

April 22, 2003

The Honorable Allan Rutter  
Administrator  
Federal Railroad Administration  
1120 Vermont Avenue, N.W.  
Washington, DC 20590

Dear Administrator Rutter:

The TRB Committee for Review of the Federal Railroad Administration (FRA) Research, Development, and Demonstration Programs held its second meeting on November 14–15, 2002, and its third meeting on March 13–14, 2003, both in Washington, D.C. The committee members who attended each of these meetings are indicated in Enclosure 1. The speakers and guests at each meeting are indicated in Enclosure 2.

The committee wants to thank Mark Yachmetz, Jo Strang, Steven Ditmeyer, Jane Bachner, Grady Cothen, Magdy El-Sibaie, Claire Orth, Robert McCown, James Smailes, Arnold Kupferman, and other FRA and Volpe staff for their continued cooperation and substantial participation in these meetings. Their presentations and the materials they provided are essential to the committee's work.

### **THE COMMITTEE'S CHARGE**

FRA's overall charge to the committee is to conduct periodic peer reviews of three programs:

- The Railroad Research and Development (Railroad R&D) Program,
- The Next Generation High-Speed Rail Technology Demonstration (NGHSR) Program, and
- The Magnetic Levitation Technology (Maglev) Deployment Program.

These peer reviews are intended to address (1) the agency's R&D management structure and approach; (2) the current direction and allocation of funds devoted to the various program areas; and (3) whether there is an appropriate balance of federal, state, and private-sector input and cost sharing.

Prior to the March meeting, FRA requested that the committee focus its discussions, and subsequent findings and recommendations, on the following specific topics: (1) future directions for the NGHSR Program; (2) the *Five-Year Strategic Plan for Railroad Research, Development, and Demonstrations*, which FRA published in March 2002; and (3) the FY 2004 budget requests for the three programs covered in the review.

The first two sections of this report address, respectively, the first of these topics and closely related issues concerning a policy framework and contextual research. The next two sections cover the second and third topics. They are followed by sections dealing with two matters of continuing concern to the committee: performance-based safety regulations and grade-crossing and trespasser research. Comments on the Railroad R&D Program and the Maglev Deployment Program are then given. Finally, a list of themes and suggested format changes for the committee's fall meeting is presented.

## **FUTURE DIRECTIONS FOR THE NGHSR PROGRAM**

Because most of the major projects being conducted under this program are nearing completion, the committee was asked to provide recommendations on future directions for the program and, if possible, to suggest potential future projects.

**Changing Needs for High-Speed Rail Technology.** The committee recognizes that the current program was conceived during previous administrations to support a policy goal of implementing higher-speed passenger rail service operating between 125 and 150 mph using nonelectric propulsion, for the most part on existing track concurrently shared by freight trains operating at much lower speeds. It was anticipated at that time that the federal government would designate high-speed passenger rail corridors and that the states would implement and deploy high-speed service up to 150 mph. The elements in the NGHSR Program were developed to demonstrate the availability of technologies to provide such high-speed service consistent with FRA safety regulations.

The Bush administration, however, is developing a new policy with regard to passenger rail service, and it is difficult for the committee to anticipate the outcome. That said, the tightening fiscal constraints on government, along with the unresolved future of Amtrak, imply a less expansive development and deployment of passenger rail service, especially higher-speed services, in the near term. With this in mind, the committee recognizes that a more likely evolution of passenger rail would be based on improved conventional services in densely used regional corridors. This implies higher-frequency services, with speeds between 79 and 125 mph, perhaps in the 90- to 110-mph range. The future market for higher-speed and longer-range rail passenger technologies is much less clear.

The states that are interested in developing passenger rail services are unlikely to be able to implement them without federal assistance and, in any case, are stalled by the current uncertainties with regard to Amtrak's future. The administration's posture toward corridor-type services may become clearer when its proposals for reauthorizing surface transportation programs are made public in coming weeks. Certainly, the prospects of additional corridor services will be largely predicated on sharing track with the freight railroads, which will require resolving the issues raised by the mixing of passenger and freight service.

Before new directions for the NGHSR Program can be established, the first challenge for FRA will be to establish a new policy on intercity passenger rail services.

**Recommendation 1.** Assuming that a federal policy regarding intercity passenger rail is adopted in the future, the committee recommends that FRA take the following actions:

- Assess the market for technology needs now and in the foreseeable future, with careful attention to the range of speeds likely to be required (revisit the emerging corridors study).
- Refocus the program to meet the more likely market needs, with emphasis on incremental speed improvements (to 79, 90, or 110 mph) and cost-effective investments to reduce trip times and to increase capacity, service frequency, and reliability.
- Address capacity and joint operations issues between passenger and freight services operating on common infrastructure. For example, this suggests the acquisition and implementation of modern analytical tools for using geographic information system (GIS) data and capacity simulation models.

Overall, the original objectives of the NGHSR Program, which were based on the policy of previous administrations, are being achieved. Positive train control (PTC) technologies are being demonstrated, a higher-speed nonelectric locomotive is available for demonstration, and a variety of approaches have been demonstrated for reducing the risk of collisions with motor vehicles at grade crossings. Given the potential differences between past and future passenger rail policy, the current emphasis should be on wrapping up the technology demonstrations; it is an appropriate time to consolidate the lessons learned and finish the current projects. Management should now direct that these projects be completed, as the committee recommends below.

**Positive Train Control.** Industry and government agree that train control improvements are required so that passenger trains can operate at higher

speeds or with greater frequency, or both, jointly with freight trains on the same tracks. As a result, NGHSR funds have been provided to demonstrate two different technologies in large, multiyear projects: the Michigan Incremental Train Control System and the North American Joint Positive Train Control (NAJPTC) Initiative. In FY 2002, FRA began providing funds for projects testing two other technologies, and in the meantime, at least one other freight railroad has begun testing yet another technology. Full implementation of these technologies now appears to be stalled pending development of an analytical methodology to determine the safety of each system.

FRA staff briefly discussed the Axiomatic Safety-Critical Assessment Process (ASCAP) project being carried out to support the NAJPTC Initiative. They indicated that this process to model all the components of the underlying signal system and the PTC system is becoming extremely complex. It is not clear when this review program will conclude. (The committee will request a presentation on this project at its next meeting.)

**Recommendation 2.** The committee recommends that FRA establish a firm timetable for the conclusion of federal expenditures on and involvement in the Illinois and Michigan PTC projects. Additional research needs related to PTC should be developed as part of the process outlined in Recommendation 1. An analytical methodology to assess the safety of each system may be one of those needs. In this regard, it is equally important that the ASCAP process be focused on results.

**Nonelectric Locomotive.** Much-needed revenue demonstrations of the high-speed turbine locomotive, which FRA funded on a cost-sharing basis, have been delayed because of contractual aspects of the agreement negotiated with the manufacturer. The committee is concerned that the full utility of this program may be restricted by an inability to test the locomotive in revenue service with a number of different types of passenger coaches. Whereas the technology itself appears able to meet the original goals set for it, the committee believes that the development of a market for such locomotives will be more dependent on federal policy with regard to rail capital investments than on the availability of a higher-speed nonelectric locomotive. The committee's judgment is that in the current economic context, most states would not be as interested in 150-mph service as in providing incremental increases in speeds in the 90- to 110-mph range, which may be achieved with a somewhat different turbine-driven locomotive. The current locomotive's major selling features are reported to be fuel efficiency and high acceleration, but those and other operating characteristics need to be demonstrated in clearly documented revenue operations using a number of passenger coaches from different manufacturers.

With a clearer market assessment, other sources of propulsion might be explored. If one vision of future rail passenger services foresees short, high-

density, urbanized corridors, then foreign experience suggests that low-cost electrification technologies for both rolling stock and infrastructure might be a promising area for exploration. Electrification technologies may well cover both overhead catenary and third-rail applications, especially at lower speeds and where clearances are critical.

**Recommendation 3.** The committee recommends that FRA expedite revenue demonstrations of the nonelectric locomotive. Additional federal investment in this product is not recommended at this time. When a market assessment as outlined in Recommendation 1 is completed, other propulsion options, which might prove to be more cost-effective and improve trip times, should be considered. Future research and demonstrations might profitably be directed toward other propulsion systems, perhaps including exploration of developments in electrification that might provide low-cost options applicable to U.S. intercity rail passenger routes.

**Advanced Locomotive Propulsion Systems.** Given the history of this project, there has clearly been more technical risk than originally contemplated. In addition to technical risk, schedule and budget risks remain, and it is not clear that the proposed benefits are worth those risks. In light of the committee's observations as to the types of rail passenger services that are likely to emerge in the near term (and the new FRA policy, when available), the lessons already learned about the flywheel technology could be used to determine its potential costs and benefits in rail passenger applications. The committee would be interested in a detailed discussion of this subject at the fall meeting.

**Recommendation 4.** The committee recommends that FRA establish a firm timetable for the conclusion of federal expenditures on and involvement in the Advanced Locomotive Propulsion Systems (ALPS) project.

## **POLICY FRAMEWORK AND CONTEXTUAL RESEARCH**

The committee's ability to comment on the direction and allocation of funds devoted to the various freight and passenger programs depends on a knowledge of the policies and objectives that the programs are intended to serve. A significant part of the R&D program has an explicit requirement to serve the agency's safety goals, which makes commentary on this program more straightforward. Even so, the predecessor committee<sup>1</sup> encouraged FRA to investigate the broader economic trends in the railroad industry to better

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<sup>1</sup> The TRB Committee for Review of the FRA Research and Development Program conducted reviews of the safety-related Railroad R&D Program and the NGHSR Program from 1998 to 2001.

understand and anticipate the kinds of safety issues the program could and should address.

This committee strongly shares that view and is encouraged that economic and policy-based contextual research, albeit quite modest in scale, is now included in the program. FRA staff gave a presentation on the initial steps being taken to carry out this research at the November meeting and provided an update at the March meeting. The committee would like to see this research continue at a quickened pace and will follow its progress with interest.

The recommendations that began with the predecessor committee related to the need to understand trends and developments in the rail *freight* industry that could influence the need for safety R&D. Now the committee views the need for contextual research and a policy framework to include intercity passenger rail and the relationship between freight and passenger operations in the long term as well as the near term.

**Recommendation 5.** The committee recommends that FRA sponsor a conference on market trends and technological developments in freight and passenger rail, and freight/passenger interactions, to develop directions for both the safety R&D and the NGHSR programs and for the appropriate level of resources that would be needed to support these programs. The committee might be able to serve as the steering committee to help design such a conference.

## **FIVE-YEAR PLAN FOR RAILROAD RESEARCH, DEVELOPMENT, AND DEMONSTRATIONS**

*Five-Year Strategic Plan for Railroad Research, Development, and Demonstrations* was published by FRA in March 2002 after a long delay in the federal review process. The committee was asked to comment on whether it believes the directions and objectives outlined in the plan are appropriate.

Although the committee finds that the plan contains good descriptive material on the programs and program elements, the plan lacks sufficient statements of justification for the topics that have been selected for research. Moreover, the plan could be improved with a more specific statement of the goals and objectives it serves and a description of how the R&D program helps in attaining these goals. A policy framework and contextual research, as discussed in the preceding section, would benefit the plan and make priority-setting more effective.

## **FY 2004 BUDGET REQUESTS**

The committee was asked to comment on the FY 2004 budget requests. Overall, the committee finds the requests in line with the FY 2003 budget.

As part of its overall charge, the committee has been asked to address issues related to cost-sharing. A review of the current work as well as the FY 2004 budget indicates that there may be some duplication of industry-related research. The committee suggests more detailed consultation with the railroads participating in the joint Association of American Railroads (AAR)/FRA research program with regard to opportunities to share resources. For example, FRA may want to revisit the issue of whether it would be beneficial for the railroads and FRA's R&D program to share inspection car capabilities by FRA's leasing existing cars and outfitting them with technologies being tested by FRA.

Some duplications between the R&D and NGHSR programs have been eliminated and a few remain (e.g., funding for grade-crossing safety). The committee understands the different purposes of these programs, but there is a continuing need for coordination between them.

In relation to Recommendations 2, 3, and 4, some adjustments to the NGHSR Program budget may be required if FRA establishes new timetables and expenditure limits for the conclusion of federal involvement in the PTC projects, nonelectric locomotive, and ALPS project.

The committee has previously supported completion of the Nationwide Differential Global Positioning System (NDGPS) and is pleased to see funding included in FRA's FY 2004 budget. The railroad industry favors completion of the system, because it furnishes a critical enabling technology that supports PTC systems and other wireless technologies. Only \$24 million is required now for completion of the system, and adequate funds need to be appropriated. Although the committee is gratified to see funds in FRA's FY 2004 request for NDGPS, the \$6.8 million requested will provide few resources for network expansion after operation and maintenance costs are covered.

**Recommendation 6.** The committee recommends that the Department make completion of the NDGPS system a high priority because of the value that the system has for all transport applications and for national transportation security.

## **PERFORMANCE-BASED SAFETY REGULATIONS**

The predecessor committee recommended that FRA conduct research on how the application of performance standards in safety regulation can be expanded. In response, 2 years ago FRA budgeted for a project on prospects for using

performance-based regulation for railroad safety purposes. The project was performed by the John F. Kennedy School of Government (through a contractual arrangement with the Volpe National Transportation Systems Center), and the committee was pleased with a detailed briefing on this project by the lead researcher at its November meeting.<sup>2</sup> In addition, the committee invited Transportation Technology Center, Inc. (TTCI)<sup>3</sup> staff to make a presentation on the industry's approach to developing risk-based performance standards at the November meeting and to provide an update on the TTCI work at the March meeting.

In addition, FRA staff gave a presentation on the work they are doing on "risk-informed" regulation and provided examples at the March meeting.

FRA staff also described cooperative efforts between the Office of Safety and the Office of R&D, for example on the locomotive crashworthiness project requested by the Railroad Safety Advisory Committee (RSAC). The purpose of that project is to develop computer-based models as a tool to assess the safety of new locomotive designs. The committee is pleased to see this level of cooperation between Safety and R&D.

Application of risk assessment or performance standards to the safety regulatory process requires appropriate supporting data, which could conflict both with the government's paperwork reduction objectives and with FRA's efforts to reduce the amount of data it requires the railroads to report. The current level of accident reporting is, unfortunately, not ideally suited for root cause analysis, particularly when human factors may be involved. The committee believes that the benefits of selected, carefully targeted additional information would be well in excess of its costs.

**Recommendation 7.** The committee recommends that the Offices of Safety and R&D continue to work on new regulatory processes that allow for the implementation of new technology. This may well require additional research to identify the data required and to develop cost-effective means for producing and analyzing data needed for reliable evaluation of safety and technology programs.

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<sup>2</sup> The committee was provided with copies of the first report on this project: *Performance-Based Regulation: Prospects and Limitations in Health, Safety, and Environmental Protection*. Regulatory Policy Program Report No. RPP-03 (2002). Coglianese, C., J. Nash, and T. Olmstead. Cambridge, Massachusetts: Regulatory Policy Program, Harvard University, John F. Kennedy School of Government. This report covered the initial phase of the project that examined generally potential benefits as well as drawbacks of expanded use of performance standards in a regulatory context, such as railroad safety. A follow-up report on several case studies of performance-based regulations used by other agencies and industries is being prepared but not yet available.

<sup>3</sup> TTCI is a for-profit subsidiary of AAR and manages AAR's cooperative industry research program.



## **GRADE-CROSSING AND TRESPASSER RESEARCH**

Because of the large number of fatalities attributable to grade-crossing accidents and trespassers, the committee has urged FRA to continue to focus on the coordination of grade-crossing and trespasser safety research. At the November and March meetings, FRA R&D staff gave presentations that provided a helpful overview of coordination of R&D resources from other federal agencies, states, and the industry, as well as the status of ongoing work. Low-cost, effective crossing protection is important to the development of higher-speed passenger operations, as discussed above.

## **RAILROAD R&D PROGRAM**

At the November meeting, the R&D staff responded to requests from the committee for information on the project management process and on R&D “success stories.” The full cooperation of the R&D staff in assembling and providing these materials and in updating the information at each meeting is greatly appreciated by the committee. There is more obvious cohesion among the activities in the Track Systems Program than in the other more diverse programs, but it is difficult for the committee to keep track of the justification for each project (e.g., RSAC or Office of Safety request), and many of the projects appear to be unconnected. The committee will recommend a different report format at the next meeting that will focus more on discussion of research areas and less on project details (see below, “Themes and Suggested Format Changes for the Fall Meeting”).

## **MAGLEV DEPLOYMENT PROGRAM**

The committee has been asked to conduct a management review of the Maglev Deployment Program. However, in light of the limited latitude of FRA’s decision-making authority in relation to this program, the committee finds that there is little to review. Meanwhile, the committee again expresses its concern that the priority assigned to this program is not justified by any realistic assessment of transportation needs or market demands. Furthermore, maglev deployment is being demonstrated in China so federal expenditures on deployment projects in the U.S. are not warranted at this time.

## **THEMES AND SUGGESTED FORMAT CHANGES FOR THE FALL MEETING**

The committee plans to hold an interim meeting in fall 2003. At this meeting, the following areas will be emphasized.

**Rail Passenger Policy.** Assuming that a new administration policy on passenger rail has been issued, the committee will request a briefing on the policy details and implications for R&D. At that point, more specific recommendations as to a revised NGHSR Program can be developed.

**Policy Framework and Contextual Research.** The committee suggested in Recommendation 5 that a conference might be helpful in gathering input from industry and other expert sources on future trends and developments in the rail freight and passenger sectors. The committee will also request an update on FRA's related work and a brief presentation on the Freight Analysis Framework developed under FHWA's leadership.

**Program Updates.** The committee would like to suggest a revised format for the presentation of program and project updates at the next meeting. Although the committee appreciates the effort that FRA staff put into the preparation and presentation of detailed reports, the committee would appreciate less emphasis on the details of individual projects and more discussion of the objectives the research is trying to achieve and the problems, if any, being encountered. For the next meeting, the committee requests (preferably in advance of the meeting) summary documents listing the status of current projects, including scope, cost, time frame, schedule and schedule compliance, researchers, and reason for undertaking the project (e.g., RSAC request). Any changes in scope, schedule, and budget since the last briefing should be mentioned. At the upcoming meeting, the committee prefers to experiment with fewer detailed presentations and more opportunity for discussion. In particular, the committee would like FRA staff to discuss how the results of individual projects are being used and how they may affect the course and dynamics of the evolving R&D program. Does the result of one project affect the direction of other specific projects? If so, how?

**Human Factors Research.** The human factors research program contains a large number of rather diffuse elements. How these elements were selected or their priority was determined is not clear to the committee from the March meeting presentation. Moreover, the managerial burden associated with such a large number of elements is of concern. The committee will request a more detailed report on this subject at the fall meeting, including a report on the "close call" workshop.

**AAR/FRA Joint Research Activities.** A representative of TTCI will be invited to participate in a discussion of AAR/FRA joint research activities, with attention to both ongoing projects and future opportunities for cooperative efforts.

**Advanced Locomotive Propulsion Systems.** The committee will be interested in a detailed discussion of the potential costs and benefits of the flywheel technology in rail passenger applications at the fall meeting.

**ASCAP.** Development of a safety evaluation process for assessing emerging PTC technologies is apparently much more complex and difficult than anticipated. The demonstration of PTC in service, however, depends on gaining FRA safety office approval. This project has become critical to deployment of PTC. The committee requests a discussion of this project at its next meeting.

## **CONCLUSION**

On behalf of the committee, I again want to thank you and the FRA and Volpe staff, who continue to work so cooperatively with the committee. We particularly want to express our collective best wishes to Steve Ditmeyer, who will leave the Office of R&D this summer for a new position. Steve has served FRA well, and we expect he will continue to do well in his new position. We look forward to a continued cooperative association with you, Mark Yachmetz, Jo Strang, Grady Cothen, and the FRA staff.

I would also like to offer to meet with you personally at your earliest convenience to discuss the findings and recommendations contained in this report.

Sincerely yours,

Louis S. Thompson  
Interim Chair, Committee for Review of the FRA Research, Development, and  
Demonstration Programs

Enclosures

**Committee for Review of the Federal Railroad Administration  
Research, Development, and Demonstration Programs**

**Committee Members Attending November 14–15, 2002,  
and March 13–14, 2003, Meetings**

**Chairman**

Dr. Alan J. Bing<sup>1</sup>  
Senior Manager  
Arthur D. Little, Inc.  
November 14–15

**Members**

Ms. Anna M. Barry  
Director of Railroad Operations  
Massachusetts Bay Transportation Authority  
March 13–14

Mr. Christopher J. Boon  
President  
Boon, Jones, and Associates, Inc.  
November 14–15  
March 13–14

Ms. Olga K. Cataldi  
Booz Allen & Hamilton, Inc.  
November 14–15  
March 13–14

Dr. Sherwood C. Chu  
Bethesda, MD  
March 13–14

Dr. William J. Harris, Jr.  
Arlington, VA  
November 14–15  
March 13–14

Mr. Craig Hill  
Vice President and Chief Systems  
Maintenance Officer  
Burlington Northern Santa Fe Railway  
November 14–15

Mr. David D. King  
Deputy Secretary for Public Transportation  
North Carolina Department of  
Transportation  
November 14–15  
March 13–14

Mr. Kenneth L. Lawson  
Bluemont, VA  
November 14–15  
March 13–14

Dr. Gerard J. McCullough  
Associate Professor, Applied Economics,  
and Director of Graduate Studies  
Center for Transportation Studies  
University of Minnesota  
November 14–15  
March 13

Dr. Thomas H. Rockwell  
President  
R&R Research, Inc.  
November 14–15  
March 13–14

Mr. Thomas P. Schmidt  
Vice President–Engineering  
CSXT  
November 14–15  
March 14

Mr. Gerhard A. Thelen  
Assistant Vice President–Mechanical  
Norfolk Southern Corporation  
November 14–15  
March 13–14

Mr. Louis S. Thompson<sup>2</sup>  
Railways Advisor  
The World Bank  
November 14–15  
March 13–14

Mr. William C. Thompson  
General Manager, Rail  
Jacobs Engineering  
March 14

**Liaison Representative**

Mr. Steven R. Ditmeyer  
Director, Office of Research & Development  
Federal Railroad Administration  
November 14–15  
March 13–14

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<sup>1</sup> Dr. Bing resigned from the committee, effective January 15, 2003.

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<sup>2</sup> Mr. Louis Thompson became Interim Chair of the committee, effective January 16, 2003.

**Invited Speakers and Guests at November 14–15, 2002, and March 13–14, 2003, Meetings**

**Federal Railroad Administration:**

Mark Yachmetz, Associate Administrator for Railroad Development (November)

Jo Strang, Deputy Associate Administrator for Railroad Development (November and March)

Jane Bachner, Deputy Associate Administrator for Policy (November and March)

Grady Cothen, Deputy Associate Administrator for Safety Standards and Program Development (November and March)

Steven Ditmeyer, Director, Office of R&D (November and March)

Claire Orth, Chief, Equipment & Operating Procedures Research Division, Office of R&D (November and March)

Magdy El-Sibaie, Chief, Track Research Division, Office of R&D (November and March)

Thomas Raslear, Human Factors Program Manager, Office of R&D (November)

Michael Coplen, Human Factors Program Manager, Office of R&D (November)

Robert McCown, Acting Chief, Program Development Division, Office of Railroad Development (November and March)

Frank Roskind, Senior Industry Economist, Office of Safety Analysis (March)

James Smailes, Grade Crossing Program Manager, Office of Railroad Development (November and March)

Steve Sill, General Engineer, Program Development Division, Office of Railroad Development (November and March)

Arnold Kupferman, Magnetic Levitation Technology Deployment Program (November and March)

**Volpe National Transportation Systems Center:**

Robert Dorer, Acting Deputy Director, Office of Safety and Security (March)

Michael Coltman, Chief, Structures and Dynamics Division (March)

Jeffrey Gordon, Structures and Dynamics Division (November)

Donald Sussman, Chief, Operator Performance and Safety Analysis Division (November)

Herbert Gould, Deputy Director, Office of Safety and Security (November)

**John F. Kennedy School of Government, Harvard University:**

Cary Coglianese, Chair, Regulatory Policy Program (November)

**Transportation Technology Center, Inc.:**

John Tunna, Scientist, Engineering and Tech Services (November and March)

Ruben Pena, Manager, Business Development (March)