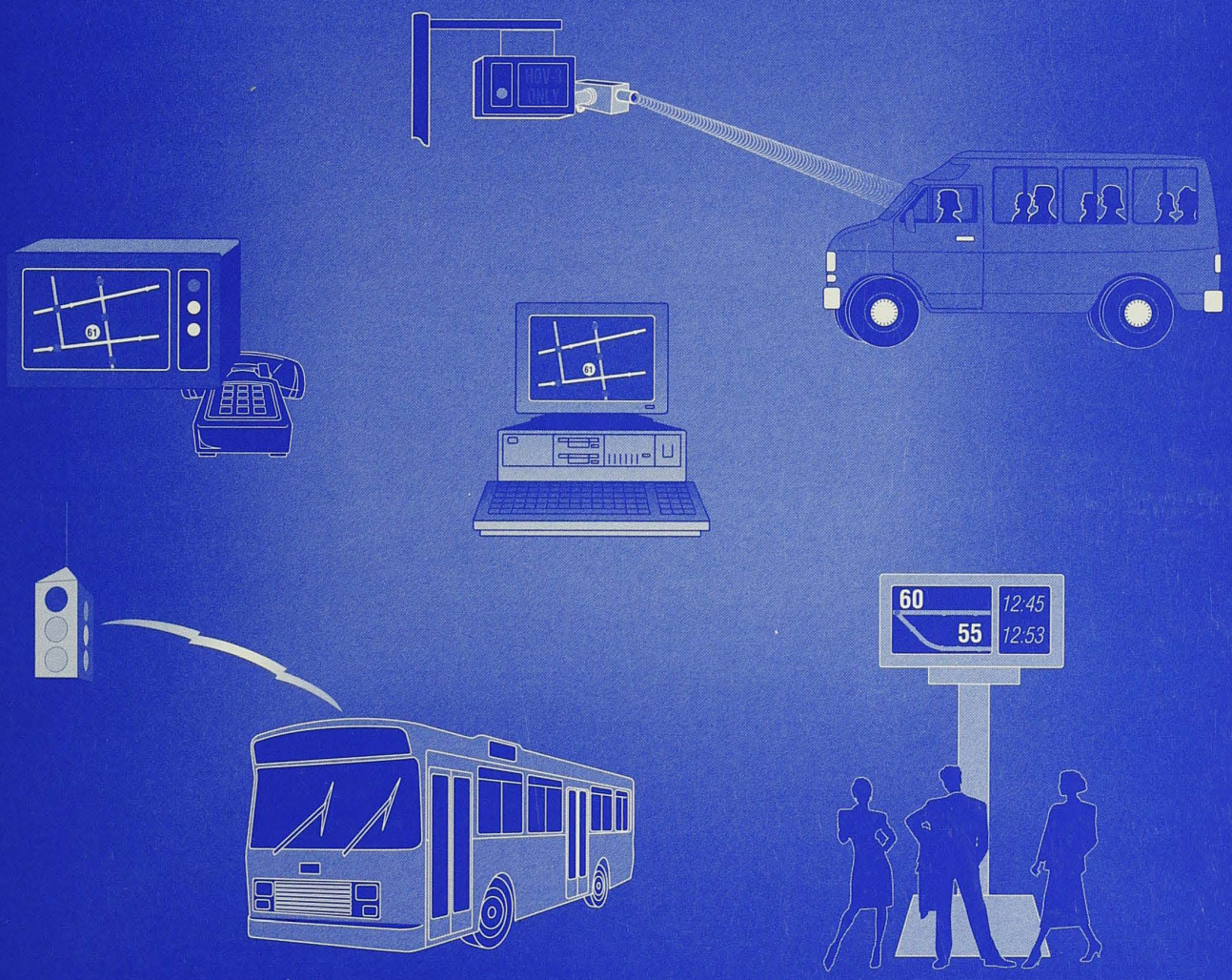
U. S. Department
of Transportation
**Federal Transit
Administration**

Advanced Public Transportation Systems



U.S. Department of Transportation IVHS Program

ADVANCED PUBLIC TRANSPORTATION SYSTEMS

Advanced Public Transportation Systems, or APTS, are advanced navigation and communication technologies applied to all aspects of public transportation system operations. APTS provides the technology for transportation agencies to make timely transit information available to the passenger and to improve the convenience, reliability, and safety of public transportation service.

The Federal Transit Administration (FTA) created the Advanced Public Transportation Systems (APTS) program as part of the U.S. DOT initiative in Intelligent Vehicle Highway Systems (IVHS). IVHS is a tool to enhance transportation mobility, energy efficiency, environmental protection, and safety. Most IVHS systems are designed for the automobile driver and not the transit rider. The goal of the APTS program is to address this imbalance by developing IVHS systems that will improve the public transit option.

The importance of IVHS as a potential solution to transportation problems has grown in recent years, primarily because of the coordinated support from representatives of business, industry, and government. Recent Federal and state legislation that encourages a strong local approach to local transportation issues has also served to promote the multimodal, integrated approach of IVHS options.

Most of the technologies needed to implement Advanced Public Transportation Systems already exist. One of the most exciting aspects of the APTS program is the interest shown by U.S. manufacturers in the application of IVHS technologies to transit, which they view as a new market in the transition of existing technology from defense to the domestic side of the economy. These commercial technologies are becoming the force for change in how transit manages its operations and improves service to the customer.

The challenge is to develop appropriate system applications in transit for these technologies. Operational tests are being conducted in "real world" environments under "live" transportation conditions. A typical operational test integrates existing technology, R&D products, institutional arrangements, public acceptance, and market support to test the technologies under real-world conditions.

Various technologies are being examined in the APTS program, and many projects and operational tests involve the integration of several different systems. For example, to help the traveler make immediate decisions about his/her travel mode or route, a series of *Smart Traveler Technologies* are being explored. To improve vehicle and fleet planning, scheduling, and operations, a number of transit operators are testing *Smart Vehicle Technologies* which represent new methods of increasing reliability, efficiency, and safety. *Smart Intermodal Systems* involve the integration of APTS technologies into traffic management and other non-transit applications of IVHS.

Smart Traveler Technologies, Smart Vehicle Technologies, and Smart Intermodal Systems represent the transfer of technological innovations into the U.S. transportation systems of the 21st century.

APTS PROJECT PLANNING AND FUNDING

The Federal Transit Administration's commitment to conduct a revitalized and expanded Transit Planning and Research Program resulted in the largest investment in these activities in the last 10 years. A total of $60 million was made available in FY 1992 to provide new emphasis to a host of initiatives, including the Advanced Public Transportation Systems Program.

In 1993 limited FTA discretionary funds under Section 26 of the Federal Transit Act, as amended, are available to support the implementation and evaluation of APTS operational tests. Currently, funds from the FHWA/IVHS Corridors program and funds from FTA Sections 3 and 9 are being used to cover capital costs. However, the availability of all the funds appropriated under ISTEA has been dramatically reduced, thereby hampering some of the progress made in 1992. In addition, budgetary pressures and congressional earmarking has put constraints on the overall APTS program.

The deployment of APTS technologies represents a critical opportunity to test the dynamic flexibility provisions of ISTEA because transportation decisions are now made based on local needs, rather than Federal requirements dictating how and where money must be spent. Flexibility offers Metropolitan Planning Organizations (MPOs), transit operators, and state highway agencies the financial resources necessary to develop the most appropriate transportation systems to maintain mobility, ease congestion, and improve our cities' air quality.

Future funding for APTS initiatives will come from both Federal sources and existing local financial resources as MPOs, state DOTs, and local transit operators work together to meet existing and future travel needs. It is critical that technical information on the costs and benefits of Advanced Public Transportation Systems be aggressively promoted to state and local decisionmakers to assure that multimodal Long-Range Plans identify potential facilities and services to address future needs. Local Transportation Improvement Plans (TIPs), which represent the major planning document for securing Federal financial assistance, should include APTS initiatives. State Implementation Plans (SIPs), required by the Clean Air Act to serve as a state's commitment to actions which will lead to the attainment of National Ambient Air Quality Standards, should also include APTS initiatives.

ISTEA gives local transportation authorities the financial capacity and programming flexibility to develop efficient transportation improvements. It establishes a new multimodal Surface Transportation Program which allows flexible use of selected FTA and FHWA grant programs so that one program can augment the other. The best way to access Federal and non-federal funds for APTS related projects is through full and active participation in project planning, programming, and selection at the local level.

The FTA/APTS program encourages initiatives at the local level and is prepared to offer technical assistance and a solid base of information support. The APTS program consists of operational tests and evaluations that are selected by local agencies and funded through a variety of programs that combine local and Federal support.

APTS PROJECT SUMMARIES

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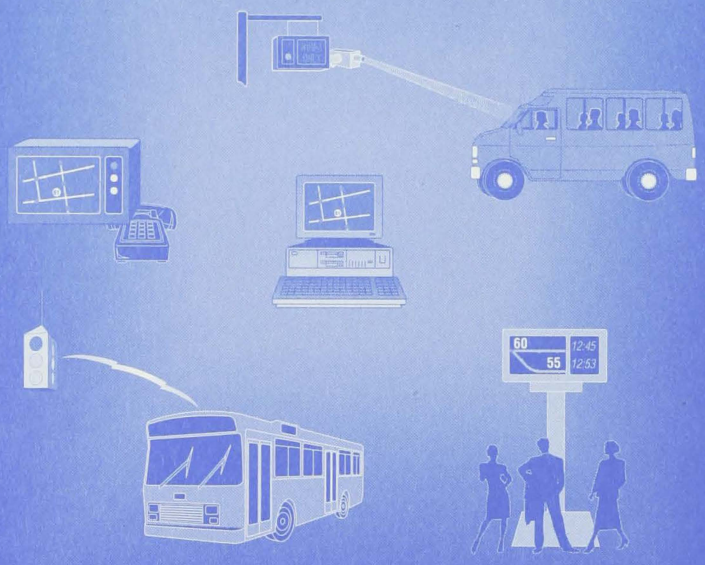
Advanced Public Transportation Systems



U.S. DEPARTMENT OF TRANSPORTATION IVHS PROGRAM

SMART TRAVELER TECHNOLOGY

Smart Traveler Technology focuses on providing basic travel information to transit users before they make personal decisions on how to travel. The concept of the Smart Traveler is to provide real-time transportation information to the public through advanced computer and communications technology.

Providing real-time information to travelers at home, in the workplace, or through roadside or transit center monitors using IVHS communication technologies can help travelers choose their mode of travel, or alter their route, in response to a delay. Several methods for gathering and providing real-time information are being researched and tested for public transportation use. A basic starting point is to ensure that automated information on all public transportation services in a given area is available at a single source. No longer will someone considering the transit option be required to check with every transit service or rideshare program to get information.

Examples of Smart Traveler technologies include interactive displays on personal computers or cable TVs that provide graphic views of public transportation services. The traveler indicates the origin and destination of the trip using a touchscreen that maps out the best route on a graphic display and shows bus numbers, bus stop locations, arrival and travel times. Real-time information can also be provided to travelers on-board a bus or other vehicle, thereby giving him or her the opportunity to complete an efficient journey. Such information can be communicated visually (via videotext) or by voice (via audiotext) to aid passengers with disabilities.

The Los Angeles County Transportation Commission is testing the use of a system which would electronically integrate and coordinate regional paratransit services provided by several public and private providers throughout the county and make the information available to potential users.

Houston METRO is demonstrating a traveler information service using IVHS technology. The project calculates, displays, and prints out the best possible travel itinerary on transit to specific destinations. The information will be provided in English, French, and Spanish.

A number of convenient fare payment options are being tested that may move transit towards a "cashless" operation. These options include the use of deposit cards, credit cards, debit cards, and other so-called "smart cards." Smart cards provide a secure, flexible method of payment, and a single card can be used in a variety of applications, such as paying transit fares or parking fees, and ATM transactions.

Ann Arbor Transportation Authority is developing a mobility pass which uses advanced card technology for either parking or transit use. Wilmington, Delaware plans to evaluate the use of smart cards for fare collection on their entire transit system. Instead of dropping coins or tokens into a fare box, passengers will swipe their prepaid, smart card through electronic readers mounted beside the drivers, and the electronic reader will automatically debit the correct transit fare from the card.

SMART VEHICLE TECHNOLOGY

Smart Vehicle Technology integrates vehicle-based APTS technologies into a single system that is designed to improve vehicle and fleet planning, scheduling, and operations. The smart vehicle implements many advanced communication and vehicle location applications that are adapted from military, aerospace, industrial, and highway use to transit use.

Some of the technologies that are being used by transit are automatic vehicle location, automatic passenger counters, on-board passenger information (both voice and visual), vehicle diagnostics, smart card readers, adaptive signal timing, automated demand-responsive dispatching systems (on-board equipment), transponders for automatic toll collection and HOV verification, and on-board automatic guidance equipment.

The common element linking all of these technologies is communications. To be effective, data must be transferred between the vehicle and the dispatch center, with computational processing either on the vehicle, at the user location, or at a central computer.

On-board sensors automatically monitor such elements as passenger loading, location of the vehicle, fare box revenue, operating condition of the engine and other equipment. This information is transmitted to a control center and is compared with the predetermined operating schedule. Deviations are noted and displayed to both the driver and the dispatcher. Corrective instructions are automatically issued to the driver to restore service or schedule adherence. Of course, if the situation persists, the human dispatcher initiates corrective action. Data on the vehicle's status is stored in the computer so that schedules, analyses, and plans can be revised using actual data.

The FTA has sponsored the development of a standardized Vehicle Area Network (VAN) that permits inputs from various on-board electronic sensors such as AVL, fare boxes, and passenger counters that can be transmitted through a common cable in the vehicle. Previously, different cables were wired separately at the factory or during installation, thereby increasing the number of wires in the bus, the bus weight, and maintenance complexity. The new standard ties these systems together through a common wiring harness, or Vehicle Area Network.

There are a number of smart vehicle tests being initiated around the U.S.

Norfolk's Tidewater Transit has implemented an Automatic Vehicle Location (AVL) system to assure the reliability of its timed transfers and improve customer service. In Chicago, AVL is being implemented to examine innovative bus service improvements, including computer-driven dispatching techniques. In Baltimore, after equipping and operationally testing 50 vehicles using a LORAN "C" based system, the MTA is now equipping its entire fleet using Global Positioning Systems (GPS) technology.

There are also a number of innovative public-private arrangements underway that integrate state-of-the-art technology with transit use. For example, in Denver the RTD has contracted with a private consortium for an automated, fully integrated mass transit communications system for its fleet. The Dallas System Consortium is also an AVL system using GPS technology. The Milwaukee County Transit System has contracted with a private consortium to provide an integrated positioning and communications system for its fleet.

The Federal Transit Administration is evaluating the efforts of these cities to monitor system performance improvements, cost savings, and expanded ridership.

SMART INTERMODAL SYSTEMS

Smart Intermodal Systems involve the integration of Advanced Public Transportation Systems (APTS) technologies into traffic management and other non-transit applications of Intelligent Vehicle Highway Systems (IVHS).

Smart intermodal systems focus on building a multimodal transportation network that ensures the adaptation of technologies that optimize the transportation system as a whole. Recognizing that transit systems operate in intermodal transportation environments, smart intermodal systems provide the link between APTS and non-transit IVHS.

A variety of technologies are involved in the design of smart intermodal systems, ranging from simple to complex. A simple version of a smart intermodal system can involve the exchange of information on traffic flow between transit dispatch centers and traffic control centers. A more complex version can involve a coordinated adaptive traffic signal timing system that closely monitors traffic flow while favoring buses that are behind schedule. This requires the integration and coordination of information between the transit dispatch and control center and the traffic management center.

Current traffic management systems are designed to optimize the flow of vehicles. Using smart intermodal systems, "traffic management" will evolve into "transportation management" whereby systems are designed to optimize the flow of people and goods.

Another example of smart intermodal systems involves integrated electronic payment systems for transit, highway tolls, and parking so that one payment medium is used to pay for a range of intermodal transportation services.

A number of smart intermodal systems tests are being initiated around the U.S. In Dallas, the Texas DOT is using imaging technology and Automatic Vehicle Identification technology to monitor and enforce HOV lanes. Imaging technology involves the use of Department of Defense target identification and tracking systems, and AVI technology involves the use of electronic tags to identify individual vehicles. The Ann Arbor Transportation Authority is considering expanding the use of "smart cards" to include the activation of an alarm at bus stops to alert the driver or as a personal security device. The Chicago Transit Authority is including an Automatic Vehicle Location system, an adaptive traffic signal timing system, a computer-assisted dispatch and control system, and real-time passenger information signs as part of their Bus Service Management System (BSMS).