## 1. Development of Research Tools and Knowledge Base

This program element's objectives are to develop research and analysis tools to evaluate crash avoidance concepts and products, and to develop a knowledge base of driver/vehicle behavior to support system development. Significant effort has been focused in six areas:

a. Develop and **analyze a comprehensive accident database.** Reports covering intersection crossings, roadway departure, backing, lane changes, rear-end crashes and other crash conditions have been completed.

b. A portable Data Acquisition System for Crash-Avoidance Research **(DASCAR)** has been developed. This in-vehicle sensing system unobtrusively monitors numerous driver behaviors/vehicle responses. The system will be critical to understanding "normal" driving behavior and evaluating crash-avoidance technologies. Specifications have been completed and a prototype delivered for testing in 1995.

c. A **standardized tool for assessing driver workload** has been completed, and will be available for use by ITS designers to measure the driver workload associated with in-vehicle features and equipment.

d. Construction has begun on the **Variable Dynamics Test Vehicle (VDTV)**, a test bed vehicle featuring adjustable ride and handling characteristics, and the capability for on- or off-board control through computer/ communication systems. This test bed will provide critical information on driver-vehicle interaction that will impact AHS and crash avoidance technology development. The initial needs study and preliminary specifications have been completed.

e. A measurement system **(vehicle-motion environment, VME)** that quantifies specific vehicle motions exhibited while moving through intersections or along highways under full traffic operations is under development. The information collected by this system will become the foundation for understanding the detailed motion of vehicles as drivers perform the real-world task of avoiding collisions. The information from this system will be useful to system designers and when estimating benefits.

f. Develop a **human factors knowledge base.** A series of studies is developing an understanding of human performance under various driving conditions and with varying distractions, information and displays.

By the end of 1996, testing of both the DASCAR and VME systems will be complete; and recommendations will be made on human factors to consider in developing crash warning systems.

## 2. Defining Crash Avoidance Opportunities and Developing Performance Guidelines

This program element objective is to identify opportunities ripe for the application of advanced technology countermeasures, and develop specific performance measures. To date, efforts have focused on developing guidelines for lateral, longitudinal, intersection, vision enhancement, and drowsy driver collision-avoidance systems. Each set of guidelines identifies and addresses a diverse range of causal scenarios, and provides input to the development of performance requirements for systems which advise drivers of potentially hazardous situations, warn of imminent collision and automatically provide collision avoidance control of vehicles. Development of these countermeasures specifications includes evaluating available crash-avoidance systems. These performance specifications will help product designers maximize safety benefits.

Preliminary guidelines for each targeted area will be complete by the end of 1995. The next steps in the development of performance guidelines will focus on an assessment of available technologies for use in meeting these performance measures.

## 3. Demonstrating Proof of Concept — Field Trials

The complexity of both driver behavior and ITS technologies requires that deployment consideration include comprehensive field testing to ensure system safety objectives are met. Field tests identify needed refinements and help define appropriate and effective deployment strategies.

This year, the Department launched a field test of **Intelligent Cruise Control (ICC)** systems targeting ease of learning and use, driver reaction, and driver attention and response to braking situations. The test evaluates a vehicle's ability to automatically maintain a safe speed and distance between it and other vehicles. The offeror selected for funding this operational test is a partnership led by the University of Michigan Transportation Research Institute and includes the Michigan Department of Transportation, Leica AG, and Haugen Associates.

The Department is also testing an **Automated Collision Notification (ACN)** in-vehicle system that identifies when a serious collision has occurred and automatically summons emergency medical service (EMS) response. The offeror selected for funding for this operational test is a partnership led by CALSPAN Advanced Technology Center and includes the New York State Department of Transportation, General Motors, Cellular One, Rockwell International, Erie County Emergency Management Service, Erie Community College, and Datumtech. The offeror proposes to design, build and deploy an automatic collision notification system using 1,000 privately-owned cars in a large area in western New York State.

## 4. Facilitating Commercial Development of Crash Avoidance Technologies

The Department is engaged in six cooperative agreements with industry for the testing and development of various crash avoiding technologies, including:

- **Development, Evaluation, and Deployment of Forward Crash Avoidance Systems (FOCAS)** — Cooperative agreement between the University of Michigan Transportation Research Institute and NHTSA, with Leica supplying hardware. The primary goal is to develop a range of commercial sensors and associated applications systems that supplement the forward crash avoidance performance of drivers. This is the second year of a three-year agreement.

- **Brake Analysis for Collision Avoidance** — Heavy Commercial Vehicles - This cooperative program with Eaton Corporation studied the feasibility of adding automatic braking to heavy commercial vehicles. The prototype was demonstrated in July and a final report published in October.

- **Vehicle-based Lane Detection** — This cooperative agreement with Rockwell International will result in a two-year field evaluation of a prototype machine-vision, lane-detection sensor. Testing of the initial prototype has been completed. The system is being upgraded for the next test phase and the final report will be delivered in 1996.

- **Human Factors Studies for the Evaluation, Analysis and Operational Assessment of an Intelligent Cruise Control (ICC) System** — A cooperative agreement with Ford to establish guidelines for key ICC operational and interface design characteristics based on driver performance and preference measurements.

- **Automotive Collision Avoidance System Development** — Cooperative Agency development of a wide range of collision-avoidance systems continues with the Delco Electronics/General Motors Partnership, under the Advanced Research Projects Agency (ARPA) Technology Reinvestment Program (TRP). The program is structured in six phases: Crash-avoidance system definition, sensor development, system studies, driver-vehicle interface studies, and cost reduction/production readiness and validation. A demonstration of level-one or existing capability of forward-looking sensors has been completed.

- **Characterization of a Forward-looking Radar Sensor** — This cooperative agreement with the Environmental Research Institute of Michigan and TRW will develop a knowledge base of radar cross-section data from laboratory measurements and a variety of freeway settings using a prototype forward-looking automotive radar sensor. Lab testing has been completed, and an advanced sensor is being integrated for road testing.

### 5. ITS Safety Evaluations

Researchers and practitioners in this area have played key roles in evaluating the safety aspects of several other field tests including the Florida TravTek, the Washington TRAVEL-AID, the Illinois ADVANCE and the Michigan FAST-TRAC project. They have also been active in supporting the human factors and safety analyses in the AHS effort.

## D. Automated Highway System

FHWA signed a cooperative agreement with the NAHSC in October 1994 to launch a multi-year research effort to develop an AHS concept. The idea of vehicle-highway communications sufficient to assume driving functions for the driver is not new. Researchers have articulated both its value and feasibility for several decades; and military and vehicle manufacturer test facility developments have proven the concept's viability. As mounting congestion conflicts with environmental constraints, the AHS promise of doubling our existing highway system's capacity is worth investigating.

Spurred by that promise, and the potential for more rapid development of component crash-avoidance technologies, the Department launched 15 AHS "precursor" studies in late 1993 to investigate the viability of both the technology and its potential benefits. The studies involved 55 organizations, ranging from universities to law firms to system integrators, and was completed in early 1995. See Exhibit 12 for a summary of primary investigation areas.

*Exhibit 12. AHS Precursor Study Topics*

- Urban and Rural AHS Comparison
- Automated Check-in
- Automated Check-out
- Lateral and Longitudinal Control Analysis
- Malfunction Management and Analysis
- Commercial and Transit AHS Analysis
- Comparable Systems Analysis
- AHS Roadway Deployment Analysis
- Impact of AHS on non-AHS Roadways
- AHS Entry/Exit Implementation
- AHS Roadway Operational Analysis
- Institutional and Societal Aspects
- Preliminary Cost/Benefit Factors Analysis

*The AHS Precursor Study addressed 14 different topics.*

Although the studies identified a number of significant technical and societal challenges, there were no "showstoppers;" reasonable courses of action were identified for each potential challenge. The studies indicated that AHS could improve vehicles/lane/hour by two- or threefold, cut travel time by 33 to 50 percent, and potentially reduce accidents by 50 to 80 percent. Not surprisingly, non-technical challenges will likely be more difficult to resolve than technical ones, and will require careful balancing of stakeholder needs (e.g., examining tradeoffs among safety, efficiency, environmental impact, cost, etc.).

Based on these findings, the Department entered a cooperative agreement with industry to further develop the concept. NAHSC's core partners include General Motors, Bechtel Corporation, the California Department of Transportation (Caltrans), the Carnegie-Mellon University Robotics Institute, Delco Electronics, Hughes Aircraft, Lockheed Martin, Parsons Brinkerhoff, and the University of California Partners for Advanced Transit and Highways (PATH) Program. To date, U.S. DOT has funded 80 percent of the research; however, the partners will fund increasing proportions of development as the concept proves its feasibility, as well as the ultimate cost of bringing spin-off and final products to market.

The consortium has outlined the following primary milestones for achievement over the next 7 years:

- develop AHS system requirements;
- identify and analyze competing concepts;
- develop critical enabling technologies;
- conduct 1997 Proof of Feasibility Demonstration;
- down-select to a preferred system configuration;
- develop, test and demonstrate final prototype AHS;
- document prototype AHS design and performance; and
- produce specifications for an operable AHS.

The team will also launch an extensive stakeholder and public outreach effort, and investigate the societal, environmental and institutional impacts of the deployed concept.

To date, the consortium has completed a Systems Description Document that defines AHS goals, objectives and functions; has begun the identification and evaluation of potential AHS approaches; has prepared a detailed work plan for the 1997 AHS technology proof-of-technical-feasibility demonstration; has launched several societal and institutional analysis efforts; and has involved numerous stakeholder organizations as Associate Participants in ongoing activities.

## E. Rural Applications of ITS

Early ITS efforts were driven by the desire to address growing transportation problems in urban areas and in interurban corridors. While many of the technologies and systems aimed at solving these problems also have application outside urban settings, the market structure, application logistics, and motivating factors underlying their deployment vary considerably from urban to rural areas. The federal program recognized these differences and, in the past year, has developed an ITS program component with a uniquely rural focus.

The rural ITS customer ranks ITS need priorities much differently than an urban dweller. These differences largely reflect characteristics of the rural environment: long driving distances, relatively low traffic volume, relatively rare traffic congestion but fewer alternate routes, travelers and tourists who may be unfamiliar with the surroundings, rugged terrain in remote areas, extreme climate conditions, and frequent roadway obstructions.

Travel and safety statistics illustrate the enormous potential role for ITS in rural environments.

- Eighty percent[5] of the road mileage in the United States is in rural and small urban areas (less than 50,000 population).

- While less than 40 percent of annual vehicle miles traveled—or about 900 billion vehicle-miles—is on rural roads, **these roads account for about 60 percent of all traffic fatalities[6].**

- **More work zone fatalities occur in rural areas than urban areas** (454 versus 376). Work zone fatalities in non-Interstate, local roadways outnumber those occurring on Interstates by 3 to 1. Accidents and lane closures from work zones can tie up rural roads for hours.

- **Rural travelers are more apt to be involved in fatal single vehicle run-off-the-road accidents than urban travelers.** Collisions with fixed objects accounted for almost one third of all fatal accidents in rural areas. Rural areas also accounted for twice the number of fatal noncollision accidents (overturns, jackknifes, etc.) than urban areas. Contributing factors are weather, road conditions, and speeding.

- **Emergency Medical Response is slower in rural areas.** The average time elapsed between a rural-area crash and EMS notification is twice that in urban areas; and the ratio is about the same for elapsed time between crash and arrival at a hospital. In rural Colorado, for example, 12 minutes on the average elapse from time of crash to EMS notification, and 57 minutes from time of crash to hospital arrival. In contrast, in urban Colorado, it takes 6 minutes for EMS notification and 28 minutes before hospital arrival. Chances of survival and less impairment are influenced by the quality of medical care received in the "Golden Hour" immediately following the crash.

- Although there are approximately 1,200 rural public transportation systems in the United States funded through the Public Transportation for Nonurbanized Areas program, of the small rural communities with less than 2,500 persons, 90 percent do not have intercity bus service, specialized transit service, or any taxi* service.

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5 Figure according to U.S. DOT/FHWA's *Highway Statistics*, 1993.

6 Figures according to U.S. DOT/FHWA's *Highway Statistics*, 1993.

- Of the rural communities with between 2,500 and 10,000 persons, three-fifths do not have intercity bus service and two-thirds do not have any specialized transit service.

ITS applications such as incident notification (Mayday), advanced hazard warning systems, advanced traveler information services, and in-vehicle crash avoidance systems, are some of the ITS applications which can address the issues above and significantly impact the safety and mobility of rural travelers.

## 1. Research and Development

The Department's first step in addressing rural America's transportation needs was to launch a $1.8 million R&D effort entitled Rural Applications of Advanced Traveler Information Systems (ATIS). FHWA commissioned this effort in 1992 to assess ways to improve safety, mobility, and services in rural areas. This effort has already produced guidance for federal ITS programs to benefit rural and small urban areas, and to provide state and local guidelines for rural ATIS implementation efforts.

The study has already produced a rural user needs assessment, a technology review, development of rural system concepts, and an activities assessment. The final products (now available in draft form) include a vision for rural ATIS and a recommended Action Plan for the U.S. DOT to facilitate implementation of rural ATIS applications, which will include explicit recommendations for further R&D and operational test projects. Results of this study will help lay the foundation for a dedicated, rurally-focused ATIS component of the federal ITS program.

Other ITS R&D programs within NHTSA and FHWA have substantial rural components—that is, they examine traveler information, vehicle control, automated roadway, or other safety technologies that have primary applications in improving rural safety. Most of these projects are covered elsewhere in this report and are contained in Appendix II, Research and Development Projects with Cost-Share Arrangements. Examples include: cooperative development of a Forward-Looking Automotive Radar Sensor; Vehicle-Based Lane Detection research; NHTSA's DASCAR project; Monitoring of Driver Status and Performance; Heavy Vehicle Dynamic Stability Enhancement; work that the NAHSC is doing in assessing automated roadways for rural environments; and many others.

## 2. Operational Tests

Many of the Department's ongoing ITS operational tests—especially those in the CVO and border crossing areas—have substantial rural components, but are not necessarily dedicated to exploring solutions to primarily rural problems, and so are discussed elsewhere in this Report. Some of the test groups dedicated to addressing rural issues are highlighted below:

a. **Mayday' systems** — several tests have been launched to explore the use of Automated Collision Notification (ACN) systems, or Mayday,' which the FHWA rural user needs assessment identified as the highest-priority, most desired service. The Puget Sound Help Me, TransCal, and Colorado Mayday projects are exploring different means of automatically delivering the critical location and status information needed by EMS in the event of

a debilitating incident. A recently awarded project in Erie County, New York, will attempt to deploy an ACN in over 1000 privately-owned vehicles to test system effectiveness.

b. **Traveler Information and Communications** — a major challenge to delivering ITS services in rural areas is the lack of resident communications infrastructure. U.S. DOT is supporting several efforts to demonstrate and evaluate options for getting information to and from travelers where they need it. Independent projects are investigating the use of AM subcarrier, FM subcarrier, data paging, cellular telephony, VSAT satellite communications, live aerial video transmission, traveler center kiosks, and portable detection and surveillance to enhance communications for critical ITS services in less-infrastructure intensive areas. Minnesota DOT's Guidestar program is experimenting with coordination and centralization of the communications systems of several public agencies, to improve information sharing and response to emergencies.

c. **Weather Monitoring and Traveler Advisories** — two projects, the Idaho Storm Warning System, and the Travel-Aid project along Snoqualmie Pass, Washington, involve the use of environmental sensors and variable message signs to convey dynamic weather and warning information to travelers along remote and accident-prone corridors.

d. **Rail Crossing Safety** — the Advanced Railroad-Highway Grade Crossing System represents a two-year prototyping and field testing cooperative effort (scheduled to wrap-up at the end of 1996) between FHWA and the state of New York, to test use of interactive devices at highway/rail crossings that communicate with both trains and vehicles to create safer situations at the crossings. This builds on previous work done by FTA and ARPA on Advanced Automatic Train Control (AATC), as well as FHWA's previous In-Vehicle Safety Advisory Warning System (IVSAWS) research.

e. **Public Transportation** — many rural residents, particularly the elderly and physically challenged, depend on paratransit service for access to basic needs such as food and medical care. Because of low population density, relatively long distances, and corresponding high costs, rural paratransit service can be infrequent and expensive to provide. ITS operational tests of paratransit are aimed at developing fleet management systems that reduce costs and enhance services using real-time vehicle location, automated scheduling, and related technologies. In Delaware County, Pennsylvania, FTA and a private sector partner are testing an Automated Billing and Identification System that will automate reservations, billing, and vehicle dispatch procedures, resulting in lower overhead costs and more efficient vehicle routing. In Michigan, an FHWA-sponsored paratransit fleet management system will automate reservations, scheduling and dispatching, and will use AVL to track the fleet. The project will also establish a regional 800' number to connect customers with regional paratransit services and information.

f. **Commercial Vehicle Projects** — in addition to those covered in this Report's CVO section, there are a dozen or more tests of technology aimed at improving safety or efficiency of motor carrier fleets through automation, especially in remote areas. For example, the Dynamic Truck Speed Warning for Long Downgrades, a recently-operational field test, provides drivers with real-time warnings and suggested speeds for downgrades based on their current weights and speeds. Other technology trials include video imaging systems to determine out-of-service vehicles, and automated mileage recording for fuel tax purposes.

## F. System Architecture and Standards

This component of the U.S. DOT's ITS program most directly addresses the charge by Congress, through ISTEA, to "provide and ensure compatibility in the implementation of intelligent vehicle-highway systems technologies...." The first step toward this goal, the development of a National System Architecture for ITS, is well underway. In conjunction with this effort, we are aggressively pursuing the development of key enabling standards for ITS. The issues surrounding the need for standards cut across all areas of the ITS program, and have impacts at both national and international levels. Numerous references to standards related activities are interspersed throughout this document but are consolidated in this section for visibility and focus.

### 1. System Architecture

The Department has entered the second phase of developing a national system architecture for ITS. The architecture will describe how ITS components interact and work together, and will ultimately guide multi-level government and private-sector business planners in developing and deploying nationally compatible systems. By ensuring system compatibility, the Department hopes to accelerate ITS introduction nationwide and develop a strong, diverse marketplace for related products and services. Initially, four teams led by Hughes Aircraft, Westinghouse Electric, Rockwell International and Loral Federal Systems were awarded contracts to develop competing architecture concepts. The National Architecture Program examined the four resulting concepts and awarded contracts to two teams, Rockwell and Loral, in February 1995 to work cooperatively to develop a consensus national architecture. Some features and themes that were common among the different Phase I concepts will be incorporated into the final National Architecture, as listed in Exhibit 13:

*Exhibit 13. National Architecture Phase I Themes and Features*

- maximizing use of existing infrastructure (e.g., communications, transportation, financial, etc.);
- allowing flexibility in route determination (e.g., from within vehicles and/or from a central location);
- using tag/beacon systems for special purposes (e.g., tolls, electronic clearance, etc.);
- using open standards to encourage competition for services and equipment;
- encouraging competitive markets via private independent service providers (e.g., weather, transit schedules, travel information, etc.);
- promoting nationwide compatibility by standardizing key interfaces (e.g., vehicle to infrastructure) and encouraging national service markets;
- permitting the use of vehicle probes for traffic data collection.

*Several key themes and features were common among the Phase I concepts evaluated, and will thus be incorporated into Phase II.*

The Department and the Phase II teams will immediately address several issues, including:

- definition of a basis for national standards to enable ITS deployment;
- how many and what kinds of paths to take toward ITS implementation;
- Federal, state, and local government roles, as well as those of private-sector entities in developing, implementing, and operating ITS systems.

Public comment and reaction is being solicited throughout Phase II of the architecture development program. The program has an active outreach and consensus activity—involving workshops, online resources, and regional forums across the Nation—in order to garner as much public input and support from involved stakeholders as possible, to ensure that the final products are based on a broad consensus among the transportation and ITS communities. The Department has planned over 20 additional coordination meetings during Phase II to ensure successful, consensus architecture development. Exhibit 14 illustrates subsystem and communications relationships.

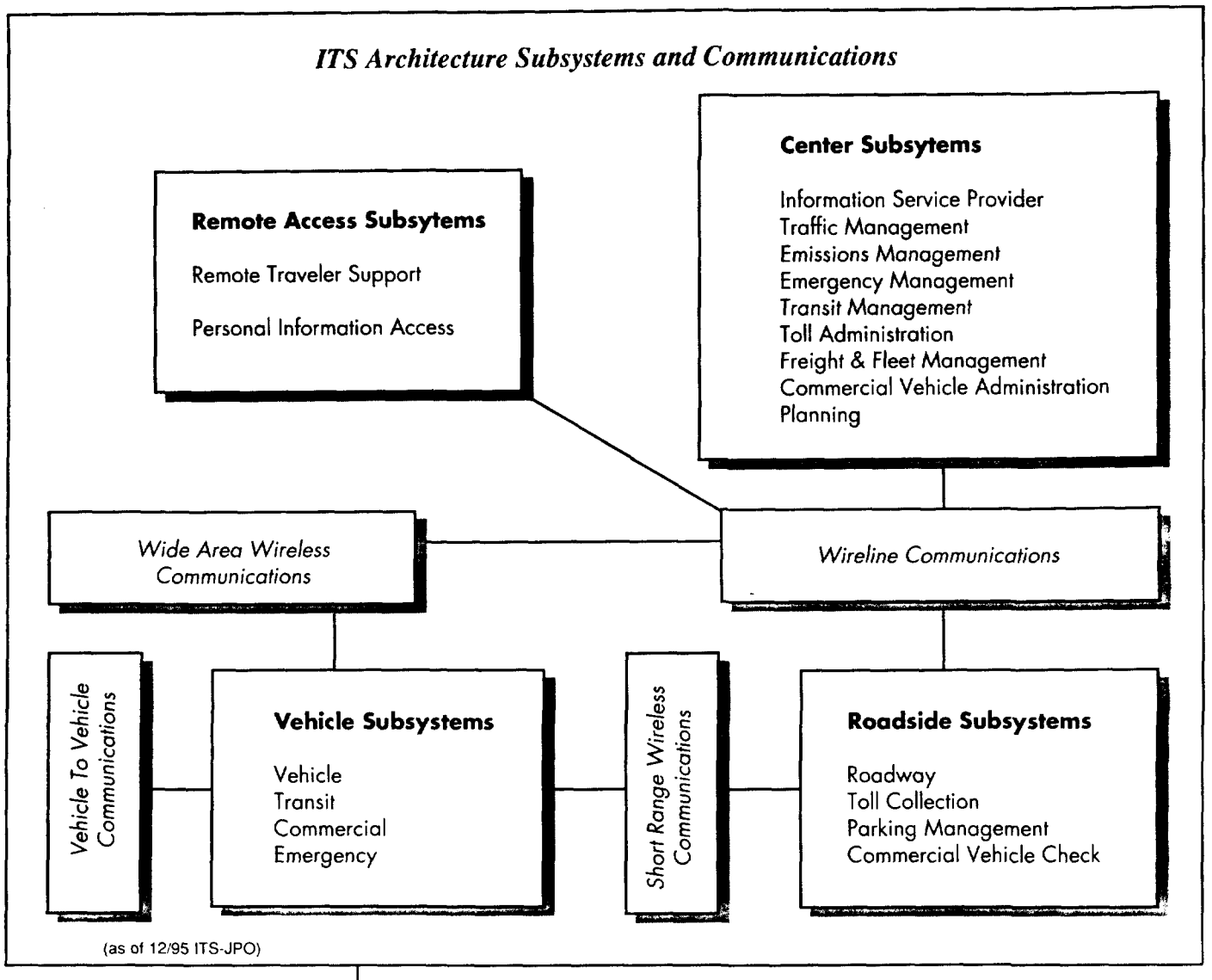


*Exhibit 14. ITS Architecture Subsystems and Communications*

*Phase II will comprise over 20 additional coordination meetings, with various architecture subsystems and communications relationships.*

Accomplishments in R&D include the establishment of the National Transit GIS and the development of national workshops for information exchange. An open architecture standard to interface interchangeable transit vehicle components was accepted by the industry and is the first officially recognized ITS standard.

FTA and Sandia National Laboratories are further assessing the system architecture needs of the transit community to ensure that the overall national ITS systems architecture development program adequately consider transit needs. In addition to its value to the national system architecture development program, the transit system architecture has been of significant utility to transit operators planning ITS technology deployments. A comparable system architecture analysis is being performed for FHWA in the CVO area by the Johns Hopkins University Applied Physics Laboratory, and for NHTSA (for the collection of collision avoidance related ITS services) by Stanford Telecomm. These efforts are being coordinated closely with the National System Architecture development effort by Rockwell and Loral.

## 2. Standards Development

The Department is currently funding a number of initiatives to facilitate standards development in critical areas that relate to the public interest. The areas of interest include but are not limited to: ensuring public safety, reducing the risk of infrastructure development by the public sector, facilitating interstate commerce, and developing enabling standards. The approaches are:

- standards precursor activities such as the **development of standards requirements**—the basis from which standards are developed;
- **agreements with multiple standards development organizations (SDOs)** to provide dedicated technical support for what is typically a voluntary process;
- **public sector participation** throughout the standards development process to ensure that the public agency customers are getting the products they need;
- **participation of U.S. experts in international ITS forums** such as the International Standards Organization Technical Committee 204 - Transport Information and Control Systems.

The Department is also working closely with ITS America and its Council of Standards Organizations subcommittee to ensure a smooth and efficient process of developing standards for ITS.

Listed below are specific U.S. DOT-funded standards requirements activities that will be handed off to SDOs in support of standards development.

- **National Architecture** - An overarching framework that will identify sub-system interfaces and information flows between these sub-systems (e.g., the transfer of traffic information between a traffic management center and vehicle). The results from this three year effort will stimulate a multitude of standards activities in the area of message set definitions (i.e., the information that needs to flow between the sub-systems) and communication links (i.e., defining the communications load for transferring data between sub-systems).
- **Commercial Vehicle Information System Network (CVISN)** - Builds upon the National Architecture activities and defines in greater detail the CVO requirements. CVISN activity supports future standards activities in the areas of electronic data interchange and vehicle-to-roadside communications.
- **Vehicle-to-roadside communications (VRC)** - A comprehensive document detailing the standards requirements for VRC applications is currently underway (this makes use of both the National Architecture and CVISN results, as well as a study by ITS America to define the requirements for electronic toll and traffic management (ETTM)). This VRC document will support standards development activities in the areas of message sets and communications links for application areas such as CVO (electronic border clearance), ETC, traffic management, transit operations, traveler information, etc.

- **Location Referencing System** - Interoperability issues currently exist based upon different commercial map databases utilizing various geographic referencing mechanisms—a location in one database map may be referenced differently in another database. A study is currently underway at the Oak Ridge National Laboratory to develop a draft protocol standard that will allow for real-time location referencing inter-operability among databases.

- **Spatial Data Transfer Standard ITS Profile (pending)** - Current compatibility issues inhibit transferring spatial data between database products. An activity is being defined to identify an "ITS profile" that will provide a mechanism to facilitate the transfer of non-real-time spatial data between various database products and public agency databases.

- **Advanced Traffic Management System (ATMS) Architecture** - This effort examines one of the sub-systems within the National Architecture effort and defines it to a deeper level of detail, sufficient for use by travel management system integrators. Current activities include surveying and standardizing the definition of terms (to form a "dictionary" of possible data elements) to foster inter-operability among existing and future commercial database systems.

- **National Transportation Control/ITS Communications Protocol (NTCIP)** - This broad-based government/industry effort is defining a suite of protocols to establish easy inter-operability among a variety of ATMS hardware and software elements. The NTCIP will determine how traffic signal systems "talk" to local controllers, changeable message signs (CMS), highway advisory radio (HAR), etc.

## G. ITS Program Management

The Joint Program Office (JPO) for Intelligent Transportation Systems was formally established in May 1994. JPO is responsible for setting a unified, strategic program direction, guiding policy coordination, and exercising fiscal control over all funding resources. JPO receives policy guidance from the ITS Management Council chaired by the Deputy Secretary of Transportation, and planning guidance from the ITS Strategic Planning Group consisting of surface transportation leaders throughout the Department.

JPO immediately developed and implemented an oversight mechanism to evaluate both program and project objectives, partly in response to an Inspector General's Program Audit of the Department's ITS Program Delivery Process. The Inspector General's December 15, 1994, audit report concluded that the Department's ITS program management and oversight controls required improvement to ensure effective project selection, cost and schedule monitoring, and timely evaluation plan preparation.

The Inspector General recommended that the JPO Director and Program Office:

1. Oversee final selection and approval for all prospective projects;

2. Establish controls to ensure that all new ITS projects are solicited and selected according to prescribed criteria and the selection basis documented;

3. Establish centralized systems to monitor ITS projects and initiate appropriate corrective actions;

4. Advise ITS-participating program office managers that Contracting Officer's Technical Representatives (i.e., technical or project managers) must review progress reports to monitor and justify billing amounts.

JPO implemented ITS program improvements with help from participating program offices in FHWA, FRA, FTA and NHTSA. The Inspector General's draft report recommendation inspired the changes, as well as implementation of improved program management and coordination processes. The improved processes include developing a computerized system to track spending and ITS project milestones, and spending plans based on program "road maps" to ensure responsible and targeted direction of funds.

# III. CONCLUSION

The Department has set a clear goal to move to targeted ITS deployment. To meet our objective, we are examining strategies to mainstream ITS into the transportation planning objectives of states and localities, and to adopt roles that complement the product-based interests of industry while representing the public interest in safety enhancement. The Department will also focus on training, skills, standards, and strategies for innovative funding (i.e., public/private partnerships) to integrate ITS technologies into the Nation's surface transportation system. Our ultimate goal is simple—facilitate the deployment of those technologies that truly improve Americans' lives. Our accomplishments to date and strategic plans for the future together form the basis we need to attain this goal.

# APPENDIX I

| *ITS Operational Tests Awarded in Fiscal Year 1995* | | |
|---|---|---|
| **Title** | **Partners** | **Description** |
| AUTOMATED COLLISION NOTIFICATION (ACN) | | |
| Field Operational Test Program of an ACN System for Emergency Notification and Personal Security User Service | Calspan, New York State Department of Transportation, General Motors, Cellular One, Rockwell International, Datumtech, Erie County EMS, Erie Community College | The project encompasses designing, building and deploying an ACN system for a large scale test, using 1000 privately-owned cars in Erie County, New York, for a period of one year. The ACN system will use 3-axis accelerometers for crash sensing, GPS for vehicle location, and cellular telephone for communications. Interface to the emergency management system (EMS) will be through a centralized dispatch facility. Local EMS providers and medical community will assist in the evaluation of the medical outcomes of crash victims to assess system benefits. |
| INTELLIGENT CRUISE CONTROL (ICC) | | |
| Intelligent Cruise Control Field Operational Test | University of Michigan Transportation Research Institute, Leica AG, Michigan Department of Transportation, Haugan Associates | The project will evaluate intelligent cruise control technology using ten passenger cars for a 24 month period with 196 lay drivers. A total of 130,000 to 200,000 vehicle-miles of operation on freeway, including 80,000 to 100,000 vehicle miles for long trips, is planned. This test will focus on evaluating the human factors and safety aspects of intelligent cruise control. |
| ADVANCED PUBLIC TRANSPORTATION SYSTEMS (APTS) | | |
| Traveler Information Kiosk | Metro-Dade Transit Agency, Metropolitan Dade County Government, FTA | Travelers will be provided with an automated trip planning capability including real-time on-line public transportation route and schedule information. |
| Transit Information System | Central Florida Regional Transportation Authority, Florida Department of Transportation, FTA | Electronic bus stop displays using vehicle location and signal preemption systems will provide travelers with next bus information. Vehicle data will be monitored for improved fleet performance and customer service. |
| INTERNATIONAL BORDER CROSSING | | |
| Expedited Processing at International Crossings | Arizona Department of Transportation, Lockheed Martin, Mexican Secretary of Transport, Hughes, the Western Highway Institute, et al. | The project will demonstrate an automated clearance system for compliance monitoring and regulatory data processing and transfer using: electronic filing, data storage, cargo security/integrity, data transfer using vehicle-to-roadside communication and a two-way radio link, License Plate Recognition, automated vehicle emissions monitoring, expedited safety inspection, electronic seals to ensure cargo integrity, and traffic management and control systems for priority assignment to minimize processing time. |
| International Border Electronic Clearance | Caltrans, U.S. Customs Service, Department of Justice Border Research & Technology Center, Qualcomm, Calstart, Scientific Atlanta, et al. | This project will facilitate development of a system compatible with the HELP/I-75 tests which positively identifies commercial vehicle and cargo using a radio frequency (RF) transponder, positive driver identification using voice recognition, cargo security using electronic signature, automated positioning of vehicles using electronic maps, a secure means of distributing and updating documents, and cargo/safety/environmental monitoring systems. |

## *ITS Operational Tests Awarded from Fiscal Year 1991 to Fiscal Year 1994*

| No. | Projects | Location | Funding | | Percent Non-Fed Funding |
|---|---|---|---|---|---|
| | | | Federal ITS | Total Cost | |
| 1 | **Ada County Travel Demand Mgmt Emissions Detection** This test will evaluate the feasibility of using remote sensing technology to monitor vehicle emissions. Active infra-red roadside emissions detection technology will determine the relative contributions of in-county and out-of-county vehicles to mobile-source emissions. | Ada County, Idaho (Boise) | $253,000 | $327,900 | 23% |
| 2* | **ADVANCE** This test will evaluate an infrastructure to support dynamic route guidance. The Traffic Information Center will combine real-time information from equipped vehicles and other sources, and transmit the processed information to equipped vehicles where it will be used to develop a preferred route. The routing information will be presented to the driver through voice instructions and screen-displayed arrows depicting the required turning movements. | Northwest suburbs of Chicago, Illinois | $21,079,185 | $31,000,000 | 32% |
| 3 | **Advanced Fare Payment Media II** This project will evaluate a computerized system for integrating various advanced fare media technologies and processing systems, including on-board electronic transit fare and data collection, and on-site travel support services such as congestion pricing, parking management and data collection. | Los Angeles, California, area | $25,290 | $300,000 | 92% |
| 4* | **Advanced Rural Transportation Information and Coordination** This project establishes a centralized communication site and coordinates the communications systems of several public agencies (highway, state patrol and transit). Response time to accident and road condition emergencies are expected to improve; real-time vehicle status and schedule information will be provided. | Itasca and St. Louis Counties, Minnesota | $903,000 | $1,542,000 | 41% |
| 5* | **Advantage I-75** The project facilitates motor-carrier operations by allowing transponder-equipped and properly documented trucks to travel any segment along the entire length of I-75 at mainline speeds with minimal stopping at weigh/inspection stations. Electronic clearance decisions at downstream stations is based on truck size and weight measurements taken upstream, and on computerized checking of operating credentials in each state. | I-75 in Florida, Georgia, Tennessee, Kentucky, Ohio, Michigan, and Ontario, Canada | $7,490,511 | $8,247,340 | 9% |
| 6 | **Ann Arbor Intermodal System** This project will evaluate an on-board bus communication and navigation system, a central control system, and a "Smart Card" fare collection system. The on-board system monitors actual performance regarding route, location, speed and status of mechanical systems. | Ann Arbor, Michigan | $1,980,000 | $2,442,500 | 19% |

* Indicates operational tests which have been funded, either partially or totally, with Congressionally earmarked funds.

| ITS Operational Tests Awarded from Fiscal Year 1991 to Fiscal Year 1994 | | | | | |
|---|---|---|---|---|---|
| **No.** | **Projects** | **Location** | **Funding** | | **Percent Non-Fed Funding** |
| | | | **Federal ITS** | **Total Cost** | |
| 7 | **Atlanta Driver Advisory System** This test will evaluate the benefits of en-route traveler advisory and traveler services information using FM subcarrier wide area communications systems and applications of the 220 MHZ frequency pairs. All elements will be integrated into Atlanta's advanced traffic management system. | Atlanta Metropolitan Area | $7,236,916 | $9,097,803 | 20% |
| 8 | **Atlanta Traveler Information System** This project will build upon the Atlanta Regional Advanced Transportation Management System infrastructure to test and evaluate provision of travel information through electronic, interactive kiosks, welcome centers, major transfers points, and other gathering points such as hotels. | Georgia, statewide with a concentration in the Atlanta Metropolitan Area | $4,000,000 | $5,000,000 | 20% |
| 9* | **Borman Expressway ATMS** This fully-functioning advanced traffic management system includes mobile units that can perform transportation management functions (e.g., control of video surveillance, highway advisory radio, changeable message signs and signals) at the site of an incident. The project is evaluating promising new electronic sensors and integrating them using spread spectrum radio. The Borman ATMS will become an essential component of the Gary-Chicago-Milwaukee Midwest Priority Corridor. | Gary-Chicago-Milwaukee Corridor | $550,000 | 1,750,000 | 69% |
| 10 | **Boston Smart Traveler** The project tested the public acceptance and potential traffic impacts of a telephone-based audiotext traffic information service. | Boston, Massachusetts | $1,515,000 | $3,395,000 | 55% |
| 11 | **"CAPITAL" - (D.C. Cellular Surveillance)** This test uses the existing cellular infrastructure extensively for area-wide surveillance to determine geolocation accuracy and traffic information completeness, and the usefulness of passive statistical processing for measuring traffic flow and incidents. | Washington, D.C., Metropolitan Area | $5,511,731 | $7,169,418 | 23% |
| 12 | **California Smart Traveler** This project consisted of two components: (1) Los Angeles Smart Card tested the use of smart cards for express transit services as well as for parking and other services at employment sites; and (2) Orange County Smart Intermodal system tested a real-time information system that will include special event information. | Los Angeles and Orange County, California | $1,500,000 | $3,300,000 | 55% |
| 13 | **Chattanooga Smart Card** This project will support the planning and development of a smart card fare and parking system to be used to increase the appeal of transit and park-and ride lots in the downtown area. | Chattanooga, Tennessee | $75,000 | $93,750 | 20% |

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## *ITS Operational Tests Awarded from Fiscal Year 1991 to Fiscal Year 1994*

| No. | Projects | Location | Funding | | Percent Non-Fed Funding |
|---|---|---|---|---|---|
| | | | Federal ITS | Total Cost | |
| 14 | **Chicago (CTA) Intermodal System**<br>This project will evaluate the process of creating a Bus Service Management System (BSMS) which includes an Automatic Vehicle Location (AVL) system, a computer-assisted dispatch and control system, real-time passenger information signs, and a traffic signal preemption system. | Chicago, Illinois | $490,000 | $3,640,000 | 87% |
| 15 | **Colorado Mayday System**<br>This project will evaluate the use of GPS for vehicle location and cellular phone for two-way communications to provide emergency and non-emergency assistance to travelers operating in an area of over 12,000 square miles in north-central Colorado. The test will involve up to 2,000 vehicles equipped with a low-cost location device called TIDGET. | North-central Colorado | $2,439,654 | $3,832,285 | 36% |
| 16 | **Connecticut Freeway Advanced Traffic Management Systems**<br>This ATMS project evaluates the use of roadside mounted radar detectors in combination with closed circuit television (CCTV) for incident detection and verification. The ATMS utilizes 44 radar detectors (wide- and narrow-beam) and compressed video. | Hartford, Connecticut | $600,000 | $1,380,000 | 57% |
| 17 | **Dallas Area Rapid Transit Personalized Public Transit**<br>This test will evaluate a combination of a fixed and flexible transit routes in the Dallas area. Fixed-route transit vehicles will be able to pick-up off-route passengers based on scheduling allowances and convenience of point-of-pick-up. | Dallas, Texas | $391,560 | $491,560 | 20% |
| 18 | **Dallas Smart Bus Evaluation**<br>This test will evaluate the effectiveness of implementing an Integrated Radio System that includes automatic vehicle location on 823 transit buses, 200 mobility-impaired vans and 142 supervisory and support vehicles. | Dallas, Texas | $460,000 | $560,000 | 18% |
| 19 | **Delaware County Ridetracking**<br>This project will develop and evaluate an automated identification and billing system (AIBS) for paratransit service. Evaluation will cover advanced technology for passenger identification, the accounting and billing data collected on each passenger trip, and the reporting required for coordination with various transportation suppliers and internal performance monitoring. | Delaware County, Pennsylvania | $200,000 | $518,000 | 61% |
| 20 | **Denver Rapid Transit District (RTD) PIDS**<br>This project will utilize the data gathered from the Automatic Vehicle Location (AVL) system, currently being installed on all RTD buses, to provide information to video monitors regarding estimated bus departures for waiting bus passengers. | Denver, Colorado | $1,000,000 | $2,000,000 | 50% |



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|---|---|---|---|---|---|
| **No.** | **Projects** | **Location** | **Funding** | | **Percent Non-Fed Funding** |
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| 21 | **Detroit/St. Clair Rivers International Border Crossing**<br>This project is studying the institutional issues of applying new technologies to the International Border at the Detroit/Port Huron, Michigan frontier. The project envisions an automated primarily paperless system, using the latest technologies, to enhance border crossing by commercial and private vehicles. The system designed will be shared with a similar site in the Buffalo, NY, area. | Detroit-Windsor Ambassador Bridge, Detroit; Blue Water Bridge, Port Huron, Michigan | $110,000 | $500,000 | 78% |
| 22 | **Detroit Transportation Center Transit Information**<br>This project provided real-time traffic condition information to dispatch centers of public transit agencies in the Detroit area. | Detroit, Michigan | $50,000 | $100,000 | 50% |
| 23 | **DIRECT**<br>This test will evaluate several alternative low-cost methods of communicating advisory information to motorists. These include use of the Radio Data System (RDS), voice on a FM subcarrier, Automatic Highway Advisory Radio (AHAR), Low Power Highway Advisory Radio (HAR), and cellular phones. | Along sections of I-75, I-94 and M-10 within the city of Detroit. | $2,500,000 | $4,400,000 | 43% |
| 24 | **Dynamic Truck Speed Warning for Long Downgrades**<br>This project provides for the installation of a weigh-in-motion station to determine the weight of each truck, and for the installation of loops to determine vehicle speeds. Drivers will be advised of individual safe downhill speeds by changeable message signs. | I-70, Straight Creek Pass, Colorado | $195,000 | $243,000 | 20% |
| 25 | **Evaluating Environmental Impacts of IVHS Using LIDAR**<br>This test combined Light Detection and Ranging (LIDAR) technology for wide area emissions detection with active infrared technology for roadside emissions detection to evaluate any improvements in air quality due to implementing traffic responsive control strategies for events at a sports complex. | Minneapolis and St. Paul, Minnesota | $500,000 | $766,847 | 35% |
| 26 | **FAST-TRAC**<br>This test combines ATMS (SCATS traffic adaptive control system) and ATIS (Siemens Ali-Scout route guidance and driver information system) for improved traffic flow. Traffic flow detection uses Autoscope video image processing technology. Infrared beacons are installed at critical locations in the network to provide a continuous exchange of real time traffic and route guidance information with equipped vehicles. | Oakland County, Michigan | $55,500,000 | $69,375,000 | 20% |

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## *ITS Operational Tests Awarded from Fiscal Year 1991 to Fiscal Year 1994*

| No. | Projects | Location | Funding | | Percent Non-Fed Funding |
|---|---|---|---|---|---|
| | | | Federal ITS | Total Cost | |
| 27* | **Genesis**<br>This project evaluates the use of personal communication devices (PCDs) to distribute transit and traffic information. Genesis provides to the urban traveler current traffic or transit data relevant to the chosen trip mode and route. | Minneapolis/ St. Paul, Minnesota | $4,082,000 | $5,307,000 | 23% |
| 28* | **HELP/Crescent**<br>This project was a multi-state, multi-national effort to design and test an integrated heavy vehicle monitoring system that uses Automatic Vehicle Identification (AVI), Automatic Vehicle Classification (AVC), and Weigh-In-Motion (WIM) technology. | British Columbia, WA, OR, CA, AZ NM, TX | $5,850,000 | $6,090,000 | 23% |
| 29 | **HELP One-Stop Electronic Purchase**<br>This test involves issuance of both annual and temporary credentials, such as International Fuel Tax Agreement (IFTA) and International Registration Plan (IRP). The customer will have terminal access to electronically obtain multiple state credentials and permits, calculate fees and make payments. | California, Arizona and New Mexico | $2,093,200 | $3,093,200 | 32% |
| 30 | **Herald En-Route Driver Advisory via AM Subcarrier**<br>This project will test the dissemination of important traveler information in difficult-to-reach, remote, rural areas using a subcarrier on an AM broadcast station. | Colorado and Iowa | $200,000 | $260,000 | 30% |
| 31* | **Houston Smart Commuter**<br>This project evaluates a real-time traffic and transit information system. The test will assess the market potential to increase bus, vanpool, and carpool use by providing traffic information, bus choices, and carpool options to travelers at home and work. | Harris County, Texas | $5,000,000 | $5,000,000 | 0% |
| 32 | **Idaho Out-of-Service Verification**<br>This project tests various types of machine-readable tags and video image analysis to assure compliance with an out-of-service order issued after a vehicle/driver safety inspection. Roadside inspection sites will be equipped with an alarm system activated when an out-of-service vehicle attempts to leave. | State of Idaho | $800,000 | $1,240,000 | 35% |
| 33 | **Idaho Storm Warning System**<br>This test investigates various sensor systems that provide accurate and reliable visibility and weather data, and uses that data to provide general warnings, speed advisories and possible road closure information to travelers on a section of I-84 in southeast Idaho. | Interstate-84 in southeastern Idaho | $804,500 | $1,231,900 | 35% |

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| No. | Projects | Location | Funding | | Percent Non-Fed Funding |
|---|---|---|---|---|---|
| | | | Federal ITS | Total Cost | |
| 34 | **Imaging Technology for Automatic Real-Time Out-of-Service Verification**<br>This project tests a system of automatic, real-time out-of-service verification among several commercial vehicle inspection sites along a 252-mile section of westbound I-90/94. Using video identification equipment, a database will be created containing key out-of-service data on specific vehicles. | 252-mile section of westbound I-90/94 in Minnesota and Wisconsin | $216,000 | $270,000 | 20% |
| 35* | **Integrated Ramp Metering/Adaptive Signal Control**<br>This test will evaluate the effects of balancing traffic flow between I-5/I-405 and the parallel arterial streets. The project integrates an existing centrally-controlled freeway ramp meter system with an arterial signal system consisting of existing signal controllers, a new Advanced Traffic Controller, and a candidate adaptive control measure. | Irvine (Orange County), California | $2,617,000 | $3,271,250 | 20% |
| 36 | **ITS for Voluntary Emissions Reduction**<br>This test will evaluate the measurement of real-time emissions using an infrared roadside emissions sensor and providing that measurement to drivers via a changeable message sign at a freeway entrance ramp, as well as education material about the fuel savings and air quality benefits of well tuned vehicles. The effectiveness of offering free or subsidized vehicle tune-ups will also be evaluated. | Denver, Colorado | $304,663 | $498,358 | 39% |
| 37 | **Los Angeles Smart Traveler**<br>This project will demonstrate the use of real-time and other reliable sources of transportation information to determine high-occupancy-vehicle (HOV) travel options. Kiosks using audiotext and Videotext will be used to provide the information which also will include transit, paratransit and rideshare options. | Los Angeles, California | $1,500,000 | $3,300,000 | 55% |
| 38 | **MidWest States One-Stop Electronic Purchase Test**<br>The project tests one-stop, multi-state electronic purchase of credentials from locations such as motor carrier facilities, permitting services, truck stops and state agencies. The carriers will be able to purchase registration, fuel tax, authority, and over-dimensional permits from eight states through the system. | MN, IA, IL, KS, MO, NE, SD, and WI | $1,300,000 | $2,377,665 | 45% |
| 39 | **Milwaukee Smart Bus**<br>This project supports the efforts of Milwaukee County to evaluate its Automatic Vehicle Location (AVL) and bus fleet management system. | Milwaukee County, Wisconsin | $50,000 | $50,000 | 0% |
| 40 | **Mobile Communications System**<br>This project will test and evaluate the use of a portable detection and surveillance system for highway construction, special events, and incident locations. Specially-equipped trailers will be placed at temporary traffic congestion locations. | Orange County, California | (FY93) $2,459,432 | $3,679,690 | 33% |

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| 41 | **MTA Baltimore Smart Bus**<br>This project implemented an Automatic Vehicle Location (AVL) system providing bus status information to the public while simultaneously improving bus schedule adherence and labor productivity. The system is expanding to include all 900 Baltimore transit buses; Global Positioning System (GPS) inputs are replacing LORAN-C for vehicle location. | Baltimore, Maryland | $2,000,000 | $6,400,000 | 69% |
| 42 | **Multi-jurisdictional Live Aerial Video Surveillance System I**<br>This test evaluated live video transmission from a gyro-stabilized camera mounted on helicopters for observing, evaluating and properly managing major highway incidents and situations of a public safety nature. | Fairfax County, Virginia | $355,000 | $355,000 | 0% |
| 43 | **Multi-jurisdictional Live Aerial Video Surveillance System II**<br>This test evaluates live video transmission from fixed-wing aircraft to county and state traffic management centers and the feasibility of transmitting live video to mobile command centers. | Montgomery County, Maryland | $445,000 | $740,000 | 40% |
| 44 | **Northern Virginia Integrated Route Deviation/Fixed Route**<br>This test will evaluate an enhanced, ridesharing-route deviation transportation system integrated with conventional transit and ridesharing in the Northern Virginia suburbs of Washington, D.C., including Prince William and Stafford Counties. The system will provide on-demand service through an audiotext request system which uses scheduling software similar to the taxi industry. | Northern Virginia | $1,184,460 | $3,243,593 | 64% |
| 45 | **NY City Metro Transportation Authority Travel**<br>This test will evaluate the effectiveness of providing comprehensive traffic and transit information via kiosks at bus stops and on board buses. The system will use data generated by the GPS bus locating system to display real-time travel information. | New York, New York | $3,000,000 | $5,029,460 | 40% |
| 46 | **On-Board Automated Mileage Test (IA)**<br>This project tests and evaluates the effectiveness of using the Global Positioning System (GPS) and first-generation on-board computers to record the miles driven within a state for fuel tax allocation purposes in a manner acceptable to state auditors. | Iowa-Minnesota-Wisconsin | $1,068,239 | $1,745,748 | 39% |
| 47 | **PASS (OR)**<br>The project examined integrating Automatic Vehicle Identification (AVI), Weigh In Motion (WIM), Automated Vehicle Classification (AVC) and On-Board Computers (OBC) to identify, weigh, and classify selected heavy vehicles in advance of weigh stations and ports-of-entry. | Ashland, Oregon, Port-of-Entry, Northbound I-5 | $350,000 | $552,900 | 33% |

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| 48 | **Puget Sound Help Me (PuSHME) Mayday System**<br>This test assesses operational, institutional and technology requirements for implementing a regional Mayday system that allows a driver to transmit an immediate notification of an incident, its location and need for assistance to a response center. | Puget Sound, Washington | $1,216,942 | $2,300,000 | 47% |
| 49 | **Rogue Valley Mobility Manager**<br>This project demonstrates the Mobility Manager concept to integrate transportation users, providers, and funding sources. Advanced electronic technology, including magnetic-stripe farecards, is used to record financial transactions. The initial phase focuses on providing transportation service to the elderly and disabled who are unable to use fixed-route transit. | Medford, Oregon | $460,000 | $935,000 | 51% |
| 50 | **RTD (Denver) Smart Bus**<br>This test evaluated the implementation of an Automatic Vehicle Location (AVL) system, as part of an upgraded communications system, providing bus location information to transit dispatchers to increase efficiency, ridership and passenger safety. | Denver, Colorado | $8,440,000 | $10,520,000 | 20% |
| 51 | **Sacramento Real-Time Ride Matching**<br>This project will use a geographic information system (GIS) to provide single-trip or multiple-trip real-time ridesharing information. | Sacramento, California | $204,000 | $825,000 | 75% |
| 52 | **San Antonio TransGuide**<br>This test will evaluate and document the San Antonio advanced traffic management system's digital communication network for cost effectiveness and benefits versus "traditional" transportation data communication systems. An additional element is the on-line evaluation and comparison of several incident detection algorithms. | San Antonio, Texas | $899,654 | $1,298,460 | 31% |
| 53 | **Santa Clara County Smart Paratransit**<br>This project will use global positioning system (GPS) technology for automatic vehicle location (AVL) operation of a paratransit system in conjunction with bus, light-rail and train operations. The service provided will allow disabled travelers to request specific transportation service. | Santa Clara County, California | $425,000 | $850,000 | 50% |
| 54 | **Satellite Communications Feasibility**<br>This project will evaluate the use of a VSAT (very small aperture terminal) satellite as the communications medium for four stationary closed-circuit television (CCTV) cameras and a mobile CCTV camera and communication platform. | I-95 in Philadelphia, Pennsylvania | $2,220,000 | $2,800,000 | 21% |

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| 55* | **SCOOT Adaptive Traffic Control System**<br>This test implements SCOOT in an area of the City of Anaheim's traffic control system to evaluate its effectiveness as an adaptive signal timing control package. SCOOT automates the traffic flow data collection and automatically optimizes traffic signal timing based on real-time traffic conditions. | Anaheim, California | $1,153,927 | $2,438,427 | 53% |
| 56 | **Seattle (Bellevue) Smart Traveler**<br>This project examines possible uses for mobile communications, such as cellular phones and information kiosks, to make ridesharing (carpooling and vanpooling) more attractive. | Metropolitan Seattle | $244,000 | $545,000 | 57% |
| 57 | **Seattle Wide Area Information for Travelers/Bellevue**<br>This project tests delivery of traveler information via three devices: the Seiko Receptor MessageWatch , an in-vehicle FM subcarrier radio and a palm-top computer. This project will also expand service currently available under the Bellevue Smart Traveler project. | Seattle, Washington | $4,526,540 | $7,200,000 | 37% |
| 58* | **Smart Call Box**<br>The project tests the feasibility of using call boxes for additional purposes. Smart Call Boxes will be evaluated to collect traffic census data; obtain traffic counts, flows and speeds for incident detection; report information from roadside weather information systems; control changeable message signs; and control roadside closed-circuit television cameras. | San Diego, California | $915,000 | $1,607,600 | 43% |
| 59* | **Smart Corridor**<br>This test evaluates the use of advanced technologies to advise travelers of current conditions and alternate routes (using communication systems such as Highway Advisory Radio (HAR), Changeable Message Signs (CMS), kiosks, and teletext), to improve emergency response, and to provide coordinated inter-agency traffic management. | Los Angeles, California | $1,100,000 | $4,000,000 (central database and expert systems development total cost) | 64% |
| 60 | **Southwest States Electronic One-Stop Shopping**<br>This project demonstrates a microcomputer-based vehicle one-stop credential purchasing process that will reduce public and private sector time and costs; streamline administrative processes and speed turn-around times; improve consistency and uniformity; extend access and availability; and ensure all commercial vehicle operators uniform access to one-stop shopping without substantial expenditures or establishment of new bureaucracies. | Arkansas, Colorado and New Mexico | $537,305 | $671,632 | 20% |

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