



U.S. Department of Transportation  
Research and Innovative Technology Administration

# Transportation Research, Development and Technology Strategic Plan

2006-2010

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## ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials	NAS	National Airspace System
ASR	Alkali-Silica Reactivity	NASA	National Aeronautics and Space Administration
BTS	Bureau of Transportation Statistics	NASS	National Automotive Sampling System
CAASD	Center for Advanced Aviation Systems Development	NCHRP	National Cooperative Highway Research Program
CCDOTT	Center for the Commercial Deployment of Transportation Technologies	NDE	Nondestructive Evaluation
CHCP	Cargo Handling Cooperative Program	NGATS	Next Generation Air Transportation System
Clarus	National Surface Transportation Weather Observing and Forecasting System	NHI	National Highway Institute
CMV	Commercial Motor Vehicle	NHTSA	National Highway Traffic Safety Administration
COE	Center of Excellence	NIST	National Institute of Standards and Technology
COMSTAC	Commercial Space Transportation Advisory Committee	NOAA	National Oceanic and Atmospheric Administration
CVISN	Commercial Vehicle Information Systems and Networks	NRC	National Research Council
DHS	Department of Homeland Security	NSF	National Science Foundation
DMV	Department of Motor Vehicles	NSTC	National Science and Technology Council
DOC	Department of Commerce	OBCMS	Onboard Condition Monitoring Systems
DOD	Department of Defense	OMB	Office of Management and Budget
DOE	Department of Energy	OST	Office of the Secretary of Transportation
DOI	Department of the Interior	PART	Program Assessment Rating Tool
DOS	Department of State	PHMSA	Pipeline and Hazardous Materials Safety Administration
DOT	Department of Transportation	PNT	Positioning, Navigation, and Timing
EPA	Environmental Protection Agency	R&D	Research and Development
FAA	Federal Aviation Administration	R&T	Research and Technology
FARS	Fatality Analysis Reporting System	RD&T	Research, Development and Technology
FHWA	Federal Highway Administration	REDAC	Research, Engineering, and Development Advisory Committee
FMCSA	Federal Motor Carrier Safety Administration	RFID	Radiofrequency Identification
FRA	Federal Railroad Administration	RITA	Research and Innovative Technology Administration
FTA	Federal Transit Administration	RTCC	Research and Technology Coordinating Committee
FY	Fiscal Year	SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
GIS	Geographic Information System	SOCP	Ship Operations Cooperative Program
GMATS	Global Maritime and Transportation School	TCRP	Transit Cooperative Research Program
GPS	Global Positioning System	TELUS	Transportation, Economics, and Land Use System
ICAO	International Civil Aviation Organization	TRAC	Transit Research Analysis Committee
ITS	Intelligent Transportation Systems	TRANSIMS	Transportation Analysis Simulation System
ITS JPO	Intelligent Transportation Systems Joint Program Office	TRB	Transportation Research Board
JPDO	Joint Planning and Development Office	TSA	Transportation Security Administration
LTAP	Local Technical Assistance Program	UHPC	Ultra-High Performance Concrete
LTCCS	Large Truck Crash Causation Study	USDA	United States Department of Agriculture
LTTP	Long Term Pavement Performance	USMMA	United States Merchant Marine Academy
MAGLEV	Magnetic Levitation	UTC	University Transportation Center
MARAD	Maritime Administration	VII	Vehicle Infrastructure Integration
MMS	Minerals Management Service		
MPO	Metropolitan Planning Organization		
MTS	Marine Transportation System		

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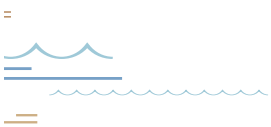


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## Executive Summary

The Department of Transportation's (DOT) Research, Development and Technology (RD&T) programs foster innovations leading to effective, integrated, and intermodal transportation solutions. This *Transportation Research, Development and Technology Strategic Plan 2006–2010* responds to requirements in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users for a five-year plan to guide transportation RD&T activities. It describes the strategic goals that are the primary purposes for RD&T and the RD&T strategies and emerging research priorities required to accomplish these goals.

For each RD&T strategy, the plan identifies anticipated funding levels and information the Department expects to gain. The plan incorporates the RD&T programs of all DOT operating administrations and considers how research by other Federal agencies, State DOTs, the private sector, academic institutions, and others contributes to Departmental goals and how unnecessary duplication is avoided. The National Research Council's (NRC) Transportation Research Board has reviewed the plan.

The Department, with leadership from the Research and Innovative Technology Administration (RITA), developed this *Transportation Research, Development and Technology Strategic Plan* through an ongoing coordination process involving all DOT operating administrations. Two crossmodal bodies lead this process: the RD&T Planning Council, composed of the heads of the operating administrations, the Under Secretary for Policy, and other senior DOT leaders; and the RD&T Planning Team, including the operating administrations' Associate Administrators for RD&T. The result is crossmodal planning and collaboration of RD&T at the highest levels of the Department.

### Department of Transportation RD&T Mission

Foster innovations leading to effective, integrated, and intermodal transportation solutions.

## DOT Strategic Goals

- Safety
- Reduced Congestion
- Global Connectivity
- Environmental Stewardship
- Security, Preparedness and Response
- Organizational Excellence

## TRANSPORTATION RESEARCH, DEVELOPMENT AND TECHNOLOGY STRATEGIC PLAN FRAMEWORK

Working across the Department, the RD&T Planning Council and RD&T Planning Team have identified the RD&T strategies and emerging research priorities that will guide RD&T investments over the next five years and advance the Department's strategic and organizational goals: *safety; reduced congestion; global connectivity; environmental stewardship; security, preparedness and response; and organizational excellence.*

### Safety

#### DOT Goal:

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

#### RD&T Strategies:

- Understand and address causal factors and risks.
- Mitigate the consequences of accidents and incidents.
- Assess impacts of new technologies, vehicles, concepts, designs, and procedures.

#### Emerging Research Priorities:

- *Human–Automation Interaction.* Increase understanding of human-machine interactions.
- *Application of Enhanced Transportation Safety Data and Knowledge.* Convert the data produced by digital technology applications into useful knowledge to improve safety.

### Reduced Congestion

#### DOT Goal:

Reduce congestion and other impediments to using the Nation's transportation system.



**RD&T Strategies:**

- Reduce passenger and freight congestion in air and surface modes.
- Extend the life of the existing transportation system and improve infrastructure durability.
- Advance use of next generation technologies and combinations of modes.
- Improve planning, operation, and management of transportation services and assets.
- Improve transportation services for underserved areas and populations.
- Advance the Nation's transportation research capability.

**Emerging Research Priorities:**

- *Congestion Reduction Policy Research and Technologies.* Analyze congestion reduction, congestion pricing, and innovative financing and the effectiveness of intelligent transportation system technologies, products, and services designed to reduce congestion.
- *System Resilience and Global Logistics.* Identify freight bottlenecks and changing transportation patterns and develop and implement technologies to enhance cargo flow.
- *Next Generation Air Transportation System.* Achieve greater aviation throughput, capacity, and productivity; reduce user and service costs; and ensure a safe, secure, and environmentally compatible aviation system.

**Global Connectivity****DOT Goal:**

Facilitate an international transportation system that promotes economic growth and development.

**RD&T Strategy:**

- Harmonize transportation standards and support leadership for U.S. transportation providers.

## **Environmental Stewardship**

### **DOT Goal:**

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

### **RD&T Strategies:**

- Understand and mitigate transportation impacts.
- Improve the environmental review process.

### **Emerging Research Priority:**

- *Energy Efficiency and Alternative Fuels.* Understand the impact of fuel prices on mobility, improve fuel efficiency, identify requirements for alternative fuel infrastructures, and assess safety impacts of alternative fuel vehicles.

## **Security, Preparedness and Response**

### **DOT Goal:**

Balance transportation security requirements with the safety, mobility, and economic needs of the Nation and be prepared to respond to emergencies that affect the viability of the transportation sector.

### **RD&T Strategies:**

- Reduce vulnerability and improve system preparedness and recovery.
- Secure hazardous materials shipments and assess the risks of hazmat events.

## **Organizational Excellence**

### **DOT Goal:**

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

### **RD&T Strategy:**

- Consistently apply the R&D Investment Criteria.

The relationship among the Department's goals, RD&T strategies, and emerging research priorities is shown in Table E-1.

**Table E-1. DOT Goals, RD&T Strategies, and Emerging Research Priorities**

DOT Goal	RD&T Strategies	Emerging Research Priorities
Safety	Understand and Address Causal Factors and Risks	Human-Automation Interaction Enhanced Safety Data
	Mitigate Accidents and Incidents	
	Assess New Technologies, Vehicles, Concepts, Designs, and Procedures	
Reduced Congestion	Reduce Passenger and Freight Congestion in Air and Surface Modes	Congestion Reduction Policy Research and Technologies
	Extend System Life and Improve Durability	
	Advance Use of Next Generation Technologies and Combinations of Modes	System Resilience and Global Logistics Next Generation Air Transportation System
	Improve Planning, Operations, and Management	
	Improve Services for Underserved Areas and Populations	
	Advance the Nation’s Transportation Research Capability	
Global Connectivity	Harmonize Standards and Support Leadership for U.S. Transportation Providers	
Environmental Stewardship	Understand and Mitigate Transportation Impacts	Energy Efficiency and Alternative Fuels
	Improve the Environmental Review Process	
Security, Preparedness and Response	Reduce Vulnerability and Improve Preparedness and Recovery	
	Secure Hazardous Materials Shipments and Assess Risks	
Organizational Excellence	Consistently Apply the R&D Investment Criteria	

## **RD&T PROGRAMS 2006-2010**

Over the next five years, the RD&T programs in the Department's operating administrations will advance DOT goals, RD&T strategies, and emerging research priorities while supporting modal priorities and mission requirements. The following DOT offices and administrations have missions that include supporting RD&T:

- Federal Aviation Administration (FAA)
- Federal Highway Administration (FHWA)
- Federal Motor Carrier Safety Administration (FMCSA)
- Federal Railroad Administration (FRA)
- Federal Transit Administration (FTA)
- Maritime Administration (MARAD)
- National Highway Traffic Safety Administration (NHTSA)
- Office of the Secretary (OST)
- Pipeline and Hazardous Materials Safety Administration (PHMSA)
- Research and Innovative Technology Administration (RITA)

### Safety RD&T

To achieve the Department’s highest priority strategic goal, DOT’s operating administrations will work with stakeholders to develop, make available, and enforce the technologies and techniques necessary to identify and resolve safety issues. Table E-2 lists DOT’s safety RD&T strategies, research areas the Department will focus on over the next five years, and the operating administrations with supporting RD&T programs.

**Table E-2. Safety RD&T Strategies, Research Areas, and Supporting DOT Operating Administrations**

RD&T Strategy	Research Areas	Operating Administrations
Understand and Address Causal Factors and Risks	Human Factors and Medical Risks	FAA, FHWA, FMCSA, FRA, NHTSA
	Vehicle, Equipment, and Infrastructure Factors	FAA, FHWA, FMCSA, FRA, FTA, NHTSA, OST, PHMSA
	Operational Factors	FAA, FHWA, FRA, FTA
	Hazardous Materials Transportation	FMCSA, FRA, OST, PHMSA
	Safety Data, Information Systems, and Risk Analysis	FAA, FHWA, FMCSA, FRA, FTA, NHTSA
Mitigate Accidents and Incidents	Emergency Response and Operations	FHWA, FTA
	Crashworthiness and Occupant Protection	FAA, FHWA, FMCSA, FRA, FTA, NHTSA
Assess New Technologies, Vehicles, Concepts, Designs, and Procedures	Safety Rulemaking and Advanced Technologies	FAA, FMCSA, NHTSA, RITA

### Reduced Congestion RD&T

Growing transportation congestion poses a substantial threat to the economy and to the quality of life of millions of Americans. The Department’s RD&T programs will seek to reduce congestion and other transportation impediments, to preserve the existing transportation system, and to improve the durability and life of transportation infrastructure. Table E-3 lists DOT’s congestion reduction RD&T strategies, research areas the Department will focus on over the next five years, and the operating administrations with supporting RD&T programs.



**Table E-3. Reduced Congestion RD&T Strategies, Research Areas, and Supporting DOT Operating Administrations**

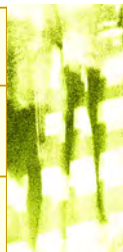
<b>RD&amp;T Strategy</b>	<b>Research Areas</b>	<b>Operating Administrations</b>
Reduce Passenger and Freight Congestion in Air and Surface Modes	Reducing Recurring Congestion	FAA, FHWA, FTA, OST
	Reducing Non-Recurring Congestion	FAA, FHWA
Extend System Life and Improve Durability	Preserving Existing Infrastructure	FAA, FHWA, FRA, FTA
	Improving Infrastructure Durability and Characterizing Materials	FAA, FHWA, FRA, OST
Advance Use of Next Generation Technologies and Combinations of Modes	Multimodal and Intermodal Transportation	FHWA, OST, RITA
	Next Generation Technologies and Systems	FAA, FHWA, FRA, OST, RITA
Improve Planning, Operations, and Management	Improving Efficiency of Operations and Investments	FAA, FHWA, FTA, OST
	Improving Planning and Decisionmaking	FHWA, FTA
	Promoting Innovations in Transportation Finance	FTA, OST
Improve Services for Underserved Areas and Populations	Improving Access for Transportation-Disadvantaged Populations	FHWA, FTA, OST
	Improving Transportation in Rural Areas and Small Communities	FHWA, FTA, OST, RITA
Advance the Nation's Transportation Research Capability	University Research and Education	FAA, FHWA, FRA, FTA, RITA
	Cooperative and Stakeholder Research	FAA, FHWA, FTA
	Technical Assistance and Training	FHWA, FTA, RITA
	DOT Research Facilities and Expertise	FAA, FRA, NHTSA

### Global Connectivity RD&T

The Nation’s continued economic prosperity depends on a strong and interconnected global transportation system. Table E-4 lists DOT’s global connectivity RD&T strategy, research areas the Department will focus on over the next five years, and the operating administrations with supporting RD&T programs.

**Table E-4. Global Connectivity RD&T Strategy, Research Areas, and Supporting DOT Operating Administrations**

RD&T Strategy	Research Areas	Operating Administrations
Harmonize Standards and Support Leadership for U.S. Transportation Providers	International Standards and Coordination	FAA, FHWA, FTA, NHTSA, OST, PHMSA
	Transportation Industry Development	FHWA, FTA, OST



### Environmental Stewardship RD&T

Transportation exerts pressure on environmental resources worldwide. The Department must balance environmental challenges with the need for a safe and efficient transportation network. Table E-5 lists DOT’s environmental stewardship RD&T strategies, research areas the Department will focus on over the next five years, and the operating administrations with supporting RD&T programs.

**Table E-5. Environmental Stewardship RD&T Strategies, Research Areas, and Supporting DOT Operating Administrations**

RD&T Strategy	Research Areas	Operating Administrations
Understand and Mitigate Transportation Impacts	Understanding Transportation Impacts	FAA, FHWA, OST, PHMSA
	Advancing Technologies, Plans, and Methods to Manage Impacts	FAA, FHWA, FRA, FTA, NHTSA, OST, PHMSA, RITA
Improve the Environmental Review Process	Environmental Streamlining	FAA, FHWA, FTA



**Security, Preparedness and Response RD&T**

There is a critical need to ensure the transportation system’s rapid response and recovery from disruptions due to attacks, natural disasters, and other major events; to protect the system against terrorism; and to ensure that it remains a vital link for defense mobilization. Table E-6 lists DOT’s security RD&T strategies, research areas the Department will focus on over the next five years, and the operating administrations with supporting RD&T programs.

**Table E-6. Security, Preparedness and Response RD&T Strategies, Research Areas, and Supporting DOT Operating Administrations**

RD&T Strategy	Research Areas	Operating Administrations
Reduce Vulnerability and Improve Preparedness and Recovery	Preparedness and Response	FHWA, FTA
	Security Risks and Vulnerabilities	FHWA, FRA, OST
Secure Hazardous Materials Shipments and Assess Risks	Hazardous Materials Risks and Vulnerabilities	FMCSA, FRA, OST, PHMSA

**Organizational Excellence RD&T**

To advance the President’s Management Agenda, the Department seeks to consistently apply the R&D Investment Criteria of relevance, quality, and performance to all RD&T programs. Table E-7 lists DOT’s organizational excellence RD&T strategy and the operating administrations with supporting RD&T programs.

**Table E-7. Organizational Excellence RD&T Strategy and Supporting DOT Operating Administrations**

RD&T Strategy	Operating Administrations
Consistently Apply the R&D Investment Criteria	FAA, FHWA, FMCSA, FRA, FTA, NHTSA, PHMSA, RITA

## RD&T PARTNERSHIPS

The Department’s RD&T programs emphasize partnership, coordination, and information sharing—both across the Federal Government and with universities, State and local governments, industry, and other organizations. This approach helps the Department to leverage scarce RD&T resources, prevent unnecessary duplication, and broaden the range of expertise brought to bear on transportation problems. Table E-8 summarizes the Department’s interagency, university, and cooperative RD&T activities.

**Table E-8. Interagency, University, and Cooperative RD&T**

Federal Partners	University Programs	Cooperative Research
Department of Agriculture	Center for Commercial Deployment of Transportation Technologies	Airport Cooperative Research Program
Department of Commerce	FAA Transportation Centers of Excellence	Cargo Handling Cooperative Program
Department of Defense	FRA University Research Program	Commercial Remote Sensing and Spatial Technologies Program
Department of Energy	Global Maritime and Transportation School	Hazardous Materials Transportation Cooperative Research Program
Department of Homeland Security	Joint University Program	Marine Environmental Research
Department of the Interior	Maritime Research and Education	Marine Transportation System
Department of State	Renewable Energy Transportation Laboratory	Maritime Standards Coordination
Environmental Protection Agency	University Transportation Centers Program	National Cooperative Freight Transportation Research
National Aeronautics and Space Administration		National Cooperative Highway Research Program
National Science Foundation		Ship Operations Cooperative Program
		Ship Structure Committee
		Short Sea Shipping Cooperative Program
		Transit Cooperative Research Program
		Transportation Pooled-Fund Program

### **Interagency Coordination**

DOT leads transportation RD&T in the Federal Government. At the Cabinet level, the Department coordinates transportation research through the White House Office of Science and Technology Policy and the National Science and Technology Council. In addition, the Department's operating administrations work directly with agencies in areas of mutual interest to avoid duplication and leverage research investments. Among the agencies with which the Department actively cooperates are the Departments of Agriculture, Commerce, Defense, Energy, Homeland Security, Interior, and State; the Environmental Protection Agency; the National Aeronautics and Space Administration; and the National Science Foundation.

### **University Research**

In addition to coordinating research with other Federal agencies, the Department actively pursues partnerships with the Nation's academic institutions. The Department's largest university program supports the University Transportation Centers, which conduct basic and applied research to advance the body of knowledge in transportation; conduct education programs to expand the transportation workforce; and provide capacity building programs to existing transportation professionals.

### **Cooperative Research and Partnerships**

The Department also engages in cooperative research with State and local agencies, industry, not-for-profit institutions, and other key stakeholders. Major activities include the Airport Cooperative Research Program, the Hazardous Materials Transportation Cooperative Research Program, the National Cooperative Freight Transportation Research Program, and the Transit Cooperative Research Program, all of which the NRC administers; the National Cooperative Highway Research Program, administered by the American Association of State Highway and Transportation Officials; the Commercial Remote Sensing and Spatial Technologies Program; and the Marine Transportation System initiative.



## EVALUATION AND ASSESSMENT OF RD&T

To ensure the effectiveness of RD&T, the Department continually assesses its research programs using three primary mechanisms: (1) systematic application of the Administration’s R&D Investment Criteria and Program Assessment Rating Tool (PART); (2) internal annual reviews of operating administration RD&T programs; and (3) external RD&T coordination and review. Table E-9 summarizes the Department’s RD&T evaluation strategy.

**Table E-9. RD&T Evaluation Strategy**

R&D Investment Criteria and PART	Annual Internal Program Review	External Coordination and Review
Assesses RD&T Relevance, Quality, and Performance	Annually Assesses Implementation of Investment Criteria and PART	Ensures That RD&T Addresses Critical Needs
Evaluates Processes for RD&T Program Planning, Budgeting, and Management	Ensures That RD&T Is Evaluated According to Best Practices	Identifies RD&T Priorities and Programmatic Direction
	Identifies Opportunities for Crossmodal Initiatives	Upholds Technical Quality of RD&T
	Prevents Unnecessary Duplication	Provides Basis for Developing Effective Performance Metrics

### R&D Investment Criteria and PART

To guide the planning and management of research across the Federal Government, the White House Office of Management and Budget (OMB) has established three broad investment criteria for RD&T: relevance, quality, and performance. These investment criteria incorporate established best practices for research evaluation as identified by the National Academy of Sciences, the Government Accountability Office, and others. One mechanism to assess how well agencies are implementing the criteria is the PART. On the basis of the PART, programs are rated as Effective, Moderately Effective, Adequate, Ineffective, or Results Not Demonstrated. To date, OMB has used the PART to assess RD&T programs in FAA, FHWA, FRA, NHTSA, and PHMSA and found each to be Moderately Effective or better. The PART results for FTA’s research program will be released in February 2007.

### **Annual RD&T Program Review**

Within the Department, the primary mechanism for ensuring implementation of the R&D Investment Criteria and PART is the annual review of modal RD&T programs. Assisted by RITA, the RD&T Planning Team's Program Review Working Group annually assesses how well each operating administration is applying the investment criteria, particularly whether RD&T programs are evaluated according to established best practices. RITA reports recommendations and conclusions to the RD&T Planning Council at the end of each year's cycle of reviews. The Program Review Working Group assessed all operating administration RD&T programs in FY 2005 and again in FY 2006.

### **External Coordination and Review**

A key element of the Department's RD&T evaluation strategy is regular consultation and engagement with stakeholders. Of particular importance is the conduct of regular external program evaluations through modal RD&T advisory committees, peer review, and broad stakeholder outreach. Such efforts avoid research duplication, uphold the technical quality of RD&T, and ensure that modal RD&T programs address critical national needs.

## **CONCLUSION**

As the Department works to implement and improve this *Transportation Research, Development and Technology Strategic Plan* it will consult with Congress, the private sector, the NRC, and other stakeholders to ensure that Departmental RD&T remains a wise public investment. When necessary, the Department will revise this plan to reflect changes in DOT and national priorities, operating administration mission requirements, and customer needs.

In particular, over the next five years the Department will work with stakeholders to shift some RD&T investments toward support of its emerging research priorities. Each of these priorities addresses identified DOT goals, offers a significant potential return on investment, is an appropriate area for Federal research, and is not likely to be duplicated by other efforts. Moreover, these emerging research priorities will be critical elements in accomplishing the Department's RD&T mission: to foster innovations leading to effective, integrated, and intermodal transportation solutions.

## Introduction

The U.S. Department of Transportation (DOT) provides global leadership to ensure a safe, secure, efficient, and interconnected transportation system for the American public. To this end, the mission of the Department's Research, Development and Technology (RD&T) program is to foster innovations leading to effective, integrated, and intermodal transportation solutions. DOT's RD&T investments leverage those of research partners to stimulate innovations through targeted research, development, and technology implementation activities. As stated in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), these activities are a basic Federal responsibility when they are of national significance, when there is a clear public benefit and private sector investment is less than optimal, when they support a stewardship role in assuring the efficient use of Federal resources, and when they present the best means to support national policy goals.

### PURPOSE AND SCOPE

This DOT *Transportation Research, Development and Technology Strategic Plan 2006-2010* presents the Department's strategy for RD&T over the next five years and beyond. It supports the broader *DOT Strategic Plan* and mirrors that plan's structure, and responds to requirements in SAFETEA-LU for a five-year strategic plan to guide transportation research activities. The plan describes the strategic and organizational goals that are the primary purposes for Departmental RD&T; the RD&T strategies the Department will pursue to achieve these goals; and, for each RD&T strategy, the anticipated funding levels and information the Department expects to gain. Importantly, the plan also identifies the emerging research priorities that the Department intends to pursue over the next several years. The plan incorporates the RD&T programs of all DOT operating administrations and considers how research by other Federal agencies, State DOTs, the private sector, and others contributes to DOT goals and how unnecessary duplication is avoided.

### PLAN DEVELOPMENT

This *Transportation Research, Development and Technology Strategic Plan* was developed as part of an ongoing process that incorporates multiyear strategic planning, annual program planning, and budget and performance planning across the Department, as well as the unique mission requirements of DOT's operating administrations.

RD&T is a basic Federal responsibility when it is of national significance, when there is a clear public benefit and private sector investment is less than optimal, when it supports a stewardship role in assuring efficient use of Federal resources, and when it presents the best means to support national policy goals.



### **Internal Coordination**

Within the Department, two internal bodies lead the RD&T planning process:

*RD&T Planning Council.* The RD&T Planning Council ensures crossmodal collaboration and coordination of RD&T at the highest levels within DOT and with external entities. The Council is chaired by the Administrator of the Research and Innovative Technology Administration (RITA) and comprises the heads of the operating administrations, the Under Secretary for Policy, and other senior DOT leaders.

*RD&T Planning Team.* The RD&T Planning Team assists the RD&T Planning Council in ensuring crossmodal collaboration and coordination of RD&T. It is chaired by RITA's Associate Administrator for Research, Development, and Technology and includes the Associate Administrators for RD&T in the operating administrations.

To support the development of the *Transportation Research, Development and Technology Strategic Plan*, the RD&T Planning Council has identified a set of RD&T strategies and emerging research priorities that will advance DOT goals and guide RD&T investments over the next five years and beyond. As described in Chapter 2, these RD&T strategies and research priorities provide the framework for this plan and for RD&T across the Department.

### **Stakeholder Input**

As required by SAFETEA-LU, the Transportation Research Board (TRB) of the National Research Council (NRC) has reviewed this *Transportation Research, Development and Technology Strategic Plan* and provided a letter report with its recommendations. The NRC letter report and the Department's response are in Appendix A.

This plan also incorporates both primary and secondary input from a broad range of Departmental stakeholders, including State and local transportation agencies, not-for-profit institutions, academia, and the private sector.

Primary outreach occurred through the posting of a working draft of the *Transportation Research, Development and Technology Strategic Plan* on the Department's Docket Management System at <http://dms.dot.gov>. At this site, stakeholders were able to access the draft and submit comments. A summary of the comments received by the required date (August 9, 2006) is in Appendix B.

To obtain further stakeholder input, the Department published a *Federal Register* Notice on July 12, 2006; announced the availability of the draft plan through RITA's

website (with a link to the Department's Docket Management System); and disseminated a notice of availability for comment on July 11 through TRB's E-Newsletter, thereby targeting approximately 20,000 stakeholders with the highest interest in RD&T. Finally, the Department presented briefings on the plan to targeted stakeholders, such as the Federal Highway Administration's Research and Technology Coordinating Committee (June 15); the Research Advisory Committee of the American Association of State Highway and Transportation Officials (July 11); and the Council of University Transportation Centers (June 22).

The preponderance of RD&T is conducted by the Department's operating administrations for modal-specific purposes. At the modal level, research advisory committees, public meetings, and forums ensure that RD&T programs are validated through external stakeholder review and participation. This *Transportation Research, Development and Technology Strategic Plan* reflects this secondary stakeholder input, primarily by incorporating the RD&T plans of the operating administrations, each of which has been developed with broad stakeholder comment and review.

## **CONTENTS**

The remaining chapters of this *Transportation Research, Development and Technology Strategic Plan* cover the following:

*Chapter 2.* Strategic planning framework for the Department's RD&T programs.

*Chapters 3 through 8.* RD&T strategies, research areas, programs, and milestones that support the Department's strategic goals.

*Chapter 9.* RD&T partnerships.

*Chapter 10.* Evaluation and assessment of RD&T.

*Appendix A.* NRC letter report and DOT response.

*Appendix B.* Stakeholder input.

*Appendix C.* RD&T funding.

*Appendix D.* Links to operating administration RD&T advisory committees and plans.





## Strategic Planning Framework

The overall aim of the Department's RD&T is to anticipate and respond to changes in the complex transportation environment and to stimulate transportation innovations on behalf of the American public. The Department conducts RD&T to advance national transportation goals and to fulfill the specific mission requirements of its operating administrations. These investments are balanced between short-term applied RD&T and longer term research, and address critical gaps in areas not likely to be addressed by other Federal agencies or industry.

### DOT MISSION AND GOALS

Although DOT's operating administrations have wide-ranging duties related to operating or overseeing various transportation sectors, they share a commitment to fulfill national objectives, as embodied in the Department's mission and by the following six strategic and organizational goals:

#### Strategic Goals

- *Safety.* Enhance public health and safety by working toward the elimination of transportation-related deaths and injuries.
- *Reduced Congestion.* Reduce congestion and other impediments to using the Nation's transportation system.
- *Global Connectivity.* Facilitate an international transportation system that promotes economic growth and development.
- *Environmental Stewardship.* Promote transportation solutions that enhance communities and protect the natural and built environment.
- *Security, Preparedness and Response.* Balance transportation security requirements with the safety, mobility, and economic needs of the Nation and be prepared to respond to emergencies that affect the viability of the transportation sector.

#### Organizational Goal

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

### DOT Mission

The national objectives of general welfare, economic growth and stability, and the security of the United States require the development of transportation policies and programs that contribute to providing fast, safe, efficient, and convenient transportation at the lowest cost consistent with those and other national objectives, including the efficient use and conservation of the resources of the United States.

*DOT Strategic Plan  
2006-2011*

Protecting segments of the population who remain at heightened risk—including teenage and older drivers, pickup drivers, and rural residents—will require targeted safety programs.

## EXTERNAL FACTORS AND CHALLENGES

The Department's strategic goals serve as the primary purposes for all of its diverse RD&T activities. Over the next several years, a number of external factors will affect the Department's ability to achieve these goals, some of which will create particular challenges for RD&T:

### Demographic Trends

Demographic trends work against the Department's ability to achieve its goals for safety, reduced congestion, and environmental stewardship. Most transportation-related fatalities and injuries occur on the Nation's roads and highways, and demographic trends make it increasingly difficult to reduce these fatalities and injuries. Within the next 25 years, the U.S. population is estimated to grow to 364 million, up from 282 million in 2000. Vehicle miles of travel (VMT) is projected to increase by approximately 60 percent from 2000 to 2030, leading to much higher numbers of highway crashes and fatalities. The increase in VMT will also lead to increased congestion—as passenger vehicles and trucks compete for space on our roads and highways—and to more emissions—even with vehicles that are increasingly fuel efficient. Travel by air for leisure and business purposes is also expected to increase, with resulting pollution from aircraft emissions and noise. Because of demographic pressures, trucks will be an increasing part of the traffic stream and will make a greater contribution to environmental problems.

Protecting segments of the population who remain at heightened risk—including teenage and older drivers, pickup drivers, and rural residents—will require targeted safety programs. Significant increases in the older population—the number of people between the ages of 65 and 84 will increase by 114 percent from 2000 to 2050—will pose highway and motor vehicle safety challenges, whether older Americans are drivers or passengers. They also will pose highway congestion challenges, as retirees take to the road for recreation and travel. Finally, the steady influx of immigrants from around the world will add complexity to the traffic safety challenge, requiring the Department to be innovative in adapting safety strategies, materials, and approaches to reach these cultures.

### Globalization

Globalization generally refers to the expansion of global linkages, the organization of social life on a global scale, and the growth of a global consciousness. People around the world are more connected to each other than ever before. Information and money flow more quickly than ever. International travel is more frequent and international communication is commonplace. Goods and services produced in one part of the world are increasingly available in all parts of the world. Although these links are not new, they are more pervasive than in the past.

In the United States, international trade represents a significant share of Gross Domestic Product. *The World Fact Book*, published by the Central Intelligence Agency, ranks the United States first in the world in imports and fourth in exports.

While international trade is usually the primary meaning of globalization, personal international travel for business and leisure is a significant trend in the globalization of transportation.

As an external factor, globalization reinforces the need for opening international transportation markets and for highly efficient intermodal connections where the U.S. and international transportation networks meet. Where connections are inefficient, congestion develops. As traditional low-cost manufacturing countries increase their standards of living, manufacturing may switch to other parts of the world. These changing trade patterns often lead to congestion because of shifts in the use of U.S. ports and inland distribution systems. As a result, existing ports and intermodal facilities are bypassed, while underutilized ports and systems suddenly need significant expansion. Globalization demands flexibility in the transportation network, and flexibility demands investment in infrastructure. Pressures on transportation services and infrastructure from globalization will affect the Department's ability to reduce congestion and to achieve its global connectivity goal.

Globalization reinforces the need for opening international transportation markets and for highly efficient intermodal connections where the U.S. and international transportation networks meet.

### **The Economy**

Cyclical and long-term changes in domestic and international economic activity have a strong impact on discretionary personal travel and shipment of goods, affecting demand for transportation infrastructure and services. Economic growth spurs new commercial and residential development, increases travel and trade, creates bottlenecks, and strains the capacity of the infrastructure. Conversely, economic stagnation reduces development, travel, and trade. Economic stagnation also shifts demand for transportation from higher cost to lower cost services.

Economic growth shifts the pattern of transportation in important ways. As incomes grow, people tend to buy more expensive goods, with a higher value per unit weight. The higher value of these goods means that the time they spend in transit is more costly to the shipper, so the shipper is more willing to pay extra for more expedited forms of transportation. As a result, air freight has been the fastest growing form of freight transportation over the past decade, with trucking close behind. Even in rail transportation, the most rapidly growing cargo has been high-value, expedited intermodal freight.

Truck traffic has been growing at a faster rate than overall vehicle traffic. Currently, trucks carry 75 percent of the Nation's commerce based on the value of the goods and more than two-thirds of these goods based on weight. An expanding economy with the resultant increase in truck traffic is an external factor that will challenge the goal of reducing traffic congestion.

The increase in high-value cargoes means that transportation costs are a smaller percentage of the overall delivered cost of the product. With transportation a smaller percentage of the total cost, shippers can afford to locate their production at a greater distance from the ultimate consumer to save on production costs. The result has been the growth of global outsourcing that has characterized the U.S. economy for the past quarter-century. This in turn has had tremendous effects on the trans-

Current and emerging technologies can significantly help the Department to achieve its safety goals by adding additional layers of safety to avoid and mitigate crashes.

portation system, placing a greater burden on the international supply chain—marine carriers, ports, and intermodal rail—to deliver the goods. The nodal points in this supply chain have become increasingly congested.

Economic growth has also changed the nature of demand for passenger travel. As people's incomes have grown, they have traveled more, but their choice of mode has shifted increasingly to air travel. Air passenger travel is a service with a high income-elasticity of demand—people buy proportionately more of it as their incomes grow. Over the past 20 years, as real incomes have risen by roughly 100 percent, airline passenger-miles have increased by 146 percent, highway passenger travel has grown by 49 percent, and population has grown by 28 percent. Thus, the economy is an external factor that can significantly affect the Department's ability to achieve its goals for reduced congestion and global connectivity.

### **Technology**

Current and emerging technologies are external factors that can significantly help the Department to achieve its safety goals. New technologies add additional layers of safety to avoid and mitigate crashes. In 2005, for example, new technology allowed the Federal Aviation Administration (FAA) safely to cut in half required vertical separations between aircraft, thereby increasing airspace capacity and reducing the risk of collision.

Technologies improve levels of highway safety. These include adaptive cruise control; brake assist; anti-lock braking systems; advanced airbags; backing up warning sensors; drowsy driver monitoring; warning devices for specific types of impending crashes (rear-end, lane/road departure, intersection); and systems that take control of the vehicle, such as electronic stability control, rollover prevention, and alcohol detection.

Additional occupant protection improvements, including advanced vehicle structures, safety belt/ignition-interlock systems, airbags, and other interior protection features, will reduce injuries and fatalities when crashes do occur. Immediately after impact, onboard communications could automatically notify rescue services of a crash, its location, and probable extent of injuries based on onboard sensors. The proliferation of traffic video surveillance in urban areas and mobile telephone communications could increase the chance of a 9-1-1 call, and possibly reduce response time by emergency personnel. Enhanced 9-1-1 technologies could also spur similar improvements in rural and suburban communities.

Technologies will play expanded roles in managing primary crash incidents and preventing avoidable secondary crashes. Devices that record onboard sensor data about crash circumstances and the behaviors of each involved vehicle help experts understand what happened and lead to vehicle, roadway design, and driver/operator training improvements. Other technologies that could help improve safety include computer simulators, biometrics, smart card driver licenses, and vehicle performance diagnostics.



Current developments in licensing car and truck drivers may also improve our ability to reduce transportation-related fatalities and injuries. Licensing is undergoing scrutiny because of traffic safety and homeland security issues. Recognition that the driver's license not only allows one to drive but also provides a means for identifying an individual has led to debate on the role of the license and licensing bodies in the United States. Because of data exchange between State and Federal law enforcement agencies, information is becoming more accessible. This exchange may reduce the large numbers of suspended, unlicensed, and uninsured motorists who are disproportionately involved in crashes. The AAA Foundation for Traffic Safety reported that 20 percent of all fatal crashes involved at least one driver who did not have a license.<sup>1</sup> Of those with invalid licenses, 28 percent had received three or more suspensions or revocations before their crashes.<sup>2</sup> Finally, because of demographic pressures, State Departments of Motor Vehicles will begin to reassess driver fitness over time and implement strategies that balance the need to maintain the mobility of the increasing older driver population while protecting public safety.<sup>3</sup>

Deployment of ITS and related technologies will reduce congestion and make travel on the highway system more reliable and predictable.

In addition to improving safety, deployment of technologies—such as vehicle performance diagnostics; automated tolling; driver warnings about weather, road hazards, and bottlenecks; vehicle self-help measures; 5-1-1 traveler telephone information; and satellite-based systems, including wireless notifications to repair services—should reduce dangerous highway breakdowns and help relieve congestion. Widespread deployment of intelligent transportation systems (ITS) and other related technologies will not only reduce congestion but also will make travel on the highway system more reliable and predictable.

### **Growth in the Motor Carrier Industry**

Truck traffic has been growing at a faster rate than overall vehicle traffic. Currently, trucks carry 75 percent of the Nation's commerce based on the value of the goods and more than two-thirds of these goods based on weight. In the future, large trucks will likely be an increasing part of the traffic stream and will make a greater contribution to safety and environmental problems. An increase in truck traffic is an external factor that will challenge the Department's safety goal of reducing large-truck-related fatalities and injuries and the environmental goal of reducing pollution and other adverse environmental effects from transportation.

### **Driver Shortages**

Approximately 2.5 million truck drivers worked in the United States during 2004. However, demand for truck and bus drivers is growing and potential driver shortages in the motor carrier industry may tempt some companies to use a higher percentage of new or unskilled drivers to meet increasing demands. Lack of qualified drivers is an external factor that may adversely impact efforts to reduce large-truck- and bus-related crashes.

<sup>1</sup> *Unlicensed to Kill: The Sequel*. AAA Foundation for Traffic Safety. Washington, DC. January 2003. <http://www.aaafoundation.org/pdf/UnlicensedToKill2.pdf>

<sup>2</sup> Ibid.

<sup>3</sup> *Strategies for Medical Advisory Boards and Licensing Review*. NHTSA. Washington, DC. July 2005. <http://www.nhtsa.dot.gov/people/injury/research/MedicalAdvisory/>

The high cost of intermodal infrastructure projects, localized opposition to new transportation development, and the stovepipe organizational structure of public transportation agencies are persistent obstacles to efficient intermodal connections in the United States.

### **U.S. Economic Cycles**

Economic cycles are external factors that can increase pipeline safety risk. Economic growth normally brings an increase in commercial and residential development, which increases the probability of excavation or outside force damage to pipelines—a major factor in pipeline safety. On the other hand, economic and budget pressures can negatively influence the priorities of pipeline safety partners—the States—for implementing and enforcing pipeline safety measures. Financial pressures on the pipeline industry can diminish the resources available to support safe operating and maintenance practices.

### **Obstacles to Intermodalism**

Persistent obstacles to efficient intermodal connections in the United States, such as the high cost of intermodal infrastructure projects, localized opposition to new transportation development, and the stovepipe organizational structure of public transportation agencies, impede the ability to improve U.S. connection points within the United States and to the global transportation network. If this situation persists, the intermodal network will continue to experience erratic service reliability. Intermodal congestion will get worse, and capacity constraints will slow the ability of the transportation network to recover from any adverse events—such as Hurricane Katrina. Increased intermodal congestion would also increase air pollution from transportation sources. Unless addressed, obstacles to intermodalism could affect the Department's ability to achieve its reduced congestion and environmental stewardship goals.

### **Flu Pandemic**

Globalization and the resulting highly integrated transportation networks make it possible for infectious diseases to spread rapidly from one region of the world to another. The outbreak of an infectious disease in one part of the world may have serious economic and financial consequences for transportation firms operating in the region. While the spread of any infectious disease would cause a serious disruption in world commerce and travel, concern is now focused on an Avian Flu Pandemic. The outbreak of a highly infectious disease such as the Avian Flu could strain all segments of our economy and all modes of transportation.

The Department has plans in place to sustain its critical business operations through a combination of teleworking (to promote social distancing) and working on-site for those functions that cannot be performed via telework. DOT will work with the Departments of State and Homeland Security as well as with State and local governments for prioritized delivery of critical systems and services nationwide. Nevertheless, a flu pandemic is an external factor that could affect the Department's ability to achieve its strategic goals.

### **Disruptions from Natural Disasters, Terrorists, and Criminal Attacks**

Natural disasters such as hurricanes, tornados, earthquakes, and floods demonstrate that the government needs to be ready to collaborate and cooperate in new and innovative ways to cope with such events effectively. Similarly, terrorist and criminal attacks on transportation systems can disrupt passenger transportation and the flow of cargo, particularly vital commodities such as food, medicines, and petroleum products. Major transportation fuel supply disruptions could occur in pumping or transporting crude oil, in refining crude oil, and in the distribution and delivery of fuels. Damage to large segments of roadways, tunnels, or bridges, as well as to waterways transport, rail freight movements, and transit services, are all plausible risks. Electricity supply disruptions, such as major blackouts or brownouts, could sharply affect the operation of certain transport sectors, particularly aviation, rail, and transit. Reliance on information technology makes the Department itself, and thus its ability to direct recovery efforts, more vulnerable when blackouts occur. The 2005 hurricane season dramatically revealed how enormous peak burdens were placed on the Nation's transportation system when millions of people attempted to vacate or relocate within a narrow window of time. Primarily the roadway system, but also mass transit, rail, air, and other modes, can be severely burdened by such events. Disruptions from natural disasters, terrorists, and criminal attacks will challenge the Department's ability to achieve its strategic goals.

### **RD&T PLANNING PROCESS**

Led by RITA, the Department's RD&T planning process ensures that all RD&T activities are aligned with DOT goals and focused on the Nation's most pressing transportation challenges. This process tracks multiyear RD&T priorities with annual budgets and performance goals. To assist RITA with RD&T planning, the Department recently established two internal bodies: the RD&T Planning Council and the RD&T Planning Team (see Chapter 1). The Department's RD&T planning process has three elements: multiyear strategic planning, annual program planning, and budget and performance planning:

*Multiyear RD&T Planning.* The RD&T Planning Council and RD&T Planning Team define long-term, multiyear RD&T strategies and emerging research priorities. These strategies and priorities guide RD&T investments and provide the framework for the Department's *Transportation Research, Development and Technology Strategic Plan*.

*Annual Program Planning.* Considering both Departmental and operating administration priorities, the Planning Council and Planning Team develop annual RD&T priorities for each upcoming fiscal year. Priorities are included in the Secretary's budget guidance to the operating administrations and in the annual RD&T funding report submitted to Congress.

*Budget and Performance Planning.* Assisted by RITA, the Planning Council and Planning Team support RD&T budgeting and program assessment through annual reviews of modal RD&T programs and budget submissions.

The RD&T Planning Council and RD&T Planning Team collaborate with other DOT-wide bodies throughout all phases of this process, including DOT's ITS Management Council, Human Factors Coordinating Committee, Center for Climate Change and Environmental Forecasting, and Hydrogen Working Group.

### **RD&T Strategies**

As indicated above, a key role for the RD&T Planning Council is to identify the critical RD&T strategies that will enable the Department to achieve its strategic goals. These overarching strategies serve as the primary research topics for the Department's diverse RD&T programs and activities. The Department's RD&T strategies for the next five years are:

#### **Safety**

- Conduct and support research to understand and address the causal factors and risks in accidents and to anticipate future safety risks in all transportation modes.
- Conduct and support research to determine the most effective ways of mitigating the consequences of transportation accidents and incidents in all modes.
- Support safety rulemaking by assessing the potential safety impacts of new transportation technologies, vehicles, concepts, designs, and procedures.

#### **Reduced Congestion**

- Conduct and support research to reduce urban and suburban traffic congestion, freight gateway congestion, and aviation system congestion.
- Conduct and support research to extend the life of the existing transportation system and improve the durability of infrastructure.
- Conduct and support research to advance the use of next generation technologies and to make effective use of combinations of modes in moving people and goods.
- Conduct and support research to improve the planning, operation, and management of surface transportation and aviation services and assets.
- Conduct and support research to improve transportation services for underserved areas and populations.

- Advance the Nation’s transportation research capability through capacity building, fellowships, grants, and cooperative research with universities, the private sector, and State and local governments.

### **Global Connectivity**

- Conduct and support research leading to harmonized international standards, improved cross-border collaboration, and global leadership for U.S. transportation providers.

### **Environmental Stewardship**

- Conduct and support research to understand the various impacts of transportation activities on the natural and built environment and communities and to advance technologies and concepts to mitigate those impacts.
- Conduct and support research on ways to improve the environmental review process to achieve the timely delivery of transportation projects.

### **Security, Preparedness and Response**

- Conduct and support research to reduce the vulnerability of transportation systems and to improve their ability to prepare for and recover from attacks, natural disasters, and emergencies.
- Conduct and support research to develop technologies and procedures to secure hazardous materials shipments and to assess the risks of hazmat events.

### **Organizational Excellence**

- Consistently apply the President’s R&D Investment Criteria—relevance, quality, and performance—to all DOT-sponsored and in-house research.

### **Emerging Research Priority Areas**

To support DOT goals and RD&T strategies, the RD&T Planning Council has also identified six emerging research priority areas to guide the Department’s RD&T investments. These priorities represent areas where the Department would make greater investments over the next five years and beyond should it have greater flexibility in RD&T program funding. In addition, these six research areas meet the following criteria: (1) they support identified Departmental goals and priorities; (2) they offer the greatest potential return on investment; and (3) they are areas where Federal RD&T is most appropriate and not likely to be duplicated by other efforts. The Department’s emerging research priorities are:



- *Human–Automation Interaction.* Conduct and support research leading to an increased understanding of human-machine interactions related to safety performance.
- *Application of Enhanced Transportation Safety Data and Knowledge.* Conduct and support efforts to convert the large quantities of data produced by applications of digital technology into useful knowledge that can improve transportation safety.
- *Congestion Reduction Policy Research and Technologies.* Strengthen policy research and analysis on congestion reduction, congestion pricing, and innovative financing, and conduct RD&T to evaluate the effectiveness and market acceptance of traveler and traffic information technologies, products, and services.
- *System Resilience and Global Logistics.* Conduct and support RD&T to identify freight bottlenecks and changing transportation patterns and to develop and implement technologies to enhance the efficiency of cargo flows.
- *Next Generation Air Transportation System.* Provide the knowledge base to achieve greater aviation throughput and capacity; reduce user and service costs, including congestion; increase service productivity; and ensure a safe, secure, and environmentally compatible aviation system.
- *Energy Efficiency and Alternative Fuels.* Conduct and support research to understand the impact of fuel prices and fuel efficiency on mobility, opportunities to improve fuel efficiency, transportation requirements associated with alternative fuel infrastructures, and safety impacts of alternative fuel vehicles.

Table 2-1 shows the relationship among the Department’s strategic and organizational goals, RD&T strategies, and emerging research priorities.

**Table 2-1. DOT Goals, RD&T Strategies, and Emerging Research Priorities**

DOT Goal	RD&T Strategies	Emerging Research Priorities
Safety	Understand and Address Causal Factors and Risks	Human-Automation Interaction Enhanced Safety Data
	Mitigate Accidents and Incidents	
	Assess New Technologies, Vehicles, Concepts, Designs, and Procedures	
Reduced Congestion	Reduce Passenger and Freight Congestion in Air and Surface Modes	Congestion Reduction Policy Research and Technologies
	Extend System Life and Improve Durability	
	Advance Use of Next Generation Technologies and Combinations of Modes	System Resilience and Global Logistics Next Generation Air Transportation System
	Improve Planning, Operations, and Management	
	Improve Services for Underserved Areas and Populations	
	Advance the Nation's Transportation Research Capability	
Global Connectivity	Harmonize Standards and Support Leadership for U.S. Transportation Providers	
Environmental Stewardship	Understand and Mitigate Transportation Impacts	Energy Efficiency and Alternative Fuels
	Improve the Environmental Review Process	
Security, Preparedness and Response	Reduce Vulnerability and Improve Preparedness and Recovery	
	Secure Hazardous Materials Shipments and Assess Risks	
Organizational Excellence	Consistently Apply the R&D Investment Criteria	





## **OPERATING ADMINISTRATION ROLES AND RESPONSIBILITIES**

In addition to supporting broad DOT goals, RD&T strategies, and emerging research priorities, the Department's operating administrations conduct RD&T to advance modal priorities based on their mission requirements, interactions with stakeholders, and understanding of transportation challenges, technologies, and operations. Appendix D provides the links to the operating administrations' RD&T advisory committees, stakeholder activities, and plans. The following DOT administrations and offices have missions that involve a supporting program of RD&T:

### **Federal Aviation Administration (FAA)**

FAA's overall mission is to provide safe and efficient aviation and commercial space transportation systems. Key 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)**

FHWA's mission is to enhance mobility through innovation, leadership, and public service. One of the agency's key roles is to be an innovator for a better future. Toward this end, 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, congestion relief, planning, and the environment. Among the agency'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.

### **Federal Motor Carrier Safety Administration (FMCSA)**

FMCSA 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.

### **Federal Railroad Administration (FRA)**

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

### **Federal Transit Administration (FTA)**

The mission of FTA is to ensure personal mobility and community vitality by supporting high-quality public transportation. 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 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 focuses on 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. MARAD has 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, the agency actively facilitates several industry-wide cooperative programs to advance innovations in marine operations. In addition, MARAD works with other Federal agencies, stakeholders, and academic researchers to highlight potential maritime solutions for transportation system problems.

### **National Highway Traffic Safety Administration (NHTSA)**

NHTSA's mission is to save lives, prevent injuries, and reduce economic costs due to road traffic crashes through education, research, safety standards, and enforcement activities. In the behavioral area, NHTSA focuses on the delivery of data-driven programs and countermeasures aimed at increasing occupant protection use, reducing alcohol-related fatalities, reducing motorcycle fatalities, promoting effective speed management, prolonging older driver mobility as long as medically practicable, promoting parental roles in effective driver education curricula, and maintaining the integrity of driver licensing processes. With respect to vehicle safety, in addition to NHTSA's traditional vehicle research, rulemaking, enforcement, and safety defect investigations, the agency assesses the lifesaving benefits of emerging technologies as they enter the vehicle fleet. NHTSA conducts a supporting program of research

in several critical areas. These include collecting and analyzing crash data trends, research on the safety impact of innovative technologies, injury causation and mitigation countermeasures, integrated safety from crash prevention to severity reduction, and driver behavioral safety.

### **Office of the Secretary of Transportation (OST)**

OST has responsibility for formulating national transportation policies that affect various modes and help ensure achievement of Department-wide goals. OST research supports the development, evaluation, and improvement of these policies and comprises work in economic and strategic analysis; safety, energy, and environment; freight and logistics; navigation and spectrum policy; aviation and international policy; and security. Key priorities include improving the economic efficiency of the operation of, and investments in, the transportation system; encouraging diffusion of best practices in transportation safety; improving the sustainability of transportation through market-based solutions and new technologies that improve fuel economy and reduce greenhouse gases and air pollutant emissions; illuminating the economic relationship of freight investments to the national economy and developing financial strategies to accelerate economic investment in freight capacity; and encouraging the development of civilian Global Positioning System and other positioning, navigation, and timing applications.

### **Pipeline and Hazardous Materials Safety Administration (PHMSA)**

PHMSA's mission is to ensure the safe and secure transportation of hazardous materials by all modes. The agency has two major safety offices: the Office of Pipeline Safety, which ensures the safe, reliable, and environmentally sound operation of pipeline transportation, and the Office of Hazardous Materials Safety, which identifies, evaluates, and mitigates risks to the safe and secure transportation of hazardous materials. PHMSA RD&T includes work in mission-critical areas, including pipeline operations, control, and monitoring; pipeline damage prevention; improved pipeline materials; hazardous materials packaging and shipping, including packaging design; hazmat emergency response, hazard identification, risk assessment, and risk management; hazmat consequence modeling; and hazardous materials transportation security.

### **Research and Innovative Technology Administration (RITA)**

RITA's mission is to enable, facilitate, and expedite innovation in the transportation system to advance the transportation and economic objectives of the United States. RITA accomplishes the RD&T components of this mission by leading crossmodal research; planning, reviewing, and coordinating RD&T Department-wide; leading the RD&T Planning Council and Planning Team; and managing the Department's University Transportation Centers Program. In addition, RITA's Bureau of Transportation Statistics (BTS) plays a key role in gathering and improving the quality of the aviation, freight, and passenger flow data upon which much of the Department's research relies.

Chapters 3 through 8 discuss operating administrations' RD&T programs in relation to DOT goals, RD&T strategies, and emerging research priorities.

## Safety

### Safety Strategic Goal

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 primary strategic goal. The Department strives to improve the benefits of transportation while consistently reducing risks to the public's health and well-being. Over the next five years, DOT will conduct RD&T and work with stakeholders to ensure that the technologies and techniques necessary to identify and resolve safety issues are developed, made available, and enforced. The following RD&T strategies represent the primary research topics in support of the Department's safety goal and outcomes:

1. Conduct and support research to understand and address the causal factors and risks in accidents and to anticipate future safety risks in all transportation modes. *Supports outcomes 1 and 2.*
2. Conduct and support research to determine the most effective ways of mitigating the consequences of transportation accidents and incidents in all modes. *Supports outcomes 1 and 2.*
3. Support safety rulemaking by assessing the potential safety impacts of new transportation technologies, vehicles, concepts, designs, and procedures. *Supports outcomes 1 and 2.*

The following sections summarize the research areas, emerging research priorities, and primary RD&T activities for advancing these strategies. Appendix C shows anticipated funding levels for FY 2006 through 2010.

## Safety

- **Understand and Address Causal Factors and Risks**
- Mitigate Accidents and Incidents
- Assess New Technologies, Vehicles, Concepts, Designs, and Procedures

## UNDERSTAND AND ADDRESS CAUSAL FACTORS AND RISKS

A foremost concern for the Department's RD&T programs is to identify the causal factors in transportation accidents and incidents, particularly human factors; to anticipate future risks; and to develop and implement technologies, concepts, practices, and other prevention strategies with the potential to improve safety. The Department will implement this RD&T strategy through research in the following key areas: human factors and medical risks; vehicle, equipment, and infrastructure factors; operational factors; hazardous materials transportation; and safety data, information systems, and risk analysis.

### Human Factors and Medical Risks

Over the next five years, the following operating administration programs will address safety issues related to human factors, human error, and medical risks. Table 3-1 shows milestones for these programs.

#### FAA

*Aeromedical Research.* Improves the safety of passengers, aircrews, and other human assets in the National Airspace System (NAS) in support of FAA's regulatory guidelines. Research in this area will address forensic toxicology, biochemistry, bioinformatics, functional genomics, radiobiology, and environmental physiology. This program will also support Safety RD&T Strategies 2 and 3 and Reduced Congestion RD&T Strategy 6.

*Air Traffic Control/Technical Operations Human Factors.* Ensures that the humans in the air traffic control system are productive and provide the required level of service within a minimum level of error. This program will support the development of guidelines, standards, reference handbooks, technical reports, checklists, tools, and informative briefings essential for implementation and enhancement of advanced operational concepts, systems, and subsystems.

*Flight Deck/Maintenance/System Integration Human Factors.* Develops more effective methods for aircrew, inspector, and maintenance technician training; develops more human-centered flight controls and displays; and increases human factors considerations in certifying new aircraft and in designing and modifying existing equipment. Through this program, FAA researchers will develop improved knowledge for certifying automation-based systems, enhancing task performance, and applying error management strategies.

## **FHWA**

*Safety Research and Innovation Deployment Program (Safety R&D).* Demonstrates the application of innovative technologies in highway safety and supports the deployment and evaluation of safety technologies and innovations at the State and local levels. In this research area, efforts will include the deployment of best practices in safety training and management. This program will also support Safety RD&T Strategy 2.

### **Emerging Research Priority: Human-Automation Interaction**

There is a need for research that will lead to an increased understanding of human-machine interactions related to safety performance. This crossmodal issue is particularly important in future transportation systems. An evolving knowledge base is needed to guide development of appropriate regulatory and certification processes and the training of system operators in all modes. A major additional concern is the possibility for unintended consequences resulting from system failures as well as unexpected natural and human-caused events and disruptions.

Key Supporting RD&T Programs:

- Air Traffic Control/Technical Operations Human Factors
- Flight Deck/Maintenance/System Integration Human Factors
- Produce Safer Drivers
- Rail Human Factors
- Crash Avoidance and Human/Vehicle Performance

*Strategic Highway Research Program II (Corporate Activities).* Conducts concentrated, results-oriented applied research focusing on solving top problems in the areas of highway safety, reliability, capacity, and renewal. Work in the area of human factors will develop fundamental knowledge of crash factors that could lead to a sizable reduction in deaths and injuries. This program will also support Reduced Congestion RD&T Strategies 1, 2, and 4.

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment).* Focuses on improving understanding of the complex relationship between surface transportation and the environment. In the area of human factors, the program will support safety-conscious planning of surface transportation systems and improvement processes. This program will also support Reduced Congestion RD&T Strategies 1, 3, 4, 5, and 6; the RD&T Strategy for Global Connectivity; and Environmental RD&T Strategies 1 and 2.

### **FMCSA**

*Produce Safer Carriers.* Seeks to improve the safety of commercial motor carriers and understand the impact of medical issues and medications on driver safety. The program will apply safety management principles; compile, communicate, and enable best management practices; support FMCSA enforcement of carrier-related regulations; enhance the performance of medical examiners who certify driver physical qualifications; and explore and enhance driver health and wellness.

*Produce Safer Drivers.* Helps ensure that commercial drivers are physically qualified, trained to perform safely, and mentally alert. Research will improve understanding of driver fatigue and other issues and assess various countermeasures, including roadside safety technologies, driving simulators, collision warning devices, and operational concepts. This program will also support Safety RD&T Strategy 2.

### **FRA**

*Grade Crossings.* Conducts research in grade crossing human factors to address two areas: why highway users have crashes with trains and why people trespass on railroad rights-of-way. In the first research area, the program will conduct field studies and laboratory simulations to examine how train conspicuity and the effectiveness of train horns affect train detection and how driver expectations and motivations affect their willingness to cross; in the second, FRA will continue to study the reasons why people trespass on railroad property, including a U.S.–Canadian study to determine how many trespasser deaths might be suicides.

*Human Factors.* Studies a variety of issues involving human error in railroad operations. The program will emphasize research on the Close Call pilot program, a fatigue model for use in improving rail crew scheduling, human factors issues for dispatchers, human-machine interface issues, remote-controlled locomotive interfaces, ballast ergonomics, and behavior-based safety approaches.

### **NHTSA**

*Crash Avoidance and Human/Vehicle Performance.* Evaluates driver-assistance technologies to ensure that the maximum safety benefits are derived. Research will determine which new technologies have the greatest potential to significantly reduce the number of crashes, and resulting injuries and fatalities, and develop and implement plans to facilitate their widespread deployment. Research into advanced safety systems will develop suitable human factors guidelines for the driver–vehicle interface associated with many emerging safety technologies.



*Highway Safety Research.* Provides the scientific basis for developing effective programs to reduce the occurrence of crashes due to unsafe driving behaviors. The program will emphasize research in support of NHTSA's goals for reducing alcohol-related fatalities and increasing safety belt use, as well as special initiatives in child passenger safety; pedestrian, bicyclist, and motorcyclist safety; and elderly driver safety and mobility.

**Table 3-1. Milestones for Human Factors and Medical Risks**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Aeromedical Research</i>		
Epidemiological assessment of toxicological and biomedical factors in aviation accidents and incidents	x	x
Bioaeronautical results, reports, and recommendations to identify human fatigue using functional genomics technology	x	x
<i>Air Traffic Control/Technical Operations Human Factors</i>		
New measures of air traffic controller performance for use in training and system development	x	
<i>Flight Deck/Maintenance/System Integration Human Factors</i>		
Personal-computer-based Human Factors Certification Job Aid for Parts 25 and 23 flight decks	x	
Methods and criteria for systems and equipment to reduce the probability of error by system specialists and technicians	x	
Methods to improve training and procedures for flight deck distractions during critical flight phases	x	
<i>Safety Research and Innovation Deployment</i>		
Knowledge gained on human factor issues associated with use of the Highway Driving Simulator or test vehicles	x	x
<i>Strategic Highway Research Program II</i>		
Implement and coordinate study design with the Transportation Research Board for selected safety projects	x	x

**Table 3-1. Milestones for Human Factors and Medical Risks (continued)**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Surface Transportation Environment and Planning Cooperative Research</i> Support safety-conscious planning of systems and improvement processes	x	x
<i>Produce Safer Carriers</i> Research to support FMCSA rulemaking activities, including driver physical qualifications Determine the effects of controlled substance and alcohol use enforcement Provide support for the Comprehensive Safety Analysis 2010 Initiative	x x x	x
<i>Produce Safer Drivers</i> Determine driver safety risk factors Conduct a field operational test of an onboard monitoring suite for changing driver behavior Validate truck simulators for training commercial motor vehicle (CMV) drivers	x x x	
<i>Grade Crossings</i> Research into human factors of locomotive engineers, drivers, and pedestrians that leads to a reduction in grade crossing accidents	x	x
<i>Human Factors—Rail</i> Research into human factors to reduce rail-related accidents and incidents	x	x
<i>Crash Avoidance and Human/Vehicle Performance</i> Conduct research to understand how vehicle technologies influence driver performance and how the driver-vehicle interface can be enhanced to reduce crash risk	x	x
<i>Highway Safety Research</i> Determine incidence of driver drug use (illicit, prescription, and over-the-counter) and assess potential role in crashes Update and maintain model specifications and Conforming Product Lists for evidential breath test, screening, and ignition interlock devices Evaluate mobilizations to increase safety belt use, nighttime belt use, and programs to increase use of child restraints	x x x	x x x

## Vehicle, Equipment, and Infrastructure Factors

Research in this area addresses the safety performance of aircraft and vehicles; crash avoidance and human-vehicle interaction; safety characteristics of highways, rail, pipelines, and other infrastructure; and safety applications of intelligent transportation systems (ITS). Work will include the RD&T programs listed below. Table 3-2 shows program milestones.

### FAA

*Advanced Materials/Structural Safety.* Assesses and addresses the safety implications of new and present-day composites, alloys, and other materials, and associated structures and fabrication techniques. Researchers will develop analytical and test methods to understand how design, load, and damage can affect composite structures and develop maintenance and repair methods. This program will also support Safety RD&T Strategies 2 and 3.

*Aging Aircraft.* Reduces the number of accidents and incidents associated with the failure of aircraft structures, components, and systems. The program will develop the knowledge, inspection tools, and techniques to prevent or mitigate the effects of safety hazards associated with the aging of airframe structures, engine components, and mechanical and electrical systems.

*Aircraft Catastrophic Failure Prevention Research.* Develops technologies and methods to assess risk and prevent occurrence of potentially catastrophic defects, failures, and malfunctions in aircraft, aircraft components, and aircraft systems. In particular, researchers will assess the use of advanced materials to protect passengers and aircraft critical systems in the event of catastrophic engine failures, and develop and publish guidelines for the use of explicit finite element analysis for analyzing engine failures.

*Airport Technology Research–Safety.* Helps to achieve the overall FAA goal of reducing aviation accidents by improving airport safety. RD&T activities will seek to improve airport lighting and marking, reduce wildlife hazards, improve airport fire and rescue capabilities, and reduce surface accidents. This program will also support Safety RD&T Strategy 3 and the RD&T Strategy for Global Connectivity.

*Fire Research and Safety.* Develops technologies, procedures, test methods, and criteria to prevent accidents caused by hidden in-flight fires and fuel tank explosions and to improve survivability during a post-crash fire. Research will focus on near-term improvements in aircraft fuel tank explosion protection, fire detection and suppression systems, and interior materials fire-test methods and criteria. This program will also support Safety RD&T Strategies 2 and 3 and the RD&T Strategy for Global Connectivity.

## Safety

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*Propulsion and Fuel Systems.* Enhances the airworthiness, reliability, and performance of civil turbine and piston engines, propellers, fuels, and fuel management systems. Researchers will also work with fuel, airframe, and engine manufacturers to test new unleaded fuels as they become available.

*Unmanned Aircraft Systems Research.* Investigates current technological capabilities to sense potential traffic conflicts. Research will determine system characteristics and limitations to enable see-and-avoid capabilities; review safety implications of system impediments to command, control, and communications; assess data concerning flight termination systems; and evaluate historical and current technology development. This program will also support Safety RD&T Strategy 3.

## **FHWA**

*Center for Excellence in Rural Safety (Safety R&D).* Provides research, training, and outreach on innovative uses of technology to enhance rural safety and economic development, assess local community needs, and improve access to mobile emergency treatment. Among other activities, the program will address the online and seminar training needs of rural transportation practitioners and policymakers.

*Center for Surface Transportation Safety (Safety R&D).* Develops and disseminates advanced transportation safety techniques and innovations in both rural areas and urban communities. The center will use a controlled access highway with state-of-the-art features to test safety devices and techniques that enhance driver performance, to examine advanced pavement and lighting systems, and to develop techniques to address older driver and fatigue issues.

*Cooperative Intersection Collision Avoidance (ITS JPO in partnership with NHTSA).* Helps to save lives by reducing crossing-path crashes. In this initiative, DOT will work in partnership with automotive manufacturers and State and local transportation agencies to pursue an optimized combination of infrastructure- and vehicle-based collision avoidance systems.

*Integrated Vehicle-Based Safety Systems (ITS JPO in partnership with NHTSA).* Addresses the 2.6 million rear-end, run-off-the-road, and lane-change crashes that occur every year. This initiative will seek to establish partnerships with the automotive, commercial vehicle, and transit vehicle industries to accelerate the introduction of integrated vehicle-based safety systems into the Nation's vehicle fleet.

*Safety Research and Innovation Deployment Program (Safety R&D).* Demonstrates the application of innovative technologies in highway safety and supports the deployment and evaluation of safety innovations at the State and local levels. In this research area, work will include the deployment of best practices in highway planning and design. This program will also support Safety RD&T Strategy 2.

*Vehicle-Infrastructure Integration (ITS JPO in partnership with NHTSA).* Researches the use of vehicles to anonymously transmit information on traffic and road conditions from every major road in the transportation network. With respect to safety, this initiative will address the 21,000 deaths that occur annually as a result of roadway departures and intersection-related incidents by working toward the deployment of advanced vehicle and infrastructure systems designed to prevent roadway departures and enhance intersection safety. This program will also support Reduced Congestion RD&T Strategy 1.

#### **FMCSA**

*Improve Safety of Commercial Motor Vehicles.* Improves truck and motor coach safety performance through applications of technology. This program will evaluate vehicle designs to improve driver health and safety, assess the impact of new vehicle technology, and evaluate and seek to increase the use of safety countermeasures such as onboard monitoring systems. This program will also support Safety RD&T Strategy 3.

#### **FRA**

*Integrated Track Stability Assessment and Monitoring System.* Provides a grant to Marshall University and the University of Nebraska to develop remote sensing technologies that can be integrated and deployed in a mobile inspection vehicle to monitor rail track. (This project will be completed in FY 2006.)

*Railroad System Issues.* Provides for research in railroad systems safety for equipment and track, railroad systems, and locomotives. In this research area, the program will address the inspection techniques, methodologies, and equipment necessary to ensure early and reliable detection of defects and unsafe conditions. This program will also support Safety RD&T Strategy 2 and Security RD&T Strategies 1 and 2.

*Rolling Stock and Components.* Researches onboard condition monitoring systems (OBCMS), wayside monitoring systems, and material and design improvements. Research will also focus on demonstrating an Advanced Concept Train, which will consist of the OBCMS along with advanced couplers; advanced hand brakes; advanced angle cocks; brake sensors; condition monitoring sensors; a communication system to transmit sensor data to the locomotive (and perhaps to wayside monitoring systems); and an Internet-accessible site in which the data may be accessed by maintenance facilities.

*Track and Structures.* Conducts research on rail inspection techniques, material and component reliability, track and structure design and performance, and track stability data processing and feedback. Working in cooperation with the railroad industry and suppliers, the program will continue development of automated systems for rail defect detection, high-speed video joint bar inspection, and track geometry inspection. This program will also support Reduced Congestion RD&T Strategy 2.

*Track and Train Interaction.* Researches the interaction among the train suspension system, wheels, and track to determine the influence of track geometry, wheel and rail profile, rail lubrication, and vehicle and track parameters on safety and performance. The program will seek to understand the causes of derailments, develop solutions to prevent them, and enhance FRA's vehicle and track performance modeling and simulation capabilities.

*Train Control.* Develops train control standards and equipment for locomotives. The focus of the program will be on developing various train control segments and related telecommunications needed to implement a nationwide positive train control system. This program will also support Reduced Congestion RD&T Strategy 3.

### **FTA**

*Identify Solutions to Improve Transit Safety (Improve Safety and Emergency Preparedness).* Assists States, local transit authorities, and the transit industry through safety technical assistance and improved technology and training programs. In this research area, FTA will evaluate the impact of new vehicle and infrastructure technologies and work with other DOT operating administrations to test the fire safety of composites and interior materials and to improve railroad grade crossing technologies. This program will also support Safety RD&T Strategy 2.

### **NHTSA**

*Crash Avoidance Initiative.* Analyzes crash data to identify safety problems and benefits of new electronic technologies and develops methodologies and performance criteria to test and evaluate these technologies.

*Heavy Vehicles.* Develops the scientific basis for improving heavy vehicle safety. The program will make heavy vehicles less prone to crashes by improving their braking, handling, and visibility characteristics; by mitigating the consequences of collisions that occur between heavy trucks and other vehicles; and by improving driver performance through use of advanced technologies to prevent crashes.

*Pneumatic Tire Research.* Seeks to reduce passenger vehicle and truck crashes due to aging or underinflated tires by developing test procedures and performance requirements.

### **OST**

*Navigation and Spectrum Policy.* Supports the formulation of positioning, navigation, and spectrum policy and the civilian management and use of the Global Positioning System (GPS). This effort will coordinate performance monitoring of the GPS civil signal with all civilian agencies, assure uninterrupted access to radio spectrum for safety-of-life radionavigation services and systems, and support the development and launch of GPS satellites with the new L5 "safety of life" signals. This program will also support Reduced Congestion RD&T Strategies 3 and 4 and the RD&T Strategy for Global Connectivity.

*Safety, Energy, and Environment.* Conducts policy research to support the formulation and recommendation of Departmental policies, plans, and guidelines related to public health and safety. Efforts in this area will assess the effectiveness of various techniques for accelerating application and adoption of safety technologies. This program will also support Reduced Congestion RD&T Strategies 1 and 5 and Environmental RD&T Strategy 1.

**PHMSA**

*Pipeline Safety R&D.* Improves pipeline inspection and analysis tools and strengthens the industry's ability to effectively manage pipeline integrity. Research will address promising technologies for improving pipeline safety, including better corrosion detection technology and direct assessment techniques; improved tools for preventing and detecting damage and leaks; and materials that can better withstand third-party damage, corrosion, and cracking. This program will also support Environmental RD&T Strategy 1.

**Table 3-2. Milestones for Vehicle, Equipment, and Infrastructure Factors**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Advanced Materials/Structural Safety</i> Knowledge base for the safe use of advanced materials in aircraft	x	
<i>Aging Aircraft</i> New technologies and tools to ensure the continued airworthiness of aircraft structures, components, and systems	x	
<i>Aircraft Catastrophic Failure Prevention</i> Guidelines for the use of explicit finite element analysis for analyzing engine failures	x	
<i>Airport Technology</i> Improved visual guidance systems to reduce runway incursions Improved airport design methods and improved runway friction	x x	x x
<i>Fire Research and Safety</i> Improved fire-test criteria for hidden materials	x	
<i>Propulsion and Fuel Systems</i> Tools, guidelines, and data to support improvements in turbine engine certification requirements	x	
<i>Unmanned Aircraft Systems</i> Identify, assess, develop, and test flight termination technologies and procedures Perform risk assessments and develop risk management concepts, models, and tools Develop and analyze methodologies for safety management of operations	x x x	x



Table 3-2. Milestones for Vehicle, Equipment, and Infrastructure Factors (continued)

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Center for Excellence in Rural Safety</i> Disseminate safety countermeasures to counties and localities	x	x
<i>Center for Surface Transportation Safety</i> Research results on examination of advanced roadway delineation and lighting systems	x	x
<i>Cooperative Intersection Collision Avoidance</i> Field-tested countermeasures for crashes from signal and stop sign violations Field-tested countermeasures for crashes from stop sign gap acceptance Field-tested countermeasures for crashes from signalized, unprotected left turns		x x x
<i>Integrated Vehicle-Based Safety Systems</i> System requirements and test specifications Prototype system Field operational test	x x	x
<i>Safety Research and Innovation Deployment</i> Improved safety analysis methods for intersections or highway interchanges Evaluation of alternative highway safety countermeasures for priority treatments decided by the States	x x	x x
<i>Vehicle-Infrastructure Integration (VII)</i> VII system architecture Prototype design Proof-of-concept tests	x x x	
<i>Improve Safety of Commercial Motor Vehicles</i> Research hazardous materials cargo tank design Conduct a field operational test of indirect viewing systems Research cargo tanks in lethal service	x x x	
<i>Railroad System Issues</i> Research to reduce rail-related accidents and incidents	x	x
<i>Rolling Stock and Components</i> Research into vehicle components that will reduce accidents and injuries	x	x
<i>Track and Structures</i> Research into improving the reliability of rails, ties, fasteners, switches, welds, and bridges to reduce the likelihood of derailments Research into reducing the stress state of the rails in continuously welded rail track	x x	x x

**Table 3-2. Milestones for Vehicle, Equipment, and Infrastructure Factors (continued)**

Research Product or Information Gained	FY 07-08	FY 09-10
<p><i>Track and Train Interaction</i>                      Research into the wheel and rail interaction to reduce the likelihood of derailment                      Research into the ride quality of rail cars to reduce the likelihood of derailment</p>	<p>x                      x</p>	<p>x                      x</p>
<p><i>Train Control</i>                      Research into Positive Train Control systems that will reduce the likelihood of train collisions</p>	<p>x</p>	<p>x</p>
<p><i>Identify Solutions to Improve Transit Safety</i>                      Demonstrate methods, techniques, and technologies to improve safety                      Update FTA Subway Environmental Simulation Software                      Fire materials testing</p>	<p>x                      x                      x</p>	<p>x</p>
<p><i>Crash Avoidance Initiative</i>                      Develop and validate crash avoidance test procedures</p>		<p>x</p>
<p><i>Heavy Vehicles</i>                      Complete safety benefits evaluation of truck tractor and semi-trailer stability control technologies                      Develop performance requirements and objective tests for tractor-trailer stability control                      Complete safety benefits evaluation for straight truck stability control technology</p>	<p>x</p>	<p>x                      x</p>
<p><i>Pneumatic Tire Research</i>                      Complete tire aging research</p>	<p>x</p>	
<p><i>Navigation and Spectrum Policy</i>                      Coordinate performance monitoring of the GPS civil signal with all civilian agencies                      Assure uninterrupted access to radio spectrum for safety-of-life radionavigation services and system                      Support the development and launch of GPS satellites with the new L5 "safety of life" signals</p>		<p>x                      x                      x</p>
<p><i>Safety, Energy, and Environment</i>                      Assess the effectiveness of various techniques for accelerating application and adoption of safety technologies</p>		<p>x</p>
<p><i>Pipeline Safety</i>                      Improvements in pipeline damage prevention and leak detection                      Improvements in pipeline operations, controls, and monitoring                      Improvements in material performance and other pipeline safety issues</p>	<p>x                      x                      x</p>	<p>x                      x                      x</p>

## Safety

- **Understand and Address Causal Factors and Risks**
- Mitigate Accidents and Incidents
- Assess New Technologies, Vehicles, Concepts, Designs, and Procedures

### Operational Factors

This research addresses the operational elements involved in transportation accidents and incidents, particularly those related to weather events, runway incursions, grade crossings, and derailments. Specific RD&T programs will include the following. Table 3-3 shows program milestones.

#### FAA

*Advanced Technology Development and Prototyping.* Improves operational safety through the following research activities:

- *General Aviation and Vertical Flight Technology*—Emphasizes the direct needs of light general aviation airplanes, helicopters, and tilt rotor aircraft.
- *Runway Incursion Reduction*—Selects and evaluates runway incursion reduction technologies to validate their technical performance and operational suitability.
- *Safer Skies*—Develops guidance materials and revisions to Advisory Circulars, Aeronautical Information Manuals, Handbook Bulletins for Air Transportation, and Notices to Airmen.
- *Safe Flight 21—Alaska Capstone*—Improves aviation system safety in Alaska through the introduction of new communications, navigation, and surveillance technologies.
- *Wind Profiling and Weather Research*—Generates turbulence advisories and wind information used by commercial and general aviation pilots in the Juneau area. (Research will be completed in FY 2006.)

*Atmospheric Hazards/Digital System Safety.* Reduces aviation's vulnerability to in-flight icing and other atmospheric hazards. The program will develop and test technologies to detect frozen contamination, predict anti-icing fluid failure, and ensure safe operations in atmospheric icing conditions; and develop technologies, advisories, and guidance materials to ensure safe operation in electromagnetic hazards resulting from electromagnetic interference, cosmic radiation, high-intensity radiated fields, and lightning. This program will also support Safety RD&T Strategy 3.

*Weather Program.* Strives to reduce the number of accidents associated with weather and to minimize the impacts of adverse weather events on NAS operational capacity. Research will increase safety and capacity by developing new technologies for providing accurate, accessible, and efficient weather observations, warnings, and forecasts. This program will also support Reduced Congestion RD&T Strategy 4.

#### FHWA

*Exploratory Advanced Research (Corporate Activities).* Addresses longer term, higher risk research with potentially dramatic breakthroughs for improving the safety aspects of highway and intermodal transportation systems. Among the topics that

the program will address are bicycle and pedestrian safety. This program will also support Reduced Congestion RD&T Strategies 2, 3, and 4 and Environmental RD&T Strategy 1.

**FRA**

*Grade Crossings.* Provides for the continued installation of crossing warning systems in designated high-speed corridors and demonstrates innovative grade crossing systems. The program will investigate improvements to existing systems, develop new components and systems, and resolve grade crossing problems such as false and mixed activations.

*Train Control.* Assists States, railroads, and suppliers to develop and deploy positive train control systems as a safety overlay to prevent train collisions, overspeed derailments, and roadway worker injuries due to operational errors. This program will also support Reduced Congestion RD&T Strategy 3.

**FTA**

*Identify Solutions to Improve Transit Safety (Improve Safety and Emergency Preparedness).* Assists States, local transit authorities, and the transit industry through safety technical assistance and improved technology and training programs. In this area, the program will provide training to the transit workforce on accident prevention and investigation, bus operator safety, and industrial safety. This program will also support Safety RD&T Strategy 2.

**Table 3-3. Milestones for Operational Factors**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>General Aviation and Vertical Flight Technology</i> Develop pilot and inspector guidance for enhanced vision for light general aviation aircraft Develop pilot and inspector guidance for helicopter and light general aviation synthetic vision displays	x	x
<i>Runway Incursion Reduction</i> Develop runway takeoff hold lights Evaluate low-cost surface surveillance systems	x x	
<i>Safer Skies</i> Develop and implement interventions for commercial and general aviation for runway incursion, approach and landing, loss of control, and weather Develop policy, regulations, and certification guidelines and standards for unmanned aircraft system operations	x x	x x
<i>Safe Flight 21</i> Develop and demonstrate a prototype satellite communication system that will complement ground-based receivers Test surveillance of mixed-equipped (transponder and Automatic Dependent Surveillance-Broadcast) aircraft	x x	

**Table 3-3. Milestones for Operational Factors (continued)**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Atmospheric Hazards/Digital System Safety</i> Publish guidance for the mitigation of electromagnetic hazards Develop and validate technologies, tools, methodologies, and procedures regarding ice contamination of aircraft	x x	
<i>Weather Program</i> Develop and make available electronically high-glance-value weather products with longer forecast lead times and increased accuracy		x (2015)
<i>Exploratory Advanced Research</i> Explore data acquisition and analysis techniques for improved system monitoring and operational performance	x	x
<i>Grade Crossings</i> Research into signal systems that will prevent accidents at grade crossings Research into detection systems that inform the approaching locomotive if there is a pedestrian or vehicle in the grade crossing	x x	x x
<i>Train Control</i> Advance state-of-the-art technologies in train tracking, microprocessors, and wireless communication Develop standards for interoperability among various positive train control implementations Enhance the safety-critical functions, efficiency, and integration of freight networks through the development of dispatch subsystems employing wireless communication and Internet pathways	x x x	x x x
<i>Identify Solutions to Improve Transit Safety</i> Provide training at the Transportation Safety Institute Update safety clearinghouse and website	x x	x

**Hazardous Materials Transportation**

RD&T programs in this area seek to identify and mitigate the risks inherent in the transportation of hazardous materials. Over the next five years, these efforts will include the following programs. Milestones are shown in Table 3-4.

**FMCSA**

*Advance Safety Through Information-Based Initiatives.* Improves the safety and productivity of commercial motor vehicle operations through the application of information systems and technologies. In this research area, the program will assess factors related to serious crashes involving hazardous materials.

**FRA**

*Hazardous Materials Transportation.* Conducts research in hazardous materials transportation safety, damage assessment and inspection, and tank car safety. Research will focus on tank car thermal protection, gasket materials, and operating environments; fitting protection; and evaluation of emergency breathing equipment for train crews. This program will also support Environmental RD&T Strategy 1.

**OST**

*Safety, Energy, and Environment.* Conducts policy research to support the formulation and recommendation of Departmental policies, plans, and guidelines related to public health and safety. Efforts in this area will address policies for coordinating hazardous materials inspection and enforcement between DOT's operating administrations and the economic and safety regulation of petroleum products pipelines. This program will also support Reduced Congestion RD&T Strategies 1 and 5 and Environmental RD&T Strategy 1.

**PHMSA**

*Hazardous Materials Safety R&D.* Provides the foundation for PHMSA's hazardous material regulatory, enforcement, and emergency response actions. The program will research the risks surrounding the transportation of hazardous materials and identify ways to minimize those risks and mitigate the consequences of such an incident, including packaging design and testing, database development, emergency response, hazard identification, human factors, root-cause analysis, and consequence modeling. This program will include Hazardous Materials Transportation Cooperative Research, an FHWA-funded pilot program administered by the National Research Council, and will also support the RD&T Strategy for Global Connectivity, Environmental RD&T Strategy 1, and Security RD&T Strategy 2.

**Table 3-4. Milestones for Hazardous Materials Transportation**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Advance Safety Through Information-Based Initiatives</i> Expand crash analysis of serious hazmat incidents Enhance hazmat shipper prioritization algorithm	x x	
<i>Hazardous Materials Transportation—Rail</i> Research to reduce the number of serious hazardous material incidents on railroads	x	x
<i>Safety, Energy, and Environment</i> Address policies for coordinating hazardous materials inspection and enforcement between DOT's operating administrations and the economic and safety regulation of petroleum products pipelines		x
<i>Hazardous Materials Safety</i> Hazardous Materials Transportation Cooperative Research Program Develop 2008 Emergency Response Guidebook Conduct performance-oriented package testing	x x x	x x x

### **Safety Data, Information Systems, and Risk Analysis**

This broad research area encompasses DOT efforts in safety data collection and analysis, risk analysis and risk management, and automated safety information systems. Over the next five years, it will encompass the following RD&T activities. Table 3-5 shows milestones for these programs.

#### **Emerging Research Priority: Application of Enhanced Safety Data and Knowledge**

Application of digital technology throughout the transportation enterprise produces large quantities of safety-relevant data. The research challenge is to convert these data into useful knowledge that can improve transportation safety. The objective is to provide decisionmakers—aviation, vehicle safety, rail, motor carrier, hazardous materials, and pipeline safety—with the information they need to make better safety decisions.

##### Key Supporting RD&T Programs:

- Aviation Safety Risk Analysis
- Safety Research and Innovation Deployment
- Transportation Safety Information Management System
- Advance Safety Through Information-Based Initiatives
- Railroad System Issues
- Improve Transit Safety
- Data Analysis Program
- Early Fatality Notification System
- Fatality Analysis Reporting System
- National Automotive Sampling System
- National Motor Vehicle Crash Causation Survey
- Special Crash Investigations
- State Data Program

#### **FAA**

*Aviation Safety Risk Analysis.* Improves safety by developing risk management methodologies, tools, technical information, procedures, and practices. In collaboration with industry, researchers will ensure that risk management decision-support tools are properly defined, developed, tested, and evaluated prior to implementa-



tion and that changes to regulations, advisory materials, and procedures are implemented in a timely manner.

#### **FHWA**

*Safety Research and Innovation Deployment Program (Safety R&D).* Demonstrates the application of innovative technologies in highway safety and supports the deployment and evaluation of safety innovations at the State and local levels. In this research area, the program will analyze data contained in the Highway Safety Information System. This program will also support Safety RD&T Strategy 2.

*Transportation Safety Information Management System (Safety R&D).* Further develops software applications for the collection, integration, management, and dissemination of safety data from—and for use among—State and local safety and transportation agencies. Data will include driver licensing, vehicle registration, emergency management systems, injury surveillance, roadway inventories, and motor carrier databases.

#### **FMCSA**

*Advance Safety Through Information-Based Initiatives.* Applies information systems and technologies to improve the safety and productivity of commercial motor vehicle operations. In particular, additional data analysis of the Large Truck Crash Causation Study (LTCCS) will provide valuable information in new research areas; the Safety Data Risk Factors initiative will complement the LTCCS by addressing the relative crash risk associated with various driver characteristics; and national deployment and expansion of Commercial Vehicle Information Systems and Networks (CVISN) capabilities will continue.

#### **FRA**

*Grade Crossings.* Provides for the continued installation of crossing warning systems in designated high-speed corridors and demonstrates innovative grade crossing systems.

*Railroad System Issues.* Provides for research in railroad systems safety for equipment and track, railroad systems, and locomotives. The program will include risk analysis of accident frequency, distribution, patterns, and consequences, and maintain a geographic information system database for information on railroad networks. This program will also support Safety RD&T Strategy 2 and Security RD&T Strategies 1 and 2.

*Train Control.* As required by Federal regulations, develops risk assessment methods for determining that any new microprocessor-based train control system is equal to or better than conventional systems as base cases, in terms of risk mitigation and accident prevention. This program will also support Reduced Congestion RD&T Strategy 3.

## **Safety**

- **Understand and Address Causal Factors and Risks**
- Mitigate Accidents and Incidents
- Assess New Technologies, Vehicles, Concepts, Designs, and Procedures

## **FTA**

*Identify Solutions to Improve Transit Safety (Improve Safety and Emergency Preparedness).* Assists States, local transit authorities, and the transit industry through safety technical assistance and improved technology and training programs. The program will support an enhanced safety and security data analysis process and produce the Transit Safety and Security Statistics Report. This program will also support Safety RD&T Strategy 2.

## **NHTSA**

*Data Analysis Program.* Provides timely and pertinent safety data analyses and supports public communication campaigns. By providing safety information to both internal and external customers, this program will continue to assist NHTSA with its mission of saving lives, preventing injuries, and reducing economic costs.

*Early Fatality Notification System.* Provides real- or near-real-time data on the number of fatalities resulting from motor vehicle crashes. This data will allow NHTSA to provide timely information to Congress, assist States in their safety programs, and inform the public about the state of highway safety.

*Fatality Analysis Reporting System (FARS).* Provides a census of all fatal highway crashes in the 50 States, District of Columbia, Puerto Rico, and Virgin Islands. FARS data will serve as the basis for the majority of NHTSA's data-driven programs over the next five years.

*National Automotive Sampling System (NASS).* Provides NHTSA and other users with nationally representative data on motor vehicle crashes. Through the NASS General Estimates System and Crashworthiness Data System, this program will continue to assist the agency in assessing motor vehicle crash trends and the interaction of occupants and vehicles in real-world crashes.

*National Motor Vehicle Crash Causation Survey.* Provides researchers with the scientific data needed to identify the specific factors or events that lead up to a crash. These data will be useful in identifying the most beneficial crash-avoidance technologies and in evaluating the potential of emerging countermeasures.

*Special Crash Investigations.* Collects and examines data from thousands of crashes to identify vehicle problems early on. A specific focus of the program will be to continue the collection and analysis of data on crashes involving vehicles equipped with advanced occupant protection systems to determine how well they perform in real-world crashes.

*State Data Program.* Works with State agencies to expand the inventory and availability of State-level crash and medical outcome data. This program will continue to complement NHTSA's national data systems by providing crucial information about the medical and financial burdens of highway crashes and as a supplementary source of crash data used in defect analysis and new technology evaluation.

**Table 3-5. Milestones for Safety Data, Information Systems, and Risk Analysis**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Aviation Safety Risk Analysis</i> Prototypes for enhanced risk management decision-support systems	x	
<i>Safety Research and Innovation Deployment</i> Reports from studies using Highway Safety Information System data Specifications for a Digital Highway Measurement System that records roadway data at state-of-the-art precision levels	x x	x x
<i>Transportation Safety Information Management System</i> Improved tools for collection, integration, management, and dissemination of safety data by State and local agencies		x
<i>Advance Safety Through Information-Based Initiatives</i> Support the deployment of expanded CVISN capabilities LTCCS data analysis Safety data risk factors	x x x	x x
<i>Grade Crossings</i> Conduct risk analysis of grade crossings to reduce accidents	x	x
<i>Railroad System Issues</i> Develop a research information database that links to FRA's existing safety database	x	
<i>Train Control</i> Conduct risk analysis of various Positive Train Control systems to improve safety at a reasonable cost	x	x
<i>Identify Solutions to Improve Transit Safety</i> Collect data for Transit Safety and Security Statistics Report	x	x
<i>Data Analysis Program</i> Publish traffic safety data in a timely manner	x	x
<i>Early Fatality Notification System</i> Publish traffic safety data in a timely manner	x	x
<i>Fatality Analysis Reporting System</i> Publish traffic safety data in a timely manner	x	x
<i>National Automotive Sampling System</i> Publish traffic safety data in a timely manner	x	x
<i>National Motor Vehicle Crash Causation Survey</i> Publish traffic safety data in a timely manner	x	x
<i>Special Crash Investigations</i> Publish traffic safety data in a timely manner	x	x
<i>State Data Program</i> Publish traffic safety data in a timely manner	x	x

## Safety

- Understand and Address Causal Factors and Risks
- **Mitigate Accidents and Incidents**
- Assess New Technologies, Vehicles, Concepts, Designs, and Procedures

## MITIGATE THE CONSEQUENCES OF ACCIDENTS AND INCIDENTS

A primary objective for the Department is to support the development of technologies, standards, and procedures that mitigate the consequences of accidents and incidents that occur. In particular, DOT seeks to minimize crash-related fatalities and injuries. Over the next five years, RD&T in two primary research areas will advance this Departmental strategy: emergency response and operations, and crash-worthiness and occupant protection.

### Emergency Response and Operations

The objective of this research is to reduce fatalities and injuries through more effective incident and emergency response. The following RD&T programs will support this area. Table 3-6 shows program milestones.

#### FHWA

*Evacuation Management and Operations (ITS JPO)*. Improves operational technology and practices to enable the safe and effective movement of people and goods during emergency evacuation situations (both with and without notice). The program will address the application of ITS technologies to improve notice and no-notice evacuation planning and execution, with an orientation that includes both decisionmakers and evacuees. This program will also support Reduced Congestion RD&T Strategy 1 and Security RD&T Strategy 1.

*Next Generation 9-1-1 (ITS JPO)*. Aims to establish the foundation for public emergency communications services in a wireless mobile society. This ITS initiative will enable an enhanced 9-1-1 system that permits the transmission of voice, data, or video from any communication device to Public Safety Answering Points and onto emergency responder networks. This program will also support Security RD&T Strategy 1.

#### FTA

*Identify Solutions to Improve Transit Emergency Preparedness (Improve Safety and Emergency Preparedness)*. Assists States, transit authorities, and the industry through safety technical assistance and improved technology and training. Research will address methods, techniques, technologies, and training to improve emergency preparedness, including a web-based approach to managing emergency incidents. This program will also support Security RD&T Strategy 1.

**Table 3-6. Milestones for Emergency Response and Operations**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Evacuation Management and Operations</i> See milestones for "Reducing Non-Recurring Congestion" under Reduced Congestion RD&T Strategy 1.		
<i>Next Generation 9-1-1</i> Development of next generation 9-1-1 requirements Next generation 9-1-1 architecture Next generation migration plan	x x x	
<i>Identify Solutions to Improve Transit Emergency Preparedness</i> See milestones for "Preparedness and Response" under Security RD&T Strategy 1.		

**Crashworthiness and Occupant Protection**

This critical area looks at assuring the crashworthiness of aircraft and vehicles and protecting occupants from injuries when accidents and incidents occur. The following RD&T programs will address this research area. Milestones are shown in Table 3-7.

**FAA**

*Advanced Materials/Structural Safety.* Assesses and addresses the safety implications of new and present-day composites, alloys, and other materials, and associated structures and fabrication techniques. Researchers will develop analytical and test methods to understand how design, load, and damage can affect composite structures and to develop maintenance and repair methods. This program will also support Safety RD&T Strategies 1 and 3.

*Aeromedical Research.* Improves the safety of passengers, aircrews, and other human assets in the NAS in support of FAA's regulatory guidelines. Research will address bio-dynamic crash protection, particularly the mechanisms and benefits of improved crash survival systems such as seat designs, restraint systems, airbags, and other advanced safety technology. This program will also support Safety RD&T Strategies 1 and 3 and Reduced Congestion RD&T Strategy 6.

*Fire Research and Safety.* Develops technologies, procedures, test methods, and criteria to prevent accidents caused by hidden in-flight fires and fuel tank explosions and to improve survivability during a post-crash fire. Research will focus on near-term improvements in fire detection and suppression systems and fire-test methods and the development of criteria for interior materials. This program will also support Safety RD&T Strategies 1 and 3 and the RD&T Strategy for Global Connectivity.

## Safety

- Understand and Address Causal Factors and Risks
- **Mitigate Accidents and Incidents**
- Assess New Technologies, Vehicles, Concepts, Designs, and Procedures

### **FHWA**

*Safety Research and Innovation Deployment Program (Safety R&D).* Demonstrates the application of innovative highway safety technologies and supports the deployment and evaluation of these innovations. A portion of program funding will be allocated to assess roadside hardware used to mitigate crash severity. This program will also support Safety RD&T Strategy 1.

### **FMCSA**

*Produce Safer Drivers.* Ensures that commercial drivers are physically qualified, trained to perform safely, and mentally alert. One element of this research and technology program will be to enhance the use of safety belts within the trucking industry. This program will also support Safety RD&T Strategy 1.

### **FRA**

*Railroad System Issues.* Provides for research in railroad systems safety for equipment and track, railroad systems, and locomotives. In this area, the program will address passenger car fire safety. This program will also support Safety RD&T Strategy 1 and Security RD&T Strategies 1 and 2.

*Train Occupant Protection.* Conducts research on locomotive and passenger car safety. The program will emphasize research on rail car crashworthiness, including crash energy management designs for both single and bi-level rail cars.

### **FTA**

*Identify Solutions to Improve Transit Safety (Improve Safety and Emergency Preparedness).* Assists States, local transit authorities, and the transit industry through safety technical assistance and improved technology and training programs. Research will address such topics as the crashworthiness of light rail vehicles. This program will also support Safety RD&T Strategy 1.

### **NHTSA**

*Human Injury Research.* Applies engineering principles to the study of the tolerance of the human body to impact. The program will employ testing and computer simulation to deduce the mechanisms of injury to affected body regions and to apply understanding of these mechanisms to the development of new injury criteria, test methods, and test devices—such as automotive crash test dummies—that lead to countermeasures to reduce injury.

*Safety Systems.* Seeks to reduce serious injuries resulting from motor vehicle crashes and to support rulemaking mandates in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users. Research will identify and clarify the crash injury problem, analyze the benefits of specific countermeasures, and develop objective tests for countermeasures offering the greatest safety benefits. With the advent of new technologies it will be possible to approach safety countermeasure development in an integrated fashion from crash prevention to severity reduction and crash protection.

**Table 3-7. Milestones for Crashworthiness and Occupant Protection**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Advanced Materials/Structural Safety</i> Neck injury certification criteria for side-facing seats	x	
<i>Aeromedical Research</i> Bioaeronautical results, reports, and recommendations to define mechanisms and benefits of improved crash survival systems	x	x
Enhanced escape slide/system performance, evacuation processes, and survivability technology	x	x
<i>Fire Research and Safety</i> Criteria for effective use of hand-held or fixed extinguishing systems to put out in-flight fires	x	
<i>Safety Research and Innovation Deployment</i> Assess roadside hardware crashworthiness	x	x
<i>Produce Safer Drivers</i> Develop low-cost technology to require safety belt use to operate a CMV	x	
<i>Railroad System Issues</i> Update fire safety standards for rail passenger cars Develop emergency evacuation procedures using the new rollover rig	x	x
<i>Train Occupant Protection</i> Develop crash energy management design for bi-level car Develop seat and interior design for rail passenger car	x	x
<i>Identify Solutions to Improve Transit Safety</i> Examine light rail and commuter rail crashworthiness improvements		x
<i>Human Injury Research</i> Identify injury risks for vulnerable automobile occupants and create injury criteria for advanced side impact dummies Develop finite element computer model and associated software to assess brain injury mechanisms	x x	x x



**Table 3-7. Milestones for Crashworthiness and Occupant Protection (continued)**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Safety Systems</i>		
Develop test and evaluation procedures for remote sensing occupant protection systems through cooperative research with industry stakeholders	x	x
Develop test and evaluation procedures for enhancing frontal vehicle-vehicle compatibility	x	x
Develop test and evaluation procedures for preventing occupant ejection in rollovers	x	

### **ASSESS IMPACTS OF NEW TECHNOLOGIES, VEHICLES, CONCEPTS, DESIGNS, AND PROCEDURES**

This RD&T strategy directly supports the regulatory missions of the Department’s operating administrations by ensuring the safety of new and emerging aircraft, vehicles, airports, commercial space operations, and digital systems. RD&T activities will support safety rulemaking and assess advanced technologies and concepts before they are introduced into transportation operations.

#### **Safety Rulemaking and Advanced Technologies**

The following programs will directly support the Department’s responsibilities for ensuring the safety of transportation technologies, operations, and procedures. Table 3-8 shows program milestones.

#### **FAA**

*Advanced Materials/Structural Safety.* Assesses and addresses the safety implications of new and present-day composites, alloys, and other materials, and associated structures and fabrication techniques. Researchers will develop analytical and test methods to understand how design, load, and damage can affect composite structures and develop maintenance and repair methods. This program will also support Safety RD&T Strategies 1 and 2.

*Aeromedical Research.* Improves the safety of passengers, aircrew, and other human assets in the NAS in support of FAA’s regulatory guidelines. In this area, the program will assess the impact of rapidly evolving medical diagnostics, treatments, and therapeutics technology on existing airman medical certification standards designed to ensure aviation safety. This program will also support Safety RD&T Strategies 1 and 2 and Reduced Congestion RD&T Strategy 6.

*Airport Technology Research–Safety.* Develops standards and guidance material for airport design, construction, and maintenance. In particular, the program will develop guidance material for improving airport lighting and marking to help reduce surface accidents and runway incursions; for improving aircraft rescues and firefighting; and for new techniques for wildlife mitigation. This program will also support Safety RD&T Strategy 3 and the RD&T Strategy for Global Connectivity.

*Atmospheric Hazards/Digital System Safety.* Reduces aviation’s vulnerability to in-flight icing and other atmospheric hazards. Researchers will develop and test technologies to detect frozen contamination, predict anti-icing fluid failure, and ensure safe operations in atmospheric icing conditions; develop technologies and advisory and guidance materials to ensure safe operation in electromagnetic hazards; and ensure the safe operation of emerging, highly complex software-based digital flight controls and avionics systems. This program will also support Safety RD&T Strategy 1.

*Commercial Space Transportation.* Ensures safety of the public during a commercial launch or re-entry activity and encourages, facilitates, and promotes U.S. commercial space transportation. The program will research the operations and maintenance activities of reusable launch vehicle developers, providing information that will be valuable in developing commercial human space flight safety regulations.

*Fire Research and Safety.* Develops technologies, procedures, test methods, and criteria to prevent accidents caused by hidden in-flight fires and fuel tank explosions and to improve survivability during a post-crash fire. The program will focus on near-term improvements in aircraft fuel tank explosion protection, fire detection and suppression systems, and interior materials fire-test methods and criteria, as well as long-range research to develop the enabling technology for ultra-fire-resistant cabin materials. This program will also support Safety RD&T Strategies 1 and 2 and the RD&T Strategy for Global Connectivity.

*Unmanned Aircraft Systems Research.* Investigates current technological capabilities to sense potential traffic conflicts. Research will determine system characteristics and limitations to enable see-and-avoid capabilities; review safety implications of system impediments to command, control, and communications; assess data concerning flight termination systems; and evaluate historical and current technology development. This program will also support Safety RD&T Strategy 1.

## **FMCSA**

*Improve Safety of Commercial Motor Vehicles.* Focuses on improving truck and bus performance through vehicle-based safety technologies and developing new data and information to improve overall commercial vehicle safety. The program will involve research, testing, and deployment of onboard safety technologies that will decrease commercial-vehicle-related fatalities and injuries and improve commercial motor carrier, vehicle, and driver safety and performance. This program will also support Safety RD&T Strategy 1.

## **NHTSA**

*Advanced Technologies Research.* Systematically evaluates new safety technologies in real-world crash scenarios. The program will conduct research, testing, and analysis of new technologies and develop deployment strategies. (This activity will be funded through other NHTSA RD&T programs.)

## **Safety**

- Understand and Address Causal Factors and Risks
- Mitigate Accidents and Incidents
- **Assess New Technologies, Vehicles, Concepts, Designs, and Procedures**

*Hydrogen Initiative.* Seeks to ensure that hydrogen internal combustion engine and fuel-cell-powered vehicles attain a level of safety comparable to other vehicles. NHTSA will conduct risk assessments of hydrogen-fueled vehicles to quantify potential failures that could indicate unsafe conditions. This program will also support Environmental Stewardship RD&T Strategy 1.

*Plastic and Composite Vehicles.* In partnership with industry, develops an automotive safety roadmap for incorporating plastics and composite materials into automotive designs. (This project will be completed in FY 2006.)

**RITA**

*Hydrogen R&D.* Supports the President’s Hydrogen Initiative through work with other agencies to evaluate hydrogen delivery infrastructure concepts, transportation and vehicle fuel system containers and components, and in-service inspection technologies. The program will support the development of appropriate consensus codes and standards. This program will also support Environmental Stewardship RD&T Strategy 1.

**Table 3-8. Milestones for Safety Rulemaking and Advanced Technologies**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Advanced Materials/Structural Safety</i> See milestone for "Crashworthiness and Occupant Protection" under Safety RD&T Strategy 2.		
<i>Aeromedical Research</i> Advanced molecular biochemical techniques to enhance aviation forensic toxicology analysis	x	x
<i>Airport Technology</i> See milestones for "Vehicle, Equipment, and Infrastructure Factors" under Safety RD&T Strategy 1.		
<i>Atmospheric Hazards/Digital System Safety</i> Guidelines for testing, evaluation, and certification of digital flight controls and avionics systems	x	
<i>Commercial Space Transportation</i> Research to support human space flight safety rulemaking		x
<i>Fire Research and Safety</i> Research and testing to support new FAA rule establishing reduced flammability limits for fuel tanks	x	
Fire-test criteria for structural composites to ensure the same level of fire safety as metallic structures	x	

**Table 3-8. Milestones for Safety Rulemaking and Advanced Technologies (continued)**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Unmanned Aircraft Systems Research</i> Define airworthiness assurance requirements		x
<i>Improve Safety of Commercial Motor Vehicles</i> Implement strategies for sharing data and information to facilitate the deployment of onboard safety technologies Test and evaluate tire pressure monitoring systems Test and evaluate camera/video imaging systems to improve visibility	x  x x	x  x x
<i>Hydrogen Initiative</i> Develop safety test and evaluation procedures for hydrogen vehicles		x
<i>Hydrogen R&amp;D</i> Distribute and update safety materials and provide safety training through the Hydrogen Safety Training Center Develop nondestructive testing technologies for advanced hydrogen storage technologies Conduct materials compatibility research and facilitate the development of statistically validated consensus codes and standards	x  x x	x  x x



## Reduced Congestion

### Reduced Congestion Strategic Goal

Reduce congestion and other impediments to using the Nation's transportation system.

#### Outcomes

1. Reduction in urban congestion.
2. Increased transportation capacity resulting from public-private transportation partnerships.
3. Increased use of integrated intelligent transportation system (ITS) networks and new incident management approaches.
4. Reduced impediments to the efficient movement of freight over the transportation network, especially at key freight gateways.
5. Meet new and growing demands for air transportation services through 2011 and beyond.
6. Increased access for all Americans.
7. Longer lasting, high-performance transportation infrastructure.

Growing congestion in U.S. transportation systems poses a substantial threat to the economy and to the quality of life of millions of Americans. In 2003 alone, congestion in the top 85 U.S. urban areas caused 3.7 billion hours of travel delay and 2.3 billion gallons of wasted fuel, for a total cost of \$63 billion. Congestion also can contribute to air pollutant emissions. The Department's RD&T programs will seek to improve our quality of life and enhance economic development by reducing congestion, preserving the existing transportation system, and improving the durability and extending the life of transportation infrastructure.

Six RD&T strategies represent the primary research topics that will contribute to reducing congestion and other transportation impediments:

1. Conduct and support research to reduce urban and suburban traffic congestion, freight gateway congestion, and aviation system congestion.  
*Supports outcomes 1 through 6.*
2. Conduct and support research to extend the life of the existing transportation system and improve the durability of infrastructure.  
*Supports outcome 7.*

3. Conduct and support research to advance the use of next generation technologies and to make effective use of combinations of modes in moving people and goods. *Supports outcomes 1 through 5.*
4. Conduct and support research to improve the planning, operation, and management of surface transportation and aviation services and assets. *Supports outcomes 1 through 5.*
5. Conduct and support research to improve transportation services for underserved areas and populations. *Supports outcome 6.*
6. Advance the Nation's transportation research capability through capacity building, fellowships, grants, and cooperative research with universities, the private sector, and State and local governments. *Supports all outcomes.*

The following sections summarize the research areas, emerging research priorities, and primary RD&T activities for advancing these strategies. Appendix C shows anticipated funding levels for FY 2006 through 2010.

## **REDUCE PASSENGER AND FREIGHT CONGESTION IN AIR AND SURFACE MODES**

Among the Department's highest priorities, this RD&T strategy is a critical element of the six-point plan identified in the DOT May 2006 *National Strategy to Reduce Congestion on America's Transportation Network*. The plan lays out a broad RD&T agenda, including design and deployment of the Next Generation Air Transportation System (NGATS) and other research leading to increased aviation capacity; operational and technological improvements, such as ITS, that increase information dissemination and improve incident response; and expansion of Bus Rapid Transit services. RD&T will focus on two primary aspects of congestion in support of the Departmental goal and this RD&T strategy: reducing recurring congestion and reducing non-recurring congestion.

### **Reducing Recurring Congestion**

This research seeks to reduce recurring causes of congestion and bottlenecks through more efficient use of airspace, improved aviation and highway operations, and enhanced transit services. The following programs will address these and related areas. Program milestones are in Table 4-1.



## FAA

*Advanced Technology Development and Prototyping.* Reduces aviation system congestion through the following research activities:

- *Airspace Management Laboratory*—Identifies issues and performs analyses in support of airspace assessment and redesign activities, including the development of data management and simulation tools for the evaluation of airspace design alternatives. This project will also support Reduced Congestion RD&T Strategy 4.
- *Airspace Redesign*—Increases system capacity and reduces congestion by removing as many airspace constraints as possible.
- *National Airspace System (NAS) Requirements*—Ensures the ongoing success of FAA projects intended to decrease avoidable weather delays and reduces accidents caused by adverse weather through implementation of new weather products.
- *Operations Concept Validation*—Documents and validates an overall concept, or “target system,” for the future management and control of national airspace system operations.
- *System Capacity Planning and Improvement*—Provides measurement tools, procedural recommendations, technologies, and problem-solving methodologies to enhance capacity and alleviate aviation system congestion, delays, and operational inefficiencies. This project will also support Reduced Congestion RD&T Strategy 4.

*National Plan for Transformation of Air Transportation—Joint Planning and Development Office (JPDO).* Leads the development and implementation of the NGATS to increase the safety, capacity, efficiency, and security of U.S. air transportation. The program will integrate capabilities across Federal agencies to meet defense, commerce, and homeland security requirements. This program will also support Reduced Congestion RD&T Strategy 3.

## Reduced Congestion

- **Reduce Passenger and Freight Congestion in Air and Surface Modes**
- Extend System Life and Improve Durability
- Advance Use of Next Generation Technologies and Combinations of Modes
- Improve Planning, Operations, and Management
- Improve Services for Underserved Areas and Populations
- Advance the Nation’s Transportation Research Capability

## Emerging Research Priority: Congestion Reduction Policy Research and Technologies

Strengthened policy research and analysis in the area of congestion reduction, congestion pricing, and innovative infrastructure financing is needed to better inform policymakers with respect to such topics as the degree to which congestion levels have declined in areas with time-varying highway tolls; the operational implications of simultaneously offering tolled and unpriced highways in the same corridor; the conditions under which tolls or other forms of user charges generate adequate revenues to finance the necessary infrastructure investment; behavioral responses of travelers to having multiple choices; and the degree to which the interests of the traveling public are protected when innovative infrastructure financing agreements are in place.

Research to evaluate the effectiveness and market acceptance of traveler and traffic information technologies, products, and services is also critical. Moreover, it is important that DOT, through its ITS program, work with public agencies, industry, and transit properties to develop data collection methods and evaluate protocols to assess the effectiveness of existing in-vehicle traffic and guidance systems, commercial traffic information systems, and transit information websites.

### Key Supporting RD&T Programs:

- Electronic Freight Management
- Integrated Corridor Management Systems
- Surface Transportation Congestion Relief Solutions
- Surface Transportation Environment and Planning Cooperative Research
- Vehicle-Infrastructure Integration
- Increase Transit Ridership
- Improve Transit Operational Efficiency
- Economic and Strategic Analysis
- Safety, Energy, and Environment
- Evacuation Management and Operations
- Clarus
- Road Weather Research and Development
- Strategic Highway Research Program II

## **FHWA**

*Electronic Freight Management (ITS JPO)*. Focuses on improving the operational efficiency, productivity, and security of the freight transportation system. The program will implement a common electronic information transfer protocol and a message portal to provide access to shipment information for all supply chain partners in real time. This program will also support Reduced Congestion RD&T Strategies 3 and 4.

*Integrated Corridor Management Systems (ITS JPO)*. Assists agencies in implementing Integrated Corridor Operations through supporting analytical tools, approaches, and technical standards. The program will demonstrate the value of Integrated Corridor Management for operating and optimizing an entire system as opposed to individual networks. This program will also support Reduced Congestion RD&T Strategy 3.

*Surface Transportation Congestion Relief Solutions (Operations R&D)*. Develops information to assist State transportation departments and Metropolitan Planning Organizations (MPOs) in measuring and addressing surface transportation congestion problems. The program will consist of research that will develop and apply transportation system congestion measurement and reporting methods and develop analytical tools and methods that lead to better congestion management and decisionmaking.

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment)*. Focuses on improving understanding of the complex relationship between surface transportation and the environment. To reduce congestion, the program will support research to improve the planning, operation, and management of surface transportation services and assets. This program will also support Reduced Congestion RD&T Strategies 3, 4, 5, and 6; Safety RD&T Strategy 1; the RD&T Strategy for Global Connectivity; and Environmental RD&T Strategies 1 and 2.

*Vehicle-Infrastructure Integration (ITS JPO)*. Researches the use of vehicles to anonymously transmit information on traffic and road conditions from every major road in the transportation network. With respect to this RD&T strategy, this initiative will give transportation agencies the information they need to implement active strategies to relieve congestion and allow motorists to share information and make informed decisions regarding travel routes, times, and modes. This program will also support Safety RD&T Strategy 1.

**FTA**

*Identify Best Practices and Technologies to Increase Transit Ridership (Increase Transit Ridership).* Identifies best practices and technologies to increase transit ridership, barriers to adopting these practices and technologies, and solutions for overcoming them. The program will demonstrate and evaluate methods, techniques, and technologies to increase ridership and identify best practices for improving transit services across the country. This program will also support Reduced Congestion RD&T Strategy 4.

*Identify Methods and Technologies to Improve Transit Operational Efficiency (Improve Capital and Operating Efficiencies).* Researches and demonstrates methods to improve bus and heavy-rail efficiency. This program will examine operational delivery strategies, such as Bus Rapid Transit, which involve fleet operations and ITS. This program will also support Reduced Congestion RD&T Strategy 4.

**OST**

*Economic and Strategic Analysis.* Analyzes the economic implications of public and private transportation policy issues. This program will build on earlier work to improve the economic analysis of congestion pricing. This program will also support Reduced Congestion RD&T Strategy 4.

*Safety, Energy, and Environment.* Uses simulation, modeling, and other analytical techniques to calculate safety outcomes from congestion mitigation and conducts research to better understand the effects of road pricing and other congestion reduction schemes on driving cycles, fuel consumption, and emissions. The program will identify and recommend measures that offer the greatest benefits for reducing congestion while improving safety outcomes, and develop a set of emission factors and fuel consumption rates for various categories of vehicles that can be used to calculate the effects of congestion mitigation measures. This program will also support Reduced Congestion RD&T Strategy 5, Safety RD&T Strategy 1, and Environmental Stewardship RD&T Strategy 1.

**Table 4-1. Milestones for Reducing Recurring Congestion**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Airspace Management Laboratory</i> Analyze, deploy, and enhance traffic data and metrics products Analyze and enhance decision-support tools Create a fully integrated aeronautical information management system	x x x	x x x
<i>Airspace Redesign</i> Regional airspace optimization and redesign High-altitude airspace redesign Oceanic airspace redesign	x x x	x x x
<i>NAS Requirements</i> Six-to-twelve-hour freezing precipitation forecast ability	x	
<i>Operations Concept Validation</i> Feasibility study on the virtual tower concept Updated Radio Technical Commission for Aeronautics NAS Concept of Operations FAA inputs to support future concepts and modernization	x x x	x x
<i>System Capacity Planning and Improvement</i> Modeling and simulation of new large aircraft ground movements Metrics for the 35 Operational Evolution Plan airports Future airport capacity study	x x x	x x x
<i>National Plan for Transformation of Air Transportation</i> Update and carry out an integrated plan for the Next Generation Air Transportation System	x	x
<i>Electronic Freight Management</i> See milestones for "Multimodal and Intermodal Transportation" under Reduced Congestion RD&T Strategy 3.		
<i>Integrated Corridor Management</i> Pioneer sites concepts of operations Pioneer sites corridor simulation Integrated corridor field operational test	x x	x
<i>Surface Transportation Congestion Relief Solutions</i> Signal timing and ramp metering adjustment with Vehicle Infrastructure Integration data Adaptive Control Systems Lite for Networks Establish a standard of practice for metropolitan area traffic management	x x	x
<i>Surface Transportation Environment and Planning Cooperative Research</i> Improved planning, operation, and management of surface transportation services and assets	x	x

**Table 4-1. Milestones for Reducing Recurring Congestion (continued)**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Vehicle-Infrastructure Integration</i> See milestones for "Vehicle, Equipment, and Infrastructure Factors" under Safety RD&T Strategy 1.		
<i>Identify Best Practices and Technologies to Increase Transit Ridership</i> Demonstrate and evaluate methods and technologies to increase ridership	x	x
<i>Identify Methods and Technology to Improve Transit Operational Efficiency</i> Update characteristics of bus rapid transit systems Develop bus rapid transit design guidelines manual for transit agencies	x	x
<i>Economic and Strategic Analysis</i> Improve economic analysis of congestion pricing		x
<i>Safety, Energy, and Environment</i> Identify and recommend measures that offer the greatest benefits for reducing congestion while improving safety Develop a set of emission factors and fuel consumption rates for various categories of vehicles that can be used to calculate the effects of congestion mitigation measures		x x

### **Reducing Non-Recurring Congestion**

RD&T in this area looks at non-recurring congestion caused by weather, traffic incidents, and work zones. Over the next five years it will encompass the programs listed below. Milestones are in Table 4-2.

#### **FAA**

*Advanced Technology Development and Prototyping.* Addresses non-recurring congestion caused by wake turbulence and other weather events. In particular, the program will develop technology and procedures to increase the use of parallel runways in adverse weather conditions.

*Wake Turbulence.* Increases the capacity of terminal airspace during inclement weather by developing modifications to air traffic control wake turbulence mitigation procedures. This program will reduce delays during less than visual flight rules conditions, implement new wake turbulence separation standards and procedures that will improve airport arrival and departure rates, and determine wake turbulence separations required with the design of more efficient airspace routes and the introduction of new aircraft designs.

## **FHWA**

*Evacuation Management and Operations (ITS JPO)*. Improves operational technology and practices to enable the safe and effective movement of people and goods during emergency evacuation situations (both with and without notice). The program will address the application of ITS technologies to improve notice and no-notice evacuation planning and execution, with an orientation that includes both decisionmakers and evacuees. This program will also support Safety RD&T Strategy 2 and Security RD&T Strategy 1.

*National Surface Transportation Weather Observing and Forecasting System (Clarus) (ITS JPO)*. Supports a partnership to develop and demonstrate an integrated surface transportation weather observing, forecasting, and data management system. The program will make use of the over 2,100 environmental sensor stations that are already deployed along America's highways to help reduce the impact of adverse weather for road users and operators.

*Road Weather Research and Development (ITS JPO)*. Seeks to reduce road congestion and safety impacts caused by adverse weather through the development and application of technology. The program will integrate existing observational networks and data management systems for road weather applications; improve weather modeling capabilities and forecast tools; enhance mechanisms for communicating road weather information to users; and integrate road weather technologies into an information infrastructure.

*Strategic Highway Research Program II (Corporate Activities)*. Conducts concentrated, results-oriented applied research focusing on solving the top problems in the area of highway safety, reliability, capacity, and renewal. Research in this area will focus on identifying and developing strategies to mitigate congestion caused by major sources of unreliable travel, such as traffic incidents, work zones, and adverse weather. This program will also support Reduced Congestion RD&T Strategies 2 and 4 and Safety RD&T Strategy 1.

*Surface Transportation Congestion Relief Solutions (Operations R&D)*. Develops information to assist State DOTs and MPOs with measuring and addressing congestion problems. Initiatives to address non-recurring congestion will focus on reducing the time required to restore traffic flow to "normal" conditions following minor traffic incidents and minimizing the impact of work zones on motorist mobility.

## **Reduced Congestion**

- **Reduce Passenger and Freight Congestion in Air and Surface Modes**
- Extend System Life and Improve Durability
- Advance Use of Next Generation Technologies and Combinations of Modes
- Improve Planning, Operations, and Management
- Improve Services for Underserved Areas and Populations
- Advance the Nation's Transportation Research Capability



**Table 4-2. Milestones for Reducing Non-Recurring Congestion**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Advanced Technology Development and Prototyping</i> Evaluate prototype ground-based departure spacing system	x	
<i>Wake Turbulence</i> Implement wake avoidance procedures at the 35 Operational Evolution Plan airports Conduct wake turbulence assessments of potential air traffic routing and separation changes in en route airspace	x x	x x
<i>Evacuation Management and Operations</i> Evacuation decision-support requirements definition Evacuation decision-support tool development Evacuation decision-support tool test	x x	x
<i>Clarus</i> Clarus prototype test Multistate regional demonstrations Clarus adopted by National Oceanic and Atmospheric Administration	x x	x
<i>Road Weather Research and Development</i> Develop weather responsive transportation management system prototype Enhanced maintenance decision-support system Road weather sensor location guidance	x x x	
<i>Strategic Highway Research Program II</i> Establish local and national monitoring programs for mobility and travel time reliability Develop analytic procedures for determining the impacts of reliability improvement strategies	x	x
<i>Surface Transportation Congestion Relief Solutions</i> Quick clearance procedures, policies, and technologies to speed system recovery from traffic incidents Policies, procedures, and technologies to reduce the impact of work zones on the traveling public	x x	

**EXTEND THE LIFE OF THE EXISTING TRANSPORTATION SYSTEM AND IMPROVE INFRASTRUCTURE DURABILITY**

An important element of the Department’s congestion reduction goal is to increase system capacity by transforming the way that infrastructure is designed, constructed, and maintained. Through RD&T, the Department seeks to develop and deploy innovative methods and technologies that will significantly improve infrastructure durability, extend its life, and reduce its long-term costs in all modes. This RD&T strategy will be advanced through research in two areas: preserving the existing infrastructure, and improving infrastructure durability and characterizing materials.

### Preserving Existing Infrastructure

This research area seeks to develop and deploy improved technologies and methods for infrastructure rehabilitation, maintenance, and repair. The primary RD&T programs that will support this area are described below. Milestones are shown in Table 4-3.

#### FAA

*Airport Technology Research–Capacity.* Develops standards and guidance materials for airport design, construction, and maintenance to ensure the cost-effectiveness of runways, taxiways, and aprons. The program will develop pavement design standards to provide manufacturers with the assurance of the compatibility of their aircraft on airports throughout the world; provide airport operators with precise cost estimates for permitting new aircraft operations on their facilities; and ensure that the Federal funds invested in rebuilding or strengthening runways are used prudently. This program will also support the RD&T Strategy for Global Connectivity.

#### FHWA

*Alkali-Silica Reactivity (Pavement R&D and Structures R&D).* Conducts research and implements technologies to address the problem of cracking and eventual failure of concrete in bridges, pavements, and other structures due to silica and alkali reaction in portland cement. Research, development, and implementation will contribute to the durability and preservation of concrete pavements and structures.

*Asphalt and Asphalt Reclamation (Pavement R&D).* Focuses on tests and procedures for in-place recycling and reclamation to build and rehabilitate pavements more economically while providing long-lasting performance. Efforts will be conducted at the South Dakota School of Mines.

*Long-Term Bridge Performance (Structures R&D).* Provides performance data on in-service bridges monitored for at least 20 years. Highway agencies will use this data to make informed decisions on all aspects of bridge design and performance and to construct bridges to meet future needs.

*Steel Bridge Testing (Structures R&D).* Assesses and improves technology used for the nondestructive evaluation (NDE) and identification of fatigue cracking in steel bridges. Research results will contribute to steel bridge preservation and durability.

#### FRA

*Track and Structures.* Conducts research on rail inspection techniques, material and component reliability, track and structure design and performance, and track stability data processing and feedback in cooperation with the railroad industry and suppliers. The program will address automated systems for rail defect detection, high-speed video joint bar inspection, and track geometry inspection; and conduct testing and evaluation on the safety performance of new products (such

### Reduced Congestion

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as composites and nanotechnologies) to support the development of appropriate engineering guides before their widespread use. This program will also support Safety RD&T Strategy 1.

**FTA**

*Identify Solutions to Improve Transit Infrastructure Maintenance (Improve Capital and Operating Efficiencies).* Conducts research on improved inspections and integrated maintenance systems for public transportation and the use of geographic information systems to track infrastructure assets.

**Table 4-3. Milestones for Preserving Existing Infrastructure**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Airport Technology</i> Research nondestructive testing methods	x	x
<i>Alkali-Silica Reactivity (ASR)</i> Develop ASR identification, monitoring, and testing procedures Develop ASR mitigation techniques for new pavements and methodology for rehabilitation of existing structures Implement and educate the public and private sectors	x x x	x  x
<i>Asphalt and Asphalt Reclamation</i> Develop design system Develop improved material tests Validate in field trials	x x x	
<i>Long-Term Bridge Performance</i> Database of quantifiable bridge performance information Protocols for standardized bridge evaluation using NDE technologies Improved asset management investment and maintenance decisionmaking for highway bridges	x	x  x
<i>Steel Bridge Testing</i> Improved technology for detecting fatigue cracks in steel bridges Guide for use of NDE technologies in steel bridge inspection and evaluation Guidance on cost-effective and timely repair and retrofitting of fatigue-cracked structures	x  x	x x x
<i>Track and Structures</i> Develop automated defect detection systems for rail and joint bars Develop an automated track and wayside equipment mapping system Develop a smart rail plug that will detect the longitudinal stress of continuously welded rail	x x x	x
<i>Identify Solutions to Improve Transit Infrastructure Maintenance</i> Improved track inspection and integrated maintenance systems		x

## Improving Infrastructure Durability and Characterizing Materials

DOT research in this area explores potential advances in the materials and methods used in the construction of airport and highway pavements, highway bridges, and railroad track and structures. The primary RD&T programs that will support this area are described below. Program milestones are in Table 4-4.

### FAA

*Airport Technology Research–Capacity.* Develops standards and guidance materials for airport design, construction, and maintenance. (See “Preserving Existing Infrastructure” above.) This program will also support the RD&T Strategy for Global Connectivity.

### FHWA

*Asphalt Research Consortium (Pavement R&D).* Focuses on research in flexible pavements and on extending the life cycle of asphalt. This research consortium will be led by the Western Research Institute in Laramie, Wyoming.

*Exploratory Advanced Research (Corporate Activities).* Addresses longer term, higher risk research with potentially dramatic breakthroughs for understanding the characterization of materials used in highway infrastructure. This program will also support Reduced Congestion RD&T Strategies 3 and 4, Safety RD&T Strategy 1, and Environmental RD&T Strategy 1.

*Fundamental Properties of Asphalt (Pavement R&D).* Promotes innovative technologies that will improve pavement durability, extend service life, and help reduce costs.

*High-Performing Steel Bridge (Structures R&D).* Demonstrates the application of high-performance steel in the construction and rehabilitation of bridges. This research will contribute to improving the durability of steel bridges.

*Innovative Bridge Research and Deployment (Structures R&D).* Promotes, demonstrates, evaluates, and documents the application of innovative designs, materials, and construction methods in the construction, repair, and rehabilitation of bridges and other highway structures. Program activities will include research and deployment of high-performance concrete bridge technology.

*Innovative Pavement Research and Deployment (Pavement R&D).* Researches, develops, demonstrates, promotes, supports, and documents the application of innovative pavement technologies, specifications and test methods, and practices. Activities will include the development and deployment of new, cost-effective, and innovative designs, materials, and practices to extend pavement life and performance; promotion and use of improved engineering design criteria and specifications; and use of accelerated construction techniques to increase safety and reduce construction time.

## Reduced Congestion

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*Long-Term Pavement Performance.* Answers questions on “how” and “why” pavements perform as they do. The program will continue to gather and process data describing the structure, service conditions, and performance of more than 2,400 pavement test sections in North America for use by highway engineers in making decisions leading to more cost-effective and better performing pavements.

*Seismic Research (Structures R&D).* Studies the vulnerability of the Federal-aid system and other surface transportation systems to seismic activity. The program will develop and implement cost-effective methods to reduce vulnerabilities and conduct seismic research, including upgrades to earthquake simulation facilities as necessary to carry out the program.

*Strategic Highway Research Program II (Corporate Activities).* Conducts concentrated, results-oriented applied research focused on solving the top problems in the area of highway safety, reliability, capacity, and renewal. This program will also support Reduced Congestion RD&T Strategies 1 and 4 and Safety RD&T Strategy 1.

*Ultra-High-Performance Concrete Demonstrations (Structures R&D).* Demonstrates the use of a steel-fiber-reinforced reactive powder concrete with over twice the compressive strength of high-performance concrete. This work will yield data leading to important new structural innovations in highway transportation.

*Wood Composite Materials (Structures R&D).* Explores innovative applications of wood composite materials in transportation structures. The program will exploit the demonstrated potential of wood composite products as an alternative method of providing low-cost, extremely durable, and environmentally sensitive material for building and repairing bridges and roadway appurtenances.

## **FRA**

*Track and Structures.* Conducts research on rail inspection techniques, material and component reliability, track and structure design and performance, and track stability data processing and feedback in cooperation with the railroad industry and suppliers. The program will address automated systems for rail defect detection, high-speed video joint bar inspection, and track geometry inspection. This program will also support Safety RD&T Strategy 1.

## **OST**

*Preparing Infrastructure for the Impacts of Climate Change.* Through the crossmodal DOT Center for Climate Change, conducts regional research on the impacts of climate change on transportation infrastructure. This effort will consider such conditions as a rise in sea levels, more extreme temperatures, and increases in severe weather events and, based on this assessment, develop recommendations for transportation planners and engineers. (This activity will be funded through other RD&T programs.)

**Table 4-4. Milestones for Improving Infrastructure Durability and Characterizing Materials**

Research Product or Information Gained	FY 07-08	FY 09-10
<p><i>Airport Technology</i></p> <p>Improved paving materials</p> <p>Advanced airport pavement design procedures</p>	<p>x</p> <p>x</p>	<p>x</p>
<p><i>Asphalt Research Consortium</i></p> <p>Validation and calibration of findings concerning the performance impact of fundamental properties of asphalt</p> <p>Advanced technological capabilities to increase pavement durability and performance and reduce life-cycle cost</p> <p>Identification of mechanism of action for polyphosphoric acid as an asphalt binder modifier as well as its potential beneficial and deleterious effects</p>	<p>x</p> <p>x</p> <p>x</p>	<p>x</p> <p>x</p> <p>x</p>
<p><i>Exploratory Advanced Research</i></p> <p>Nuclear system for nondestructive measurement of chlorides in concrete</p> <p>Guidelines for preventing delayed ettringite formation in concrete</p> <p>Recommendations for use of retarders to control setting of concrete</p>	<p>x</p> <p>x</p>	<p>x</p>
<p><i>Fundamental Properties of Asphalt</i></p> <p>Establish linkage between mechanical/engineering properties of an asphalt mixture and its individual constituents to the fundamental chemical/molecular properties of the mix components</p> <p>Develop engineering performance prediction model of asphalt pavement that relates engineering properties to chemical/molecular parameters</p> <p>Develop improved chemical and physicochemical methods to enhance the characterization and performance prediction of modified asphalts</p>		<p>x</p> <p>x</p> <p>x</p>
<p><i>High-Performing Steel Bridge</i></p> <p>Modern fracture control plan to guide fabrication and maintenance of bridges</p> <p>Designers guide for efficient use of high-performance steel</p> <p>Economically efficient and structurally durable corrosion-resistant steel</p>	<p>x</p> <p>x</p>	<p>x</p>
<p><i>Innovative Bridge Research and Deployment</i></p> <p>Develop and deploy Accelerated Bridge Construction techniques to increase safety and durability and reduce construction time and traffic congestion</p> <p>Continue the improvement in and deployment of high-performance materials for infrastructure applications</p> <p>Develop and deploy improved methods for economical bridge foundation designs</p>	<p>x</p> <p>x</p> <p>x</p>	<p>x</p> <p>x</p> <p>x</p>
<p><i>Innovative Pavement Research and Deployment</i></p> <p>Develop and implement quality assurance technologies</p> <p>Guidance for optimizing pavement surface characteristics</p> <p>Improved design systems, materials selection, and performance prediction technologies to optimize pavement performance for new and recycled materials</p>	<p>x</p> <p>x</p> <p>x</p>	<p>x</p> <p>x</p> <p>x</p>



**Table 4-4. Milestones for Improving Infrastructure Durability and Characterizing Materials (continued)**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Long-Term Pavement Performance (LTPP)</i> Develop database and supporting documentation Develop and implement quality assurance technologies Develop and implement LTPP product website	x x	x
<i>Seismic Research</i> Design details to accommodate seismic behavior and design of prefabricated segmental bridge piers for accelerated bridge construction in seismic regions Design criteria for protection of bridges against earthquakes and other hazards Implementation of improved earthquake loss estimation technology	x x	x x
<i>Strategic Highway Research Program II</i> Develop technologies for faster in situ construction Develop rapid construction techniques that provide minimal disruption to the public Develop innovative and equitable contracting methodologies	x x x	x x x
<i>Ultra-High-Performance Concrete (UHPC) Demonstrations</i> Precast UHPC bridge deck with enhanced durability UHPC superstructure and deck solutions based on simple modifications to existing practice that can be implemented immediately Design provisions and examples compatible with American Association of State Highway and Transportation Officials specifications	x x	x x
<i>Wood Composite Materials</i> Development of alternate materials Development of design systems for bridges and other structures Guidelines and code development	x	x x
<i>Track and Structures</i> Research durability of new rail steels, tie materials, fastener types, concrete bridges, switches, and welding techniques	x	x



## **ADVANCE USE OF NEXT GENERATION TECHNOLOGIES AND COMBINATIONS OF MODES**

This RD&T strategy focuses on the development and introduction of advanced technologies and concepts that will significantly improve the capacity, efficiency, and performance of the transportation network. Over the next five years, the Department will implement this strategy through research in two areas: multimodal and intermodal transportation, and next generation technologies and systems.

### **Multimodal and Intermodal Transportation**

An important activity for the Department is to conduct research leading to an integrated and interconnected transportation system that meets the needs of a growing economy and is efficient, accessible, and cost-effective for both passengers and freight. The primary RD&T programs that will support this area are described below. Table 4-5 shows program milestones.

### **Emerging Research Priority: System Resilience and Global Logistics**

Research is needed to identify freight bottlenecks and changing transportation patterns and to develop and implement technologies to enhance the efficiency of cargo flows. RD&T priorities include such areas as universal electronic manifests; advanced location and geospatial systems for end-to-end tracking and identification of containerized and bulk cargo and hazardous materials; the feasibility of key corridors for Short Sea Shipping and short-haul rail/inland ports/cargo consolidation centers; and decision-support systems and tools to help State and local governments realign intermodal capacity, implement congestion pricing, and leverage private sector infrastructure investment.

#### **Key Supporting RD&T Programs:**

- Advanced Travel Forecasting Procedures Program
- Electronic Freight Management
- Integrated Corridor Management Systems
- Surface Transportation Environment and Planning Cooperative Research
- Freight and Logistics
- National Cooperative Freight Transportation Research

## Reduced Congestion

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### **FHWA**

*Advanced Travel Forecasting Procedures Program (Planning and Environment).* Continues deployment of the Transportation Analysis Simulation System (TRANSIMS) as a planning tool. The program will develop additional applications and uses of the TRANSIMS model. This program will also support Reduced Congestion RD&T Strategy 4.

*Electronic Freight Management (ITS JPO).* Focuses on improving the operational efficiency, productivity, and security of the freight transportation system. The program will implement a common electronic information transfer protocol and a message portal to provide access to shipment information for all supply chain partners in real time. This program will also support Reduced Congestion RD&T Strategies 1 and 4.

*Integrated Corridor Management Systems (ITS JPO).* Assists agencies in implementing Integrated Corridor Operations through support for analytical tools, approaches, and technical standards. The program will demonstrate the value of Integrated Corridor Management for operating and optimizing an entire system as opposed to individual networks. This program will also support Reduced Congestion RD&T Strategy 1.

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment).* Focuses on improving understanding of the complex relationship between surface transportation and the environment. Research in this area will advance the state of the practice in multimodal and intermodal transportation planning. This program will also support Reduced Congestion RD&T Strategies 1, 4, 5, and 6; Safety RD&T Strategy 1; the RD&T Strategy for Global Connectivity; and Environmental RD&T Strategies 1 and 2.

### **OST**

*Freight and Logistics.* Supports the National Freight Action Policy and Departmental priorities related to port and freight capacity issues. In particular, this effort will engage the freight community, both public and private, in developing and implementing solutions for our freight capacity challenges and reducing the environmental impacts of freight, and will support the President's Ocean Action Plan.

### **RITA**

*National Cooperative Freight Transportation Research Program.* Awards contracts and grants for research on critical freight transportation issues through an FHWA-funded program administered by the National Research Council. Among other topics, the program will address techniques for estimating the public benefits of freight transportation projects, approaches for calculating the contribution of truck and rail traffic to congestion, use of technology to increase the capacity of truck-only highway lanes, and freight transportation research needs in all modes.

**Table 4-5. Milestones for Multimodal and Intermodal Transportation**

Research Product or Information Gained	FY 07-08	FY 09-10
<p><i>Advanced Travel Forecasting Procedures (TRANSIMS)</i>                      Demonstrate mode-split procedures combining highway, transit, and non-motorized modes for tracking and simulating travelers on a second-by-second basis                      Use multiprocessor and 64-bit computer technology to simulate movements of vehicles and persons for entire regions</p>	x  x	  x
<p><i>Electronic Freight Management</i>                      Develop prototype electronic freight manifest system                      Deploy system in one air cargo supply chain                      Test functionality and economic benefits of information transfer protocol</p>	x x x	
<p><i>Integrated Corridor Management</i>                      See milestones for "Reducing Recurring Congestion" under Reduced Congestion RD&amp;T Strategy 1.</p>		
<p><i>Surface Transportation Environment and Planning Cooperative Research</i>                      Advance the state of the practice in multimodal and intermodal transportation planning</p>	x	x
<p><i>Freight and Logistics</i>                      Engage the freight community in developing and implementing solutions for freight capacity challenges and reducing freight environmental impacts</p>		x
<p><i>National Cooperative Freight Transportation Research</i>                      Research critical freight transportation issues to improve planning, operations, and infrastructure of freight systems</p>	x	x

**Next Generation Technologies and Systems**

The goal of research in this area is to apply advances in information, communication, and other technologies to develop and introduce broad advances in aviation and surface transportation systems. The primary RD&T programs that will support this area are described below. Program milestones are shown in Table 4-6.

**FAA**

*Center for Advanced Aviation Systems Development (CAASD)*. Develops knowledge to produce a safer, more efficient global air transportation system. Studies performed at the CAASD will comprise an essential component of FAA research, system engineering, and operations research, including efforts to identify and test technologies for worldwide application to air traffic management, navigation, communication, separation assurance, surveillance, system safety, and security. This program will also support Reduced Congestion RD&T Strategy 4.

*National Plan for Transformation of Air Transportation–JPDO.* Leads the development and implementation of the NGATS to increase the safety, capacity, efficiency, and security of U.S. air transportation. The program will integrate capabilities across Federal agencies to meet defense, commerce, and homeland security requirements. This program will also support Reduced Congestion RD&T Strategy 1.

**FHWA**

*Exploratory Advanced Research (Corporate Activities).* Addresses longer term, higher risk research with potentially dramatic breakthroughs for improving data analysis techniques for system condition and performance monitoring and for system operational assessment. This program will also support Reduced Congestion RD&T Strategies 2 and 4, Safety RD&T Strategy 1, and Environmental RD&T Strategy 1.

**FRA**

*High-Speed Rail Corridor Planning.* Provides funding to States for studies and analyses related to the development of high-speed intercity passenger rail corridors. (This program will be completed in FY 2006).

## Emerging Research Priority: Next Generation Air Transportation System

The goal of NGATS research is to provide the knowledge base to achieve aviation throughput and capacity gains; reduce user and service costs; increase service provider productivity; and ensure a safe, secure, and environmentally compatible aviation system.

Major research areas include best practices for next generation safety management; wake vortex information to support separation reduction; reducing the uncertainties of noise and environmental impacts; and developing a common weather forecast system and probabilistic weather forecast methods.

Key Supporting RD&T Programs:

- Center for Advanced Aviation Systems Development
- National Plan for Transformation of Air Transportation
- Navigation and Spectrum Policy

*Train Control.* Develops train control standards and equipment for locomotives. In cooperation with railroads and suppliers, the program will develop the interoperability standard and requirements specifications for next generation advanced train control systems using wireless communication, Global Positioning System (GPS), and advanced microprocessor technologies. This program will also support Safety RD&T Strategy 1.

### **OST**

*Navigation and Spectrum Policy.* Supports the formulation of positioning, navigation, and spectrum policy and the civilian management and use of the GPS. This effort will fund DOT's share of support for operation of the National Space-Based Positioning, Navigation, and Timing (PNT) Coordination Office, develop long-term implementation plans for integrated PNT technologies, and examine potential transportation applications for space-based technologies. This program will also support Reduced Congestion RD&T Strategy 4, Safety RD&T Strategy 1, and the RD&T Strategy for Global Connectivity.

### **RITA**

*Commercial Remote Sensing Products and Spatial Technologies.* Develops a policy for new applications of commercial remote sensing and spatial information technologies for national infrastructure development and construction. The program will carry out major national initiatives to implement the policy, including validating new methods, tools, and systems for cost-effectively monitoring the quality of infrastructure construction and assessing infrastructure condition; developing and verifying new applications of integrated remote sensing and spatial information technologies for mitigating freight congestion and increasing the capacity of freight flows through intermodal systems; and developing new service applications for corridor planning and decisionmaking to reduce the time and costs required for completing environmental and transportation impact assessments.

## **Reduced Congestion**

- Reduce Passenger and Freight Congestion in Air and Surface Modes
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**Table 4-6. Milestones for Next Generation Technologies and Systems**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Center for Advanced Aviation Systems Development</i> Investigate and expand use of GPS and advanced navigation systems	x	x
<i>National Plan for Transformation of Air Transportation</i> Update and carry out an integrated plan for the NGATS	x	x
<i>Exploratory Advanced Research</i> Explore data analysis techniques for system condition and performance monitoring Explore and develop enabling network and sensor technologies, modeling capabilities, and systems analysis techniques, e.g.,TRANSIMS		x x
<i>Train Control</i> Develop Positive Train Control systems to prevent collisions, overspeed conditions, exceeding movement authority, and other human errors	x	x
<i>Navigation and Spectrum Policy</i> Support operation of the National Space-Based PNT Coordination Office Develop long-term implementation plans for integrated PNT technologies Examine potential transportation applications for space-based technologies		x x x
<i>Commercial Remote Sensing</i> Validate faster methods for infrastructure condition assessment Develop technology application guidelines for mitigating congestion caused by infrastructure maintenance and repair Validate space-based technology application for freight flow management	x x x	

### **IMPROVE PLANNING, OPERATION, AND MANAGEMENT OF TRANSPORTATION SERVICES AND ASSETS**

One necessary factor in reducing transportation congestion is to plan, manage, operate, and finance surface transportation and aviation services in a more efficient and cost-effective manner. In particular, work in three research areas will advance this RD&T strategy over the next five years: improving efficiency of operations and investments; improving transportation planning and decisionmaking; and promoting innovations in transportation finance.

#### **Improving Efficiency of Operations and Investments**

Research in this area seeks to improve the efficiency of aviation and surface operations, the quality of transit services, and the effectiveness of public investments in radionavigation systems. The primary RD&T programs that will support this area are described below. Table 4-7 shows program milestones.



## FAA

*Advanced Technology Development and Prototyping.* Improves the efficiency of aviation operations through the following activities:

- *Airspace Management Laboratory*—Provides decision-support capabilities to national, regional, and local airspace system management specialists and develops and implements information management systems to improve the end-to-end integrity of post-operational data. This program will also support Reduced Congestion RD&T Strategy 1.
- *System Capacity Planning and Improvement*—Provides measurement tools, procedural recommendations, technologies, and problem-solving methodologies to enhance capacity and alleviate aviation system congestion, delays, and operational inefficiencies. This program will also support Reduced Congestion RD&T Strategy 1.

*Center for Advanced Aviation Systems Development.* Develops knowledge to produce a safer, more efficient global air transportation system. Studies will comprise an essential component of FAA research, system engineering, and operations research, including efforts to identify and test technologies for worldwide application to air traffic management, navigation, communication, separation assurance, surveillance, system safety, and security. This program will also support Reduced Congestion RD&T Strategy 3.

*Weather Program.* Strives to reduce the number of accidents associated with weather and to minimize the impacts of adverse weather events on NAS operational capacity. Research will increase safety and capacity by developing new technologies for providing accurate, accessible, and efficient weather observations, warnings, and forecasts. This program will also support Safety RD&T Strategy 1.

## FHWA

*Advanced Travel Forecasting Procedures Program (Planning and Environment).* Continues deployment of TRANSIMS as a planning tool. This program will develop additional applications and uses of TRANSIMS and will demonstrate methods to analyze the effect of operational improvements on travel demand. This program will also support Reduced Congestion RD&T Strategy 3.

*Electronic Freight Management (ITS JPO).* Focuses on improving the operational efficiency, productivity, and security of the freight transportation system. The program will implement a common electronic information transfer protocol and a message portal to provide access to shipment information for all supply chain partners in real time. This program will also support Reduced Congestion RD&T Strategies 1 and 3.

## Reduced Congestion

- Reduce Passenger and Freight Congestion in Air and Surface Modes
- Extend System Life and Improve Durability
- Advance Use of Next Generation Technologies and Combinations of Modes
- **Improve Planning, Operations, and Management**
- Improve Services for Underserved Areas and Populations
- Advance the Nation's Transportation Research Capability



*Exploratory Advanced Research (Corporate Activities)*. Addresses longer term, higher risk research with potentially dramatic breakthroughs in innovative financing of fully automated intermodal transportation systems. This program will also support Reduced Congestion RD&T Strategies 2 and 3, Safety RD&T Strategy 1, and Environmental RD&T Strategy 1.

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment)*. Focuses on improving understanding of the complex relationship between surface transportation and the environment. This program will also support Reduced Congestion RD&T Strategies 1, 3, 5, and 6; Safety RD&T Strategy 1; the RD&T Strategy for Global Connectivity; and Environmental RD&T Strategies 1 and 2.

#### **FTA**

*Identify Best Practices and Technologies to Increase Transit Ridership (Increase Transit Ridership)*. Identifies best practices and technologies to increase transit ridership, barriers to adopting these practices and technologies, and solutions for overcoming them. The program will demonstrate and evaluate methods, techniques, and technologies to increase ridership and identify best practices for improving transit services across the country. This program will also support Reduced Congestion RD&T Strategy 1.

*Identify Methods and Technologies to Improve Transit Operational Efficiency (Improve Capital and Operating Efficiencies)*. Researches and demonstrates methods to improve bus and heavy-rail efficiency. The program will examine operational delivery strategies, such as Bus Rapid Transit, which involve fleet operations and ITS. This program will also support Reduced Congestion RD&T Strategy 1.

#### **OST**

*Aviation and International Policy*. Conducts policy research to support DOT's role in promoting the U.S. aviation industry. Among other activities, the program will update a study examining airport access issues, particularly access to gates and terminal buildings, and their effects on the operating and competitive structures of the airline industry. This program will also support Reduced Congestion RD&T Strategy 5 and the RD&T Strategy for Global Connectivity.

*Economic and Strategic Analysis.* Analyzes the economic implications of public and private ownership and operation of transportation systems. In this research area, the program will assess the aggregate costs and benefits of transportation infrastructure investments and develop productivity estimates for each transportation mode. This program will also support Reduced Congestion RD&T Strategy 1.

*Navigation and Spectrum Policy.* Supports the formulation of positioning, navigation, and spectrum policy and the civilian management and use of the GPS. The program will support the planning and development of the *Federal Radionavigation Plan* and updates to the Federal Radionavigation System to account for new GPS signals, advances in augmentation systems, and enhancements to ground-based radionavigation aids. This program will also support Reduced Congestion RD&T Strategy 3, Safety RD&T Strategy 1, and the RD&T Strategy for Global Connectivity.

**Table 4-7. Milestones for Improving Efficiency of Operations and Investments**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Airspace Management Laboratory</i> Analyze, deploy, and enhance traffic data and metrics products Analyze and enhance decision-support tools Create a fully integrated aeronautical information management system	x x x	x x x
<i>System Capacity Planning and Improvement</i> See milestones for "Reducing Recurring Congestion" under Reduced Congestion RD&T Strategy 1.		
<i>Center for Advanced Aviation Systems Development</i> Evaluate airspace redesign enhancements in all operational domains Research and evaluate new air traffic management and control operating concepts	x x	x x
<i>Weather Program</i> Develop and make available electronically high-glance-value weather products with longer forecast lead times and increased accuracy		x (2015)

**Table 4-7. Milestones for Improving Efficiency of Operations and Investments (continued)**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Advanced Travel Forecasting Procedures (TRANSIMS)</i> Use simulation technologies to understand the impact of operational improvements on the demand for travel	x	x
<i>Electronic Freight Management</i> See milestones for "Multimodal and Intermodal Transportation" under Reduced Congestion RD&T Strategy 3.		
<i>Exploratory Advanced Research</i> Policy research, including economic impact analysis of highway investment and congestion on business logistics costs Explore innovative financing alternatives for surface transportation		x x
<i>Surface Transportation Environment and Planning Cooperative Research</i> Improved understanding of the relationship between transportation and the environment	x	x
<i>Identify Best Practices and Technologies to Increase Transit Ridership</i> Identify best practices for ridership improvement	x	
<i>Identify Methods and Technologies to Improve Transit Operational Efficiency</i> Collect and make available geospatial data Develop parameters for shared-use-track demonstrations	x x	
<i>Aviation and International Policy</i> Examine airport access issues and their effects on the operating and competitive structures of the airline industry		x
<i>Economic and Strategic Analysis</i> Assess the aggregate costs and benefits of transportation infrastructure investments Develop productivity estimates for each transportation mode		x x
<i>Navigation and Spectrum Policy</i> Support the planning and development of the <i>Federal Radionavigation Plan</i> and updates to the Federal Radionavigation System		x

**Improving Planning and Decisionmaking**

RD&T activities in this area address the improvement of transportation models and other decisionmaking tools; their more effective use in the planning process; and broadening stakeholder participation in transportation planning and decision-making. The following sections describe the primary RD&T programs that will support this area. Program milestones are shown in Table 4-8.

## **FHWA**

*Advanced Travel Forecasting Procedures Program (Planning and Environment).* Continues deployment of TRANSIMS as a planning tool and develops additional applications and uses. This program will develop methods to include time of day in the modeling process, thereby improving the model's capability to respond to the effects of congestion on travel demand. This program will also support Reduced Congestion RD&T Strategy 3.

*Center for Environmental Excellence (Planning and Environment).* Assists States in planning and delivering environmentally sound surface transportation projects. The center will provide technical assistance, information on best practices, and training in the use of tools and decisionmaking processes. This program will also support Reduced Congestion RD&T Strategy 6 and Environmental RD&T Strategies 1 and 2.

*Strategic Highway Research Program II (Corporate Activities).* Conducts concentrated, results-oriented applied research focused on solving the top problems in the area of highway safety, reliability, capacity, and renewal. This program will also support Reduced Congestion RD&T Strategies 1 and 2 and Safety RD&T Strategy 1.

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment).* Focuses on improving understanding of the complex relationship between surface transportation and the environment. This program will also support Reduced Congestion RD&T Strategies 1, 3, 5, and 6; Safety RD&T Strategy 1; the RD&T Strategy for Global Connectivity; and Environmental RD&T Strategies 1 and 2.

*Transportation, Economics, and Land Use System (TELUS) (Planning and Environment).* Helps MPOs and State DOTs develop their transportation improvement programs and carry out other transportation planning responsibilities. A fully integrated information management and decision-support system, TELUS will help States and MPOs assure public participation in the transportation planning process.

## **FTA**

*Identify Practices and Technologies to Control Capital and Operating Costs (Improve Capital and Operating Efficiencies).* Identifies practices, methods, and technologies to improve risk management, analyze capital cost variables, improve design and control methods, and identify appropriate standards. This program will also examine alternative delivery providers, costs of technology adoption, and improved planning models. This program will also support the RD&T Strategy for Global Connectivity.

## **Reduced Congestion**

- Reduce Passenger and Freight Congestion in Air and Surface Modes
- Extend System Life and Improve Durability
- Advance Use of Next Generation Technologies and Combinations of Modes
- **Improve Planning, Operations, and Management**
- Improve Services for Underserved Areas and Populations
- Advance the Nation's Transportation Research Capability

**Table 4-8. Milestones for Improving Planning and Decisionmaking**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Advanced Travel Forecasting Procedures (TRANSIMS)</i> Use simulation technologies to understand the impact of travel, by time of day, on overall mobility	x	x
<i>Center for Environmental Excellence</i> Promote the advancement of Context-Sensitive Solutions Identify and promote technology and geospatial innovations	x x	x x
<i>Strategic Highway Research Program II</i> Develop framework for collaborative decisionmaking on additions to highway capacity	x	x
<i>Surface Transportation Environment and Planning Cooperative Research</i> Develop and/or support accurate models for evaluating transportation control measures Develop indicators of economic, social, and environmental performance of transportation systems to facilitate alternative analysis	x x	x x
<i>Transportation, Economics, and Land Use System</i> Use TELUS to assist States and MPOs in the development of transportation improvement programs and other transportation planning initiatives	x	x
<i>Identify Practices and Technologies to Control Capital and Operating Costs</i> Provide enhanced tools and methods for technical planning Develop improved models of the performance of bus operations Develop voluntary industry standards	x x x	x x x

**Promoting Innovations in Transportation Finance**

This research addresses innovative mechanisms for financing transportation services and improvements, including public-private partnerships and user fees. The primary RD&T programs that will support this area are described below. Table 4-9 shows program milestones.

**FTA**

*Identify Practices and Technologies to Control Capital and Operating Costs (Improve Capital and Operating Efficiencies)*. Identifies practices, methods, and technologies to improve risk management, analyze capital cost variables, improve design and control methods, and identify appropriate standards. This program will also support the RD&T Strategy for Global Connectivity.

## OST

*Center for Excellence in Project Finance.* Supports State DOTs in the development of transportation project finance plans and oversight tools. The center will develop and offer training in state-of-the-art financing methods through an FHWA-funded grant managed by OST.

*Economic and Strategic Analysis.* Analyzes the economic implications of public and private transportation policy issues. This program will advance the Department's understanding of the barriers to public-private partnerships and other innovative financing techniques. This program will also support Reduced Congestion RD&T Strategy 1.

**Table 4-9. Milestones for Promoting Innovations in Transportation Finance**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Identify Practices and Technologies to Control Capital and Operating Costs</i> Establish Center for Transit-Oriented Development	x	x
<i>Center for Excellence in Project Finance</i> Develop and offer training in state-of-the-art financing methods		x
<i>Economic and Strategic Analysis</i> Advance understanding of the barriers to public-private partnerships and other innovative financing techniques		x

## IMPROVE TRANSPORTATION SERVICES FOR UNDERSERVED AREAS AND POPULATIONS

Improving mobility for traditionally underserved areas and populations is a core Departmental priority. This RD&T strategy will involve research in two major areas: improving access for the elderly, people with disabilities, and other transportation-disadvantaged populations; and improving transportation in rural areas and small communities.

### Improving Access for Transportation-Disadvantaged Populations

RD&T programs in this research area seek to improve mobility and accessibility through technology applications and service coordination. The primary RD&T programs that will support this area are described below. Milestones for these programs are in Table 4-10.

## Reduced Congestion

- Reduce Passenger and Freight Congestion in Air and Surface Modes
- Extend System Life and Improve Durability
- Advance Use of Next Generation Technologies and Combinations of Modes
- Improve Planning, Operations, and Management
- **Improve Services for Underserved Areas and Populations**
- Advance the Nation's Transportation Research Capability

### **FHWA**

*Mobility Services for All Americans (ITS JPO)*. Builds upon several past and current DOT-led activities to increase mobility and accessibility for the transportation disadvantaged and the general public. The program will achieve more efficient use of Federal transportation funding resources through technology integration and service coordination.

### **FTA**

*Identify Solutions to Provide Public Transportation for Targeted Populations (Increase Transit Ridership)*. Undertakes research to determine how to expand transit services to elderly and mobility-impaired populations, with an emphasis on using existing systems. The program will also research methods to improve coordination of human services and examine technologies to improve accessibility.

### **OST**

*Aviation and International Policy*. Conducts policy research to support DOT's role in promoting the aviation industry. In this area, the program will research space requirements, maneuvering needs, reach ranges, and other key factors for occupied power wheelchairs and scooters used in airports, terminals, and other facilities. This program will also support Reduced Congestion RD&T Strategy 4 and the RD&T Strategy for Global Connectivity.

*Safety, Energy, and Environment*. Conducts policy research to support the formulation and recommendation of Departmental policies, plans, and guidelines related to public health and safety. The program will update a plan providing strategies for improved senior safety and mobility and fund the fulfillment of DOT's responsibilities under Executive Order No. 13330 on Human Service Transportation ("United We Ride"), including policy development and demonstration and testing of new technologies. This program will also support Reduced Congestion RD&T Strategy 1, Safety RD&T Strategy 1, and Environmental RD&T Strategy 1.



**Table 4-10. Milestones for Improving Access for Transportation-Disadvantaged Populations**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Mobility Services for All Americans</i> Pilot site concept of operations Model system planning and design Model deployment and evaluation	x x	x
<i>Identify Solutions to Provide Public Transportation for Targeted Populations</i> Facilitate access to public transportation for persons with disabilities Demonstrate transit vehicle guidance technology to improve accessibility Establish and support National Technical Assistance Center for Senior Transportation	x x	x x
<i>Aviation and International Policy</i> Research space requirements, maneuvering needs, reach ranges, and other key accessibility factors		x
<i>Safety, Energy, and Environment</i> Provide strategies for improved senior safety and mobility Fulfill DOT's responsibilities for "United We Ride"		x x

**Improving Transportation in Rural Areas and Small Communities**

This research addresses the many transportation issues facing rural areas and small communities, including the need for improvements in rural transportation planning, infrastructure, and transit services. The following RD&T programs will address these issues. Table 4-11 shows program milestones.

**FHWA**

*Center for Transportation Advancement and Regional Development (Planning and Environment).* Assists in the development of small metropolitan and rural regional transportation systems that are responsive to the needs of businesses and local communities. The program will accomplish its goals through comprehensive training, education, and research activities. This program will also support Reduced Congestion RD&T Strategy 6.

*Rural Interstate Corridor Communications (ITS JPO).* Aims to improve communications services in rural communities. The program will assess the feasibility of installing fiber-optic cabling and wireless communication infrastructure along rural multistate Interstate System route corridors.

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment).* Focuses on improving understanding of the complex relationship between surface transportation and the environment. In this area the program will support research initiatives to improve transportation in rural and small communities. This program will also support Reduced Congestion RD&T Strategies 1, 3, 4, and 6; Safety RD&T Strategy 1; the RD&T Strategy for Global Connectivity; and Environmental RD&T Strategies 1 and 2.

**FTA**

*Identify Cost-Effective Solutions to Provide Rural Transportation Services (Increase Transit Ridership).* Researches appropriate classifications of transit services in rural areas and logical approaches to provide these services. The program will identify parameters for appropriate transit vehicles for rural use.

**OST**

*Aviation and International Policy.* Conducts policy research to support DOT's role in promoting the aviation industry. In this research area, the program will study the economic impact of air service in small communities. This program will also support Reduced Congestion RD&T Strategy 4 and the RD&T Strategy for Global Connectivity.

**RITA**

*Cold Region and Rural Transportation Research.* Supports the development of a research facility for basic and applied research on surface transportation issues facing rural and cold regions.

**Table 4-11. Milestones for Improving Transportation in Rural Areas and Small Communities**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Center for Transportation Advancement and Regional Development</i> Improved knowledge of transportation and economic development	x	x
<i>Rural Interstate Corridor Communications</i> Report to Congress	x	
<i>Surface Transportation Environment and Planning Cooperative Research</i> Enhanced knowledge of strategies to improve transportation in rural areas and small communities	x	x
<i>Identify Cost-Effective Solutions to Provide Rural Transportation Services</i> Demonstrate rural service solutions Identify improved transit vehicles for rural applications	x	x x
<i>Aviation and International Policy</i> Assess economic impact of air service in small communities		x
<i>Cold Region and Rural Transportation Research</i> Design and build research infrastructure Evaluate research projects Ensure long-term sustainability of research facility	x	x x

## ADVANCE THE NATION'S TRANSPORTATION RESEARCH CAPABILITY

This broad Departmental strategy, which also cuts across all DOT goals, seeks to strengthen the foundation for the 21st century transportation system through a world-class transportation workforce and a national research capability. The strategy will emphasize research activities in four key areas: university research and education; cooperative and stakeholder research; technical assistance and training; and DOT research facilities and expertise.

### University Research and Education

RD&T in this area supports university-based transportation research and education activities, including the Department's expanded University Transportation Centers (UTC) Program. The supporting RD&T programs will include those listed below. Milestones are in Table 4-12. (See Chapter 9 for additional information about the Department's university programs.)

#### FAA

*Aeromedical Research.* Offers FAA National Research Council postdoctoral and senior research awards. Research interns at the Civil Aerospace Medical Institute will continue to work closely with scientists, engineers, and physicians on research projects relevant to aerospace safety. This program will also support Safety RD&T Strategies 1, 2, and 3.

*Joint University Program.* Provides grants from FAA and the National Aeronautics and Space Administration to the Massachusetts Institute of Technology, Ohio State University, and Princeton University. Research will provide increased knowledge and solutions in disciplines such as air traffic control theory, human factors, satellite navigation and communications, capacity issues in air traffic control, synthetic vision, and meteorological hazards. (This program will be funded through other FAA research activities.)

*Transportation Centers of Excellence Program.* Improves aviation through unique consortia of Federal, university, and industry researchers. Funded through contracts, grants, and cost sharing, these consortia will work to improve aviation through shared resources, leveraged funding, and pooled talent. (This program will be funded through other FAA research activities.)

#### FHWA

*Eisenhower Fellowship Program.* Seeks to attract the best and brightest minds to transportation research and the transportation workforce. Encompassing all modes, the program will award fellowships based on applicants' academic achievements, recommendations, and likelihood of pursuing a career in transportation.

### Reduced Congestion

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- Advance Use of Next Generation Technologies and Combinations of Modes
- Improve Planning, Operations, and Management
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- **Advance the Nation's Transportation Research Capability**

*Garrett A. Morgan Technology and Transportation Education Program.* Focuses on improving the preparation of elementary and secondary school students, particularly women and minorities, in science, technology, engineering, and mathematics. The program will award grants to State and local educational agencies for internships, curriculum development, and other activities related to transportation.

*Transportation Education Development Pilot Program.* Seeks to train individuals at all educational levels for careers in transportation. This pilot program will focus on curriculum development for in-service professional development programs.

**FRA**

*University Research Program.* Competitively awards university research grants for work on challenging priority areas identified in the *FRA Strategic Plan*. The program will continue to fund university research using discretionary funds or in accordance with congressional mandates. (This research will be funded through other FRA programs.)

**RITA**

*University Transportation Centers Program.* Invests in university-based centers of excellence to advance transportation innovation, research, education, and technology transfer. RITA will continue to manage this FHWA- and FTA-funded program, for which the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) authorized an expansion from 33 to 60 UTCs, 20 of which will be competitively selected.

**Table 4-12. Milestones for University Research and Education**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Aeromedical Research</i> Academic collaboration in aeromedical research	x	x
<i>Eisenhower Fellowship Program</i> Increase number of Eisenhower Fellowships	x	x
<i>Garrett A. Morgan Program</i> Manage grants to enhance education outreach for underrepresented student groups	x	x
<i>Transportation Education Development Pilot Program</i> Develop curriculum to address high-priority transportation workforce development needs	x	x
<i>University Transportation Centers Program</i> Basic and applied transportation research projects Transportation education programs Technology transfer programs	x x x	x x x

## Cooperative and Stakeholder Research

The Department provides support for a number of cooperative research activities, particularly those with State and local transportation agencies, airport operating authorities, and the transit industry. During the next five years, specific RD&T programs will include those listed below. Milestones are in Table 4-13. (See Chapter 9 for additional information about the Department's cooperative research and partnerships.)

### FAA

*Airport Cooperative Research Program.* Carries out applied research on problems that are shared by airport operating agencies and that are not being adequately addressed by existing research programs. Mandated by the Vision 100—Century of Aviation Reauthorization Act, the program will be administered by the Transportation Research Board (TRB), with research projects selected by an independent governing board of airport managers and others appointed by the Secretary. This program will also support Environmental RD&T Strategy 2.

### FHWA

*State Planning and Research.* Helps States to address their unique transportation concerns before they become critical problems. The program will give high priority to applied research, technology transfer, and research for setting standards and specifications. (This research will be carried out by the States and funded through their apportionments from highway grant programs.)

### FTA

*Transit Cooperative Research Program.* Funds research on issues significant to the transit industry. Administered by the TRB, the program will continue to emphasize local problem solving in transit planning, service concepts, vehicles and equipment, facilities, operations, human resources, maintenance, and administrative practices.

## Reduced Congestion

- Reduce Passenger and Freight Congestion in Air and Surface Modes
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- Advance Use of Next Generation Technologies and Combinations of Modes
- Improve Planning, Operations, and Management
- Improve Services for Underserved Areas and Populations
- **Advance the Nation's Transportation Research Capability**

**Table 4-13. Milestones for Cooperative and Stakeholder Research**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Airport Cooperative Research Program</i> Carry out applied research on airport safety, security, environmental stewardship, administration, policy and planning, design, maintenance, and operations	x	
<i>Transit Cooperative Research Program</i> Carry out applied research on public transportation to address industry needs	x	x

### Technical Assistance and Training

RD&T activities in this area address the professional capacity building of the transportation workforce through technical assistance, training, technology transfer, and peer exchange. The primary RD&T programs that will support this area are described below. Table 4-14 shows program milestones.

#### FHWA

*Center for Environmental Excellence (Planning and Environment)*. Assists States in planning and delivering environmentally sound surface transportation projects. The center will provide technical assistance, information on best practices, and training in the use of tools and decisionmaking processes. This program will also support Reduced Congestion RD&T Strategy 4 and Environmental Stewardship RD&T Strategies 1 and 2.

*Center for Transportation Advancement and Regional Development (Planning and Environment)*. Focuses on training, education, and research geared toward developing small metropolitan and rural regional transportation systems. The center will promote the use of innovative strategies to expand the capabilities, capacity, and effectiveness of regional transportation networks, including activities related to freight projects, transit system upgrades, roadways, bridges, and intermodal facilities. This program will also support Reduced Congestion RD&T Strategy 5.

*Freight Planning Capacity Building*. Supports research, training, and education in freight planning at the State and local levels. Among other activities, the program will identify and disseminate best practices in freight planning; provide opportunities for freight transportation staff to engage in peer exchange; refine data and analysis tools used to assess freight transportation needs; and facilitate relationships between governmental and private entities.

*Garrett A. Morgan Technology and Transportation Education Program*. Provides for transportation career awareness and preparation outreach activities for elementary school and secondary school students. The program will help students better understand the contribution transportation makes to the U.S. economy and standard of living and help provide for the next generation of transportation workers.



*Local Technical Assistance Program (LTAP).* Improves skills and knowledge of local transportation providers through training, technical assistance, and technology transfer. The program will continue to support 57 LTAP centers serving each State, Puerto Rico, and American Indian tribal government.

*National Highway Institute (NHI).* Provides leadership and resources for the development and delivery of training and education programs to improve the quality of our highway system and its intermodal connections. Established in 1970, the NHI will continue to provide training, resource materials, and educational opportunities to the surface transportation community to develop both core competencies and new skills.

*Professional Capacity Building (ITS JPO).* Ensures that sufficient numbers of trained public transit, highway agency, and motor vehicle regulatory professionals are available to build, operate, and maintain an integrated, interoperable, and intermodal ITS infrastructure. The program will cultivate the next generation of transportation professionals and increase awareness of ITS benefits and deployment options among public-sector decisionmakers and industry.

*Surface Transportation Congestion Relief Solutions Assistance and Training.* Offers technical assistance and training to State and local transportation agencies. The program will work with agencies to improve their approaches to surface transportation congestion measurement, analysis, and project programming.

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment).* Focuses on improving understanding of the complex relationship between surface transportation and the environment. The program will strengthen and advance State, local, and tribal capabilities regarding the complex relationship between surface transportation and the environment. This program will also support Reduced Congestion RD&T Strategies 1, 3, 4, and 5; Safety RD&T Strategy 1; the RD&T Strategy for Global Connectivity; and Environmental RD&T Strategies 1 and 2.

*Transportation Education Development Pilot Program.* Establishes funding and provides for a series of pilot programs to develop training and education curriculums for surface transportation workers. The program will focus on developing new skills to ensure a skilled, technically competent transportation workforce.

## **FTA**

*Improve the Capacity of the Transit Industry and Workforce (Improve Capital and Operating Efficiencies).* Promotes best practices in transit workforce development. Among other efforts, the program will continue to inform domestic transit agencies about technological opportunities available internationally. This program will also support the RD&T Strategy for Global Connectivity.

## **Reduced Congestion**

- Reduce Passenger and Freight Congestion in Air and Surface Modes
- Extend System Life and Improve Durability
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- **Advance the Nation's Transportation Research Capability**



*National Transit Institute.* Develops and teaches new methods and techniques to improve transit workforce performance. The institute will continue to conduct courses at sites nationwide on a variety of subjects, ranging from advanced technology and multimodal planning to management development and training effectiveness.

**RITA**

*Technology Transfer Grant.* Supports the creation of an Advanced Transportation Technology Center at Argonne National Laboratory. The center will conduct research and demonstration projects leading to the exchange of research results with the private sector and universities.

**Table 4-14. Milestones for Technical Assistance and Training**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Center for Environmental Excellence</i> Problem-solving sessions on Federal environmental legislation, policies, and procedures Workshops on implementing SAFETEA-LU Environmental Review Process provisions Transfer knowledge to environmental and transportation professionals	x x x	x x x
<i>Center for Transportation Advancement and Regional Development</i> Transfer knowledge to economic development and transportation professionals	x	x
<i>Freight Planning Capacity Building</i> Courses and workshops that improve freight professional capacity Integrate environmental considerations in public sector freight planning and project development Provide information and tools to effectively enforce truck size and weight regulations	x x x	x  x
<i>Garrett A. Morgan Program</i> Manage grants to enhance training for underrepresented student groups	x	x
<i>Local Technical Assistance Program</i> Expand course content and program scope to meet customer needs	x	x
<i>National Highway Institute</i> Develop new course offerings to meet changing program requirements	x	x
<i>Professional Capacity Building</i> Create ITS Learning Center	x	
<i>Surface Transportation Congestion Relief Solutions Assistance and Training</i> Advance State, local, and tribal capabilities regarding the complex relationship between surface transportation and the environment	x	x

**Table 4-14. Milestones for Technical Assistance and Training (continued)**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Surface Transportation Environment and Planning Cooperative Research</i> Strengthen and advance State, local, and tribal capabilities regarding the complex relationship between surface transportation and the environment	x	x
<i>Transportation Education Development Pilot Program</i> Develop curriculum to address high-priority workforce skills and training needs	x	x
<i>Improve the Capacity of the Transit Industry and Workforce</i> Identify international transit best practices	x	x
<i>National Transit Institute</i> Train transit professionals	x	x
<i>Technology Transfer Grant</i> Traffic modeling and simulation for emergency transportation planning Multidimensional data visualization of various transportation problems	x x	

**DOT Research Facilities and Expertise**

Within this RD&T strategy, this area includes RD&T activities supporting the maintenance, operation, and upgrading of the Department’s research, demonstration, and testing facilities. The primary RD&T programs that will support this area are as follows:

**FAA**

*Civil Aerospace Medical Institute.* Provides aerospace medical expertise across the full spectrum of aviation-related scientific, medical, and bioengineering disciplines. The Institute will both modernize existing capabilities and expand into the revolutionary areas developed by basic medical research. (This program will be funded under Aeromedical Research.)

*William J. Hughes Technical Center.* Supports FAA research facilities at the William J. Hughes Technical Center in support of program goals. These centralized facilities will comprise aircraft, NAS systems, simulators, a communication systems laboratory, and a human factors laboratory.

**FRA**

*Railroad Facilities and Test Equipment.* Provides for the procurement, maintenance, and improvement of facilities and equipment used to test new railroad systems. The program will improve research capabilities at FRA's Transportation and Technology Center, at the Volpe National Transportation Systems Center, and at railroad research contractors, and will also fund operation and maintenance of FRA's T-16 and T-18 track research instrumentation platforms, and their enhancements, to incorporate and demonstrate new inspection technologies as an ongoing process to expedite deployment and beneficial return on research investments.

**NHTSA**

*Vehicle Research and Test Center.* Supports NHTSA's safety research programs through vehicle and equipment test procedure development, testing, safety performance criteria, and breakthrough research in crash prevention, crash protection, and integrated safety. Testing and research done at the center, which houses NHTSA's anthropomorphic dummy laboratory, will address such priorities as vehicle compatibility, rollover protection, driver distraction, and human injury research.

## Global Connectivity

### Global Connectivity Strategic Goal

Facilitate an international transportation system that promotes economic growth and development.

#### Outcomes

1. Reduced barriers to trade in transportation goods and services.
2. Safer, more efficient, and cost-effective movement of passengers and cargo throughout international and domestic transportation systems, including U.S. ports of entry, modal, and intermodal supply chains.
3. Sustained international leadership in promoting U.S. transportation policies.
4. Enhanced competitiveness of U.S. transport providers and manufacturers in the global marketplace.
5. Harmonized and standardized regulatory and facilitation requirements in the international arena.
6. Expanded opportunities for all businesses in the transportation sector, especially small, women-owned, and disadvantaged businesses.

Our transportation system is our lifeline to economic growth, freer trade, and greater cultural exchange. America's continued economic prosperity depends on a strong and interconnected global transportation system. Toward this end, the Department will continue to liberalize aviation markets worldwide, expand the capacity and efficiency of our freight transportation system, improve intermodal linkages, and ensure efficient trade movements across borders. The following RD&T strategy represents the primary research topic in support of Global Connectivity:

Conduct and support research leading to harmonized international standards, improved cross-border collaboration, and global leadership for U.S. transportation providers. *Supports all outcomes.*

The following sections summarize the research areas and primary RD&T activities for advancing this strategy. Appendix C shows anticipated funding levels for FY 2006 through 2010.



## Global Connectivity

- **Harmonize Standards and Support Leadership for U.S. Transportation Providers**

## HARMONIZE TRANSPORTATION STANDARDS AND SUPPORT LEADERSHIP FOR U.S. TRANSPORTATION PROVIDERS

Critical outcomes for the Department's global connectivity goal are reduced barriers to trade in transportation goods and services, enhanced competitiveness of U.S. transportation providers and manufacturers, and harmonized and standardized international regulatory and facilitation requirements. Research in two primary areas will contribute to these outcomes and support the global connectivity RD&T strategy: international standards and coordination, and transportation industry development.

### International Standards and Coordination

To achieve the global connectivity goal and outcomes, the Department incorporates support for harmonized international standards and decisionmaking, particularly with regard to transportation safety and environmental issues, within a number of RD&T activities. The primary RD&T programs that will support this area are described below. Program milestones are shown in Table 5-1.

#### FAA

*Airport Technology Research.* Supports the development of pavement design standards that airports throughout the world need to accommodate new large aircraft. The International Civil Aviation Organization (ICAO) will use data from FAA's National Pavement Test Facility to develop pavement standards for aircraft weighing in excess of a million pounds. This program will also support Safety RD&T Strategies 1 and 3 and Reduced Congestion RD&T Strategy 2.

*Environment and Energy.* Develops, applies, and disseminates knowledge and tools in support of harmonized emissions- and noise-related certification standards, operational procedures, and abatement technology. Through this program, FAA will continue to represent the United States on the ICAO Committee on Aviation Environmental Protection, which establishes and assesses the adequacy of international standards for aircraft noise and engine exhaust emissions. This program will also support Environmental RD&T Strategy 1.

*Fire Research and Safety.* Develops technologies, procedures, test methods, and criteria to prevent accidents caused by hidden in-flight fires and fuel tank explosions. The program will support international standards and cooperation in several areas, including fuel tank protection, fire and smoke detectors, halon replacement, lithium battery fire hazards, and improved material fire tests. This program will also support Safety RD&T Strategies 1, 2, and 3.

**FHWA**

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment).* Focuses on improving understanding of the complex relationship between surface transportation and the environment. In this research area, the program will focus on improving surface transportation decisionmaking and coordination across borders. This program will also support Safety RD&T Strategy 1; Reduced Congestion RD&T Strategies 1, 3, 4, 5, and 6; and Environmental RD&T Strategies 1 and 2.

**FTA**

*Identify Practices and Technologies to Control Capital and Operating Costs (Improve Capital and Operating Efficiencies).* Supports efforts to develop voluntary standards for public transportation. This program will also support Reduced Congestion RD&T Strategy 4.

**NHTSA**

*International Coordination of Research.* Supports agency efforts toward future harmonized test devices and procedures development. (This activity will be funded through other NHTSA RD&T programs.)

**OST**

*Navigation and Spectrum Policy.* Supports the formulation of positioning, navigation, and spectrum policy and the civilian management and use of the Global Positioning System. This effort will examine potential applications of international space-based Positioning, Navigation, and Timing (PNT) systems and augmentations. This program will also support Safety RD&T Strategy 1 and Reduced Congestion RD&T Strategies 3 and 4.

**PHMSA**

*Hazardous Materials Safety R&D.* Provides the foundation for PHMSA's hazardous material regulatory, enforcement, and emergency response actions. The program will conduct studies to support regulatory changes and provide the basis for adaptation of international standards. This program will also support Safety RD&T Strategy 1, Environmental RD&T Strategy 1, and Security RD&T Strategy 2.

**Table 5-1. Milestones for International Standards and Coordination**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Airport Technology</i> Develop international pavement design standards to accommodate new large aircraft	x	x
<i>Environment and Energy</i> Develop international noise standard for subsonic jets and large airplanes	x	
<i>Fire Research and Safety</i> Research and tests in support of reduced flammability limits for fuel tanks Fire-test criteria for structural composites	x x	
<i>Surface Transportation Environment and Planning Cooperative Research</i> Improve transportation decisionmaking and coordination across borders	x	x
<i>Identify Practices and Technologies to Control Capital and Operating Costs</i> Develop voluntary international standards for transit	x	x
<i>Navigation and Spectrum Policy</i> Examine potential applications of international space-based PNT systems and augmentations		x
<i>Hazardous Materials Safety</i> Support development of international standards	x	x

**Transportation Industry Development**

Programs in this research area promote the export of U.S. transportation goods and services and international technology transfer. The following RD&T programs will support this area. Program milestones are in Table 5-2.

**FHWA**

*International Highway Transportation Outreach Program.* Informs the U.S. highway community of technological innovations in foreign countries and promotes U.S. highway transportation expertise, goods, and services. This program, which supports all DOT strategic goals, will undertake activities to leverage international research and test global best practices and technological developments for adaptation and use in the United States, and will also conduct technology transfer and technical assistance activities to promote U.S. standards and industry, with special focus on key emerging markets and other areas of priority for U.S. foreign policy.



**FTA**

*Improve the Capacity of the Transit Industry and Workforce (Improve Capital and Operating Efficiencies).* Conducts research to advance the U.S. transit industry. The program will conduct technology transfer activities with foreign countries; support trade missions, market research, and other trade-related activities; and continue training and information diffusion programs in Latin America and Africa to develop U.S. transit exports. This program will also support Reduced Congestion RD&T Strategy 6.

**OST**

*Aviation and International Policy.* Conducts policy research to support DOT's role in promoting the U.S. aviation industry. Among other efforts, the program will develop a methodology for quantifying the economic impacts of air transportation; examine the operating and competitive structures of the air cargo industry; analyze changes in airline labor contracts and their impact on industry cost structures; define the requirements for and develop the aviation data modernization system; and continue the Office of the Secretary's Project on the Future of the Airline Industry. This program will also support Reduced Congestion RD&T Strategies 4 and 5.

**Table 5-2. Milestones for Transportation Industry Development**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>International Highway Transportation Outreach Program</i> Acquire knowledge on new technology advances and best practices abroad Promote the U.S. highway transportation industry through technology exchange and technical assistance	x x	x x
<i>Improve the Capacity of the Transit Industry and Workforce</i> Research foreign transit markets Promote U.S. transit exports	x x	x x
<i>Aviation and International Policy</i> Develop methodology for quantifying the economic impacts of air transportation Examine operating and competitive structures of the air cargo industry and changes in airline labor contracts Define the requirements for and develop the aviation data modernization system		x x x



## Environmental Stewardship

### Environmental Stewardship Strategic Goal

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

#### Outcomes

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

Transportation exerts pressure on environmental resources worldwide. The Department must balance environmental challenges with the need for a safe and efficient transportation network. The following RD&T strategies represent the primary research topics in support of environmental stewardship:

1. Conduct and support research to understand the various impacts of transportation activities on the natural and built environment and communities and to advance technologies and concepts to mitigate those impacts. *Supports outcomes 1 and 2.*
2. Conduct and support research on ways to improve the environmental review process to achieve the timely delivery of transportation projects. *Supports outcome 2.*

The following sections summarize the research areas, emerging research priority, and primary RD&T activities that will advance these strategies. Appendix C shows anticipated funding levels for FY 2006 through 2010.

## Environmental Stewardship

- **Understand and Mitigate Transportation Impacts**
- Improve the Environmental Review Process

## UNDERSTAND AND MITIGATE TRANSPORTATION IMPACTS

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. Increased travel boosts transportation's share of energy consumption and continues to challenge efforts to reduce air pollutant emissions. This Departmental RD&T strategy has two critical concerns: more fully understanding transportation's impact on the environment, and advancing technologies, plans, and methods to manage these impacts.

### Understanding Transportation Impacts

Research in this critical area develops improved understanding of the broad environmental impacts of aviation, highway, and hazardous materials transportation activities. The primary RD&T programs that will support this area are described below. Table 6-1 shows program milestones.

#### FAA

*Environment and Energy.* Develops and validates methodologies, models, metrics, and tools to assess and mitigate the effects of aircraft noise and emissions in a manner that balances the interrelationships between emissions and noise and includes economic consequences. Among other efforts, research will develop a better science-based understanding of the impacts of aircraft noise and emissions on air quality and climate change. This program will also support the RD&T Strategy for Global Connectivity.

#### FHWA

*Center for Environmental Excellence (Planning and Environment).* Assists States in planning and delivering environmentally sound surface transportation projects. The center will contribute to understanding and mitigating transportation impacts through the documentation and sharing of best practices. This program will also support Environmental RD&T Strategy 2 and Reduced Congestion RD&T Strategies 4 and 6.

*Exploratory Advanced Research (Corporate Activities).* Addresses longer term, higher risk research with potentially dramatic breakthroughs for assessing the effects of transportation decisions on human health and the environment. This program will also support Safety RD&T Strategy 1 and Reduced Congestion RD&T Strategies 2, 3, and 4.

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment).* Focuses on improving understanding of the complex relationship between surface transportation and the environment. Environmental research will improve the state of the practice regarding research that addresses the impact of transportation on the environment. This program will also support Environmental RD&T Strategy 2; Safety RD&T Strategy 1; Reduced Congestion RD&T Strategies 1, 3, 4, 5, and 6; and the RD&T Strategy for Global Connectivity.

**OST**

*Safety, Energy, and Environment.* Conducts policy research to support the formulation and recommendation of Departmental policies, plans, and guidelines related to environmental enhancement and communities, public health, and safety. In this area, research will address the issues and environmental implications related to new energy and emissions reduction technologies, particularly alternative fuels. This program will also support Safety RD&T Strategy 1 and Reduced Congestion RD&T Strategies 1 and 5.

**PHMSA**

*Hazardous Materials Safety R&D.* Provides the foundation for PHMSA’s hazardous material regulatory, enforcement, and emergency response actions. Although PHMSA has focused on safety, such efforts have a secondary positive impact on the environment. In this research area, PHMSA will seek better ways to consider and evaluate these environmental effects. This program will also support Safety RD&T Strategy 1, the RD&T Strategy for Global Connectivity, and Security RD&T Strategy 2.

**Table 6-1. Milestones for Understanding Transportation Impacts**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Environment and Energy</i>		
Aviation Environmental Portfolio Management Tool		x
Direct measurements of hazardous air pollutants and particulate matter from engines to replace factors used in modeling tools		x
Assess impacts of aviation on regional air quality and climate change		x
<i>Center for Environmental Excellence</i>		
Collaborate on research agenda development	x	x
Document good practices through solicitation of case studies and best practices	x	x

**Table 6-1. Milestones for Understanding Transportation Impacts (continued)**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Exploratory Advanced Research</i> Identify research to better understand the impacts of transportation on the environment	x	
<i>Surface Transportation Environment and Planning Cooperative Research</i> Improve the state of the practice regarding the impact of transportation on the environment	x	x
<i>Safety, Energy, and Environment</i> Address issues and environmental implications of new energy and emissions reduction technologies		x
<i>Hazardous Materials Safety</i> See milestones for "Hazardous Materials Safety" under Safety RD&T Strategy 1.		

**Advancing Technologies, Plans, and Methods to Manage Impacts**

Applying the knowledge gained through the research described above, RD&T in this area seeks to mitigate transportation’s negative impacts through improved environmental standards, planning tools, and technologies. The RD&T activities that will address this area are described below. Program milestones are shown in Table 6-2.

**FAA**

*Environment and Energy.* Develops and validates methodologies, models, metrics, and tools to assess and mitigate the effects of aircraft noise and emissions in a manner that balances the interrelationships between emissions and noise and includes economic consequences. Research will address improved certification standards, operational procedures, and other actions to reduce aircraft noise and seek to minimize the impact of aviation emissions. This program will also support the RD&T Strategy for Global Connectivity.

**FHWA**

*Center for Environmental Excellence (Planning and Environment).* Assists States in planning and delivering environmentally sound surface transportation projects. In this research area, the center will promote and document best practices, technology, and geospatial innovations. This program will also support Environmental RD&T Strategy 2 and Reduced Congestion RD&T Strategies 4 and 6.

*Renewable Transportation Systems (Planning and Environment).* Focuses on research, development, and field testing of hydrogen fuel cell and biofuel transportation technologies. The program will be carried out through an FHWA grant to the University of Vermont. (This program will be completed in FY 2006.)

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment).* Focuses on improving understanding of the complex relationship between surface transportation and the environment. The program will advance technologies, plans, and methods to manage the impact of transportation on the environment. This program will also support Environmental RD&T Strategy 2; Safety RD&T Strategy 1; Reduced Congestion RD&T Strategies 1, 3, 4, 5, and 6; and the RD&T Strategy for Global Connectivity.

## Emerging Research Priority: Energy Efficiency and Alternative Fuels

RD&T in this area will increase the awareness and understanding of decisionmakers, both inside and beyond the Government, as to the impact of fuel prices and fuel efficiency on the capability of the transportation system to move people and goods, the availability of opportunities to improve fuel efficiency, the transportation requirements associated with alternative fuel infrastructures, and the impact of alternative-fuel-equipped vehicles on safety. Potential initiatives include analysis of the influence of both fuel price and fuel efficiency on the demand for travel and shipments; development and analysis of fuel production, distribution, and delivery scenarios; and the safety impacts of weight reductions and alternative fuel use.

Key Supporting RD&T Programs:

- National Fuel-Cell-Bus Technology Development
- Protect the Environment and Promote Energy Independence
- Hydrogen Initiative
- Safety, Energy, and Environment
- Advanced Vehicle Technology
- Bio-Based Transportation
- Hydrogen R&D

### **FRA**

*Hazardous Materials Transportation.* Conducts research in hazardous materials transportation safety, damage assessment and inspection, and tank car safety. The program's safety-related activities in tank car thermal protection, gasket materials, and operating environments will also yield benefits for environmental stewardship. This program will also support Safety RD&T Strategy 1.



## Environmental Stewardship

- **Understand and Mitigate Transportation Impacts**
- Improve the Environmental Review Process

### **FTA**

*National Fuel Cell Bus Technology Development Program.* Facilitates the development of commercially viable fuel cell bus technology and related infrastructure. Research will further fuel cell technology as it relates to transit bus operations, including hydrogen production, energy storage, fuel cell technologies, vehicle–system integration, and power electronics technologies.

*Protect the Environment and Promote Energy Independence.* Seeks to identify and overcome barriers to the adoption of technologies that will improve energy efficiency and reduce emissions from transit vehicles. A key activity will be an FTA program to encourage the deployment of new low-emission technology, including hybrid transit buses. This program will also support Environmental RD&T Strategy 2.

### **NHTSA**

*Hydrogen Initiative.* Seeks to ensure that hydrogen internal-combustion-engine and fuel-cell-powered vehicles attain a level of safety comparable to other vehicles. In support of the President's Hydrogen Initiative, NHTSA will conduct risk assessments of hydrogen-fueled vehicles to quantify potential failures that could indicate unsafe conditions. This program will also support Safety RD&T Strategy 3.

### **OST**

*Safety, Energy, and Environment.* Conducts policy research to support the formulation and recommendation of Departmental policies, plans, and guidelines related to environmental stewardship, public health, and safety. The program will identify technologies and policies that encourage sustainability; examine potential market-based mechanisms for increasing fuel economy; analyze incentives for partnerships to support transportation needs, especially freight, while reducing community impacts; conduct research to reduce transportation emissions, including greenhouse gases, and increase transportation energy security; and research non-chemical methods of preventing the entry of potential disease-carrying insects onto aircraft. This program will also support Safety RD&T Strategy 1 and Reduced Congestion RD&T Strategies 1 and 5.

### **PHMSA**

*Pipeline Safety R&D.* Improves pipeline inspection and analysis tools and strengthens the industry's ability to effectively manage pipeline integrity. Research will address improvements in corrosion detection technology and direct assessment techniques; tools for preventing and detecting damage and leaks; and materials that can better withstand third-party damage, corrosion, and cracking. This program will also support Safety RD&T Strategy 1.

**RITA**

*Advanced Vehicle Technology.* Supports research and development of advanced vehicle technology concepts at the University of Kansas Transportation Research Institute. Research will focus on technologies related to vehicle emissions, fuel cells and catalytic processes, and intelligent transportation systems.

*Bio-Based Transportation.* Supports bio-based transportation research of national importance at the National Biodiesel Board and at various research centers identified in the Farm Security and Rural Investment Act of 2002. This RITA-managed grant will be funded by FHWA.

*Hydrogen R&D.* Supports the President’s Hydrogen Initiative through work with other agencies to evaluate hydrogen delivery infrastructure concepts, transportation and vehicle fuel system containers and components, and in-service inspection technologies. The program will support the development of appropriate consensus codes and standards. This program will also support Safety RD&T Strategy 3.

**Table 6-2. Milestones for Advancing Technologies, Plans, and Methods to Manage Impacts**

Research Product or Information Gained	FY 07-08	FY 09-10
<p><i>Environment and Energy</i></p> <p>Implement new continuous-descent approach noise and emission abatement procedure at low-traffic airports during nighttime operations</p> <p>Determine feasibility of using continuous-descent approach procedures at airports with greater traffic levels and with mixed fleets and operations</p> <p>Deploy elements of an Internet-based capability to inform the public about aircraft noise</p>	x	x  x
<p><i>Center for Environmental Excellence</i></p> <p>Document good practices through solicitation of case studies and best practices</p> <p>Promote the advancement of Context-Sensitive Solutions</p> <p>Identify and promote technology and geospatial innovations</p>	x x x	x x x
<p><i>Surface Transportation Environment and Planning Cooperative Research</i></p> <p>Advance technologies, plans, and methods to manage the impact of transportation on the environment</p>	x	x



**Table 6-2. Milestones for Advancing Technologies, Plans, and Methods to Manage Impacts (continued)**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Hazardous Materials Transportation—Rail</i> Research plans and methods for safe transportation of hazardous materials on railroads	x	x
<i>National Fuel Cell Bus Technology Development Program</i> Prepare transit vehicles for use of fuel cells	x	x
<i>Protect the Environment and Promote Energy Independence</i> Increase deployment of hybrid electric vehicles Prepare transit vehicles for use of hydrogen Improve energy efficiency of rail systems	x x x	x x x
<i>Hydrogen Initiative</i> See milestones for “Safety Rulemaking and Advanced Technologies” under Safety RD&T Strategy 3.		
<i>Safety, Energy, and Environment</i> Identify technologies and policies that encourage sustainability Examine potential market-based mechanisms for increasing fuel economy Conduct research to reduce transportation emissions		x x x
<i>Pipeline Safety</i> Improvements in pipeline damage prevention and leak detection Improvements in pipeline operations, controls, and monitoring	x x	x x
<i>Advanced Vehicle Technology</i> Identify potential new research areas and prepare a strategic implementation plan	x	
<i>Bio-Based Transportation</i> Complete tests of biofuels for compatibility with new and emerging exhaust after-treatment technologies Publish a national fuel specification standard for biodiesel blends Continue research to improve the energy efficiency of producing biofuels with a focus on cellulosic ethanol	x x x	
<i>Hydrogen R&amp;D</i> See milestones for “Safety Rulemaking and Advanced Technologies” under Safety RD&T Strategy 3.		

## IMPROVE THE ENVIRONMENTAL REVIEW PROCESS

A key element of the Department's environmental stewardship goal is to balance the importance of preserving environmental quality with the need for a safe and efficient transportation network. Through this RD&T strategy, the Department is emphasizing its commitment to implementing Executive Order 13274, "Environmental Stewardship and Transportation Infrastructure Project Reviews," signed by President Bush to speed up decisionmaking on vital airport, highway, transit, and intermodal transportation projects while safeguarding the environment. The focus of this RD&T strategy will be research in the area of environmental streamlining.

### Environmental Streamlining

The objective of environmental streamlining is to balance the need for timely delivery of transportation projects with protection of the environment. The RD&T programs that will support this objective are listed below. Milestones for these programs are in Table 6-3.

#### FAA

*Airport Cooperative Research Program.* Carries out applied research on problems that are shared by airport operating agencies and that are not being adequately addressed by existing research programs. Mandated by the Vision 100—Century of Aviation Reauthorization Act, the program will be administered by the Transportation Research Board, with research projects selected by an independent governing board of airport managers and others appointed by the Secretary. This program will also support Reduced Congestion RD&T Strategy 6.

#### FHWA

*Center for Environmental Excellence (Planning and Environment).* Assists States in planning and delivering environmentally sound surface transportation projects. In this area, the center will conduct problem-solving sessions and workshops to support environmental stewardship and streamlining. This program will also support Environmental RD&T Strategy 1 and Reduced Congestion RD&T Strategies 4 and 6.

*Surface Transportation Environment and Planning Cooperative Research Program (Planning and Environment).* Focuses on improving understanding of the complex relationship between surface transportation and the environment. The program will support research to promote environmental streamlining and stewardship. This program will also support Environmental RD&T Strategy 1; Safety RD&T Strategy 1; Reduced Congestion RD&T Strategies 1, 3, 4, 5, and 6; and the RD&T Strategy for Global Connectivity.

## Environmental Stewardship

- Understand and Mitigate Transportation Impacts
- Improve the Environmental Review Process

**FTA**

*Protect the Environment and Promote Energy Independence.* Seeks to identify and overcome barriers to the adoption of technologies that will improve energy efficiency and reduce emissions from transit vehicles. The program will respond to changes in environmental review requirements in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). This program will also support Environmental RD&T Strategy 1.

**Table 6-3. Milestones for Environmental Streamlining**

<b>Research Product or Information Gained</b>	<b>FY 07-08</b>	<b>FY 09-10</b>
<i>Airport Cooperative Research Program</i> Research to develop guidance to protect airports from incompatible land uses that constrain development	x	
<i>Center for Environmental Excellence</i> Problem-solving sessions on Federal environmental legislation, policies, and procedures Workshops on implementing SAFETEA-LU Environmental Review Process revisions	x x	x x
<i>Surface Transportation Environment and Planning Cooperative Research</i> Research to promote environmental streamlining and stewardship	x	x
<i>Protect the Environment and Promote Energy Independence</i> Research to promote environmental streamlining and stewardship	x	x

## Security, Preparedness and Response

### Security, Preparedness and Response Strategic Goal

Balance transportation security requirements with the safety, mobility, and economic needs of the Nation and be prepared to respond to emergencies that affect the viability of the transportation sector.

#### Outcomes

1. Expert transportation sector intelligence.
2. Preparedness for emergencies affecting the transportation sector.
3. Effective response to emergencies affecting the transportation sector.

There is a critical need to ensure the transportation system's rapid response and recovery from disruptions due to attacks, natural disasters, and other major events. DOT will also work with the Department of Homeland Security (DHS), Defense Department, and State, local, and private-sector partners to protect our transportation system against terrorism and to ensure that it remains a vital link for defense mobilization. Two RD&T strategies represent the primary research topics in support of the Department's security goal:

1. Conduct and support research to reduce the vulnerability of transportation systems and to improve their ability to prepare for and recover from attacks, natural disasters, and emergencies. *Supports all outcomes.*
2. Conduct and support research to develop technologies and procedures to secure hazardous materials shipments and to assess the risks of hazmat events. *Supports all outcomes.*

The following sections summarize the research areas and primary RD&T activities for advancing these strategies. Appendix C shows anticipated funding levels for FY 2006 through 2010.

## Security, Preparedness and Response

- **Reduce Vulnerability and Improve Preparedness and Recovery**
- Secure Hazardous Materials Shipments and Assess Risks

### REDUCE VULNERABILITY AND IMPROVE SYSTEM PREPAREDNESS AND RECOVERY

One of the Department's most pressing concerns is to work with DHS to identify, support, and conduct RD&T on technologies, policies, and methods that will assure the continued security and preparedness of the Nation's transportation network. In support of this RD&T strategy, the Department will conduct research in two critical areas: preparedness and response, and transportation security risks and vulnerabilities. The primary RD&T programs that will support these areas are described below.

#### Preparedness and Response

The focus of this RD&T is to improve the transportation system's ability to mitigate and respond to attacks, natural disasters, emergencies, and other significant events that place a substantial demand on the transportation system. These efforts will include the RD&T programs described below. Table 7-1 shows program milestones.

#### FHWA

*Evacuation Management and Operations (ITS JPO)*. Improves operational technology and practices to enable the safe and effective movement of people and goods during emergency evacuation situations (both with and without notice). The program will address the application of intelligent transportation system technologies to improve notice and no-notice evacuation planning and execution, with an orientation that includes both decisionmakers and evacuees. This program will also support Safety RD&T Strategy 2 and Reduced Congestion RD&T Strategy 1.

*Next Generation 9-1-1 (ITS JPO)*. Aims to establish the foundation for public emergency communications services in a wireless mobile society. This initiative will enable an enhanced 9-1-1 system that permits the transmission of voice, data, or video from any communication device to Public Safety Answering Points and onto emergency responder networks. This program will also support Safety RD&T Strategy 2.

#### FTA

*Identify Solutions to Improve Transit Emergency Preparedness (Improve Safety and Emergency Preparedness)*. Assists States, transit authorities, and the industry through security technical assistance and improved technology and training. Research will address methods, techniques, technologies, and training to improve emergency preparedness, including a web-based approach to managing emergency incidents. This program will also support Safety RD&T Strategy 2.



**Table 7-1. Milestones for Preparedness and Response**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Evacuation Management and Operations</i> See milestones for "Reducing Non-Recurring Congestion" under Reduced Congestion RD&T Strategy 1.		
<i>Next Generation 9-1-1</i> See milestones for "Emergency Response and Operations" under Safety RD&T Strategy 2.		
<i>Identify Solutions to Improve Transit Emergency Preparedness</i> Develop web-based emergency preparedness Support metropolitan-area preparations for emergency situations	x x	x x

**Security Risks and Vulnerabilities**

Research in this area seeks to develop, deploy, and promote technologies, designs, and procedures to reduce the vulnerability of the transportation system and to accurately assess security risks and vulnerabilities. The RD&T programs that will support this area are described below. Milestones for these programs are in Table 7-2.

**FHWA**

*Anti-Ram Barriers.* Develops models of vehicles and roadside hardware to assess and improve roadside objects used as anti-ram barriers.

*Bridge and Tunnel Security Research.* Conducts research to develop and implement technologies and methodologies to reduce risk and vulnerability of bridges and tunnels from terrorist acts.

**FRA**

*Railroad System Issues.* Provides for research in railroad systems safety and infrastructure security. The program will develop encryption technology and key management for wireless communications used in train control and operations management to protect train movements and routings from hackers and vandalism that may lead to train collisions, runaway equipment, overspeed derailments, possible danger to roadway workers, or disruption to the national railroad network. This program will also support Security RD&T Strategy 2 and Safety RD&T Strategies 1 and 2.

**OST**

*Security Policy.* Conducts research to support the development of Departmental security policy. In this area the program will assess the mobility and economic impacts of container security measures and of a terrorist attack on a major transit system. This program will also support Security RD&T Strategy 2.

**Table 7-2. Milestones for Security Risks and Vulnerabilities**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Anti-Ram Barriers</i> Assess and develop improved anti-ram planter systems Assess "pile-type" anti-ram foundation systems	x x	
<i>Bridge and Tunnel Security</i> Develop and implement technologies and methods to reduce vulnerability of tunnels and bridges	x	
<i>Railroad System Issues</i> In cooperation with DHS, research measures to protect terminals and critical infrastructure from terrorist attack	x	x
<i>Security Policy</i> Assess mobility and economic impacts of container security measures Assess mobility and economic impacts of a terrorist attack on a major transit system		x x

### SECURE HAZARDOUS MATERIALS SHIPMENTS AND ASSESS THE RISKS OF HAZMAT EVENTS

Working with DHS, the Department has a lead role in developing technologies, tools, and procedures to ensure the secure shipment of hazardous materials and to prepare for potential hazmat emergencies. DOT will advance this RD&T strategy over the next five years through security research in the area of hazardous materials risks and vulnerabilities.

#### Hazardous Materials Risks and Vulnerabilities

DOT research in this area addresses such critical issues as hazardous materials routing, tank car security, and emergency response. The RD&T programs that will support this area are described below. Table 7-3 shows program milestones.

**FMCSA**

*Improve Security Through Safety Initiatives.* Develops and implements safety initiatives that also have security benefits for truck and motor coach operations. In particular, the program will examine hazardous materials routing procedures and security risks and develop an enhanced routing tool for use by FMCSA and industry.

**FRA**

*Railroad System Issues.* Provides for research in railroad systems safety and infrastructure security. In this area, the program will conduct research on tank car security. This program will also support Security RD&T Strategy 1 and Safety RD&T Strategies 1 and 2.

**OST**

*Security Policy.* Conducts research to support the development of Departmental security policy. One project will work with industry to explore measures that can be taken to limit exposure to toxic inhalation materials in urban areas while maintaining expeditious delivery of these shipments. This program will also support Security RD&T Strategy 1.

**PHMSA**

*Hazardous Materials Safety R&D.* Provides the foundation for PHMSA’s hazardous material regulatory, enforcement, and emergency response actions. In this research area, the program will identify and quantify security risks inherent in hazardous materials transportation, point to ways to control and minimize these risks, and assess emergency response capabilities for both intentional and unintentional hazardous material transportation incidents. This program will also support Safety RD&T Strategy 1, the RD&T Strategy for Global Connectivity, and Environmental Stewardship RD&T Strategy 1.

**Security, Preparedness and Response**

- Reduce Vulnerability and Improve Preparedness and Recovery
- Secure Hazardous Materials Shipments and Assess Risks

**Table 7-3. Milestones for Hazardous Materials Risks and Vulnerabilities**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>Improve Security Through Safety Initiatives</i> Research security measures to reduce risks in routing hazardous materials	x	
<i>Railroad System Issues</i> Research technology and operational plans to improve the safe and secure shipment of hazardous materials	x	
<i>Security Policy</i> Explore measures to limit exposure to toxic inhalation materials in urban areas		x
<i>Hazardous Materials Safety</i> Assess security risks, vulnerabilities, and consequences	x	x



## Organizational Excellence

### Organizational Excellence Goal

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

### Outcomes

1. Achieved strategic management of human capital goals.
2. Achieved competitive sourcing goals.
3. Achieved financial performance goals.
4. Achieved budget and performance integration goals.
5. Achieved E-government goals.
6. Achieved real property goals.

In support of the President's Management Agenda, the Department has adopted the following RD&T strategy to advance organizational excellence:

Consistently apply the President's R&D Investment Criteria—relevance, quality, and performance—to all DOT-sponsored and in-house research. *Supports all outcomes.*

The following sections summarize the primary RD&T activities that will advance this RD&T strategy. Appendix C shows anticipated funding levels for FY 2006 through 2010.

### **CONSISTENTLY APPLY THE R&D INVESTMENT CRITERIA**

Through the RD&T Planning Council and RD&T Planning Team, RITA conducts annual reviews of operating administrations' RD&T programs to ensure effective implementation of the R&D Investment Criteria of relevance, quality, and performance and to ensure that research programs are evaluated according to



## Organizational Excellence

- Consistently Apply the R&D Investment Criteria

established best practices. These reviews also enable the operating administrations to identify areas of mutual interest and to prevent unnecessary duplication.

As described in Chapter 10, the Department's operating administrations also have processes in place to ensure that research is relevant to stakeholder and national needs, is peer-reviewed, and is meeting performance objectives. The primary RD&T programs that will support these processes are shown below. Table 8-1 lists program milestones.

### **FAA**

*System Planning and Resource Management.* Meets the Administration's criteria for addressing customer needs, increasing program efficiency, and reducing management and operating costs. The program will continue to produce the annual *National Aviation Research Plan*; administer the congressionally mandated Research, Development, and Engineering Advisory Committee; conduct external program coordination; and undertake strategic planning for FAA research programs.

### **FHWA**

*RD&T Review and Evaluation.* Ensures that stakeholders are engaged throughout the RD&T planning process and supports external review of research programs. Among other activities, this work will support the Transportation Research Board (TRB) Research and Technology Coordinating Committee and an independent assessment process for FHWA's 24 laboratories by panels of external experts. (This activity will be funded through other FHWA RD&T programs.)

### **FMCSA**

*Enable and Motivate Internal Excellence.* Improves the performance and excellence of FMCSA's research and technology program. This effort will develop and update strategic and tactical plans for research and technology; engage stakeholders in program planning and execution; produce technical reports, briefs, and web-based information; and develop and monitor fiscal and performance accountability.

### **FRA**

*Review of FRA RD&T Programs.* Through a committee established by the TRB, reviews the management structure and approach of FRA research programs; the direction and allocation of research funds; and whether there is an appropriate balance of Federal, State, and private-sector input and cost sharing. This committee will be refocused to assist with developing an updated five-year plan for railroad research. (This activity will be funded through other FRA RD&T programs.)

### **FTA**

*Provide Transit Research Leadership.* Ensures FTA's ability to lead transit research in partnership with the transit industry. Activities will include continued support for the Transit Research Analysis Committee, which provides stakeholder review of FTA

research programs; the transit-related activities of the TRB; and technical support for research activities, including program evaluations and reporting.

**NHTSA**

*NHTSA RD&T Planning and Outreach.* Develops the five-year report on safety rule-making and supporting research priorities and conducts public meetings to share research results. In addition to these activities, NHTSA will develop a five-year strategic research plan. (This activity will be funded through other NHTSA RD&T programs.)

**PHMSA**

*Stakeholder and Peer Review.* Supports ongoing stakeholder input into the development of PHMSA's pipeline safety and hazardous materials safety RD&T programs. Efforts will support pipeline safety R&D Forums, the work of the pipeline safety research Blue Ribbon Panel, and implementation of peer-review requirements for highly influential and influential research. (This activity will be funded through other PHMSA RD&T programs.)

**RITA**

*RD&T Coordination (R&D Planning and Management).* Implements an integrated planning process for RD&T aligned with Departmental goals. The program will continue to work through the DOT RD&T Planning Council and RD&T Planning Team to coordinate and provide strategic direction for DOT's research programs, to promote efficient use of RD&T resources, and to prevent unnecessary research duplication.

**Table 8-1. Milestones for Applying the R&D Investment Criteria**

Research Product or Information Gained	FY 07-08	FY 09-10
<i>System Planning and Resource Management</i> Publish annual aviation research plan Work with research advisory committee to plan and implement RD&T investments	x x	x x
<i>Enable and Motivate Internal Excellence</i> Build strategic roadmaps Implement/capture research management performance metrics Support President's Management Agenda	x x x	x x x
<i>Provide Transit Research Leadership</i> Update Strategic Research Plan and work with Transit Research Analysis Committee to improve research management Support TRB core activities Produce Transit Conditions and Performance Report	x x x	x x x
<i>RD&amp;T Coordination</i> RD&T Planning Council review of RD&T budgets, programs, and priorities	x	x





## RD&T Partnerships

The Department's RD&T program emphasizes partnership, coordination, and information sharing—both across the Federal Government and with universities, State and local governments, industry, and other organizations. This approach helps the Department to leverage scarce RD&T resources, prevent unnecessary duplication, and broaden the range of expertise brought to bear on transportation problems.

### COORDINATION WITH OTHER FEDERAL AGENCIES

As the agency with the most direct responsibility for transportation, DOT leads transportation RD&T in the Federal Government. To further this role, the Department works closely with other agencies to avoid duplication and to leverage research investments.

The Department coordinates Federal RD&T through the White House Office of Science and Technology Policy and the National Science and Technology Council (NSTC). Chaired by the President, the NSTC is a Cabinet-level council that coordinates science and technology policies across the Government. In addition, the Department's operating administrations coordinate with particular agencies in specific research areas of mutual interest. Among the agencies with which the Department actively collaborates are the following:

#### Department of Agriculture

The Department of Agriculture (USDA) conducts research to ensure that Americans have reliable, adequate supplies of high-quality food and other agricultural products. Of particular interest to transportation is USDA research in a number of fields related to advancing the use of agricultural waste and feedstocks for bio-based and renewable fuels. USDA currently coordinates the Federal interagency Biomass R&D Board, established by the Biomass Research & Development Act of 2000. Joint efforts with DOT include:

- Work with RITA to coordinate and seek technical expertise for the bio-based transportation research grant identified in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).
- Collaboration on the President's Hydrogen Initiative, primarily in the areas of renewable hydrogen production.

#### Department of Commerce

With a mission of promoting economic growth by developing and applying technology, measurements, and standards, the National Institute of Standards and



## NSTC Subcommittee on Biometrics

Biometrics is a technology that is rapidly becoming a useful security, cost-saving, and convenience tool for the Federal Government. Although the Government is using the technology for many applications, further development and assessment are needed to improve the technology's utility. To address these issues, the NSTC has established the Subcommittee on Biometrics, a joint subcommittee of the NSTC Committee on Technology and the Committee on Homeland and National Security. The subcommittee's purpose is to:

- Foster U.S. Government collaboration, and minimize duplication, on biometrics research, development, test, and evaluation by developing and implementing interagency coordination plans that emphasize mid- and long-term, rather than immediate, needs and issues.
- Function as the Government focal point and clearinghouse for information on biometrics research, technologies, and technical and policy issues.
- Support the coordinated participation of Government agencies in international working groups on biometric technologies and develop common Government positions when possible.

In addition to DOT, membership on the subcommittee includes the Departments of Commerce, Defense, Homeland Security, Justice, State, and Treasury; the National Science Foundation; the Social Security Administration; the Government Printing Office; and the intelligence community. The subcommittee is currently developing and implementing a number of interagency coordination plans, including those for research and development in fingerprint, face, and iris recognition; biometrics test and evaluation; system considerations such as human-system interface issues; and program management.

Technology (NIST) conducts much of the transportation-related RD&T in the Department of Commerce (DOC). NIST research on materials is particularly important. Another DOC agency that performs research of relevance to transportation is the National Oceanic and Atmospheric Administration (NOAA). Current DOC collaboration with DOT includes:

- NIST research with FHWA on high-performance concrete.
- FRA–NIST work on the fire safety of passenger rail car materials.
- NIST collaboration with PHMSA to advance pipeline materials for Arctic operations.
- NOAA work with PHMSA on emergency planning for major storm events to lessen impacts on the pipeline infrastructure.

- NOAA research with FHWA on technologies for road weather observations.
- MARAD–NOAA collaboration to evaluate the effectiveness of ballast water testing technologies.
- DOC participation in the Joint Planning and Development Office (JPDO) currently defining the future air transportation system.

### **Department of Defense**

The Department of Defense (DOD) accounts for a large proportion of all Federal RD&T. In the area of transportation, 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. DOD also conducts research in such areas as human performance, materials science, microelectronics, and nanotechnology. Examples of collaborative work with DOT include:

- FHWA–U.S. Army Corps of Engineers studies on concrete curing and pavement performance.
- FHWA work with the Navy on high-performance steel for bridges.
- FHWA’s project with the Army’s Cold Region Research and Engineering Laboratory to develop a winter weather Maintenance Decision Support System.
- The FAA–NASA–DOD Aviation Safety Program.
- FRA work on a Rail Car Inspection Guide for the military through DOD’s Technical Support Working Group.
- The JPDO.

### **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 also 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. DOE research of interest to DOT includes the following:

- Joint work with RITA and other DOT operating administrations on implementing the President’s Hydrogen Initiative.

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- Research at Argonne National Laboratory on fuel cells, hybrid vehicles, intelligent transportation systems, and rail technologies.
- FAA's Airworthiness Assurance "Center of Excellence" at Sandia National Laboratories, which conducts research on aircraft maintenance; crashworthiness; inspection and repair techniques; propulsion, fuel system, and landing gear safety; and new materials.
- Collaboration between PHMSA and DOE's National Energy Technology Laboratory on a program of research, development, demonstration, and standardization to ensure the integrity of pipeline facilities.
- Work at DOE's laboratories on testing and demonstration of technologies for detecting chemical, biological, and explosive agents.

### **Department of Homeland Security**

Established by the Homeland Security Act of 2002, the Department of Homeland Security (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. TSA protects the Nation's transportation systems to ensure freedom of movement for people and commerce. The missions of the Coast Guard are homeland security, maritime law enforcement, marine safety, and marine environmental protection. DHS collaboration with DOT includes:

- Operation Safe Commerce, a public-private partnership providing a test bed for technologies that increase container security.
- FRA-DHS research on real-time tracking of hazardous materials tank cars and development of a rail addendum to the overall DOT-DHS Memorandum of Understanding.
- FMCSA-TSA efforts on Untethered Trailer Tracking and Commercial Vehicle Information Systems and Networks.
- FHWA support for development of an advanced Driver Training Range at the Federal Law Enforcement Training Center and joint research on anti-ram barriers.
- FAA-DHS collaboration through the JPDO.
- Work with MARAD on mariner/transportation worker credentials, biometrics, and radiofrequency identification (RFID) technology.

### **Department of the Interior**

The Department of the Interior (DOI) protects and manages the Nation's natural resources and cultural heritage and provides scientific and other information about

those resources. Within DOI, the Minerals Management Service (MMS) oversees the Nation's natural gas, oil, and other mineral resources on the Outer Continental Shelf. MMS has two major programs: Offshore Minerals Management and Minerals Revenue Management. The offshore activity is supported by a Technology Assessment and Research Program that conducts research associated with operational safety, pollution prevention, and oil spill response and cleanup capabilities. Current collaborative work with DOT includes:

- Joint MMS–PHMSA research to address pipeline safety.
- MMS–PHMSA research to enhance environmental protection of offshore areas.

### **Department of State**

Within the Department of State (DOS), the Facility Security Division has responsibility for ensuring the security of DOS facilities worldwide. FHWA's Office of Safety Research and Development, located at the Turner-Fairbank Highway Research Center in McLean, Virginia, has assisted DOS with providing security from explosive-laden vehicles at pedestrian entrances and facility perimeters. Work includes:

- Use of FHWA roadside hardware analysis and simulation tools and engineering expertise to develop anti-ram barriers and walls that meet DOS requirements and the construction limitations of the host countries.

### **Environmental Protection Agency**

Transportation research in the Environmental Protection Agency (EPA) primarily involves emissions abatement, control, and compliance, and programs on air and water quality. Particular work of interest to DOT includes:

- EPA's Clean Automotive Technology Program, which partners with industry to develop clean, advanced automotive technology.
- EPA coordination with PHMSA on a program of research, development, demonstration, and standardization to ensure the integrity of pipeline facilities.

### **National Aeronautics and Space Administration**

The National Aeronautics and Space Administration (NASA) has a distinguished background in aeronautical and space transportation research. Although topics such as propulsion, aerodynamics, and control systems have predominated, NASA is now also addressing aviation safety and air traffic management. NASA and FAA are full research partners, and NASA also works with other DOT administrations in areas of mutual interest. Among NASA's collaborative efforts with DOT are:

- Sharing budget information, discussing metrics and goals, and coordinating research with FAA at the senior management level through the NASA–FAA Executive Committee and at the working level through the Interagency Air Traffic Management Integrated Product Team.

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## Joint Planning and Development Office

In 2003, 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.

- The FAA–NASA Aviation Safety Program.
- Joint meetings of FAA and NASA research advisory committees.
- FAA–NASA research on aircraft noise and emissions reduction.
- FAA–NASA collaboration on the development of technologies for the future air transportation system through the JPDO.
- A memorandum of understanding between FHWA and NASA regarding FHWA's use of and training in NASA computational analysis tools.

### **National Science Foundation**

An independent Federal agency, the National Science Foundation (NSF) strengthens U.S. science and engineering through education and research. NSF accomplishes this mission through an annual investment in approximately 20,000 research and education projects. Of particular relevance to DOT are:

- NSF's Materials Research Science and Engineering Centers, which conduct a range of research on material properties, synthesis, structure, and performance.



- A DOT–NSF Partnership for Research in Information and Communications Systems for Surface Transportation.
- Research with FHWA and State DOTs on the long-term durability of materials and structures.
- Innovations Deserving Exploratory Analysis, a program that provides start-up funding for promising, but unproven, innovations in surface transportation.

## UNIVERSITY RESEARCH

In addition to coordinating RD&T with other Federal research agencies, the Department actively pursues research and technology partnerships with the Nation’s leading academic institutions. The following are DOT’s major university programs:

### Center for the Commercial Deployment of Transportation Technologies

MARAD and the U.S. Transportation Command provide coordinated support to the Center for the Commercial Deployment of Transportation Technologies (CCDOTT), a chartered university center at California State University in Long Beach. The center is congressionally sponsored, with funding provided from DOD.

The CCDOTT functions as a partnership of academic institutions, government agencies, and private companies. It has three purposes: 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; sponsor applied research in support of defense and commercial infrastructure initiatives; and provide a bilateral technology transfer/dual-use bridge between 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.

### FAA Transportation Centers of Excellence

Centers of Excellence (COEs) are unique consortia of Federal, university, and industry researchers working to improve aviation through shared resources, leveraged funding, and pooled talent. Following an extensive selection process, university core members enter into cooperative agreements with FAA. Subsequently, research scientists are funded through matching grants and cost-share contracts. COE members are required to provide matching funds from non-Federal sources, solidifying their partnership with FAA and enabling the centers to strive to be an independent national resource. Through these partnerships between government, academia, and industry, all parties maximize and strengthen their technological capabilities.

The current COEs are Airliner Cabin Environment, Joint Center for Advanced Materials Research, Aircraft Noise and Aviation Emissions Mitigation, General Aviation, Airworthiness Assurance, Operations Research, and Airport Technology.

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### **FRA University Research Program**

This FRA program awards competitive research grants to universities for work on challenging priority areas identified in the *FRA Strategic Plan*. Efforts are supported using discretionary funds or in accordance with congressional mandates. When the work progresses to the prototype stage, cooperating railroads or FRA technical support contractors provide field testing support as necessary. Current studies include work at Marshall University and the University of Nebraska on human factors, infrastructure durability, and a high-precision differential global positioning system (GPS), and research at Ohio University on the development of high-performance nationwide differential GPS services and related user equipment.

### **Global Maritime and Transportation School**

Located at the U.S. Merchant Marine Academy (USMMA) in Kings Point, New York, the Global Maritime and Transportation School (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.

### **Joint University Program**

Jointly sponsored by FAA and NASA, the Joint University Program seeks to materially improve the efficiency, performance, and safety of air transportation in the United States by identifying promising targets for development, by conducting associated long-term research, and by educating technological leaders.

Through the program, leading academic researchers and their students are involved in solving critical aeronautical problems, particularly those related to aircraft guidance, navigation, and control; meteorological hazards; and human factors. The program currently provides research grants to the Massachusetts Institute of Technology, Ohio University, and Princeton University.

### **Maritime Research and Education**

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. USMMA laboratories and research contribute to maritime innovation and to building a talented and skilled maritime workforce.

To inform the public about the maritime industry and potential educational and career opportunities, MARAD has established a Maritime Careers Program with the maritime academies, maritime training institutions, and shipbuilding organizations. The program seeks to ensure that the maritime workforce is prepared to contribute effectively to the evolving maritime environment.

### **Renewable Energy Transportation Laboratory**

Located at the USMMA, the Renewable Energy Transportation Laboratory acts as a test bed 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 fuel-cell-powered boat.

### **University Transportation Centers Program**

The Department’s largest university research program, the University Transportation Centers (UTC) Program conducts basic and applied research to advance the body of knowledge in transportation; conducts education programs to expand the transportation workforce; and provides capacity building programs to transportation professionals.

The UTC Program is managed by RITA and funded by FHWA and FTA. The program has a multimodal focus and is supportive of the Department’s strategic goals. SAFETEA-LU authorized the most significant expansion of the UTC Program to date, increasing the annual funding for UTCs and the number of UTCs to 60 from the 33 established in the Transportation Equity Act for the 21st Century. With this expansion comes new opportunities for the program to make an even greater contribution to transportation research, education, and technology transfer.

In 2006, DOT will competitively select 20 UTCs and fund an additional 40 named in SAFETEA-LU. Each UTC will have a specific transportation theme that advances one or more of the Department’s strategic goals. SAFETEA-LU requires that the UTCs support the national surface transportation research agenda described in the April 2002 Report of the National Highway Research and Technology Partnership, *Highway Research and Technology: The Need for Greater Investment*; the FTA National Research and Technology Program described in the September 2005 FTA *Strategic Research Plan*; and other documents specified by RITA, which currently include the *DOT Strategic Plan*, *Transportation Research, Development and Technology Strategic Plan*, and *National Strategy to Reduce Congestion on America’s Transportation Network*.

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## SAFETEA-LU University Transportation Centers

### Regional UTCs (FY 05-06)

Massachusetts Institute of Technology  
City University of New York  
Pennsylvania State University  
University of Tennessee  
University of Wisconsin\*  
Texas A&M University  
Iowa State University  
North Dakota State University  
University of California  
University of Washington

### Regional UTCs (FY 07-09)

Massachusetts Institute of Technology  
City University of New York  
Pennsylvania State University  
University of Tennessee  
Purdue University  
Texas A&M University  
University of Nebraska  
North Dakota State University  
University of California  
University of Washington

### Tier I UTCs (FY 05-06)

Rutgers University  
San José State University  
South Carolina State University  
University of Alabama  
University of Arkansas\*\*  
University of Central Florida  
University of Idaho  
University of Missouri-Rolla\*  
University of South Florida  
University of Southern California

### Tier I UTCs (FY 07-09)

Georgia Institute of Technology  
Iowa State University  
Rutgers University  
San José State University  
University of Florida  
University of Idaho  
University of Maryland  
University of Michigan  
University of South Florida  
University of Southern California/  
California State University,  
Long Beach

### Tier II UTCs (FY 06-09)

California State University,  
San Bernardino  
Cleveland State University  
George Mason University  
Hampton University  
Kansas State University  
Louisiana State University  
Michigan Technological University  
North Carolina State University  
Northwestern University\*  
University of Akron  
University of Arkansas\*\*  
University of California, Davis  
University of Connecticut  
University of Delaware in Newark  
University of Detroit Mercy  
University of Massachusetts,  
Amherst  
University of Memphis  
University of Nevada, Las Vegas  
University of Rhode Island  
University of Toledo  
Utah State University  
Youngstown State University

### National UTCs (FY 05-09)

Marshall University  
Montana State University  
Northwestern University\*  
Oklahoma State University  
Portland State University  
University of Alaska  
University of Minnesota  
University of Missouri-Rolla\*  
University of Vermont  
University of Wisconsin\*

### Title III UTCs (FY 06-09)

Jackson State University  
Knoxville National  
Transportation Research Center  
Morgan State University  
North Dakota State University\*\*\*  
Texas A&M  
University of Alabama  
University of Alabama,  
Birmingham  
University of Denver/  
Mississippi State University

\*These three universities are to receive two grants.

\*\*SAFETEA-LU limits Arkansas to receiving only one of its two authorized grants in FY 06.

\*\*\*Authorized to receive funds only in FY 06-07.

By statute, each UTC must develop a strategic plan that describes how it will meet the program's legislative intent. UTCs must also report annually on the progress made in achieving identified strategic goals using specified measurable performance indicators. The Department will document the extent to which each UTC is meeting legislative requirements, undertaking research directly supporting DOT goals and the *Transportation Research, Development and Technology Strategic Plan*, and making measurable progress toward achieving its strategic goals.

To date, the UTCs have been perceived to be an underutilized resource for the conduct of the Department's RD&T program. To rectify this, RITA will provide proactive, periodic feedback to the UTCs on DOT goals, objectives, and priorities; ensure DOT participation in UTCs' research-selection processes; and facilitate a closer working relationship between the UTCs and DOT program offices. RITA will also sponsor regular workshops to showcase UTC research and produce an annual report describing UTC accomplishments.

## COOPERATIVE RESEARCH AND PARTNERSHIPS

The Department engages in cooperative and joint research with stakeholders across the transportation enterprise, including State and local agencies, industry, and not-for-profit institutions. Among these joint activities, the Department's primary cooperative programs and partnerships are:

### Airport Cooperative Research Program

Mandated by Congress in the Vision 100—Century of Aviation Reauthorization Act, the Airport Cooperative Research Program carries out applied research on problems that are shared by airport operating agencies and that are not being adequately addressed by existing Federal research programs. An independent governing board of airport managers and others appointed by the Secretary of Transportation selects the research projects. The Transportation Research Board (TRB) administers the program.

### Cargo Handling Cooperative Program

The Cargo Handling Cooperative Program (CHCP) is a 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. CHCP participants pursue innovations that will increase the productivity and cost-effectiveness of cargo operations.

The CHCP emphasizes integrated systems for freight movement through advances in infrastructure design, seamless international transportation networks, and 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

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to use the program's framework to obtain funding for selected projects, such as Chassis Tag Research and Security Container Seal Processes.

### **Commercial Remote Sensing and Spatial Technologies Program**

Managed by RITA, the Commercial Remote Sensing and Spatial Technologies Program will promote partnerships with consortia teams by bringing together resources and expertise from university research centers, industry, technology service providers for transportation systems, and State transportation agencies. The products from the program will address a variety of commercial applications to solve multimodal transportation challenges. These applications will involve the development of products and services that integrate advances in satellite and aerial high-resolution imageries; GPS, including navigation tools and services; and geographic information systems, including mapping and visualization tools.

### **Hazardous Materials Transportation Cooperative Research Program**

This PHMSA program was established by SAFETEA-LU. Administered by the TRB, the program, once implemented, will provide grants for research on a number of safety and security issues, with possible topics including hazardous materials data and analysis, planning and preparing for hazardous materials emergencies, support for first responders, and hazardous materials commodity flow studies.

### **Marine Environmental Research**

MARAD works with industry partners, researchers, and other agencies to test and evaluate the effectiveness of technologies with the potential to reduce marine environmental impacts. For example, MARAD is at the forefront of efforts to test and evaluate the effectiveness of emerging technologies and processes for ballast water treatment. MARAD and its partners are also evaluating hydrogen fuel cell technology, cold ironing, and auxiliary power operations in an effort to reduce shipboard emissions while in port, as well as technologies and procedures designed to reduce air emissions in environmentally critical areas.

### **Marine Transportation System**

The Marine Transportation System (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, the Federal team, and the MTS National Advisory Council, 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 technologies to maritime transportation. Moreover, in support of the MTS, MARAD is coordinating efforts of the Committee for the Maritime Transportation System, the Marine Board, and industry partners to evaluate concepts for an improved MTS from a total transportation system perspective. The



focus is on exploring maritime concepts that will reduce congestion, increase safety, and more efficiently move commerce systemwide. In particular, effective use of the MTS has the potential to reduce system congestion, since it has the capacity to handle the much higher freight volumes anticipated in the future.

### **Maritime Standards Coordination**

MARAD participates in International Maritime Organization and International Labor Organization activities to support the development and implementation of standards that will improve the effectiveness of domestic and international transportation systems. The agency is actively involved in the implementation of standards for training certification, watchkeeping, and other maritime-related areas. Moreover, MARAD has been instrumental in developing standards for identity management (including mariner/transportation worker credentials and border management) and in interagency standards-setting efforts (for biometrics, freight security, and RFID). MARAD also currently holds the Secretariat position for the International Standards Organization subcommittee that sets standards for piping and machinery.

### **National Cooperative Freight Transportation Research**

Established by SAFETEA-LU and managed by RITA, the National Cooperative Freight Transportation Research Program supports research on critical freight transportation issues. Among these are techniques for estimating and quantifying the public benefits of freight transportation projects; alternative approaches to calculating the contribution of truck and rail traffic to congestion; the feasibility of consolidating origins and destinations for freight movement; incorporating estimates of international trade into landside transportation planning; using technology to increase the capacity of truck-only highway lanes; and emerging and future freight transportation research needs in all modes. The National Research Council will administer the program, award contracts and grants through competition and merit review, and establish an advisory committee representing a cross-section of freight stakeholders. This committee will recommend a national research agenda for freight transportation that includes a multiyear strategic plan.

### **National Cooperative Highway Research Program**

Established in 1962, the National Cooperative Highway Research Program (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 State Planning and Research funds to support the program, which is administered by the TRB.

Projects in the NCHRP are solely the prerogative of the American Association of State Highway and Transportation Officials (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

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- University Research
- **Cooperative Research and Partnerships**



FHWA. 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. Project findings are published and disseminated in the NCHRP report series.

### **Ship Operations Cooperative Program**

MARAD's Ship Operations Cooperative Program (SOCP) is a 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.

### **Ship Structure Committee**

An international cooperative program with 10 participating agencies, the Ship Structure Committee advances ship safety and structural integrity. This program, in which MARAD participates, 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.

### **Short Sea Shipping Cooperative Program**

This program 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.

**Transit Cooperative Research Program**

Through the Transit Cooperative Research Program (TCRP), 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 program, maintains a publications list and a description of all TCRP studies on its website at <http://www4.trb.org/trb/crp.nsf/TCRP+projects>.

**Transportation Pooled-Fund Program**

When there is significant or widespread interest in solving a transportation-related problem, several Federal, State, regional, or local transportation agencies, academic institutions, foundations, or private firms may jointly fund research, planning, or technology transfer activities as a pooled-fund study. To qualify, more than one agency, academic institution, or private company must find the subject important enough to commit funds or other resources. If a subject has been studied previously, the new effort should provide additional information that will complement or advance previous investigations.

A State DOT or FHWA must sponsor each pooled-fund study. Participation by foreign governments, local agencies, private companies, foundations, and academic institutions is at the discretion of the lead State. FHWA provides financial management of the program. In 2005, the program included 113 State-led studies and 63 FHWA-led projects with a total value of approximately \$128 million. Details on individual pooled-fund studies are available at <http://www.pooledfund.org/>.



## Evaluation and Assessment of RD&T

To ensure the effectiveness of RD&T, the Department continually assesses its research programs using three primary mechanisms: (1) systematic application of the Administration's R&D Investment Criteria and Program Assessment Rating Tool (PART); (2) internal annual reviews of operating administration RD&T programs; and (3) external RD&T coordination and review. This evaluation strategy is shown in Table 10-1.

**Table 10-1. RD&T Evaluation Strategy**

R&D Investment Criteria and PART	Annual Internal Program Review	External Coordination and Review
Assesses RD&T Relevance, Quality, and Performance	Annually Assesses Implementation of Investment Criteria and PART	Ensures That RD&T Addresses Critical Needs
Evaluates Processes for RD&T Program Planning, Budgeting, and Management	Ensures That RD&T Is Evaluated According to Best Practices	Identifies RD&T Priorities and Programmatic Direction
	Identifies Opportunities for Crossmodal Initiatives	Upholds Technical Quality of RD&T
	Prevents Unnecessary Duplication	Provides Basis for Developing Effective Performance Metrics

### R&D INVESTMENT CRITERIA AND PART

To guide the planning and management of research across the Federal Government, the White House Office of Management and Budget (OMB) has established three broad investment criteria for RD&T: *relevance*, *quality*, and *performance*. 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.

## Evaluation and Assessment of RD&T

- R&D Investment Criteria and PART
- Annual Program Review
- External Coordination and 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.

*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 and document retrospective performance annually.

The R&D Investment Criteria incorporate established best practices for research evaluation as identified by the National Academy of Sciences, Government Accountability Office, and others. OMB uses the PART to assess how well agencies are implementing the criteria. Essentially a questionnaire, the PART measures all aspects of program planning, budgeting, and management. It has four sections:

*Program Purpose and Design.* Assesses whether a program's purpose and design are clear and sound.

*Strategic Planning.* Assesses whether the agency has established valid long-term and annual goals for the program.

*Program Management.* Assesses agency management of the program, including financial oversight and improvement efforts.

*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.

On the basis of the PART, OMB rates programs as Effective, Moderately Effective, Adequate, Ineffective, or Results Not Demonstrated. To date, OMB has used the PART to assess RD&T programs in FAA, FHWA, FRA, NHTSA, and PHMSA. Each program has been rated Moderately Effective or better and has implemented all PART recommendations. The PART results for FTA's research program will be released in February 2007.

### **ANNUAL INTERNAL PROGRAM REVIEW**

Within the Department, the primary mechanism for ensuring implementation of the R&D Investment Criteria and PART is the annual review of modal RD&T programs.

Through the RD&T Planning Council and RD&T Planning Team, RITA works with the operating administrations to conduct annual reviews of RD&T programs to assess how well they are applying the criteria, particularly whether programs are evaluated according to established best practices. Members of a Program Review Working Group represent each of the Department's research-performing administrations and the Office of the Secretary.

The objectives of these internal reviews are to:

- Continuously improve transportation research management and performance.
- Identify, share, and learn best practices.
- Identify opportunities for leveraging RD&T resources and for crossmodal research initiatives.
- Prevent unnecessary research duplication.

RITA reports recommendations and conclusions to the RD&T Planning Council at the end of each year's cycle of reviews. DOT's Program Review Working Group assessed all operating administration RD&T programs in FY 2005 and again in FY 2006. The working group found no research duplication and identified a number of areas for crossmodal collaboration, including geospatial technologies, freight capacity, security, alternative energy technologies, and advanced materials and sensors.

## **EXTERNAL COORDINATION AND REVIEW**

A critical element of the Department's RD&T evaluation strategy is regular consultation and engagement with stakeholders. Such efforts avoid duplication, uphold the technical quality of DOT research, and ensure that RD&T programs are wise public investments that address critical needs.

Within the operating administrations, stakeholder input is essential for establishing RD&T priorities, programmatic activities, and performance metrics. Of particular importance is the conduct of regular external program evaluations. Table 10-2 summarizes the various review mechanisms employed, the results of the most recent RD&T reviews, and program evaluations in FY 2006. The following paragraphs provide details about these and other RD&T planning activities.

### **FAA**

A primary method by which FAA ensures RD&T effectiveness is its Research, Engineering, and Development Advisory Committee. Established by Congress in 1989, this committee reports to the FAA Administrator on RD&T issues and provides a link between agency research 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. It meets twice a year with FAA senior managers and annually reviews FAA's RD&T budget. Committee members represent corporations, universities, associations, consumers, and other agencies.

Another body, the Commercial Space Transportation Advisory Committee, advises on RD&T in commercial space transportation safety. This committee comprises senior executives from the U.S. commercial space transportation industry, including entrepreneurial firms as well as large aerospace companies; space-related State government officials; academia; and representatives from space advocacy organizations.

**Table 10-2. Research Evaluation Processes in Operating Administrations**

Agency	Review Process	Recent Reviews and Recommendations	FY 2006 Reviews
FAA	<p>Annual review by the Research, Engineering, and Development Advisory Committee (REDAC)</p> <p>Commercial Space Transportation Advisory Committee (COMSTAC) reviews safety-related commercial space transportation R&amp;D</p>	<p>REDAC: November 2005 letter report recommends that FAA:</p> <ul style="list-style-type: none"> <li>Develop a procedure for identifying and funding research on emerging aircraft safety issues</li> <li>Develop a procedure for funding researcher-initiated aircraft safety projects</li> <li>Ensure that aircraft safety research is connected with operational needs</li> <li>Enhance collaboration with other agencies in environmental RD&amp;T</li> <li>Fund scoping studies on fuel, energy, and water quality issues</li> <li>Strengthen domestic and international environmental research partnerships</li> <li>Establish a working group to recommend research to determine the degree to which separation standards can be reduced using existing technology</li> </ul> <p>COMSTAC: Provided recommendations in January 2006 on research proposals of interest to the industry</p>	<p>REDAC: June 20, 2006</p> <p>COMSTAC: October 26, 2005 May 23-24, 2006</p>



**Table 10-2. Research Evaluation Processes in Operating Administrations (continued)**

Agency	Review Process	Recent Reviews and Recommendations	FY 2006 Reviews
FHWA	<p>Periodic review by the Transportation Research Board (TRB) Research and Technology Coordinating Committee (RTCC)</p> <p>Lab Assessment Program</p>	<p><i>RTCC:</i> Met twice in FY 2006 and provided advice on issues including:</p> <ul style="list-style-type: none"> <li>Implementation of the Corporate Master Plan for Research and Technology</li> <li>Conduct and management of an advanced research program</li> <li>Conduct of the Lab Assessment Program</li> <li>Engaging University Transportation Centers in carrying out a national surface transportation research agenda</li> </ul> <p><i>Lab Assessment:</i> Independent panels assessed research at FHWA's Aerodynamics, Coatings and Corrosion, and Crash Analysis laboratories</p>	<p><i>RTCC:</i></p> <ul style="list-style-type: none"> <li>November 1-2, 2005</li> <li>June 14-15, 2006</li> </ul> <p><i>Lab Assessments:</i></p> <ul style="list-style-type: none"> <li>March 13-16, 2006</li> <li>June 19-22, 2006</li> <li>September 9-14, 2006</li> </ul>
FMCSA	<p>Regular inputs on planning and programs from key stakeholders</p>	<p><i>Stakeholder Forum:</i> January 2006 forum addressed research needs and accomplishments in key areas, including:</p> <ul style="list-style-type: none"> <li>State data quality</li> <li>Lane departure warning systems development and deployment</li> <li>Large Truck Crash Causation Study</li> <li>Medical programs</li> <li>Wireless inspection technologies</li> <li>Fatigue management</li> <li>Hazardous materials safety</li> </ul>	<p><i>Sixth Annual Forum:</i> January 22, 2006</p>

Table 10-2. Research Evaluation Processes in Operating Administrations (continued)

Agency	Review Process	Recent Reviews and Recommendations	FY 2006 Reviews
FRA	Annual review by the TRB Committee for the Review of the FRA Research, Development, and Demonstration Programs; other external review mechanisms	<p><i>Committee Report:</i> May 2005 letter report concludes that FRA:</p> <p>Is making progress on completing the Nationwide Differential Global Positioning System network, which the committee feels is vital to the full development and deployment of positive train control and other applications</p> <p>Should, to the extent possible, close out remaining high-speed-rail projects so that resources can be deployed elsewhere</p> <p>Continue work on a new five-year strategic R&amp;D plan and include in the plan:</p> <ul style="list-style-type: none"> <li>(1) consideration of the intermodal effects of safety countermeasures;</li> <li>(2) discussion of planned outreach to customers and stakeholders; and</li> <li>(3) measures of the effectiveness of research results</li> </ul> <p>Address railroad congestion issues, particularly the relationship between rail system capacity and safety</p>	<p><i>Review Committee:</i> June 28-29, 2006</p>
FTA	Transit Research Analysis Committee (TRAC)	<p><i>TRAC Report:</i> March 2006 letter report commends FTA for the completion of the September 30, 2005, Strategic Research Plan and makes several recommendations, including:</p> <p>Move aggressively to brief stakeholders on the Strategic Research Plan</p> <p>Review the plan annually in light of current events and accomplishments</p> <p>Develop a three-to-five-year research program plan linking the Strategic Research Plan with FTA's annual program of research</p>	<p><i>TRAC:</i> December 5-6, 2005 July 6-7, 2006</p>

**Table 10-2. Research Evaluation Processes in Operating Administrations (continued)**

Agency	Review Process	Recent Reviews and Recommendations	FY 2006 Reviews
NHTSA	Broad-based research meetings with automotive manufacturers and suppliers	<p><i>Research Meetings:</i> Meetings with auto manufacturers and suppliers to discuss developments in automotive technologies and deployment strategies that include specific recommendations for:</p> <ul style="list-style-type: none"> <li>New Car Assessment Program</li> <li>Lane departure warning systems</li> <li>Advanced occupant restraint systems</li> <li>Vehicle compatibility</li> </ul>	<p><i>Research Meetings:</i></p> <ul style="list-style-type: none"> <li>Honda December 5-6, 2005</li> <li>Hyundai March 1, 2006</li> <li>General Motors March 29, 2006</li> <li><i>Automotive Occupants Restraints Council:</i> March 17, 2006</li> <li><i>Society of Automotive Engineers:</i> May 8-10, 2006</li> </ul>
PHMSA	Periodic outreach events, stakeholder meetings, peer reviews	<p><i>R&amp;D Forum:</i> March 2005 government/industry pipeline safety R&amp;D Forum identified the following key challenges:</p> <ul style="list-style-type: none"> <li>Maintaining the safety, security, and reliability of an aging pipeline infrastructure</li> <li>Managing significant energy demand forecasts</li> <li>Protecting the environment while addressing national energy needs</li> <li>Fostering the development of new technologies and strengthening industry consensus standards</li> <li>Leveraging research resources while improving program performance</li> </ul>	<p><i>R&amp;D Workshops:</i></p> <ul style="list-style-type: none"> <li>January 25-26, 2006</li> <li>February 28-March 1, 2006</li> </ul>

Table 10-2. Research Evaluation Processes in Operating Administrations (continued)

Agency	Review Process	Recent Reviews and Recommendations	FY 2006 Reviews
RITA	National Research Council (NRC) Review of RD&T Strategic Plan	NRC Review: June 2006 NRC panel review assessed the draft RD&T Strategic Plan and DOT's research coordination process and submitted a letter report in August 2006	NRC Committee: June 21-22, 2006

**FHWA**

Within FHWA, the TRB Research and Technology Coordinating Committee reviews RD&T, advises on research activities, and provides policy-level recommendations on program direction and management. The committee consists of 18 members from the States, academia, and private sector. It provides high-level, overarching advice on the composition and management of FHWA's research and technology (R&T) program in the form of letter reports to the Administrator and more in-depth TRB Special Reports. In particular, the committee examined national highway research and technology needs and roles in TRB Special Report 261, which urged FHWA to focus on long-term, fundamental research; address gaps and emerging issues; conduct policy research; and engage in technology transfer.

Another mechanism for evaluating FHWA research is the Lab Assessment Program, which provides independent evaluation of the research performed by FHWA laboratories. The assessment process is designed to enhance lab quality and performance by providing feedback to managers and staff on their work. It provides a credible, professional, and objective assessment that further improves stakeholder confidence in the value of the work performed and the outcomes produced. The lab assessment is a form of expert and peer review by technical and scientific experts whose knowledge and expertise enable them to make reliable and unbiased judgments regarding the conduct of the reviewed research. The assessment process is continuous, with each lab assessed once every four years. Assessment criteria are based on the Administration's R&D Investment Criteria.

Finally, FHWA has broad interaction with R&T stakeholder groups, including the Association of American State Highway and Transportation Officials, and engages customers throughout the entire R&T process. For stakeholder input to the Intelligent Transportation Systems (ITS) Program, FHWA had previously relied on ITS America as a Utilized Federal Advisory Committee. The Department has determined that this program has matured to the point where a formal DOT Advisory Committee is needed and is in the process of establishing such a body.

## **FMCSA**

FMCSA obtains input on its R&T program from various stakeholders, including the National Transportation Safety Board, safety advocacy groups, the national enforcement community, the motor carrier industry, commercial driver groups, truck manufacturers, the driver training community, sleep researchers, insurance representatives, truck manufacturers, and the motor coach industry. The agency holds annual stakeholder forums to solicit recommendations for R&T projects and improved program planning. This input is reflected in a recently completed five-year strategic plan and in annual budget submissions.

## **FRA**

FRA research is guided by inputs from both internal and external stakeholders, including 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 Congress, this committee conducts an annual assessment of FRA's Railroad R&D program. Reviews address FRA's research management structure and approach; current direction and allocation of funds devoted to various program areas; and 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 another program area, the TRB has established a Strategic Hazardous Materials Transportation Research Program.

## **FTA**

Formed in October 2003 under the TRB, FTA's Transit Research Analysis Committee assesses research needs and advises the agency on the Federal role in transit research, high-priority research opportunities, and processes for ensuring that FTA receives input and cooperation from stakeholders. Members represent transit authorities, community service agencies, State DOTs, research institutes, consulting firms, and equipment manufacturers. FTA has incorporated input and advice from the committee in its recently completed five-year *Strategic Research Plan*.

## **MARAD**

Although MARAD receives no direct RD&T funding, the agency works closely with stakeholders to stimulate innovation through collaborative efforts such as the Marine Transportation System initiative, the Short Sea Shipping Cooperative Program, and several other cooperative research programs. This approach brings together the maritime industry, academia, and agencies to identify, coordinate, facilitate, and accomplish maritime RD&T. Recommendations for future research also come from the Marine Transportation System National Advisory Council, a Federal Advisory Council to MARAD.

## **Evaluation and Assessment of RD&T**

- R&D Investment Criteria and PART
- Annual Program Review
- External Coordination and Review

### **NHTSA**

NHTSA assures the quality and effectiveness of its research through several means, including collaborative research with manufacturers and suppliers and regular public meetings with stakeholders. Public meetings provide a forum in which researchers can present their work, respond to comments, and obtain broad input on the agency's RD&T program. In particular, NHTSA holds meetings with auto manufacturers and suppliers to discuss developments in automotive technologies and deployment strategies, including specific recommendations for NHTSA's New Car Assessment Program, lane departure warning systems, advanced occupant restraint systems, vehicle compatibility, and other areas.

### **PHMSA**

PHMSA's pipeline safety program relies on stakeholder involvement, including R&D Forums and meetings of a Blue Ribbon Panel, to make sure that RD&T is aligned with the pipeline safety mission, makes use of the best available knowledge and expertise, and considers stakeholder perspectives. Stakeholders represented include Federal and State agencies, industry, pipeline trade associations, and standards organizations. PHMSA's Office of Hazardous Materials Safety conducts its RD&T activities in consultation with other agencies, State and local governments, international organizations, the regulated industry, and the interested public.

### **RITA**

RITA works with stakeholders to ensure the effectiveness of its RD&T planning efforts and to identify RD&T priorities. In addition, RITA will rely on the Advisory Council for Transportation Statistics for advice on the quality and objectivity of BTS data and analyses and review by the NRC to ensure the effectiveness of RD&T strategic planning and coordination activities.

Appendix D lists website links to additional information about operating administration RD&T evaluation activities, advisory committees, and plans.



## APPENDIX A

### National Research Council Letter Report

August 2, 2006

The Honorable Maria Cino  
Acting Secretary  
U.S. Department of Transportation  
400 Seventh Street, S.W.  
Washington, DC 20590

Dear Secretary Cino:

Section 5208 of the 2005 Safe, Accountable, Flexible, Efficient Transportation Act: A Legacy for Users (SAFETEA-LU) requires the Department of Transportation (USDOT) to develop a 5-year strategic plan for Federal transportation research, development, and technology (RD&T). The act calls for the plan to describe the primary purposes, topics, expected outcomes, and anticipated funding of RD&T. It also calls for the plan to integrate the RD&T programs of all USDOT operating agencies and reflect input from a wide range of stakeholders. The act further calls on the National Research Council (NRC) to review the plan.

On June 21–22, 2006, NRC, under the auspices of the Transportation Research Board (TRB), convened a 15-member committee of experts in transportation engineering, economics, system operations and administration, environmental policy, and research management. Senior officials from the Office of the Secretary of Transportation (OST) and Research and Innovative Technology Administration (RITA) provided a draft of the Strategic RD&T Plan for 2006–2010 and briefed the committee on its content and development. Research managers from the department's operating agencies participated in the briefings. Afterward, the committee met in closed session to establish its findings and begin preparing this review, which was completed through correspondence. The enclosures contain the roster of committee members and the meeting agenda, which lists the individuals who briefed the committee. Biographical information about the committee is available at: <http://www8.nationalacademies.org/cp/CommitteeView.aspx?key=48663>.

On behalf of NRC and the committee, I thank the many USDOT officials who participated in the briefings, which were introduced by Chief of Staff John Flaherty and led by RITA Administrator Ashok Kaveeshwar. They asked the committee for a candid assessment of the plan and advice on RITA's potential role in future strategic planning. The committee also benefited from discussions with Martin Spitzer, professional staff member of the Science Committee of the U.S. House of Representatives. He explained the Science Committee's intent in drafting the legislation calling for the RD&T strategic plan and the NRC review.

The committee's review is contained in this letter. It is offered in a forward-looking spirit with the intention of aiding current and future strategic planning by USDOT.

Overarching themes and advice in the committee's review are as follows:

- Strategic RD&T planning is a critical responsibility of USDOT. Because the Federal government owns and operates very little of the nation's transportation system, its contributions to improving multiple aspects of the system's functioning occur in large part through RD&T. Well-considered investments in RD&T are thus essential elements in USDOT's overall performance. In an environment marked by shrinking research spending and increased congressional earmarking, it is incumbent upon USDOT to articulate the national importance of RD&T and put forward a thoughtful and persuasive plan for RD&T investment.
- The Strategic RD&T Plan for 2006–2010 is a reasonable first effort. It offers useful descriptions of the many RD&T programs within the department. At the same time, it is more a compendium of individual RD&T activities than a strategic plan that articulates department-wide priorities and justifications for RD&T programs and budgets.



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- The document's current limitations as a strategic plan can and must be overcome to make it more useful for decision makers in Congress, the executive branch, and USDOT, as well as for other transportation stakeholders and partners from the states and private industry. In particular, plans should be informed by a systems-level and intermodal perspective on transportation and the challenges that lie before this important sector. USDOT should develop such a perspective, and its emerging research priorities should reflect it.
- USDOT faces constraints to strategic RD&T planning and investment, especially because of earmarking and multiple, narrowly defined authorizations (designations) of RD&T budgets. Yet the importance of easing these constraints makes effective strategic planning even more necessary. A well-constructed strategic plan, the key elements of which are described in this review, can foster the alliances needed to reach executive branch and congressional agreement on Federal funding for RD&T to address the nation's pressing transportation needs.
- RITA can have a meaningful role in strategic RD&T planning. Absent from the USDOT research portfolio is any policy or intermodal research that should guide strategic planning and policy development. RITA could fill these gaps if it had the resources to do so. More generally, effective participation by RITA in the strategic planning process will require financial resources, direct involvement by and cooperation with the modal agencies, and the support of Congress and USDOT.

### REQUEST FOR THIS REVIEW

SAFETEA-LU calls for NRC to review the details of the 5-year strategic RD&T plan. Section 5208 lays out a number of content requirements and considerations for USDOT in developing it. The act requires, at a minimum, that the plan describe the primary purposes of the transportation RD&T program in

- Reducing congestion and improving mobility,
- Promoting safety,
- Promoting security,
- Protecting and enhancing the environment,
- Preserving the existing transportation system, and
- Improving the durability and extending the life of transportation infrastructure.

The act specifically requires the plan to list the primary RD&T topics that USDOT intends to pursue to accomplish these six purposes. The act permits other categorizations such as fundamental research in the physical and natural sciences, applied research, technology development, and social science research. For each of the RD&T topics, the plan must show the funding levels anticipated over the period and describe the information expected to be obtained from the research portfolio during the period.

The legislation also calls on the Secretary to ensure that the plan reflects input from a wide range of stakeholders; includes and integrates the RD&T programs of all USDOT operating agencies; and avoids wasteful duplication of related RD&T conducted by other Federal agencies, states, and private and nonprofit organizations.

With these statutory requirements in mind, the committee reviewed the current version of the strategic RD&T plan. The first part of this review presents the committee's findings. The committee took a pragmatic approach in under-

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### National Research Council Letter Report

taking this review; it realizes that this is USDOT's first response to SAFETEA-LU and is cognizant of the political and institutional constraints that USDOT confronts in formulating a strategic plan. Anticipating USDOT's need for future strategic planning, the committee offers its view of what a strategic plan could and should be in the second part of this review. The review concludes with advice on potential roles for RITA in developing and implementing strategic RD&T plans in the future.

### **CURRENT STRATEGIC RD&T PLAN: STRENGTHS AND LIMITATIONS**

The Strategic RD&T Plan for 2006–2010 has strengths and limitations. The focus of this review is on the strengths and limitations of the plan itself and not the agency research programs referenced in it. Key elements of a strategic plan that are not part of the current document but that should be in future plans are identified and discussed later in this review.

#### **Plan Strengths**

In covering the RD&T of the nine operating agencies and OST, the plan presents information from scores of RD&T activities scattered across the department. For policy makers, such an overview can be helpful in comprehending program coverage, funding levels, and subject matter. Indeed, the plan may be the first document that attempts to relate all major USDOT RD&T activities to shared priorities and goals. This is a difficult exercise, and USDOT deserves credit for carrying it out.

On the basis of presentations to the committee by USDOT RD&T managers, it appears that communications processes used to develop the plan have fostered dialogue among the research managers of the operating agencies. This is a desirable development, since such interaction can spur collaboration and improved outcomes in common areas of RD&T. Such interagency dialogue can also reduce the potential for duplication of research. These exchanges have led the USDOT presenters to conclude that duplication of RD&T is not a common occurrence.

Another strength of the plan is that, by highlighting six emerging research priorities, it reveals how strategic planning can have an important role in shaping the direction of RD&T policy and investment. The priorities listed are a promising start; they are cross-modal in nature and will require some fundamental research.

Finally, OST is drafting a strategic plan for all USDOT activity (more general than RD&T), which will be completed later in the summer. An early draft of this plan was circulated during the committee's meeting. The committee observed that the goals and priorities in this broader strategic plan are aligned with those of the RD&T plan. Moreover, the broader plan posits RD&T as one of the key levers available to USDOT to further these national transportation goals and priorities. The committee is encouraged to see RD&T emphasized in this manner.

#### **Plan Limitations**

USDOT's ability to engage in strategic RD&T planning and investment is limited by several well-recognized and deep-seated political and institutional constraints. One would expect a strategic plan to recognize and seek ways to mitigate such constraints. The committee believes that the following are important factors constraining USDOT's ability to invest strategically in RD&T:

- Earmarking and designation of RD&T topics, projects, and institutions. In the past few years, transportation RD&T programs have experienced a dramatic growth in legislation specifying that research centers, projects, or studies be located at particular institutions. Even when RD&T funds are not earmarked in this manner, authorizing legislation and appropriations language often contain instructions designating the specific topics of RD&T. Congressional actions thus give little discretion to USDOT and its operating agencies to allocate resources across strategic RD&T priorities.
- Modal agencies have mode-specific missions, authorities, and constituencies that limit the department's ability to pursue inter- and crossmodal RD&T. The modal orientations of Federal transportation programs have deep historical roots; they are the way U.S. transportation policy has been framed and administered for decades. Not surprisingly, the modal framework extends to and emerges from the numerous congressional authorizing and appropriating committees that govern the operating agencies. A result is marked differences in RD&T resources available to individual agencies; at one extreme, the department's only agency with responsibility pertaining to water transportation, the Maritime Administration, has no RD&T resources.
- Research to support regulatory and programmatic obligations consumes much of the RD&T resources available to each operating agency. While it is within the purview of most operating agencies to conduct more general and policy-oriented research to help improve the performance of their respective modes, the agencies often have few, if any, discretionary resources available to engage in such research.

More generally, the plan does not explain how the varied missions of USDOT and its operating agencies influence the RD&T portfolio. A few illustrations make the point. With the major exception of the air traffic control system, the Federal government does not actually own or operate the nation's transportation infrastructure. For railroads, pipelines, automobiles, and motor carriers, the Federal role centers on safety regulation. The plan is short on explanation of why and to what degree the RD&T activities of these agencies are devoted to supporting such regulatory functions. The Federal highway and transit programs are less regulatory, but they focus instead on providing resources and expertise for system infrastructure development and connectivity. The plan does not discuss how the RD&T programs of the USDOT agencies concerned, the Federal Highway Administration and the Federal Transit Administration, meet the needs and seek to complement the RD&T of the states, counties, cities, and regional agencies that own and operate the nation's highway and transit systems. The Federal Aviation Administration (FAA) is both a safety regulator and the operator of the air traffic control system, and it administers aid for airport infrastructure development. The plan does not explain how FAA's RD&T activities are shaped by its multiple roles.

Such context would be helpful in understanding why a large proportion of the research funded within the department is mode-specific. While it should not be used to justify an absence of department-wide strategic RD&T planning, such context is needed to give perspective on opportunities for integrating RD&T plans across agencies.

### **Shortcomings in Plan's Organization of RD&T**

Given the requirement to develop a strategic RD&T plan in less than a year, it is not surprising that the plan is primarily a compendium of existing RD&T activities and not a detailed and documented analysis of objectives, alternatives, and choices as implied by a strategic plan. Yet even with the time constraint, the committee believes that USDOT could have better organized and analyzed the RD&T program along dimensions in addition to broad topic areas, several examples of which are given later in this review. Overall, the committee finds that the plan's organizational structure is not well suited to examining many research balance and content issues.

SAFETEA-LU calls for RD&T to be described in accordance with the six primary purposes of transportation RD&T that are listed above. The plan is fairly consistent with these six, grouping RD&T according to the strategic goals of safety, reduced congestion, global connectivity, environmental stewardship, security and emergency response, and organizational excellence. However, any such categorization of RD&T into a handful of areas is bound to produce an

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overly simplified and potentially misleading picture. This stems from the fact that RD&T is often aimed at addressing more than one goal. For example, RD&T that enhances transportation capacity and reduces congestion may lead to changes in safety performance. Likewise, research that yields improvements in safety and environmental performance may have congestion and security effects.

The way that RD&T activities are grouped into the six broad topic areas of the strategic plan could lead to confusion about the extent of transportation research in these areas. The level of funding for research pertaining to environmental stewardship (\$52.5 million) appears remarkably low relative to total reported RD&T spending (\$1.1 billion), and it is seemingly out of proportion with the strategic plan's own identification of challenges from climate change, transportation fuel, and environmental constraints on expanding capacity. Funding in this area may or may not be low; however, it is difficult to know with confidence from this document because of the gross categorizations of RD&T activities.

Similarly, it is difficult to understand the rationale for the plan's characterizing RD&T on construction and maintenance under the goal of reducing congestion. Congressional direction for the development of the plan highlights system preservation and durability. Given the more than \$40 billion invested annually in highway, transit and airport infrastructure through Federal programs, research to preserve and extend the life and serviceability of these assets appears to be a worthy goal in its own right.

Also confusing is the plan's summary funding table, which lists spending on the University Transportation Centers (UTC) program and all cooperative research programs as being aimed at reducing congestion. Funding for these and similar programs is shown to be \$313 million per year—accounting for almost half of the \$652 million in total funding shown for the goal of reduced congestion. UTC and cooperative research programs cover a multitude of topics, from research on safety and the environment to system capacity. The UTC program also aids in transportation workforce development. In fact, the UTC and cooperative research programs are described in the plan as activities to “advance the nation's transportation workforce and research capability.” This grouping has the effect of overstating the extent to which USDOT's RD&T addresses congestion and understating its contribution to other goals, such as security, environmental stewardship, and safety.

These examples illustrate how bundling so many diverse RD&T activities on a single dimension and into a small number of categories can yield a weak analytic framework for decision making.

#### **Absence of Stakeholder Input in the Current Plan**

The important role that stakeholders can and should play in strategic planning and in building a constituency to support USDOT's RD&T priorities is discussed in more detail later in this review. The strategic plan lists various means by which the individual operating administrations shape their RD&T programs with input from technical experts, system owners and operators, transportation users, and other interested and affected parties. Such program-specific stakeholder involvement, however, is not a substitute for and should not be confused with seeking stakeholder input during the development of the strategic RD&T plan itself. Stakeholders can provide information and advice on a range of topics, from the allocation of RD&T resources across the department to crossmodal issues warranting further research. They should be consulted during the process of identifying emerging research priorities. A significant limitation of the current strategic RD&T plan is that it was not developed with such external input.

#### **WHAT A STRATEGIC PLAN COULD AND SHOULD DO**

Recognizing that there is no general blueprint for a strategic plan, the committee urges USDOT to develop a strategic RD&T plan and supporting processes that (a) articulate the role and value of USDOT's RD&T, (b) highlight and

promote ways to overcome constraints to strategic RD&T investment, (c) describe the RD&T program in various dimensions to inform decisions, (d) identify gaps in cross-modal policy and systems research, and (e) promote efficient and effective research processes.

### **Articulate the Role and Value of USDOT's RD&T**

Like the transportation system itself, transportation RD&T is highly decentralized and includes the efforts of USDOT and other Federal agencies, private industry, and state and local governments. By one estimate, USDOT accounts for only 6 percent of all transportation-related research at the Federal level, with the Departments of Defense and Energy accounting for the large majority (Brach 2005). USDOT should therefore explain how its RD&T programs interact with, complement, and leverage other RD&T activities. Although USDOT accounts for a small share of the total research enterprise, it is the only organization responsible for fostering a national transportation system. Having such a national perspective and the ability to leverage its research, USDOT can take a leadership role in transportation RD&T.

USDOT's leadership role should be expressed in its strategic RD&T plan, which should explain how transportation RD&T can help further national transportation goals and priorities. The plan should assess the major issues in transportation, analyze the strengths and weaknesses of USDOT's RD&T programs with regard to these issues, and establish the goals and priorities for making the choices that guide future RD&T. For the strategic RD&T plan to do this, USDOT's goals and priorities must be well articulated—for instance, in an overarching strategic plan for the department. That broader plan should identify the key challenges facing transportation now and in the coming decades, such as the challenges arising from trends in demographics and changing energy sources. As noted earlier, USDOT is drafting such an overarching plan linked to the strategic RD&T plan. An example of another document that offers perspective on emerging challenges facing transportation is the Critical Issues in Transportation report developed triennially by the TRB Executive Committee, most recently in January 2006 (TRB 2006).

A strategic RD&T plan also provides the department with an opportunity to explain all that is encompassed by "research, development, and technology." The outcomes of RD&T should be explained as consisting of not only technology development but also other desired results such as information for decisions, operational solutions to problems, knowledge to support future research, technology transfer, and a well-educated generation of transportation professionals. The plan should provide compelling examples of how transportation RD&T, in its many forms, has benefited the nation.

The plan should estimate how much the Federal government invests in transportation RD&T relative to investments made at other levels of government and by the private and nonprofit sectors. It should also compare the transportation sector's investment in RD&T with that of other major economic sectors and assess whether RD&T investments are commensurate with the problems and challenges facing the transportation sector. The committee suspects that such benchmarking would reveal that investment in transportation-related RD&T is lagging at the Federal level and when compared with many other sectors of the economy.

### **Highlight and Promote Ways to Overcome Constraints to Strategic RD&T Investment**

In addition to a compelling vision of what RD&T can do to achieve national transportation goals, a plan can offer a realistic assessment of the constraints to strategic RD&T planning. The political and institutional constraints that limit a strategic approach to RD&T investment should be major considerations in the plan itself—indeed, a central part of

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the plan. Strategic planning requires being proactive in furthering and evolving toward desired outcomes. While these political and institutional constraints can be sensitive to address in a plan, some are subject to change and should be highlighted as a step toward constructive change. One need look no further than the creation of USDOT itself, now 40 years ago, for insight into how seemingly insurmountable institutional and legislative constraints can be modified, if not overcome.

The committee observes that the earmarking and designation of transportation RD&T have become much more prevalent in recent years (Brach and Wachs 2005). While less common in the Federal aviation program, earmarking and designations pervade authorizations and appropriations for Federal surface transportation RD&T. This prevalence is a concern. Not only does it impair USDOT's ability to allocate RD&T resources in a coherent and strategic manner, it can reduce the efficiency and quality of the research through lack of competition and merit review. In the face of earmarking and other constraints, USDOT's reluctance to offer strategic guidance for RD&T investment can have the perverse effect of perpetuating these constraints by creating the appearance of a vacuum in leadership needed to surmount them. If USDOT develops and promotes a well-constructed plan, it can mobilize constituencies with a shared interest in well-targeted and high-quality research.

#### **Describe the RD&T Program in Various Dimensions to Inform Decisions**

Given the congressional requirement to develop a strategic RD&T plan in less than a year, the committee understands why the current plan is limited in analyses of the RD&T program. At the same time, the committee believes that USDOT could have gone further in presenting the program along a number of dimensions that would be helpful to decisionmaking.

SAFETEA-LU identifies other approaches to describing and categorizing research in addition to topic areas, including fundamental and applied; physical, natural, and social sciences; and technology development. The committee would like to have seen a description of the RD&T program with regard to some of these dimensions as well as topic areas, perhaps expanded to include others such as probability of success (e.g., high risk, low risk), time frame (e.g., long term, near term), size and scale, tractability, and potential impact (e.g., incremental, breakthrough).

Other recent external reviews of USDOT RD&T programs have questioned whether sufficient attention is being given to research aimed at achieving breakthroughs in the understanding of transportation-related phenomena (TRB 2001, 6). Likewise, the committee questions whether USDOT is investing sufficiently in long-range research to support critical policy decisions. The current plan's organization makes it difficult to know whether these specific concerns are warranted and to assess the program's balance on other dimensions.

#### **Identify Gaps in Cross-Modal Policy and Systems Research**

USDOT should look at the transportation enterprise from a multimodal and department-wide perspective as a larger system in which interactions and interdependencies occur among modes, as they do between transportation and other large-scale societal and natural systems such as the economy, land use, national defense, and the environment. The nine modal agencies—with their own statutory requirements and narrow missions—seldom take such a broad and systems-level approach to programming their RD&T. For example, in seeking to reduce the nation's highway fatalities and injuries, the National Highway Traffic Safety Administration is not likely to assess the implications of changes in public transit use or air travel for this outcome. Likewise, the Federal Highway Administration and the Federal Aviation Administration do not have strong incentives to examine the implications of congestion pricing of highway and runway facilities for issues such as metropolitan land use and energy demand.



The absence within USDOT of RD&T pertaining to water transportation was noted earlier. The transfer of the U.S. Coast Guard to the Department of Homeland Security has left USDOT with limited research capability to support policies affecting water transportation, which plays an important role in the movement of both domestic and international freight. Such a gap in research coverage stymies achievement of a multimodal, systems view; this gap is unlikely to be filled by mode-specific research programs.

Indeed, the advent of intermodal freight containerization some 50 years ago and the resulting demand for public investments to improve the connectivity of the freight modes illustrate the importance of USDOT conducting forward-looking research that explores emerging trends and technologies requiring policy responses. Major influences on the transportation enterprise during the next 50 years will surely differ from those influencing it during the past 50 years. USDOT should conduct research now that examines these trends and developments to inform national transportation policies, as well as to shape the RD&T strategic plan itself.

The need for such forward-looking and crosscutting research can be highlighted in a strategic plan, along with opportunities and approaches for meeting this need.

### **Promote Efficient and Effective Research Processes**

The plan should develop and describe the various processes to be used across the department in selecting research topics and researchers to ensure relevance, quality, and performance. The extent to which the different processes are used and the reasons why should be explained.

The document should define the role of stakeholders in identifying research needs and in fostering the use of research results. In this regard, the plan should clearly indicate the processes by which stakeholder input will be sought and used for strategic planning. The plan should also explain how duplication of research, both across public agencies and with the private sector, is avoided and where cooperation and collaboration are desirable and taking place. In this regard, the plan should explain the ways in which RD&T from the private sector and elsewhere in government, from this country and abroad, is brought to bear on pressing national issues.

Procedures for determining the appropriate research processes should be formulated and explained in the plan. Such processes range from in-house research facilities and staff to the various forms of extramural RD&T, such as grants, competitive proposals, sole-source arrangements, and cooperative programming. The plan should explain the reasons for differing research processes among the department's major RD&T programs, including any differences among RD&T programs that are more applied or exploratory in nature. The extent to which these processes are used should be examined, along with means for diffusion and deployment of research results. It should likewise explain how methods of communicating and delivering RD&T results vary across the department, while bringing attention to those that have shown the most success.

Methods for ensuring relevance, quality, and performance should be developed and explained. There is a general recognition in the research community, for example, that competition and expert peer review foster both high-quality and cost-effective RD&T. Likewise, the involvement of stakeholders and constituents in guiding research programs can help ensure that products from research address genuine needs and are applied. The plan offers USDOT an opportunity to take stock of research processes, gleaned from across the operating agencies, that are most effective in producing high-quality, cost-effective, and useful research results.

Finally, expected outcomes from RD&T should be defined along with processes for tracking performance. As an example, the UTC program is expected to produce qualified transportation professionals as well as applicable research reports. Measures for both outcomes should be described. Performance-based metrics for other kinds of



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RD&T can also be developed; for example, to track the quantity and quality of research to support regulatory and policy proposals. In general, the plan should explain the extent to which quantifiable goals, timetables, and performance measures are part of RD&T programs.

#### **FURTHER CONSIDERATIONS AND RITA'S ROLE**

SAFETEA-LU requires that USDOT solicit input on its strategic plan from a wide range of stakeholders. The draft plan lists various means by which individual operating agencies obtain input from stakeholders on their RD&T programs. The strategic plan itself, however, was not developed with input or advice from stakeholders or other outside experts. Because of time constraints, USDOT solicited public comments and stakeholder feedback after the plan's development and concurrent with this committee's review.

Stakeholder input, including that of experts in transportation systems and system users such as travelers and shippers, must be sought during the development of the strategic plan. Such external input is essential in establishing plan credibility and building support for it in Congress. A broad-based strategic plan with stakeholder support should help ensure that research priorities reflect a shared view of the critical goals for and issues affecting the nation's transportation system. As noted earlier, a strength of the current plan is its listing of six emerging research priorities. The current plan, however, does not explain why or how these emerging priorities were chosen or whether they correspond to what transportation stakeholders and other experts would view as emerging priorities.

The committee was asked to comment on the six emerging research priorities in the plan, but a more relevant question is whether effective processes have been established for identifying such priorities. RITA can help meet this need by providing a venue for soliciting input from stakeholders and technical experts. As discussed earlier, the RD&T portfolio of the department is shaped largely by the collection of plans, priorities, and capabilities of the individual RD&T programs of operating administrations. Drawing on the information from its stakeholder consultations, RITA could assist senior leadership in identifying and prioritizing some of the RD&T portfolio in a more deliberate fashion.

RITA could perform other functions important for strategic RD&T planning. It can take the lead in tracking the transportation-related RD&T of other Federal agencies, in the private sector, at other levels of government, and by entities outside the United States. USDOT needs such information to ensure that its RD&T programs are filling critical gaps and that they are collaborative where possible and appropriate. RITA can likewise identify opportunities for usefully integrating RD&T among the modal agencies. In developing the current plan, RITA has demonstrated a potential to foster interagency communication and cooperation—something that has long been needed.

Perhaps of greater long-run significance, RITA is the logical entity to promote and perhaps even undertake the kind of crosscutting policy and systems-level research discussed above. For example, it could encourage research to examine the effects of mode shifts on energy use, congestion, safety, and land use. RITA is in a position to seek resources from Congress and the department to conduct research on topics such as these that transcend individual modes.

In the committee's view, RITA can begin exercising some of these functions supportive to strategic RD&T planning. However, RITA has a small staff and limited financial resources. Whether it can aspire to an even greater role in strategic RD&T planning is an open question. RITA was created on a separate track from SAFETEA-LU, and whether Congress and USDOT share a similar vision of RITA's strategic mission remains unclear. For RITA to participate effectively in the strategic planning process, it will require financial resources, direct involvement by and cooperation with the modal agencies, and the support of Congress and USDOT leadership.

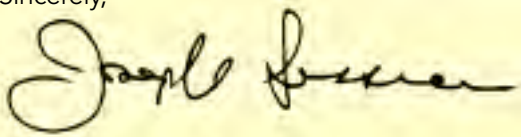
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#### CONCLUDING REMARKS

In closing, the committee is pleased that USDOT is engaged in strategic R&D planning and has welcomed the opportunity to undertake this review. Given the time constraints and organizational realities within USDOT, the current strategic plan is a reasonable first effort. Time will not permit all of the advice in this review to be integrated into the plan that is going to Congress in September of this year, but the committee hopes its advice will prove useful in future strategic planning. The committee has striven to be candid and constructive in its review and trusts that its advice will be received in this spirit. I welcome the opportunity to discuss this review and look forward to progress in this important area.

Sincerely,



Joseph M. Sussman

Chair

Committee on the Review of the USDOT Strategic Plan for R&D

#### REFERENCES

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#### COMMITTEE ON THE REVIEW OF THE USDOT STRATEGIC PLAN FOR R&D

(Members in attendance at the meeting shown in bold)

**Joseph M. Sussman**, Chairman, JR East Professor of Civil and Environmental Engineering and Engineering Systems, Massachusetts Institute of Technology, Cambridge

**Christopher P. L. Barkan**, Associate Professor and Director, Railroad Engineering Program, University of Illinois at Urbana–Champaign

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**Lillian C. Borrone**, Assistant Executive Director and Director of Port Commerce, Port Authority of New York and New Jersey (retired), Wilmington, North Carolina

**Leigh B. Boske**, Associate Dean and Professor of Economics and Public Affairs, LBJ School of Public Affairs, University of Texas, Austin

**David G. Burwell**, Partner, BBG Group, Bethesda, Maryland

Raymond F. Decker, Chief Technical Officer, Thixomat, Inc., Ann Arbor, Michigan

**Irwin Feller**, Senior Visiting Scientist, American Association for the Advancement of Science, State College, Pennsylvania

**David W. Fowler**, Joe J. King Chair in Engineering and T.U. Taylor Professorship, Department of Civil Engineering, University of Texas, Austin

**Angela Gittens**, Vice President, Airport Business Services, HNTB Companies, Miami, Florida

**Lester A. Hoel**, L.A. Lacy Distinguished Professor of Engineering and Director, Center for Transportation Studies, University of Virginia, Charlottesville

**Thomas Imrich**, Chief Pilot, Research, Boeing Commercial Aircraft/Boeing Company, Seattle, Washington

**Carl L. Monismith**, Robert Horonjeff Professor of Civil Engineering (Emeritus) and Professor in Graduate School, University of California, Berkeley

**Peter F. Sweatman**, Director, Transportation Research Institute, University of Michigan, Ann Arbor

**Michael S. Townes**, President and CEO, Hampton Roads Transit, Hampton, Virginia

**Richard N. Wright**, Director of Building and Fire Research, National Institute of Standards and Technology (retired), Montgomery Village, Maryland

## APPENDIX A

### National Research Council Letter Report

#### DOT RESPONSE TO NRC RECOMMENDATIONS

Dr. Joseph M. Sussman  
Chair  
Committee on the Review of the USDOT RD&T Strategic Plan  
National Research Council  
500 Fifth Street, N.W.  
Washington, DC 20001

Dear Dr. Sussman:

On behalf of the U.S. Department of Transportation, I thank you and the members of the National Research Council (NRC) Review Committee for the dedication, time and energy you devoted to reviewing and assessing the Department's five-year *Transportation Research, Development and Technology (RD&T) Strategic Plan*. I have received and reviewed the committee's report, and I am pleased with the committee's recommendations and guidance.

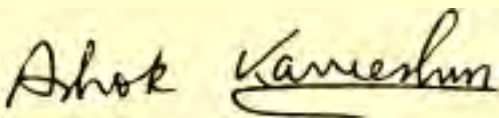
I appreciate your valuable insights and the quality of the letter report, not to mention the expeditious manner in which it was prepared and delivered to the Department.

Strategic planning is a dynamic process. The plan we are finalizing at this time is envisioned as a living document that will evolve as we incorporate additional recommendations and the results of ongoing research.

During our next steps in the strategic planning process, we will embrace many of the committee's recommendations. We will work to delineate a systems-approach to cross-modal research, describe the constraints on the Department's RD&T programs, establish a framework for stakeholder input, and bolster the functions and role of the Research and Innovative Technology Administration in strategic research planning and coordination.

Within a year's time, we hope to present to the committee a supplement to the plan and look forward to continued interaction with the NRC review committee.

Sincerely,



Ashok Kaveeshwar  
Administrator  
Research and Innovative Technology Administration

## APPENDIX B

### Stakeholder Input

As required by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, this *Transportation Research, Development and Technology Strategic Plan* incorporates input from a broad range of Departmental stakeholders, including State and local transportation agencies, not-for-profit institutions, academia, and the private sector.

Primary outreach occurred through the posting of a working draft of the plan on the Department's Docket Management System at <http://dms.dot.gov>. At this site, stakeholders were able to access the draft and submit comments. To obtain further stakeholder input, the Department published a *Federal Register* Notice on July 12, 2006. The Department also announced the availability of the draft plan through RITA's website (with a link to the Department's Docket Management System) and disseminated a notice of availability for comment on July 11 through TRB's E-Newsletter. Through these mechanisms, the Department requested comments from stakeholders in the following specific areas:

- The relevance of the Department's emerging research priorities to the Nation's most pressing transportation challenges.
- Future directions for Departmental research.
- Ways to minimize unnecessary research duplication.

The comments received are posted at:

<http://dms.dot.gov/search/searchResultsSimple.cfm> (Docket #25247)

Comments included the following:

#### **Overall Comments**

- Commend DOT for preparing a multiyear strategic RD&T plan.
- Multiple comments on options for organizing or connecting RD&T programs and projects to goals and strategies.
- Continue emphasis on standards development, transit safety, and emergency preparedness.
- Place greater emphasis on RD&T supporting infrastructure preservation and durability.
- There is no obvious duplication of highway research with that of State DOTs.

#### **Requests for Additional Information**

- Provide more information on collaboration with other departments. *Addressed in Chapter 9.*
- Provide more information on DOT internal RD&T coordination. *Addressed in Chapter 10.*
- Provide more information on metrics and performance. *Addressed in Chapter 10.*
- Provide more information on the historical background for transportation RD&T.

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### Stakeholder Input

- Provide information on the deployment of research results.
- Discuss DOT's unique role in highway RD&T.
- Acknowledge constraints on strategic RD&T planning.
- Provide more details on RD&T programs that will support DOT's emerging research priorities.
- Include the role of transportation libraries in information sharing and dissemination of research results.

#### **Need for Additional Research**

- Support further research in advanced vehicle technologies for safety.
- Support maritime and policy research.
- Accelerate development and deployment of fuel efficiency technologies for commercial aviation.
- Include research and development initiatives to advance real-time traffic data collection and dissemination.
- Further research on human factors in hazmat incidents, train control systems, standardized measurements for puncture-resistant tank cars, and remote monitoring.
- Research on transportation impacts on climate change.
- Research on unintended consequences to pedestrians of the reduction in sound emitted by hybrid and future vehicles.

## APPENDIX C

### RD&T Funding

#### Anticipated Funding for RD&T Strategies FY 2006-2010

Table C-1. Funding in Support of DOT RD&T Strategies (\$000)

Safety RD&T Strategy 1—Understand and Address Causal Factors and Risks

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA	165,915	129,324	127,724	127,960	126,987
FHWA	95,876	94,486	94,486	94,486	94,486
FMCSA	9,454	10,117	10,117	10,117	10,117
FRA	20,492	18,103	18,103	18,103	18,103
FTA	4,468	7,870	7,870	7,870	7,870
NHTSA	55,162	53,246	53,246	53,246	53,246
OST	2,765	1,965	1,965	1,965	1,965
PHMSA	9,695	10,132	10,132	10,132	10,132
RITA	79	0	0	0	0
<b>Total</b>	<b>363,906</b>	<b>325,243</b>	<b>323,643</b>	<b>323,879</b>	<b>322,906</b>

\*Outyear numbers are for planning purposes only. FAA funding levels for FY 2008-2010 are from the 2006 *National Aviation Research Plan*.



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### RD&T Funding

#### Anticipated Funding for RD&T Strategies FY 2006-2010

**Table C-2. Funding in Support of DOT RD&T Strategies (\$000)**

**Safety RD&T Strategy 2—Mitigate the Consequences of Accidents and Incidents**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA**	—	—	—	—	—
FHWA	9,036	8,229	8,229	8,229	8,229
FMCSA**	—	—	—	—	—
FRA	7,585	6,518	6,518	6,518	6,518
FTA	1,024	0	0	0	0
NHTSA	26,786	22,591	22,591	22,591	22,591
<b>Total</b>	<b>44,431</b>	<b>37,338</b>	<b>37,338</b>	<b>37,338</b>	<b>37,338</b>

\*Outyear numbers are for planning purposes only.

\*\*Provides secondary support and does not allocate specific funding for this RD&T strategy.

**Table C-3. Funding in Support of DOT RD&T Strategies (\$000)**

**Safety RD&T Strategy 3—Assess Impacts of New Technologies, Vehicles, Concepts, Designs, and Procedures**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA	1,773	2,369	2,315	2,300	2,258
FHWA	627	627	627	627	627
FMCSA**	—	—	—	—	—
NHTSA	4,956	4,289	4,289	4,289	4,289
RITA	1,175	1,191	1,191	1,191	1,191
<b>Total</b>	<b>8,531</b>	<b>8,476</b>	<b>8,422</b>	<b>8,407</b>	<b>8,365</b>

\*Outyear numbers are for planning purposes only. FAA funding levels for FY 2008-2010 are from the 2006 *National Aviation Research Plan*.

\*\*Provides secondary support and does not allocate specific funding for this RD&T strategy.

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### RD&T Funding

#### Anticipated Funding for RD&T Strategies FY 2006-2010

**Table C-4. Funding in Support of DOT RD&T Strategies (\$000)**

**Reduced Congestion RD&T Strategy 1—Reduce Passenger and Freight Congestion in Air and Surface Modes**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA	32,056	21,660	21,540	21,511	21,419
FHWA	38,257	42,517	42,517	42,517	42,517
FTA	2,014	2,059	2,059	2,059	2,059
OST	0	493	493	493	493
<b>Total</b>	<b>72,327</b>	<b>66,729</b>	<b>66,609</b>	<b>66,580</b>	<b>66,488</b>

\*Outyear numbers are for planning purposes only. FAA funding levels for FY 2008-2010 are from the 2006 *National Aviation Research Plan*.

**Table C-5. Funding in Support of DOT RD&T Strategies (\$000)**

**Reduced Congestion RD&T Strategy 2—Extend the Life of the Existing Transportation System and Improve Infrastructure Durability**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA	10,138	9,547	9,547	9,547	9,547
FHWA	80,454	80,500	80,500	80,500	80,500
FRA	1,339	1,361	1,361	1,361	1,361
FTA	4,024	0	0	0	0
OST	2,214	0	0	0	0
<b>Total</b>	<b>98,169</b>	<b>91,408</b>	<b>91,408</b>	<b>91,408</b>	<b>91,408</b>

\*Outyear numbers are for planning purposes only. FAA funding levels for FY 2008-2010 are from the 2006 *National Aviation Research Plan*.

## APPENDIX C

### RD&T Funding

#### Anticipated Funding for RD&T Strategies FY 2006-2010

**Table C-6. Funding in Support of DOT RD&T Strategies (\$000)**

**Reduced Congestion RD&T Strategy 3—Advance Use of Next Generation Technologies and Combinations of Modes**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA	57,512	49,244	52,880	54,886	56,538
FHWA	20,246	15,101	15,101	15,101	15,101
FRA	24,496	7,500	7,500	7,500	7,500
OST	2,241	998	998	998	998
<b>Total</b>	<b>104,495</b>	<b>72,843</b>	<b>76,479</b>	<b>78,485</b>	<b>80,137</b>

\*Outyear numbers are for planning purposes only. FAA funding levels for FY 2008-2010 are from the 2006 *National Aviation Research Plan*.

**Table C-7. Funding in Support of DOT RD&T Strategies (\$000)**

**Reduced Congestion RD&T Strategy 4—Improve Planning, Operation, and Management of Transportation Services and Assets**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA**	—	—	—	—	—
FHWA	29,910	30,111	30,111	30,111	30,111
FTA	15,402	10,004	10,004	10,004	10,004
OST	0	876	876	876	876
<b>Total</b>	<b>45,312</b>	<b>40,991</b>	<b>40,991</b>	<b>40,991</b>	<b>40,991</b>

\*Outyear numbers are for planning purposes only.

\*\*Provides secondary support and does not allocate specific funding for this RD&T strategy.

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### RD&T Funding

#### Anticipated Funding for RD&T Strategies FY 2006-2010

**Table C-8. Funding in Support of DOT RD&T Strategies (\$000)**

**Reduced Congestion RD&T Strategy 5—Improve Transportation Services for Underserved Areas and Populations**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FHWA	8,547	10,961	10,961	10,961	10,961
FTA	9,626	10,359	10,359	10,359	10,359
OST	0	713	713	713	713
<b>Total</b>	<b>18,173</b>	<b>22,033</b>	<b>22,033</b>	<b>22,033</b>	<b>22,033</b>

\*Outyear numbers are for planning purposes only.

**Table C-9. Funding in Support of DOT RD&T Strategies (\$000)**

**Reduced Congestion RD&T Strategy 6—Advance the Nation's Transportation Research Capability**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA	31,885	31,674	31,720	31,793	31,851
FHWA**	256,845	274,679	274,679	274,679	274,679
FRA	1,814	2,380	2,380	2,380	2,380
FTA	20,520	22,369	22,369	22,369	22,369
NHTSA	4,794	4,376	4,376	4,376	4,376
OST	1,856	0	0	0	0
<b>Total</b>	<b>317,714</b>	<b>335,478</b>	<b>335,524</b>	<b>335,597</b>	<b>335,655</b>

\*Outyear numbers are for planning purposes only. FAA funding levels for FY 2008-2010 are from the 2006 *National Aviation Research Plan*.

\*\*Includes State Planning and Research, University Transportation Research, and Training and Education.

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### RD&T Funding

#### Anticipated Funding for RD&T Strategies FY 2006-2010

Table C-10. Funding in Support of DOT RD&T Strategies (\$000)

Global Connectivity RD&T Strategy—Harmonize Transportation Standards and Support Leadership for U.S. Transportation Providers

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA**	—	—	—	—	—
FHWA	4,152	4,199	4,199	4,199	4,199
FTA	1,123	658	658	658	658
OST	1,774	2,616	2,616	2,616	2,616
PHMSA**	—	—	—	—	—
<b>Total</b>	<b>7,049</b>	<b>7,473</b>	<b>7,473</b>	<b>7,473</b>	<b>7,473</b>

\*Outyear numbers are for planning purposes only.

\*\*Provides secondary support and does not allocate specific funding for this RD&T strategy.

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### RD&T Funding

#### Anticipated Funding for RD&T Strategies FY 2006-2010

**Table C-11. Funding in Support of DOT RD&T Strategies (\$000)**

**Environmental Stewardship RD&T Strategy 1—Understand and Mitigate Transportation Impacts**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA	17,537	17,052	16,496	16,387	15,975
FHWA	20,150	20,197	20,197	20,197	20,197
FRA	665	786	786	786	786
FTA	10,866	1,258	1,258	1,258	1,258
NHTSA**	—	—	—	—	—
OST	2,131	567	567	567	567
PHMSA	2,056	2,104	2,104	2,104	2,104
RITA**	—	—	—	—	—
<b>Total</b>	<b>53,405</b>	<b>41,964</b>	<b>41,408</b>	<b>41,299</b>	<b>40,887</b>

\*Outyear numbers are for planning purposes only. FAA funding levels for FY 2008-2010 are from the 2006 *National Aviation Research Plan*.

\*\*Provides secondary support and does not allocate specific funding for this RD&T strategy.

**Table C-12. Funding in Support of DOT RD&T Strategies (\$000)**

**Environmental Stewardship RD&T Strategy 2—Improve the Environmental Review Process**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA**	—	—	—	—	—
FHWA	4,425	4,472	4,472	4,472	4,472
FTA	773	808	808	808	808
<b>Total</b>	<b>5,198</b>	<b>5,280</b>	<b>5,280</b>	<b>5,280</b>	<b>5,280</b>

\*Outyear numbers are for planning purposes only.

\*\*Provides secondary support and does not allocate specific funding for this RD&T strategy.

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### RD&T Funding

#### Anticipated Funding for RD&T Strategies FY 2006-2010

**Table C-13. Funding in Support of DOT RD&T Strategies (\$000)**

**Security, Preparedness and Response RD&T Strategy 1—Reduce Vulnerability and Improve System Preparedness and Recovery**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FHWA**	—	—	—	—	—
FRA	977	999	999	999	999
FTA	3,365	2,448	2,448	2,448	2,448
OST	948	256	256	256	256
<b>Total</b>	<b>5,290</b>	<b>3,703</b>	<b>3,703</b>	<b>3,703</b>	<b>3,703</b>

\*Outyear numbers are for planning purposes only.

\*\*Provides secondary support and does not allocate specific funding for this RD&T strategy.

**Table C-14. Funding in Support of DOT RD&T Strategies (\$000)**

**Security, Preparedness and Response RD&T Strategy 2—Secure Hazardous Materials Shipments and Assess the Risks of Hazmat Events**

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FHWA**	—	—	—	—	—
FMCSA	1,002	1,171	1,171	1,171	1,171
FRA	977	999	999	999	999
OST	0	256	256	256	256
PHMSA**	—	—	—	—	—
<b>Total</b>	<b>1,979</b>	<b>2,426</b>	<b>2,426</b>	<b>2,426</b>	<b>2,426</b>

\*Outyear numbers are for planning purposes only.

\*\*Provides secondary support and does not allocate specific funding for this RD&T strategy.



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### RD&T Funding

#### Anticipated Funding for RD&T Strategies FY 2006-2010

Table C-15. Funding in Support of DOT RD&T Strategies (\$000)

Organizational Excellence RD&T Strategy—Consistently Apply the R&D Investment Criteria

Operating Administration	Support for RD&T Strategy				
	FY 06	FY 07	FY 08*	FY 09*	FY 10*
FAA	2,886	2,278	2,226	2,214	2,173
FMCSA	1,642	1,170	1,170	1,170	1,170
FTA	1,623	3,852	3,852	3,852	3,852
OST	921	170	170	170	170
RITA	1,216	3,171	3,171	3,171	3,171
<b>Total</b>	<b>8,288</b>	<b>10,641</b>	<b>10,589</b>	<b>10,577</b>	<b>10,536</b>

\*Outyear numbers are for planning purposes only. FAA funding levels for FY 2008-2010 are from the 2006 *National Aviation Research Plan*.

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-16. FAA RD&T Funding (\$000)

FAA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
<b>Research, Engineering and Development</b>	<b>129,880</b>	<b>136,620</b>	<b>130,000</b>
<i>Improve Aviation Safety</i>	104,886	96,040	88,162
Fire Research and Safety	6,525	6,182	6,638
Propulsion and Fuel Systems	7,115	5,741	4,048
Advanced Materials/Structural Safety	6,643	5,881	2,843
Atmospheric Hazards/Digital System Safety	4,086	3,407	3,848
Aging Aircraft	18,998	19,807	18,621
Aircraft Catastrophic Failure Prevention Research	1,107	3,307	1,512
Flight Deck/Maintenance/ System Integration Human Factors	11,700	8,099	7,999
Aviation Safety Risk Analysis	8,571	4,883	5,292
Air Traffic Control/Airway Facilities Human Factors	9,391	9,557	9,654
Aeromedical Research	10,079	8,800	6,962
Weather Program Safety	20,671	20,376	19,545
Unmanned Aircraft Systems	0	0	1,200
<i>Improve Efficiency</i>	9,321	20,192	21,166
National Plan for Transformation of Air Transportation	5,059	17,919	18,100
Wake Turbulence	4,262	2,273	3,066
<i>Reduce Environmental Impact</i>	11,795	15,840	16,008

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-16. FAA RD&T Funding (\$000) (continued)

FAA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
Environment and Energy	11,795	15,840	16,008
<i>Mission Support</i>	3,878	4,548	4,664
System Planning and Resource Management	516	1,189	1,234
William J. Hughes Technical Center Laboratory Facility	3,362	3,359	3,430
<b>Facilities and Equipment</b>	<b>119,863</b>	<b>159,526</b>	<b>96,800</b>
<i>Advanced Technology Development and Prototyping</i>	102,701	104,702	49,500
<i>Plant (F)</i>	17,162	16,929	17,200
<i>Center for Advanced Aviation System Development</i>	0	37,895	30,100
<b>Airport Improvement Program</b>	<b>0</b>	<b>9,900</b>	<b>27,870</b>
<i>Airport Technology (T)</i>	0	9,900	27,870
<b>Operations</b>	<b>13,380</b>	<b>13,581</b>	<b>8,353</b>
<b>Commercial Space Transportation</b>	<b>110</b>	<b>75</b>	<b>125</b>
<b>Subtotal, R&amp;D<sup>1</sup></b>	<b>246,071</b>	<b>292,873</b>	<b>218,078</b>
<b>Subtotal, Technology Investment (T)<sup>2</sup></b>	<b>0</b>	<b>9,900</b>	<b>27,870</b>
<b>Subtotal, Facilities (F)<sup>3</sup></b>	<b>17,162</b>	<b>16,929</b>	<b>17,200</b>
<b>Total FAA</b>	<b>263,233</b>	<b>319,702</b>	<b>263,148</b>

<sup>1</sup> Composed of basic research (without specific application), applied research (for a specific need), and developmental research (design, development, and improvements of prototypes and processes).

<sup>2</sup> Demonstration projects and other related activities associated with R&D.

<sup>3</sup> Acquisition, design, and construction and repairs of all physical facilities for use in R&D.

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-17. FHWA RD&T Funding (\$000)

FHWA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
<b>Surface Transportation Research</b>	<b>85,491</b>	<b>196,400</b>	<b>196,400</b>
Safety	8,113	8,296	8,296
Safety (T)	1,432	6,788	6,788
Pavements	13,280	20,144	20,144
Pavements (T)	0	10,847	10,847
Structures	10,226	14,514	14,514
Structures (T)	1,394	11,875	11,875
Policy	7,470	0	0
Environmental, Planning, and Right-of-Way	9,510	7,821	7,821
Environmental, Planning, and Right-of-Way (T)	4,475	11,731	11,731
Highway Operations	6,474	3,011	3,011
Highway Operations (T)	4,316	4,517	4,517
R&T Technical Support	6,640	0	0
Long-Term Pavement Performance	8,300	8,465	8,465
Advanced Research	623	0	0
R&T Strategic Plan/Performance Measures	623	0	0
International Outreach	332	251	251
Asset Management	2,283	0	0

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-17. FHWA RD&T Funding (\$000) (continued)

FHWA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
Corporate Activities	0	54,578	54,578
OST, RITA, FMCSA, NHTSA & PHMSA	0	17,774	17,774
OST, RITA, FMCSA, NHTSA & PHMSA (T)	0	15,788	15,788
<b>Technology Deployment Program (T)</b>	<b>41,501</b>	<b>0</b>	<b>0</b>
<b>Training and Education</b>	<b>24,706</b>	<b>26,700</b>	<b>26,700</b>
National Highway Institute (T)	10,487	9,270	9,270
Local Technical Assistance Program (T)	11,148	10,719	10,719
Eisenhower Transportation Fellowship Program (T)	3,071	2,124	2,124
Garrett A. Morgan Program	0	1,207	1,207
Transportation Education Development Pilot Program	0	1,811	1,811
Freight Planning Capacity Building	0	845	845
Surface Transportation Congestion Relief Assistance	0	724	724
<b>Intelligent Transportation Systems</b>	<b>198,359</b>	<b>110,000</b>	<b>110,000</b>
Research	44,175	51,667	51,667
Operational Test	9,979	11,671	11,671
Architecture and Standards (T)	15,104	17,666	17,666
ITS Program Support	9,546	11,165	11,165
Integration (T)	9,546	11,165	11,165

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-17. FHWA RD&T Funding (\$000) (continued)

FHWA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
ITS Deployment (T)	104,310	0	0
Evaluation (T)	5,699	6,666	6,666
<b>University Transportation Research (T)</b>	<b>59,594</b>	<b>69,700</b>	<b>69,700</b>
<b>Other</b>	<b>149,983</b>	<b>148,681</b>	<b>165,723</b>
State Planning and Research	149,983	148,681	165,723
<b>Administrative Expenses</b>	<b>16,548</b>	<b>17,044</b>	<b>17,556</b>
<b>Subtotal, R&amp;D<sup>1</sup></b>	<b>304,105</b>	<b>379,669</b>	<b>397,223</b>
<b>Subtotal, Technology Investment (T)<sup>2</sup></b>	<b>272,077</b>	<b>188,856</b>	<b>188,856</b>
<b>Subtotal, Facilities (F)<sup>3</sup></b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total FHWA</b>	<b>576,182</b>	<b>568,525</b>	<b>586,079</b>

<sup>1</sup> Composed of basic research (without specific application), applied research (for a specific need), and developmental research (design, development, and improvements of prototypes and processes).

<sup>2</sup> Demonstration projects and other related activities associated with R&D.

<sup>3</sup> Acquisition, design, and construction and repairs of all physical facilities for use in R&D.

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-18. FMCSA RD&T Funding (\$000)

FMCSA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
<b>Motor Carrier Safety</b>	<b>10,516</b>	<b>12,098</b>	<b>12,458</b>
<i>Produce Safer Drivers</i>	2,750	3,623	4,271
Produce Safer Drivers	2,750	3,366	4,271
Produce Safer Drivers (T)	0	257	0
<i>Improve Safety of Commercial Motor Vehicles</i>	2,777	2,772	3,147
Improve Safety of Commercial Motor Vehicles	1,777	297	3,147
Improve Safety of Commercial Motor Vehicles (T)	1,000	2,475	0
<i>Produce Safer Carriers</i>	120	871	629
Produce Safer Carriers	120	871	629
Produce Safer Carriers (T)	0	0	0
<i>Advance Safety Through Information-Based Initiatives</i>	1,035	1,483	1,349
Advance Safety Through Information-Based Initiatives	460	815	1,349
Advance Safety Through Information-Based Initiatives (T)	575	668	0
<i>Improve Security Through Safety Initiatives</i>	500	297	450
Improve Security Through Safety Initiatives	0	297	450
Improve Security Through Safety Initiatives (T)	500	0	0
<i>Enable and Motivate Internal Excellence</i>	1,250	937	450
Enable and Motivate Internal Excellence	1,150	937	450



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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-18. FMCSA RD&T Funding (\$000) (continued)

FMCSA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
Enable and Motivate Internal Excellence (T)	100	0	0
<b>Administrative Expenses</b>	<b>2,084</b>	<b>2,115</b>	<b>2,162</b>
<b>Subtotal, R&amp;D<sup>1</sup></b>	<b>8,341</b>	<b>8,698</b>	<b>12,458</b>
<b>Subtotal, Technology Investment (T)<sup>2</sup></b>	<b>2,175</b>	<b>3,400</b>	<b>0</b>
<b>Subtotal, Facilities (F)<sup>3</sup></b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total FMCSA</b>	<b>10,516</b>	<b>12,098</b>	<b>12,458</b>

<sup>1</sup> Composed of basic research (without specific application), applied research (for a specific need), and developmental research (design, development, and improvements of prototypes and processes).

<sup>2</sup> Demonstration projects and other related activities associated with R&D.

<sup>3</sup> Acquisition, design, and construction and repairs of all physical facilities for use in R&D.

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-19. FRA RD&T Funding (\$000)

FRA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
<b>Railroad Research and Development</b>	<b>35,737</b>	<b>54,525</b>	<b>34,650</b>
Railroad System Issues	3,001	3,168	3,168
Human Factors	3,422	3,366	3,366
Rolling Stock and Components	2,510	4,688	2,871
Track and Structures	3,670	3,861	3,861
Marshall University/University of Nebraska	1,984	1,485	0
Track and Train Interaction	3,175	3,168	3,168
Train Control	893	7,326	7,920
Grade Crossings	1,885	1,881	2,178
Hazardous Materials Transportation	967	1,188	1,287
Train Occupant Protection	6,150	6,039	4,950
Corridor Planning	0	7,118	0
R&D Facilities and Test Equipment (F)	1,334	1,337	1,881
Nationwide Differential Global Positioning System (T)	6,746	9,900	0
<b>Next Generation High-Speed Rail</b>	<b>19,493</b>	<b>0</b>	<b>0</b>
HS Train Control Systems (T)	7,440	0	0
Non-Electric Locomotives (T)	1,687	0	0
Grade Crossing & Innovative Technologies (T)	4,315	0	0

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-19. FRA RD&T Funding (\$000) (continued)

FRA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
Track/Structures Technology (T)	992	0	0
Corridor Planning (T)	3,075	0	0
MAGLEV (T)	1,984	0	0
<b>Safety and Operations</b>	<b>4,227</b>	<b>3,820</b>	<b>3,996</b>
Salaries and Expenses	3,096	3,244	3,394
Salaries and Expenses (T)	1,131	576	602
<b>Subtotal, R&amp;D<sup>1</sup></b>	<b>30,753</b>	<b>46,532</b>	<b>36,163</b>
<b>Subtotal, Technology Investment (T)<sup>2</sup></b>	<b>27,370</b>	<b>10,476</b>	<b>602</b>
<b>Subtotal, Facilities (F)<sup>3</sup></b>	<b>1,334</b>	<b>1,337</b>	<b>1,881</b>
<b>Total FRA</b>	<b>59,457</b>	<b>58,345</b>	<b>38,646</b>

<sup>1</sup> Composed of basic research (without specific application), applied research (for a specific need), and developmental research (design, development, and improvements of prototypes and processes).

<sup>2</sup> Demonstration projects and other related activities associated with R&D.

<sup>3</sup> Acquisition, design, and construction and repairs of all physical facilities for use in R&D.

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-20. FTA RD&T Funding (\$000)

FTA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
<b>National Program</b>	<b>37,200</b>	<b>54,451</b>	<b>40,500</b>
<i>Increase Transit Ridership</i>	15,019	13,717	12,800
Increase Transit Ridership	0	0	1,500
Increase Transit Ridership (T)	15,019	13,717	11,300
<i>Improve Capital and Operating Efficiencies</i>	5,347	18,755	11,755
Improve Capital and Operating Efficiencies	1,932	1,980	4,200
Improve Capital and Operating Efficiencies (T)	3,415	16,775	7,555
<i>Improve Safety and Emergency Preparedness</i>	9,002	8,786	10,201
Improve Safety and Emergency Preparedness	0	0	500
Improve Safety and Emergency Preparedness (T)	9,002	8,786	9,701
<i>Protect Environment &amp; Promote Energy Independence</i>	6,408	11,593	1,950
Protect Environment & Promote Energy Independence	1,788	3,119	1,200
Protect Environment & Promote Energy Independence (T)	4,620	8,474	750
<i>Provide Transit Research Leadership</i>	1,424	1,600	3,794
Provide Transit Research Leadership	300	300	300
Provide Transit Research Leadership (T)	1,124	1,300	3,494
<b>Transit Cooperative Research Program (T)</b>	<b>8,184</b>	<b>8,910</b>	<b>9,300</b>
<b>National Transit Institute (T)</b>	<b>3,968</b>	<b>4,257</b>	<b>4,300</b>

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-20. FTA RD&T Funding (\$000) (continued)

FTA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
Rural Transit Assistance Program (T)	5,208	0	0
University Transportation Centers (T)	5,952	6,930	7,000
<b>Subtotal, Research and University Programs</b>	<b>60,512</b>	<b>74,548</b>	<b>61,100</b>
Administrative Expenses	224	280	585
<b>Subtotal, R&amp;D<sup>1</sup></b>	<b>4,244</b>	<b>5,679</b>	<b>8,285</b>
<b>Subtotal, Technology Investment (T)<sup>2</sup></b>	<b>56,492</b>	<b>69,149</b>	<b>53,400</b>
<b>Subtotal, Facilities (F)<sup>3</sup></b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total FTA</b>	<b>60,736</b>	<b>74,828</b>	<b>61,685</b>

<sup>1</sup> Composed of basic research (without specific application), applied research (for a specific need), and developmental research (design, development, and improvements of prototypes and processes).

<sup>2</sup> Demonstration projects and other related activities associated with R&D.

<sup>3</sup> Acquisition, design, and construction and repairs of all physical facilities for use in R&D.

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### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-21. NHTSA RD&T Funding (\$000)

NHTSA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
<b>Research and Analysis</b>	<b>69,401</b>	<b>71,908</b>	<b>64,211</b>
<i>Crashworthiness</i>	25,263	22,994	19,226
Safety Systems	9,151	9,134	7,726
Biomechanics (Human Injury Research)	16,112	13,860	11,500
<i>Crash Avoidance</i>	9,788	12,065	9,165
Driver/Vehicle Performance	3,488	6,980	6,750
National Advanced Driver Simulator	3,591	0	0
Heavy Vehicles	2,098	4,470	2,115
Pneumatic Tire Research	611	615	300
<i>Data Programs (T)</i>	32,608	34,188	33,883
Fatal Accident Reporting System (T)	6,543	6,992	7,063
National Accident Sampling System (T)	12,046	12,108	12,230
Data Analysis Program (T)	1,970	1,980	2,000
State Data Program (T)	2,504	2,515	2,890
Special Crash Investigations (T)	1,675	1,683	1,700
National Motor Vehicle Crash Causation Survey (T)	6,887	7,920	7,000
Early Fatality Notification System (T)	983	990	1,000
<i>Crash Avoidance</i>	492	495	0

## APPENDIX C

### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-21. NHTSA RD&T Funding (\$000) (continued)

NHTSA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
<i>Vehicle Research and Test Center</i>	1,004	1,002	1,012
<i>Hydrogen New Initiative</i>	0	916	925
<i>NAS Tire Study</i>	246	0	0
<i>Plastic and Composite Vehicles</i>	0	248	0
<b>Highway Safety Research</b>	<b>4,571</b>	<b>4,621</b>	<b>6,833</b>
<b>Administrative Expenses</b>	<b>19,625</b>	<b>15,169</b>	<b>13,458</b>
<b>Subtotal, R&amp;D<sup>1</sup></b>	<b>60,989</b>	<b>57,510</b>	<b>50,619</b>
<b>Subtotal, Technology Investment (T)<sup>2</sup></b>	<b>32,608</b>	<b>34,188</b>	<b>33,883</b>
<b>Subtotal, Facilities (F)<sup>3</sup></b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total NHTSA</b>	<b>93,597</b>	<b>91,698</b>	<b>84,502</b>

<sup>1</sup> Composed of basic research (without specific application), applied research (for a specific need), and developmental research (design, development, and improvements of prototypes and processes).

<sup>2</sup> Demonstration projects and other related activities associated with R&D.

<sup>3</sup> Acquisition, design, and construction and repairs of all physical facilities for use in R&D.

## APPENDIX C

### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-22. OST RD&T Funding (\$000)

OST RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
Transportation Planning, Research, and Development	19,490	14,850	8,910
<b>Total OST</b>	<b>19,490</b>	<b>14,850</b>	<b>8,910</b>

Table C-23. PHMSA RD&T Funding (\$000)

PHMSA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
<b>Research and Special Programs</b>	<b>2,733</b>	<b>0</b>	<b>0</b>
Hazardous Materials	1,831	0	0
Research and Technology	374	0	0
Administrative Expenses	528	0	0
<b>Hazardous Materials Safety</b>	<b>0</b>	<b>1,829</b>	<b>2,093</b>
<b>Administrative Expenses</b>	<b>0</b>	<b>464</b>	<b>480</b>
<b>Pipeline Safety</b>	<b>9,591</b>	<b>9,458</b>	<b>9,663</b>
Pipeline Safety	8,986	8,907	9,093
Administrative Expenses	605	551	570
<b>Total PHMSA</b>	<b>12,324</b>	<b>11,751</b>	<b>12,236</b>



## APPENDIX C

### RD&T Funding

#### RD&T Program Funding FY 2005-2007

Table C-24. RITA RD&T Funding (\$000)

RITA RD&T Program	FY 2005 Actual	FY 2006 Enacted	FY 2007 Request
Hazardous Materials R&D	80	79	0
Hydrogen R&D	500	495	495
R&D Planning and Management	171	536	247
Administrative Expenses	1,170	1,360	1,392
Transportation Futures Program	0	0	2,228
<b>Total RITA</b>	<b>1,921</b>	<b>2,470</b>	<b>4,362</b>

## APPENDIX D

Links to Operating Administration Advisory Committees, Stakeholder Activities, and RD&T Plans

### FAA

Research, Engineering, and Development Advisory Committee  
<http://research.faa.gov/redac/>

National Aviation Research Plan  
<http://research.faa.gov/publications/narp/>

RD&T Annual Reviews and Accomplishment Reports  
<http://research.faa.gov/publications/annual/>

### FHWA

Research and Technology Coordinating Committee  
<http://www8.nationalacademies.org/cp/projectview.aspx?key=154>

Corporate Master Plan for Research and Deployment of Technology & Innovation  
<http://www.fhwa.dot.gov/legsregs/directives/policy/cmp/03077.htm>

Five-Year ITS Program Plan  
<http://www.its.dot.gov/index.htm>

### FMCSA

Research and Technology Stakeholder Forums  
<http://www.fmcsa.dot.gov/facts-research/research-technology/report/2004-stakeholder-report.htm>  
<http://www.fmcsa.dot.gov/facts-research/research-technology/report/Forum-Report-digital-version-all.htm>

Research and Technology Strategic Plan  
<http://www.fmcsa.dot.gov/facts-research/research-technology/report/rt-5year-strategicplan.htm>

### FRA

Committee for Review of the Federal Railroad Administration Research, Development, and Demonstration Programs  
<http://www8.nationalacademies.org/cp/projectview.aspx?key=SAIS-P-01-08-A>

Five-Year Strategic Plan for Railroad Research, Development, and Demonstrations  
<http://www.fra.dot.gov/us/content/225>

## APPENDIX D

Links to Operating Administration Advisory Committees, Stakeholder Activities, and RD&T Plans

### FTA

Transit Research Analysis Committee

<http://www8.nationalacademies.org/cp/projectview.aspx?key=71>

Strategic Research Plan

<http://www.fta.dot.gov/documents/StrategicResearchPlan.doc>

### NHTSA

Vehicle Safety Rulemaking and Supporting Research Priorities: Calendar Years 2005-2009

<http://www.nhtsa.gov/cars/rules/rulings/PriorityPlan-2005.html>

Research and Development Public Meetings

<http://www-nrd.nhtsa.dot.gov/departments/nrd-01/presentations/presentations.html>

### PHMSA

Office of Pipeline Safety R&D Strategic Plan

<http://primis.phmsa.dot.gov/rd/splan.htm>

Pipeline Safety Internal, External, Stakeholder, and Peer Reviews

<http://primis.phmsa.dot.gov/rd/reviews.htm>

### RITA

Committee on the Review of the USDOT Strategic Plan for R&D

<http://www8.nationalacademies.org/cp/projectview.aspx?key=48663>

Research Activities of the Department of Transportation: A Report to Congress

[http://www.rita.dot.gov/publications/research\\_activities\\_of\\_the\\_department\\_of\\_transportation\\_a\\_report\\_to\\_congress/](http://www.rita.dot.gov/publications/research_activities_of_the_department_of_transportation_a_report_to_congress/)





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