

May 29, 2002

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

Dear Administrator Rutter:

At the request of the Federal Railroad Administration (FRA), the Transportation Research Board (TRB) has convened the Committee for Review of the FRA Research, Development, and Demonstration Programs. As you know, the committee held its first meeting here in Washington, D.C., on April 18–19, 2002. The enclosed committee roster indicates the members who attended this meeting.*

The committee is pleased that FRA has chosen to continue an ongoing peer review of its research, development, and demonstration programs and has found the work of prior TRB committees helpful in the past.¹ The committee appreciated your participation in its meeting on April 18 and your interest in its work. On behalf of the committee, I would like to invite you to participate in future meetings to the extent possible. Regular, direct interaction with you will help provide a sharper focus for the committee's work and its recommendations to FRA. The committee's next meeting will be held in early November.

The committee also wants to thank Mark Yachmetz, Steven Ditmeyer, Magdy El-Sibaie, Claire Orth, Robert McCown, James Smailes, Arnie Kupferman, and other FRA staff, as well as Robert Ricci, Jeffrey Gordon, and Herbert Gould of the Volpe Center, for their spirit of cooperation and substantial participation in the April meeting. The materials and presentations they provided are essential to the committee's work.

¹ The TRB Committee for an Assessment of Federal High-Speed Ground Transportation R&D reviewed the Next Generation High-Speed Rail Program (NGHSR) during 1996 and 1997. That committee was followed by the Committee for Review of the FRA Research and Development Program, which conducted reviews of the safety-related Railroad R&D program and the NGHSR Program from 1998 to 2001. Both of these committees were congressionally mandated.

THE COMMITTEE'S CHARGE

FRA has asked the committee to conduct peer reviews of three programs:

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

Conduct of a program management review of the maglev program is an additional assignment for this committee. Otherwise, the committee's tasks continue those of its predecessor committee: the conduct of periodic peer reviews that specifically 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.²

This committee benefits from having FRA's recently approved *Five-Year Strategic Plan for Railroad Research, Development, and Demonstrations* as a major, initial input to the peer review process. As requested, the committee will comment on whether it believes the directions and objectives outlined in the plan are appropriate.

Your remarks at the meeting provided additional direction for the committee's work, in particular with regard to the desire for demonstrable benefits from R&D; the development of performance-based safety standards; the completion of outstanding safety rulemakings; the potential for government investment in passenger and freight railroad infrastructure; the completion of Nationwide Differential GPS (NDGPS); and the prospects for developing a 21st-century locomotive that is efficient and environmentally friendly.

In this report, the committee will first address two overarching topics that it views as critical to assessing the directions and objectives of the various programs and the Five-Year Strategic Plan. First, the committee will address the need for a policy framework for the research, development, and demonstration programs, and FRA's initial project on contextual research. Second, any new technology or process that results from research, development, or demonstration will be subject to regulation if it is to be implemented. The committee will discuss FRA's initial efforts at conducting research on how performance-based regulations might be applied to the rail safety. The remainder of the letter will focus on more specific program elements.

² A summary of the predecessor committee's letter reports, including its major recommendations, is contained in its letter report of April 24, 2001, which is included as Appendix B of FRA's *Five-Year Strategic Plan for Railroad Research, Development, and Demonstrations*.

POLICY FRAMEWORK AND CONTEXTUAL RESEARCH

In its assessment of the current direction and allocation of funds devoted to the various program areas and the appropriateness of the directions and objectives of the Five-Year Strategic Plan, the committee is concerned whether the programs' directions are related in a formalized way to either the future directions of the railroad industry or FRA's policy development. The predecessor committee recommended that FRA conduct contextual research on technological and operational developments within the railroad industry that could influence the need for safety R&D.³ This committee is pleased to see that contextual research is now formally included in the R&D program, and looks forward to seeing the initial research plans and results.

The predecessor committee understood the term "context" to mean developments initiated by industry that are *external* to FRA. However, this definition may change to include consideration of the implications of *internal* decision-making in light of the possibility of the agency's taking a more active role in transportation policy development. In the committee's view, it is highly desirable that a policy framework be incorporated into the planning and evaluation of the safety-related Railroad R&D program. This framework would be used to test Railroad R&D, and perhaps future NGHSR, projects as to whether they support FRA policies.

From your comments and those of Mark Yachmetz, it appears that policy development is being considered in relation to potential government investment in multimodal infrastructure that would encompass railroads in addition to the more traditional public expenditures on highways, transit, and aviation to meet national transportation and mobility goals. Such policy changes could require research to support decision making by quantifying the safety, performance (efficiency and service quality), and environmental impacts of alternative modal investments. Similarly, the development of a longer-term policy for intercity passenger rail may require additional research support. With FRA's overarching safety mandate, good cooperation between the Office of Safety and the R&D and

³ In its April 2001 letter report, the predecessor committee provided a summary of its rationale for recommending contextual research, as follows: "Conduct contextual research on technological and operational developments within the railroad industry that may influence the need for safety R&D. In recent years, the work of the Office of R&D has been devoted almost entirely to safety research in support of FRA's regulatory mandate. Because of the long time frame involved in planning and conducting research, results may be produced long after the need has arisen. FRA should try to anticipate tomorrow's safety issues, technology challenges, and related research needs by conducting research on the future context of freight and passenger railroad operations. Aspects of the future context of railroad operations from which safety issues could arise include increased traffic flows and strains on capacity; the relative mix of commodities in freight traffic; the mix of freight and passenger services; the introduction of new technology and equipment, both freight and passenger; mergers of rail companies; and changes in public policy concerning passenger rail."

demonstration programs is needed in planning short- and long-term research and understanding safety issues related to NGHSR projects.

Recommendation 1. The committee supports the inclusion of contextual research in the R&D program. In addition, the committee strongly encourages FRA to consider the broader policy framework—including the administration’s views of the role of railroads in the national transportation system and possible new types of public investment in railroad infrastructure—in future plans for R&D and demonstrations.

PERFORMANCE-BASED SAFETY REGULATIONS

The predecessor committees concluded that R&D, implementation of new technology, and safety regulations are inextricably combined. Those committees realized that although the overall mission of FRA’s Railroad R&D program is to serve the agency’s safety mandate, frequently the development of new technology or safety methods gets ahead of the regulatory process. Therefore, the predecessor committee made recommendations that FRA conduct research on how the application of performance standards in safety regulation can be expanded. In the April 2001 letter report, the committee summarized its views of this subject as follows: “Performance standards facilitate the introduction of new technology by expressing safety requirements as an outcome—for example, a maximum failure rate for a specific accident type—rather than as design requirements and operating and maintenance procedures.”

The committee is pleased that the R&D program encompasses performance-based regulations and that the Kennedy School project has been initiated. The committee will request a more detailed briefing on this project at its next meeting before making additional recommendations on this topic. In addition, the committee is interested in a new Association of American Railroads (AAR)/Transportation Technology Center, Inc. (TTCI) project on this subject, mentioned by a committee member, and would like to learn more about the industry approach.

In general, in considering a possible transition to performance-based regulations, the committee suggests that FRA examine not simply the approach adopted by the regulator, but also the industry’s options for complying with various regulatory approaches. Any analysis of regulatory approaches needs to address at a basic level just what kind(s) of safety management techniques and practices are likely to be successful in reducing the number of rail accidents. (The predecessor committee commented in one of its reports that the Safety Assurance and Compliance Program, through which a systemwide safety review of an entire railroad is undertaken, is a step in this direction.) The analysis would then go on to consider, given the industry’s most successful safety management techniques

and practices, what a regulator must do to protect the public interest—the safety of rail workers, passengers, and bystanders. Additional analysis would be required to understand the regulatory change *process* and how the anxieties of all stakeholders regarding such changes can be addressed.

RAILROAD R&D PROGRAM

The stated mission of the safety-related Railroad R&D program is to conduct research aimed at improving the safety of freight (Class 1, regional, and shortline), intercity passenger, and commuter railroad operations, as well as of railroad employees, passengers, motorists at grade crossings, and trespassers. The committee comments below on several aspects of this program: the need for data on root causes to support the research, FRA's development of a project evaluation and investment analysis process, and research management issues.

Data on Root Causes. There is a continuing need for good data on root causes of accidents to support effective safety-related research.⁴ The research plan encompasses continued attention to the extraction and use of available data on past accidents, as well as initiation of a detailed review of a sample of future accidents as they occur. All of these efforts should take advantage of the insights and experience of railroad management and labor and of the FRA safety team to defuse suspicions of bias.

Recommendation 2. The committee strongly encourages FRA to undertake joint government–industry efforts to develop more-comprehensive data on samplings of past accidents.⁵ In addition, the committee recommends that FRA establish procedures for a program of detailed forensic reviews of a sampling of future accidents addressing both their multiple causes and the nature and extent of their consequences. With this type of data, FRA would be able to calculate a more complete measure of “harm” for accidents resulting from various causes.⁶

⁴ The predecessor committee's April 2001 letter report includes an Annex: Existing Accident Data Sources for Root-Cause Analysis, which provides a list of databases that can be analyzed for improved understanding of accidents and accident trends.

⁵ The committee notes several approaches that have been adopted in the past to address specific safety issues: (1) the Railway Progress Institute–AAR Railroad Tank Car Safety Research and Test Project has developed an extensive database of details on tank car accidents; (2) the Switching Operations Fatalities Analysis (SOFA) project is building a database on the causes of accidents in switching operations, including human factors causes; and (3) the Railroad Safety Advisory Committee's Positive Train Control subcommittee has reviewed accidents to identify those that could have been prevented by positive train control.

⁶ In the project evaluation and investment analysis process, Volpe staff use the term “harm” to include the total of dollar values assigned to fatalities and injuries, costs of evacuations, and property and equipment damage resulting from an accident or incident.

Project Evaluation and Investment Analysis. In response to the predecessor committee's recommendation that FRA incorporate a risk-based rationale into its safety-related Railroad R&D program design, FRA and Volpe staff have been developing an R&D project evaluation and investment analysis process.⁷ In general, the committee continues to support this effort, but it also has some concerns. One specific area of concern relates to the values assigned to harm that are associated with various types of injuries. Perhaps these values could be explained more fully at the next meeting. Moreover, while the committee appreciates the work that has gone into developing this process during the past 3 to 4 years, it is concerned that the effort has not been completed for all areas of research, including the critical area of human factors. Understanding that there may be distortions in the existing data and that true accident causes are not always known, perhaps the project ratings and guidance on project selection could be provided at a somewhat lower level of detail.

Research Management. In preparation for this meeting, the committee requested that FRA staff present broad program overviews to orient those committee members who did not serve on either of the prior committees. These presentations were helpful in understanding the broad direction of the research program, but there are several issues related to research management that the committee would like to discuss at its next meeting. In particular, the committee would like more information in the areas of defining research goals, managing projects to adhere to budget and schedule, obtaining the desired output, managing industry participation (including cost sharing), ensuring quality control, and disseminating research results through multiple channels.

The committee members are favorably impressed with the Track Systems R&D program and believe the management of that program offers some lessons learned that might be shared with others. It is a cohesive program, and its projects appear to be focused on problems for which improvements in engineering and science can yield implementable results. A high level of industry cooperation characterizes the problem-solving approach of this program.

The tight meeting schedule significantly reduced the time available for presentation of the Equipment, Hazmat, and Operating Practices programs. Perhaps as a result, the committee was left with the impression that these programs are less focused—an impression that may be due in part to the nature and diversity of the subjects that must be covered. The management of these

⁷ This process begins with a review of recent rail industry harm data and an assessment of causes of potential safety hazards as a way of measuring risk. For any given accident cause or factor contributing to a hazard, fault-tree logic is applied to identify specific points in an accident chain-of-events where countermeasures could have prevented the accident, or subsequent harm, or both. Potential countermeasures are then reviewed by FRA R&D to identify those that could be developed or improved by R&D. Individual R&D projects that would support development of or improvement to countermeasures are developed and rated, and the ratings are used in project selection. (A more detailed description of the process is provided in Chapter 4 of the Five-Year Strategic Plan.)

programs is diffused by their numerous small projects, and in some cases it is not clear how priorities are set. The passenger car safety project, recommended and supported by the American Public Transportation Association, is a good example of work with direct industry involvement and the potential for results that can be implemented easily to improve safety.

The committee urges FRA to continue its focus on human factors research. Committee members had questions about several human factors projects, including whether crew resource management is an appropriate concept for use by railroads and whether the remote control study is properly scoped. The committee would like to review current projects at the next meeting, and will also ask member Tom Rockwell to report on the results of the TRB conference on human factors research needs to be held in September. Moreover, the committee intends to explore whether there is a need for more part-task simulators for use in research on the role and functions of locomotive engineers. (A part-task simulator is one on which trainees or research subjects can perform only a limited number of the engineer's tasks, but that still permits testing on some aspects of sensing, decision-making, and control. Building and operating such simulators consume fewer research dollars than full-function and full-motion simulators.) At its next meeting, the committee would also like to hear about the outcome of the workshop scheduled for September at the Volpe Center on the possible application of the Federal Aviation Administration's (FAA) "near-miss" reporting system to railroads. Additionally, FRA could consider the possibility of conducting small discussion groups among train crews to obtain information on lessons learned from past incidents and near misses that could be used to support human factors research.

NEXT GENERATION HIGH-SPEED RAIL PROGRAM

Many of the projects being conducted under this program are in their final phases. In several cases, however, there are barriers to completion or to the implementation of products that are of concern to the committee.

Positive Train Control. There is agreement between industry and government that train control improvements are required so that higher-speed passenger trains can operate jointly with freight trains on the same tracks. As a result, NGHSR funds have been provided to demonstrate two different technologies. The Incremental Train Control System project, in cooperation with Michigan Department of Transportation (DOT), now allows trains to operate on the equipped corridor at 90 mph. However, the goal of 110-mph operation is being delayed by a lack of additional funds and questions about General Electric's continued cooperation with the project. This project should be completed so that the technology can be demonstrated and evaluated.

The North American Joint Positive Train Control Initiative, funded by FRA, Illinois DOT, and AAR, is also experiencing delays. There is concern about whether Lockheed Martin can continue the project on schedule. Moreover, it is not known whether the system will ultimately benefit the freight railroads or be better suited to high-speed passenger operations.

NDGPS is needed to support positive train control systems and should be completed. In several of its letter reports, the predecessor committee recommended completion of the system, but funding has been limited and shifted from agency to agency. Only \$27 million is required now for completion of the system.

Development of a safety evaluation process (the Axiomatic Safety-Critical Assessment Process, or ASCAP) is consuming more funds and time than anticipated. The committee is concerned about the management of this project, but specific details were not provided at the April meeting and are not included in the Five-Year Strategic Plan.

Recommendation 3. The committee recommends a joint effort of the NGHSR and Railroad R&D programs to determine what additional research could assist in advancing the development of positive train control.

Recommendation 4. The committee recommends that FRA and other agencies within the U.S. Department of Transportation (USDOT) complete NDGPS. Completion of the system should be a high priority for USDOT.

Nonelectric Locomotive. Bombardier has produced a high-speed turbine locomotive, and testing has been completed. Demonstration of the locomotive in various corridors around the country is being delayed, apparently because of institutional issues that need to be resolved. Details on the operation of this locomotive by Amtrak need to be worked out. Moreover, from the reactions of several committee members, it appears that the availability of the locomotive for demonstration purposes—and potential future use of additional units—has not been conveyed effectively to potential customers, especially commuter agencies. This locomotive could be well suited to regional commuter operations where longer routes are similar to intercity corridors for which it was designed.

Recommendation 5. The committee urges FRA to resolve institutional issues associated with the nonelectric locomotive and proceed with demonstrations of the locomotive for commuter agencies, state DOTs, and other potential customers.

Advanced Locomotive Propulsion Systems. This project has produced a high-speed alternator that will be useful in the nonelectric (turbine) locomotive.

Otherwise, the committee sees no need for continued funding of this project. Even if a workable flywheel energy storage system is developed and provides improved acceleration, there would be trade-offs to accommodate the size and weight of the equipment. As a result, it appears unlikely that the flywheel system could be used in high-speed passenger trains. The predecessor committees, which had explored the project in greater detail, had also expressed concerns about the ability of this equipment to withstand the rigors of the railroad operating environment.

Recommendation 6. The committee recommends termination of the Advanced Locomotive Propulsion Systems project.

GRADE-CROSSING AND TRESPASSER RESEARCH

Because of the large number of fatalities attributable to grade-crossing accidents and trespassers, the committee urges FRA to continue to focus on the coordination of grade-crossing and trespasser safety research. Because of the fragmentation of responsibility and research in this area across a number of agencies, coordination is critical. As the Five-Year Strategic Plan emphasizes, the annual number of trespasser fatalities now exceeds that of fatalities associated with grade crossings; thus research must include this critical safety issue. Effective evaluation of the benefits of demonstration projects and communication of the project results are important for the transfer of successful technology and operating practices from the demonstration site to other locations.

MAGLEV DEPLOYMENT PROGRAM

The committee has been asked to conduct a program management review of the Maglev Deployment Program, but the necessary management details have not yet been provided. On the basis of the program overview presented at the April meeting, the committee is concerned that adequate economic feasibility studies have not yet been completed for either project being funded under this program. The committee's view is that additional federal funds should not be spent on the preparation of environmental impact statements until the investment-grade revenue estimates and refined financial and partnership plans for each project have been completed. Because a number of milestones are scheduled to occur in the next few months, the committee will review the status of the projects at its November meeting, when more information should be available.

THEMES FOR THE FALL MEETING

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

Performance-Based Regulations and Safety Management. The committee will invite the Kennedy School project director to make a presentation on the initial research project. As background, the committee would like FRA staff to provide details on the process by which the Kennedy School was selected to conduct this project. In addition, a representative of AAR/TTCI will be invited to discuss the industry's project on performance-based regulations.

R&D Management Case Studies. R&D staff will be asked to provide a few examples of past successful research projects (particularly those in which a controversial subject was addressed), including details on how information about the project results was communicated to potential users, whether the results were implemented, and what lessons were learned about project design and research methodology. In general, the committee would like to have some sense of how much FRA-funded research has been published in the open literature.

Human Factors Research. FRA and Volpe Center staff will be asked to report on the results of the workshop on the possible application of the FAA's near-miss reporting system to the rail industry. Committee member Tom Rockwell will be asked to report on the TRB conference on human factors research needs. The predecessor committee recommended more diversity in human factors researchers conducting FRA-funded projects. The committee requests a list of contractors for projects under way or completed during the last year, including Volpe subcontractors.

Security. The issue of security research related to railroad infrastructure and operations was not on the agenda at the April meeting. The committee will ask FRA staff to provide an update on research activities in this area, and, if appropriate, to invite a representative of the Transportation Security Administration to address the committee.

Policy Framework and Contextual Research. The committee proposes to help advance contextual research by convening—either as part of a future meeting or as a stand-alone workshop—a meeting of appropriate industry and government representatives to discuss factors that should comprise the context for future research.

Current Project Updates. The committee will request project updates from FRA staff.

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 look forward to this continued association.

Sincerely yours,

Alan J. Bing
Chair, Committee for Review of the FRA Research, Development, and
Demonstration Programs

Enclosure

*As is standard policy for National Research Council committees, the members of this committee meet in executive session at the outset of each meeting to discuss any potential or perceived conflicts of interest that might have arisen for any of them. The committee has agreed to abide by TRB policies for dealing with conflicts of interest that may arise in the bidding for or winning of FRA contracts by firms with which members are associated. In the interest of full disclosure, we note the following FRA-related activities.

First, FRA provides funds for two research programs that TRB administers on FRA's behalf. TRB has established policies and procedures to ensure that this committee can evaluate these programs independently of any impact its evaluation might have on TRB or the National Research Council. The Innovations Deserving Exploratory Analysis (IDEA) high-speed rail (HSR) program solicits technological innovations that may be useful in upgrading the existing U.S. rail system to accommodate operations up to 125 mph and beyond in support of FRA's Next Generation High-Speed Rail Program. In fiscal year (FY) 2001, FRA allocated \$500,000 for the HSR-IDEA Program. FRA funding for this program in FY 2002 is also budgeted at \$500,000. The Safety-IDEA program supports innovative approaches to improving railroad and motor carrier safety. It is funded jointly by FRA and the Federal Motor Carrier Safety Administration. FRA's Office of Research and Development has budgeted \$250,000 in FY 2001-2002 funds for support of the Safety-IDEA program. These IDEA programs are administered by TRB's Special Programs Division. IDEA investigations explore the feasibility of innovative and unproven new concepts or evaluate novel applications of advanced technologies to improve safety and efficiency. An IDEA contract award is a pass-through of funds to independent research entities to provide one-step, short-term support.

Second, individuals with the expertise and experience necessary to review the FRA R&D program generally have some prior or ongoing relationship with the sponsor. For example, Alan Bing explained that he has several potential conflicts of interest. The status of these conflicts is uncertain because his employer, Arthur D. Little, Inc. (ADL), will be sold to one or more buyers in the near future. ADL has two active task order contracts under which work is done for FRA. One is a contract with the Volpe Center, concerned primarily with crashworthiness research that involves mainly engineering analysis carried out by another ADL group. Under the second contract, ADL is a subcontractor to another company, funded directly by FRA, on all aspects of the R&D program. There is one active project under this contract on railroad security issues, in which Bing has no involvement. Bing's involvement with work under both contracts is currently limited to minor support of crashworthiness research. A task expected during the next 2 to 3

months from Volpe will involve Bing directly. Under this task, Bing will participate in a discussion of the application of risk analysis to safety assessment of positive train control systems for the Railroad Safety Advisory Committee's Positive Train Control subcommittee.

Third, Thomas Schmidt is also a member of the management committee for the North American Joint Positive Train Control Program, which is funded in part by the FRA Office of R&D and is being managed by Transportation Technology Center, Inc. staff. However, he does not directly participate in the work of that committee.

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

Committee Members Attending April 18–19, 2002, Meeting

Chairman

Dr. Alan J. Bing
Senior Manager
Arthur D. Little, Inc.
April 18 and 19

Members

Ms. Anna M. Barry
Director of Railroad Operations
Massachusetts Bay Transportation Authority
April 18 and 19

Mr. Christopher J. Boon
President
Boon, Jones, and Associates, Inc.
April 18 and 19

Ms. Olga Cataldi
Booz Allen & Hamilton, Inc.

Dr. Sherwood C. Chu
Bethesda, MD
April 18 and 19

Dr. William J. Harris, Jr.
Arlington, VA
April 18 and 19

Mr. Craig Hill
Vice President and Chief Systems
Maintenance Officer
Burlington Northern Santa Fe Railway
April 19 (by teleconference on April 18)

Mr. David D. King
Deputy Secretary for Public Transportation
North Carolina Department of
Transportation
April 18 and 19

Mr. Kenneth L. Lawson
Bluemont, VA
April 18 and 19

Dr. Gerard McCullough
Associate Professor, Applied Economics,
and Director of Graduate Studies
Center for Transportation Studies
University of Minnesota
April 18 and 19

Dr. Thomas H. Rockwell
President
R&R Research, Inc.
April 18 and 19

Mr. Thomas P. Schmidt
Vice President-Engineering
CSXT
April 18 and 19

Mr. Gerhard A. Thelen
Assistant Vice President-Mechanical
Norfolk Southern Corporation
April 18 and 19

Mr. Louis S. Thompson
Railways Adviser
The World Bank
April 18 and 19

Mr. William C. Thompson
General Manager, Rail
Jacobs Engineering
April 18 and 19

Liaison Representative

Mr. Steven R. Ditmeyer
Director, Office of Research & Development
Federal Railroad Administration
April 18 and 19