

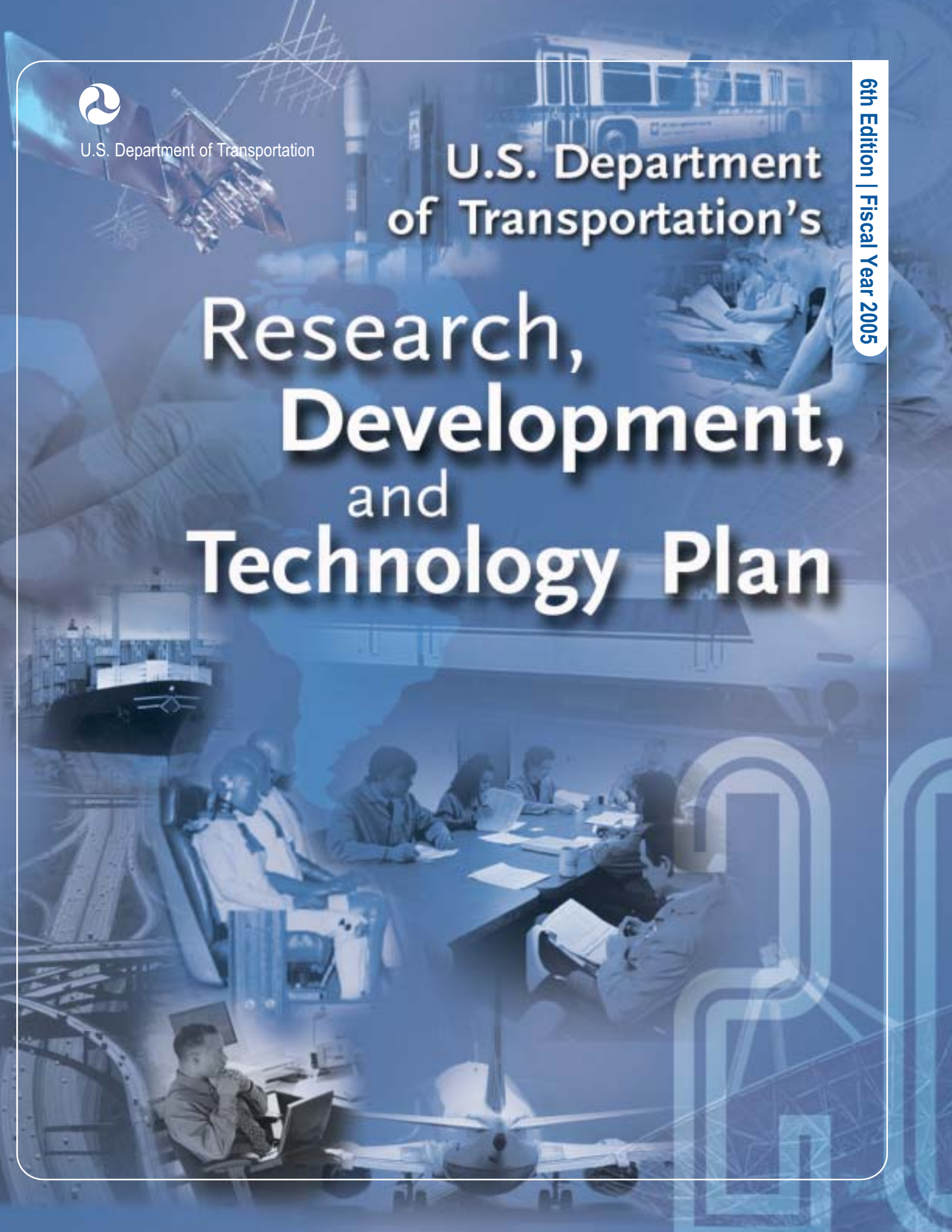


U.S. Department of Transportation

U.S. Department
of Transportation's

Research, Development, and Technology Plan

6th Edition | Fiscal Year 2005



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**U.S. Department of Transportation
Research, Development, and Technology Plan
6th Edition
FY 2005**

**Prepared for:
U.S. Department of Transportation
Washington, DC**

**Prepared by:
Research and Special Programs Administration
Volpe National Transportation Systems Center
Cambridge, MA**

October 2004

This edition of the *Research, Development, and Technology (RD&T) Plan* reflects the President's FY 2005 budget submission. It does not incorporate the Departmental restructuring newly legislated in the Norman Y. Mineta Research and Special Programs Improvement Act. This legislation will separate the two major functions of the Research and Special Programs Administration into two stand alone organizations: the Research and Innovative Technology Administration and the Pipeline and Hazardous Materials Safety Administration. This restructuring will be incorporated into the FY 2006 and subsequent editions of the *RD&T Plan*.

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LIST OF ACRONYMS

AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACS	Advanced Control Systems
APTA	American Public Transportation Association
ATC	Air Traffic Control
ATD&P	Advanced Technology Development & Prototyping
ATM	Air Traffic Management
ATS	Air Traffic Services
AVA	Air Void Analyzer
BAC	Blood Alcohol Content/Blood Alcohol Concentration
BRT	Bus Rapid Transit
BTS	Bureau of Transportation Statistics
CAASD	Center for Advanced Aviation System Development
CCDOTT	Center for the Commercial Deployment of Transportation Technologies
CDAS	Cooperative Driver Assistance Systems
CDS	Crashworthiness Data System
CHCP	Cargo Handling Cooperative Program
CMV	Commercial Motor Vehicle
COMSTAC	Commercial Space Transportation Advisory Committee
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
DHS	Department of Homeland Security
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FARS	Fatality Analysis Reporting System
FDR	Full-Depth Reclamation
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FRP	Fiber-Reinforced Polymer/Federal Radionavigation Plan
FTA	Federal Transit Administration

GAO	Government Accountability Office
GES	General Estimates System
GMATS	Global Maritime and Transportation School
GPR	Ground-Penetrating Radar
GPRA	Government Performance and Results Act
GPS	Global Positioning System
HPMS	Highway Performance Monitoring System
ICMTS	Interagency Committee of the Marine Transportation System
ISAC	Interlayer Stress-Absorbing Composites
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITS	Intelligent Transportation Systems
ITS JPO	Intelligent Transportation Systems Joint Program Office
IVI	Intelligent Vehicle Initiative
IWICP	Inland Waterways Intermodal Cooperative Program
JPDO	Joint Planning and Development Office
LTAP	Local Technical Assistance Program
LTPP	Long-Term Pavement Performance
MARAD	Maritime Administration
MDSS	Maintenance Decision Support System
MPO	Metropolitan Planning Organization
MTS	Marine Transportation System
MTSNAC	Marine Transportation System National Advisory Council
MwRSF	Midwest Roadside Safety Facility
NADS	National Advanced Driving Simulator
NAFTA	North American Free Trade Agreement
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NASS	National Automotive Sampling System
NCHRP	National Cooperative Highway Research Program
NCSA	National Center for Statistics and Analysis
NDGPS	Nationwide Differential Global Positioning System
NHI	National Highway Institute
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
NIST	National Institute for Standards and Technology
NMVCCS	National Motor Vehicle Crash Causation Survey
NSF	National Science Foundation
NTI	National Transit Institute

OMB	Office of Management and Budget
OPS	Office of Pipeline Safety
OST	Office of the Secretary of Transportation
PART	Program Assessment Rating Tool
PHMSA	Pipeline and Hazardous Materials Safety Administration
PCI	Prestressed Concrete I-Beam
PRS	Performance-Related Specifications
R&D	Research and Development
R&T	Research and Technology
RD&T	Research, Development, and Technology
REB	Research Executive Board
REDAC	Research, Engineering, and Development Advisory Committee
RITA	Research and Innovative Technology Administration
RSPA	Research and Special Programs Administration
RTCC	Research and Technology Coordinating Council
SAFER	Steel and Foam Energy Reduction
SBIR	Small Business Innovation Research
SCOOP	Short Sea Shipping Cooperative Program
SOC	Ship Operations Cooperative Program
SP&R	State Planning & Research
SPS	Specific Pavement Studies
SSC	Ship Structure Committee
STRAHNET	Strategic Highway Network
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21 st Century
TFHRC	Turner-Fairbank Highway Research Center
TIG	Technology Implementation Group
TIM	Traffic Incident Management
TRB	Transportation Research Board
TREAD	Transportation Recall Enhancement, Accountability, and Documentation
TSA	Transportation Security Administration
TSIS	Traffic Software Integrated System
TTC	Transportation Technology Center
TTCI	Transportation Technology Center, Inc.
USMMA	United States Merchant Marine Academy
UTC	University Transportation Center
VMT	Vehicle-Miles Traveled
VRTC	Vehicle Research and Test Center

WIM
WJHTC

Weigh-in-Motion
William J. Hughes Technical Center

1. INTRODUCTION

Americans depend on safe, efficient, and secure transportation systems. Whether we travel on roads, boats, rails, or in the air, we rely on our transportation systems to get us where we need to go. The same systems play a crucial role in our national economic well-being—making it possible to move goods from place to place and to succeed in the global marketplace. Transportation is also critical to our national defense and to providing security against terrorism.

The Department of Transportation (DOT) works in tandem with owners and operators of our transportation systems to provide leadership and guidance on behalf of the public. DOT is responsible for the nation’s freedom of movement—ensuring that there are sufficient and safe roads, rails, transit systems, airways, and seaways to keep the country in motion and its economy growing. As always, DOT’s top priority is to guarantee the safety of the traveling public. Fostering the innovations that will improve transportation safety—while ensuring security, increasing capacity, and reducing environmental degradation—are the goals of DOT’s Research, Development, and Technology (RD&T) program.

RD&T IN DOT

Established in 1967, DOT sets Federal transportation policy and works with Federal, state, local, and private sector partners to promote a safe, secure, efficient, and interconnected national transportation system. DOT’s RD&T program leverages the research investments of its partners to stimulate transportation improvements through targeted research, development, and technology implementation. Although DOT’s operating administrations have wide-ranging duties related to operating or overseeing the various transportation sectors, they share a common commitment to fulfill national goals. In particular, all DOT modes embrace the objectives identified in the *DOT Strategic Plan 2003-2008*: safety, mobility, global connectivity, environmental stewardship, security, and organizational excellence. These objectives provide the framework for the Department’s diverse RD&T activities. DOT’s RD&T program also supports the Department’s broad statutory authorities to:

Restructuring of RD&T

In November 2004, Congress passed the Norman Y. Mineta Research and Special Programs Improvement Act. The Act creates two new organizations out of the existing Research and Special Programs Administration: (1) the Pipeline and Hazardous Materials Safety Administration (PHMSA) to further the highest degree of safety in pipeline and hazardous materials transportation; and (2) the Research and Innovative Technology Administration (RITA) to coordinate research and advance innovative technologies. In particular, RITA will review RD&T programs; conduct transportation statistics research, analysis, and reporting; and support transportation-related education and training. This restructuring will be reflected in subsequent editions of the *Research, Development, and Technology Plan* and in the report submitted by the RITA Administrator to Congress.

- Operate Federally provided transportation services, such as those supporting the nation’s civil aviation system.
- Manage public investment in transportation in concert with state and local governments.

- Assure transportation safety by setting and enforcing standards and regulations.
- Work with other Federal agencies and organizations to carry out broad mandates, such as clean air and national security.
- Promote the adequacy, efficiency, and robustness of transportation and transportation industries.

DOT Mission

“Develop and administer policies and programs that contribute to providing fast, safe, efficient, and convenient transportation at the lowest cost consistent with the national objectives of general welfare, economic growth and stability, the national security, and the efficient use and conservation of the resources of the United States.”

DOT Strategic Plan 2003-2008, p. 19.

RD&T MISSIONS OF DOT ORGANIZATIONS

The following DOT operating administrations and offices have missions that involve a supporting program of transportation RD&T:

BUREAU OF TRANSPORTATION STATISTICS (BTS)

The BTS has a threefold mission: collect, compile, analyze, and publish transportation statistics; improve the comparability and quality of these statistics; and promote improvements in transportation data acquisition, dissemination, and use. Although BTS funding is authorized in the research section of the Transportation Equity Act for the 21st Century (TEA-21), it is not part of DOT’s formal RD&T program. However, the BTS is a key resource for determining transportation research needs, priorities, and investment decisions. The BTS will become part of RITA under the Norman Y. Mineta Research and Special Programs Improvement Act.

FEDERAL AVIATION ADMINISTRATION (FAA)

The overall mission of the FAA is to provide safe and efficient aviation and commercial space transportation systems. Key mission elements are the regulation of civil aviation and commercial space transportation to promote safety, and the safe and efficient use of airports and airspace by civil and military users. This broad mission requires an extensive RD&T program carried out in cooperation with industry and other Federal agencies. Components of this program include research in space and air traffic system technology, aviation weather products, airport technology, aircraft safety, commercial space transportation safety, human factors, and mitigation of aircraft emissions and noise.

FEDERAL HIGHWAY ADMINISTRATION (FHWA)

The FHWA provides leadership, expertise, and resources to continually improve the quality of the highway system and its intermodal connections. Cooperating with states and other partners, the agency coordinates Federal highway programs and conducts supporting research in highway safety, pavement and structures, operations, asset management, planning, and the environment. Among the FHWA’s major highway programs are the Federal-Aid Highway Program—which provides financial assistance to states to construct and improve the National Highway System,

urban and rural roads, and bridges—and the Federal Lands Highway Program—which provides access to and within national forests, national parks, Indian reservations, and other public lands.

Housed in the FHWA, the Intelligent Transportation Systems Joint Program Office (ITS JPO) fosters the application of information technologies to improve surface transportation mobility, capacity, safety, and environmental compatibility. Among the ITS JPO's major activities are the development of a truly intelligent vehicle and the deployment of an information infrastructure for urban and rural highways, commercial vehicle operations, and public transit. Toward this end, the ITS JPO partners with other DOT operating administrations, including the Federal Motor Carrier Safety Administration, Federal Railroad Administration, Federal Transit Administration, and National Highway Traffic Safety Administration.

FEDERAL MOTOR CARRIER SAFETY ADMINISTRATION (FMCSA)

The FMCSA, formerly an office within the FHWA, has as its mission the reduction in the number and severity of commercial motor vehicle crashes. The agency's research and technology (R&T) program supports this mission through the discovery, application, and dissemination of new knowledge, and the assessment, development, and promotion of new technologies. FMCSA R&T addresses the safety performance of drivers, carriers, and vehicles, and also includes crosscutting projects relating to crash problem assessment and program support. In addition, R&T manages safety systems for the Intelligent Vehicle Initiative heavy vehicle (commercial truck and bus) platform; Commercial Vehicle Information Systems and Networks; and safety systems and technologies.

FEDERAL RAILROAD ADMINISTRATION (FRA)

The FRA promulgates and enforces railroad safety regulations; administers financial assistance programs to railroads, including Amtrak; conducts research in support of improved railroad safety; fosters the development of high-speed-rail passenger service; and consolidates government support of rail transportation activities. The FRA RD&T program covers railroad system issues (safety, security, environment); human factors; rolling stock and components; track and structures; track/train interaction; train control; grade crossings; hazardous materials; train occupant protection; and research and development facilities and equipment. The FRA's Next Generation High-Speed Rail demonstration program addresses positive train control systems, turbine high-speed locomotives, grade crossing protection, and high-speed track and structures technology.

FEDERAL TRANSIT ADMINISTRATION (FTA)

The mission of the FTA is to ensure personal mobility and community vitality by supporting high-quality public transportation. The FTA accomplishes its mission through leadership, financial resources, and technical assistance. Research is focused on analyzing potential solutions to transit challenges, developing research projects to evaluate and test these best practices and technologies, and working with the transit industry to implement those research solutions that are found to have significant return on investment. Conducted in partnership with the broader transit community, FTA research is aimed at increasing transit ridership, improving

safety and emergency preparedness, improving capital and operating efficiencies, and protecting the environment and promoting energy independence.

MARITIME ADMINISTRATION (MARAD)

MARAD is responsible for developing and maintaining a U.S. merchant marine capable of moving the nation's waterborne commerce and serving as a military auxiliary in time of war or national emergency. Among MARAD's functions in carrying out its missions are programs to improve the efficiency and productivity of the U.S. maritime industry, including ports and intermodal transportation systems. While MARAD currently has no directly funded RD&T budget, the agency actively facilitates several industry-wide cooperative programs to advance innovation in marine operations.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA)

The NHTSA's overall mission is to reduce deaths, injuries, and economic losses resulting from motor vehicle crashes. To fulfill this mission, the NHTSA establishes and enforces safety standards for new motor vehicles and equipment; provides highway safety grants to state and local governments; promotes use of safety belts, child safety seats, and airbags; provides information to consumers; and sets and enforces standards for fuel economy, odometers, and theft prevention. The NHTSA conducts a supporting program of research in six critical areas: highway safety, vehicle safety systems, biomechanics, crashworthiness and crash avoidance, intelligent vehicles, and crash-data collection and analysis.

OFFICE OF THE SECRETARY OF TRANSPORTATION (OST)

The OST has responsibility for formulating national transportation policies that affect various modes and help ensure achievement of Department-wide objectives. Covering a broad range of activities, OST research supports the development, evaluation, and improvement of these policies. In the security area, the OST funds data collection on biological agent detection and supports development and use of the Global Positioning System and other communications and navigation technology. Safety research includes work with the Department's Safety Council addressing crossmodal issues such as the role of human factors in the transport network. Mobility improvements include development and use of planning and analysis tools for managing congestion and facilitating intermodal connectivity, along with studies of transportation requirements for older Americans. Economic development research addresses, among other issues, the condition of the nation's energy delivery infrastructure, innovative financing of transportation infrastructure, and the relative efficiency of the nation's freight systems. Finally, OST environmental research targets climate change as well as transportation's effect on the human and natural environment.

RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION (RSPA)

RSPA has a unique multimodal mandate. In contrast to other DOT operating administrations, which focus on specific transportation sectors, RSPA looks at the system as a whole. As mentioned above, the Norman Y. Mineta Research and Special Programs Improvement Act

restructures RSPA into two new administrations: the PHMSA, which will further pipeline and hazardous materials transportation safety through RD&T and other activities; and RITA, which will coordinate DOT research and advance innovative technologies. In particular, RITA will provide the operational capability, resources, and support necessary for strong RD&T management and coordination. It will advise the Secretary and Deputy Secretary on science and engineering matters and lead DOT efforts to establish RD&T goals and priorities. Among RITA's specific efforts will be the creation of a database of all DOT RD&T projects and an enhanced process for evaluating research throughout the Department.

RD&T PLAN SCOPE AND CONTENTS

The FY 2005 *Research, Development, and Technology Plan* establishes priorities for the Department's RD&T activities and links them to specific objectives and outcomes. It presents DOT's RD&T planning process, identifies the RD&T programs necessary to achieve Departmental objectives, and discusses DOT's overall strategy in carrying out the needed RD&T activities.

The *RD&T Plan* directly supports the Department's five-year *Strategic Plan*, serving as the implementation document for that plan's RD&T elements. As such, the *RD&T Plan* provides a key resource for the Department's budget and program development process and helps to avoid program duplication. The remaining sections of the plan are as follows:

Section 2 outlines how the Department plans and coordinates RD&T internally, across the government, and with other transportation stakeholders, and the processes for evaluating RD&T programs.

Section 3 discusses the Department's strategic objectives and identifies the key RD&T strategies for meeting them.

Section 4 is a summary of the entire RD&T program, organized by operating administration, as proposed in the Department's FY 2005 budget request.

Section 5 discusses state and local research and technology development activities.

Section 6 addresses RD&T performance assessment.

Appendix A presents the RD&T-related efforts of MARAD and the BTS, agencies which conduct research activities but do not have explicit research funding.

Appendix B is Section 5108 of TEA-21, which calls for a DOT *RD&T Plan*.

Appendix C shows the FY 2005 RD&T budget authority for each DOT operating administration.

2. THE RESEARCH, DEVELOPMENT, AND TECHNOLOGY PLANNING PROCESS

As stated in Section 1, the Department's entire RD&T program is geared toward meeting the strategic objectives defined in the *DOT Strategic Plan*. Other key inputs to the planning process include the *RD&T Plan* and the needs and priorities of the operating administrations. These processes help to ensure that DOT meets the Administration's criteria for Federal investments in research and development (R&D):

- *Relevance*: Programs must have clear plans; must be relevant to national priorities, agency missions, and customer needs; and must justify their claim on taxpayer resources.
- *Quality*: Programs must maximize quality through the use of clearly stated, defensible methods for awarding funding.
- *Performance*: Programs must maintain a set of high-priority, multi-year objectives with annual performance measures and targets.

The Department uses these criteria to evaluate the individual RD&T activities of the operating administrations. (Section 6 discusses the investment criteria in greater detail.) The following paragraphs outline the current processes for strategically planning and coordinating RD&T across the agency. These processes will be refined as DOT implements the Norman Y. Mineta Research and Special Programs Improvement Act, particularly the creation of RITA.

STRATEGIC RD&T PLANNING

DOT STRATEGIC PLAN

To help ensure the relevancy of its RD&T program, the Department makes certain that all research activities support the objectives and outcomes identified in its five-year *Strategic Plan*.

In 1997, the Department published its first *Strategic Plan*, which provided a vision for advancing the nation's transportation system. The plan set forth the overall direction and mission of the Department and identified broad goals, strategic outcomes, and challenges.

DOT Objectives

Strategic Objectives

Safety: Enhance public health and safety by working toward the elimination of transportation-related deaths and injuries.

Mobility: Advance accessible, efficient, intermodal transportation for the movement of people and goods.

Global Connectivity: Facilitate a more efficient domestic and global transportation system that enables economic growth and development.

Environmental Stewardship: Promote transportation solutions that enhance communities and protect the natural and built environment.

Security: Balance homeland and national security transportation requirements with the mobility needs of the nation for personal travel and commerce.

Organizational Excellence

Advance the Department's ability to manage for results and achieve the goals of the President's Management Agenda.

DOT Strategic Plan 2003-2008, p. 19.

The *DOT Strategic Plan 2003-2008* identifies the five-year outcomes and strategies for the Department's strategic and organizational excellence objectives (identified as "strategic goals" in previous plans). The RD&T activities that support these objectives are summarized in Section 3.

The Department's annual *RD&T Plan* directly supports the *Strategic Plan*. It aids budget and program development, the establishment of research priorities, and the linkage of Departmental RD&T to the goals it is intended to achieve.

RD&T PLANNING IN THE OPERATING ADMINISTRATIONS

Within DOT, it is the operating administrations that define and conduct RD&T—based on their close interaction with the transportation community and their understanding of current and future transportation technologies, operations, and challenges. As indicated above, this understanding of RD&T needs is combined and integrated with broad DOT objectives. The process is formalized in agencies' own strategic and performance plans and in the Performance Agreements concluded between each operating Administrator and the Secretary.

The effectiveness of RD&T is assured through the systematic application of the R&D investment criteria and the Office of Management and Budget's Program Assessment Rating Tool (PART). (See Section 6.) In particular, a critical factor in meeting the criteria is the regular conduct of external program evaluations. Table 2-1 summarizes the various review mechanisms employed by DOT's operating administrations. The following paragraphs provide details about these and other RD&T planning efforts.

Federal Aviation Administration

As shown in Table 2-1, a primary means by which the FAA ensures that its research meets the R&D investment criteria is the Research, Engineering, and Development Advisory Committee. Established by Congress in 1989, this group reports to the FAA Administrator on RD&T issues and provides a link between the FAA's RD&T program and similar efforts in industry, academia, and government. The committee considers aviation research needs in six key areas: air traffic services, airport technology, aircraft safety, aviation information security, human factors, and the environment. Representing corporations, universities, associations, consumers, and other agencies, up to 30 committee members hold two-year terms. The committee meets with FAA senior managers two times a year and annually reviews the agency's RD&T budget submission.

For R&D on commercial space transportation safety, the FAA uses the Commercial Space Transportation Advisory Committee (COMSTAC) to provide advice and recommendations. Established in 1984, the COMSTAC is composed of up to 25 members from industry, academia, state government, and space advocacy groups, each recommended by the Administrator and appointed by the Secretary for a two-year term. The COMSTAC annually provides suggestions for R&D projects and periodically evaluates and comments on FAA commercial space transportation reports and activities.

Table 2-1. Research Evaluation Processes in DOT’s Operating Administrations

DOT Administration	External Review Process	Recent Reviews and Recommendations	Reviews in FY 2004
<i>FAA</i>	Annual review by the Research, Engineering, and Development Advisory Committee; the Commercial Space Transportation Advisory Committee reviews safety-related commercial space transportation R&D	A June 2003 letter report of the Research, Engineering, and Development Advisory Committee recommends that the FAA: <ul style="list-style-type: none"> • Develop a mechanism for supporting deployed technology • Work with the committee to inform Congress of the difficulties created by funding research out of Facilities and Equipment funds • Develop mechanisms to allow researchers to gain access to relevant aviation-related facilities • Continue its participation in and active support for the new Interagency Joint Planning and Development Office 	May 2004 September 2004
<i>FHWA</i>	Periodic review by the Transportation Research Board (TRB) Research and Technology Coordinating Committee	A committee report to the FHWA Administrator in December 2003 addresses: <ul style="list-style-type: none"> • Local/regional stakeholder involvement in highway research and technology • Intelligent Transportation Systems research • Research activities in the Office of Operations • Status of the implementation of the Corporate Master Plan for Highway Research and Technology • The upcoming assessment of the FHWA’s asphalt pavement laboratories • Results of the Symposium on Highway Research and Technology held in April 2003 	June 14-15, 2004
<i>FMCSA</i>	Regular inputs on R&T planning and programs from key stakeholders	Stakeholder forums held November-December 2003 advised that the FMCSA: <ul style="list-style-type: none"> • Improve commercial vehicle data sources • Ensure that research and technology resources are aligned with organizational objectives • Improve “follow-through” on research and policy initiatives • Develop a knowledge management system to monitor research in the field • Develop a Research and Technology Strategic Plan based on internal and external input • Initiate a number of recommended research projects 	November-December 2003
<i>FRA</i>	Annual review by the TRB Committee for the Review of the FRA Research, Development, and Demonstration Programs; other external review mechanisms	A May 2004 letter report recommends that the FRA: <ul style="list-style-type: none"> • Identify the customers of various research programs and develop closer working relationships with them through periodic and systematic outreach • Include development of a close-call warning system in its FY 2006 budget • Undertake research related to energy, alternative fuels, emissions, and fuel efficiency to support freight railroad operations and the public interest • Refocus its high-speed-rail program to support efforts by state and local agencies • Complete a model for estimating maintenance costs for mixed high-speed passenger and freight corridors • Conduct a study on future trends in intermodal traffic 	December 2003 May 2004

Table 2-1. Research Evaluation Processes in DOT’s Operating Administrations (Cont.)

DOT Administration	External Review Process	Recent Reviews and Recommendations	Reviews in FY 2004
<i>FTA</i>	Transit Research Analysis Committee	The initial meeting of the committee, held April 2004, addressed: <ul style="list-style-type: none"> • The FTA’s draft Strategic Transit Research Plan • The FTA role in transit research • The history of the FTA’s research program 	April 5-6, 2004
<i>NHTSA</i>	Regular public meetings to present agency research and obtain stakeholder input	A public meeting held July 31, 2003, discussed the following with stakeholders: <ul style="list-style-type: none"> • What NHTSA has learned from the industry about tire aging • An update on NHTSA’s frontal offset research • NHTSA forward-lighting research 	TBD
<i>RSPA</i>	Periodic outreach events, stakeholder meetings, and TRB reviews	On May 20, 2004, a Blue Ribbon Panel convened by RSPA’s Office of Pipeline Safety asked that the agency: <ul style="list-style-type: none"> • Continue the process of stakeholder input for the identification of technical gaps and challenges • Determine proactive, rather than reactive, solutions to potential future safety and integrity issues • Better integrate R&D accomplishments into the development of industry consensus standards • Finalize strategic and performance plans and address technology demonstrations and the transfer of program outputs 	May 20, 2004

Federal Highway Administration

Established at the behest of the FHWA, the TRB Research and Technology Coordinating Committee reviews, guides, and advises the agency on research activities and provides policy-level recommendations on program direction. The committee consists of 18 members, including top-level administrators, researchers, and practitioners from the states, academia, and private sector.

The committee examined national highway R&T needs and roles in *TRB Special Report 261*, which urged the FHWA to focus on long-term, fundamental research; address gaps and emerging issues; conduct policy research; and engage in technology transfer. The report also recommended more substantive stakeholder involvement in making decisions, setting priorities, and allocating resources for the FHWA’s research programs.

The FHWA recently developed an agency-wide plan for R&T called the *Corporate Master Plan for Research and Deployment of Technology & Innovation*. The purpose of the plan is to continue to improve the effectiveness and efficiency of R&T, including deploying and implementing technologies and innovations that improve the quality, cost-effectiveness, and timeliness of products, procedures, processes, practices, and techniques. The plan sets out a role, new focus, and guiding principles for the agency’s R&T program, within the context of improving highway transportation. Moreover, it outlines the FHWA’s corporate strategy for investing in and conducting research in cooperation with partners and stakeholders.

Federal Motor Carrier Safety Administration

The FMCSA's R&T office developed and began implementing a Research Executive Board (REB) in FY 2004. The Agency has established an FMCSA-wide program for prioritizing, budgeting, and managing research; seeking input and collaboration from stakeholders through public forums; and facilitating the harmonization of budgets and performance through the use of a balanced scorecard.

In support of the scorecard, a software tool, called E-Portfolio, helps evaluate the impact, feasibility, and cost of each proposed R&T project. For general safety projects, the tool evaluates the impact in terms of the number and severity of crashes addressed. For hazardous material safety projects, the impact is evaluated as risks, by estimating the probability of occurrence and the potential loss. In both cases, the expected result is taken into account for the evaluation. The tool is also used to formulate, update, and manage the FMCSA's R&T budget.

The REB provides management-level review of proposed studies based on the impact on safety and contributions to the FMCSA's mission. The FMCSA also obtains input on its research program through numerous other mechanisms, including the National Transportation Safety Board, safety advocacy groups, national enforcement community, motor carrier industry, commercial driver groups, driver training community, sleep researchers, insurance representatives, truck manufacturers, and motor coach industry. In particular, stakeholder meetings held in November and December 2003 yielded more than 150 recommendations for research projects and for improved R&T planning. The Agency has developed a 5-year FMCSA R&T Strategic Plan, which includes stakeholder input and six strategic objectives. The plan has been completed and is in formal coordination for delivery to Congress.

Federal Railroad Administration

FRA research is guided by inputs from both internal and external stakeholders, including the FRA's Office of Safety, the Association of American Railroads Railway Technology Working Committee and Tank Car Committee, the American Public Transportation Association Research Needs Conference, and the Highway–Railroad Grade Crossing Research Needs Conference. Of particular importance is the TRB Committee for Review of the FRA Research, Development, and Demonstration Programs. Initially established by the Congress, this committee conducts an annual assessment of the FRA's Railroad R&D, Next Generation High-Speed Rail, and Maglev Technology Deployment programs. The reviews address three areas: (1) the research management structure and approach; (2) the current direction and allocation of funds devoted to the various program areas; and (3) whether there is an appropriate balance of Federal, state, and private sector input and cost sharing. The committee includes representatives from states, railroads, labor unions, universities, financial institutions, and research organizations. To evaluate FRA research in yet another program area, the TRB is establishing a new Strategic Hazardous Materials Transportation Research Program.

Federal Transit Administration

Formed in October 2003 under the TRB, the Transit Research Analysis Committee independently reviews and assesses research needs and advises the FTA on (1) the Federal role in transit research; (2) high-priority research opportunities; and (3) processes for ensuring that the FTA research program receives the input and cooperation of transit stakeholders. Committee members include representatives of transit authorities, community service agencies, state DOTs, research institutes, consulting firms, and equipment manufacturers. The first committee meeting was held in April 2004. Based on this and subsequent meetings, the committee will draft annual letter reports to the FTA summarizing its findings and recommendations.

National Highway Traffic Safety Administration

To develop the most effective means of improving safety, the NHTSA conducts research on reducing crash-related fatalities and injuries, preventing crashes, and understanding driver behavior. The agency assures the effectiveness of its research through several means, including regular public meetings with stakeholders. The meetings provide a forum in which researchers can present their work, respond to comments, and obtain broad input on the NHTSA's RD&T program. The most recent public meeting was held in July 2003.

Research and Special Programs Administration

RSPA research addresses pipeline safety, hazardous materials transport, and strategic RD&T planning. The Office of Pipeline Safety (OPS) has created a Blue Ribbon Panel to ensure that the R&D program is aligned with the needs of the pipeline safety mission, makes use of the best available knowledge and expertise, and considers stakeholder perspectives. The panel has representatives from Federal and state agencies involved in pipeline safety, industry R&D-funding organizations, pipeline trade associations, and standards organizations. At a June 2003 meeting, the OPS sought the perspective of the panel on R&D priorities, program design, and measures to evaluate the effectiveness of the R&D investment. In May 2004, the panel reviewed the scope and implementation of Broad Agency Announcements (R&D solicitations); the program structure as embedded in the R&D Strategic Plan; the submissions to the PART evaluation; and R&D performance measures. Information about the panel meetings can be found on the OPS website at <http://primis.rspa.dot.gov/rd>. In another program area, the TRB Committee for Review of the National Transportation Science and Technology Strategy oversees and reports on RSPA activities in strategic RD&T planning.

Maritime Administration, Bureau of Transportation Statistics, and Saint Lawrence Seaway Development Corporation

While these DOT operating administrations do not receive RD&T funding, they are involved in a broad range of research activities affecting transportation. Through the Department's RD&T planning process, these activities are integrated with other DOT programs to help ensure coordination and effectiveness.

RD&T COORDINATION

The Department's RD&T planning process emphasizes cooperation, information sharing, and collaboration—both within DOT and across the Federal Government. The Department also promotes partnerships with state and local agencies, private companies, research organizations, and universities.

INTERNAL COORDINATION OF RD&T PROGRAMS

Within DOT, the Research and Technology Coordinating Council (RTCC) ensures a consistent approach across RD&T programs and budgets. The council coordinates RD&T agency-wide; helps managers set unified directions for research; and evaluates RD&T programs to ensure they support DOT objectives. The RTCC consists of the senior RD&T official in each operating administration and representatives of the OST.

In May 2003, the U.S. General Accounting Office (GAO) [now the Government Accountability Office] reviewed DOT processes for coordinating RD&T. The GAO found no duplication of research but offered recommendations for improving coordination efforts. The Department is addressing these recommendations through systematic application of the R&D investment criteria—specifically by applying the criteria to the operating administrations' RD&T budgets. Table 2-2 on the next page summarizes the GAO's recommendations and DOT's responses.

The RTCC is implementing the enhanced coordination process through regularly scheduled reviews of operating administration RD&T programs. (See box.) The primary purpose of the reviews is to ensure that RD&T activities meet the R&D investment criteria. Section 6 summarizes the results of the reviews for FY 2004.

Schedule of RTCC Program Reviews

<i>FAA</i>	August 2003
<i>FHWA</i>	January 2004
<i>FMCSA, NHTSA</i>	April 2004
<i>FRA</i>	June 2004
<i>FTA</i>	July 2004
<i>RSPA</i>	September 2004

INTERAGENCY PLANNING AND COORDINATION

As the agency with the most direct responsibility for transportation, DOT serves as leader of transportation RD&T in the government. In this role, the Department works closely with agencies whose missions involve research relevant to transportation—particularly those discussed below—to avoid duplication and to leverage research investments. One particular example is the Joint Planning and Development Office (JPDO), through which the FAA, Department of Commerce (DOC), Department of Defense (DOD), Department of Homeland Security (DHS), and National Aeronautics and Space Administration (NASA) are defining the air transportation system of the future. (See the box on page 2-10.)

Table 2-2. DOT Actions in Response to GAO Recommendations

GAO Recommendation	DOT Response
<i>Develop a strategy for reviewing all DOT research projects to identify areas of unnecessary research duplication, overlap, and opportunities for joint efforts.</i>	Existing coordination practices have been successful in avoiding the occurrence of unnecessary research duplication. To further strengthen these efforts, the Department has decided to augment these efforts through systematic application of the PART concept and the R&D investment criteria across all operating administration research programs.
<i>Develop and apply quantifiable performance measures to assess the effectiveness of research coordination efforts.</i>	DOT does not agree that implementing performance measures to assess the effectiveness of research coordination represents the best possible use of limited resources, because (1) the most useful and effective performance measures focus on results, while coordination is a process; (2) there are no performance measures capable of quantifying effective coordination; and (3) existing coordination processes have been effective in preventing unnecessary research duplication, and GAO did not identify any instances in its report.
<i>Develop a strategy to ensure that the results of all DOT's transportation research activities are evaluated according to established best practices.</i>	Establishing use of the R&D investment criteria as part of the Department's strategy for augmenting coordination and evaluation of R&D, with its requirements for prospective and retrospective assessment of research relevance, quality, and performance, will lead to all operating administrations reviewing their research programs against established best practices. The RTCC will summarize the results of these efforts in the annual <i>DOT Research, Development, and Technology Plan</i> , likely beginning with the FY 2005 edition.
<i>Include in the Department's annual research plan a summary of all research program evaluations conducted and a schedule of future evaluations.</i>	The RTCC will incorporate summary information of research program evaluations and a schedule for future evaluations in the annual <i>DOT Research, Development, and Technology Plan</i> , starting with the FY 2005 edition.
<i>Document RSPA's process for evaluating the results of its own multimodal research programs and apply this process to any future multimodal research programs that RSPA conducts.</i>	RSPA will document its process and apply it to its future multimodal research programs. Results will be incorporated in the annual <i>DOT Research, Development, and Technology Plan</i> , starting with the FY 2005 edition.

Department of Commerce

A number of DOC agencies conduct research of importance to transportation, including the National Oceanic and Atmospheric Administration, National Weather Service, and National Institute for Standards and Technology (NIST). Most recently, the Department joined with the FAA, DOD, DHS, and NASA in establishing the JPDO, which is preparing a *National Plan for the Transformation of Air Transportation*. In other areas, the NIST conducts much of the DOC's transportation-related research, particularly in construction materials. For example, the NIST works with the FHWA on concrete mixture optimization and curing, the durability of Portland cement concrete for pavements and bridges, the application of x-ray tomography to determine concrete properties, and the economics of high-performance concrete. In rail transportation, the NIST looks at the fire safety of passenger rail car materials for the FRA.

Department of Defense

The DOD accounts for a large proportion of Federal RD&T. In the area of transportation, the DOD seeks advances in aviation and space technologies; surface vehicles; ship design and propulsion; satellite positioning and communications; chemical, biological, and explosive agent detection; and high-performance materials. The Defense Advanced Research Projects Agency, in particular, provides substantial funding for research on maritime and other transportation technologies. The DOD also conducts research in human performance, materials science, microelectronics, and nanotechnology. An example of collaborative research is a U.S. Army Corps of Engineers–FHWA study on concrete curing. In addition, the DOD shares in the development of new aviation safety technologies through a joint FAA–NASA–DOD Aviation Safety Program. Another joint effort is the JPDO, through which the DOD, FAA, NASA, and other agencies are defining the Next Generation Air Transportation System. Finally, the FRA has worked with the DOD’s Technical Support Working Group on a Rail Car Inspection Guide for use by the military.

Department of Energy

Primarily concerned with energy conservation and reducing petroleum dependence, the Department of Energy (DOE) conducts research in alternative fuels, propulsion systems, and related technologies. DOE and DOT work closely on implementation of the President’s Hydrogen Initiative: DOE’s role in hydrogen production, storage, and use complements DOT’s role in hydrogen infrastructure, heavy vehicles, and safety. DOE has more than 20 major laboratories and research facilities, many with strong capabilities in advanced materials, energy conversion and storage, and other transportation-relevant areas. Argonne National Laboratory, for example, researches fuel cells, hybrid vehicles, Intelligent Transportation Systems, and rail technologies. Part of the FAA’s Airworthiness Assurance “Center of Excellence,” Sandia National Laboratories partner with DOT on research addressing aircraft maintenance; inspection and repair techniques; risk analysis methodologies; fire safety; and new materials. DOE laboratories also work closely with DOT on tests and demonstrations of technologies for detecting chemical, biological, and explosive agents.

Department of Homeland Security

Established by the Homeland Security Act of 2002, the DHS prevents, protects against, and responds to acts of terrorism on U.S. soil. Two DHS agencies are former DOT operating administrations: the Transportation Security Administration (TSA) and the U.S. Coast Guard. Working closely with DOT, the TSA conducts research to improve current security technology, particularly methodologies for detecting chemical, biological, or similar threats. In addition, the FMCSA is coordinating with the TSA on the Untethered Trailer Tracking Project, the Commercial Vehicle Information Systems and Networks program, and the Hazardous Materials Safety and Security Field Operational Test. The Coast Guard collaborates with DOT on several research activities, including enhancing protection of the Global Positioning System (GPS) from interference, expanding the Nationwide Differential GPS to serve as a positioning system for surface transportation, and implementing an International Maritime Information Safety System.

The DHS and DOT together manage Operation Safe Commerce, a public–private partnership that provides a test-bed for technologies that could substantially increase container shipment security. The DHS has also worked with the FRA on a joint project to determine the vulnerability of hazardous materials tank cars to small arms fire. A third collaborative effort is the JPDO. Finally, the DHS Directorate of Science and Technology conducts a range of relevant research, including work related to weapons of mass destruction, critical infrastructure protection, and internet security.

Environmental Protection Agency

Transportation research in the Environmental Protection Agency (EPA) primarily involves emissions abatement, control, and compliance, and programs in air and water quality. For example, the EPA’s Clean Automotive Technology Program includes research and partnerships with industry to develop clean, advanced automotive technology. Conducted at the EPA National Vehicle and Fuel Emissions Laboratory, this research complements DOT and other Federal efforts in advanced vehicles. The program was formerly known as the Partnership for a New Generation of Vehicles.

National Aeronautics and Space Administration

NASA has a long and distinguished background in aeronautical and space transportation research. Although topics such as propulsion, aerodynamics, and control systems predominate, the agency, working closely with the FAA, also emphasizes aviation safety and air traffic management. Safety research addresses human factors, aging aircraft, aircraft icing, airworthiness of new classes of aircraft, and crashworthiness. Air traffic management topics include traffic flow management, airport surface operations, and air traffic control in the terminal, en route, and oceanic domains.

NASA and the FAA are full partners in many research projects, with coordination at the senior management level through the FAA–NASA Executive Committee and at the working level through the Interagency Air Traffic Management Integrated Product Team and the FAA–NASA Aviation Safety Program. The two agencies also collaborate on

environmental topics, including aircraft noise and aircraft emissions reduction. NASA and the FAA have annual joint meetings of their advisory committees, the Aerospace Technology Advisory Committee (NASA) and the Research, Engineering, and Development Advisory

Joint Planning and Development Office: Transforming Air Transportation

In 2003, the FAA, NASA, and other agencies joined to form the JPDO, charged with developing a *National Plan for the Transformation of Air Transportation*. The plan’s purpose is threefold: establish a vision for future air transportation; set national aerospace goals; and ensure that the United States remains at the forefront of aviation. The JPDO will coordinate the development and use of new technologies to ensure that, when available, they may be used to their fullest potential in aircraft and the air traffic control system. It also will facilitate the transfer of technology to the private sector and to Federal agencies with operational responsibilities.

The JPDO plan will lay the groundwork for a system that meets the needs of all users and that is efficient in the application of aerospace resources. This Next Generation Air Transportation System will provide the capacity and flexibility to support future demands—while ensuring the safety of the flying public. It will be part of an integrated national and global transportation system, one that simultaneously satisfies the nation’s economic, defense, and homeland security needs.

Committee (FAA). Finally, through the JPDO, NASA, the FAA, and other agencies are collaborating to develop technologies leading to the Next Generation Air Transportation System.

National Science Foundation

An independent Federal agency, the National Science Foundation (NSF) seeks to strengthen U.S. science and engineering through education and research. The NSF accomplishes this mission through an annual investment in approximately 20,000 research and education projects—efforts that ultimately will lead to broad transportation improvements. Of particular relevance to DOT are the NSF's Materials Research Science and Engineering Centers, which conduct research on material properties, synthesis, structure, and performance. The NSF also engages in cooperative research, such as a joint project with the FHWA and state DOTs on the long-term durability of materials and structures, and an NSF–DOT Partnership for Research in Information and Communications Systems for Surface Transportation.

3. RESEARCH, DEVELOPMENT, AND TECHNOLOGY STRATEGY

The DOT *Strategic Plan 2003–2008* identifies five strategic objectives for transportation: safety, mobility, global connectivity, environmental stewardship, and security. This section of the *RD&T Plan* discusses these objectives, their outcomes, and strategies for achieving them, and summarizes the key supporting RD&T activities. (Note: This section does not reflect the restructuring of RD&T called for in the Norman Y. Mineta Research and Special Programs Improvement Act. These changes will be reflected in subsequent editions of the RD&T Plan.)

SAFETY

Strategic Objective:

“Enhance public health and safety by working toward the elimination of transportation-related deaths and injuries.”

Outcomes:

1. Reduction in transportation-related deaths.
2. Reduction in transportation-related injuries.

Safety is DOT’s most important objective. Transportation enables the movement of people and goods, fueling our economy and improving our quality of life. However, it also exposes people, property, and freight to the risk of harm. Through its RD&T program, the Department strives to improve the benefits of transportation while constantly reducing the risk to health and well-being. Working with its stakeholders, DOT will ensure that the technologies and techniques necessary to identify and resolve safety issues are developed, made available, and used.

PERSPECTIVE AND OUTLOOK

America’s transportation network must provide for the safe movement of people and goods. However, it will be difficult to reach improved safety levels due to increased demand for transportation services and greater diversity in terms of vehicles, goods, and operators.

As the aviation system grows in size and complexity, safety will remain a critical and highly visible government responsibility. To a large degree, effective countermeasures have been developed for the historically dominant accident causes, leaving the more difficult challenges—as well as new and emerging problems—still to be identified and addressed.

On our highways, increased travel will lead to more opportunities for accidents. Growth in goods movement will result in greater numbers of large trucks, perhaps increasing the number and severity of crashes as the mix of vehicles becomes more varied. Human diversity will create still other challenges, such as language comprehension, greater numbers of elderly drivers, and differing cultural norms—all of which could impede safety efforts. Finally, as driver distractions—such as mobile phones, in-vehicle entertainment, and navigation services—become more prevalent, driver inattention raises the risk of highway crashes.

SUPPORTING RD&T ACTIVITIES

To meet its safety objective, the Department is collaborating with public and private transportation providers, manufacturers, academia, and labor unions to support, promote, and conduct national and international research on safety in all transportation modes. As stated in DOT's *Strategic Plan*, among the RD&T strategies supporting safety are the following:¹

- Conducting, supporting, and publishing research in all modes on safety-enhancing technologies and on topics related to safety such as human performance, differing cultural norms, behavior, and unsafe trends.
- Developing, promoting, and supporting public education and information activities that advance safe behavior, safe operations, and best safety practices in all modes of transportation.
- Providing training and technical assistance to industry and other levels of government on safety issues and safety management practices.
- Working with stakeholders to build safety into the transportation infrastructure and into operational procedures through research, planning, design, engineering, incentives, and incorporation of safety-enhancing technologies.
- Mitigating the consequences of safety incidents through more effective response, technology, and coordination with private transportation providers and state and local government.
- Capitalizing on secure, advanced technology to provide information to the public in languages and formats they understand on the benefits of safe behavior and practices in all modes of transportation.
- Increasing the implementation of infrastructure and operational improvements focused on enhancing the ability of drivers to remain on the roadway, reducing the adverse consequences of roadway departure, improving intersection safety, and protecting pedestrians in the roadway environment.

The following are among the specific RD&T programs supporting safety:

Aircraft Safety (FAA)

Provides the technical research basis for developing the standards, rules, regulations, and guidance materials that help to ensure aviation safety. Establishes safety standards and acceptable practices through the development of technical information, tools, and technology to ensure safe operation of the civil aircraft fleet.

¹ DOT *Strategic Plan 2003-2008*, pp. 22-23.

Airport Technology (FAA)

Part of the Advanced Technology Development and Prototyping program, provides technology solutions that will allow the nation's airports to establish and maintain an operational environment free of accidents and fatalities.

Aviation Weather Safety (FAA)

Improves the safety of flight operations through research to improve weather forecasting algorithms and provide technical input to the development of safer standards and procedures.

Biomechanics (NHTSA)

Uses the principles of engineering to study human injury mechanisms in vehicle crashes and to develop intervention and prevention strategies.

Carrier Compliance and Safety (FMCSA)

Supports the enforcement of carrier-related Federal Motor Carrier Safety Regulations by applying principles of safety management science from other industries and best management practices from both the motor carrier and other industries.

Commercial Vehicle Information Systems and Networks [CVISN] (FMCSA/ITS JPO)

Develops and deploys cost-effective information systems and communication networks that provide electronic access to timely and accurate motor carrier safety and other information. CVISN is a collection of information systems and communication networks that together provide a framework for states, the Federal Government, and private stakeholders to electronically collect, process, and exchange motor carrier safety information and commercial vehicle and driver data.

Commercial Vehicle Operations (FMCSA/ITS JPO)

Supports DOT's safety objective by developing and deploying Intelligent Transportation Systems (ITS) technologies to enhance the safety of commercial vehicle operations. Activities include work on qualified driver systems, innovative technologies to support safety enforcement and compliance, and support for states' efforts to fully deploy CVISN.

Commercial Vehicle Safety Performance (FMCSA)

Focuses on improving truck and bus performance through vehicle-based safety technologies and developing new data and information to improve occupant protection and overall vehicle safety.

Crash Avoidance Initiative (NHTSA)

Evaluates new driver assistance technologies and develops performance standards and consumer education materials to ensure their maximum safety benefits (proposed).

Crosscutting Safety Initiatives (FMCSA)

Consolidates information on driver, carrier, vehicle, and roadway environmental factors that place commercial motor vehicles at risk, and on the potential applicability of countermeasures. Develops and fosters R&T partnerships with other organizations in the motor carrier safety community.

Crossmodal Human Factors Research (DOT-wide)

Under the auspices of the Departmental Safety Council and Human Factors Coordinating Committee, studies the interaction of humans with technology in challenging scenarios common to all transportation modes, such as those involving operators, operations controllers, and emergency responders. The program addresses such issues as fatigue and distraction, with the aim of developing operator fatigue management systems and of training people through simulation of real-life conditions found in transportation environments.

Data Programs—National Center for Statistics and Analysis [NCSA] (NHTSA)

Collects, analyzes, and disseminates traffic crash data for government and public use. The NCSA includes several core programs: the Fatality Analysis Reporting System, which provides a census of all fatal highway crashes in the United States; nationally representative motor vehicle crashworthiness data through the National Automotive Sampling System; the National Motor Vehicle Crash Causation Survey of nationally representative data on the causes of crashes; and Special Crash Investigations, a program that identifies and documents the effects of rapidly changing vehicle technologies to assess their impacts on motor vehicle crashes. A new data program—the Early Fatality Notification System—seeks to provide near-real-time counts of motor vehicle fatalities without depending on police accident reports.

Driver Behavior/Simulation Research (FMCSA/NHTSA)

Focuses on understanding the causes of driver-error-related crashes and develops and tests approaches for their mitigation. Research looks at driver distraction, alcohol impairment, and older driver safety issues.

Driver Safety Performance (FMCSA)

Improves the safety behavior of commercial motor vehicle drivers and non-commercial drivers in the vicinity of trucks and buses. Ensures that commercial drivers are adequately trained, physically qualified, and mentally alert.

Driver/Vehicle Performance (NHTSA)

Improves the capability of driver/vehicle systems to avoid crashes by improving vehicle performance, introducing collision avoidance systems, and making vehicles more compatible with the capabilities and behaviors of the driving population.

Grade Crossings (FRA)

Conducts research in grade crossing human factors and infrastructure.

Hazardous Materials (RSPA)

Provides the technical, analytical, and legal foundation for RSPA's hazardous materials regulatory, enforcement, and emergency response actions.

Hazardous Materials R&D (RSPA)

Develops ways to minimize the threat to the public of intentional misuse of hazardous materials—and to do so without substantial impact on the flow of hazardous materials commerce. This effort is part of RSPA's Research and Technology program.

Hazardous Materials Transportation (FRA)

Conducts research in hazardous materials transportation safety, damage assessment and inspection, and tank-car integrity.

Heavy Vehicles (NHTSA)

Supports the NHTSA's rulemaking and consumer information efforts by developing the scientific basis for improving the safety of heavy vehicles. Research aims to make these vehicles less prone to crashes by (1) improving their braking, handling, and visibility characteristics; and (2) mitigating the consequences of collisions that do occur between heavy trucks and other vehicles.

High-Speed Train Control Systems (FRA)

Continues development and demonstration of high-speed train control systems on the Chicago–St. Louis and Detroit–Chicago corridors.

Highway Safety Research (NHTSA)

Determines the causes of crashes; identifies target populations; measures perceptions and awareness levels; develops and tests countermeasures; and evaluates the effectiveness of in-place programs that will reduce traffic deaths, injuries, and associated monetary costs. This research provides the scientific basis for the NHTSA's national leadership in highway safety.

Human-Centered Systems (FHWA)

Part of the FHWA's Safety RD&T program, seeks to improve safety and enhance operations by addressing the needs of users of the highway transportation system. Studies show that inappropriate driver perceptions and behaviors are implicated in 80 to 90 percent of highway crashes. This research addresses intersections, pedestrians and bicycles, traffic control devices, and transportation management centers.

Human Factors (FRA)

Conducts human factors research to identify root causes for repetitive human errors and develop effective countermeasures by targeting human factors in yards, terminals, and mainline operations.

Human Factors and Aerospace Medicine (FAA)

Conducts applied research to identify methods, procedures, technology, and training to enhance human performance and thereby help to reduce the fatal aviation accident rate. Project areas include human factors relating to air traffic services, commercial and general aviation flight decks, aircraft and airway facilities maintenance, and aeromedical research. The program ensures that human factors issues are addressed in the acquisition and integration of FAA systems and applications.

Hydrogen Fuels R&D (RSPA)

As part of the President's Hydrogen Fuel Initiative, conducts research into codes and standards for the safe handling and transport of large quantities of hydrogen fuel and the safety of onboard hydrogen vehicle power and storage systems. This work is conducted under RSPA's Research and Technology program.

Infrastructure Safety (ITS JPO)

Applies technology to continuously improve highway safety by reducing the number and severity of highway crashes.

Intelligent Vehicle Initiative [IVI] (FHWA/FMCSA/FTA/ITS JPO/NHTSA)

Aims to prevent crashes by helping drivers avoid hazardous mistakes. Goals are to (1) prevent driver distraction; and (2) facilitate accelerated development and deployment of crash avoidance systems. Included are activities that will increase safety under normal conditions through the design of in-vehicle communication and information systems; in degraded driving conditions where the risk of a crash is increased; and in dangerous situations through crash avoidance.

Intersection Safety (FHWA)

An element of Safety RD&T, seeks to improve intersection safety by reducing the number and severity of intersection-related crashes. Efforts seek to identify the most common and severe problems—and determine the most effective design configurations and treatments—at both signalized and unsignalized intersections and interchanges.

Nationwide Differential Global Positioning System [NDGPS] (FHWA/FRA)

Continues installation of the NDGPS, which will provide precise positioning and navigation information to ensure the safety and security of lives and property. An expansion of the Coast Guard's DGPS, the NDGPS will serve as the positioning system for railroad positive train control systems, road departure warning systems, and the national mayday system. It is now operational on more than 85 percent of the land area of the United States. Full operational capability, with dual-redundant coverage throughout the continental United States, will be available by 2008.

Navigation and Spectrum Policy (OST)

Formulates DOT navigation systems and spectrum policy. Provides overall planning guidance on positioning, navigation, and spectrum matters under DOT purview.

Pavement Research (FHWA)

Provides pavements that are safe, cost-effective, long-lasting, and easily maintained. With over 13,000 fatality reports noting pavement as a contributing factor, the pavements program has been redirected to go beyond incremental improvements to developing and delivering breakthrough technologies and pavement systems that will radically improve the standards for pavement performance.

Pedestrian and Bicyclist Safety (FHWA/NHTSA)

Focuses on identifying problem areas for pedestrians and bicycles, developing analytic tools that allow planners and engineers to better understand and target these problem areas, and evaluating countermeasures to reduce the number of crashes involving pedestrians and bicycles.

Pipeline Safety Research (RSPA)

Studies technologies and processes to more fully incorporate risk-based approaches into pipeline regulations.

Planning and Decision Making Research—Safety-Conscious Planning (FHWA)

Part of the Planning, Environment, and Realty program, develops collaborative strategies to (1) integrate safety into the planning process; and (2) build analytical tools to support Metropolitan Planning Organizations, state DOTs, and local governments. Research identifies institutional

issues and barriers, along with potential solutions; collects data; and conducts spatial and statistical analyses.

Pneumatic Tire Research (NHTSA)

Supports rulemaking initiatives for upgrading existing tire standards and establishing a warning system in new motor vehicles to indicate when a tire is significantly underinflated.

Public Safety Program (ITS JPO)

Seeks to improve emergency response and reduce delay in rural and metropolitan areas through research and testing of technologies and procedures for detecting, locating, and properly responding to highway incidents.

R&D Facilities and Equipment (FRA)

Addresses the acquisition, upgrading, and maintenance of FRA-owned research facilities and equipment.

Railroad System Issues (FRA)

Conducts research to address system safety and security for freight, commuter, intercity passenger, and high-speed passenger railroads. Also includes research on performance-based regulations.

Roadway Departure (FHWA)

A component of FHWA Safety RD&T, emphasizes keeping vehicles on the roadway and minimizing the consequences of leaving it. Research includes development of the Interactive Highway Safety Design Model.

Rolling Stock and Components (FRA)

Identifies, analyzes, demonstrates, and disseminates information about onboard and wayside systems for monitoring railroad equipment.

Runway Incursion Reduction (FAA)

An element of Advanced Technology Development and Prototyping, develops technologies and other solutions that minimize the chance of injury, death, and damage (or loss of property) due to runway accidents or incidents within the civil aviation system.

Safe Flight 21—Alaska Capstone Program (FAA)

Conducts studies within remote operating environments to validate the potential of selected communications, navigation, and surveillance technologies—combined with related air traffic procedures—to increase aviation safety.

Safer Skies (FAA)

A joint effort with the Department of Defense, National Aeronautics and Space Administration, and industry, analyzes causes of aviation accidents and develops and implements new intervention technologies and strategies to prevent or reduce the leading accident causes.

Safety and Security (FTA)

Develops standards for alternative-fuel safety (e.g., hydrogen fuel cells) and technical guidance materials for the transit industry. Trains approximately 4,000 transit industry professionals in system safety, accident prevention and investigation, industrial safety, and bus operator safety. Improves detection and prevention of drug and alcohol use by transit operators and measures to deal with operator fatigue.

Safety, Energy, and Environment (OST)

Analyzes, formulates, and recommends Departmental policies, plans, and guidelines for the safe and secure crossmodal transportation of hazardous materials.

Safety Management Program (FHWA)

Uses data from the Highway Safety Information System and other sources to understand how safety is affected by the geometric design of highways, the use of traffic control measures, the size and performance capabilities of vehicles, and the needs and abilities of users. This work is a component of Safety RD&T.

Safety Systems (NHTSA)

Increases occupant protection by providing improvements in vehicle structure and interior compartment design, in combination with improvements in occupant restraint systems, through enhanced safety standards.

Safety Systems and Technologies (FMCSA)

Improves the safety and productivity of commercial vehicle operations through the application of life-saving safety systems and technologies. Efforts include accelerated research and testing of new technologies and operational concepts at a real-world, “smart” laboratory site and deployment of CVISN.

Speed Management (FHWA)

A Safety RD&T effort, focuses on developing and testing engineering measures and technologies to manage speeds; assessing the conditions that necessitate changed speeds; and conducting behavioral studies to encourage wider adoption of travel speeds appropriate for the class of road, roadway design, and travel conditions.

Structures Research (FHWA)

Provides highway managers and engineers with information and tools to design, build, and maintain safer and better performing infrastructure assets. The program encompasses new techniques to reduce damage and prevent structural collapse of bridges caused by corrosion and natural hazards, and applies non-destructive evaluation techniques to measure structural integrity and cumulative fatigue loading. Other research focuses on improving the longevity of new or replacement construction through variations of the more familiar construction materials—such as steel and concrete—and more exotic materials—including fiber-reinforced polymer composites and aluminum.

Track and Structures (FRA)

Conducts research on automated track inspection technologies, provides technical support for regulatory actions and inspections, and investigates failure mechanisms.

Track and Train Interaction (FRA)

Researches derailment mechanisms and vehicle/track performance.

Train Control (FRA)

Conducts research in train control test and evaluation.

Train Occupant Protection (FRA)

Focuses research on the structural crashworthiness and interior safety of intercity and commuter passenger rail cars and locomotives. Efforts also address fire safety and emergency response issues.

Training and Education (FHWA)

Provides training and technical assistance to promote the application of technologies and to help maintain high levels of technical competence. Programs such as the National Highway Institute (NHI) and Local Technical Assistance Program (LTAP) are important tools for education and training in support of FHWA and DOT safety goals.

Vehicle Research and Test Center (NHTSA)

As NHTSA’s research, development, test, and evaluation facility, assists program offices in the areas of crashworthiness, applied biomechanics, and crash dummy development.

Visibility Research (FHWA)

Enhances the safety of road users by investigating issues such as nighttime driving, roadway lighting, and sign and pavement marking. This effort is part of the FHWA’s Safety RD&T program.

MOBILITY

Strategic Objective:

“Advance accessible, efficient, intermodal transportation for the movement of people and goods.”

Outcomes:

1. Improved infrastructure in all modes.
2. Reduced congestion in all modes.
3. Increased reliability throughout the system.
4. Increased access for all Americans.

Mobility, as much as any other factor, defines us as a nation, and is intertwined with our economic growth. The U.S. transportation system connects people with work, school, community services, markets, and other people. It carries over 4.6 trillion passenger-miles of travel and 3.9 trillion ton-miles of freight every year—generated by more than 260 million people and 6 million businesses. DOT’s aim is an affordable, reliable, and accessible transportation system. Among the objectives of RD&T is to optimize investment in these public systems and maximize their benefits to all Americans.

PERSPECTIVE AND OUTLOOK

Shifting demographic and economic patterns present new challenges for transportation mobility.

Population, the key driver in transportation demand, is projected to increase by over 3 million people per year over the next several years. Much of this growth will be concentrated in urban regions, resulting in congestion on roads within cities and suburbs. Changes in population structure will also affect demand for transportation services. The population will become increasingly elderly and more diverse, creating unfamiliar accessibility and equity issues.

The increased mobility needs of the population will likely conflict with the increased mobility needs of commerce. In commerce, the focus will continue to shift from physical economic centers operating from stock inventory to a more service-oriented market in which in-time customer orders and electronic economic centers demand more reliable, efficient transportation.

Growth in e-commerce and the increased emphasis on reliable delivery will put more commercial traffic on the road, further aggravating conflicts between private and commercial mobility.

The continued globalization of the U.S. economy will pressure capacity at or around our ports and borders. By 2020, U.S. foreign trade may grow by more than half its current tonnage, increasing inland waterway traffic and congestion at marine ports and terminals. In aviation, air travel may return to its pre-9/11 levels by 2006, with a mix of air traffic that will be more complex. This increased growth and complexity will require more capacity in the air traffic control system and at certain airports.

SUPPORTING RD&T ACTIVITIES

The Department is expanding alliances with a range of public and private stakeholders in all modes to meet its mobility objective and outcomes. The *Strategic Plan 2003-2008* identifies the following RD&T strategies:²

- Exploiting web-enabled and other secure information technologies to update contingency planning, to speed response and restoration actions, to communicate emerging mobility issues, and to share information on best practices in improving mobility in all modes.
- Examining ways to encourage cargo movements by water to bring improved capacity to our intermodal transportation system.
- In consultation with our public and private sector partners, conducting research and expediting the deployment of technologies, as well as innovative operation and service concepts, that improve the reliability and efficiency of the system and the durability of the infrastructure.
- Providing technical assistance and training to improve intermodal transportation planning and effective management and operation of the system.

Among the supporting RD&T programs are:

Advanced Control Systems (FHWA)

Uses advanced traffic signal control and logic to run real-time adaptive control systems. This project is part of the Traffic Management Research element of Highway Operations R&D.

Advanced Pavement Systems (FHWA)

Provides pavements that are safe, cost-effective, long-lasting, and easily maintained. Develops advanced pavement design systems that work with and enhance the new *Pavement Design Guide*; creates new models for the next generation design guide; and encourages the broad use of

² *ibid.*, pp. 32-33.

life-cycle cost analyses in the pavement design process. Work is conducted under the FHWA's Pavement Research program.

Advanced Quality Systems for Pavements (FHWA)

Part of the Pavement Research program, develops and delivers pavement guidelines and demonstrates advanced pavement technologies.

Airport Technology (FAA)

An element of Advanced Technology Development and Prototyping, enhances airport system efficiency through better airport planning, design, and pavements.

Bridge of the Future (FHWA)

An element of the FHWA's Structures Research program, builds upon previous work in high-performance concrete, high-performance steel, and advanced composite materials to develop totally new bridge systems that have a 100-year life with no maintenance; that are adaptable to new demands; and that are highly resilient to attack, floods, earthquakes, and overloads.

Center for Advanced Aviation System Development (FAA)

Provides detailed reports, briefings, and concept demonstration systems used in the evaluation of new air traffic management and air traffic control operating concepts and infrastructure replacements.

Dynamic Traffic Assignment (FHWA)

Part of the Highway Operations R&D program, uses expert computer processing to develop real-time traffic estimation and prediction systems that forecast where and when drivers travel on the road network.

Fleet Operations (FTA)

Supports increased transit ridership through the identification, development, and implementation of cost-effective transportation solutions, including Bus Rapid Transit, shared track, and multimodal transportation management.

Grade Crossing and Innovative Technologies (FRA)

Promotes a comprehensive approach to crossing hazards on a total corridor basis through a joint railroad-state demonstration program that evaluates multiple solutions and the exploration of opportunities for interlinking railroad signal systems, grade crossing protection, automatic train control systems, and highway applications. This project is part of the Next Generation High-Speed Rail Program.

High-Speed Non-Electric Locomotives (FRA)

Seeks to develop and demonstrate a lightweight, high-speed, turbine-powered locomotive capable of 150 mph and meeting all applicable FRA safety standards. The program is also developing a hybrid flywheel-turbine propulsion system in partnership with industry and academia.

ITS (FHWA/FMCSA/FTA/ITS JPO)

Applies advances in communication, navigation, sensor, and information-processing technologies to extend the capacity of the existing infrastructure through freeway management, traffic signal control, electronic toll collection, transit management, and other advances. Current strategies focus on deploying the ITS infrastructure, completing key initiatives, and investing in tools that will increase system capacity. Highlights include the IVI—which uses enabling technologies to accelerate the development, availability, and widespread use of vehicle-based and infrastructure-cooperative crash avoidance systems—and rural technologies research—which applies ITS technology to rural settings.

Metropolitan and Rural Policy Development (FTA)

Develops better estimates of transit condition, performance, and long-term investment needs; identifies and evaluates the benefits of transit; researches the relationship between transit and land-use planning; and provides technical assistance to encourage use of innovative financing.

Planning and Project Development (FTA)

Assists state and local transit planners in implementing Federal multimodal planning provisions.

Planning, Environment, and Realty (FHWA)

Ensures that transportation land use and development decisions are addressed through a comprehensive intermodal and multimodal planning process that supports the integration of planning and management of real property with environmental concerns. Research helps decision makers to identify solutions to address economic, social, environmental, land use, and technical developments, and provides capacity-building tools to state, metropolitan, rural, and tribal institutions.

Policy Research (FHWA)

Using information on economics, demographics, highway travel, and spending trends, provides unique and crucial analyses of the interrelationships among highway programs, systems, services, and institutional relationships. Analyses provide a framework for assessing the stewardship of the nation's highways as a component of the overall transportation system.

Positive Train Control Systems Development and Demonstration (FRA)

Makes use of automatic onboard location systems, including Differential GPS; onboard computers; digital communications links; safety-critical databases; and computerized wayside control systems to enhance the safety, capacity, and efficiency of both freight and passenger operations. These systems will permit deployment of high-speed passenger rail services. Activities are part of the FRA's Next Generation High-Speed Rail and Railroad R&D programs.

Railroad Communications Development and Testbed (FRA)

A project of the Next Generation High-Speed Rail program, works closely with industry committees to assess and demonstrate new communications technologies and provide repeatable, objective tests to support future decisionmaking on communications operations for the railroad industry. Railroads are already employing an ever-growing mix of wireless communications technologies, including conventional voice dispatch radio; digital telemetry from the rear to the front of virtually every freight train; digital remote control of yard locomotives and supplemental locomotives in through freight trains; both privately owned and public microwave and fiber optic ground networks; and microwave-energized transponders mounted on each rail vehicle to automatically report the vehicle identification to wayside readers.

Safe Flight 21—Ohio River Valley Program (FAA)

Conducts detailed risk assessments for communications, navigation, and surveillance systems with high potential for increasing aviation efficiency.

Specialized Customer Services (FTA)

Seeks to improve transit services for low-income, elderly, and other transit-dependent travelers, including persons with disabilities.

Strategic Work Zone Analysis Tools (FHWA)

Develops tools to improve work zone safety, including a detailed simulation model to evaluate the effects of work zones on surrounding areas; an expert systems software program; and QuickZone, a work zone delay impact analysis tool. This effort is part of the FHWA's Highway Operations R&D program.

Systems Management Information (ITS JPO)

Consists of five activities: (1) the Advanced Data Collection program, which develops new techniques and technologies for monitoring the surface transportation system; (2) the Data Management program, which develops techniques and guidance for processing and managing the data associated with highway and transit monitoring; (3) the Telecommunications program, which conducts research and develops guidance to address various ITS telecommunications issues; (4) the Weather program, which develops specifications for weather sensors and guidance for deploying sensor networks; and (5) the Data Dissemination program, which develops

guidance for exchanging information about transportation services and providing that information to travelers.

Track and Structures Technology (FRA)

Part of the Next Generation High-Speed Rail program, demonstrates advanced and economical technologies to resolve corridor capacity constraints and bottlenecks.

Training and Education (FHWA)

Through programs such as the NHI and LTAP, provides training and education to promote the application of technology and help maintain high levels of technical competence.

University Transportation Centers Program (FHWA, FTA, RSPA)

Ensures the availability of a future cadre of professionals prepared to design, deploy, operate, and maintain the complex transportation systems of the future. Managed by RSPA and funded by the FHWA and FTA, this program invests in university-based centers of excellence that conduct research to advance knowledge, share that knowledge with stakeholders, and use knowledge to educate students in a broad range of disciplines.

Weather Responsive Travel Management (FHWA)

Part of Highway Operations R&D, addresses issues associated with improving traffic management and operations during adverse weather conditions, including natural and human-caused disasters.

GLOBAL CONNECTIVITY

Strategic Objective:

“Facilitate a more efficient domestic and global transportation system that enables economic growth and development.”

Outcomes:

1. Reduced barriers to trade in transportation goods and services.
2. More efficient movement of cargo throughout the supply chain.
3. Enhanced international competitiveness of U.S. transport providers and manufacturers.
4. Harmonized and standardized regulatory and facilitation requirements.
5. The most competitive, cost-effective, and efficient environment for passenger travel.
6. Expanded opportunities for all businesses, especially small, women-owned, and disadvantaged businesses.

Transportation systems within and among nations have become lifelines to the future, to economic growth, to freer trade, and to greater cultural exchange. Our increasingly global economy hinges on smooth supply chains and just-in-time manufacturing. Transportation is

critical to both. With leaner inventories, companies depend on transportation being efficient enough to give them a competitive edge.

PERSPECTIVE AND OUTLOOK

Globalization of the economy will continue to put pressure on U.S. borders and ports. For example, by 2025 total U.S. waterborne trade is expected to increase by 47 percent, with 82 percent of this growth coming from the continuing boom in foreign trade.

Within the hemisphere, there are international transportation issues concerning our northern and southern borders. In particular, trade with Mexico may double by 2008, magnifying cross-border traffic, safety, environmental, security, and capacity issues.

One of our most important international exports has become aviation safety. The FAA will continue to broaden its network of partnerships with civil aviation authorities and promote relationships with regional safety organizations.

SUPPORTING RD&T ACTIVITIES

A domestic and international intermodal approach is central to DOT's role in promoting global connectivity. As identified in the *Strategic Plan*, the following are among the key RD&T strategies:³

- Encouraging and facilitating intermodal transportation planning worldwide.
- Supporting and conducting research on issues concerning the intersection of passenger and freight transportation.
- Accelerating the use of technologies such as ITS that reduce travel time delays at key intermodal transfer points, in significant corridors, and at international border crossings.

The following RD&T programs support the Department's global connectivity objective:

Aviation and International Policy (OST)

Develops and coordinates aviation policy and analyzes industry developments. Enhances the development of domestic and international aviation by providing the quality data required to support it.

³ *ibid.*, pp. 44-45.

Economic and Strategic Analysis (OST)

Analyzes the economic implications of public and private transportation policy issues, including the changing structure of transportation firms and industries, the financing of transportation infrastructure projects, and the economic viability of new transportation technologies.

Intermodalism (OST)

Coordinates Federal intermodal transportation policy and initiates policies to promote efficient intermodal transportation. Coordinates Federal research on intermodalism.

International Mass Transportation Program (FTA)

Promotes U.S. transit products and services overseas and cooperates with foreign public-sector entities on research in public transportation.

ITS (FHWA/FMCSA/FTA/ITS JPO)

Applies advances in communication, navigation, sensor, and information-processing technologies to extend the capacity of the existing infrastructure through freeway management, traffic signal control, electronic toll collection, transit management, and other advances.

Joint International Research (FHWA)

Part of the Policy Research program, leverages resources through international forums and enhances global partnerships.

Planning and Decision Making Research—Border Planning (FHWA)

Leads coordination activities with the U.S./Canada Transportation Border Working Group and the U.S./Mexico Joint Working Committee to address infrastructure needs, promote effective communication, and enhance land transportation at borders. Research issues range from alleviating congestion and bottlenecks at border crossings to coordinating joint solutions with Federal, state, and bi-national agencies. This effort is part of the Planning, Environment, and Realty program.

Planning and Decision Making Research—Freight Management (FHWA)

Increases the efficiency of intermodal freight movement over the nation's highways, railroads, waterways, and ports by engaging major freight stakeholders in deploying technologies, improving modeling tools, and developing standards for freight information exchange. This effort is an element of the FHWA program on Planning, Environment, and Realty.

ENVIRONMENTAL STEWARDSHIP

Strategic Objective:

“Promote transportation solutions that enhance communities and protect the natural and built environment.”

Outcomes:

1. Reduced pollution and other adverse environmental effects of transportation and transportation facilities.
2. Streamlined environmental review of transportation infrastructure projects.

Current trends in transportation are exerting pressure on environmental resources worldwide. In the United States, commercial and personal travel has grown substantially in recent years and will continue to increase in the future. Americans want solutions to transportation problems, but they want solutions that are consistent with sound environmental planning.

PERSPECTIVE AND OUTLOOK

Transportation faces several challenges in environmental stewardship over the coming years. Many of these stem from a growing and increasingly mobile population and an expanding economy.

Population growth will strain the nation’s transportation infrastructure, increasing demand for energy and the number of vehicles on the road. Suburban areas will likely absorb a disproportionate amount of the growth, amplifying its effects and creating additional challenges with regard to emissions, noise, and infrastructure.

Along with a growing population, periods of economic growth will strain the capacity of the system, leading to calls for the expansion of ports, highways, and airports.

Finally, climate change will likely prove a challenge to transportation, both in terms of adapting to impacts on the system and of mitigating transportation-related greenhouse gas emissions.

SUPPORTING RD&T ACTIVITIES

DOT’s *Strategic Plan* calls for a balance between environmental challenges and the need for a safe and efficient transportation network. Among the RD&T strategies for achieving this vision are:⁴

- Supporting the President’s Hydrogen Fuel Initiative through research on fuel distribution and delivery infrastructure, transportation of associated hazardous materials, and vehicle safety.

⁴ *ibid.*, pp. 54-55.

- Supporting interdisciplinary research on connections among transportation, energy, and the environment.
- Adopting transportation policies and promoting technologies that reduce or eliminate environmental degradation.
- Collaborating with Federal agencies and the private sector to support and conduct research on technologies that improve energy efficiency, foster the use of alternative fuels, and reduce vehicle emissions.
- Working with transportation partners to mitigate the adverse environmental effects that presently occur from existing transportation systems.

FY 2005 funding will support the following RD&T activities:

Crosscutting Environmental Issues (DOT-wide)

Supports environmental research of interest to more than a single transportation mode. One effort, the DOT Center for Climate Change and Environmental Forecasting, fosters awareness of potential links between transportation and global climate change and formulates policy options to deal with the challenges of these links. The OST and operating administrations also cooperate on issues related to air and water quality, noise, habitat and species, and land use.

Environment and Energy (FAA)

Develops new models, metrics, and operational and technical improvements to mitigate environmental impacts related to aviation. Enhances scientific knowledge to identify, understand, and measure the issues and impacts associated with aircraft noise and aviation emissions. A long-term goal is the creation of new analytical tools to understand better the relationship between noise and emissions and different types of emissions and to analyze the costs and benefits of different policies and actions—contributing to achieving the FAA’s goal of enhancing capacity in an environmentally sound manner.

Environmental Stewardship Research—Air Quality (FHWA)

An element of the Planning, Environment, and Realty program, conducts research on particulates, air toxins, transportation emissions, energy and global climate change, congestion mitigation, and rural air quality. Develops analytical techniques and cost-effective mitigation strategies to reduce transportation-related emissions and permit development of viable transportation programs.

Environmental Stewardship Research—Context-Sensitive Solutions (FHWA)

Recognizes the need to plan, design, and operate transportation facilities and services within the context of the linkages among transportation systems and other factors defining the quality of life. Conducts research, develops tools and methods, and provides educational materials to

inform the public of livability issues. Work identifies techniques to show how transportation projects enhance communities, increase societal benefits, and encourage creative solutions—while meeting the goals of community residents and businesses. Activities are part of the Planning, Environment, and Realty program.

Environmental Streamlining (FHWA)

Identifies and develops time-sensitive, cost-effective techniques to redesign, integrate, and balance environmental and transportation decision making at the Federal, state, tribal, and local levels. Analyzes causes for process delays, sponsors pilot streamlining efforts, develops new procedures, and provides training. Efforts are part of the FHWA's Planning, Environment, and Realty program.

Equipment and Infrastructure (FTA)

Accelerates the commercial introduction of low-emission, high-efficiency vehicles to the transit industry.

Pavement Research (FHWA)

Assesses the impacts of construction and repair materials on surface and ground waters.

Pipeline Safety Research (RSPA)

Conducts R&D leading to improved pipeline inspection tools that enable operators to locate and repair pipeline problems before an event occurs.

Planning and Decision Making Research (FHWA)

Part of the Planning, Environment, and Realty program, develops tools to support sound environmental planning.

Railroad System Issues (FRA)

Addresses environmental issues related to railroad operations, including locomotives.

Safety, Energy, and Environment (OST)

Formulates and recommends Departmental policies, plans, and guidelines related to the natural and human environment. Among the program's responsibilities are policy advice and activities on air quality, water quality, ecosystem management, noise, emissions, sustainability, and historic preservation.

SECURITY

Strategic Objective:

“Balance homeland and national security transportation requirements with the mobility needs of the nation for personal travel and commerce.”

Strategic Outcomes:

1. Rapid recovery of transportation in all modes from intentional harm and natural disasters.
2. A U.S. transportation system that meets national security requirements.

Transportation security is equal in importance to transportation safety. As we have witnessed, the nation’s transportation system has vulnerabilities that need to be guarded against attack. Moreover, our borders are subject to intrusions by smugglers of contraband or weapons of mass destruction and by illegal migrants. DOT’s objective is to contribute to security by working with the Department of Homeland Security (DHS), other Federal agencies, state and local governments, the private sector, and citizens to minimize transportation’s vulnerability to disruption, damage, or exploitation through crime or terrorism.

PERSPECTIVE AND OUTLOOK

As plans to attack transportation persist, the Department will draw on its industry-wide expertise to facilitate a system that is safe, efficient, and secure. In particular, DOT will continue to collaborate with DHS and other agencies to ensure security throughout the system, protect it from natural disasters, and implement cybersecurity programs to protect critical infrastructure.

SUPPORTING RD&T ACTIVITIES

In its *Strategic Plan 2003-2008*, DOT identifies strategies for working with DHS and state, local, and private sector partners to elevate transportation security levels while improving the network’s safety and efficiency. Among the RD&T strategies are:⁵

- Monitoring the transportation system 24/7 to provide real-time reports and to help ensure rapid response and recovery from disruptions to transportation throughout the nation.
- Implementing cybersecurity programs to adequately protect DOT systems integrated with the national critical infrastructure.
- Employing advancements in secure, certified, and accredited IT technology and communications to improve the accuracy, speed, and simplicity of exchanging security, emergency response, and defense deployment information with Federal, state, and local governments and with the private sector.

⁵ *ibid.*, pp. 62-63.

Supporting RD&T activities include the following:

Safety and Security (FTA)

Helps to improve the state of transit readiness for potential terrorist attacks, with particular focus on security training, public awareness, and emergency response. Includes design standards for, and testing and validation of, security technologies that can be transitioned quickly into a transit environment, particularly those that will help prevent, reduce the impact of, and enhance recovery from terrorist attacks.

Safety, Reliability, and Security of Bridges (FHWA)

Part of the Structures Research program, conducts research on bridge surveillance and monitoring as a means of improving infrastructure security.

Strategic Highway Network [STRAHNET] (FHWA)

Focuses on data management and analysis of 61,044 miles of the National Highway System (NHS). The STRAHNET includes the 45,376-mile Interstate system; 15,668 miles of non-Interstate highways; and approximately 1,700 miles of additional roadways (STRAHNET connectors) that connect military bases to the NHS. The FHWA maintains and examines national data on the condition of roads and bridges, including the STRAHNET and STRAHNET connectors, and provides this information to the Defense Department's Military Traffic Management Command Transportation Engineering Agency to support its national defense strategies. This effort is part of the Field Services and Delivery program.

Weather Responsive Travel Management (FHWA)

Addresses issues associated with improving traffic management and operations during evacuations in response to natural or human-caused disasters. This activity is part of the FHWA's Highway Operations R&D program.

4. THE FY 2005 RESEARCH, DEVELOPMENT, AND TECHNOLOGY PROGRAM

This section describes the RD&T programs of each DOT operating administration, including agency missions and planned FY 2005 activities. All budget figures are cited from official DOT totals for RD&T. (See Appendix C.) (Note: This section does not reflect the restructuring of RD&T called for in the Norman Y. Mineta Research and Special Programs Improvement Act.)

FEDERAL HIGHWAY ADMINISTRATION

MISSION

The FHWA's mission is enhancing mobility through innovation, leadership, and public service. The FHWA faces the continuous challenge of enhancing the movement of people and goods, while ensuring the safety and security of the traveling public and promoting the protection of the environment.

Major FHWA programs include the Federal-Aid Highway Program, which provides Federal financial assistance to the states to construct and improve the National Highway System (NHS), urban and rural roads, and bridges. In addition, the Federal Lands Highway Program provides access to and within national forests, national parks, Indian reservations, and other public lands by preparing plans and contracts, supervising construction of facilities, and conducting bridge inspections and surveys. In support of these activities, the FHWA manages a comprehensive RD&T program.

FHWA RD&T places a very high value on new technologies, materials, and innovations to improve the nation's roadways. Due to FHWA efforts, applications of advanced technology to the nation's highways are yielding impressive results in safety, mobility, productivity, environmental quality, and security. The FHWA strategically invests in RD&T to improve the transportation system. The agency's approach emphasizes partnership with a broad range of organizations, including other DOTs and Federal agencies; state, local, and county governments; and international organizations. The goal is to identify, develop, and accelerate the transformation of new ideas into better transportation systems, processes, and services.

Research, Development, and Technology

The FHWA has a history of success in playing a lead role in national highway research. RD&T delivery is a shared responsibility within the agency, involving Headquarters program offices, the Office of RD&T, the National Highway Institute (NHI), the Resource Center, and Division Offices. Each plays an important role in identifying research needs and implementing strategies. The Office of RD&T, located at the Turner-Fairbank Highway Research Center (TFHRC) in McLean, Virginia, has a unique role in that it conducts and manages research in support of FHWA program offices; coordinates the RD&T program; champions the advancement of technological innovation in support of the agency's strategic goals and performance objectives; advances knowledge through research, development, testing, and evaluation; and provides support and assistance throughout the FHWA in RD&T matters.

In an effort to further improve its RD&T program, the FHWA developed a Corporate Master Plan for Research and Deployment of Technology and Innovation. The purpose of the plan is to continue to improve the effectiveness and efficiency of RD&T, including the end goal of deploying and implementing technologies and innovations that improve the quality, cost effectiveness, and timeliness of products, procedures, processes, and practices. The Corporate Master Plan presents a role, new focus, and clear direction for the agency's RD&T program within the context of improving highway transportation. Moreover, it outlines the FHWA's corporate strategy for investing in and conducting research in cooperation with its partners and stakeholders.

CURRENT PROFILE AND FUNDING LEVELS

Initiatives in the FHWA's FY 2005 budget request, shown in Table 4-1, emphasize the Safety, Infrastructure, Operations, Planning and Environment, and Policy areas. RD&T activities for the ITS JPO are described later in this section.

Table 4-1. Comparative Summary of FHWA RD&T Activity (\$000)*

Item	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
R&D	\$287,839	\$318,371	\$393,925
Technology	\$240,196	\$273,369	\$171,096
Facilities	0	0	0
Total	\$528,035	\$591,740	\$565,021

* Figures are from Appendix C.

FY 2005 Budget in Brief Highlights

Continue work on identifying ways to reduce the number of injuries and fatalities on our nation's roadways by demonstrating the application of innovative technologies in highway safety; deploying and evaluating safety technologies and innovations at the state and local levels; and assuring the deployment of best practices in training, management, design, and planning.

Surface Transportation Research

Safety RD&T

Safely getting people where they need to go is the FHWA's top priority. The agency works in partnership with the NHTSA, FMCSA, FRA, and other public and private organizations to achieve its safety goals. The FHWA saves lives by improving the infrastructure and operation of U.S. highways, minimizing the factors that cause crashes, and reducing the severity of injuries for crashes that do occur.

Key Safety Research

- **Intersection-Related Crashes** account for more than 50 percent of the combined fatal and injury crashes each year. In this research, the FHWA seeks to identify the most common and severe problems and determine the most effective design configurations and treatments at both signalized and unsignalized intersections and interchanges.
- **Pedestrian and Bicyclist** crashes account for 15 percent of fatal crashes annually. Research focuses on identifying problem areas, developing analytic tools for planners and engineers to better understand and target problems, and evaluating infrastructure and operational countermeasures to improve pedestrian and bicyclist safety.
- **Roadway Departure** research emphasizes keeping vehicles on the roadway and minimizing the consequences of leaving it. Development of the Interactive Highway Safety Design Model is a key study area. Another vital resource is the FHWA/NHTSA National Crash Analysis Center, which addresses scientific issues in crash testing and computer modeling and serves as a common resource for the government, automotive industry, and roadside hardware manufacturers.
- The maximum benefits of safety technologies and practices can only be realized through a **Strategic Approach** to safety. Such an approach comprises efforts to manage and develop safety processes and tools; to improve data and information; to evaluate safety programs and countermeasures; to transfer technology; and to develop materials for decision makers, practitioners, and the general public.

Shown in the box above, areas of emphasis in FY 2005 will continue to be intersections, pedestrian and bicyclist safety, and roadway departures, as these areas typically involve the greatest number of deaths and injuries. The FHWA undertook a comprehensive self-assessment in 2003 that involved all of the states, the District of Columbia, and Puerto Rico. This resulted in a better understanding of where each state could strengthen efforts to reduce fatal highway crashes.

Supporting safety efforts, shown below, will include photometric and visibility research, speed management, human-centered systems research, and safety management assessments. Advancement of Intelligent Transportation System (ITS) technologies, including intelligent cruise control, viewer enhancers, and onboard vehicle sensors, will be another key part of the safety initiative. The long-term safety strategy is a technology-based system approach that enhances the safety of roads, vehicles, and highway users.

Key Supporting Safety Research

- The **Visibility Program** investigates such issues as nighttime driving, roadway lighting, and sign and pavement marking to help drivers and enhance the safety of road users.
- **Speed Management** is a complex issue, involving engineering, environmental, and behavioral factors. Research in this area focuses on developing and testing engineering measures and technologies to manage speeds; assessing the conditions that necessitate changed speeds; and conducting behavioral studies to encourage wider adoption of travel speeds appropriate for the class of road, roadway design, and travel conditions.
- **Human-Centered Systems** research shows that inappropriate driver perceptions and behaviors are implicated in 80 to 90 percent of highway crashes. Work in this area focuses on two major issues: highway safety and intelligent highway infrastructure systems. Specific topics include intersections, pedestrians and bicycles, traffic control devices, and transportation management centers.
- The **Safety Management Program** uses data from the Highway Safety Information System and other sources to understand how safety is affected by the geometric design of highways, the use of traffic control measures, the size and performance capabilities of vehicles, and the needs and abilities of users. Efforts are underway to develop a set of analytical tools for use in the safety improvement process.

Infrastructure RD&T

The FHWA's infrastructure RD&T delivery and deployment program focuses on improving the performance, and significantly reducing the long-term costs, of highway infrastructure. The program is comprehensive and coordinated, conducting infrastructure research that cuts across the boundaries of asset management, pavement, and structures. Research addresses four critical elements necessary for success: information, people, technology, and deployment.

The Infrastructure program has been guided by recommendations of the National Highway R&T Partnership for Renewal of the Nation's Highway Infrastructure and of the Transportation Research Board (TRB) Research and Technology Coordinating Committee. Infrastructure RD&T goes well beyond renewal, aiming to develop and deliver breakthrough technologies that will radically change the standards for performance of pavements and bridges and the way they are managed. The program targets several well-defined areas where gaps in existing knowledge, understanding, or technology have been identified as opportunities for high-payoff research. It also emphasizes deployment through real-world demonstration of new technologies and innovations. Specific projects include:

- *Asset Management*—For highway systems, asset management is a new way of doing business. Cutting across function, asset class, and eventually, even mode, it is a fact-based, holistic resource allocation process that addresses several critical concerns. For one, the highway system is mature and experiencing ongoing deterioration. According to the *2002 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance* report to Congress, annual capital expenditures by all levels of government could increase by over 65 percent without exhausting the supply of cost-beneficial investments in highways and bridges. Second, on the performance side, there are major problems with congestion. Third, state DOTs face significant management challenges, including shortages of experienced staff, a focus on short-term and “worst-first” decision making, decisions made asset class by asset class, heightened accountability, and a lack of quality data. Asset management research addresses these issues through work in four areas:
 - *Information*—Providing the data and information that states need to drive the asset management process.
 - *Capacity Building and Knowledge*—Providing the professionals who know what needs to be done and how to do it. This includes training workers and technicians, developing professionals, and educating decision makers. The objective is to get the word out about best practices and innovative technologies.
 - *Technology*—Making asset management work by providing the best tools, techniques, procedures, and guidance.
 - *Deployment*—Championing, enabling, and supporting real-world application of asset management technology and information.

Key Asset Management Research

Information for Decision Making

- Conduct data integration research, development, and implementation activities.
- Use asset condition data to assess engineering performance of various asset parameters.
- Provide technical assistance to states in the implementation of data collection standards.
- Evaluate rolling weight deflectometer.

Management Systems

- Provide guidance for Government Accounting Standards Board implementation (using modified approach).
- Evaluate innovative technologies for asset management.
- Develop tunnel management system.
- Develop hardware management system.
- Provide technical assistance and training on asset management.

Engineering Economic Analysis Tools

- Make improvements to bridge management.
- Develop Advanced Economic Investment Analysis course.
- Develop and deliver project-level analytic models and tools.
- Develop and deliver program-level analytic models and tools.

Quality Management, Construction, and System Preservation

- Conduct conferences on transportation system and pavement preservation.
- Implement stewardship and oversight recommendations and policy.
- Undertake new construction- and preservation-related training initiatives, including a Quality Assurance Specification Development training course.
- Apply customer-oriented construction management, quality management, and preservation information.
- Develop and implement performance-related specification technology.
- Support continuous quality improvement using state “champions” to show best practices.

- *Structures*—There are approximately 600,000 large highway bridges in the United States and millions of smaller structures. Of the larger bridges, 165,099 (28 percent) are substandard, but more importantly, U.S. drivers cross deficient bridges more than 1 billion times each day. The average highway bridge in the United States was constructed more than 35 years ago. The need to reconstruct and rehabilitate bridges is evident by the number of work zones around the country.

Bridges are vital links in the nation’s transportation network: while the NHS represents only about 4 percent of the total miles of roads in the country, 25 percent of all highway bridges are on the NHS. The vulnerability of highway bridges to natural hazards—such as floods, winds, and earthquakes—as well as to terrorist attacks, remains a serious concern. The public rightly expects that the nation’s multi-trillion-dollar investment in highway infrastructure be managed effectively, efficiently, and securely.

The FHWA is committed to developing and delivering technology to meet these needs. The agency’s vision for structures RD&T is to get out in front of the bridge deterioration curve and stay there. The FHWA is working toward this vision through research in three strategic areas: (1) the bridge of the future, a totally new generation of high-performance, low-maintenance bridges; (2) stewardship and management for effectively dealing with existing

bridges; and (3) ensuring the safety, reliability, and security of bridges by addressing both natural and human-caused hazards.

Key Structures Research

The Bridge of the Future

Build upon previous research in high-performance concrete, high-performance steel, and advanced composite materials to develop totally new bridge systems aimed at the following performance objectives:

- One-hundred-year life with no maintenance.
- A fraction of current construction time.
- A fraction of current life-cycle cost.
- Adaptability to new demands.
- Resilience to attack, floods, earthquakes, and overloads.
- A total systems approach.

Stewardship and Management for the Future

- Research new ways to improve visual inspection of bridges and new methods for defining their physical condition.
- Plan multiple research contracts to optimize maintenance coating operations, improve laboratory and field forensic analysis of coating systems, improve standards for quality assurance, and assess corrosion performance of alternative reinforcement.
- Develop new inspection technologies, such as monitoring systems for major structures and technology for evaluating bridge foundations after earthquakes; investigate rapid and economical means of load-testing bridges; and conduct a literature review and synthesis of current state-of-the-art research on risk-based and life-cycle bridge management.

Safety, Reliability, and Security of Bridges

- Continue directed study at the Multidisciplinary Center for Earthquake Engineering Research and in-house seismic research in partnership with Japan.
- Develop a unified scour prediction and evaluation procedure based on a comparison of independent lab studies conducted by the FHWA Hydraulics Lab and the University of Florida.
- Conduct research on bridge surveillance and monitoring as a means of improving infrastructure security.

- *Pavements*—A key FHWA goal is to improve the mobility and safety of the 160,000-mile NHS. To do so requires the effective restoration and preservation of the existing pavement infrastructure. Providing long-lasting and high-performing pavements is a complex and ongoing challenge. Approximately 7 percent of the NHS is in poor condition. Most of the system is more than 35 years old, and it is estimated that there is a \$59 billion annual shortfall in the resources needed to maintain its condition. Moreover, more than 13,000 fatality reports note pavement as a contributing factor. Highway users have clearly stated their desire for pavements that are safer, smoother, and quieter.

FHWA research focuses on pavements that are safe, cost-effective, environmentally friendly, and long-lasting; that can be effectively maintained; and that meet customer needs. The agency has redirected the program to go beyond incremental improvements to develop and deliver breakthroughs that will radically improve the standards for pavement performance. Research also seeks to fill critical gaps in pavement knowledge, understanding, and technology.

Key Pavement Research

Advanced Pavement Systems

- Develop training workshops, guidance on material testing, and local calibration procedures to help deliver the new *Pavement Design Guide*.
- Validate proposed Superpave and structural design models through TFHRC laboratory and full-scale accelerated performance testing.
- Develop new predictive models for the next-generation pavement design guide.
- Evaluate the performance of modified asphalt binders through accelerated testing in cooperation with state DOT and industry partners.
- Develop and deliver findings, technologies, and tools resulting from the Long-Term Pavement Performance (LTPP) program.

Advanced Quality Systems for Pavements

- Conduct workshops on, and implement best practices for, building and preserving smooth pavements.
- Demonstrate asphalt pavement warranty criteria based on pavement performance elements. Using the mobile laboratory and TFHRC, support asphalt quality control/quality assurance, performance-related specifications (PRS) validation, equipment evaluation, and Superpave mixture design and construction.
- Develop guidelines for measuring the workability of concrete pavements.
- Deliver guidelines on curing concrete pavements.
- Continue work to develop and deliver computer-based guidelines for job-specific mix optimization.
- Work with the states to demonstrate the applicability of PRS to concrete and asphalt pavements.
- Demonstrate the use of precast concrete panels for high-volume urban reconstruction projects.
- Develop and deliver HIPERPAV II, which includes longer term performance of jointed plain concrete pavement and early-age behavior of continuously reinforced pavement.
- Test and evaluate an innovative concrete pavement feature that will lead to high performance.
- Evaluate the effect of concrete shrinkage on pavement performance.

Enhanced User Satisfaction

- Continue research on specifications for the use of recycled materials in highway applications.
- Conduct workshops, field trials, and demonstrations of innovative uses of recycled materials.
- Develop enhanced pavement surface characteristics for improved safety, smoothness, and noise.

- *LTPP Program*—Resulting from the Strategic Highway Research Program that began in 1987, the LTPP program is a comprehensive 20-year study of in-service pavements throughout North America. Operation of the program was transferred to the FHWA under the Intermodal Surface Transportation Efficiency Act (ISTEA) and continued under the Transportation Equity Act for the 21st Century and the proposed Safe, Accountable, Flexible, and Efficient Transportation Equity Act.

The LTPP program's goal is to provide answers to how and why pavements perform as they do. To this end, the program gathers, processes, and analyzes data describing the structure, service condition, and performance of approximately 2,300 in-service test sections in all 50 states, the District of Columbia, Puerto Rico, and the 10 Canadian provinces. The collected data are housed in the LTPP database, the most comprehensive source of information on pavement performance in the world. These data document the performance of a broad array of pavement designs in a range of service conditions, making possible the development, calibration, and validation of pavement performance models. For example, LTPP data make possible the validation and calibration of the *2002 Pavement Design Guide*, which is being developed under the National Cooperative Highway Research Program. This guide will provide more accurate performance predictions so that the frequency of premature failure is

reduced—resulting in substantial annual savings over the next 50 years. The guide will also contain tools for evaluating the effects of variations in materials, traffic loading conditions, and design features.

Key LTPP Research

Data

- Coordinate and communicate activities with states, provinces, industry, and FHWA field offices.
- Collect, process, and release all required LTPP data (profile, deflection, materials characteristics, traffic, distress, drainage, and climatic/seasonal data).
- Operate the Material Reference Library and storage facility.
- Award a new contract for photographic distress data collection.
- Award a new contract for support of the LTPP falling weight deflectometer Calibration Centers.
- Award a new contract to perform Phase II specific pavement studies (SPS) on traffic weigh-in-motion (WIM) installation and data collection.
- Award a new contract for SPS material testing.

Analysis

- Continue analysis of LTPP data.
- Award new task orders for LTPP data analysis:
 - Development of tools to improve WIM data collection.
 - Types and frequencies of measurements for accurate description of pavement condition.
 - Estimation of layer properties for flexible Portland cement concrete pavements.
 - Impact of design features on pavement response in rehabilitated pavements.

Products

- Continue the development and delivery of the LTPP database as a product for use by the highway community.
- Continue customer service and technical assistance to users of LTPP data.
- Award a new contract for the DataPave Online product.

Highway Operations

The Operations team conducts research on the application of ITS and other cutting-edge technologies to move people and goods better, quicker, and safer. Work is supported by the TFHRC's Traffic Research Laboratory and Intelligent Intersection Traffic Control Laboratory. The program focuses on three key areas:

- *Traffic Management Research*—This research uses advanced technologies and techniques to develop dynamic control systems that estimate and predict the status of a traffic network, including the flow of traffic through work zones, so that decision makers can make appropriate, proactive traffic management decisions.
- *Infrastructure-Based and Infrastructure-Vehicle Systems to Prevent Intersection Collisions*—Research in this area is supported by the Intelligent Intersection Traffic Control Laboratory, an outdoor facility for developing and evaluating advanced traffic control systems and components.
- *Enabling Research*—This research looks at fundamental technologies—such as communications, the Global Positioning System (GPS), and sensors—that enable other applications to work. For example, control systems rely on sensors for adequate traffic data.

Key Traffic Management Research

- **Advanced Control Systems (ACS)** research uses advanced traffic signal control and logic to run real-time adaptive control systems. Sensors and other devices monitor the flow of traffic and change traffic signals to optimize flow, minimizing stops and delays and the need for traffic engineering intervention.
- **ACS “Lite”** will provide similar benefits as full ACS, but with fewer surveillance and other costs, making it ideal for smaller communities.
- **Dynamic Traffic Assignment** uses expert computer processing to develop real-time Traffic Estimation and Prediction Systems. This enables dynamic control systems that anticipate problems before they occur rather than simply reacting to existing conditions.
- **Next Generation Simulation** research is a new role for the FHWA. Rather than developing simulation software, this research develops traffic simulation resources in the form of core algorithms and validation data sets. The user community is involved in all phases of this effort.
- The **Strategic Work Zone Analysis Tools** program is developing a work zone delay impact analysis tool, called QuickZone; an expert system software program; a cost/alternative analysis spreadsheet; and a detailed simulation model to evaluate the effects of the work zone on surrounding areas. The QuickZone Partnership Program takes advantage of QuickZone’s open source code approach to customize the software, providing state and local agencies with a tool that best meets their needs.
- **Weather Responsive Travel Management** research addresses the issues associated with improving traffic management and operations during adverse weather conditions, including supporting evacuations in response to natural or human-caused disasters.
- **The Traffic Software Integrated System (TSIS)** is a collection of sophisticated computer-based tools for use by traffic engineers and researchers. For example, Fairfax County, Virginia, used the TSIS to evaluate incident management; this allowed them to quantify the benefits and demonstrate that more than 500 hours of delay could be saved.

Key Intersection Collision Avoidance and Enabling Technologies Research

- The **Intelligent Vehicle Initiative (IVI)** researches integrated in-vehicle systems that help drivers of all types of vehicles—cars, trucks, buses, fire trucks, ambulances, snowplows—operate more safely and effectively. The IVI is a multi-agency effort coordinated by DOT’s ITS JPO.
- A group of state DOTs, the **IVI Infrastructure Consortium**, is partnering with the FHWA to develop promising concepts for the infrastructure components of intersection collision avoidance systems. The consortium represents stakeholders from state and local governments and promotes deployment of cost-effective collision avoidance.
- **Cooperative vehicle–highway automation** research explores future concepts and technologies for the automation of buses, trucks, and passenger cars to improve mobility and quality of life in urban areas.
- The **Nationwide Differential GPS (NDGPS)** can pinpoint a person’s or vehicle’s position to within 3 meters. It can be used to direct emergency responders to the exact location of a crash, to monitor and respond to hazardous pavement conditions, to provide drivers with in-vehicle route guidance, and to afford a host of other transportation applications. The service is free to all users.
- A **Higher Accuracy Version of NDGPS** will provide 10-cm accuracy nationwide. When developed, it will enable in-vehicle collision warning systems that could potentially save thousands of lives each year.
- **Winter Road Maintenance Decision Support Systems (MDSS)** use weather and road condition information to help operators make more informed decisions on when and where to dispatch crews to plow, sand, and apply chemicals. The first release of the MDSS is being field tested in Iowa.

Environmental, Planning, and Realty

Planning, environment, and realty research is carefully targeted to assist state DOTs; Metropolitan Planning Organizations (MPOs); and other state, regional, and local agencies in planning and implementing high-quality, effective transportation programs. A key goal is to develop tools, best practices, and training that provide an opportunity for improved transportation decision making. Research relies on expert contributions from varied disciplines, including transportation planning, natural sciences, economics, social services, organizational management and finance, law, computer technology and information management, model development, communications, and engineering. Each program area has extensive networks and continually responds to internal and external concerns and recommendations. Research is conducted collaboratively with other offices, organizations, and agencies, including the Environmental Protection Agency (EPA), Department of Energy, U.S. Army Corps of Engineers, FTA, and FMCSA. Priority areas for FY 2005 include:

- *Planning and Decision Making Research*—This activity provides quality data, analysis, and information to transportation decision makers. Investments focus on ways to share and improve institutional intelligence for transportation planners at the local, regional, metropolitan, state, interstate, and bi-national (border planning) levels. Projects develop data and analytic tools to support sound environmental, safety, intermodal, multimodal, freight, and tribal planning concerns and processes. Use of these tools puts transportation planners in a better position to review, analyze, and understand the problems they are addressing.
- *Environmental Stewardship Research*—This research focuses on understanding the impacts that transportation facilities and services have on the natural and human environment. Work develops state-of-the-art tools for predicting and assessing impacts, develops cost-effective mitigation and enhancement techniques, and provides training. In particular, research continues to validate and improve the noise model and focus on environmental programs associated with air and water quality. Other efforts provide guidance and technical assistance to Federal, state, and local government staff regarding Federal laws, regulations, executive orders, policies, and procedures on technical topics related to historic preservation. In yet another area, research on context-sensitive solutions seeks to integrate environmental stewardship with transportation planning.
- *Environmental Streamlining Research*—Through this work, the FHWA identifies and develops time-sensitive and cost-effective techniques to redesign, integrate, and balance environmental and transportation decision making at the Federal, state, tribal, and local levels. Research is closely linked to system planning, focusing on analyzing causes for process delays, sponsoring pilot streamlining efforts, developing new procedures through programmatic agreements, and providing training in consensus building and dispute resolution.

- *Realty Research*—Realty research supports the acquisition and management of real estate as required for the development of transportation services and facilities. Work focuses on the delivery of modern acquisition and valuation technologies; state-of-the-art corridor assessment methodologies; development and implementation of access management tools; and preparation and use of electronic performance standards, including production of universal information systems.

Key Planning, Environment, and Realty Research

Planning and Decision Making Research

- Transportation Capacity-Building Program—Disseminate training and technical assistance on the conduct of state, metropolitan, rural, and tribal transportation planning processes.
- Transportation Planning—Develop knowledge, advance the state of the practice, and support information and technical exchange in the following areas: multimodal/intermodal planning, state and metropolitan planning, border planning, tribal consultation, operations and freight, safety-conscious planning, public involvement, environmental justice, land use and sustainability, linking planning and the environment, and performance-based planning.
- Travel Modeling, Data Analysis, and Related Tools—Identify innovative applications of Geographic Information Systems and related technologies. Using the Transportation Analysis Simulation System, create regional microsimulations of travel supply and demand to develop new methods of travel forecasting, develop analytical methods to support the planning and environmental decision-making processes, and provide support and training in data collection and survey methods, including the use of census data for transportation planning.

Environmental Stewardship Research

- Air Quality—Advance knowledge on the contribution to particulate matter pollution of surface transportation sources, establish analytic techniques, and evaluate control strategies.
- Climate Change—Assess the contribution of surface transportation to greenhouse gases, develop ways to anticipate the impacts of climate change on infrastructure and services, and develop response strategies.
- Transportation and Air Quality Planning Integration—Provide technical support to stakeholders on the implementation of new air quality standards and conformity requirements.
- Water Quality—Study the relative impacts of highway stormwater runoff in relation to established Total Maximum Daily Loads and the influence of impervious surfaces.
- Wetlands—Improve practical techniques for the analysis of wetland functions and values.
- Wildlife and Biodiversity—Study the ecosystem fragmentation effects of transportation corridors and the effectiveness of wildlife crossings.
- Brownfields—Promote revitalization through pilot studies that apply techniques for coordinated redevelopment activities.
- Vegetation Management—Develop ecosystem-based vegetation management techniques.
- Highway Traffic Noise—Provide accurate, up-to-date highway traffic noise prediction.
- Bicycle/Pedestrian Enhancements—Develop best practices for bicycle and pedestrian programs.
- Context-Sensitive Solutions—Provide tools and resources for practitioners.
- Historic Preservation—Support information-dissemination techniques and training opportunities.

Environmental Streamlining Research

- Develop and implement an environmental impact statement teambuilding initiative.
- Deliver a course on “Applying Spatial Data Technologies to Transportation.”
- Develop environmental databases and tools for faster and more cost-effective transportation decisions.
- Implement national environmental process improvements.

Realty Research

- Synthesize practices and issues relating to commercial uses within highway rights-of-way.
- Develop and implement right-of-way data management and knowledge-sharing systems.
- Synthesize practices for the advanced acquisition of rights-of-way.
- Evaluate the effects of third-party transactions under the Uniform Act.

Policy

In policy research, the FHWA has five focus areas: (1) improving the collection and dissemination of core data concerning facilities and highway users; (2) developing analytical tools to evaluate the impacts of a broad range of highway policy options; (3) analyzing short-term and long-term issues that will affect surface transportation programs; (4) identifying legislative and strategic initiatives to address these issues; and (5) pursuing research through international forums and global partnerships in support of the *Strategic Plan* and U.S. foreign policy objectives. The box below outlines the priorities for FY 2005.

Key Policy Research

- **Characteristics and Impacts of Highway System Use**—Assess trends in the use of highway and related transportation systems by different groups of users and the potential implications of these trends for transportation policies and programs.
- **Highways and the Economy**—Provide national transportation policy makers with empirical assessments of the economic benefits of highway infrastructure investments.
- **Future Directions in Highway Financing**—Examine the long-term viability of existing highway financing mechanisms and explore issues relating to alternatives, including the future role of the private sector in providing and managing transportation resources.
- **Highway Needs and Investment Analysis**—Improve highway and bridge analytical tools to better estimate how congestion, delay, vehicle operating costs, safety, air quality, infrastructure conditions, and other key performance indicators will change in the future under alternative investment strategies.
- **Legislative Analysis and Strategic Planning**—Support the development, analysis, and implementation of transportation legislation and address strategic initiatives that are likely to influence future legislative and political directions.
- **Highway Performance Monitoring System (HPMS)**—Enhance data quality through improved collection and reporting procedures, updated reporting software, and new data review and analysis tools. The HPMS provides critical system condition, performance, and operational data.
- **Travel Monitoring Analysis System**—Produce early year-end estimates of highway travel and vehicle classification data used in the FHWA performance measurement process and in the evaluation of freight policies. New research will focus on enhancing analytical tools to provide (1) more accurate estimates of monthly travel by vehicle type, and (2) traffic analysis software that supports mechanistic pavement design.
- **National Household Transportation Survey**—Provide data on daily personal travel behavior and changes in personal travel over time. New research will focus on security issues, such as the dispersal of family units during the day; congestion, such as average speeds and vehicle occupancy; and safety, such as aging drivers and their travel characteristics.
- **Highway Finance Data**—Support the development of new analytical tools and procedures to assist states in improving the quality of their financial data reporting. Decision makers at the Federal, state, and local levels, as well as the Congress, rely on this data to make informed decisions about highway taxation and finance.
- **Motor Fuel Attribution**—Develop new analytical tools and procedures to assist states in improving the quality of state-reported motor-fuel data, which are a critical input to the apportionment of Federal-aid highway funds.
- **Scanning Program**—Address national priorities identified by Federal experts and the highway community, including safety and technological innovation.
- **Joint International Research**—Through forums such as the World Road Congress, leverage resources and enhance partnerships and innovation.

FHWA policy research provides a unique and crucial perspective not found in any single program area. The Office of Policy uses information on economics, demographics, highway travel, and spending trends to provide an understanding of the interrelationships among highway programs, systems, services, and institutions. In turn, these analyses provide a framework for assessing the stewardship of the nation's highways as a component of the overall transportation system. Such knowledge is further used to identify issues, assess the effectiveness of current programs and policies, and evaluate alternatives.

R&T Technical Support/Corporate Business

This program focuses on effective communication of research results, technology marketing, knowledge management, technical consultation, and peer review. Technology marketing efforts identify emerging technologies with broad applicability and develop plans to make them available to those who need them. Knowledge management techniques leverage the FHWA's collective expertise and nurture the exchange of information among stakeholders in the highway community. The quality of FHWA research is assured through technical consultation and peer review, working with entities such as the TRB and through support of the Small Business Innovation Research (SBIR) program. Finally, the TFHRC continues to be a major resource, serving transportation researchers within the Federal Government, the states, and academia.

Field Services and Delivery

The Federal Lands Highway Program provides transportation engineering services for planning, design, construction, and assistance with the management of highways and bridges on, or providing access to, Federally owned or tribal lands. Federal Lands Highway construction projects and other engineering activities provide opportunities to showcase the latest highway technologies and innovations.

Key Federal Lands Technology

- **Fish Passage**—Evaluate the success of fish passage through culverts to better define design criteria, identify the critical factors for design, and standardize designs based on these critical factors.
- **Geographic Information Systems**—Implement a system that is compatible with the FHWA asset management and pavement and bridge management systems.
- **High-Performance Materials for Structures**—Implement and evaluate high-performance steel and concrete on Federal Lands projects.
- **Design Visualization**—Implement software that helps to identify possible design and construction issues early in the design process and that allows stakeholders to get a better understanding of a proposed design through the use of visual aids.
- **Context-Sensitive Design**—Provide tools and resources for partner agencies and deliver a training course.
- **Nondestructive Investigation Technology**—Implement and evaluate nondestructive investigation technologies in multiple Federal Lands projects.
- **Geofabrics/Geocomposite Reinforcement**—Implement and evaluate reinforcement technologies on Federal Lands projects.

The main objective of the Federal Lands Technology Program is to engage the Federal Lands management agencies in innovative practices that will improve the service life of Federal Lands infrastructure, improve safety, and minimize environmental impacts during construction. The Federal Lands Technology Program also provides opportunities to evaluate technology in all areas of transportation engineering.

Resource Center

The FHWA Resource Center provides technical assistance and program support functions. It accelerates the adoption of innovations by partnering with Division Offices to coordinate with states and localities; identifying and prioritizing technologies; leading in technology marketing and dissemination; and conducting national and international exhibition programs. The center also facilitates field tests and evaluations of innovations for their more efficient transfer to the transportation community.

Training and Education

Without a skilled, technically competent workforce, the benefits of technology applications are lost. Technological innovation should not be considered as the separate and distinct activities of research, development, deployment, and implementation, but rather as an integrated process that develops and delivers innovation through a well-trained, effective, and efficient workforce. The effort must clearly define the desired result and delivery process, including workforce training and development. This is a fundamental shift in the way many have viewed technology development and delivery, but one that will be increasingly important as decision makers look to technological innovation to address the country's pressing transportation needs.

At all levels, there is a growing recognition of the challenge of assuring an effective, technically competent, and well-trained transportation workforce. This concern is particularly evident in the highway sector. State DOTs alone employ more than 250,000 transportation workers, and over 38,000 local agencies develop and manage local road programs. The transportation system also depends on the expertise of a large number of private engineering design, construction, and operations contractors that assist Federal, state, and local transportation agencies.

The importance of workforce development is highlighted in the President's Management Agenda, which lists the strategic management of human capital as one of five key objectives. A concern for the transportation workforce was evident at a National Workforce Summit held in May 2002 by the FHWA, FTA, and RSPA. Involving leaders from Federal, state, and local agencies; academia; industry; labor unions; professional associations; and consulting firms, the meeting was the first-ever coordinated initiative focused on developing the people necessary to preserve and advance the nation's transportation system. Summit participants concurred on the need to address three critical areas: (1) ensuring that young people are attracted to the transportation jobs of the future; (2) assuring that transportation workers use the latest technologies and practices; and (3) developing partnerships throughout the transportation and education communities to institutionalize workforce development.

Within the FHWA, education and training activities promote the application of new technologies; assure a qualified highway transportation workforce; and maintain the workforce at

a high level of technical competence. As noted below, established programs such as the NHI, Local Technical Assistance Program (LTAP), and Eisenhower Fellowship Program are considered the cornerstones for education and training in the transportation community.

NHI

The NHI develops and administers training and education programs that assist in applying new technologies to the planning, design, construction, maintenance, and rehabilitation of the nation's transportation infrastructure. It offers training to Federal, state, and local transportation agencies, and, increasingly, to the private sector; provides technical course materials for inclusion in undergraduate and graduate curricula; and collaborates with community colleges, technical schools, and secondary and grade schools to identify tomorrow's transportation professionals.

LTAP

The LTAP improves the skills and knowledge of local transportation providers through training, technical assistance, and technology transfer. There are currently 57 LTAP centers serving each state, Puerto Rico, and American Indian tribal government. The centers tailor their programs to provide technology services, technical assistance, training, products, advice, and educational resources to meet the needs of the local transportation workforce. Located at universities or state highway agencies, LTAP centers are funded through Federal LTAP funds, state DOTs, the Bureau of Indian Affairs, universities, and local agencies.

Eisenhower Transportation Fellowship Program

The Dwight D. Eisenhower Transportation Fellowship Program was established by ISTEA in 1991. Encompassing all modes of transportation, the program seeks to attract the best and brightest minds to transportation research and the transportation workforce. Selection criteria for awards include applicants' academic achievements, recommendations, and likelihood of pursuing a career in transportation. The NHI manages the program.

Eisenhower Transportation Fellowship Program Award Categories

- **Graduate Fellowships** enable students to pursue masters and doctoral degrees in transportation-related fields at universities of their choice.
- **Grants for Research Fellowships** acquaint undergraduate and graduate students with transportation research, development, and technology transfer at DOT facilities.
- **Historically Black Colleges and Universities Fellowships** provide students with additional opportunities to enter careers in transportation and serve as a feeder for other Eisenhower fellowships.
- **Hispanic-Serving Institutions Fellowships** provide students with additional opportunities to enter careers in transportation. They also serve as a feeder for other Eisenhower fellowships.
- **Tribal Colleges Fellowships** identify transportation-related activities and provide student and faculty fellowship opportunities. In addition, they serve as a feeder for other Eisenhower fellowships.
- **Faculty Fellowships** give faculty in transportation fields the opportunity to enhance and update their transportation knowledge, including attendance at conferences, courses, seminars, and workshops.

Eisenhower fellowships provide both students and faculty with opportunities to deepen their understanding of transportation-related fields of study and help to retain top talent in the U.S. transportation industry. The program has six award categories, shown in the box above.

University Transportation Research

This program advances U.S. technology and expertise in transportation disciplines through education, research, and technology transfer at university-based centers of excellence. The University Transportation Centers (UTC) program was initiated in 1987 under the Surface Transportation and Uniform Relocation Assistance Act, which authorized the establishment and operation of transportation centers in each of the 10 standard Federal regions. The program is jointly funded by the FHWA and FTA, and coordinated by RSPA. (See pages 4-47 and 4-60.)

Other Research Programs

State Planning and Research (SP&R)

As required by Title 23, Section 505 of the United States Code, 2 percent of the apportionments that states receive from highway grant programs are for SP&R. Of this amount, 25 percent must be allocated to RD&T. Section 5 provides a more detailed discussion of the SP&R program.

Multimodal Research

The Multimodal Research Program provides funds to conduct applied research, development, demonstration, and testing of technologies that have multimodal transportation applications. The FHWA will cooperate with relevant Federal agencies to coordinate research within the larger Federal framework.

INTELLIGENT TRANSPORTATION SYSTEMS JOINT PROGRAM OFFICE

Mission

The ITS program is managed by the ITS JPO, which is directed by a career senior executive who reports to the Deputy Secretary of Transportation and the Federal Highway Administrator. Six DOT operating administrations have ITS components in their programs: the FHWA, FTA, FMCSA, FRA, NHTSA, and MARAD. Senior executives from those agencies and others compose DOT's ITS Strategic Planning Group, which manages the policy direction of the ITS program.

The ITS JPO fosters and supports the application of advanced technologies to improve surface transportation safety, mobility, capacity, and environmental compatibility. Major program elements include development and deployment of intelligent vehicles, commercial vehicle operations, and public transit systems. The ITS JPO is also responsible for establishing and maintaining the National ITS Architecture, ITS standards, project evaluations, and overall program assessment.

Current Profile and Funding Levels

The total FY 2005 budget request for ITS RD&T is shown below.

Table 4-2. Comparative Summary of ITS JPO Activity (\$000)*

Item	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
ITS	\$207,443**	\$230,631**	\$121,000

*Figures are from Appendix C.

**Figures for FY 2003 and FY 2004 include funds for the ITS Deployment program, whereas the budget for FY 2005 is for R&D only.

Components of the ITS budget include the following: (1) Safety Research (\$38 million); (2) Mobility Research (\$24 million); (3) System Management Information (\$14 million); (4) Deployment Support (\$10 million); (5) Architecture and Standards (\$15 million); (6) Evaluation (\$6 million); and (7) Program Support (\$9 million).

Safety Research

The ITS Safety Research activity consists of four specific programs: IVI, Commercial Vehicle Operations (CVO), Public Safety, and Infrastructure Safety.

The IVI aims to prevent crashes by helping drivers avoid hazardous mistakes. The goals of DOT's IVI activities are to prevent driver distraction and to facilitate accelerated development and deployment of crash avoidance systems. Included in this program are activities that will increase safety (1) under normal driving conditions through the design of in-vehicle communication and information systems; (2) in degraded driving conditions where the risk of a crash is increased; and (3) in dangerous situations through crash avoidance systems.

The CVO program supports DOT's safety objective by developing and deploying ITS technologies to improve the safety of commercial vehicle operations. The program includes work on qualified driver systems; innovative technologies to support safety enforcement and compliance; and combined support for states' efforts to fully deploy Commercial Vehicle Information Systems and Networks (CVISN).

The Public Safety program seeks to improve emergency response and reduce delay in rural and metropolitan areas through research and testing of technologies and procedures for detecting, locating, and properly responding to incidents on our highways.

The Infrastructure Safety program applies technology to continuously improve highway safety by reducing the number and severity of highway crashes. It also supports programs that target high-crash areas, and will focus on several critical types of crashes that appear to be amenable to infrastructure-based technology solutions (for example, intersection, pedestrian, speed-related, and run-off-the-road crashes).

Mobility Research

The ITS Mobility Research activity comprises four programs: Traffic Management; Transit Management; Intermodal Freight Management; and Cooperative Driver Assistance Systems (CDAS).

The Traffic Management program supports the DOT and FHWA objectives of enhancing safety, mobility, and environmental stewardship through long-term and applied research to develop advanced tools (models, software, guidance documents) that practitioners can use to improve the management and control of traffic.

The Transit Management initiative explores and advances the use of new technologies to improve the mobility of all transit patrons by increasing transit service availability, reliability, and convenience, and by reducing travel times.

The Intermodal Freight Management program increases the efficiency of intermodal freight movement over the nation's highways, railroads, waterways, and ports. In FY 2005, work will engage major freight stakeholders in deploying technologies, improve modeling tools to help increase mobility, and continue to develop standards for freight information exchange.

CDAS enhances mobility through long-term research to explore the potential of cooperative-vehicle and infrastructure-based systems to improve traffic flow, optimize the operation of freeways and arterial roadways for all vehicles, and improve the productivity and efficiency of transit and commercial vehicle fleets.

System Management Information

The System Management Information activity consists of five specific programs: Advanced Data Collection; Data Management; Telecommunications; Weather; and Data Dissemination.

The Advanced Data Collection program develops new technologies and techniques for monitoring the surface transportation system. In FY 2005, a major focus will be the development of vehicle-based monitoring systems.

The Data Management program develops techniques and guidance for transportation agencies for processing and managing the large amounts of data associated with highway and transit monitoring. This year, the program will focus on data quality, fusing data from various sources to provide useful information, and managing large databases using advanced data management techniques.

The Telecommunications program conducts research and develops guidance to (1) support advanced vehicle-based data collection systems; (2) overcome the communication limitations for ITS applications in rural America; and (3) lower the communication costs of ITS.

The Weather program conducts research to develop specifications for weather sensor equipment and guidance for transportation agencies deploying weather sensor networks.

The Data Dissemination program develops guidance for exchanging information about transportation services—both among agencies and between the public and private sectors—in near-real-time. It also supports systems that provide this information to travelers, such as “511” and in-vehicle information systems.

Deployment Support

The ITS Deployment Support activity comprises three efforts: Technical Assistance, Training, and Outreach. These programs support the DOT goal set in January 1996 to deploy integrated ITS systems in 75 of the largest metropolitan areas by 2006.

The Technical Assistance program facilitates the implementation of ITS systems at the state and local level. Activities include development and distribution of technical guidance documents; tours of “best practices” for state and local officials; and access to officials with hands-on experience in various areas of ITS development, deployment, and operations.

The Training program ensures that Federal, state, and local professionals have the knowledge, skills, and abilities to successfully implement, operate, and manage ITS. This activity supports the development and delivery of ITS training courses to the national ITS workforce and offers awareness to decision makers and other transportation professionals.

The purpose of the Outreach program is to disseminate and foster the sharing and exchange of information—both technical and practical—to educate practitioners and state and local decision makers about the benefits of ITS and how to deploy effective, integrated ITS technologies.

Architecture and Standards

This activity supports the National ITS Architecture and Standards programs, which foster national and regional interoperability.

The National ITS Architecture provides a framework through which ITS systems can be effectively planned and implemented. The program’s near-term goal is to support the development and use of regional and project ITS architectures among those planning and deploying ITS. It also provides for maintenance of the National ITS Architecture and for updates based on changed or emerging policies, lessons learned, developing standards, and deployment experiences.

The Standards program supports the widespread deployment of standardized, interoperable ITS technologies. The intent is that open standards will move agencies out of proprietary systems and lead to wide availability and use of interoperable ITS that are competitively priced and meet the needs of transportation agencies and the traveling public.

Evaluation

The Evaluation program assesses the costs and impacts of ITS technology deployments and/or integration on the surface transportation system. Among the program's activities are field operational tests of new and innovative technology applications expected to provide benefits in operational settings. This effort also contributes to fulfilling the mandates of the Government Performance and Results Act by developing and continuously refining techniques for measuring the effects of ITS deployments and/or integration on transportation system performance.

Program Support

This effort provides the technical, advisory, and administrative support necessary to carry out the Federal ITS program. It also supports the building of public/private consensus on program issues and ensures the proper technical review, support, and integration of ITS projects.

FEDERAL MOTOR CARRIER SAFETY ADMINISTRATION

MISSION

The FMCSA mission is to reduce commercial-vehicle-related fatalities and injuries. DOT's safety goal is to reduce the fatality rate by 41 percent from 1996 to 2008, resulting in a rate of 1.0 fatalities per 100 million vehicle-miles traveled (VMT) by 2008. To contribute to achieving this overall goal, the FMCSA has set a comparable goal of reducing the large truck fatality rate by 41 percent from 1996 to 2008. This reduction translates into a rate of 1.65 fatalities in truck crashes per 100 million miles of truck travel. The new goal represents an additional 14,232 lives saved between 2002 and 2008, when compared to the lives lost at the 1996 base fatality rate (2.81 truck fatalities per 100 million truck-miles traveled).

CURRENT PROFILE AND FUNDING LEVELS

The FY 2005 budget submission supports studies and technology deployment that will assist the FMCSA in meeting its safety goal. The submission is the result of a new methodology developed to support the President's Management Agenda for budget and performance integration. This new process includes an FMCSA cross-organizational Research Executive Board designed to provide a broad perspective on research and technology needs throughout the agency; external stakeholder forums that capture requirements from states, industry, and academia; an electronic scorecard that rates proposed projects on safety, feasibility, and cost; and a consolidated portfolio of information on R&T projects that are ongoing and completed. The FY 2005 budget request is detailed in Table 4-3.

Table 4-3. Comparative Summary of FMCSA R&T Activity (\$000)*

Item	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
R&D	\$6,155	\$6,642	\$9,375
Technology Investment	\$2,764	\$2,362	\$3,500
Facilities	0	0	0
Total	\$8,919	\$9,004	\$12,875

*Figures are from Appendix C.

FY 2005 Budget in Brief Highlights

Conduct research and technology activities supporting Commercial Vehicle Safety, Hazardous Material Safety, and Hazardous Material Security.

The FMCSA’s R&T program is data-driven and comprehensive, addressing the major crash factors within the agency’s purview. The program includes (1) Driver Safety Performance; (2) Commercial Vehicle Safety Performance; (3) Carrier Compliance and Safety; (4) Safety Systems and Technologies; and (5) Crosscutting Safety Initiatives.

Driver Safety Performance

The principal goals of Driver Safety Performance R&T are to (1) improve the safety behavior of commercial motor vehicle (CMV) drivers and noncommercial vehicle drivers in the vicinity of large trucks and buses; and (2) ensure that commercial drivers are adequately trained, physically qualified, and mentally alert. The following projects are planned for FY 2005:

Commercial Driver—Performance Enhancement

The FMCSA will develop a safety training needs assessment for drivers and managers in the newly regulated class of small passenger-carrying vehicles (9 to 15 passengers), as well as identify unique operating characteristics of those vehicles and the training that should be required to ensure safe operation. In addition, the FMCSA will augment the number of drivers and trucks studied in FY 2004 to identify and classify unsafe commercial and non-commercial driving behaviors to gather a more representative sample of commercial drivers, truck types, and operations. The FMCSA will conduct a simulator validation study to assess the purported benefits of truck simulators to potentially enhance the training and licensing environment.

Commercial Driver—Fatigue

This activity supports hours-of-service rulemaking. The FMCSA will develop several designs (or design concepts, depending on funding availability) for Electronic On-Board Recorders. In addition, the FMCSA will initiate a review of CMV driver alertness-monitoring technologies.

Commercial Driver—Physical Qualifications

In the area of physical qualifications for the commercial driver, the FMCSA will assess the level of safety of medical exemption programs and will conduct an evaluation of the current medical examination process for CMV operators who hold commercial driver licenses.

Commercial Vehicle Safety Performance

The commercial vehicle program focuses on improving truck and bus performance through vehicle-based safety technologies. The program consists of initiatives aimed at (1) testing, evaluating, and deploying advanced, intelligent vehicle safety technologies; and (2) developing new data and information to improve occupant protection and overall vehicle safety. The following projects are planned for FY 2005:

Intelligent Vehicle Safety Technologies

The FMCSA will facilitate the deployment of crash avoidance technologies developed under the agency's R&T program and the IVI. The FMCSA will also test and evaluate advanced vision enhancement systems.

Occupant Protection and Safety

The FMCSA will examine, identify, validate, and develop guidelines regarding cargo tank designs, configurations, stability, and damage tolerance, as well as other areas of interest. The agency will work with NHTSA to perform compliance testing on large truck air brakes. The FMCSA also will test and evaluate rear signaling systems for commercial vehicles to prevent rear-end crashes and will gain an understanding of the operational requirements for on-board hydrogen fuel systems.

Carrier Compliance and Safety

The Carrier Compliance and Safety area supports the FMCSA's enforcement of carrier-related Federal Motor Carrier Safety Regulations. As such, this research supports the agency's overall efforts to improve carrier safety. This is accomplished by (1) applying principles of safety management science from other industries, and (2) compiling best management practices from both the motor carrier and these other industries and communicating these practices to motor carrier managers. In FY 2005, this program area will (1) develop a shipper prioritization program that focuses limited field resources, and (2) develop and validate a portable-digital-assistant-type of technology to enhance the roadside inspection process.

Safety Systems and Technologies

The goal of this R&T is to improve the safety and productivity of commercial vehicle operations through the application of life-saving safety systems and technologies. Efforts in FY 2005 will include the following:

Driver, Vehicle, and Roadside Strategies—Safety Technologies for 2010

This effort supports accelerated research and testing of new safety technologies and operational concepts at a real-world “smart” laboratory site. Results of this work will reduce the number of truck and motor coach fatalities and injuries. Research products will include (1) a roadside laboratory at a weigh station to expeditiously demonstrate, evaluate, and deploy new technologies and operational concepts; (2) a computer model that will assess new technologies and concepts; and (3) radiation detection equipment to identify hidden shipments of hazardous materials as they travel along the nation’s highways.

CVISN Deployment

Through this project, Federal and state agencies work together with the motor carrier industry to develop and deploy cost-effective information systems and communication networks that provide electronic access to timely and accurate motor carrier safety and other information. In particular, the project supports electronic exchange of information among states, the motor carrier industry, and the FMCSA to improve the targeting of high-risk and uninspected truck and bus operators. In FY 2005, the FMCSA will support nationwide CVISN deployment by providing an opportunity for states and motor carriers to share lessons learned related to the technical and institutional aspects of CVISN. The FMCSA will also assist states in the expansion of their CVISN deployment projects by identifying and prototyping new CVISN capabilities in a few states. Funding for this project is supplemented by the ITS JPO.

Crosscutting Safety Initiatives

The goal of this program area is to gain a deeper and broader understanding of (1) driver, carrier, vehicle, and roadway factors that place commercial motor vehicles at risk; and (2) the potential applicability of countermeasures. Many safety issues are crosscutting in that they involve significant aspects of vehicle safety, driver safety, carrier safety, and the environment in which they operate. Crosscutting initiatives also form and foster R&T partnerships and enhance the management, effectiveness, and impact of the overall FMCSA R&T program. In FY 2005, research partners will be engaged through an expanded use of cooperative agreements with industry, academia, and other government agencies on common program priorities. This will leverage investments through cost sharing, advance FMCSA R&T initiatives, and proactively promote transportation partnerships.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

MISSION

Established by the Highway Safety Act of 1970, the NHTSA's mission is to save lives, prevent injuries, and reduce traffic-related health care and other economic costs. The agency supports DOT's goal to reduce highway-related fatalities to 1.0 per 100 million VMT by 2008.

CURRENT PROFILE AND FUNDING LEVELS

The NHTSA conducts research on reducing traffic fatalities and injuries in crashes, crash prevention, and driver behavior to develop the most efficient and effective means of bringing about safety improvements. To carry out its mission, the NHTSA conducts a supporting program of RD&T to address pre-crash, crash, and post-crash issues. As shown in Table 4-4, the President's budget requests approximately \$105 million for these activities in FY 2005. The NHTSA's specific RD&T programs are summarized below.

Table 4-4. Comparative Summary of NHTSA RD&T Activity (\$000)*

Item	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
R&D	\$59,684	\$63,240	\$ 67,759
Technology	\$25,574	\$32,514	\$ 37,252
Facilities	0	0	0
Total	\$ 85,258	\$95,754	\$105,011

* Figures are from Appendix C.

FY 2005 Budget in Brief Highlights

Provide leadership in research on crash causation and prevention, including crashworthiness research for occupant protection; biomechanics; driver distraction testing; national crash data systems; and a newly proposed initiative on crash avoidance.

Highway Safety Research

The NHTSA's highway safety behavioral research program determines the causes of crashes; identifies target populations; measures perceptions and awareness levels; develops and tests countermeasures; and evaluates the effectiveness of in-place programs that will reduce traffic deaths, injuries, and associated monetary costs. This research provides the scientific basis for the NHTSA's national leadership in highway safety. Special emphasis is placed on supporting programs to achieve the Department's goals for 2005 of reducing alcohol-related traffic fatalities to no more than 0.53 per 100 million VMT and increasing national safety belt use from 79 percent to 80-85 percent, as well as special initiatives in child passenger safety; pedestrian,

bicyclist, and motorcyclist safety; and elderly driver safety and mobility. Specific activities work to:

- Develop strategies to prevent alcohol- and drug-impaired driving, identify and apprehend repeat offenders and suspended drivers, and evaluate sanctioning programs.
- Develop strategies to increase the use of safety belts, child safety seats, and booster seats on every trip.
- Develop strategies to improve safe mobility for older drivers, including the testing of driver evaluation tools and evaluation of rehabilitation options.
- Determine the incidence of aggressive driving and examine appropriate countermeasures.
- Improve safety for pedestrians, bicyclists, and motorcyclists by developing and testing countermeasures and assessing motorcycle crash risks.
- Examine the effectiveness of automated speed-enforcement devices.
- Determine the accuracy and reliability of pre-hospital data elements for crash victims and for assessing the needs for Emergency Medical Technician continuing education to improve patient care.
- Develop and evaluate new programs for specific target populations (e.g., military and college students) to alleviate fatigued driving.

The program will:

- Complete and publicize the results of 12 highway safety research projects.
- Complete and publicize the results of 6 evaluation studies.

Crashworthiness

Safety Systems

The NHTSA's research program will lead to enhanced occupant protection by providing improvements in vehicle structure and interior compartment design, in combination with improvements in occupant restraint systems, through enhanced safety standards. Achieving these improvements requires research and analysis of real world crash data, development of test procedures that reproduce the crash environment, evaluation of injury likelihood from crash test measurements, development and evaluation of vehicle countermeasures, and estimates of potential safety benefits achieved through safety standards that are promulgated. Work in these areas ensures that the NHTSA's efforts to improve motor vehicle safety through promulgation of

safety standards are accomplished on sound technical and scientific bases that will lead to the reduction of the highway fatality rate. Specific activities in FY 2005 will:

- Initiate activities to identify and develop test procedures for safety issues related to alternatively fueled (including hydrogen) vehicles.
- Evaluate developed test procedures and demonstrate countermeasures to improve crash compatibility of vehicles in frontal, side, and rear crashes.
- Evaluate vehicle fleet performance using the upgraded design of the side-impact moving deformable barrier test. Explore countermeasures to improve side-crash safety.
- Evaluate vehicle fleet performance using the recently developed side-impact pole test procedure. Explore countermeasures to improve safety.
- Evaluate production systems that use advanced restraint system technologies for frontal crash protection. Continue cooperative agreements for developing near-term advanced restraint systems, such as adaptive airbag systems and other technologies that have the potential for reducing occupant deaths and injuries.

These and related research activities will allow the NHTSA to be in a position to establish requirements and safety ratings to reduce the injury risks resulting from vehicles' crash incompatibilities.

Biomechanics

The rapid implementation of new and diverse safety technologies has increased the demand for biomechanical evaluation. Biomechanics research provides the critical scientific link between the mechanical conditions of an impact and the human injury consequences. This research uses the principles and practices of engineering to study human injury mechanisms in vehicle crashes; develops criteria to predict injury risk in automobile crashes; and provides test devices, such as dummies, that mimic human impact responses to allow, using the injury criteria, a prediction of injury risk for a particular impact situation. This work directly supports the development of intervention and prevention strategies by correctly detecting, modifying, and ultimately limiting the appropriate mechanical components of the impact process that causes injury. Efforts in FY 2005 will:

- Continue an initiative based at seven trauma centers—the Crash Injury Research and Engineering Network—to provide detailed, hospital-based, crash injury studies that identify and analyze critical safety issues and accelerate identification of emerging issues.
- Develop and apply the NHTSA's capability to simulate, in detail, the human body in the automotive crash environment and predict the injury consequences of the occupant's interaction with typical automotive restraints and structures.

- Continue an extensive, multiple-university-based impact trauma research program to characterize human impact and injury responses of major body regions that are vulnerable in automotive crashes.
- Continue efforts to develop and extend the technologies of the NHTSA's advanced frontal dummy, THOR, to adequately represent the human population at risk. Develop a viable side-impact child dummy in support of the Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act.
- Support research activities by maintaining and improving the Biomechanics Database.
- Ensure that current test devices possess sufficient repeatability and reproducibility to make objective tests suitable for regulation.
- Ensure that the Vehicle Research and Test Center (VRTC) has appropriate and sufficient equipment to address pending research and rulemaking issues.

Crash Avoidance

Driver/Vehicle Performance

Nearly 90 percent of motor vehicle crashes are the result of driver error. Loss of vehicle control, often resulting in rollover, has become a greater safety problem as the population of vehicles on the road has shifted more toward light trucks and sport-utility vehicles. Many of these crashes could be reduced if the vehicles' collision avoidance systems were improved to be more compatible with the capabilities and behaviors of the driving population, including older and younger drivers and those who are unfamiliar with new vehicle technologies. This program supports the NHTSA's rulemaking and consumer information efforts by developing the scientific basis for measuring and improving the collision avoidance capabilities of the driver/vehicle combination. Research areas include vehicle rollover, braking, handling, stability, direct and indirect visibility, lighting/signaling, and controls and displays, as well as human factors issues associated with the interaction between the driver and vehicle. Specific efforts in FY 2005 will:

- Complete initial development of an adaptive interface research vehicle.
- Complete a field test to support rulemaking on alternative rear lighting and signaling approaches.

Driver Behavior/Simulation Research

Given that 90 percent of crashes are due to driver error, it is vital for research to focus on understanding the causes of these crashes and to develop and test approaches for their mitigation. This need is heightened by the widespread use of in-vehicle communication and information technologies, such as wireless phones and devices that provide access to e-mail and the Internet, all of which have the potential to place great demands on driver attention. The role of alcohol-related impairment in crashes is a major focus, particularly in light of recent actions to reduce the

national standard legal blood alcohol content (BAC) limit to .08. NHTSA research in these areas will include the following:

- Using the National Advanced Driving Simulator (NADS), continue research to examine the cognitive aspects of cell phone use by drivers and to better understand the conditions under which drivers are willing to use these devices.
- Examine driver distraction issues using the NADS in the context of advanced in-vehicle technology, including both carry-on devices and original equipment manufacturer systems.
- Continue research on the NADS to examine the interaction of BAC level and situational/environmental demand.
- Initiate efforts to establish older driver research protocols to address issues related to older driver assessment and these drivers' use of prescription drugs in combination with low levels of alcohol.

Heavy Vehicles

Approximately one out of nine people who die in traffic crashes every year is killed in a collision involving a large truck. Although they account for only about 4 percent of registered vehicles, large trucks are involved in 8 percent of fatal crashes, and 11 percent of all fatalities occur in crashes involving a large truck. Primarily as a result of the huge mass differential between heavy trucks and cars—which may be as much as 20 to 1—approximately 80 percent of truck-related fatalities are the occupants of the other vehicles that collide with trucks. Since there is not enough crush distance available in heavy trucks to dissipate the forces of a collision, the most effective way to attack this problem is to concentrate on countermeasures to avoid the collision in the first place. This NHTSA program supports the agency's rulemaking efforts by developing a scientific basis for improving the safety of heavy vehicles by (1) making them less prone to crashes through improvements in their braking, handling, and visibility characteristics; and (2) mitigating the consequences of collisions that do occur between heavy trucks and other vehicles. Work in FY 2005 will:

- Complete research in support of shortened stopping distances for common tractor-trailer combinations.
- Complete an initial assessment of video mirror systems for the elimination of blind spots.
- Initiate human factors research to study ways to deal with operator motion-sickness problems associated with video mirrors.
- Explore the role of pre-crash recorders in improving large truck safety.

Pneumatic Tire Research

Each year, there are 23,500 tire-related tow-away crashes involving light vehicles. These crashes kill between 400 and 650 people and injure another 10,200. Properly maintained and inflated tires are crucial for safety. Operating a vehicle with substantially under-inflated tires can result in tire failure—including tire separation and blowouts—with the potential for a loss of control of the vehicle. To address this issue, the NHTSA is conducting research to provide the technical foundation for current and potential future regulatory activities. RD&T activities in FY 2005 will:

- Continue research and testing of new tire strength and debanding test methodologies to support upgrade of passenger car tire standards.
- Extend the tire research program to support an upgrade of standards for heavy truck tires, including retreaded tires.

IVI

The IVI supports DOT's safety objective by (1) ensuring that safety is not compromised by the introduction of in-vehicle systems; and (2) facilitating the development, deployment, and evaluation of driver-assistance safety products. The NHTSA is the lead agency involved in IVI research, which is funded from the FHWA's RD&T budget, developing crash avoidance countermeasures for light vehicles using intelligent technologies. These efforts will support the early incorporation of IVI technologies into the marketplace and form the basis for the development of more advanced systems. Specific work in FY 2005 will include:

- *Intersection crash countermeasures*—Complete testing of in-vehicle systems to avoid crashes due to traffic control violations and begin field operational tests of this countermeasure. Begin driver performance studies of lateral and forward gap acceptance situations at intersections.
- *Naturalistic driving study*—Begin widescale, naturalistic pre-crash and near-crash driving study.
- *Driver distraction studies*—Conduct research to characterize driver distraction and workload for advanced driver interface development.
- *Light vehicle fleet study*—Conduct field operational test of a set of collision warning systems thought to be nearly market-ready, perhaps through the General Services Administration.
- *Advanced technology to enhance restraint use.*
- *Advanced technology to improve triage, transport, and treatment of crash victims.*
- *Protocols to evaluate the safety effectiveness of advanced technology.*

- *Assessment of truck driver distraction/real-time onboard driver monitoring*—Develop a data recorder and driver feedback interface.
- *Truck naturalistic driving study.*
- *Drowsy driver field operational test and evaluation.*

Data Programs

Fatality Analysis Reporting System (FARS)

The FARS is a data collection system that provides a census of all fatal highway crashes in the 50 states, the District of Columbia, and Puerto Rico. The program is the lifeblood of agency data support for most of the traffic and highway safety countermeasures aimed at reducing the number of fatalities and injuries on U.S. highways. The benchmark metrics provided by the FARS database uniquely position the NHTSA, its customers, and its partners to deliver solidly based data-driven program countermeasures. Data-rich program documents with timely and accurate information save lives, reduce injuries, and reduce the societal costs associated with fatal crashes. The FARS program's annual data files are also instrumental in defining data-driven safety initiatives in the FHWA, FMCSA, and OST. Ongoing activities are to:

- Collect and code FARS data in the 50 states, District of Columbia, and Puerto Rico.
- Create the 2004 FARS electronic data files on approximately 42,000 crash fatalities.
- Create and deliver FARS system-wide training to all analysts and supervisors.
- Increase the quality of drug and alcohol information by establishing direct electronic links between FARS analysts and their sources (medical examiners, coroners, hospitals, and police jurisdictions).

National Automotive Sampling System (NASS)

About 6.3 million police-reported traffic crashes occur annually in the United States. It is critical to the NHTSA's mission to have a nationwide database of nationally representative crashes that form the basis for initiating countermeasures to address the crash situation in this country. Program activities in FY 2005 will:

- Collect Crashworthiness Data System (CDS) data at all CDS crash investigation sites.
- Collect General Estimates System (GES) data at all CDS sites and at GES-only sites.
- Collect nationally representative data on crashes involving late-model vehicles equipped to meet the requirements of the upgraded Federal Motor Vehicle Safety Standard for occupant protection.

- Continue to collect data in support of the requirements of the TREAD Act and Anton's Law as they relate to the performance of tires in motor vehicle crashes and the effectiveness of child safety seats in reducing injuries to children.

National Motor Vehicle Crash Causation Survey (NMVCCS)

While fatality rates have declined, the number of fatalities and injuries stubbornly remains at staggeringly high levels. To substantially reduce highway fatality and injury rates, more needs to be done in primary prevention—finding ways to prevent crashes from occurring in the first place. This program provides crash researchers with the real-time data, collected on-scene, that is essential to understanding crash causation and to defining and developing effective countermeasures. FY 2005 activities will:

- Conduct crash investigations within the NMVCCS to provide detailed information about the causal factors in real-world crashes.
- Collect NMVCCS cases at CDS sites.
- Continue data quality control and completeness evaluations.
- Continue to improve public availability of data.
- Continue to improve NMVCCS data collection procedures, methodologies, variables, and attributes to support NHTSA research and regulatory initiatives on crash causation.
- Continue a cooperative effort with local law enforcement jurisdictions for on-scene crash investigations.

Special Crash Investigations

Special crash investigations save lives by identifying vehicle problems early on, before needless deaths and injuries have occurred. Through this program, the NHTSA examines thousands of crashes of high interest to the agency and performs in-depth investigations of approximately 225 of these crashes through its network of three field contractors. These real-world crashes enable the NHTSA to assess the safety performance of new technology in occupant protection systems. Specific activities in FY 2005 will:

- Perform in-depth crash investigations nationwide involving new and emerging technology in occupant protection systems: advanced frontal, rollover, and side-impact air bags; complex sensing systems and sophisticated deployment control modules; automatic air-bag shutoff systems; and advanced crash data collection systems.
- Provide detailed vehicle and trauma information on air-bag-related crashes to support research and regulatory initiatives on occupant protection systems in passenger cars.

- Perform in-depth crash investigations on children properly installed in child safety seats. Priority will be given to crashes where the vehicles were equipped with lower anchors and tethers for children.
- Perform in-depth crash investigations nationwide involving school buses, alternative-fuel vehicles, and adaptive devices for the physically challenged.
- Facilitate the collection and use of collision avoidance and crashworthiness data from onboard event data recorders.
- Develop and test new technologies to improve the quality and completeness of Special Crash Investigation data reports.
- Continue collaborative efforts with automobile manufacturers for the collection of data from event data recorders.

State Data Program

State crash data are vital to the NHTSA's efforts to reduce deaths, injuries, and associated healthcare costs resulting from highway crashes. The national data systems do not generate sufficient crash outcome information for all events and persons involved, and crash data alone do not provide information about the medical and financial outcomes of crash victims. To get an accurate description of the tragic consequences of crashes, the NHTSA must use hospital statistics. This program provides such crucial data. In FY 2005, work will:

- Increase the number of states linking statewide crash and injury databases.
- Meet customer needs for quality and timely completion and dissemination of research results in the following critical areas: (1) databases that support analyses in different NHTSA safety program areas; (2) assistance to states in improving their databases and analytical efforts; (3) use of linked databases in support of NHTSA programs; (4) programs to promote the use of linked crash and medical outcome files; and (5) programs to provide customer service to states interested in data linkage through technical assistance.
- Encourage states to adopt standardized elements for motor vehicle crash data to improve data quality and comparability and their use by local, state, and national agencies.

Data Analysis Program

The success of the NHTSA's mission to reduce fatalities and injuries depends on effective and reliable analysis of crash data. This program ensures that sufficient analytical resources are available. Specific projects in FY 2005 will:

- Provide expert analytic support to internal and external customers in a broad range of statistical and traffic safety areas.

- Support the NHTSA by analyzing available data to identify injury mechanisms and associated outcomes in motor vehicle crashes.
- Continue the essential evaluation of the effectiveness of emerging occupant protection systems.
- Continue to provide accurate and timely traffic safety and related information to the NHTSA's varied customers, both through the production and distribution of annual fact sheets and reports and by responding to numerous information requests.
- Provide the metrics used to track NHTSA activities under both the NHTSA and DOT annual performance plans.

Early Fatality Notification Reporting System (or Fast FARS)

The NHTSA and the highway safety community have an essential need for real-time, or near-real-time, data on the number of fatalities resulting from motor vehicle crashes. Such data are required to provide timely information to the Congress, report on progress in meeting agency and Departmental goals, assist states in their safety programs, and inform the public about the state of highway safety. The NHTSA's existing data programs, the FARS and the NASS, were designed to provide a detailed annual accounting of motor vehicle crash characteristics. Because considerable time is necessary to obtain the data these systems require, they cannot produce the real-time crash fatality data that the NHTSA needs. This new initiative will:

- Develop and implement an Early Fatality Notification Reporting System to provide near-real-time counts of crash-related fatalities that do not depend on completed Police Accident Reports.
- Evaluate, improve, and continuously monitor state fatality notification programs, including identifying under-reporting.
- Develop an electronic reporting system that FARS state personnel can use to receive and record fatality count data from law enforcement agencies across their state and to collect them into the national system.
- Develop statistical procedures for adjustments to notification data and for publication of data and information.

Crash Avoidance Initiative

The rapid advance of new electronic technologies will radically change the design and performance of automobiles over the next 10 years. To ensure that the maximum safety benefits are derived, the

NHTSA is proposing to evaluate these technologies and develop performance standards and consumer educational materials. Proposed activities in FY 2005 will:

- Analyze real-world crash data to identify safety problems and project the safety contributions of new technologies.
- Develop new assessment methodologies and safety performance criteria to test and evaluate technologies.

VRTC

Located in East Liberty, Ohio, the VRTC is the NHTSA's research, development, test, and evaluation facility. Its in-house researchers assist all of the NHTSA's program offices, particularly in the areas of crashworthiness, applied biomechanics, crash dummy development, and TREAD-related rulemaking. Ongoing efforts will:

- Maintain the equipment necessary for conducting research and test activities.
- Support the NHTSA's ongoing priority programs.

LONGER TERM OUTLOOK

The NHTSA will continue to promote educational, engineering, and enforcement programs with the aim of ending preventable tragedies and reducing economic costs associated with vehicle use and highway travel. Since fatalities, injuries, and property damage will continue as unintended byproducts of motor vehicle use, the NHTSA envisions four major roles for itself:

- Be a catalyst for improving the human element.
- Facilitate the design and deployment of the most effective vehicle and road technology.
- Drive the costs associated with traffic crashes to an absolute minimum.
- Exploit information technology to create a foundation for safety research, policy decision making, and safety impact evaluation.

While the NHTSA recognizes the need for a long-term component in its research plan, the resources available to the agency allow only minimal efforts toward meeting long-term research needs. In the shorter term, the NHTSA is assessing the impact of future vehicle technologies on safety; improving the quality and robustness of real-world data on crash causation and occupant protection using advanced data collection and crash reconstruction methods; and assessing driver capabilities in coping with the varying work load and attentional demands due to technologies and other factors.

FEDERAL RAILROAD ADMINISTRATION

MISSION

The FRA promulgates and enforces railroad safety regulations; administers financial assistance programs to railroads, including Amtrak; conducts research and development in support of improved railroad safety; fosters the development of high-speed-rail passenger service; and consolidates government support of rail transportation activities.

CURRENT PROFILE AND FUNDING LEVELS

The FRA has a comprehensive research program that addresses all areas of safety for freight, intercity passenger, and commuter railroads: railroad system issues (safety, security, and environment); human factors; rolling stock and components; track and structures; track/train interaction; train control; highway–railroad grade crossings; hazardous materials transportation; safety of train occupants; and facilities and equipment. The FRA also manages the Next Generation High-Speed Rail program, which demonstrates technologies aimed at fostering the deployment of high-speed passenger service in corridors around the country. The FY 2005 budget request is shown in Table 4-5. Descriptions of the Railroad R&D and Next Generation High-Speed Rail programs follow.

Table 4-5. Comparative Summary of FRA RD&T Activity (\$000)*

Item	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
R&D	\$31,133	\$30,517	\$31,366
Technology	\$31,231	\$29,631	\$17,850
Facilities	\$1,167	\$1,332	\$1,425
Total	\$63,531	\$61,480	\$50,641

* Figures are from Appendix C.

FY 2005 Budget in Brief Highlights

Support research on rail systems safety, track and structures, train occupant protection, human factors in train operations, rolling stock and components, track and train interaction, track control, grade crossings, hazardous materials, and installation of the NDGPS.

Railroad R&D

The Railroad R&D program comprises 11 program elements, some of which are funded exclusively by the FRA, and others that are carried out cooperatively with railroads, suppliers, universities, and other organizations. The FRA owns the Transportation Technology Center (TTC) near Pueblo, Colorado. The TTC is located on 50 square miles of land leased from the state of Colorado, and is operated under a Care, Custody, and Control contract by Transportation Technology Center, Inc. (TTCI), a wholly owned subsidiary of the Association of American

Railroads (AAR). A portion of the FRA's program is carried out there under contract with TTCI and another portion under a joint funding agreement with the AAR.

A significant portion of the FRA's Railroad R&D program is carried out by or under the supervision of staff at DOT's Volpe National Transportation Systems Center in Cambridge, Massachusetts. Yet another program element is carried out by technical companies working under competitively awarded task order contracts. The remainder of the program is carried out through grants, cooperative agreements, and contracts by universities, railroads, railroad suppliers, consulting engineers, and other organizations with appropriate technical expertise, including the SBIR program and the TRB's Innovations Deserving Exploratory Analysis program.

The 11 program elements of the Railroad R&D program are:

Railroad System Issues

- Addresses contextual research; system safety issues for freight, commuter, intercity passenger, and high-speed passenger railroads, including performance-based regulations; security in the railroad system; and environmental issues related to railroad operations, including locomotives.

Human Factors

- Conducts research to identify root causes for repetitive human errors and develop effective countermeasures by targeting human factors in yards, terminals, and mainline train operations for freight, conventional passenger, and high-speed passenger services.

Rolling Stock and Components

- Conducts research to identify, analyze, demonstrate, and disseminate information about onboard and wayside systems for monitoring the condition of wheels, bearings, truck suspension systems, and brakes.

Track and Structures

- Conducts research on automated track inspection technologies, provides technical support for regulatory actions and inspection strategies, and investigates failure mechanisms of rail, bridges, and signal systems.

Track and Train Interaction

- Conducts research to reduce the risk of derailments and identify causes through tests, evaluations, and development of computer simulation tools.

Train Control

- Undertakes four types of activities regarding train control: facilitation; risk analysis; testing and evaluation; and development of support systems, including the NDGPS network.

Grade Crossings

- Conducts research for both conventional and high-speed grade crossings through analyses of accident statistics and driver behavior, and through demonstrations and evaluations of new techniques and processes for improving crossings.

Hazardous Materials Transportation

- Conducts research in hazardous materials transportation safety, damage assessment and inspection, and tank-car integrity through evaluations, models, and laboratory and field tests.

Train Occupant Protection

- Conducts research on structural crashworthiness and interior safety of intercity and commuter rail equipment, and freight and passenger locomotives, through dynamic modeling, simulations, component testing, and full-scale crash testing.

R&D Facilities and Equipment

- Addresses the acquisition, upgrading, and maintenance of FRA-owned facilities and equipment required to accomplish the whole spectrum of railroad research objectives.

NDGPS

- Continues installation of the NDGPS, which will provide precise positioning and navigation information to ensure the safety and security of lives and property throughout the United States.

Next Generation High-Speed Rail

The four program elements of the Next Generation High-Speed Rail Program allow technology enhancements to achieve cost-effective, reliable intercity passenger rail service on corridors where rail travel times can be made competitive, primarily by improvements to existing railroad facilities. The High-Speed Train Control Systems program develops and demonstrates communications-based train control systems. The High-Speed Turbine-Electric Locomotive program facilitates the development and deployment of domestically produced, high-speed, high-acceleration locomotives that do not require electric power from wayside supplies via costly catenary systems. The Grade Crossing and Innovative Technologies program demonstrates innovative solutions for reducing grade crossing hazards on high-speed rail lines and a comprehensive methodology by which states and their partners can address the implementation of high-speed rail service on existing infrastructure. Finally, the Track and Structures program

demonstrates advanced, economical track and structure technologies to resolve corridor capacity constraints and bottlenecks.

High-Speed Train Control Systems

- Continues development, installation, and safety validation of a flexible-block, high-speed train control system on the Chicago–St. Louis Corridor in a joint Federal, state, Amtrak, and railroad industry effort.
- Continues revenue service high-speed demonstration of the Incremental Train Control System on a segment of the Detroit–Chicago corridor in a joint Federal, state, and Amtrak effort.

High-Speed Non-Electric Locomotives

- Continues to support the rolling demonstration of a prototype lightweight, turbine-powered, high-speed locomotive capable of 150 mph and meeting all applicable FRA safety standards.
- Continues the development of a hybrid flywheel-turbine Advanced Locomotive Propulsion system with funding from partners in academia and industry.

Grade Crossing and Innovative Technologies

- Continues to improve grade crossing safety by promoting a comprehensive approach to crossing hazards on a total corridor basis through a demonstration program that evaluates multiple solutions and opportunities for interlinking railroad signal systems, grade crossing protection, automatic train control systems, and highway applications.
- Continues to solicit a wide range of technology projects from the entire spectrum of U.S. industry and academia to facilitate the implementation of high-speed rail.
- Continues support for the Sealed Corridor Project conducted by the North Carolina DOT, where low-cost, innovative hazard-reduction systems at crossings have been shown to save lives.

Track and Structures Technology

- Continues to seek out and demonstrate advanced, economical technologies to resolve corridor capacity constraints and bottlenecks through lower cost design and installation methods for high-speed switches and crossovers, improved methods for upgrading track structures, and more cost-effective methods of track construction.

LONGER TERM OUTLOOK

The changes that have occurred in the U.S. freight railroad industry in the past 7 years have been as dramatic as any that have taken place during the industry's 175-year history. There are now only 4 major freight railroads, each representing about 20 percent of the industry's business. In addition, there are a small number of mid-sized railroads that serve regional markets, and a large and growing number of short-line railroads throughout the country that have emerged as the large railroads have sold off unprofitable branch lines to private operators with the ability to provide better service at lower cost.

These structural changes in the industry have been occurring as the market for railroad freight transportation has continued to reach record levels. Industry profitability reached an all-time high in 1997, but has since fallen off as the major railroads have had difficulties in implementing mergers and acquisitions. As a result, the market capitalization of the major railroads has fallen significantly, seriously affecting their ability to raise capital for further improvements and to fund research programs.

The nature of freight railroad operations has also evolved. Railroad companies have responded to the growing demand for their services by running more, heavier, and faster trains. The industry's share of the intercity freight market has grown from less than 38 percent in 1990 to more than 40 percent today. For the first time since World War II, some railroads face capacity constraints on certain lines. Trucking companies, long viewed as competitors of the railroads, are now among their largest customers, as they contract for the long-haul transport of containers and trailers.

Passenger operations have been evolving rapidly as well. Congestion on highways in and between major urban areas has led to renewed interest in commuter and intercity rail passenger services. The most rapidly growing segment of the railroad industry (and transit industry) is the commuter rail market: the number of commuter trips has grown by 27 percent over the past decade. To reduce pressures on highways and airports, many states are also planning to use existing rail lines for high-speed passenger service. The result will be a greater commingling of freight and passenger trains on common tracks, which will raise new safety concerns.

FEDERAL TRANSIT ADMINISTRATION

MISSION

The FTA mission is to improve public transportation for America's communities. The FTA seeks to deliver products and services that are valued by its customers and to assist transit agencies in better meeting their customers' needs. To accomplish these goals, the FTA partners with the transportation industry to undertake research, development, technical assistance, and education that will improve the quality, reliability, and cost-effectiveness of transit in the United States.

FTA RD&T is focused on increasing transit ridership, improving safety and emergency preparedness, improving capital and operating efficiencies, and protecting the environment and promoting energy independence. These efforts are a key component of the FTA's overall

program for FY 2005. New technologies are now being developed that may improve performance in the delivery of safe, reliable, and efficient transit service. RD&T addresses all phases of the innovation process, including technical feasibility, demonstration of prototype systems and services in operational environments, and deployment of proven innovations. Among the projects that the FTA is currently implementing are fuel-cell buses, hybrid-electric buses, clean fuels, and transit-related ITS. Another area of emphasis is technical assistance to help transit agencies increase ridership and leverage Federal investments in public transportation infrastructure.

CURRENT PROFILE AND FUNDING LEVELS

The FTA performs most Departmental RD&T on mass transit vehicles, infrastructure, service innovations, and operations. The FY 2005 budget request is shown in Table 4-6.

Table 4-6. Comparative Summary of FTA RD&T Activity (\$000)*

Item	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
R&D	\$2,014	\$4,625	\$2,587
Technology Investment	\$58,027	\$54,265	\$48,619
Facilities	0	0	0
Total	\$60,041	\$58,890	\$51,206

*Figures are from Appendix C.

FY 2005 Budget in Brief Highlights

Continue support of the National Research Program, Transit Cooperative Research Program, National Transit Institute training programs, and University Transportation Research Program.

Transit vehicles and control technologies tend to be specialized, and guideways may be shared with mixed traffic on highways or railroad track, or operated exclusively on busways or subways. Many transit RD&T areas thus cut across modes in their applicability. The FTA’s major RD&T programs are presented below.

National Research Program

RD&T within the FTA’s National Research Program can be characterized as follows:

- *Joint Partnerships*—The FTA enters into agreements with both public and private research organizations, transit providers, and industry to promote the early deployment of innovation in public transportation services, management, operational practices, and technology. Current efforts include developing high-priority rail transit standards for commonality in design and operations, and partnering with the industry to identify and disseminate best practices for reducing and controlling costs and schedules for major transit construction projects.

- *Advanced Technologies*—The FTA assists in the study, design, and demonstration of fixed-guideway technologies, bus and bus rapid transit technologies, fuel-cell-powered transit buses, advanced propulsion control for rail transit, and other technologies under development. The agency encourages activities for reducing the life-cycle costs of vehicles, systems, and facilities. In direct support of the President’s Hydrogen Fuel Initiative, the FTA is working to accelerate the commercial introduction of low-emission, high-efficiency transit vehicles. Similarly, the FTA is collecting, analyzing, and disseminating objective information on the performance of hybrid-electric and other clean-fuel buses, and is providing technical assistance to the National Park Service for planning and instituting transit systems in the National Parks.

These national research efforts encompass the following programs:

Safety and Security

The FTA’s Safety and Security program promotes public health, safety, and security by working toward the elimination of transit-related deaths, injuries, and property damage and the improvement of transit security. The program supports continued progress toward the achievement of DOT’s safety and security objectives. Specific RD&T activities include:

- *Safety and Security Technology*—This program provides assistance for the conduct of research in a number of areas vital to transit safety and security. Of special importance are the investigation of available nuclear/biological/chemical/radiological detection systems within various transit environments; development of a computer model to assess transit system vulnerabilities and develop security response protocols; and a number of training initiatives to address terrorist and other emergency events.
- *Technical Assistance for Safety and Security Enhancements*—This effort includes (1) establishing a national training model whereby transit police and security personnel learn counterterrorism strategies; (2) forums to help metropolitan areas and the surrounding communities become better prepared to respond to emergency situations; (3) conducting the Land Transportation Antiterrorism Training Program at four transit agencies; (4) identifying and analyzing critical issues to be addressed in the decontamination of transit facilities and equipment following a release of weapons of mass destruction; (5) developing comprehensive approaches to the management of emergency incidents; and (6) linking specific document source materials to each of the FTA’s top 20 safety action items.
- *Safety and Security Training*—This activity supports transit safety and security training programs at the Transportation Safety Institute. The transit industry has benefited from the strong relationship between the Institute and the FTA over the past 25 years.
- *Alternative Fuel Safety*—This effort provides technical assistance to the FTA for its Alternative Fuels Safety Research Program. It supports standards development activities, development of new technical guidance documents for the transit industry, and special research studies on issues concerning the use of alternative fuels in transit.

- *Design Standards for Transit Security Systems*—In consultation with transit industry and homeland security representatives, this program develops criteria, guidelines, and standards for transit facilities, vehicles, and other assets that will prevent and discourage acts of terrorism and facilitate emergency response to such acts.

Within these areas, high-priority RD&T activities for FY 2005 will be:

- Evaluating the impact of new vehicle and infrastructure technologies on transit safety and security.
- Providing training for approximately 6,000 professionals through the Transportation Safety Institute's training programs on system safety, accident prevention and investigation, system security, emergency management, industrial safety, alternative fuels, bus operator safety, and fatigue awareness.
- Testing materials used in transit vehicles for fire/life safety and updating FTA guidelines.
- Providing guidance on emergency preparedness planning drills.
- Assisting grantees and states in implementing Federal regulatory requirements for drug and alcohol testing.
- Providing outreach to transit authorities through the dissemination of timely safety and security information and by maintaining a national safety and security clearinghouse and web site.
- Conducting safety awareness outreach activities in cooperation with the American Public Transportation Association and Operation Lifesaver.
- Conducting a pilot project on the collection and analysis of transit accidents and causal factors.
- Providing guidance on transit bus safety, including dissemination of model bus safety plans.

Equipment and Infrastructure

The goals of the FTA's Equipment and Infrastructure program are to decrease the petroleum-derived energy intensity of transit, improve fuel/energy efficiency, help protect the environment, and improve passenger service and comfort through technology development. RD&T includes:

- *Bus Equipment and Infrastructure*—This program supports DOT's environmental stewardship objective. The bulk of the funds requested for bus technology will support the goal of reducing mobile source emissions and help increase the nation's energy independence. The effort will employ a mixed approach of developing, deploying, and disseminating information and technology.

The FTA investigates means to power transit by “sustainable” sources of energy—sources that eliminate or minimize petroleum consumption and all forms of harmful emissions, not just by the vehicle but also by all of the links in the energy “chain.” Fuel-cell propulsion systems powered by hydrogen from renewable sources, as recently championed by the President’s Hydrogen Fuel Initiative, might be one such endpoint. However, due to their more advanced state of readiness, various evolutionary bridging technologies—such as alternative fuels, hybrid-electric propulsion systems, and efficient “clean diesel” engines—offer ways to begin taking steps toward the goal of sustainability now while work progresses on revolutionary technologies that will take years to develop and deploy.

- *Rail Equipment and Infrastructure*—The goal of this program is to identify and share cost-effective strategies to address critical communications, security, and safety concerns, and to provide a forum for transit construction engineers to regularly share information about current issues and solutions.

FY 2005 activities in these two areas will include:

- Studying the effectiveness of three electric power pickup systems for buses being tested in Europe and their potential application in the United States. The systems have the potential to eliminate bus tailpipe emissions without adding visually intrusive overhead wires or on-board battery systems.
- Leading an effort to define technical targets, performance goals, and cost estimates for the next generation of fuel-cell buses, and resolving issues with regard to hybrid-electric emission certification, verification, and safety.
- Working with industry to develop rail operating standards and practices, particularly focusing on vehicle electrical interface standards. The development of industry standards and best practices will lead to reduced capital and operating costs and will improve system safety.
- Demonstrating an advanced high-capacity data communications system link.

Fleet Operations

The FTA Fleet Operations program supports increased transit ridership through the identification, development, and implementation of cost-effective transportation solutions, including bus rapid transit, shared track, and multimodal transportation management. Specific activities include:

- *Bus Rapid Transit (BRT)*—This initiative is focused on the research, planning, and deployment of BRT systems in the United States to improve transit-based operations and serve as an alternative to more expensive light-rail transit systems.

- *Regional Passenger Information Integration*—This project conducts operational tests to demonstrate the integration of separate ITS elements to increase rail passenger mobility.

Activities in FY 2005 will address the following:

- Developing BRT simulation techniques that will produce both visual and analytical tools to assess the impacts of individual BRT elements or BRT systems in specific community environments.
- Defining requirements for, and identifying elements of, an ITS communications backbone for an integrated multimodal center capable of monitoring and managing transportation activity within a region on a real-time basis.
- Conducting research to determine the components of bus service innovations, including BRT, and to produce the most cost-effective solutions for increasing ridership.
- Within the Geospatial Data Coordination activity, continuing efforts to transform prototype models incrementally, congruent with evolving standards and Geographic Information Systems practice, into practical and publicly accessible tools in the Transportation Geo-Spatial One-Stop Toolbox.

Specialized Customer Services

RD&T activities in this area are designed to improve services for low-income, elderly, and other transit-dependent travelers, including persons with disabilities, to improve access to jobs, educational opportunities, health care, and other essential activities.

In FY 2005, one area of emphasis will be the mobility manager concept. Mobility managers serve as transportation “travel agents” and service coordinators, achieving effective delivery of services for customers and cost-efficiency for taxpayers.

Information Management and Technology

This program supports the DOT strategic mobility objective by developing and disseminating to the transit community knowledge of advanced transit technology and innovation. It also supports the TRB for the conduct of transit and transportation research and the FTA’s participation in the SBIR program. Work in FY 2005 will include the following:

- Producing a research and technology annual report that documents lessons learned and best practices from transit research and demonstration programs and two issues of the *Transit Research and Technology Journal*.
- Disseminating information by conducting sessions at annual meetings of the TRB, American Public Transportation Association (APTA), and American Association of State Highway and Transportation Officials.

- Continuing participation in and support of the SBIR program.

Metropolitan/Rural Policy Development

In support of the strategic objective of improving mobility, this program enables the FTA to develop better estimates of transit's condition, performance, and long-term investment needs; identify and evaluate the benefits of transit; conduct research into the relationships between transit and land-use planning; expand testing of standardized onboard passenger surveys; and provide technical assistance to encourage the use and development of new and innovative financing techniques. These activities allow the FTA to further refine national data on transit's role and performance in serving the needs of passengers and communities, including its role in providing basic mobility, relieving traffic congestion, and contributing to community vitality. Among the efforts in FY 2005 will be:

- Pursuant to 49 USC 308, conducting the necessary data collection and research to report on the condition and performance of transit in the United States and on transit investment needs.
- Conducting additional research and analysis to refine and quantify estimates of the benefits of transit and identify specific practices that yield higher benefits. The dissemination of this information is expected to help public transportation operators make more cost-effective capital investment and operating decisions.
- Identifying and disseminating information about innovative financing techniques and providing periodic reports and workshops for FTA grantees.

Planning and Project Development

This FTA activity assists state and local transportation planners in implementing Federal multimodal planning provisions. Activities encompass improved planning methods (for example, the development of enhanced travel modeling procedures); general transportation planning assistance (including long-range multimodal and job access planning); land use and environmental planning; research to advance the state-of-the-practice for New Starts-related analyses; and financial planning. Efforts in FY 2005 will include:

- Supporting institutional capacity building by documenting best practices and providing guidance, technical assistance, and training to facilitate informed project selection by decision makers at the state, MPO, and transit operator levels.
- Completing project evaluations and producing Congressionally required New Starts reports.
- Initiating two new "challenge grant" programs to promote and disseminate professional information on innovative practices for coordinated land use/transportation planning.

- Continuing efforts to streamline environmental approval processes through transit-specific measures, including peer-to-peer exchanges; development of performance measures; identification of innovative mitigation strategies; and identification and dissemination of best practices in the transit community.
- Providing a forum for ongoing training and information sharing on lessons learned and ideas to improve the planning and project development process for major capital investments.

Human Resources

The FTA's efforts related to human resources provide assistance for meeting Federal requirements for Title VI of the Civil Rights Act of 1964, the Americans With Disabilities Act, and the DOT Disadvantaged Business Enterprise regulation. In FY 2005, this activity will also support educational opportunities for high school students interested in the field of transportation.

Performance and Review

This effort conducts program evaluation activities required by the Program Assessment Rating Tool process and the Government Performance and Results Act, including the development of data for benchmarking, documenting, and assessing FTA progress in helping to achieve DOT strategic objectives. In FY 2005, this effort will also develop data analysis capabilities to support a new incentive program designed to reward urbanized areas that increase transit ridership.

International Mass Transportation Program

Under this program, the FTA promotes U.S. transit products and services overseas and cooperates with foreign public sector entities on research in public transportation. Trade missions and other international gatherings enable U.S. vendors to showcase their products and services and facilitate technology transfer to developing nations.

In FY 2005, the program will emphasize two activities:

- Informing domestic transit agencies about technological innovations available internationally.
- Affording domestic businesses the opportunity to become more globally competitive.

Transit Cooperative Research Program (TCRP)

Through the TCRP, the FTA funds research on issues significant to the transit industry. Research is directed to near-term, local problem-solving in transit planning, service concepts, vehicles and equipment, facilities, operations, human resources, maintenance, and administrative practices. More than 260 products of TCRP research have been delivered to the public transportation community.

The TRB, which administers the TCRP, maintains a publications list and a description of all TCRP studies on its web site: <http://www4.trb.org/trb/crp.nsf/TCRP+projects>. One copy of each TCRP product is available free of charge from the APTA, which maintains the TCRP site: <http://www.tcrponline.org/>.

National Transit Institute (NTI)

The NTI develops and teaches new methods and techniques to improve transit workforce performance. The institute conducts courses at sites nationwide on a wide variety of subjects, ranging from advanced technology and multimodal planning to management development and training effectiveness. The NTI also holds annual transit trainer workshops to bring together trainers and industry human resources specialists to learn the latest training techniques and share training experiences. Currently, the NTI and FTA are working to develop and present workshops and seminars designed to assist the transit industry in understanding and implementing advanced public transportation systems. NTI course offerings are available online at <http://www.ntionline.com/>.

University Transportation Centers

Through RSPA, the FTA currently provides funding to four universities selected as UTCs to perform cutting-edge research in transit disciplines and technologies. In addition to producing research results, the program trains graduate students as the next generation of professionals to lead transit research, planning, and operations. (See pages 4-16 and 4-60.) Program funds are matched with support from private industry, universities, and state and local governments.

LONGER TERM OUTLOOK

Overall, the FTA has had a good deal of success in collecting and analyzing data and information through its RD&T programs, and in identifying and disseminating best practices in the public transportation arena. The FTA will continue to improve its ability to introduce into the transit marketplace advanced technologies that drive operational efficiencies and increase ridership.

Crosscutting themes are continued emphasis on safety and security, energy, and operational efficiency, and greatly improved access to mobility for persons with disabilities, elderly persons, and low-income persons.

The FTA will emphasize integration of emerging advanced technologies—such as new vehicle subsystems and ITS—to provide high levels of service and cost-effective system performance. BRT systems in several forward-looking cities will begin to reap the benefits of this integrated approach and provide high levels of service quality, energy efficiency, and congestion mitigation that will serve as benchmarks for the transit industry and communities everywhere.

FEDERAL AVIATION ADMINISTRATION

MISSION

The FAA's mission is to provide a safe and efficient aerospace system that contributes to national security and promotion of U.S. aerospace safety. As the leading authority in the international aerospace community, the FAA is responsive to the dynamic nature of customer needs, economic conditions, and environmental concerns. Key mission elements are (1) the regulation of civil aviation and commercial space transportation to promote safety; and (2) the safe and efficient use of airports and the airspace by both civil and military aircraft.

In support of this mission, the FAA's research program develops and validates technologies, systems, and procedures that directly advance agency goals to increase system safety and efficiency in an environmentally sound manner. The program is in accordance with the agency's operational and regulatory responsibilities: air traffic services; certification of aircraft and aviation personnel; certification of airports; environmental standards for civil aviation; and licensing of commercial space launches and reentries, and of commercial space launch sites and reentry sites. Research activities are undertaken through a variety of mechanisms, including in-house initiatives; partnerships with other agencies, universities, Centers of Excellence, not-for-profit organizations, international organizations, and industry; and technology transfer to the private sector.

CURRENT PROFILE AND FUNDING LEVELS

An infusion of new technology and procedures is essential if air traffic services are to continue to support safe and efficient flight operations in the future. A major FAA challenge today is modernizing an aging infrastructure of air navigation facilities. The system architecture provides the road map for this continuing modernization process, and the research program provides the necessary system development initiatives. Table 4-7 shows the President's budget request for FAA RD&T in FY 2005.

Table 4-7. Comparative Summary of FAA RD&T Activity (\$000)*

Item	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
R&D	\$256,862	\$231,867	\$204,499
Technology Investment	\$0	\$0	\$0
Facilities	\$17,585	\$16,403	\$18,000
Total	\$274,447	\$248,270	\$222,499

*Figures are from Appendix C.

FY 2005 Budget in Brief Highlights

Continue research on aviation safety, mobility, and environmental issues.

The agency aligns its research program structure with FAA major strategic and enabling goals. This goals-based structure departs in some instances from the Department’s RD&T budget structure, which is shown in Appendix C. Table 4-8 summarizes the relationship between the FAA’s research program areas and DOT’s RD&T budget categories.

Table 4-8. Relationship of FAA R&D Program Areas to RD&T Budget Categories

FAA Program	RD&T Category
Aviation Safety Goal Area	RE&D: <i>Weather</i> RE&D: <i>Aircraft Safety Technology</i> RE&D: <i>Human Factors and Aviation Medicine</i> Facilities and Equipment: <i>Advanced Technology Development and Prototyping</i> Facilities and Equipment: <i>Safe Flight 21: Alaska Capstone</i>
Aviation Capacity Goal Area	RE&D: <i>System Development and Infrastructure</i> RE&D: <i>Environment and Energy</i> RE&D: <i>National Plan for Transformation of Air Transportation</i> Facilities and Equipment: <i>Advanced Technology Development and Prototyping</i> Facilities and Equipment: <i>Safe Flight 21: Ohio River Valley</i>
Operational Excellence in Aviation R&D Goal Area	RE&D: <i>System Development and Infrastructure</i>
Commercial Space Transportation Safety Goal Area	Commercial Space Transportation

Aviation Safety Goal Area

Research emphases supporting the FAA Aviation Safety goal include:

Aviation Weather Safety

Products of the Aviation Weather Safety program include improved weather forecasting algorithms and technical input to the development of safer standards and procedures for avoiding or mitigating weather-related aviation hazards.

Aircraft Safety

The Aircraft Safety program provides the technical research basis to develop the standards, rules, regulations, and guidance materials that help to ensure aviation safety. The program establishes safety standards and acceptable practices through development of technical information, tools, and technology to ensure safe operation of the civil aircraft fleet. Specific projects address fire-resistant materials; aircraft fire safety research; structural safety and advanced materials and

structures; propulsion and fuel systems; flight safety and atmospheric hazards research; aging aircraft, including aging nonstructural systems; aircraft catastrophic failure prevention research; and aviation safety risk analysis.

The Aircraft Safety program studies the many hazards that face all aircraft in flight, as well as special hazards that apply to select portions of the fleet. For example, older aircraft are more susceptible to structural problems associated with fatigue and corrosion, while new aircraft—with digital flight control and avionics systems, associated imbedded software, and construction using new non-metallic materials—present significant challenges in certification and continued airworthiness.

Human Factors and Aerospace Medicine

The FAA Human Factors and Aerospace Medicine program conducts applied research to identify methods, procedures, technology, and training to enhance human performance and thereby help reduce the fatal aviation accident rate. Project areas include human factors relating to air traffic services, commercial and general aviation flight decks, and aircraft and airway facilities maintenance. The program ensures that human factors issues are addressed in the acquisition and integration of FAA systems and applications. The program also sponsors and conducts aeromedical research, with a critical focus on increasing post-accident survivability.

Specific research on human factors provides the scientific and technical information to improve pilot, maintainer, and controller performance through guidelines, handbooks, advisory circulars, rules, and regulations critical to the design, operation, maintenance, and certification of equipment, training, and procedures.

Aeromedical research projects provide critical information for regulation and certification related to cabin and passenger safety and security, protective devices, toxicology, and recommendations for medical standards.

Advanced Technology Development and Prototyping (ATD&P)

Evaluations and recommendations produced by the ATD&P program shape long-term investment decisions regarding potential technologies for improving the safety of air traffic services, procedures, and infrastructure. ATD&P projects associated with the agency's safety goal are Runway Incursion Reduction, General Aviation and Vertical Flight Technology, National Airspace System (NAS) Safety Assessments, Safer Skies, and Airport Technology. This last program provides technology solutions that will allow the nation's airports to establish and maintain an operational environment free of accidents and fatalities.

Safe Flight 21

The Alaska Capstone project conducts studies within remote operating environments to validate the potential of selected advanced communications, navigation, and surveillance technologies—combined with related air traffic procedures—to increase NAS safety.

Aviation Capacity Goal Area

Among the research emphases supporting the Aviation Capacity goal are:

Center for Advanced Aviation System Development (CAASD)

The CAASD provides detailed reports, briefings, and concept demonstration systems used in the evaluation of new air traffic management (ATM) and air traffic control (ATC) operating concepts and infrastructure replacements. These products are critical elements in beginning the development of a more efficient, more available, and safer next-generation ATM and ATC system. The CAASD provides new technology research for global ATM, including developments in traffic flow management, navigation, separation assurance, surveillance technology, and system safety.

Environment and Energy

The FAA Environment and Energy program develops new models, metrics, and operational and technical improvements to mitigate environmental impacts related to aviation. The program enhances scientific knowledge to identify, understand, and measure the issues and impacts associated with aircraft noise and aviation emissions. A long-term goal is the creation of new analytical tools to understand better the relationship between noise and emissions and different types of emissions and to analyze the costs and benefits of different policies and actions—contributing to the achievement of the FAA’s goal of enhancing capacity in an environmentally sound manner.

Advanced Technology Development and Prototyping

Evaluations and recommendations produced by the ATD&P program shape long-term investment decisions regarding potential technologies needed to move the FAA systems architecture from the planning stages to acquisition and implementation of newer, more efficient air traffic system technologies and management procedures. The products of ongoing activities, such as modeling, prototyping, simulations, demonstrations, and evaluations, are common to the program, as are the development of new and refined procedures, standards, guidance, and performance metrics. ATD&P projects associated with the agency’s capacity goal include Aviation System Capacity Improvement, Separation Standards, Operations Concept Validation, NAS Requirements Development, Domestic Reduced Vertical Separation Minima, and Airport Technology. Capacity-related research within the airports program focuses on better airport planning, design, and pavements.

Safe Flight 21

The Ohio River Valley project conducts detailed risk assessments of communications, navigation, and surveillance systems with high potential for increasing the efficiency of the NAS. Documentation from this research is guiding the FAA and stakeholder community in making decisions regarding the implementation suitability and readiness of these technologies.

National Plan for Transformation of Air Transportation

This program enables FAA involvement in the interagency Joint Planning and Development Office, which has a mandate to prepare a vision for future air transportation that will allow the nation to remain a highly mobile society and a leader in aviation within the global marketplace.

Operational Excellence in Aviation R&D Goal Area

Systems Planning and Resource Management

Through this activity, the FAA works to increase customer and stakeholder involvement in FAA research, increase research program efficiency, and foster greater proliferation of U.S. standards and technology to meet global aviation needs. Among other efforts, the program supports the activities of the FAA's Research, Engineering, and Development Advisory Committee.

William J. Hughes Technical Center (WJHTC)

The FAA test beds located at the WJHTC support program goals that address both safety and capacity. The WJHTC maintains and operates agency test bed laboratories utilized by research program managers in achieving these goals.

Commercial Space Transportation Safety Goal Area

This program area provides structured and evolutionary services that keep pace with the global growth in commercial space transportation. The program has three main thrusts: space transportation vehicle safety, space transportation infrastructure, and a space and air traffic management system. The program's outputs vary in scope from commercial human spaceflight requirements, modeling and simulation studies, and emergent technology evaluations, to the procedures, standards, and guidance required to perpetuate the safe record of our national introduction of commercial space traffic into the NAS.

Together with many Federal and state agencies, the U.S. commercial space transportation industry is developing advances in vehicle technology and associated infrastructure.

The FAA program plans and develops regulations, guidance, licensing approaches, and methods to assess the safety of evolving space transportation vehicles. Partnerships are developing in the areas of Expendable Launch Vehicles, Reusable Launch Vehicles, and spaceports that can accommodate new or improved vehicles. The cooperative development and deployment of safe, capable, operable, reliable, and economical space transportation vehicles will enhance the international competitiveness of the United States.

To accommodate new space transportation vehicles, a number of state agencies and private companies are planning to develop new or improved space transportation infrastructure. Some of these efforts also involve the Department of Defense (DOD) and National Aeronautics and Space Administration (NASA), agencies that have generally constructed, owned, and operated a U.S. space transportation infrastructure. The FAA will need to play an increasingly important

role, however, in protecting public health, safety, and property—especially at those sites where DOD and NASA have little or no involvement. Accordingly, the FAA will work to enhance its ability to assess the safety of operations at non-Federal space launch and landing sites.

LONGER TERM OUTLOOK

Aviation Safety Goal Area

Aviation Weather and Aircraft Safety

The need for safety and safety-related research will continue indefinitely. With the emergence of new and advanced technologies, there will be an ongoing need to improve air transportation system safety and to understand the impact of new technology on operator performance. Much work remains to be done before the timely and accurate forecasting of weather can optimally help the FAA stay abreast of increasing demands for a safer, more efficient NAS. New and better forecasting algorithms must be found, and better use must be made of automation and communications to make weather information available to all who need it.

As air traffic increases and aircraft continue to age, there will remain a need to address issues related to aging aircraft. Moreover, with new technology, new damage mechanisms may occur, introducing hazards that must be understood and addressed. One example will be safety concerns with the next generation of commercial aircraft, particularly those that are very large and that make far greater use of composite materials. Aircraft safety research must be continued to understand the impact of technology changes on current regulatory safety standards, certification procedures, and acceptable practices for demonstration of compliance mandates.

Baseline data will be established to show direct causal relationships between research outputs and accidents and incidents. Research programs will focus on targets that will have the greatest impact on aviation safety. The programs will be multiyear efforts requiring stabilized resources to plan, execute, and complete. Successful implementation of research outputs will require full partnerships and close cooperation within FAA organizations and the aviation community.

Human Factors and Aerospace Medicine

Human factors research will continue to address areas that have the greatest impact on aviation safety. These will be multiyear efforts requiring stabilized resources to plan, execute, and complete. In particular, the FAA will develop new human system performance measurement strategies to ensure that the envelope of human performance capabilities and limitations is commensurate with the intended safety benefits of new systems, procedures, and training.

The aeromedical program will continue to emphasize the mitigation of accidents and reduction in the severity of injuries encountered in events such as the precautionary evacuation of passengers from an aircraft. Also, in concert with the FAA's broad commitments to harmonize safety regulations on a global scale, this program—collaborating with domestic and international laboratories—will generate research data for use in developing internationally harmonized aviation standards and regulations. Aeromedical research will be increasingly required to

interpret data derived from around the world and to determine whether this data should be accepted or re-collected before being integrated into regulatory considerations and outputs.

Advanced Technology Development and Prototyping Program

Management of these projects maintains a long-term view of the research requirements needed to continue safe and efficient operation, maintenance, and use of the NAS in the future. The composition of the research portfolio can be expected to change over time. As some of today's technologies transition to full-scale development, others with the potential for improving safety will take their place. Thus, the need to fund air traffic services (ATS) technology development and verification will continue.

Aviation Capacity Goal Area

ATS and Related Programs

Advanced technologies are already having a profound effect on the aviation system. As these technologies are introduced to improve system efficiency and flexibility, a new FAA paradigm is emerging under the general term, "Free Flight." Although the composition of the program portfolio will change over time as some efforts come to fruition and transition to a relevant implementation or operational environment, continued investment in research will ensure that the FAA stays current with the ever-increasing demands on the air traffic system. Further, continued investment in ATS research will ensure that the FAA has an effective risk-identification/mitigation strategy for the high-risk areas of the future NAS architecture.

Environment and Energy

The FAA predicts steady growth in the demand for aviation services throughout the first decade of the century. The growth in aircraft operations to meet this demand will produce increased environmental impacts and create barriers to further growth. Removing these barriers will require a combination of improvements in aircraft environmental performance, enhanced environmental procedures for aircraft operations, environmentally compatible land use around airports, new policies and approaches in regulation and mitigation, and policy and incentives to accelerate technology introduction into fleets. While improvements in operational procedures represent near-term solutions, the other elements, especially new aircraft and engine designs and improved aircraft capabilities, require long-term, sustained research, development, and technology implementation strategies.

As the FAA builds more user flexibility into the NAS, it must address any environmental consequences—impacts as well as improvements. The agency must expand the current suite of environmental analysis tools to address the consequences of alternative actions. Improvements in models, metrics, and information will permit a better dialogue among communities, airlines, and airports in managing the impact of aviation on the environment.

The solution to controlling the environmental consequences of new aircraft technologies will be found through a coordinated approach involving the FAA and other Federal agencies—such as

the EPA, NASA, and DOD—from the early stages of research. The FAA also must plan research efforts to support continued international harmonization and standardization of aviation environmental certification standards and procedures.

Airport Technology (Advanced Technology Development and Prototyping)

The FAA will continue friction testing of new products to eliminate the lack of traction on runways and airport surfaces as a cause of accidents. Operation of the FAA’s national pavement test facility, which began in June 1999, will continue for 10 years. The data collected from this facility will allow the smooth introduction of the new heavy aircraft expected to join the commercial fleet.

Commercial Space Transportation Safety Goal Area

The Commercial Space Transportation program will maintain a long-range view of the research requirements for safe, capable, operable, reliable, and economical space transportation. Technological advances in expendable and reusable launch vehicles, as well as increasing numbers of launches and launch and landing sites, will require increasing attention to research. Commercial space transportation is now—and is likely to remain for some time—a research-intensive concern of government and industry alike.

RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION

MISSION

RSPA is the Department’s multimodal research, safety, and transportation systems administration, responsible for addressing intermodal and multimodal issues to assure the safe, secure, effective, and efficient transportation of people and goods. In contrast to other DOT operating administrations, which focus on specific sectors of the U.S. transportation system, RSPA concentrates on the system as a whole. Its mission is to “make America’s transportation systems more integrated, effective, and secure by conducting and fostering crosscutting research and special programs to enhance the quality of life, safety, the environment, and well-being of all Americans.”⁶

The objectives of RSPA are to protect the nation from the risks inherent in the transportation of hazardous materials by all modes, including pipelines; to provide multimodal expertise in transportation and logistics research, analysis, strategic planning, systems engineering, and training; to serve as the principal advisor to the Secretary with respect to scientific and technical matters; to serve as the principal advisor to the Secretary in planning and implementing the civil sector response to emergencies impacting the nation’s transportation systems; and to support the Secretary in promoting innovation, utilization of new approaches, and application of technologies with intermodal or transmodal impacts.⁷

⁶ DOT Organization Manual (DOT 1100. 68B Chg 2).

⁷ See 49 CFR 1.53.

CURRENT PROFILE AND FUNDING LEVELS

As shown below in Table 4-9, the President's budget requests about \$15 million for RSPA RD&T in FY 2005.

Table 4-9. Comparative Summary of RSPA RD&T Activity (\$000)*

Item	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
R&D	\$13,692	\$13,880	\$14,965
Technology	0	0	0
Facilities	0	0	0
Total	\$ 13,692	\$13,880	\$14,965

*Figures are from Appendix C.

FY 2005 Budget in Brief Highlights

Conduct activities to improve DOT's RD&T program and to promote the safe transport of hydrogen fuels and fuel systems so that alternative-fuel vehicles can be developed as a safe alternative to petroleum-fuel vehicles.

RSPA conducts RD&T through two major programs: (1) Pipeline Safety and (2) Research and Special Programs.

Pipeline Safety Research

RSPA's Office of Pipeline Safety (OPS) is the lead agency in the Department for pipeline regulation and research. The Pipeline Safety Research program studies technologies and processes to more fully incorporate risk-based approaches into pipeline regulations. Data gathered will help government and industry to make informed, risk-based safety decisions. Moreover, improved inspection tools will enable operators to more effectively and efficiently locate and repair pipeline problems before a potentially catastrophic or severely disruptive event occurs.

The OPS has organized its research around the eight R&D program elements shown below. Each element has associated safety issues, technology needs or gaps, and R&D opportunities. As a result of the Pipeline Safety Improvement Act of 2002, the program elements reflect the Department's responsibilities in the Five-Year Interagency R&D Program Plan. All R&D projects are linked to at least one of these program elements. In addition, each element has associated goals that define the desired outcomes for R&D and that support RSPA's performance goals for pipeline safety: (1) reducing the number of pipeline incidents; and (2) reducing the amount of hazardous materials spilled per million ton-miles shipped.

Damage Prevention

Preventing, detecting, and repairing defects that could cause leaks or ruptures is the key to preventing safety incidents. For this R&D program element, the principal goal is the reduction in the number of incidents and accidents resulting from excavation damage and outside force. The key to achieving this goal is to keep people from contacting the pipe and causing damage. Critical needs are for methods to locate and map the pipe location, prevent contact with the pipe from excavation tools, and “listen” for or detect contact. In particular, detecting contact by third parties, at the time it happens, would allow pipeline operators to inspect the pipe for damage and take measures to prevent delayed ruptures from dents, gouges, or corrosion. Other needs are for tools to monitor encroachment to supplement aerial and foot patrols.

Pipeline Assessment and Leak Detection

The goal of this program element is to identify and locate critical pipeline defects using inline inspection, direct assessment, and leak detection.

OPS R&D seeks to develop better tools and methods for finding, locating, and evaluating defects before they become critical to pipeline safety. Although many techniques are available, no one method is comprehensive. For instance, internal inspections using smart pigs may detect wall thinning, but can miss crack defects in welds. Hydrostatic (pressure) testing conveys information on the current strength of the pipe but may miss growing defects that barely pass the pressure test. Another method, visual inspection of exposed pipe, locates pipe coating holidays but is often incapable of detecting internal corrosion. Direct assessment is a process that extends these methods’ capabilities by integrating information from multiple sources, including electronic surveys.

Leak detection presents special safety problems, which differ in kind and extent between natural gas and hazardous liquid pipelines. Gaseous leaks disperse into the atmosphere and are difficult to detect. With liquid pipelines, even small spills may cause significant damage to the environment.

Defect Characterization and Mitigation

This element’s goal is to improve the capability to characterize the severity of pipeline defects and to mitigate them before they lead to incidents or accidents. Detecting defects is only part of the problem. Once detected, the issues are the severity of the defect—whether it is likely to grow—and what can or should be done to prevent a leak or rupture. A reduction in wall thickness due to active corrosion is a problem. Pipelines are built with safety factors, but at some point these factors are eroded until a leak or rupture becomes likely. Adding to the complexity are the characteristics of the steel, particularly its strength and toughness; the type of coating; the soil conditions; the bedding of the pipeline in the ditch; the pattern of defects (singly or in colonies); and the fracture mechanics of the type of pipe. Both the pipe environment and the character of the defect determine the way in which a defect is repaired or mitigated—options may include cutouts, welding repairs, sleeves, recoating, or reductions in pressure. The large number of variables puts a premium on research in this critical program element.

Improved Design, Construction, and Materials

This program element seeks to improve the integrity of pipeline facilities through better materials and techniques for design and construction. Many miles of pipelines are installed each year. Better materials, improved design techniques, and enhanced construction methods can make future pipelines safer and easier to maintain. Newer materials are stronger and tougher, but these features create design and construction issues. One engineering methodology for understanding the interaction of pipe design, material, and construction variables is limit state design. Moreover, special construction techniques are needed for installing pipe in environments such as the deep sea, sour gas transportation, and the Arctic. The goal is the widespread use of new technologies that will allow pipelines to be constructed with enhanced safety margins.

Systems for Pipeline Mapping and Information Management

The goal of this element is to enhance the ability to prevent and respond to incidents and accidents through the management of information related to pipeline location and threat definition. Information technology is advancing rapidly, as processor speeds increase and memory becomes less expensive. This opens up the potential for better understanding of pipeline risks and better modes of responding to emergencies. Pipeline information is useful to safety regulators, accident investigators, local public safety officials, and local planning officials. One existing information system, the National Pipeline Mapping System, provides a basis for better regulatory analysis and incident response.

Enhanced Operation Controls and Human Factors Management

This element's objective is to improve the safety of pipeline operations through enhanced controls and human factors management. Pipeline control systems, information systems, sensors, and actuators can prevent accidents or reduce their consequences; however, poor use of controls, especially problems caused by human factors, can exacerbate safety problems. Better understanding should reduce the potential for safety incidents from operator error or system failure. The goal is to understand the interactions among information, controls, and human factors and to use this knowledge to enhance pipeline safety.

Risk Management and Communications

This program element aims to reduce the probability of incidents and accidents and to mitigate the consequences of pipeline hazards. Modeling the risk environment is incredibly difficult. It requires both an analysis of engineering principles and experience as presented in analyses of pipeline incidents. If presented effectively, risk information can be used by operators, regulators, and public officials to make decisions that take risks into consideration. One goal is to understand the risk environment and to use this knowledge to minimize both the likelihood of pipeline incidents and their severity. A second is to find ways to communicate the nature of risks so that citizens and their public officials can operate to reduce risk or otherwise manage it.

Safety Issues for Emerging Technologies

This element seeks to identify and assess emerging pipeline system technologies for opportunities to enhance safety. The energy economy changes constantly, as demand for energy grows, prices vary, and the pattern of production and use of energy evolves. The OPS recognizes the need to anticipate and assess safety issues for emerging technologies. Examples are the expansion of liquid natural gas imports, and the associated facilities and operations, and the potential use of hydrogen as a primary fuel source.

Research and Special Programs

Through this program area, RSPA conducts RD&T supporting its missions in (1) hazardous materials safety and (2) research and technology.

Hazardous Materials

Currently, there are over 800,000 shipments of hazardous materials each day in the United States—more than 10 percent of all freight tonnage transported. Release of these materials during transportation could result in serious injury or death and harm to the natural environment. The threat of terrorist attacks increases the risks inherent in transporting these products. RSPA addresses these issues across all modes, as hazardous materials are transported by truck, rail, waterways, and air. Specific RD&T programs are:

- *Information Systems*—This RSPA effort develops software to more efficiently use data from the Hazardous Materials Information System to identify trends that indicate a possible safety risk to the public.
- *Research and Analysis*—Transporting hazardous materials exposes the public to risks. Through this effort, RSPA identifies those risks—risk assessment—and finds ways to minimize their potential impacts—risk management. Funding pays for the technical information, analyses, and research needed to manage the public risk associated with hazardous materials transportation without imposing undue burdens on industry.
- *Regulation Compliance*—This effort supports testing to ensure the integrity of hazardous materials packaging. The United States Army Materiel Command, Logistics Support Activity, Packaging, Storage, and Containerization Center (located in Tobyhanna, Pennsylvania) provides all testing services.

Research and Technology

This RSPA program supports a variety of multimodal research and technology activities. Specific activities include:

- *Hazardous Materials R&D*—This activity develops ways to minimize the threat to the public of intentional misuse of hazardous materials without substantial impact on the flow of these materials in commerce.

- *Hydrogen Fuels R&D*—Part of the President’s Hydrogen Fuel initiative, this effort works to remove barriers to the widespread deployment of hydrogen-fueled vehicles. In FY 2005, RSPA will carry out research into codes and standards for the safe handling and transport of large quantities of hydrogen fuel, and on the safety of on-board hydrogen vehicle power and storage systems, so that fuel-cell vehicles and direct hydrogen-fueled vehicles can be developed as a safe alternative to petroleum-fueled vehicles.
- *R&D Planning and Management*—This RSPA program is the only one in DOT that conducts transportation research coordination. It minimizes duplication in research plans and programs—as documented in the Congressionally mandated *RD&T Plan* and as endorsed by the National Research Council. Funding for this effort also supports (1) DOT’s Congressionally mandated technology transfer program, which disseminates information and reports on the Department’s RD&T; and (2) the SBIR program, which requires that a fixed percentage of RD&T funding be set aside for small business research projects.
- *UTC Program*—Through this program, which is managed by RSPA and funded by the FHWA and FTA (see pages 4-16 and 4-47), DOT invests in university-based centers of excellence that conduct research to advance knowledge, share that knowledge with stakeholders, and use knowledge to educate students in a broad range of disciplines. To ensure the effectiveness of these investments, RSPA maintains a system to coordinate the centers’ education, research, and technology transfer activities and disseminate the results of their research.

OFFICE OF THE SECRETARY OF TRANSPORTATION

MISSION

The OST has responsibility for formulating national transportation policy and a leadership role in areas of national transportation planning, reducing transport’s environmental and safety impacts, managing aviation and international issues, overseeing the radionavigation and positioning program, regulatory modernization, and other areas. Carried out in coordination with other agencies and departments, the OST’s RD&T helps meet these responsibilities.

CURRENT PROFILE AND FUNDING LEVELS

The FY 2005 budget request for OST is shown in Table 4-10. Carried out primarily through contracts with other Federal agencies, academic institutions, not-for-profit research organizations, and private firms, RD&T activities address five areas: (1) Aviation and International Policy; (2) Safety, Energy, and Environment; (3) Economic and Strategic Analysis; (4) Intermodalism; and (5) Radionavigation and Spectrum Policy.

Table 4-10. Comparative Summary of OST RD&T Activity (\$000)*

Item	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
R&D	\$23,463	\$20,426	\$10,800
Technology	0	0	0
Facilities	0	0	0
Total	\$23,463	\$20,426	\$10,800

* Figures are from Appendix C.

FY 2005 Budget in Brief Highlights

Continue comprehensive analysis of aviation practices, mergers, and international alliances to support the formulation of national transportation policies.

Aviation and International Policy

The OST’s comprehensive focus on aviation policy will support research in a wide variety of data management, economic, regulatory, and other analytical areas. In FY 2005, efforts will focus on the following:

Aviation Data Modernization

This effort will extend the third and last phase of the Department’s aviation data reengineering project, which is determining how the data collection system can take optimum advantage of technology developments and incorporate user-friendly data warehouse and retrieval features. The program is also reviewing the feasibility of outsourcing certain data collection and management functions. This work is central to DOT’s effort to enhance the development of domestic and international aviation by providing the quality data needed to support it.

Air Transportation Demand

The purpose of this project is twofold: (1) identify the “true” demand for air travel in domestic and U.S.-originating international markets independent of existing constraints due to the diverse cost structures of different airlines and markets; and (2) identify changes in industry structure that would be necessary to meet this demand. Work will broaden and deepen DOT’s ongoing effort to monitor changes in the airline industry by including substantial input from outside experts.

Aviation Economic Model

Through this project, OST analysts will continue to use a sophisticated airline network computer model to assess a range of industry factors and conditions, including (1) the evolving competitiveness of domestic and international aviation markets; (2) the rational economic bases

for carrier selection decisions; (3) the effects on competition of proposed mergers and alliances; and (4) the funding required for airport improvements.

Airline Cost Structures

This effort examines changes in airline cost structures and how these changes affect the industry's operations and competition. In FY 2005, the project will focus on (1) developing an analytical module for analyzing differences in the cost structures of various types of airlines in an effort to more accurately evaluate the implications of differing airline business models on the competitive structure of the industry; and (2) evaluating recent changes in airline labor contracts and work rules to determine the impact they will have on the health and viability of the airlines and their employees.

International Alliances and Operations

This study will examine the role of international airline alliances in a potential U.S.–European Union aviation area.

Regional Jet Service

In this project, OST will examine the implications of the regional jet phenomenon, particularly its impact on the network carrier business model and the overall structure of the industry.

Small Community Air Service

In support of the Essential Air Service Program and the Small Community Air Service Development Pilot Program, this project will evaluate (1) the impacts of nearby low-fare service on traffic and service to small communities; (2) the relative cost of linking small communities to nearby jet service with air transportation versus surface transportation; (3) the likelihood of serving communities within 100 miles of a large or medium hub without subsidies; and (4) the relationship of commercial air service to small communities' economic development.

Impact of Taxes and Fees

This project will document the impact of airline taxes and fees on the demand for air service and the financial condition of the industry. In addition, work will assess the feasibility of alternative sources and distributions of revenue for supporting aviation.

North American Free Trade Agreement (NAFTA)

In support of NAFTA, this study will assess the impact of implementing provisions of the agreement that affect foreign investment and access. Efforts will include verifying baseline data and developing an analytical framework.

Safety, Energy, and Environment

Through this program, the OST analyzes, formulates, and recommends Departmental policies, plans, and guidelines regarding safety, including hazardous materials; energy issues; and the natural and human environment. Activities in FY 2005 will include the following:

Safety and Human Factors

This work focuses on two areas: (1) a crossmodal fatigue management evaluation project in coordination with the Department's Human Factors Coordinating Committee; and (2) a study of how the perception of risk influences the dispatch and operation of freight transportation conveyances.

Safe and Accessible Transportation for Older and Disabled Americans

The OST continues to emphasize the specialized transportation needs of older and disabled Americans. This research will focus on identifying useful technologies, including those dealing with pedestrian accessibility issues.

Instruments to Encourage Sustainability

This study will identify policy instruments to help transportation agencies manage the environmental impacts of transportation and take advantage of changing technologies. Work will address (1) environmental implications of increasing freight transportation, including the degree to which impacts can be mitigated at the metropolitan level; (2) policy tools to help communities use their transportation plans, resources, and programs to improve safety and mobility, reduce congestion, and support economic growth in an environmentally friendly way; and (3) implementation of a sustainable transportation partnership with other agencies and the private sector to promote a balanced multimodal approach to technology sharing with developing nations.

Energy, Environment, and Climate

This OST activity addresses the issues and environmental implications surrounding new energy and emissions technologies. In FY 2005, work will (1) explore policies that may assist the transportation industry in transitioning smoothly to new truck emission standards effective in 2007; (2) examine incentives for the availability of an alternative-fuels infrastructure; and (3) address policy issues related to a hydrogen infrastructure and to codes and standards for hydrogen-powered vehicles.

Economic and Strategic Analysis

This OST program analyzes the economic implications of public and private transportation policies, issues involving the financing of transportation infrastructure projects, and the

economic viability of new transportation technologies. In FY 2005, specific research activities will address:

Alternatives for Financing Surface Transportation Improvements

In light of the expected decline in future Highway Trust Fund revenues, this activity will examine alternatives to existing revenue sources at the Federal, state, and local levels. The revenue systems implemented in other nations and the institutional barriers to new approaches will be studied, as well as strategies and alternatives under consideration in the United States.

Passenger Rail Demand

In cooperation with the FRA, FTA, and Amtrak, this study will review current research on the factors influencing the demand for passenger rail transportation and validate hypotheses applicable to the U.S. experience. The goal is to assess the potential of improved intermodal access and connectivity at passenger terminals for increasing the financial and economic viability of rail passenger service.

Transportation and the National Economy

Transportation cost and performance play critical roles in the health of the nation's economy. This project aims to develop a better understanding of the relationship and effects of freight transportation on economic growth, performance, and global trade.

Value Pricing

This research will identify and evaluate the technology applications best suited to maximizing both the operational efficiency and political acceptability of value pricing programs. Worldwide, such programs are being viewed as a means of managing transportation capacity, improving efficiency, and increasing revenue—all within a framework of system-wide equity.

Intermodalism

Through this program, the OST coordinates Federal intermodal transportation policy, provides technical assistance to states and MPOs for intermodal planning, and coordinates Federal research on intermodalism. Work in FY 2005 will focus on the following:

DOT National Freight Action Plan

This project will provide oversight and coordination of freight activities among DOT's operating administrations in accordance with the *National Freight Action Plan*. In addition, it will evaluate various financing schemes and estimate their ability to raise adequate, equitable, and reliable resources for the development and operation of the Marine Transportation System. A third activity will analyze the economic impacts of increased transportation security. Finally, building on prior research, the OST will investigate the financial, economic, and other benefits of proposed truck-only tolled highway lanes, including projected safety outcomes.

Intermodal Passenger Terminal Projects

This effort will survey current and planned intermodal terminal projects to determine the key challenges and opportunities involved in fostering transportation links between modes. The project will synthesize lessons and practices from U.S. and European experiences that would be useful for planning and implementing future intermodal passenger terminals.

Non-Work Trips and Congestion

Although the current focus of congestion mitigation is the reduction of daily work trips, recent surveys indicate that these trips' share of personal travel—and thus of congestion—is declining. The goal of this research is to understand how congestion mitigation measures may affect non-work travel and assess the resulting policy implications.

Navigation and Spectrum Policy

Through this program, the OST formulates DOT navigation systems and spectrum policy; provides overall planning guidance on matters under DOT purview; provides guidance on the regulation or certification of government and private sector providers of navigation services; and carries out other responsibilities related to positioning, navigation, and spectrum policy and program requirements. In FY 2005, work will focus on the following activities:

GPS Protection, Coordination, and Policy Development

This effort provides Departmental leadership for representing civil needs and applications related to the GPS and GPS modernization. In FY 2005, it will support the development and implementation of policies and actions originating from national GPS policy and international negotiations, including (1) GPS architecture plans; (2) GPS management and funding; and (3) strategies for cooperating with foreign navigation, positioning, and timing systems. The project will also develop and publish the *2005 Federal Radionavigation Plan (FRP)*, the official source of U.S. policy and planning with respect to Federally provided radionavigation systems.⁸

Spectrum Protection, Coordination, and Policy Development

Spectrum is a finite national resource. To ensure that the traveling public has the safest, most effective modes of transport, DOT has a need both to protect current spectrum allocations and to seek new, innovative uses for radio technologies in transportation. This research provides the data needed to support the Department's policy positions. Research in FY 2005 will include technical analyses, economic assessments, intergovernmental coordination, and consultations with industry stakeholders.

⁸ The FRP is required by the National Defense Authorization Act of 1998 (10 U.S.C. 2281(c)) and jointly published by DOT and DOD.

5. STATE AND LOCAL RESEARCH, DEVELOPMENT, AND TECHNOLOGY ACTIVITIES

STATE PLANNING AND RESEARCH PROGRAM

Initiated in 1944 as Highway Planning and Research, the State Planning and Research (SP&R) program helps states to address their unique transportation concerns. Title 23, section 505 of the United States Code requires states to set aside 2 percent of their apportionments from various highway grants for SP&R. Of this amount, states must allocate a minimum of 25 percent for RD&T. In general, projects are funded through 80 percent Federal-aid and 20 percent state matching funds.

State DOTs select and conduct RD&T through a variety of means, including in-house staff, contracts with research organizations, and university partnerships. Highest priority is given to applied research that addresses state or regional problems. States use a portion of SP&R funds to support joint efforts such as the National Cooperative Highway Research Program (NCHRP), Transportation Pooled-Fund studies, and the Transportation Research Board (TRB). Many states also use SP&R funding to support the Local Technical Assistance Program and the University Transportation Centers.

Wisconsin DOT: SP&R Program

Wisconsin DOT's research program focuses on applied research that addresses the needs of its customers. Initiatives include:

- Evaluation of Concrete Deck and Crack Sealers
- Integrated Tools for Bridge Management
- Determination of Resilient Modulus Values for Selected Soil Distributions
- Field Validation of Modified Binder Selection Guidelines
- Development of Modulus-to-Temperature Relations for Hot-Mix Asphalt Mixtures
- Investigation of New Devices for Determining Mechanistic Properties and Performance
- Evaluation of Methods for Characterizing Air-Void Systems in Paving Concrete

Wisconsin also uses a variety of mechanisms to facilitate program planning. Among these are a crossagency Council on Research and a Technology Advancement Unit.

STATE-FUNDED RESEARCH

In addition to research supported by SP&R, some states conduct RD&T entirely with their own resources. States fund research for two primary reasons: (1) the project is so focused on a state-specific issue that it is not eligible for Federal funding; or (2) the state views research as an investment—whether focused solely on state problems or having broader applicability.

The most significant accomplishments of state-funded research are in solving state-specific problems. Since there are generally fewer administrative or management requirements with state funds, research may be accomplished more quickly and focused on urgent, short-term needs. Despite these benefits, fiscal constraints are limiting states' research investments. As reported by the American Association of State Highway and Transportation Officials (AASHTO), DOTs are finding it more difficult to devote funding to RD&T due to severe budget cutbacks.

Table 5-1 highlights examples of state transportation research funded through a variety of mechanisms.

Table 5-1. Examples of State Transportation Research

State	Topic	Problem	Solution	Benefits
Arizona	Pavement Smoothness Research	The most important roadway attribute to the traveling public is pavement smoothness.	Conduct progressive pavement research to create smoother pavements.	Smoother pavements are characteristically longer lasting and help reduce user costs.
California	Quick Change Signpost	The typical signpost replacement takes a 2-person crew 30-40 minutes. During this time, crews are subjected to the hazards posed by passing traffic.	Reduce the time needed to change a damaged sign to 10 minutes by installing a permanent, reusable concrete footing designed to accommodate wooden signposts.	Although the initial cost of the footings is \$190, subsequent replacements are \$30 less. This makes the procedure cost-effective for “high-hit” locations. Even more important is the safety benefit.
Connecticut	Bridge Monitoring	To effectively manage bridges, DOTs must assess their day-to-day condition and behavior and take effective countermeasures.	In cooperation with the FHWA and University of Connecticut, develop a network of nine in-service bridges retrofitted with automated monitoring systems.	The use of monitoring systems to determine bridge condition affords a proactive response to maintenance and inspection needs.
Michigan	Passive Cathodic Protection on PCI-Beam Ends	There is a need to determine whether passive cathodic protection systems afford sufficient protection to corroding PCI-beam ends.	Develop and evaluate passive cathodic protection systems on prestressed concrete I-beam (PCI-beam) ends that do not yet need “overcasting” repair but could use protection from further deterioration.	Michigan DOT will save money by applying this less expensive alternative.
New Jersey	Fast-Track Concrete	New Jersey has some of the highest traffic volumes in the country. When the need arises to take a lane out of service, severe traffic disruption can occur.	Develop a fast-track concrete material for pavement slab/joint removal and replacement.	While the cost is more than traditional materials, this concrete achieves the required strength in as little as 6.5 hours—significantly reducing delays from lane closures.
Pennsylvania	Bicycle-Friendly Shoulder Rumble Strips	Bicyclists are concerned about traversing rumble strips because they can be uncomfortable to ride over and may result in a loss of control.	Bicycle-friendly rumble strips that minimize vibration, discomfort, and loss of control, while transmitting sufficient auditory and tactile stimuli to drowsy or inattentive motorists.	Installed along non-freeways, the new rumble strip configurations will assist Pennsylvania DOT in reducing crashes and fatalities.
South Carolina	Use of Waste Tires for Highway Landscaping	Discarded tires are South Carolina’s most abundant waste material. The DOT and Clemson University researched the use of waste tires to reduce the amount going to state landfills.	An application for using waste tires as rubber mulch.	Although the rubber mulch is identical to traditional bark mulch, it lasts much longer—about 4 to 5 years. This offsets the initial higher cost.
Utah	Use of Carbon Fiber Wrap to Retrofit Bridges	Many bridges are nearing the end of their design life. Innovative methods are required to extend these structures’ lives and optimize limited resources.	Demonstrate how carbon fiber wrap could be applied to extend the life of bridges and enhance their seismic capacity.	This strategy is a cost-effective treatment for structures with significant corrosion. The ability to increase seismic capacity is an added advantage.

COOPERATIVE RESEARCH

Along with SP&R- and state-funded activities, DOTs partner with one another, the FHWA, universities, and the private sector to conduct RD&T. Such partnerships include state contributions to the NCHRP and transportation pooled-fund studies.

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Established in 1962, the NCHRP addresses issues of interest to state DOTs. In most cases, projects are focused on problems of immediate national concern that can be solved through applied research. Results are intended to have an impact on practice through products such as specifications, user manuals, and guidelines. States voluntarily contribute 5.5 percent of SP&R funds to support the program, which is administered by the TRB.

Projects in the NCHRP are solely the prerogative of AASHTO and its member departments. AASHTO's Standing Committee on Research selects projects annually from a list of problem statements submitted by the departments, AASHTO committees, and the FHWA. Project findings are published and disseminated in the NCHRP report series.

The credibility of NCHRP research is based, to a great degree, on the program's ability to reach consensus through technical advisory panels. Each NCHRP project is assigned to a panel, appointed by the TRB, which is looked to for technical guidance and counsel. Heavy emphasis is placed on appointing members who represent potential users of the research results.

Cooperative Research: Security

Recently, an AASHTO Security Task Force identified several high-priority areas for security research. These have resulted in both NCHRP and pooled-fund studies:

- *NCHRP projects* are developing guidelines and best practices for state DOT vulnerability assessments, security plans, and emergency response.
- Texas DOT is leading two *pooled-fund studies*: (1) Rapid Bridge Replacement, which is assessing case studies of responses to bridge failures; and (2) Bridge Design, Construction, and Retrofit, which is surveying and synthesizing guidance on design and construction practices that make bridges less vulnerable to attack.

TRANSPORTATION POOLED-FUND PROGRAM

The pooled-fund program allows Federal, state, and local agencies, as well as other organizations, to combine resources to support RD&T. To qualify, more than one partner must find a study important enough to commit funds or other resources. If a subject has been studied previously, the new effort should complement or advance previous investigations.

A Federal, state, regional, or local transportation agency may initiate a pooled-fund project. Private companies, foundations, and academic institutions can partner with any or all of the sponsoring agencies. The FHWA provides financial management of the program.

State DOTs' interest in pooled-fund studies stems from their ability to cooperatively address problems through a leveraged funding mechanism. In 2003, the program included 151 state-led

studies and 139 FHWA-led projects—with a total value of approximately \$130 million. Details on individual pooled-fund studies are available at <http://www.pooledfund.org/>.

TECHNOLOGY TRANSFER AND DEPLOYMENT

“Technology transfer” refers to those activities leading to the adoption of new techniques or products. State DOTs undertake a variety of such efforts, using both SP&R and state-only funds. For instance, states often include technology transfer in their SP&R work programs—either as part of a research project or as a stand-alone effort. Among states’ technology transfer and deployment activities are conferences and workshops; demonstrations of successful technologies; publication and dissemination of reports; and development of reference materials such as specifications, design guides, and manuals. States also work with the TRB to share experiences through the Transportation Research Information System. Table 5-2 provides specific examples of state technology transfer activities.

Table 5-2. State Technology Transfer and Deployment Activities

State	Topic	Description
Arizona	511 Enhancement	The Arizona DOT, in collaboration with Maricopa County, the cities of Phoenix and Tucson, and several Metropolitan Planning Organizations, has recently made enhancements to its 511 system. These include interactive voice recognition; updates of travel conditions in a general region in addition to full reports on specific routes; and information on nonrecurring congestion, roadway construction, weather conditions, and traffic incidents.
California	Preventative Maintenance Forum	Hosted by California DOT and the California Chip Seal Association, a recent pavement maintenance forum brought together more than 200 road surface and materials experts, as well as other transportation professionals, to address the economic necessity of practicing preventative maintenance.
Georgia	Regional Incident Management Assessment	Georgia DOT recently conducted an FHWA Traffic Incident Management (TIM) self-assessment at a meeting of the Metro Atlanta Traffic Incident Management task force. The effort was one of the first to use the TIM self-assessment tool to address regional incident management issues.
Michigan	Smart Traffic Signal System	Developed by Oakland County, Michigan, FAST-TRAC is the largest, and one of the oldest, “adaptive” traffic signal systems in North America. Studies show that the system reduces motorist travel time by up to 32 percent in off-peak times and 9 percent during rush hours, while reducing serious injury accidents by over 50 percent.
Nebraska	SAFER Barrier	The University of Nebraska’s Midwest Roadside Safety Facility (MwRSF) has developed a SAFER (Steel and Foam Energy Reduction) barrier that has been tested and installed in all four turns of the Indianapolis Motor Speedway. The barrier absorbs energy during a crash—giving the driver a better chance of survival in crashes up to 150 miles per hour. The MwRSF is looking for ways to incorporate the barrier on highways.
New York	Structural Health Workshop	The New York DOT Research and Development Bureau recently published the proceedings of its workshop on engineering structural health. Held in 2003, the meeting focused on sensor allocation and measurement, structural identification, damage detection, and decision making.

AASHTO TECHNOLOGY IMPLEMENTATION GROUP

In addition to the activities in Table 5-2, Table 5-3 shows several technologies that are ready for implementation. All developed by state DOTs, these technologies were identified by AASHTO’s Research Advisory Committee in response to a request from its Technology Implementation Group (TIG).

Each year, the TIG identifies technologies for emphasis in the following year and develops individual deployment plans. The FHWA and AASHTO provide “seed money” for implementation. Table 5-4 shows the technologies identified for 2001, 2002, and 2003.

Table 5-3. State Technologies Ready for Implementation

Technology	Description
California Automated Roadside Debris Vacuum	This add-on vacuum system for sewer and ditch cleaning trucks makes litter removal safer and 500 percent more efficient. It allows for regular collection of litter while greatly reducing the hazardous manual labor involved.
Florida Drilled Shaft Grouting in Sand	When deep foundations are constructed in sandy soils, the end bearing is typically discounted due to the large displacements required to mobilize a reasonable capacity. Post-grouting the tip provides the needed capacity at reduced depths, reducing overall project costs.
Illinois Interlayer Stress-Absorbing Composites (ISAC)	The use of 2- to 3-inch-thick asphalt concrete overlays results in susceptibility to reflection cracking from joints and cracks in the underlying pavement. Once cracks reach the surface of the pavement, water can enter the system and cause deterioration, leading to potholes. The ISAC technology provides a solution to the reflection-cracking problem.
Kansas Air Void Analyzer (AVA)	The AVA is a portable device that measures the entrained air void structure of fresh concrete in about 30 minutes. It can be used at the job site to make admixture adjustments that can dramatically improve the air void structure—and thus freeze-thaw durability.
Kansas Fiber-Reinforced Polymer (FRP) Bridges	FRP bridges save costs on a life-cycle basis, extend the time between bridge closures for maintenance, and cut the time for construction. Installation time for deck replacements is measured in days and accomplished with light-duty equipment.
Maine Full Depth Reclamation (FDR)	FDR is a cost-effective, in-place recycling technique used by many transportation agencies for roadway rehabilitation.
Missouri Work Zone Strategies	These strategies decrease road user delays and confusion in work zones by identifying and avoiding work during peak traffic times, providing greater communication with the public, and managing work more efficiently.
Nevada FRP Seismic Retrofit	This technology improves confinement and shear strength of columns with variable cross sections by providing an FRP jacket, without significantly increasing shear demand.
New Jersey Crash Notification System	This system provides vital notification to emergency response units, even when a driver is unable. The information helps units locate accidents and estimate their severity.
New Jersey Portable Seismic Pavement Analyzer	This equipment has greater sensitivity to pavement delamination than the traditional chain drag. It can be used to produce a 3-D image of the delaminated area and to evaluate elastic moduli of a deck or pavement slab for quality control purposes.
Oregon Rockfall Catchment Area Design Guide	This guide allows both risk assessment of existing rock slopes and design of new slopes to meet rockfall retention criteria based on empirical probability. A designer can use the guide to determine slope/ditch configurations to retain 30 to 99 percent of rockfall.
South Dakota Non-Corrosive, Environmentally Benign De-icer	This technology meets three important needs: (1) effective de-icing and anti-icing; (2) non-corrosive material suitable for use on high-cost, steel-reinforced structures and roadways; and (3) minimal environmental impact.
Texas Ground-Penetrating Radar (GPR)	GPR provides a nearly continuous estimate of surface-layer thickness, giving highway engineers a more accurate picture of the road’s subsurface. It collects information about highway base layers with greater accuracy and with lower costs in labor, time, and delay.
Utah Design-Build Process	Projects constructed using design-build can be completed in less time, since the design can be overlapped with the construction. This results in savings to the traveling public due to reduced project delays.
Utah Global Positioning System (GPS) Surveying	The use of GPS has resulted in increased productivity and lower overall costs than traditional survey methods, with labor reductions of 60 to 90 percent. The accuracy of the data is better or at least comparable to traditional methods.
Washington State Ramp-Metering Algorithm	This easier-to-use ramp-metering algorithm has reduced total travel time system-wide, increasing traffic flow in comparison to previous algorithms.

Table 5-4. TIG Focus Technologies

2001	
Accelerated Construction Technologies	This activity promotes creative techniques to reduce construction time, including innovative contracting practices that reduce congestion and enhance quality and safety.
Intelligent Transportation System (ITS) Technologies for Work Zones	In work zones, ITS technologies increase safety for workers and road users and ensure a more efficient traffic flow. These technologies—which include ramp metering, intrusion alarms, and queue detection—monitor and manage traffic through and around work zones to minimize the impact of delays.
Prefabricated Bridge Elements and Systems	These elements and systems may be manufactured on- or off-site and brought to the job location ready to install. They minimize the traffic impacts of bridge construction, improve safety, make construction less disruptive to the environment, and lower life-cycle costs.
2002	
Air Void Analyzer	The AVA measures the air content, specific surface, and spacing factor of fresh portland cement concrete in real time. Implementation goals include the development of common test protocols, specifications, and data collection forms.
Ground-Penetrating Radar	This vehicle-mounted technology collects information about highway pavement layer thickness without incurring the time, labor costs, and traffic delays associated with traditional methods.
Global Positioning System	With satellites that transmit signals continuously, the GPS has many highway applications, including surveying pavement conditions and inventorying highway assets. Use of the GPS increases accuracy and reduces labor, time, and costs.
2003	
Thermal Imaging Safety Screening System for Commercial Vehicle Brakes	This system allows a weigh-station operator to view the relative temperatures of brake drums through the wheel rims of commercial vehicles. When a brake is defective, the brake drum appears to be the same temperature as the wheel rim and darker than a properly operating brake. The system was developed using off-the-shelf components and advanced infrared technology.
Low-Cost Highway–Rail Warning System	This active warning system can replace passive warning signs at low-volume highway–railroad intersections. It consists of locomotive-installed hardware and a crossing device mounted on standard crossing poles. Wireless communication between the locomotive and device activates the warning signal.
FRP Repair of Overhead Sign Supports	FRP can be used to repair cracks in, and provide structural integrity to, overhead sign supports. It can also prevent subsequent support failure.

Recently, the TIG and FHWA held a workshop on the benefits of effective technology implementation. The meeting afforded an opportunity to share implementation strategies, as well as methods for measuring their effectiveness. Participants included AASHTO committee chairs, state DOT engineers, and the FHWA.

PERFORMANCE MANAGEMENT AND MEASUREMENT

PEER EXCHANGE

Required under 23 CFR, Section 420.209(a)(7), peer exchanges among state transportation researchers are an effective tool for fostering excellence in research management. Such exchanges provide an opportunity for sharing best practices through an open exchange of knowledge and ideas.

Among state DOTs there has been a strong positive reaction to the first series of peer exchanges, which covered general program management issues. The results are reported in two NCHRP reports: *Documenting Peer Exchange Administrative Experiences* (NCHRP Project No. 20-38A) and *Peer Exchange: A Value-Added Program Management Tool* (NCHRP Project 20-7, Task 125).

States are currently conducting the second round of peer exchanges. For this round, they have the option of selecting focus areas for in-depth feedback. Among the areas that states have selected for peer exchanges are university research, technology transfer, and performance measurement.

ASSESSING RESEARCH PERFORMANCE

State DOTs assess the performance of their research through various means, including cost-benefit analysis, budget- and scheduling-related measures, post-project implementation, and indicators tied to strategic goals. Due to the difficult and often intangible nature of measuring outcomes, most measures focus on program outputs. Another issue is the long timeframe for developing and implementing research. NCHRP Synthesis 300, *Performance Measures for Research, Development, and Technology Programs*, details some best practices among state research offices for assessing RD&T.

In December 2002, Florida DOT hosted a three-day workshop on research performance measures. Attended by the FHWA, TRB, and representatives from 22 states, the workshop identified the following needs:

- Research evaluation methods tailored to the different types of RD&T projects.
- A toolbox of best practices (both qualitative and quantitative) for measuring research performance and value.
- A process for collecting and analyzing data routinely made available by state DOTs to improve reporting of research results.

To address these needs, the AASHTO has approved the use of NCHRP funds to document best practices and develop a web-based tool for compiling data on state research results. This work, which will be completed in June 2005, will yield better information on the contributions of state RD&T and on the best methods for assessing them.

Iowa DOT: Peer Exchange

In October 2003, Iowa DOT hosted a peer exchange focusing on research performance measures and program evaluation. Among the best practices that were shared were cost-benefit methodologies; technical panels; customer satisfaction surveys; assessment of risk versus reward; research progress reports; and measurement dashboards.

6. ASSESSING RESEARCH, DEVELOPMENT, AND TECHNOLOGY

R&D INVESTMENT CRITERIA

As discussed in Section 2, the Administration's R&D investment criteria provide broad guidelines for planning and managing all levels of Federal RD&T. Each of the criteria has both prospective and retrospective elements:

- *Relevance*: Programs must have complete plans, with clear goals and priorities; must articulate their potential public benefits; and must be relevant to national and customer needs. Agencies must assess relevance periodically through both prospective and retrospective independent review.
- *Quality*: Programs must use clearly stated, defensible methods for awarding funding; those allocating funds through means other than a competitive, merit-based process must justify funding methods and document how quality is maintained. Agencies must assess the quality of research using retrospective reviews by technical experts.
- *Performance*: Programs must maintain long-term objectives—with annual measures and targets—and define appropriate outputs, outcomes, schedules, and decision points. Agencies should express program results in terms of public benefits. Performance must be retrospectively documented annually.

The R&D investment criteria have three aims: (1) improve program management; (2) inform funding decisions; and (3) increase public understanding of the benefits of Federal research. As stated by the Office of Management and Budget (OMB), applying the criteria affords agencies several potential benefits:⁹

- Both agencies and the Administration are able to make program decisions based on information beyond anecdotes and prior-year funding levels.
- The improved process for budgeting, selecting, and managing RD&T programs increases the overall productivity of the Federal research portfolio.
- The criteria communicate the Administration's expectations for proper program management and set standards for information provided in program plans and budget justifications.
- Application of the criteria helps to improve public understanding of the benefits and effectiveness of Federal RD&T.

Through its Research and Technology Coordinating Council (RTCC), DOT is implementing the criteria through an enhanced process for coordinating and evaluating RD&T. A primary mechanism is the periodic review of operating administrations' RD&T programs. Tables 6-1 through 6-7 show the results of the RTCC reviews for FY 2004.

⁹ Memorandum for the Heads of Executive Departments and Agencies, M-03-15, June 5, 2003.

Table 6-1. RTCC Review of FHWA Program

R&D Investment Criterion	Program Evidence
<i>Relevance</i>	<ul style="list-style-type: none"> • Research program is mission-oriented and supports FHWA and DOT goals. • Stakeholders are engaged throughout the R&T process, including agenda setting and planning. • Stakeholders are involved in agenda setting and planning through the Transportation Research Board (TRB) Research and Technology Coordinating Committee, the National Partnership Initiative, and other advisory groups. • Stakeholders are engaged in the development of multi-year program plans, which are revisited annually. • External experts and advisory groups ensure program relevance throughout the research process itself. • Stakeholders are engaged in technology transfer and innovation delivery activities. • The program employs a number of mechanisms for customer feedback, including surveys and focus groups.
<i>Quality</i>	<ul style="list-style-type: none"> • Investment decisions are based on competition and merit review whenever possible. • External experts are consulted frequently during the conduct of research; merit reviews of results are encouraged. • An assessment process for the FHWA’s 24 laboratories provides independent expert evaluation of research efforts.
<i>Performance</i>	<ul style="list-style-type: none"> • Stakeholders are involved in reviewing performance retrospectively. • The FHWA has conducted cost-benefit studies for elements of the program. • Program results are linked to the FHWA and DOT performance plans. • Performance is documented in an annual performance report.

Table 6-2. RTCC Review of FMCSA Program

R&D Investment Criterion	Program Evidence
<i>Relevance</i>	<ul style="list-style-type: none"> • Research supports both FMCSA and DOT safety goals. • Customers and stakeholders are involved in developing a draft FMCSA <i>5-Year R&T Strategic Plan</i>. • Program managers work closely with committees and research boards, including the TRB and the Association of American State Highway and Transportation Officials. • An intermodal management council sets priorities for Intelligent Transportation System (ITS) activities. • Several research projects are carried out in partnership with industry.
<i>Quality</i>	<ul style="list-style-type: none"> • Annual stakeholder forums afford customer review of research quality. • Expert panels review selected research projects. • Research is peer-reviewed internally and assessed at the program level. • Competitive procurements specify that support for FMCSA goals is a requirement.
<i>Performance</i>	<ul style="list-style-type: none"> • Performance is linked to FMCSA and DOT goals and documented annually in the Department’s performance plan. • Quantitative indicators include the number of studies developed, papers presented, and technologies under evaluation. • Cost-benefit analyses assess the performance of the ITS elements of the program.

Table 6-3. RTCC Review of NHTSA Program

R&D Investment Criterion	Program Evidence
<i>Relevance</i>	<ul style="list-style-type: none"> • Research program is mission-oriented and supports NHTSA and DOT goals. • Specific goals and priorities for the next five years are laid out in the <i>NHTSA Vehicle Safety Rulemaking and Research Priority Plan</i>. • NHTSA’s research programs support regulatory actions and other initiatives that prevent thousands of fatalities and serious injuries each year. • NHTSA research addresses clearly identified safety problems and seeks new solutions that make maximum use of advanced technologies. • Research programs often involve cooperative efforts with foreign governmental agencies, the automotive industry, and other vehicle-safety-related organizations.
<i>Quality</i>	<ul style="list-style-type: none"> • NHTSA research findings are frequently presented to other NHTSA offices, thus ensuring critical internal review. • NHTSA research findings are frequently presented to the public in a variety of formats, ensuring critical outside review. • NHTSA research results are presented in international forums and are often the basis of actions taken by international bodies. • Investment decisions are based on competition and merit review whenever possible.
<i>Performance</i>	<ul style="list-style-type: none"> • Key research milestones are identified and tracked in performance targets. • The NHTSA research program provides input for cost-benefit studies of alternative solutions to safety problems.

Table 6-4. RTCC Review of FRA Program

R&D Investment Criterion	Program Evidence
<i>Relevance</i>	<ul style="list-style-type: none"> • All R&D elements contribute to Departmental and FRA goals. • Developed with other DOT agencies and key stakeholders, a five-year strategic R&D plan outlines a vision for the future and the technologies needed to realize it. • The TRB Committee for Review of the FRA Research, Development, and Demonstration Programs provides annual prospective and retrospective review. • Other inputs to the R&D planning process include coordination with the FRA’s Office of Safety, the American Public Transportation Association Research Needs Conference, the Highway–Railroad Grade Crossing Research Needs Conference, and the Association of American Railroads Railway Technology Working Committee and Tank Car Committee.
<i>Quality</i>	<ul style="list-style-type: none"> • The FRA awards research contracts and grants on a competitive basis to the greatest extent possible. • The TRB conducts periodic peer reviews of the FRA’s R&D programs that address (1) the management structure and approach; (2) the direction and allocation of funds; and (3) the appropriate balance of Federal, state, and private sector inputs and costs.
<i>Performance</i>	<ul style="list-style-type: none"> • Inputs are tracked via an annual procurement plan; monthly obligations reports; and monthly progress reports that track actual vs. planned technical accomplishments, costs, and schedules. • All FRA R&D contributes to the goals in the FRA’s and Department’s annual performance plans; the FRA is developing annual and long-term measures and targets to accurately assess the progress of its R&D in meeting these goals. • The DOT <i>Performance and Accountability Report</i> provides a public accounting of FRA performance against the goals in the previous year’s performance plan.

Table 6-5. RTCC Review of FTA Program

R&D Investment Criterion	Program Evidence
<i>Relevance</i>	<ul style="list-style-type: none"> • Research program is mission-oriented and supports FTA and DOT strategic goals. • Stakeholders are engaged throughout the process, including agenda setting and planning. • Program managers work closely with committees and research boards, including the TRB and organizations such as the American Public Transportation Association. • Stakeholders are involved in agenda setting and planning through the TRB’s Transit Research Analysis Committee. • Stakeholders are engaged in the development of a Strategic Transit Research Plan. • External experts and advisory groups ensure program relevance throughout the research process itself. • Stakeholders are engaged in technology transfer and innovation delivery activities. • Prospective projects are evaluated on a scorecard system that incorporates the relevance criterion of the OMB R&D investment criteria.
<i>Quality</i>	<ul style="list-style-type: none"> • Investment decisions are based on competition and merit review whenever possible. • External experts are frequently consulted during the conduct of research; merit reviews of results are encouraged.
<i>Performance</i>	<ul style="list-style-type: none"> • Stakeholders are involved in reviewing performance retrospectively. • Program results are linked to the FTA and DOT performance plans. • All research projects are required to obtain approval of their performance measurement plan.

Table 6-6. RTCC Review of FAA Program

R&D Investment Criterion	Program Evidence
<i>Relevance</i>	<ul style="list-style-type: none"> • Goals, priorities, and benefits are laid out in the <i>National Aviation Research Plan</i> and the <i>R&D Strategy</i>; these support both the FAA and DOT strategic plans. • Relevance is assessed both prospectively and retrospectively through the Research, Engineering, and Development Advisory Committee (REDAC) and other external review mechanisms. • Within the FAA, researchers work closely with agency customers to ensure the continuing relevance of research products.
<i>Quality</i>	<ul style="list-style-type: none"> • The FAA uses both an external and an internal peer-review process to ensure quality. • Managers prepare and vet program plans through a process that ensures good science and proper use of public funds. • Program quality is assessed retrospectively through the REDAC and other regular and ad hoc reviews.
<i>Performance</i>	<ul style="list-style-type: none"> • The program has long-term performance measures tied to specific research projects that support accomplishment of national and agency goals. • The program has annual performance measures that can demonstrate progress toward long-term goals. • Performance is documented in an annual performance plan and in quarterly and annual performance plan goal reports.

Table 6-7. RTCC Review of RSPA Program

R&D Investment Criterion	Program Evidence
<i>Relevance</i>	<ul style="list-style-type: none"> • All RSPA RD&T supports DOT objectives for safety, environment, and organizational excellence. • Planning workshops held by RSPA’s Office of Pipeline Safety (OPS) provide stakeholder input on RD&T gaps and priorities. • An OPS Blue Ribbon Panel comments on program priorities and performance measures. • The TRB Committee for Review of the National Transportation Science and Technology Strategy oversees and reports on RSPA strategic planning activities. • A review of the University Transportation Centers (UTC) program by George Washington University (GWU) found that all stakeholders surveyed had “extremely favorable” or “somewhat favorable” impressions of the program.
<i>Quality</i>	<ul style="list-style-type: none"> • To the extent possible, RSPA awards research contracts and grants through a competitive, merit-based process. • Retrospective quality review is provided through the TRB, OPS Blue Ribbon Panel, and customer outreach.
<i>Performance</i>	<ul style="list-style-type: none"> • GWU found that the UTCs are achieving the three core objectives of the program as directed by Congress. • RSPA’s RD&T budget aligns program activities with specific performance goals. • The budget identifies sources of data for measuring success or failure in achieving the goals. • All goals support broader DOT strategic and organizational excellence objectives. • RD&T performance is retrospectively documented in DOT’s <i>Annual Performance and Accountability Report</i>.

PROGRAM ASSESSMENT RATING TOOL

The OMB’s Program Assessment Rating Tool, or PART, assesses how well agencies are implementing the R&D investment criteria in their research programs. Essentially a questionnaire, the PART measures all aspects of program planning, budgeting, and management. There is a different PART for each of seven types of Federal programs: direct Federal programs, competitive grant programs, block/formula grant programs, regulatory-based programs, capital assets and service acquisition programs, credit programs, and R&D programs. All PARTs have four sections:

- *Program Purpose and Design*—Assesses whether a program’s purpose and design are clear and sound. On the R&D PART, the majority of questions are designed to assess the criterion of program relevance.
- *Strategic Planning*—Assesses whether the agency has established valid long-term and annual goals for the program. Questions on the R&D PART address the prospective aspects of the investment criteria, especially prospective performance.
- *Program Management*—Assesses agency management of the program, including financial oversight and improvement efforts. In addition to general management issues, questions on the R&D PART address prospective quality and performance.

- *Program Results and Accountability*—Assesses whether a program is meeting its annual and long-term goals and how effective the program is based on independent evaluations. For R&D programs, this section addresses the retrospective aspects of all three investment criteria, particularly program performance.

Table 6-8 shows the relationship between the R&D investment criteria and the PART. It also provides examples of evidence for the PART that indicates how agencies are meeting the investment criteria.

Table 6-8. Relationship Between R&D Investment Criteria and PART

Relevance		Quality		Performance	
<i>Prospective</i> PART Sections I & II	<i>Retrospective</i> PART Sections I & IV	<i>Prospective</i> PART Section III	<i>Retrospective</i> PART Section IV	<i>Prospective</i> PART Sections II & III	<i>Retrospective</i> PART Section IV
A clear and unambiguous mission	Regularly scheduled independent evaluations with a plan for addressing conclusions	Competitive, merit-based process for awarding funds (competitive grant programs) or some other clearly stated, defensible method for allocating funding	Regularly scheduled independent evaluations with a plan for using the results to guide future funding decisions	Two or three specific, easily understood long-term outcome measures and targets	Annual documentation of performance against planned program targets, outputs, schedules, and costs
A program plan defining broad issues and goals, priorities, required resources, and outputs				A limited number of annual measures and targets that support the long-term goals	
Authorizing legislation				Planned program outputs, schedules, and costs	Assessments of customer satisfaction
Documentation of potential benefits					
Independent review by customers and/or advisory bodies					

Approximately 20 percent of Federal programs by budget are evaluated through the PART process. By FY 2008, all Federal programs will have undergone a PART analysis.

Among the Department’s RD&T programs, the FAA’s Research, Engineering, and Development has been assessed. Evaluated for the FY 2005 budget, this program was rated “Effective” as a result of its PART analysis.¹⁰ DOT and OMB are jointly assessing RD&T programs in three additional operating administrations for FY 2006: the FHWA, FRA, and NHTSA. The FHWA and NHTSA have already used the PART to evaluate their programs ahead of the budget schedule.

¹⁰ The PART showed that the FAA program is meeting or exceeding its annual targets and making significant progress toward its long-term goals.

RELATIONSHIP TO GOVERNMENT PERFORMANCE AND RESULTS ACT

The R&D investment criteria and PART complement the 1993 Government Performance and Results Act (GPRA), which requires agencies to prepare strategic plans and to develop and use performance measures to manage their programs. Reported in annual performance plans, these GPRA measures focus on broad outcomes rather than specific program results.

In particular, the PART strengthens and reinforces the GPRA by (1) encouraging careful development of outcome measures; and (2) requiring that agency goals be appropriately ambitious. Performance measures included in agencies' GPRA plans and reports and those developed for the PART must be consistent. Moreover, as stated by the OMB, the PART process helps agencies to integrate operational decisions with strategic and performance planning by:¹¹

- Improving performance measures over time through the PART review.
- Aligning programs with budgets.
- Aligning programs and measures with GPRA goals.

The remainder of this section addresses the issue of effectively measuring RD&T performance.

DEVELOPING RD&T PERFORMANCE GOALS

The PART requires that agencies develop and define two types of performance goals:

- *Long-term performance goals*—Two to three easily understood outcome measures and targets that directly and meaningfully support the program's purpose over a period of time consistent with the agency's strategic plan (typically 5-10 years).
- *Annual performance goals*—Discrete, quantifiable measures and targets that gauge the program's progress toward achieving its long-term performance goals.

Agencies begin with identifying a program's purpose or strategic goals and then, based on these, the relevant performance goals. These goals are a combination of performance measures and targets. *Performance measures* reflect specific outcomes and outputs and are the indicators used to gauge program results. *Targets* are the

Performance Measurement Definitions

- *Performance goals*: A combination of performance measures (outcomes or outputs) and targets (levels of those measures).
- *Outcomes*: The intended result or consequence that will occur from carrying out a program activity. Outcomes are of direct importance to the public.
- *Outputs*: The goods or services produced by a program. These should describe the level of activity that will be provided over a period of time and be logically connected to intended outcomes.

Measures of outcomes, rather than outputs, are more appropriate for the PART, since they represent the direct public benefits; however, output measures may be acceptable for some research activities.

¹¹ Instructions for the Program Assessment Rating Tool for FY 2006.

quantifiable or otherwise measurable characteristics that tell how well a program must accomplish a given performance measure.

For the purposes of the PART, the best performance goals are those that capture a program’s mission, inform budget decisions, and are clear to program users and partners. As stated above, these program-specific goals should complement the broader goals identified in agencies’ strategic and performance plans.

DOT PERFORMANCE GOALS

Table 6-9 on the next page shows the five-year outcomes and goals identified in DOT’s *Strategic Plan 2003-2008*. These long-term goals provide the framework for RD&T planning across the Department and are the basis for all programmatic performance assessment, including the PART process. Following Table 6-9, Tables 6-10 through 6-17 show the performance goals submitted with operating administrations’ FY 2005 RD&T budgets and the DOT goals that they support.¹²

Shown below, Figure 6-1 summarizes Tables 6-9 through 6-17, indicating which modal RD&T programs measure performance against each of DOT’s strategic objectives.

<i>RD&T Program</i>	Safety	Mobility	Global Connectivity	Environment	Security
<i>FHWA</i>	X	X	X	X	X
<i>FMCSA</i>	X				
<i>NHTSA</i>	X				
<i>FRA</i>	X	X		X	
<i>FTA</i>	X	X	X	X	X
<i>FAA</i>	X	X		X	
<i>RSPA</i>	X			X	
<i>OST</i>	X		X	X	

Figure 6-1. RD&T Program Support for DOT Strategic Objectives

As shown, each of the administrations assesses the performance of its RD&T against DOT’s highest priority: transportation safety. Other top objectives for RD&T are support for environmental stewardship and for mobility. Also important, though not as directly relevant for RD&T, are efforts contributing to DOT objectives for global connectivity and security.

¹² Except for the FAA (see below), all performance goals are from the Department’s FY 2005 budget request. Agencies’ performance plans may include other performance measures and targets.

Table 6-9. DOT Strategic Outcomes and Performance Goals

Strategic Objective	Outcomes	Performance Goals (Measures + Targets)
<i>Safety</i>	<ul style="list-style-type: none"> • <i>Reduction in transportation-related deaths</i> • <i>Reduction in transportation-related injuries</i> 	<ul style="list-style-type: none"> • By 2008, reduce highway fatalities to 1.0 per 100 million vehicle-miles traveled and large truck fatalities to 1.65 per 100 million truck-miles traveled. • By 2008, reduce commercial aviation fatal accidents to 0.01 per 100,000 departures and general aviation fatal accidents to 325. • By 2008, reduce train accidents and incidents to 16.14 per million train miles. • By 2008, reduce transit fatalities to 0.488 per 100 million passenger miles. • By 2008, reduce total incidents for gas and hazardous liquid pipelines to 307. • By 2008, reduce the number of serious hazardous materials incidents to 488.
<i>Mobility</i>	<ul style="list-style-type: none"> • <i>Improved infrastructure in all modes</i> • <i>Reduced congestion in all modes</i> • <i>Increased reliability throughout the system</i> • <i>Increased access for all Americans</i> 	<ul style="list-style-type: none"> • By 2008, increase the percentage of vehicle-miles traveled on pavement with acceptable ride quality to 94.9 percent. • By 2008, decrease the growth in the percentage of urban area road travel occurring in congested conditions by 0.2 percent annually. • By 2008, increase the percentage of flights arriving on time to 83.64 percent. • By 2008, increase bus and transit rail fleets' compliance with the Americans With Disabilities Act to 100 percent.
<i>Global Connectivity</i>	<ul style="list-style-type: none"> • <i>Reduced barriers to trade in transportation goods and services</i> • <i>More efficient movement of cargo throughout the supply chain</i> • <i>Enhanced international competitiveness of U.S. transport providers and manufacturers</i> • <i>Harmonized and standardized regulatory and facilitation requirements</i> • <i>The most competitive, cost-effective, and efficient environment for passenger travel</i> 	<ul style="list-style-type: none"> • Number of passengers in international markets with Open Skies aviation agreements (<i>2008 target under development</i>). • Through 2008, maintain the U.S. St. Lawrence Seaway lock availability at 99 percent. • Travel time in freight-significant corridors (<i>2008 target under development</i>). • Border-crossing delay (<i>2008 target under development</i>). • Number of overseas airport slots opened to competition through aviation agreements (<i>2008 target under development</i>). • Number of regulatory requirements formalized (<i>2008 target under development</i>). • Number of passenger travel markets opened to competition through multilateral or regional agreements (<i>2008 target under development</i>).
<i>Environment</i>	<ul style="list-style-type: none"> • <i>Reduced pollution and other adverse environmental effects of transportation and transportation facilities</i> • <i>Streamlined environmental review of transportation infrastructure projects</i> 	<ul style="list-style-type: none"> • By 2008, reduce the number of people exposed to significant aviation noise to 396,000. • Ratio of wetland acres replaced per acre unavoidably affected by Federal-aid Highway projects (<i>2008 target under development</i>). • Tons of hazardous liquid materials spilled per million ton-miles shipped by pipeline (<i>2008 target under development</i>). • 12-month moving average number of area transportation emissions conformity lapses (<i>2008 target under development</i>). • Percentage of DOT facilities characterized as No Further Remedial Action Planned under the Superfund Amendments and Reauthorization Act (<i>2008 target under development</i>). • By 2008, reduce the median time to complete Environmental Impact Statements to 36 months and Environmental Assessments for DOT-funded infrastructure projects to 12 months.

Table 6-9. DOT Strategic Outcomes and Performance Goals (Cont.)

Strategic Objective	Outcomes	Performance Goals (Measures + Targets)
<i>Security</i>	<ul style="list-style-type: none"> All modes have implemented steps that would prepare them for a rapid recovery of transportation from intentional harm and natural disasters The U.S. transportation system meets national security requirements 	<ul style="list-style-type: none"> By 2008, achieve an “A” rating indicating all modes have taken steps needed for a rapid recovery from intentional harm and natural disasters. Through 2008, maintain the timely availability of DOD-required shipping capacity at 94 percent of that required; maintain the timely availability of DOD-required commercial port use at 93 percent of that required.

Table 6-10. FHWA RD&T Performance Goals

DOT Goals	FHWA Performance Goals
<p>Safety By 2008, reduce highway fatalities to 1.0 per 100 million vehicle-miles traveled and large truck fatalities to 1.65 per 100 million truck-miles traveled.</p>	<p>Reduce highway fatalities to 1.38 per 100 million vehicle-miles traveled by 2005.</p>
<p>Mobility By 2008, increase the percentage of vehicle-miles traveled on pavement with acceptable ride quality to 94.9 percent.</p> <p>By 2008, decrease the growth in the percentage of urban area road travel occurring in congested conditions by 0.2 percent annually.</p>	<p>Increase the percentage of travel on the National Highway System (NHS) meeting pavement performance standards for acceptable ride to 93.5 in 2005 from 90.6 in 2002.</p> <p>In 2005, keep the total urban area road travel time that occurs in congested conditions at 32.8 percent.</p>
<p>Global Connectivity Reduce travel time in freight-significant corridors.</p> <p>Reduce border-crossing delay.</p>	<p>Reduce travel time in significant freight corridors (<i>target under development</i>).</p> <p>Reduce delay per 1,000 commercial vehicles processed at NHS border crossings (<i>target under development</i>).</p>
<p>Environmental Stewardship 12-month moving average number of area transportation emissions conformity lapses.</p> <p>Increase the ratio of wetland acres replaced per acre unavoidably affected by Federal-aid Highway projects.</p> <p>By 2008, reduce the median time to complete Environmental Impact Statements to 36 months and Environmental Assessments for DOT-funded infrastructure projects to 12 months.</p>	<p>In 2005, maintain the 12-month moving average number of area transportation emissions conformity lapses at 6.0.</p> <p>In 2005, replace an average of 1.5 acres of wetlands for every acre adversely affected on a program-wide basis.</p> <p>Decrease the median completion time for all Environmental Impact Statements and Environmental Assessments in Federal-aid Highway and Federal Lands Highway projects from 45 and 15 months, respectively.</p>
<p>Security By 2008, achieve an “A” rating indicating all modes have taken steps needed for a rapid recovery from intentional harm and natural disasters.</p>	<p>Complete security plans and standards with industry.</p> <p>Identify critical bridges and tunnels.</p> <p>Improve emergency preparedness in the top 30 metropolitan areas considered at significant risk.</p>

Table 6-11. FMCSA R&T Performance Goals

DOT Goals	FMCSA Performance Goals
<p>Safety* By 2008, reduce highway fatalities to 1.0 per 100 million vehicle-miles traveled and large truck fatalities to 1.65 per 100 million truck-miles traveled.</p> <p>By 2008, reduce the number of serious hazardous materials incidents to 488.</p>	<p>Reduce the rate of large-truck-related fatalities per 100 million truck-miles traveled to 1.96 in 2005.</p> <p>In 2005, reduce serious, reportable truck-related hazardous materials incidents to 409 from a 2000 baseline of 463.</p>

*All FMCSA R&T supports DOT's Strategic Safety Objective.

Table 6-12. NHTSA RD&T Performance Goals

DOT Goals	NHTSA Performance Goals
<p>Safety* By 2008, reduce highway fatalities to 1.0 per 100 million vehicle-miles traveled and large truck fatalities to 1.65 per 100 million truck-miles traveled.</p>	<p>Reduce the rate of alcohol-related highway fatalities per 100 million vehicle-miles traveled to 0.53.</p> <p>Increase safety belt use to 80-85 percent of the driving population by 2005.</p> <p>By 2005, increase restraint use among children age 0-7 to 91 percent.</p> <p>Reduce the rate of passenger vehicle occupant highway fatalities to 1.15 per 100 million passenger VMT by 2005.</p> <p>Reduce the rate of increase in motorcycle rider highway fatalities per 100 million motorcycle VMT to 37 by 2005.</p> <p>By 2005, reduce the rate of non-occupant highway fatalities per 100 million VMT to 0.16.</p>

*All NHTSA RD&T supports DOT's Strategic Safety Objective.

Table 6-13. FRA RD&T Performance Goals

DOT Goals	FRA Performance Goals
<p>Safety By 2008, reduce train accidents and incidents to 16.14 per million train miles.</p> <p>By 2008, reduce the number of serious hazardous materials incidents to 488.</p>	<p>By 2005, reduce train accidents and highway-rail incidents per million train miles to 17.14 from 17.84 in 2003.</p> <p>By 2005, reduce the number of serious hazardous materials incidents in transportation to 503.</p>
<p>Mobility By 2008, decrease the growth in the percentage of urban area road travel occurring in congested conditions by 0.2 percent annually.</p>	<p>In 2005, keep the total urban area road travel time that occurs in congested conditions at 32.8 percent.</p>
<p>Environmental Stewardship 12-month moving average number of area transportation emissions conformity lapses.</p> <p>Increase the percentage of DOT facilities characterized as No Further Remedial Action Planned under the Superfund Amendments and Reauthorization Act.</p>	<p>In 2005, maintain the 12-month moving average number of area transportation emissions conformity lapses at 6.0.</p> <p>In 2005, increase to 93 percent the number of DOT facilities characterized as No Further Remedial Action Planned.</p>

Table 6-14. FTA RD&T Performance Goals

DOT Goals	FTA Performance Goals
Safety By 2008, reduce transit fatalities to 0.488 per 100 million passenger miles.*	In 2005, keep transit fatalities at or below 0.482 per 100 million passenger miles.
Mobility By 2008, increase bus and transit rail fleets' compliance with the Americans With Disabilities Act to 100 percent.	Increase the percentage of key stations that are ADA-compliant from 82 percent in 2003 to 97 percent in 2005.
Global Connectivity Enhanced international competitiveness of U.S. transport providers and manufacturers (Strategic Outcome).	<i>Measures and targets under development.</i>
Environmental Stewardship 12-month moving average number of area transportation emissions conformity lapses.	Increase by 2 percent per year the number of energy-efficient and low-emission vehicles; the target for 2005 is 4,257.
Security By 2008, achieve an "A" rating indicating all modes have taken steps needed for a rapid recovery from intentional harm and natural disasters.	Assist transit agencies in developing emergency plans, conducting drills, and providing training.

*Based on an estimated rate of 0.492 fatalities per 100 million passenger miles in 2003.

Table 6-15. FAA RD&T Performance Goals

DOT Goals	FAA Performance Goals*
Safety By 2008, reduce commercial aviation fatal accidents to 0.01 per 100,000 departures and general aviation fatal accidents to 325.	Reduce the airline fatal accident rate to 0.028 per 100,000 departures. Reduce the number of general aviation and nonscheduled Part 135 fatal accidents to 349. Reduce accidents in Alaska for general aviation and all Part 135 operations to no more than 125 per year. Reduce the number of the most severe runway incursions (Categories A and B) at towered airports to 33. Reduce the number of the most serious air traffic control operational errors (Categories A and B) to no more than 629. Reduce serious injuries from turbulence accidents to 18.
Mobility By 2008, increase the percentage of flights arriving on time to 83.64 percent.	Achieve an airport arrival efficiency rate of 96 percent at the 35 largest airports. Achieve an airport arrival capacity at the 35 largest airports in excess of 50,667 per day. Achieve an airport arrival capacity for the 8 major metropolitan areas of 21,313 per day. Increase the percentage of all flights arriving within 15 minutes of schedule at the 35 largest airports to 82 percent.
Environmental Stewardship By 2008, reduce the number of people exposed to significant aviation noise to 396,000.	Reduce the number of people exposed to significant noise to 400,000.

*The FAA goals shown are for FY 2004. Targets for FY 2005 are under development.

Table 6-16. RSPA RD&T Performance Goals

DOT Goals	RSPA Performance Goals
<p>Safety By 2008, reduce total incidents for gas and hazardous liquid pipelines to 307.</p> <p>By 2008, reduce the number of serious hazardous materials incidents to 488.</p>	<p>Reduce the number of natural gas pipeline incidents and hazardous liquid pipeline accidents to 295 in 2005.</p> <p>Reduce the number of serious hazardous materials incidents in transportation to 503 in 2005.</p>
<p>Environmental Stewardship Reduce the hazardous liquid materials spilled per million ton-miles shipped by pipeline.</p>	<p>Reduce the amount of oil or other hazardous liquids spilled from pipelines per million ton-miles from 0.015 in 2003 to 0.012 in 2005.</p>

Table 6-17. OST RD&T Performance Goals

DOT Goals	OST Performance Goals
<p>Safety By 2008, reduce train accidents and incidents to 16.14 per million train miles.</p>	<p>By 2005, reduce train accidents and highway–rail incidents per million train miles to 17.14 from 17.84 in 2003.</p>
<p>Global Connectivity Increase the number of passengers in international markets with Open Skies aviation agreements.</p> <p>Reduce travel time in freight-significant corridors.</p> <p>Increase the number of regulatory requirements finalized.</p> <p>Increase the number of passenger travel markets opened to competition through multilateral or regional agreements.</p>	<p>By 2005, increase the number of potential air transportation consumers in international markets traveling between the U.S. and countries with Open Skies and open transborder aviation agreements from 1.48 billion in 2003 to 1.53 billion.</p> <p>Reduce travel time in significant freight corridors (<i>target under development</i>).</p> <p>Increase the number of bilateral and multilateral cooperative agreements for transportation practices and standards (<i>target under development</i>).</p> <p>Increase to 10 rounds the number of international negotiations conducted annually to remove market-distorting barriers to trade in transportation.</p>
<p>Environmental Stewardship 12-month moving average number of area transportation emissions conformity lapses.</p>	<p>In 2005, maintain the 12-month moving average number of area transportation emissions conformity lapses at 6.0.</p>

APPENDIX A RELATED TECHNICAL ACTIVITIES

The following DOT agencies perform RD&T-related activities but have yet to receive an explicit RD&T budget:

MARITIME ADMINISTRATION (MARAD)

The goal of MARAD, through its umbrella Research, Technology, Demonstration, and Deployment (RTDD) initiative, is to stimulate and facilitate innovation in the U.S. maritime transportation system. Through innovation, enhanced transportation products and services will become available that can meet future commercial growth and national security needs—while enhancing environmental stewardship and transportation safety.

MARAD's mission is to strengthen U.S. maritime industries to support the nation's economic and security needs. Meeting these critical needs requires a healthy and efficient maritime transportation system—with modern ships, shipbuilding capacity, and a skilled and innovative workforce. In support of its mission, MARAD has two primary responsibilities:

- Promote the development and maintenance of an adequate, well-balanced U.S. Merchant Marine capable of carrying the nation's domestic waterborne commerce and a substantial portion of its foreign commerce. The Merchant Marine also plays a key role during a national crisis, serving as a naval and military auxiliary in time of war or other emergency.
- Ensure that the United States has adequate shipbuilding and repair services, efficient ports, effective intermodal water and land transportation systems, and reserve shipping capacity.

For nearly a decade, MARAD has received no direct Congressional RD&T funding to invest in maritime innovation. The same will be true for FY 2005. However, MARAD has worked, and will continue to work, to foster innovation collaboratively through public-private partnerships and interagency agreements—characterized by the highly innovative Marine Transportation System (MTS), Short Sea Shipping, industry cooperative, and other initiatives described below. Through these programs, knowledgeable agency personnel work with industry leaders to stimulate and facilitate collaborative investments. This approach brings together the maritime industry, academia, and government agencies to identify, gather, coordinate, stimulate, facilitate, and accomplish RD&T leading to maritime innovation. With industry and academic participation, MARAD is dedicated to building an infrastructure with a core of leaders and researchers that will help the maritime industry innovate successfully in the 21st century.

Recent developments and trends, however, may prove particularly challenging in future years without a much greater level of investment in maritime RD&T. Projections of required capacity growth and the critical need for greater security—combined with increasing global competition and environmental and safety concerns—point to serious problems if innovations are not researched and developed. These significant challenges will require investment of both time and funding to initiate effective, collaborative RD&T that can prepare a foundation for the future and enable timely implementation.

MTS RESEARCH AND TECHNOLOGY

The MTS is a Secretarial initiative to advance maritime interests in the United States. Seventeen different Federal agencies and all industry components are actively engaged in its development. Industry groups include entities involved with intermodal connections, cargo, and passenger movements, and other public and private stakeholders. The Interagency Committee of the MTS (ICMTS), the Federal team, and the MTS National Advisory Council (MTSNAC), the industry team, each have formed Research and Technology and other subcommittees to assist with coordination and priority setting. The MTS initiative has energized the intermodal industry, as well as Federal, state, and local transportation agencies, to coordinate and accelerate the application of advanced communication, information, and Intelligent Transportation Systems technologies.

MARAD's facilitation of the MTS process helps keep participants focused and on track. The intermodal industry is driven by private sector demand. The public sector cannot design and deliver new intermodal services, nor should it force such systems upon the marketplace. However, through the collaborative MTS process, these disparate parties join together to focus attention on issues and opportunities, provide seed money to leverage private investment and test applications, and underwrite standards development through industry and user consensus.

As stated in a June 2002 report to Congress, meeting the challenges facing the MTS—and its intermodal, point-to-point domestic, and international transportation components—will require a dedicated RD&T investment.¹ At the behest of the Secretary, the MTSNAC is discussing and developing input on MTS needs and on recommendations for specific initiatives (such as Short Sea Shipping) to help DOT develop legislation that will strengthen the MTS initiative.

In FY 2005, MARAD will continue its work with the MTSNAC, ICMTS, and their subcommittees to bring industry and government together to advance new ideas and reduce duplication of effort.

SHIP OPERATIONS COOPERATIVE PROGRAM (SOCP)

The SOCP is a long-producing, effective public–private partnership that promotes national security and economic growth through the identification, development, and application of new methods, procedures, and technologies for maritime vessel activities. The program's objective is to improve the competitiveness, productivity, efficiency, safety, and environmental responsiveness of U.S. vessel operations. The SOCP currently has more than 40 member organizations that contribute funding, resources, and active project management.

An example of how the SOCP advances security is the application of “smart” identification cards. In the maritime industry, smart cards can significantly improve security in all shoreside and shipboard environments, providing secure identification of individuals along with their

¹*Maritime Research and Technology Development: A Report to Congress* ([http://www.marad.dot.gov/research/R&D/Report 6-02.pdf](http://www.marad.dot.gov/research/R&D/Report%206-02.pdf)).

training and qualification profiles. Since 9/11, the SOCP's efforts have been expanded, turning the pursuit of smart identification cards into an international maritime effort. The SOCP is now beginning a trial implementation stage to ensure that the technology will work when applied to the entire maritime industry. Working with the Department of Homeland Security (DHS), MARAD acts as the Federal facilitator, leading the coordination of national and international standard setting for smart identification cards.

MARAD, industry, labor, and government will continue to work through the SOCP in FY 2005 to address common challenges and identify improvements in ship operations.

CARGO HANDLING COOPERATIVE PROGRAM (CHCP)

The CHCP is an active public-private partnership established in 1983 to increase the productivity of marine freight transportation by fostering cargo-handling RD&T among intermodal freight entities. The program's focus is on industry-driven technology priorities and a system-level approach to freight transportation. Such a focus is critical to achieving an enhanced and integrated transportation system for the movement of international and domestic freight.

CHCP participants pursue innovations that will increase the productivity and cost-effectiveness of cargo operations. The program emphasizes integrated systems for freight movement through advances in (1) infrastructure design; (2) seamless international transportation networks; and (3) communication and information flows. Initiatives are based on a system-level approach—from origin to destination—so that intermodal transfer points, port connections, and other subsystems all meet system requirements. Although the CHCP has not independently funded research for the past several years, its members have been able to use the program's framework to obtain funding for selected projects, such as Chassis Tag Research and Security Container Seal Processes.

The CHCP will address security-oriented issues in FY 2005, including the expert review of proposals for security technology and the development of cargo handling standards that ensure security as well as operational efficiency.

INLAND WATERWAYS INTERMODAL COOPERATIVE PROGRAM (IWICP)

The IWICP brings industry leaders together to discuss the scope, content, and structure of a public-private partnership to foster RD&T related to inland waterways. Established to promote intermodal transportation on the inland waterways of the United States, the IWICP focuses on industry-driven priorities that support an integrated transport system for the movement of domestic and international freight.

By introducing technology and intermodal networks, the IWICP seeks to increase the productive and efficient flow of cargo moved on a secure inland waterway system. The program addresses the following priorities: (1) developing new markets for waterways services; (2) business practices; (3) professional development; (4) public policy; and (5) port and terminal administration. One area that the program will pursue in FY 2005 is the practicality of and potential for "container-on-barge" cargo movements. This concept involves the unloading of

container ships at ports and the transshipment of containers to further destinations by barge, thereby reducing the movement of freight on highways. The program will also focus on the potential for higher speed craft movements of containers. Both of these services hold promise for reducing roadway delays around congested port areas and the consequent air emissions.

SHORT SEA SHIPPING COOPERATIVE PROGRAM (SCOOP)

The SCOOP is MARAD's most recent industry-inspired partnership. Formed in October 2003, the program's purpose is to share resources and in-kind services in the development of Short Sea Shipping in North America. Short Sea Shipping is the water transportation of freight and passengers that does not cross an ocean. Both MARAD and the 35 private sector partners that formed the program believe that increased awareness and application of Short Sea Shipping can decrease traffic congestion, improve safety, and benefit the environment. One of the program's first goals is to conduct outreach to future users of a North American Short Sea Shipping System.

MARAD facilitated the creation of the program as a follow-up to a conference that discussed the potential for introducing Short Sea Shipping (a highly successful European Commission effort) in the United States. In October 2004, a third conference will continue collaboration among the more than 60 program members pursuing various efforts in FY 2005. MARAD will continue to share information, resources, and technologies with U.S.- and foreign-based entities to promote Short Sea Shipping as a tool for reducing congestion and accommodating increases in cargo movement.

MARITIME ENERGY AND EMISSIONS TECHNOLOGIES PROGRAM

Over the past few years, MARAD has become a recognized leader in the maritime energy and emissions field. With no RD&T funding, MARAD has leveraged knowledge of the maritime industry with other organizations' funding to become active in almost every important maritime energy and emissions issue in the nation. The program has enabled or helped facilitate more than 20 projects, with a total value of over \$10 million. MARAD's contribution, primarily end-of-year swept funds, has been less than 1 percent of this figure. Program efforts include studies and demonstrations of fuel cells, hydrogen, diesel technologies and fuels, natural gas and reduction technologies, and measurement protocols.

Due to its expertise and initiative, MARAD has been selected to manage a \$1 million program sponsored by the Environmental Protection Agency, the California Air Resources Board, the Ports of Los Angeles and Long Beach, and five local California emissions control districts. Through a cooperative agreement with American President Lines, the program will demonstrate emission reduction technologies on a containership calling on California ports. The results will provide vital information to these ports' efforts to deal with increasingly critical air emissions issues.

MARAD is also assisting the Port Authority of New York and New Jersey in reducing emissions that threaten port expansion and dredging. The agency is advising on the Staten Island Ferry emission reduction program, and has received funding to provide technical consulting services to

a New York State program that is installing reduction technologies on private ferries serving metropolitan New York.

In another effort, MARAD is working with DOT administrations and the Department of Energy to develop a program on maritime hydrogen and fuel cells. MARAD also is involved with the Naval Sea Systems Command in a diesel engine retrofit program that will benefit both Navy and commercial operations. The results of these efforts will be disseminated through workshops and conferences, an *Energy Technologies* newsletter, and the MARAD website (http://www.marad.dot.gov/NMREC/energy_technologies/homepage.html).

UNITED STATES MERCHANT MARINE ACADEMY (USMMA)

Located in Kings Point, New York, the USMMA is one of five Federal service academies. Its four-year program provides the broad college education required for a Bachelor of Science degree, with the specialized training for licensing as a merchant marine officer, and the military knowledge for commissioning in a reserve component of the Armed Forces. The Academy's mission is "to educate and graduate professional officers and leaders of honor and integrity, who are dedicated to serving the economic and defense interests of the United States in our Armed Forces and Merchant Marine, and who will contribute to an intermodal transportation system that effectively ties America together" (<http://www.usmma.edu/>). USMMA laboratories and research contribute to maritime innovation and to building a talented and skilled maritime workforce.

Beginning in July 2005, the USMMA will offer a 36-credit, 3-semester Master of Marine Engineering program as a way of supporting the marine industry, enhancing the marine engineering profession, and offering engineering professionals the opportunity to advance their technical education. The program's focus is the application of advanced knowledge to the solution of marine engineering challenges. It centers on an 18-credit core and is augmented by 12 credits of relevant electives and 6 credits for a thesis or design project. The thesis/design project will allow students to develop academically and professionally by investigating relevant topics of interest. It will also encourage students to undertake industry-supporting research and to publish the results. To ensure availability to the greatest number of transportation professionals, the program will be offered as a residential program, a distance-learning program, or a combination of the two.

Renewable Energy Transportation Laboratory

The USMMA's Renewable Energy Transportation Laboratory acts as a testbed for a full range of alternative energy technologies. It facilitates advancements in renewable technologies, gives students a hands-on aspect to their studies, and promotes interest in the application of alternative energy systems. Currently receiving financial and technical support from the Long Island Power Authority and from Plug Power (in Latham, New York), the laboratory features integrated and fully operational wind, solar photovoltaic, and hydrogen-fuel-cell generators (which develop nonpolluting power for hydrogen production and the operation of two electric work carts); an "Electrathon" endurance race car; and a hydrogen-fuel-cell-powered boat. Additions and improvements planned for FY 2005 should ensure that the laboratory continues to grow in scope and effectiveness.

Global Maritime and Transportation School (GMATS)

Also at the USMMA, the GMATS offers “the most extensive maritime and transportation professional education program in the United States” (<http://www.usmma.edu/gmats>). In partnership with key domestic and international industry associations, the school offers a comprehensive program of short courses, technical seminars, and training designed specifically for mariners, as well as for transportation industry professionals from the private sector, government, and military.

The GMATS is designated as a National Maritime Enhancement Institute, recognizing its expertise, capabilities, and industry affiliations contributing to the advancement of safe, secure, economically viable, and environmentally sensible marine and intermodal transportation systems. The GMATS Division of Research and Special Projects conducts applied research in a number of areas, including maritime security; modal and intermodal freight systems; marine and intermodal terminal operations; maritime training and education; industry leadership and business ethics; port and waterway design and traffic management; maritime business and economics; communication and information systems; shipboard operations; and marine engineering, shipbuilding, and naval architecture. The school will undertake the following activities in FY 2005:

- Develop an annual regional intermodal freight transportation study focusing on freight movement through Baltic Sea ports to and from the Commonwealth of Independent States, northern and western Europe, and the rest of the world to better understand intermodal transportation trends and emerging global business practices.
- Provide technical assistance in maritime security and training to Cape Verde.
- Continue a multiyear effort to develop and deliver computer- and web-based training in navigation, seamanship, and ship handling to U.S. Navy Surface Warfare Officers and to apply performance-based requirements and measurements similar to those recently mandated for commercial operations.
- Continue a survey, assessment, and technical assistance for the New York City Department of Transportation to enhance the safety, security, and efficiency of Staten Island Ferry operations.

CENTER FOR THE COMMERCIAL DEPLOYMENT OF TRANSPORTATION TECHNOLOGIES (CCDOTT)

MARAD and the U.S. Transportation Command provide coordinated support to the CCDOTT, a chartered university center at California State University in Long Beach. The center is Congressionally sponsored, with funding provided through the Department of Defense (DOD) appropriations bill.

The CCDOTT functions as a partnership of academic institutions, government agencies, and private companies. It has three purposes: (1) leverage advanced transportation technologies—including emerging high-speed ship systems, decision support tools, tagging and tracking, and agile port and terminal systems—to solve defense and commercial infrastructure problems; (2) sponsor applied research in support of defense and commercial infrastructure initiatives; and (3) provide a bilateral technology transfer/dual-use bridge between the DOD and industry. The center has completed a series of studies to date, and is now implementing these efforts as well as pursuing further research. MARAD will continue its efforts with the center in FY 2005.

SHIP STRUCTURE COMMITTEE (SSC)

An international cooperative program with 10 participating agencies, the SSC advances ship safety and structural integrity. The program enhances the safety of life at sea, promotes technology and educational advancements, and protects the marine environment through research on ship structural design, life-cycle risk management, and production technologies. Among the two dozen or so projects that are typically underway are efforts addressing the structural safety of high-speed ferries, structural problems on modern cruise ships, the use of aluminum in ship structures, structural fire protection, design guidelines for structural repairs, and the relationship of structural integrity to chemical treatment of ballast water. In FY 2005, MARAD will continue its involvement with the SSC, identifying needed research, setting priorities, and managing committee-funded research.

SECURITY-RELATED RESEARCH AND OTHER ADVISORY EFFORTS

In support of the DHS, MARAD evaluates proposed security RD&T and works to engage industry experts and practitioners to ensure these efforts' effectiveness. In addition, while not contributing RD&T funding, MARAD supports various other research areas that can benefit from the agency's broad expertise in maritime transportation systems and the maritime industry.

BUREAU OF TRANSPORTATION STATISTICS (BTS)

The BTS started operations in December 1992. Its mission is twofold: (1) lead in developing transportation data and information of high quality; and (2) advance their use in public and private transportation decision making. In fulfilling its mission, the BTS compiles, analyzes, and makes accessible information on the nation's transportation systems; collects information on intermodal transportation and other areas as needed; and works to enhance the quality and effectiveness of government statistics.

Although the BTS is not formally included in the DOT RD&T budget submission, its funding is authorized in the Research section of the Transportation Equity Act for the 21st Century (TEA-21). The agency provides the critical knowledge and understanding of our transportation system required for the assessment of research needs and opportunities and for the formulation of policy. Under TEA-21, the BTS has an annual authorized budget of \$31 million. It does not have specific RD&T programs, but many of its projects have research components. For example, Section 5109 of TEA-21 [codified at 49 U.S.C. 111(g)] authorizes a BTS grants program to support research at the interface of transportation science and statistical inference.

APPENDIX B
EXCERPT FROM THE TRANSPORTATION EQUITY ACT FOR
THE 21ST CENTURY

Transportation Equity Act for the 21st Century [Public Law 105–178, as amended by title IX of Public Law 105–206]. An Act to authorize funds for Federal-aid highways, highway safety programs, and transit programs, and for other purposes.

SECTION. 5108. SURFACE TRANSPORTATION RESEARCH STRATEGIC PLANNING

Chapter 5 of title 23, United States Code (as added by section 5101 of this title), is amended by adding at the end the following:

Sec. 508. Surface transportation research strategic planning

“(a) IN GENERAL.—The Secretary shall—

“(1) establish a strategic planning process, consistent with section 306 of title 5 for the Department of Transportation to determine national transportation research and technology development priorities related to surface transportation;

“(2) coordinate Federal surface transportation research and technology development activities;

“(3) measure the results of those activities and how they impact the performance of the surface transportation systems of the United States; and

“(4) ensure that planning and reporting activities carried out under this section are coordinated with all other surface transportation planning and reporting requirements.

“(b) IMPLEMENTATION.—The Secretary shall—

“(1) provide for the integrated planning, coordination, and consultation among the operating administrations of the Department of Transportation, all other Federal agencies with responsibility for surface transportation research and technology development, State and local governments, institutions of higher education, industry, and other private and public sector organizations engaged in surface transportation-related research and development activities;

“(2) ensure that the surface transportation research and technology development programs of the Department do not duplicate other Federal, State, or private sector research and development programs; and

“(3) provide for independent validation of the scientific and technical assumptions underlying the surface transportation research and technology development programs of the Department.

“(c) SURFACE TRANSPORTATION RESEARCH AND TECHNOLOGY DEVELOPMENT STRATEGIC PLAN.—

“(1) DEVELOPMENT.—The Secretary shall develop an integrated surface transportation research and technology development strategic plan.

“(2) CONTENTS.—The plan shall include—

“(A) an identification of the general goals and objectives of the Department of Transportation for surface transportation research and development;

“(B) a description of the roles of the Department and other Federal agencies in achieving the goals identified under subparagraph (A), in order to avoid unnecessary duplication of effort;

“(C) a description of the overall strategy of the Department, and the role of each of the operating administrations of the Department, in carrying out the plan over the next 5 years, including a description of procedures for coordination of the efforts of the Secretary with efforts of the operating administrations of the Department and other Federal agencies;

“(D) an assessment of how State and local research and technology development activities are contributing to the achievement of the goals identified under subparagraph (A);

“(E) details of the surface transportation research and technology development programs of the Department, including performance goals, resources needed to achieve those goals, and performance indicators as described in section 1115(a) of title 31, United States Code, for the next 5 years for each area of research and technology development;

“(F) significant comments on the plan obtained from outside sources; and

“(G) responses to significant comments obtained from the National Research Council and other advisory bodies, and a description of any corrective actions taken pursuant to such comments.

“(3) NATIONAL RESEARCH COUNCIL REVIEW.—The Secretary shall enter into an agreement for the review by the National Research Council of the details of each—

“(A) strategic plan or revision required under section 306 of title 5;

“(B) performance plan required under section 1115 of title 31; and

“(C) program performance report required under section 1116,

with respect to surface transportation research and technology development.

“(4) PERFORMANCE PLANS AND REPORTS.—In reports submitted under sections 1115 and 1116 of title 31, the Secretary shall include—

“(A) a summary of the results for the previous fiscal year of surface transportation research and technology development programs to which the Department of Transportation contributes, along with—

“(i) an analysis of the relationship between those results and the goals identified under paragraph (2)(A); and

“(ii) a description of the methodology used for assessing the results; and

“(B) a description of significant surface transportation research and technology development initiatives, if any, undertaken during the previous fiscal year that were not in the plan developed under paragraph (1), and any significant changes in the plan from the previous year’s plan.

“(d) MERIT REVIEW AND PERFORMANCE MEASUREMENT.—

Not later than 1 year after the date of enactment of this section, the Secretary shall transmit to Congress a report describing competitive merit review procedures for use in selecting grantees and contractors in the programs covered by the plan developed under subsection (c) and performance measurement procedures for evaluating the programs.

“(e) PROCUREMENT PROCEDURES.—The Secretary shall—

“(1) develop model procurement procedures that encourage the use of advanced technologies; and

“(2) develop model transactions for carrying out and coordinating Federal and State surface transportation research and technology development activities.

“(f) CONSISTENCY WITH GOVERNMENT PERFORMANCE AND RESULTS ACT OF 1993.—The plans and reports developed under this section shall be consistent with and incorporated as part of the plans developed under section 306 of title 5 and sections 1115 and 1116 of title 31.

APPENDIX C
DOT FY 2005 RD&T BUDGET AUTHORITY

Table C-1. DOT FY 2005 President's Budget: RD&T Budget Authority (\$000), Summary

Mode and Program		FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
FHWA				
	Subtotal, R&D	287,839	318,371	393,925
	Subtotal, Technology	240,196	273,369	171,096
	Subtotal, Facilities	0	0	0
Total FHWA		528,035	591,740	565,021
FMCSA				
	Subtotal, R&D	6,155	6,642	9,375
	Subtotal, Technology	2,764	2,362	3,500
	Subtotal, Facilities	0	0	0
Total FMCSA		8,919	9,004	12,875
NHTSA				
	Subtotal, R&D	59,684	63,240	67,759
	Subtotal, Technology	25,574	32,514	37,252
	Subtotal, Facilities	0	0	0
Total NHTSA		85,258	95,754	105,011
FRA				
	Subtotal, R&D	31,133	30,517	31,366
	Subtotal, Technology	31,231	29,631	17,850
	Subtotal, Facilities	1,167	1,332	1,425
Total FRA		63,531	61,480	50,641
FTA				
	Subtotal, R&D	2,014	4,625	2,587
	Subtotal, Technology	58,027	54,265	48,619
	Subtotal, Facilities	0	0	0
Total FTA		60,041	58,890	51,206
FAA				
	Subtotal, R&D	256,862	231,867	204,499
	Subtotal, Technology	0	0	0
	Subtotal, Facilities	17,585	16,403	18,000
Total FAA		274,447	248,270	222,499
RSPA				
	Subtotal, R&D	13,692	13,880	14,965
	Subtotal, Technology	0	0	0
	Subtotal, Facilities	0	0	0
Total RSPA		13,692	13,880	14,965
OST				
	Subtotal, R&D	23,463	20,426	10,800
	Subtotal, Technology	0	0	0
	Subtotal, Facilities	0	0	0
Total OST		23,463	20,426	10,800
TOTAL DOT				
	Total, R&D	680,842	689,568	735,276
	Total, Technology	357,792	392,141	278,317
	Total, Facilities	18,752	17,735	19,425
GRAND TOTAL		1,057,386	1,099,444	1,033,018

Table C-2. FY 2005 President’s Budget: RD&T Budget Authority (\$000), Program Details

Mode and Program	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
FHWA			
Research and Technology Program			
Surface Transportation Research	91,652	101,997	199,000
a. Safety	9,400	8,003	23,681
Safety (T)	1,659	3,430	10,149
b. Pavements	14,009	15,906	10,051
c. Structures	10,623	6,124	12,638
d. Structures (T)	1,449	7,794	16,085
e. Policy	7,538	8,947	12,940
f. Environmental, Planning, and Realty	10,256	11,134	0
Environmental, Planning, and Realty (T)	4,826	4,772	37,810
Highway Operations	6,904	9,046	22,288
Highway Operations (T)	4,602	3,877	9,552
g. R&T Technical Support	7,241	8,947	10,130
h. Long-Term Pavement Performance	8,942	9,941	15,488
i. Advanced Research	738	596	0
j. R&T Strategic Plan/Performance Measures	604	746	0
k. International Outreach	0	0	0
l. Asset Management	2,861	2,734	5,438
Field Services R&T Delivery and R&T Strategic Plan	0	0	0
m. Field Services & Delivery	0	0	5,970
n. Resource Centers	0	0	4,000
o. Corporate Business	0	0	2,780
Technology Deployment Program	44,708	49,705	0
a. Technology Deployment (T)	44,708	49,705	0
Training and Education	17,883	19,882	26,000
a. National Highway Institute (T)	7,153	7,953	9,805
b. Local Technical Assistance Program (T)	8,942	9,941	12,697
c. Eisenhower Transportation Fellowship Program (T)	1,788	1,988	3,498
Intelligent Transportation Systems	207,443	230,631	121,000
a. Research	53,027	51,693	0
b. Operational Test	4,778	11,929	0
c. Evaluation/program assessment (T)	6,500	0	0
d. Architecture and Standards (T)	15,032	17,894	15,000
Commercial Vehicle Operations (T)	0	0	0
e. Mainstreaming/Integration (T)	0	0	0
f. ITS Program & System Support (T)	0	0	0
ITS Program Support	10,499	9,444	9,000
Advanced Technology Applications	0	0	0
g. Integration	0	0	0
Integration/Deployment Support (T)	8,521	11,432	10,000
h. ITS Deployment (T)	109,086	121,280	0
i. Security	0	0	5,000
j. Safety	0	0	38,000
k. Mobility	0	0	24,000
l. System Management Information (T)	0	0	14,000
m. Evaluation (T)	0	6,959	6,000
University Transportation Research	23,695	26,344	26,500
a. University Transportation Research (T)	23,695	26,344	26,500
Multimodal Research	0	0	24,000
Other	126,949	147,265	151,252
a. State Planning & Research	124,714	147,265	151,252
b. TRANSIMS (T)	2,235	0	0
Administrative Expenses	15,705	15,916	17,269
Subtotal, R&D	287,839	318,371	393,925
Subtotal, Technology Investment (T)	240,196	273,369	171,096

Mode and Program	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
Subtotal, Facilities (F)	0	0	0
Total FHWA	528,035	591,740	565,021
FMCSA			
Motor Carrier Safety	6,954	6,959	10,791
<i>Driver Safety Performance</i>	2,136	1,699	3,286
a. Noncommercial Driver - Performance Enhancement	298	1,052	0
b. Commercial Driver - Performance Enhancement	298	465	2,450
c. Commercial Driver - Performance Enhancement (T)	0	0	0
d. Commercial Driver – Fatigue	994	182	556
e. Commercial Driver - Fatigue (T)	0	0	0
f. Commercial Driver - Physical Qualifications	546	0	280
<i>Commercial Vehicle Safety Performance</i>	1,945	1,441	3,550
a. Intelligent Vehicle Safety Technologies	256	0	0
b. Intelligent Vehicle Safety Technologies (T)	1,689	994	550
c. Policies, Regulations, and Standards	0	0	0
d. Policies, Regulations, and Standards (T)	0	0	0
e. Occupant Protection and Safety	0	447	2,000
f. Occupant Protection and Safety (T)	0	0	1,000
<i>Carrier Compliance and Safety</i>	795	348	395
a. Carrier Compliance and Safety	795	348	395
b. Carrier Compliance and Safety (T)	0	0	0
<i>Safety Systems and Technologies</i>	695	1,267	1,850
a. Safety Technologies for 2010 Project	0	297	0
b. Safety Technologies for 2010 Project (T)	596	224	1,300
c. CVISN Deployment Project (T)	99	746	550
<i>Crosscutting Safety Initiatives</i>	1,383	1,999	1,710
a. Risk Assessments	1,003	1,601	1,610
b. Partnerships and Communications (T)	380	398	100
<i>Security</i>			
a. Crosscutting Safety Initiatives	0	205	0
Administrative Expenses	1,965	2,045	2,084
Subtotal, R&D	6,155	6,642	9,375
Subtotal, Technology Investment (T)	2,764	2,362	3,500
Subtotal, Facilities (F)	0	0	0
Total FMCSA	8,919	9,004	12,875
NHTSA			
Research and Analysis	60,668	69,467	76,768
<i>Crashworthiness</i>	23,700	26,269	23,693
a. Safety Systems	8,990	11,078	9,318
b. Biomechanics	14,710	15,191	14,375
c. Partnership for a New Generation of Vehicles	0	0	0
<i>Crash Avoidance</i>	10,414	9,677	9,803
a. Driver/Vehicle Performance	3,414	3,450	3,495
b. Driver Behavior Simulation Research	3,390	3,509	3,555
c. National Advanced Driver Simulator	0	0	0
d. Heavy Vehicles	2,632	2,105	2,132
e. Pneumatic Tire Research	978	613	621
<i>Data Programs (T)</i>	25,574	32,514	37,252
a. Fatal Accident Reporting System (T)	5,700	5,797	5,913
b. National Accident Sampling System (NASS)(T)	11,365	11,964	12,230
c. Data Analysis Program (T)	1,916	1,983	2,023
d. State Data Program (T)	2,407	2,492	2,542
e. Occupant Protection Survey (T)	600	1,600	1,632
f. Special Crash Investigations (T)	1,621	1,678	1,712
g. National Motor Vehicle Crash Causation Survey (T)	1,965	7,000	10,200
h. Early Fatality Notification System (T)	0	0	1,000
<i>Crash Avoidance</i>	0	0	5,000
<i>Technology Transfer Programs (T)</i>	0	0	0

Mode and Program	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
<i>Vehicle Research and Test Center</i>	980	1,007	1,020
Highway Safety Research	7,025	7,207	7,383
Administrative Expenses	17,565	19,080	20,860
Subtotal, R&D	59,684	63,240	67,759
Subtotal, Technology Investment (T)	25,574	32,514	37,252
Subtotal, Facilities (F)	0	0	0
Total NHTSA	85,258	95,754	105,011
FRA			
Railroad Research and Development	29,134	33,824	36,025
<i>Equipment, Operations & Hazmat</i>	0	0	0
<i>Track & Vehicle-Track Interaction</i>	0	0	0
<i>Railroad Systems Safety & Security</i>	0	0	0
a. Railroad Systems Safety & Security	0	0	0
b. Railroad Systems Safety & Security (T)	0	0	0
<i>R&D Facilities & Equipment (F)</i>	0	0	0
<i>Railroad Systems Issues</i>	3,204	3,017	3,225
<i>Human Factors</i>	3,803	3,442	4,178
<i>Rolling Stock and Components</i>	2,471	2,520	2,587
<i>Track and Structures</i>	5,092	5,716	4,125
<i>Track and Train Interaction</i>	3,328	3,134	3,350
<i>Train Control</i>	1,242	895	950
<i>Grade Crossings</i>	1,426	1,243	1,935
<i>Hazardous Materials Transportation</i>	993	944	1,000
<i>Train Occupant Protection</i>	6,408	6,163	6,450
<i>R&D Facilities and Test Equipment (F)</i>	1,167	1,332	1,425
<i>NDGPS (T)</i>	0	5,418	6,800
Next Generation High-Speed Rail	30,252	23,200	10,000
<i>HS Train Control Systems (T)</i>	6,458	10,000	5,000
<i>Non-Electric Locomotives (T)</i>	9,239	5,900	2,000
<i>Grade Crossing & Innovative Technologies (T)</i>	3,228	4,300	2,000
<i>Track/Structures Technology (T)</i>	994	1,300	1,000
<i>Corridor Planning (T)</i>	5,862	1,700	0
<i>MAGLEV (T)</i>	4,471	0	0
Safety and Operations	4,145	4,456	4,616
<i>Salaries and Expenses (R&D)</i>	3,166	3,443	3,566
<i>Salaries and Expenses (T)</i>	979	1,013	1,050
MAGLEV (T)	0	0	0
Subtotal, R&D	31,133	30,517	31,366
Subtotal, Technology Investment (T)	31,231	29,631	17,850
Subtotal, Facilities (F)	1,167	1,332	1,425
Total FRA	63,531	61,480	50,641
FTA			
National Program	31,407	35,289	32,330
<i>Safety and Security</i>	8,160	13,713	12,295
a. Safety and Security	0	0	0
b. Safety and Security (T)	8,160	13,713	12,295
<i>Equipment and Infrastructure</i>	6,754	6,628	2,020
a. New Bus and Rail Vehicles and Infrastructure	1,498	2,386	0
b. New Bus and Rail Vehicles and Infrastructure (T)	5,256	4,242	2,020
<i>Fleet Operations</i>	4,723	4,799	4,350
a. Bus Rapid Transit	0	0	0
b. Bus Rapid Transit (T)	4,723	4,799	4,350
<i>Specialized Customer Services (T)</i>	5,602	4,726	6,550
<i>Information Management Technology</i>	865	3,274	1,535
a. Information Management & Technology	0	0	0
b. Information Management & Technology (T)	865	3,274	1,535
<i>Metropolitan/Rural Policy Development</i>	790	475	1,250
a. Metropolitan/Rural Policy Development	0	0	200

Mode and Program	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
b. Metropolitan/Rural Policy Development (T)	790	475	1,050
<i>Planning and Project Development</i>	3,316	974	1,870
a. Planning and Project Development	0	0	0
b. Planning and Project Development (T)	3,316	974	1,870
<i>Human Resources (T)</i>	335	400	1,085
<i>Performance and Review (T)</i>	450	100	575
<i>International Mass Transportation Program (T)</i>	412	200	800
Transit Cooperative Research Program	8,196	8,201	8,411
<i>Transit Cooperative Research Program</i>	0	2,000	2,000
<i>Transit Cooperative Research Program (T)</i>	8,196	6,201	6,411
National Transit Institute (T)	3,974	3,976	4,078
Rural Transit Assistance Program (T)	5,216	5,219	0
<i>Subtotal, Transit Planning and Research</i>	48,793	52,685	44,819
Fuel Cell Bus & Bus Facilities (T)	4,771	0	0
Bus Testing (TEA-21) (T)	0	0	0
University Transportation Centers	5,961	5,965	6,000
University Transportation Centers	0	0	0
University Transportation Centers (T)	5,961	5,965	6,000
Administrative Expenses	516	240	387
Subtotal, R&D	2,014	4,625	2,587
Subtotal, Technology Investment (T)	58,027	54,265	48,619
Subtotal, Facilities (F)	0	0	0
Total FTA	60,041	58,890	51,206
FAA			
Research, Engineering and Development	147,485	118,734	117,000
<i>System Development and Infrastructure</i>	7,151	3,902	4,664
a. System Planning & Resource Management	988	497	1,275
b. WJHTC Laboratory Facility	6,163	3,405	3,389
c. Center for Advanced Aviation System Development	0	0	0
d. Information System Security	0	0	0
<i>Weather</i>	33,659	23,711	23,134
a. Weather Program	33,659	23,711	23,134
<i>Airport Technology</i>	0	0	0
<i>Aircraft Safety Technology</i>	60,998	57,173	43,673
a. Fire Research and Safety	6,085	9,668	5,578
b. Advanced Materials/Structural Safety	2,930	7,223	2,197
c. Propulsion and Fuel Systems	7,541	6,607	3,672
d. Flight Safety/Atmospheric Hazards Research	6,160	4,568	4,119
e. Aging Aircraft	29,643	20,498	18,351
f. Aircraft Catastrophic Failure Prevention Research	1,869	758	1,116
g. Aviation Safety Risk Analysis	6,770	7,851	8,640
<i>System Security Technology</i>	0	0	0
a. Explosives and Weapons Detection	0	0	0
b. Airport Security Technology Integration	0	0	0
c. Airport Security Human Factors	0	0	0
d. Aircraft Hardening	0	0	0
e. FY 2002 DOD Supplemental	0	0	0
<i>Human Factors (HF) and Aviation Medicine</i>	23,868	26,020	24,421
a. Flight Deck/Maintenance/System Integration HF	10,072	8,344	8,294
b. Air Traffic Control/Airway Facilities HF	7,531	8,846	9,467
c. Aeromedical Research	6,265	8,830	6,660
<i>Improve Efficiency</i>	0	0	5,100
a. National Plan for Transformation of Air Transportation	0	0	5,100
<i>Environment and Energy</i>	21,809	7,928	16,008
<i>Strategic Partnerships</i>	0	0	0
Facilities and Equipment	114,153	116,211	92,000
a. Advanced Technology Dev. & Prototyping	96,568	99,808	74,000
b. Plant (F)	17,585	16,403	18,000

Mode and Program	FY 2003 Enacted	FY 2004 Enacted	FY 2005 Budget
Airport Improvement Program			
Airport Technology (T)	0	0	0
Operations	12,213	13,208	13,380
Commercial Space Transportation	596	117	119
Subtotal, R&D	256,862	231,867	204,499
Subtotal, Technology Investment (T)	0	0	0
Subtotal, Facilities (F)	17,585	16,403	18,000
Total FAA	274,447	248,270	222,499
RSPA			
Research and Special Programs	4,693	4,239	5,302
Hazardous Materials	1,455	1,315	2,057
Research and Technology	1,560	1,140	1,305
Emergency Transportation	0	0	0
Administrative Expenses	1,678	1,784	1,940
Pipeline Safety	8,999	9,641	9,663
Pipeline Safety	8,687	9,058	9,058
Administrative Expenses	312	583	605
Total RSPA	13,692	13,880	14,965
OST			
Transportation Planning, Research & Development	23,463	20,426	10,800
Total OST	23,463	20,426	10,800
DOT SUBTOTALS			
R&D	680,842	689,568	735,276
Technology Investment (T)	357,792	392,141	278,317
Facilities (F)	18,752	17,735	19,425
DOT GRAND TOTAL	1,057,386	1,099,444	1,033,018

