

# RESEARCH, DEVELOPMENT, DEMONSTRATION, AND TECHNOLOGY DEPLOYMENT

## FEDERAL TRANSIT ADMINISTRATION

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In 1961 President Kennedy signed the first legislation authorizing the federal government to test the performance of innovative transit services, operations, management practices, institutional arrangements, and technology in real-world applications. Evaluation of these demonstration projects was crucial to drawing conclusions about technical and financial feasibility and the potential for improving public transit throughout the nation. In 1964 federal program authority was extended to research, development, and training.

These activities are of even greater significance today as the Federal Transit Administration works in partnership with communities across America to create a world-class mass-transportation network for the 21st century. The goal is to safely take people from where they are to where they want to go, at a time they want to go, and at a price they can afford. To realize this goal, the agency conducts programs and projects advancing research, development, demonstration, and deployment of innovative technologies with transit applications in areas such as navigation, vehicle design, information, and communications. Through these programs and projects, the agency is promoting transit facilities and services that not only provide personal mobility but also enhance quality of life in U.S. communities.

### RESEARCH PROGRAM AREAS

FTA's research program focuses on technologies and practices that can be adapted to improve transit systems. The agency is involved in all phases of the innovation process, from research and development establishing the technical feasibility of these technologies and practices to demonstration of the successful operation of prototype systems

and services. The agency also provides technical assistance to transit operators willing to test, evaluate, and implement significant, innovative technologies. Research-related activities are being conducted in a variety of areas.

#### **Safety and Security**

New technologies are modified and adopted for the safety and security of transit patrons, workers, and organizations. Such applications include advanced grade crossings, warning systems, equipment, facilities, computer-system security provisions, and safe handling of alternative fuels.

#### **Fleet Operations**

Transit throughput is improved by advancements in information technologies, traffic-signal coordination, and system integration, thereby increasing the capacity and quality of bus and rail operations on streets, aerial guideways, and subways at lower cost than more capital-intensive investments. The lower-cost investments include technologies for both advanced public-transportation systems and the transit component of the U.S. Department of Transportation's Intelligent Transportation Systems (ITS) Initiative.

#### **Equipment and Infrastructure**

Equipment research focuses on improvements of electric, hybrid-electric, and alternative-fuel buses, light-weight transit vehicles, and advanced control systems. Transit infrastructure improvements include new construction techniques and innovative engineering-management methods.

#### **Rural and Specialized Services**

Transit services tailored for low-income, elderly, and other transit-dependent travelers, including persons with disabilities, are improved through

experimentation with services, technical assistance, and government-resource coordination as well as through advanced technologies in the areas of customer information, dispatching systems, and automatic fare collection. Special emphasis is placed on service innovations for residents of rural areas and citizens affected by welfare reform.

### **Professional Capacity Building**

Performance of the transit industry's work force is improved through research, education, and training designed to develop the skills of potential employees and enhance the skills of current employees. Productivity of the work force is increased through the exploration of new methods and techniques to promote efficiency in the workplace. Special emphasis is placed on simultaneously improving day-to-day transit management and operations and linking new technology with the knowledge and skills required for effective service provision. Professional capacity building is a major purpose of the National Transit Institute, the Human Resources Program, the Transit Cooperative Research Program, and the University Transportation Centers Program.

### **Policy, Planning, and Program Support**

Innovative planning tools are developed, and the performance of transit systems is assessed. Policy studies are aimed at defining and measuring the benefits of public transit. In addition, practical knowledge is augmented to meet fundamental industry-wide challenges, such as accommodating the travel needs of persons with disabilities, financing transit construction and maintenance, and complying with requirements of the Clean Air Act. Support is provided for the management of safety, security, emergency preparedness, and drug and alcohol programs. Finally, technical assistance is provided to convey to the transit community the results of research, technology development, and demonstration projects.

## **FEDERAL SUPPORT FOR RESEARCH AND DEVELOPMENT**

Because transit costs universally exceed fare-box revenues, public funds at all levels of government are invested in acquiring, operating, and maintaining the nation's transit systems. The Federal Transit Administration supports advances in technology and the demonstration of innovative ways to provide better transit service as a means to obtain full value from future capital and operating resources.

The agency targets investment at continuous improvement in transit technology so that transit

operators will eventually be able to purchase more cost-effective advanced vehicles and equipment. It also supports demonstration of promising but fundamentally risky new service or operational concepts, thereby providing information that can be used in making decisions about ways to best improve service or reduce costs at the local level.

In appropriating funds for the agency's discretionary research programs, Congress has specified that an increasing portion of the funds be used for advanced technology development and deployment programs. It allocated \$39.25 million for agency research, development, demonstration, and technology innovation in fiscal year 1997, earmarking \$18 million for advanced technology systems, namely the advanced-technology transit bus, the fuel-cell transit bus, two electric-vehicle projects, and a computerized maintenance-management system. Of the remaining \$21.25 million, \$17.25 million was appropriated for statutory components of professional capacity building, namely, the Transit Cooperative Research Program, the National Transit Institute, and the University Transportation Centers Program, along with \$2 million for another statutory program, Project ACTION, which facilitates compliance with the transit-accessibility requirements of the Americans with Disabilities Act.

Earmarking leaves scarce funding for other research and development projects at the national level and heightens the importance of research funded by the Transit Cooperative Research Program, the University Transportation Centers Program, and the State Planning and Research Program, through which funds are distributed by formula.

### **Transit Cooperative Research Program**

The Transit Cooperative Research Program is an important component of the federal government's support of transit innovation. Since it was authorized in 1991 by the Intermodal Surface Transportation Efficiency Act, the program has been producing research results of great importance to the transit industry, which is directly involved in identifying and setting priorities for the program's research projects. The program emphasizes studies to address immediate problems involving facilities, service concepts, operations, planning, policy, human resources, maintenance, and administrative practices.

TCRP fosters cooperation among federal, state, local, and private-sector transportation-research organizations, thereby improving communications and facilitating the transfer of technical information. Participants include members of the transit community and researchers throughout the nation.

Projects are selected by an independent governing body, the Board of the Transit Development Corporation. The Transportation Research Board administers the program, convening expert technical panels to define the scope of research efforts, evaluate proposals, and guide projects through completion. The American Public Transit Association ensures that research results are widely disseminated to the transit industry.

The Transit Cooperative Research Program complements the Federal Transit Administration's national research and development programs, which are focused on a limited number of nationally significant transit innovations. (TCRP and some of the program's products are described in this issue; see page 23.)

#### **University Transportation Centers Program**

The Federal Transit Administration and the Federal Highway Administration give \$6 million annually to 10 regional university transportation centers and 3 specialized centers. In addition to providing professional education and training to future transportation researchers, managers, and consultants, the University Transportation Centers Program also undertakes research projects on a 50/50 cost-sharing basis with project sponsors.

#### **National Transit Institute**

The purpose of the National Transit Institute is to provide training and support development of the transit industry and its work force. The institute plays a key role in the Federal Transit Administration's efforts to build professional capacity in the transit industry, particularly as the capacity relates to the introduction and deployment of new tech-

nology and related support systems. The institute, FTA, and the transit industry have formed a partnership to train transit professionals at a time when resources are shrinking and demands for greater efficiencies in performance and productivity are rising. The Federal Transit Administration provides \$3 million annually for the institute through a cooperative agreement with Rutgers University.

## **PARTNERSHIPS**

The Federal Transit Administration is increasingly implementing its research and innovation-deployment programs in partnership with other government agencies at the federal, state, and local levels and with consortia formed by transit-industry suppliers, transit operators, national laboratories, and universities. Some programs involving such partnerships are the Advanced Public Transportation Systems program, now entirely funded jointly by the Highway Trust Fund through the U.S. Department of Transportation's Intelligent Transportation Systems Joint Program Office; the Advanced Technology Transit Bus program, with substantial funding from the Los Angeles County Metropolitan Transportation Authority; the Advanced Automatic Train Control Program, funded on a 50/50 basis by the Defense Advanced Research Projects Agency (DARPA) and a consortium comprised of a transit operator and two equipment suppliers; and the Fuel Cell Transit Bus program, also funded in large part by DARPA.

From the perspective of the federal government, there is a need to leverage limited capital and research and development funds, and to encourage cost reduction and technological innovation. From the transit operator's perspective, there is a need for more efficient, reliable, and maintainable equipment to increase cost-effectiveness, enhance system performance, and stimulate competition in the equipment marketplace. Although reluctant to be pioneers in research and development because of the limited size of the transit market, suppliers believe that the industry as a whole needs more research and development to improve products, increase manufacturing productivity, and expand export opportunities.

FTA invests federal funds in partnership with the transit industry to promote technological innovation where benefits are too widely spread for any one company to recover its investment at a profit; the cost or risk is too great for any individual transit operator or supplier to bear alone; or the potential benefits will be realized too far in the future to meet private-investment criteria or the expectations of state and local taxpayers.

### **FEDERAL TRANSIT ADMINISTRATION HOME PAGE**

In recognition of the global importance of electronic-information networks, the Federal Transit Administration has established a home page on the World Wide Web at <http://www.fta.dot.gov>. The home page not only contains information about transit research and development but also gives the transportation community rapid access to the Web sites of other transit-related organizations and programs. Links are provided to the National Transportation Institute site (<http://policy.rutgers.edu/nti>); the University Transportation Centers Program clearinghouse site ([http://dur.volpe.dot.gov/dur/utc\\_list.html](http://dur.volpe.dot.gov/dur/utc_list.html)); and two Transportation Research Board sites, one for Transportation Cooperative Research Program projects (<http://www2.nas.edu/trb/tcrp5.html>) and one for transportation research in progress (<http://www3.nas.edu/rips>).

## ADVANCED TECHNOLOGY SYSTEMS

The Federal Transit Administration is involved in many advanced-technology projects, including those described below.

### ***Advanced Technology Transit Bus***

The advanced-technology transit bus combines affordable electric-drive technologies and state-of-the-art composite materials, including fiberglass/epoxy skins molded around a foam core to make a simple body shell. The bus has low operating and maintenance costs and ultra-low emissions, weighs one-third less than current buses, and provides easy access for elderly passengers and those with disabilities. Its light weight, structural strength, and crashworthiness lead to greater fuel-efficiency, less brake and tire wear, and longer service life. The bus features advanced suspension systems, electronic-mechanical parts and wheel motors, and other technologies applicable to heavy-duty vehicles used for other purposes.

### ***Demonstration of Universal Electric Transportation Subsystems (DUETS)***

An advanced alternatively fueled electric-hybrid drive system, advanced suspension components, and advanced vehicle-control networks are being developed and tested for transit bus applications. The resulting technologies will provide ultra-low emissions, improved vehicle handling, reduced structural loading, and interfaces with intelligent transportation systems. FTA will encourage further adaptation of electric-hybrid technologies to meet requirements of the Clean Air Act and Americans With Disabilities Act.

### ***Fuel Cell Propulsion for Transit Buses***

Preliminary engineering and development activities are being undertaken to create a 12-meter (40-foot) bus powered by a domestically produced fuel cell. Fuel cells promise highly efficient and environmentally acceptable propulsion for transit vehicles. Technologies for phosphoric-acid and proton-exchange-membrane fuel cells are being developed for bus-propulsion systems operating with liquid fuels. Partnering with the Federal Transit Administration in this multiyear program are the Defense Advanced Research Projects Agency and the U.S. Department of Energy.



FEDERAL TRANSIT ADMINISTRATION

Federal Transit Administrator Gordon J. Linton uses GO CARD to pay fare on Washington Metropolitan Area Transit Authority's Metrorail system.

### ***Operational Tests of Technologies***

The Federal Transit Administration continues to provide leadership for select demonstration projects to implement technologies for advanced public-transportation systems. These projects provide substantial benefits in customer service and the operational management of transit fleets. In one project, researchers demonstrated user acceptance of stored-value "smart" cards to pay for fares or parking at Washington Metropolitan Area Transit Authority Metrorail stations. In another project, paratransit and fixed-route services will be integrated into a mobility-management system in Winston-Salem, North Carolina. A computer keeps track of the location of paratransit and fixed-route fleets through an automatic vehicle-location system. Clients picked up at their homes in paratransit vehicles are transferred to fixed-route vehicles at computer-determined optimal points. If necessary, another paratransit vehicle is provided to pick up the client at a second transfer point for the remainder of the trip. This approach reduces the costs of complying with requirements of the Americans with Disabilities Act.