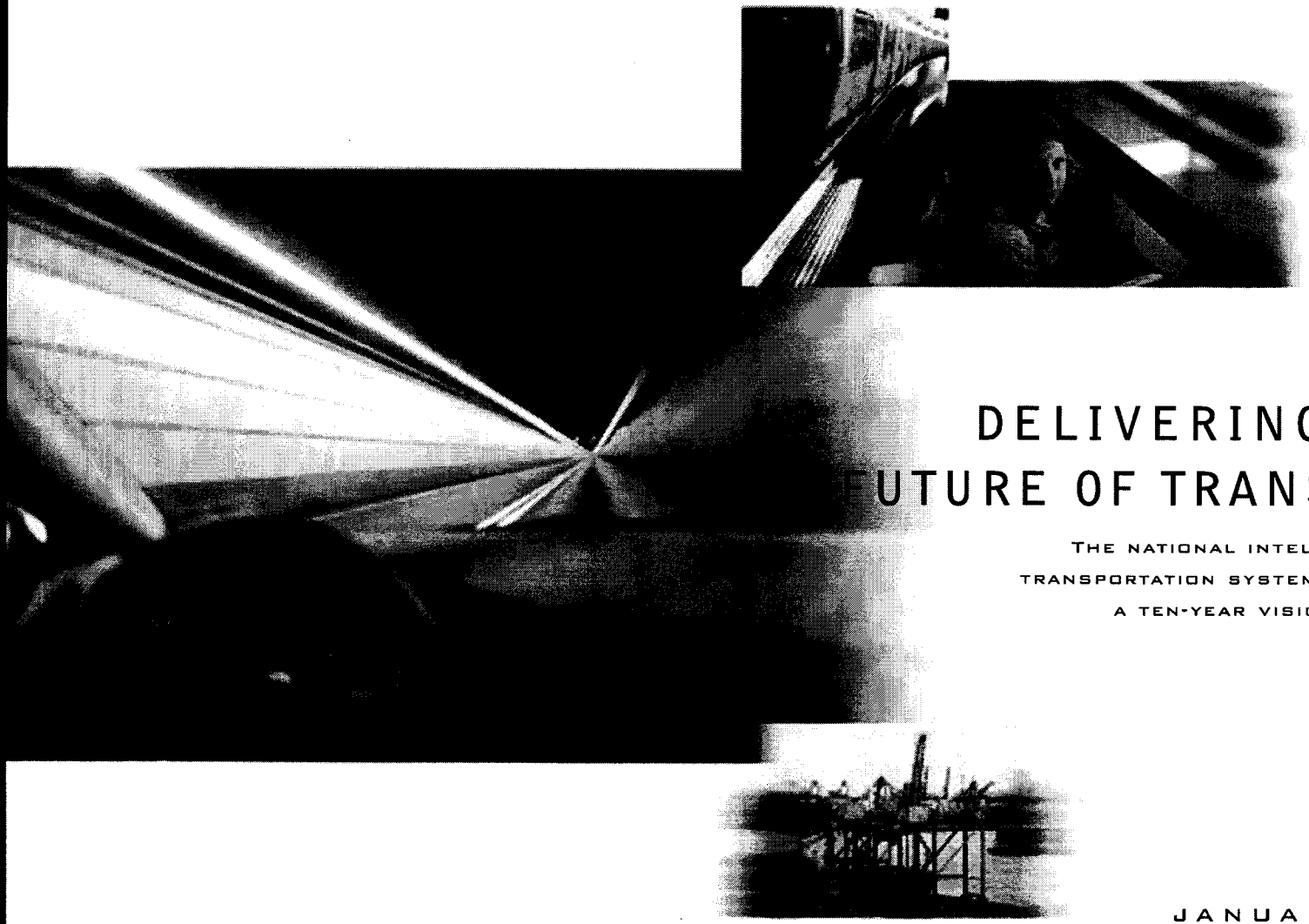
For More Info.

ITS 2002 America

April 29 - May 2, 2002
Long Beach Convention Center
Long Beach, California
www.itsa.org

Paul Najarian (202) 484-4137 najarian@itsa.org

ITS America



DELIVERING THE FUTURE OF TRANSPORTATION

The National Intelligent Transportation Systems Program Plan: A Ten-Year Vision

January 2002

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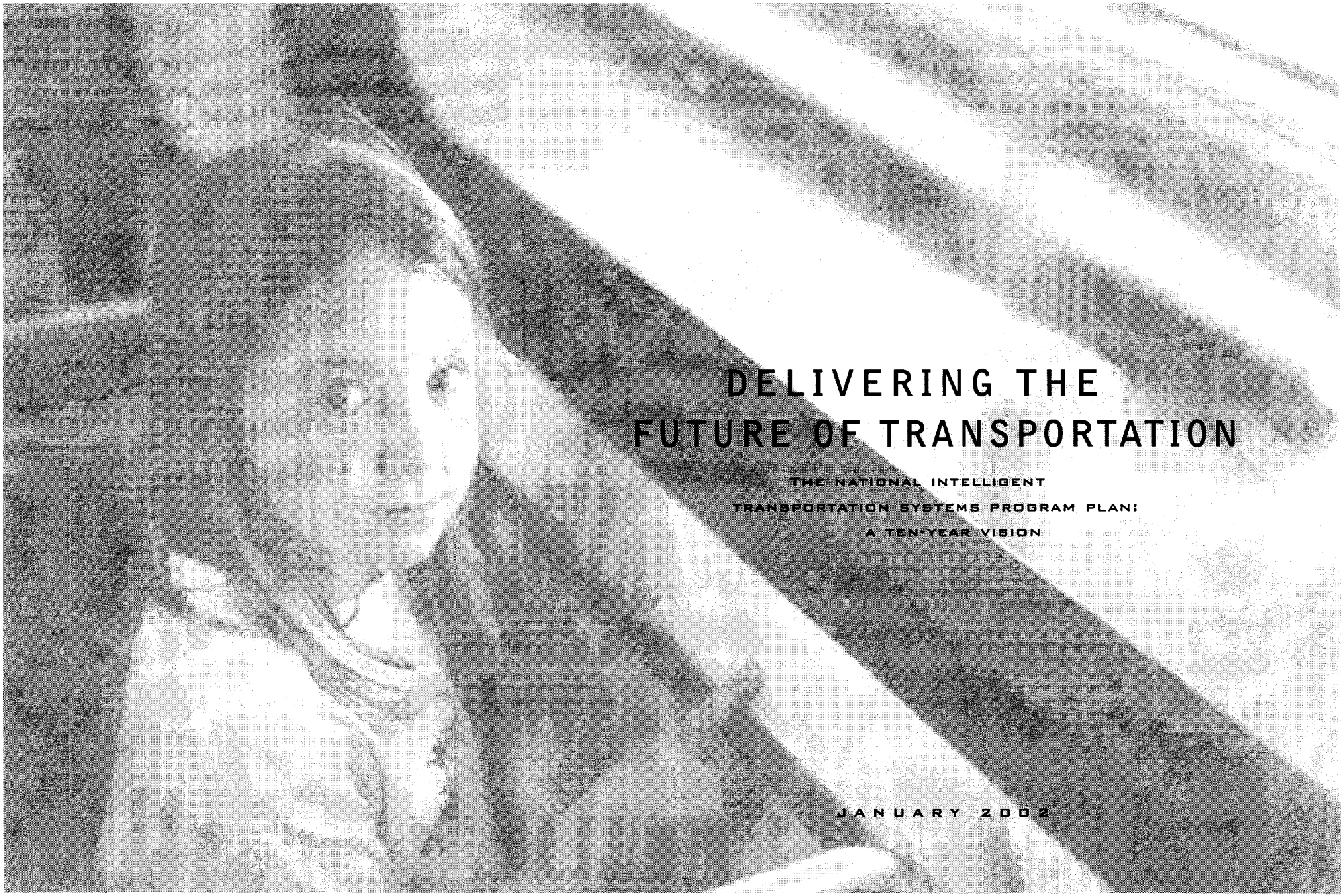
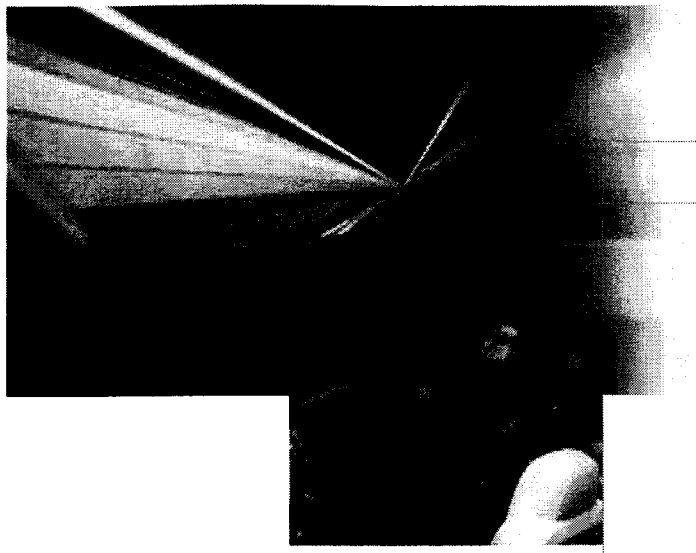


DELIVERING THE FUTURE OF TRANSPORTATION

THE NATIONAL INTELLIGENT TRANSPORTATION SYSTEMS PROGRAM PLAN: A TEN-YEAR VISION

JANUARY 2002



"Intelligent Transportation Systems have already proved their value in improving mobility and safety, not only in North America but in Europe and Asia as well."

Norman Mineta
Secretary of Transportation
April, 2001

INTRODUCTION

Intelligent Transportation Systems (ITS) is the application of computers, communications, and sensor technology to surface transportation. ITS encompasses technologies that can lead to:

- Better management and operations of the existing highway, public transportation and railroad infrastructure to ease congestion and respond to crises.
- Safer and more convenient travel for people.
- More efficient and secure freight movements.

Used effectively, ITS opens the door to new ways of managing, operating, expanding, refining, reconfiguring and using the transportation system.

The objective of *The National Intelligent Transportation Systems Program Plan: A Ten-Year Vision* is to advance the safety, efficiency and security of the surface transportation system, provide increased access to transportation services and reduce fuel consumption and environmental impact.

To accomplish this objective, the Plan describes a broad set of policy, program and research activities, including necessary institutional reforms, enabled by ITS technologies.

Over the past 10 years, the public and private sectors have invested billions of dollars in ITS research and development and in initial deployments of the resulting products and services.

Major public initiatives such as the National ITS Architecture, the Standards Development program, Commercial Vehicle Information Systems and Networks (CVISN), the Metropolitan Model Deployment Initiative, ITS deployment support, transit programs, Rural ITS, public safety activities and the Evaluation program have provided the groundwork upon which this National Program Plan is built. Many of these initiatives are ongoing efforts that support the ideas presented in this Plan and they must keep pace with the changes the next 10 years will bring. They provide vital links and guidance to integration and interoperability to realize this Plan's objectives.

THE VISION

> > >

The ITS Vision is to ensure that:

- Future transportation systems will be managed and operated to provide seamless, end-to-end intermodal travel for passengers regardless of age, disability, or location, as well as efficient, seamless, end-to-end intermodal freight movement.

- Future transportation systems will be safe, customer oriented, performance driven, and institutionally innovative, enabled by information from a fully integrated spectrum of computing, communications, and sensor technologies.

- Public policy and private sector decision-makers will seize the opportunity to make ITS a vital driver in achieving the vision of the transportation system for the 21st century.

ITS brings technology to transportation

THE OUTCOME

>>>

The introduction of ITS technologies into the institutional and funding framework of surface transportation, the current and proposed transportation infrastructure and future vehicle development offers the opportunity to achieve:

- An electronic information network that works in concert with the physical infrastructure to maximize the efficiency, safety and utility of the system, encourage modal integration and consumer choice, and provide quick response in times of national crises.
- Secure systems that can both detect and respond to regional crises.
- Far fewer and less severe crashes for all types of vehicles and far faster response and recovery when crashes do occur.
- Information for operators and users of the transportation system to help contain congestion and increase the effective capacity of the system while reducing the need for new construction.
- Facilities, technology, and information that help reduce energy consumption and negative environmental impact.
- A vital domestic ITS industry that is able to compete effectively at home and in the international marketplace.

15-40% reduction

in accidents with

ramp metering

THE GOALS

The National Intelligent Transportation Systems Program Plan: A Ten-Year Vision **identifies benefit areas and associated goals against which change and progress can be measured.**

These goals provide the guideposts for fully realizing the opportunities that ITS technology can provide in enhancing the operation of the nation's transportation systems, in improving the quality of life for all citizens and in increasing user satisfaction, whether for business or personal travel. The goals include:

SAFETY

The goal is to reduce annual transportation-related fatalities by 15% overall by 2011, saving 5,000-7,000 lives per year.

SECURITY

The goal is a transportation system that is well-protected against attacks and responds effectively to natural and manmade threats and disasters, enabling the continued movement of people and goods even in times of crisis.

EFFICIENCY/ECONOMY

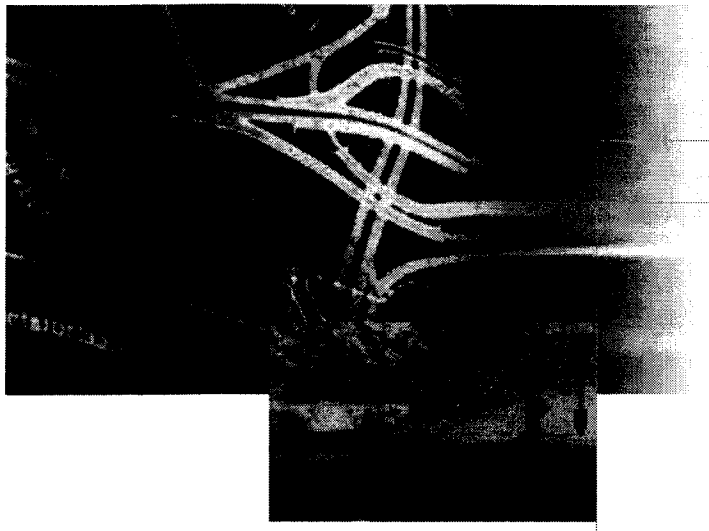
The goal is to save at least $20 billion per year by enhancing throughput and capacity with better information, better system management, and the containment of congestion by providing for the efficient end-to-end movement of people and goods, including quick, seamless intermodal transitions.

MOBILITY/ACCESS

The goal is universally available information that supports seamless, end-to-end travel choices for all users of the transportation system.

ENERGY/ENVIRONMENT

The goal is to save a minimum of one billion gallons of gasoline each year and to reduce emissions at least in proportion to this fuel saving.



PROGRAMMATIC THEME #1

This Plan develops a series of Programmatic and Enabling Themes to describe the opportunities, benefits and challenges of the transportation system of the future and activities required to realize this system.

PROGRAMMATIC THEMES reflect opportunities to apply technology to the problems and priorities of surface transportation.

13% reduction in travel time with up-to-date roadway conditions

A new bold transportation vision is needed to set the directions and mold the institutions of the next 50 years. This new bold vision is based on information management and availability, on connectivity and on system management and optimization – in short, the creation of an Integrated Network of Transportation Information.

An Integrated Network of Transportation Information will:

- Create, operate, maintain and update the information management mechanisms to gather, analyze, coordinate, extrapolate, and store the data and interact with adjoining external systems. This will necessarily be done at multiple levels by a large number of organizations under consistent guidelines for information gathering, validating, sharing, and coordinating.
- Implement appropriate policies, procedures and security technologies to ensure that the system is secure and that only authorized stakeholders have access to data.

An Integrated Network of Transportation Information will facilitate:

- Availability of information to allow travel choices wherever and whenever desired without being limited by physical disability, age or location.
- Full coordination between bus and rail transit, railroads, highway and arterial systems and eliminating missed connections, confusion during detours and diversions due to emergency and weather conditions.
- A single payment medium for regional and national travel.
- Timely and accurate commercial vehicle and freight data shared electronically among authorized stakeholders to support safety, security, productivity, mobility and environmental goals.

An Integrated Network of Transportation Information will require:

- Forging new partnerships within and between the public sector at all levels and the private sector in its broadest sense, including manufacturers, carriers, service providers and travelers in all modes.
- Research into traveler behavior and requirements, user response to new types of information and personal services, and the types and quality of data that will be most useful to travelers and that will affect their travel patterns and behavior.
- Reaching out to the public safety community to assure a high level of communication and interface to support emergency and disaster response.

PROGRAMMATIC THEME #2

Transportation-related safety is clearly more than safe driving. However, in recent years, motor vehicle crashes have resulted in more than 40,000 fatalities and over 3 million injuries each year.

Driver error remains the leading cause of crashes, cited in more than 80 percent of police crash reports. In-vehicle systems, infrastructure improvements and cooperative vehicle-infrastructure systems can help drivers avoid hazardous mistakes by minimizing distraction, helping in degraded driving conditions and providing warnings or control in imminent crash situations.

80% of police reports cite driver error as cause of accident

Advanced Crash Avoidance Technologies will lead to:

- The development, integration and deployment of a new generation of in-vehicle electronics to prevent many crashes and reduce the severity of those which still occur.
- Mechanisms that can determine fitness to drive.
- Selective automated enforcement.

Advanced Crash Avoidance Technologies will permit:

- Deployment of driver assistance products such as curve speed warning, collision warning, adaptive cruise control, stability control, traction control and lane departure warning.
- Deployment of active safety products such as forward and rear collision avoidance, intersection collision avoidance and lane departure prevention, many of which will be facilitated by vehicle-vehicle cooperation.

Advanced Crash Avoidance Technologies will require:

- Addressing manufacturers' proprietary and competitive concerns.
- Significant research and public-private cooperation to assure that safety systems operate consistently and expectedly and that they do not distract the driver's attention from the driving task.
- Mounting a campaign of public outreach and education on the safety, efficiency and mobility benefits of the new ITS products and how to use them properly.

20-40% reduction in accident response time with better interagency cooperation

PROGRAMMATIC THEME #3

Getting emergency response teams as quickly as possible to the scene of a crash or other injury-producing incident is critical to saving lives and returning roadway to normal, unimpeded operation.

ITS technologies coupled with computer-aided dispatch, wireless communications, records management systems, private call centers and Web sites can be used to achieve these objectives.

Automatic Crash & Incident Detection, Notification and Response will lead to:

- Faster and more reliable incident detection and notification.
- Improved incident response time through more efficient dispatch operations and more efficient movement of emergency vehicles through traffic.

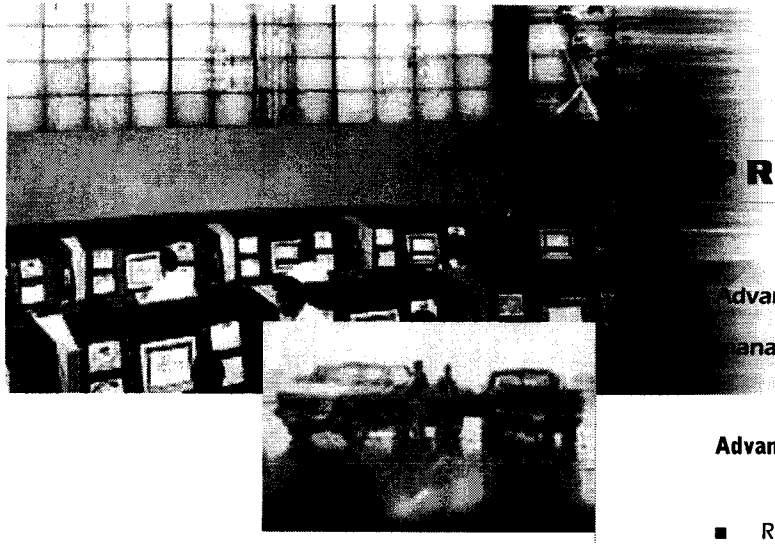
Automatic Crash and Incident Detection, Notification and Response

Automatic Crash & Incident Detection, Notification and Response will permit:

- Getting help to and clearing an accident scene more swiftly, without compromising the care of the injured, which minimizes additional congestion and helps get traffic back to normal more quickly.
- More appropriate responses to incidents, through better information about the severity, location and environment of the incident and nature of the injuries.
- Linking emergency medical services (EMS) through real-time voice, visual and data communications with crashed vehicles, dispatchers, ambulances, fire and rescue, law enforcement and other emergency responders, emergency physicians, hospitals, as well as trauma centers.

Automatic Crash & Incident Detection, Notification and Response will require:

- Developing programs and funding mechanisms to stimulate cooperation among public and private communications organizations, the widespread deployment of onboard collision notification devices, and better progress toward a nationwide wireless enhanced 911 network.



PROGRAMMATIC THEME #4

Advanced transportation management involves using advanced technology to intelligently and adaptively manage the flow of goods and people through the physical infrastructure.

Advanced Transportation Management will permit:

- Real-time surveillance and detection of traffic incidents and similar problems.
- The infrastructure and vehicles to communicate and cooperate more effectively.
- Rapid acquisition and analysis of flow data (traffic movement, rapid transit and rail operational data).
- Real-time operational responses to current and projected flows and condition.
- Continuous capability during times of crisis or infrastructure destruction.
- Prediction of near-term transportation system conditions.

13% reduction in fuel consumption with improved traffic signals

Advanced Transportation Management will lead to:

- Reduced congestion and more freely flowing traffic.
- Making work zones and highway-rail intersections safer.
- Managing travel speeds in anticipation of and in reaction to changing weather conditions.
- Clearing incidents more quickly, thereby reducing secondary incidents and the resultant congestion.

Advanced Transportation Management will require:

- A wide-ranging program of research to develop the information technologies to create a smarter infrastructure, including better sensors, better use of vehicles on the road as sources of information about traffic and road conditions, and opportunities for promoting vehicle-infrastructure cooperation.
- Coordinating and funding the transformation of research results into guidelines, best practices, and industry consensus standards as rapidly as possible, and widely disseminate to decision-makers and system designers.
- Establishing a mechanism for cooperation among public agencies, private industry and the research community to pursue research on Cooperative Vehicle-Highway Automation Systems (CVHAS), perhaps building on the existing eleven-state regional pooled-fund program.
- Research and development that focuses on automating commercial and public transportation vehicles in dedicated guideways, providing mechanisms to help guide road maintenance equipment (e.g., snowplows) accurately and quickly, especially under adverse conditions.

ENABLING THEME #1

ENABLING THEMES set the stage and lay the groundwork for the application of technology to surface transportation.

Creating a Culture of Transportation Systems Management and Operations over the next 10 years that will be increasingly focused on safety, security, customer service and systems performance.

The demands of both the external and internal environments are generating changes in the culture of both service providers and users.

Creating a Culture of Transportation Systems Management and Operations will permit:

- A multi-disciplinary approach to transportation system management and operations.
- High levels of cooperation among neighboring jurisdictions.
- An expanded focus on performance and customer service.
- New forms of cooperation between the public and private sectors.

Higher levels of coordination are essential to capitalize on many of the more exciting promises of ITS

Creating a Culture of Transportation Systems Management and Operations will lead to:

- A broader set of alliances among product and service suppliers focusing on common issues of interoperability.
- Management and control facilities coordinated locally, regionally and/or nationally across modes and by private as well as public service providers.
- A shift in focus by transportation infrastructure and vehicle-related service providers away from product and facility outputs to performance improvement outcomes.

Creating a Culture of Transportation Systems Management and Operations will require:

- Focusing the ITS research agenda on how the technologies or applications can be coordinated and integrated effectively, as well as on the technologies to address specific problems.
- Providing more help to the ITS and planning communities to adjust to an operations orientation, including practical methods of handling ITS capital and operating-resource issues.

ENABLING THEME #2

ITS, and the information management and communications capabilities that it brings, will support a new level of cooperative operations among multiple agencies, across boundaries and travel modes.

An increase in the level of investment in ITS by the public sector will improve the cost-benefit balance of the transportation network as a whole.

New Public Sector Roles, Relationships and Funding will permit:

- Effective cooperative relationships between public and private sector organizations, especially relating to information sharing and management, that promote safety, efficiency and productivity of travel.
- Travelers for commercial, business, personal, or other purposes to benefit from more seamless management of the transportation system.

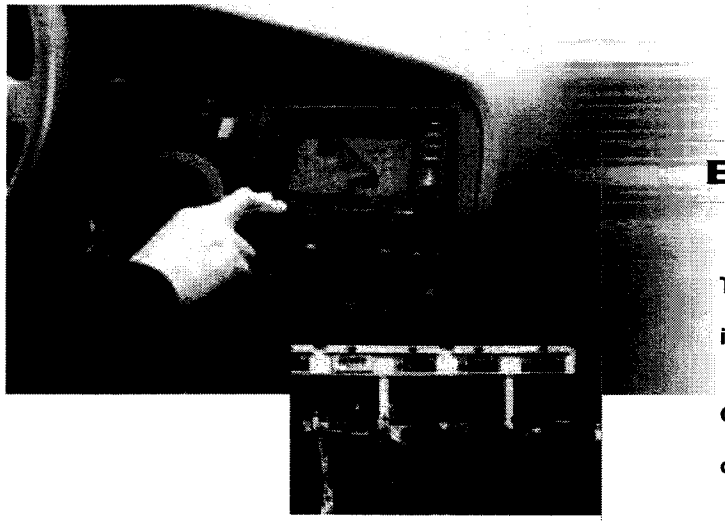
8-10% reduction in transit travel time with signal priority

New Public Sector Roles, Relationships and Funding will lead to:

- Combining public and private investments to create a mix of technology and operational infrastructure not obtainable through public or private sponsorship alone.
- Alternative pricing strategies to make the means of collecting revenues simpler, increasing overall revenues.
- Better management of the existing public investment in transportation infrastructure.
- A higher return on investment than in existing systems.

New Public Sector Roles, Relationships and Funding will require:

- Rethinking methods for procurement and management of private sector services by public agencies.
- Encouraging the creation of new regional operating organizations.
- Studying and modernizing workforce requirements to support emerging organizations and institutions.



85% reduction in toll plaza delay with electronic toll tags

ENABLING THEME #3

Traditional business-government partnerships need to be redefined to enhance private sector opportunities in the commercial market place.

Government needs to help accelerate deployment by adopting and encouraging the adoption by others of appropriate ITS products and services.

New Federal Policies and Initiatives to Achieve Extensive Private Sector Product Deployment will permit:

- The private sector will provide products and services that will satisfy requirements of governments, businesses and consumers.
- The private sector will partner with governments in the development or delivery of transportation services. The rapid evolution of transportation-related technologies gives the private sector greater flexibility in selecting and incorporating technologies more quickly and effectively.
- The private sector will be innovators in designing new approaches to transportation issues through research and development of new products, systems and services, relationships and businesses.

Federal Policies & Initiatives to Achieve Extensive Private Sector Product Deployment

New Federal Policies and Initiatives to Achieve Extensive Private Sector Product Deployment will lead to:

- Revising procurement rules to allow more efficient purchase of ITS products by government agencies.
- Exploring the best methods for delivering accurate and useful real-time information, readily, quickly and widely.
- The sharing of transportation system information among all relevant parties. Such relationships will necessarily include appropriate provisions for maintaining the privacy of individual drivers.

New Federal Policies and Initiatives to Achieve Extensive Private Sector Product Deployment will require:

- **Enhanced Outreach** - Government could use advertising campaigns to underscore the value of mobile information and communications (i.e., telematics) systems that promote safer and more efficient travel.
- **Greater Public Access** - Government can help defray the private sector's cost of creating information products and services (i.e., enhanced advanced crash data in standard formats).
- **Early Adoption** - Government can be an early adopter of ITS technologies in fleets and offices. This creates a lower-risk environment for adoption, generates early sales volume, and helps to lower the cost for the general public of adopting ITS technology.
- **Creative User Incentives** - Government could give subsidies or other incentives to consumers who purchase ITS products and services.
- **Barrier Removal** - Government should carefully review regulations and procedures and remove those which inhibit the efficiency of the ITS market.

41,000 people die on American highways each year

ENABLING THEME #4

While the new information opportunities that ITS creates are clearly valuable – in many cases essential – the sheer volume of information also creates potential problems: overload, distraction, and confusion.

ITS designers must consider what the vehicle operator is capable of doing, while operating a vehicle safely. User-centered design is a fundamental concept within human-factors engineering and is a proven method of promoting effective, successful, and safe design.

A focus on Human Factors will permit:

- The rollout of safe and usable ITS products and services for all users.
- Reducing the liability concerns that designers and manufacturers face.

A focus on Human Factors will lead to:

- Determining the level of workload associated with different secondary tasks.
- Understanding the attention, workload and distraction issues for professional drivers and how these differ from those for private vehicle drivers.
- Harmonization of external signs and signals with in-vehicle signs and signals.
- Orchestrating consistency of in-vehicle warnings across all vehicles.
- Presentation of traveler information on the Web and at kiosks in a way that maximizes usefulness and minimizes potential confusion.

A focus on Human Factors will require:

- Making the study of transportation and ITS-related human factors an issue of national concern and importance, to focus attention and resources and to move the exploration forward as aggressively as possible.
- Creating a national coalition of public and private stakeholders to take responsibility for exploring and authoritatively stating guidelines for ITS-related human factors.

THE STAKEHOLDERS

Over a dozen major stakeholders are identified and called on to contribute to the realization of this Plan. Most of these stakeholders fall into one of three macro-level groups: The Public Sector, The Private Sector, and The Universities.

THE PUBLIC SECTOR

- Includes government agencies at all levels that have responsibility for planning, building, maintaining, operating, overseeing, and in many cases funding the transportation system, particularly the roadway infrastructure and public transportation.

- The overriding responsibility of the public sector is to look out for the public good: to ensure the transportation system serves the widest possible constituency effectively and safely, to safeguard the environment and to foster a robust and productive transportation industry.

- The public sector's regulatory role and the magnitude of the funds it controls gives it enormous power for setting directions and for influencing which programs happen.

- This Plan encourages both coordination and flexibility, helping public agencies to work with one another and with the private sector, to pursue common goals and realize the vision.

- This Plan encourages the public sector to let the private sector develop and deploy as much of ITS as it reasonably can, and to focus public sector resources on updating and transforming public institutions, managing and updating the infrastructure, spearheading high-risk/high-reward research and safeguarding the public welfare.

- This plan encourages the public sector to be early adopters of ITS technologies where these technologies have clear promise for saving lives, time and money. Such early adoption will not only allow these agencies (and the people they employ and serve) to be the beneficiaries of these savings, it will help to encourage the widespread rollout of ITS and its benefits to the general population more quickly and more economically.

THE STAKEHOLDERS

THE PRIVATE SECTOR

- The private sector's primary responsibility is to create and deliver systems, products and services to business, government, and consumers. The private sector has successfully filled several niches (most notably emergency notification and traveler information) that had previously been assumed to require a public sector presence.

The speed at which the private sector will be able to deliver benefit ITS products and services will be strongly conditioned by the state of the economy, the general business climate, and the regulatory environment. Most of these are beyond the control of the Private Sector, but some of them can be positively influenced by an interested and supportive public sector.

- This Plan encourages a high level of cooperation and a deeper and more interactive relationship between the private and public sectors, especially where there are opportunities for synergies in research and information sharing.

- This Plan encourages initiatives that will enhance the acceleration of ITS markets.

- This Plan calls on the private sector to actively lead and participate in ITS research and to work aggressively to develop and deliver the ITS products and services which can help save lives, time and money.

THE UNIVERSITIES

- This Plan calls on the Universities to be responsible for reinventing the transportation profession for the 21st century to meet the challenges that a new focus on customer-oriented, performance-driven operations will present.

- This Plan calls on the Universities to reconfigure the curriculum for transportation-related engineers, managers and other professionals to incorporate and exploit new approaches and technologies for building and operating the transportation infrastructure. These include: the ability of software to leverage the power of devices, the new focus on customer-driven performance, and the need for regional cooperation in transportation management.

- This Plan recognizes the essential role that Universities play in carrying out a significant part of ITS research.

- The Universities will participate in the research and development of new models for funding and conducting transportation research related to technology development and deployment, human factors, institutional renewal and transformation, and public policy.

- The Universities will conduct research, as directed by public and industry priorities, in all these areas, and disseminate the results.

- The Universities will facilitate the translation of research results into public policy, professional practice, and industrial action.

> > >

NOTES

This document summarizes

The National Intelligent Transportation Systems Program Plan:

A Ten-Year Vision. The full document or an eight-page

brochure can be obtained through the

Intelligent Transportation Society of America.

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DSRC Spectrum: Issues for Licensing and Service Rules

March 20, 2002

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Issues

- Overview of DSRC
- Applications
- Eligibility
- Channelization
- Licensing
- Technical Characteristics
- Interoperability
- Frequency Coordination

Overview of DSRC

- 75 MHz at 5850-5925 MHz ("DSRC band")
- FCC allocation in October 1999
- Implementing Rules:
  - 47 CFR § 90.7: Definition of Dedicated Short Range Communications Services ("DSRCS")
  - 47 CFR § 90.371: DSRC Service in Intelligent Transportation Systems Radio Service (in Part 90, subpart M)
  - Propose rule change: substitute "private" for "commercial" environments

ASTM DSRC Standard

- ASTM DSRC Standards Writing Group
  - Public and private industry members
  - Activities funded by US DOT
  - Selection of IEEE 802.11a standard variant
  - Currently drafting standard

Overview of DSRC

- Congressional Mandate for ITS Interoperability
- International DSRC Activities
  - Europe
  - Japan
- Licensing and Service Rules
  - Nationwide interoperability
  - Competitive markets
  - System Expansion
  - Spectrum Efficiency

Proposed Applications

- Roadside-to-vehicle
- Vehicle-to-vehicle
- Predominantly public safety
  - traffic data
  - toll collection
  - in-vehicle signing (especially for safety warnings)
  - commercial vehicle administration
  - emergency vehicle (video, signal priority, approach warning)
- Private applications
  - payment (gas, drive-thru, parking)
  - data transfer (vehicle diagnostic, mapping, entertainment)
  - commercial vehicle operation

Eligibility

- "Expansive and inclusive" definition of public safety services needed to reach "traditional" and "non-traditional" public safety entities
- Federal, state and local public agencies
  - public safety
  - traffic, transit, public works, toll, rail
- Non-profit
  - roadside assistance
  - others

Licensing

- Site specific "communications zone"
- First-come/first-served
- Public safety:
  - larger size specific "communications zone"
  - shared area licenses among public safety eligibles
  - "ribbon" zones for public safety alongside highways or trunk/secondary roads
  - multiple roadside units per license in contiguous and non-contiguous service areas
- Private:
  - smaller site specific "communications zones"
  - multiple roadside units per license in contiguous and non-contiguous service areas

Other Issues

- Channelization
- Frequency Coordination
- Permissible Uses
- Technical

Interoperability

- Congressional mandate for interoperability
  - "national interoperable Intelligent Transportation Systems infrastructure": TEA 21 and ISTEA
- How to ensure interoperability among devices and applications?
- Currently drafting ASTM DSRC standard

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DriveBy InfoFueling - Telematics beyond the Anytime Anywhere Paradigm

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DaimlerChrysler Research and Technology North America, Palo Alto, California

Introduction

Telematics Services are enabled by the convergence of wireless communication technology, location technology and information technology in the vehicle. Telematics services include safety services, navigation, remote-diagnosis, convenience, infotainment, entertainment and more. In other words, for people on the move, telematics helps them arrive safe and in time; for people that have little time to waste, telematics makes the time in the car more productive; for people wanting to get away, telematics makes the ride more enjoyable.

Wireless communication is a key technology for providing such services and the purposes that they serve. However, telematics services have different requirements in terms of communication. For example, automatic airbag deployment notification is a safety service that sends out an emergency message (including the car's location) in case an airbag or an ETR (emergency tensioning retractor) deploys so that emergency and medical responses would be available at the right location and the earliest possible time. The usage of the automatic airbag deployment notification service is rather rare, the message is small, but its importance is very high. Therefore, the communication technology must have high availability and low latency while channel bandwidth, usage cost and scalability are of lesser concern. On the other hand, a media rich content oriented service such as digital map download (see Figure 1) or digital music

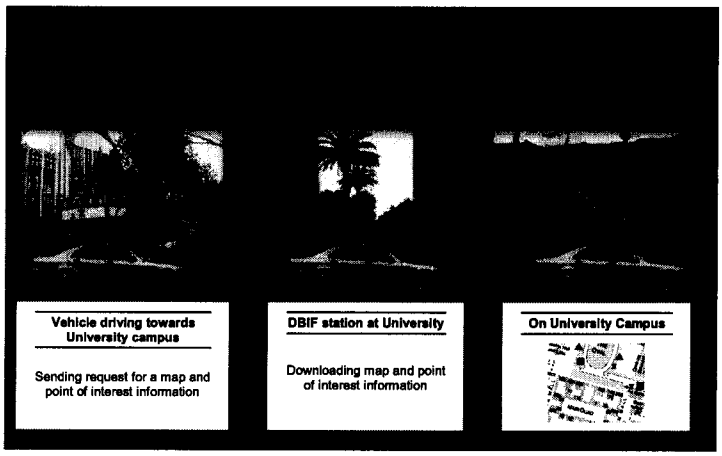

Figure 1: DriveBy InfoFueling example

download would place high emphasis on low usage cost, high bandwidth and scalability on the communication technology.

It is easy to demand high bandwidth, low cost and ubiquitous coverage for wireless communication solutions from the carriers. Such a solution – if it existed - would address all of the communication concerns and would provide an ideal platform for all telematics services. Unfortunately, this "ideal" communication solution has yet to be found. The simple explanation is that quality of service (such as bandwidth, latency, etc.), cost, and availability (such as coverage) are three competing factors in any wireless system design. It is simply impossible to optimize all three factors at the same time.

The current wireless communication offerings are dominated by the cellular business model. From such a perspective, the killer application is voice telephony service. All cellular technologies have the same goals regarding voice service: it is important to support "anytime, anywhere" calls, channel bandwidth must not vary, etc. Towards these goals, all cellular architectures share the same fundamental similarities: Spectrum needs to be secured, wide-reaching tower networks need to be built, and towers need to be connected in elaborately designed networks to assure stable service quality.

Telematics, however, presents some different requirements for communications. For example, scalability and capacity are measured in terms of millions of cars cramped at the same place (highways) and at the same time (commuting hours). People have a very different tolerance level for wireless data cost versus the wireless voice cost. For some services such as music download, communication availability is somewhat relaxed, yet for others, not so.

It is not to say cellular model is wrong. It serves its purposes well. However, there is a mismatch between the cellular model and telematics needs in communication. Some new wireless communication approaches are necessary to successfully support telematics platforms sure to come in millions of cars in the years ahead. This is where DriveBy InfoFueling comes in.

What is DriveBy InfoFueling?

DriveBy InfoFueling (or simply InfoFueling) is creating an infrastructure of wireless local area network access points at the roadside to allow high volumes of data to be transmitted within the several seconds it takes for a car to drive by one access point's coverage. Simply put, DriveBy InfoFueling is a concept of high-bandwidth, cost-effective communication technologies for

vehicular usage developed at DaimlerChrysler Research and Technology North America, Inc. in Palo Alto, California (DCRTNA). DriveBy InfoFueling complements conventional wireless technologies to support more of the communication requirements of telematics services and to open up even more service possibilities for our customers.

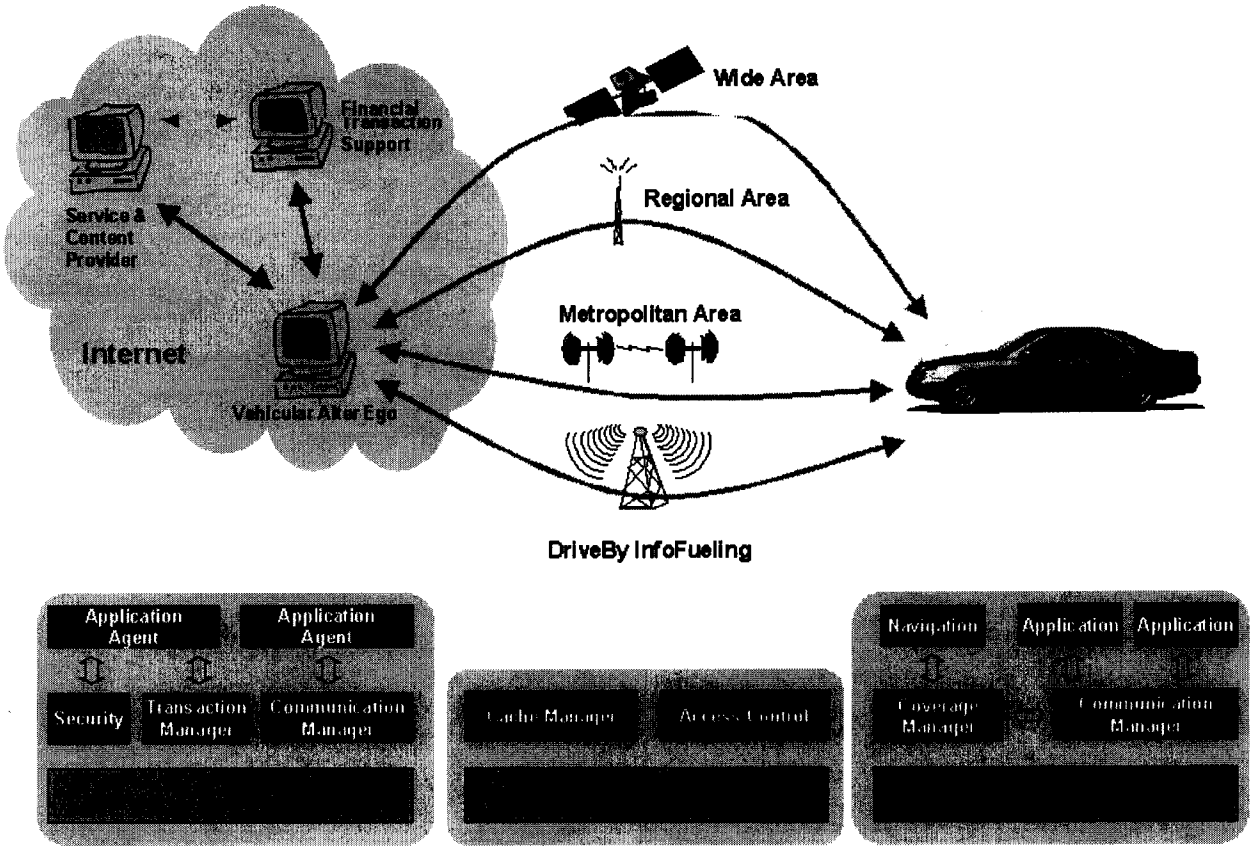

Figure 2: DriveBy InfoFueling System Overview

For a car to properly utilize DriveBy InfoFueling, the following technologies are necessary and have been developed and shown in a research prototype by DaimlerChrysler Research (Figure 2):

- **High-Bandwidth Wireless Local Area Network Technology**. Wireless Local Area Network Technology such as IEEE 802.11 is an accepted technology for the office and home environment. In the U.S. a committee made up of private businesses and public agencies[1]

[1] The committee is the Dedicated Short Range Communications (DSRC) 5.9 GHz Standards Writing Group, a sub-group of the American Society for Testing and Materials (ASTM) E17.51.

recently selected 802.11a R/A (road access) as the base technology for licensed telematics applications[2]. Multiple tests in our lab as well as independent tests done by the industry verified that IEEE 802.11a can be utilized to reliably transmit multiple megabytes of data during a drive-by at vehicular speed (60 MPH and above).

- **Wireless Service Availability Prediction**. We developed technology to predict when a car will have coverage for a certain wireless service, including DriveBy InfoFueling access points. With GPS (Global Positioning System), navigation software, digital map and traffic information, we can predict when the car will be where on which road. This and the knowledge of where the DriveBy InfoFueling stations are makes wireless service availability prediction possible.

- **Route Dependent Communication Management**. Based on the wireless service availability prediction, we developed a communication support architecture to enable route dependent communication management. This means that applications can be managed to always use the optimal wireless technology for any given route segment and application requirement. Such communication management can be configured for various goals such as minimizing cost, required bandwidth, etc.

- **Vehicular Alter Ego (VAE)**. VAE is a server technology that, on a car's behalf, arranges for the content retrieval in the backend. VAE is necessary because the car is not assumed or required to stay constantly connected while using DriveBy InfoFueling technology. The VAE is also a natural place to implement the financial transaction technology that needs to be supported in the context of mobile e-commence.

DriveBy InfoFueling technology breaks away from the often hyped "anytime, anywhere" paradigm for wireless communication by creating a new "sometime, somewhere" communication paradigm. Introducing a new communication paradigm is not always ideal since there is no user experience, no infrastructure and no applications. However, we believe that DriveBy InfoFueling will overcome those issues by offering a solution that is scalable and has the right price for a significantly increased performance.

[2] 802.11a R/A is a version of the IEEE 802.11a standard, modified to operate at the 5.850-5.925 GHz ITS band.

Wireless technologies place severe restrictions on the information pipeline between the cars and the telematics service providers for the following reasons:

- **It is expensive**. For example, using the optimal service plans of today's cellular service providers to transmit a digital music file during regular commute hours would cost many dollars, well in excess of the value of the song itself.
- **It does not provide enough capacity**. It is common knowledge that cellular calls during the commuting hour are often blocked because all channels are occupied. The shortage of radio spectrums and the hodgepodge of networks standards in the US combined with ever increasing demand means this problem is not likely to be resolved soon.
- **It does not provide enough bandwidth**. It takes approximately half an hour to download a three minute MP3 song over current GSM or CDMA technology. Even if the more advanced General Packet Radio Service (GPRS) system is deployed in the next few years, it still would take more than ten minutes to get the song.

In comparison, DriveBy InfoFueling technology enables more services more cost effectively to our customers because:

- **It is low cost:** $0.10 per Megabyte would be a conservative estimation, because there is no need for the radio frequency spectrum license and the infrastructure can piggyback on top of emerging digital networks that are already extending to the roadside (i.e. gas stations, coffee-chains, fast food restaurants). This cost level would be at least one order of magnitude lower than any other communication service.
- **It is scalable:** As demands grow, simply adding a few DriveBy InfoFueling stations in between existing ones on the roadside would keep up the system capacity. In other words, serving millions of cars during commuting hour is absolutely feasible.
- **It is high performance:** Using IEEE 802.11a, each drive-by at an InfoFueling station at 60 MPH would allow many Megabyte of data to be transferred. In other words, several songs discussed above could easily be transferred during one single drive-by in just seconds.

Application Scenarios

DriveBy InfoFueling technology can enable many new applications scenarios not feasible in today's communication landscape. The following is a selection of possible scenarios.

Access to up-to-date map data and point of interest information

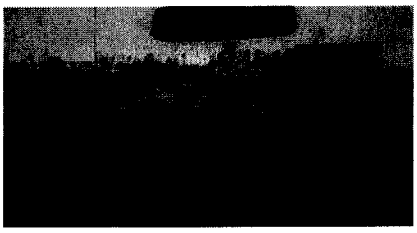

Figure 3: Map and POI data

Have you ever driven in a city that is unfamiliar to you? A navigation system can be of great help to give you turn by turn directions and guide you to your destination. However, wouldn't it be nice if those directions would be augmented with up-to-date traffic data and current point of interest information? Digital map data for navigation systems is currently provided on CDs or DVDs and can be up to 12 months old. Imagine you drive into San Francisco on Highway 101 and you pass a sign reading "Welcome to San Francisco". Attached to that sign could be a DriveBy InfoFueling station that would transmit the latest map data and point of interest information into your vehicle. The turn-by-turn directions can now be refined based on the latest map data, current traffic conditions and a suggestion for a parking garage close to your destination that is automatically selected based on current availability. DriveBy InfoFueling would make that not only technically possible but also economically feasible.

Productivity Services

Figure 4: Productivity Services

Imagine you drive from your office to an external meeting, and you need directions. With DriveBy InfoFueling technology your calendar data, emails and contact database can automatically be synchronized with the telematics platform in your vehicle. Based on the current time and date and your calendar entry your navigation system can automatically pick the destination address for your meeting out of your contact database and compute the optimal route. While you are driving, the agenda, the list of participants and the email invitation can be read to you with text-to-speech technology to better prepare you for the meeting. Up-to-date traffic conditions can be received via DriveBy InfoFueling stations along the route and based on that information, the navigation system can guide you around potential traffic, bringing you to the meeting well-prepared and in time.

Rich Media Download

Figure 5: Rich Media Download

Just like many other people, you probably listen to the radio in your car to enjoy a variety of music and news content while driving. The amount of content and the quality will increase further with the emerging Digital Satellite Radio (DSR) technology. Both analog and digital radio are broadcast technologies with edited programs. Sometimes those programs play a song that you really like and that you would want to own but you couldn't catch the artist or song title on the radio. Even if you did, by the time you arrive at home, you probably forgot all about it and next time you are in the music store you certainly will not remember it either. Wouldn't it be nice if you could purchase a legal copy of a song right when you listen to it in your car and have the song downloaded into your car. DriveBy InfoFueling technology makes it possible. Pressing an "instant buy button" on your car stereo system could send a purchase request of the song (based on the station id and the current time) to an online music site. The Vehicle Alter Ego (VAE) would issue a secure payment on your behalf to purchase a legal copy. The purchased song can then be forwarded to the next DriveBy InfoFueling station along your route and finally be transmitted into your car while you are driving by. You can then listen to the song over and over again just like you would on a CD.

Infrastructure support for Post-PC Devices

Figure 6: Post-PC Devices

Another scenario where DriveBy InfoFueling technology can be beneficial is to provide infrastructure support for so called post-PC devices. Post-PC devices are personal digital assistants (PDAs), digital cameras (still or video) or other handheld devices. A standard digital camera for example, might have 32MB of storage space to hold pictures. If that storage space is used up, the pictures usually need to be transferred over to a PC or a laptop to free up the memory and to be able to take more pictures. On a road-trip, however, you most likely do not have your PC or laptop with you to upload the pictures. DriveBy InfoFueling could provide this infrastructure support that would allow you to transfer the pictures directly to an online photo-site. This would not only allow you to use your digital camera to take more pictures, it would also allow others to immediately admire the pictures you have just taken.

Standardization Efforts

The application scenarios for DriveBy InfoFueling presented above are just a small subset of applications made possible by so called 5.9 GHz Dedicated Short Range Communications (DSRC) technology. DSRC applications can be grouped into different categories such as:

- public safety (e.g. stop sign or traffic light beacons)
- traffic management (e.g. redirection of vehicles based on the current traffic situation)
- transit systems (e.g. electronic toll collection)
- traveler information (e.g. map data or point of interest information)
- infotainment (e.g. news, email or music download)

However, to be successful, all those applications depend on industry-wide standards. The fact that 802.11a R/A was selected as the physical layer (PHY) and media access control layer (MAC) for DSRC is not sufficient. The overall architecture, upper layer protocols and other issues need to be addressed. The ASTM E17.51 subcommittee for DSRC has therefore recently organized itself into eight different task forces (Architecture, Security, Lower Layers, Upper Layers, Layer Management, Vehicle to Vehicle Communication, Early Adopter Applications and Industry Consortium) to look into those issues and to come up with standards in those areas.

The higher layer protocols used in our DriveBy InfoFueling prototype are still proprietary but we are actively looking into adapting to open standards as they emerge. For the lower layers we are using standard 802.11a equipment that operates in the standard home and office mode (IEEE 802.11a) as well as in a mode that uses the specifically designated ITS band (802.11a R/A).

Conclusion and Outlook

In this paper we described a technology called DriveBy InfoFueling. DriveBy InfoFueling is a disruptive technology that introduces a new "sometimes, somewhere" communication paradigm that could be used as a communication channel for many telematics services such as:

- Access to up-to-date map data and point of interest information
- Delivering media rich content such as music on demand
- Collecting vehicular data for tele-diagnosis and vehicle condition monitoring
- Extending communication infrastructure support into vehicles for post-PC devices such as digital cameras, PDAs, etc.

DriveBy InfoFueling does not intend to replace "anytime, anywhere" communication solutions such as cellular connections. In fact, those technologies are still a necessity for telematics especially for safety and security applications. However, DriveBy InfoFueling complements conventional wireless technologies to open up even more telematics service possibilities for our customers by offering less expensive services with higher performance in a scalable way. Today, DriveBy InfoFueling is still in the research stage. But the DaimlerChrysler Research team is always eager to transfer such cutting-edge technologies into our products because they add to the unparalleled ownership experience found in every vehicle we build.

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