Review of the Federal Railroad Administration Research and Development Program: Letter Report April 2008

DETAILS

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AUTHORS

TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

April 29, 2008

The Honorable Joseph H. Boardman
Administrator
Federal Railroad Administration
1200 New Jersey Avenue, S.E.
Washington, DC 20590

Dear Administrator Boardman:

The Transportation Research Board's (TRB's) Committee for Review of the Federal Railroad Administration (FRA) Research and Development (R&D) Program held its first meeting on November 15–16, 2007, in Washington, D.C., and its second meeting in Colorado Springs, Colorado, on March 5–6, 2008. Attending committee members are listed in Enclosure 1, and participating FRA and Volpe staff and other guests are listed in Enclosure 2.

This committee's work began in fall 2007 as a follow-up to that of prior committees[1] having similar charges. Approximately two-thirds of its members, including the chair, were carried over from the predecessor committee, with the remaining members being newly appointed.

This committee is charged with conducting an annual review and evaluation of FRA's R&D program covering such topics as program management structure and approach, allocation of resources among program areas, outreach to the program's customers and stakeholders, project selection criteria, and project management.

The committee thanks those who participated in and contributed to its November and March meetings, including Jo Strang, Magdy El-Sibaie, Claire Orth, and Gary Carr of FRA; Mike Coltman and Jeff Gordon of the Volpe Center; and other members of the FRA R&D staff. Without the full cooperation of FRA management and staff, the committee would be unable

[1] The Committee for Review of the FRA Research and Development Program conducted reviews of the safety-related Railroad R&D Program and the Next-Generation High-Speed Rail Demonstration Program from 1998 to 2001. The scope of that committee's work expanded, and it became the Committee for Review of the FRA Research, Development, and Demonstration Programs, which served from 2002 to 2005 and was renewed for an additional term from 2005 to 2007.

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

500 Fifth Street, NW
Washington, DC 20001

Phone: 202 334 2934
Fax: 202 334 2003
www.TRB.org

to fulfill its charge. At the November meeting, the committee recognized the recent appointment of Magdy El-Sibaie to the position of Director of FRA's Office of R&D. The committee is encouraged by the overall direction of the program, as evidenced in the discussions during both meetings.

The committee is asked to review the major research directions of the FRA R&D program, as well as the content of the research program areas, for applicability to the needs of the program's customers and stakeholders both within and external to FRA.

The program information presented by FRA to the committee during the November and March meetings covered a broad range in terms of the level of detail, with many of the presentations focused on specific projects of varying scope and magnitude. In general, the committee thought these detailed presentations to be useful but lacking relevant information upon which the committee might make judgments. The committee's charge is to contribute at the strategic level, and it believes that it can best leverage its collective expertise if the material is organized and presented at that level. (See Future Committee Meetings and Activities below.)

This letter report will focus primarily on the updated program information as presented during the March 2008 meeting and will address the following topics:

- Stakeholder involvement in the R&D program,
- Development of a project evaluation process,
- Review of research priorities from 2006 workshop proceedings,
- Future committee meetings and activities, and
- The role of academic research in railroad engineering and transportation.

STAKEHOLDER INVOLVEMENT IN THE R&D PROGRAM

A key element of the committee's charge is to focus on "outreach to the program's customers and stakeholders." A major purpose of the 2006 workshop (see below) was to seek input from a broad range of the program's customers and stakeholders. In the proposed project evaluation process (discussed in the following section), two evaluation factors relate to stakeholder opinions and support. In many ongoing projects that have not been subjected to this process, however, the committee does not see adequate evidence of internal or external stakeholder involvement in project selection and conduct nor evidence of support from the relevant stakeholders

who would be required to act if the research produced positive results. The following are a few examples of concern to the committee:

- Cab Technology Integration Laboratory (CTIL): Who are the stakeholders? What are the goals of the research that will be undertaken in this laboratory? Will it duplicate industry simulators? The committee fears that a stand-alone laboratory facility at Volpe will be costly and may not allow adequately for the needed integration with high-priority R&D efforts such as positive train control (PTC), close call reporting, and computer-assisted train handling.
- Tank car research: Has research been adequately coordinated with all stakeholders so that the results of the research will be likely to have a practical use? Have all the major failure modes of tank cars in accidents been accounted for in the research, and what are the related effects on risk? Is the FRA program looking toward the Notice of Proposed Rule Making and comment process to see what concerns about the research process may surface?
- Grade-crossing research and new 5-year plan: Many more different types of stakeholders need to be brought into the process, including experts in driver behavior and in trespass and suicide prevention. The committee believes that FRA can play a stronger role in integrating recent research results and ongoing deployment activities aimed at making better use of scarce resources for reducing crossing accidents and trespasser fatalities.
- Electronically controlled pneumatic brakes: Is FRA maximizing the opportunity to develop new performance-based rules, with (perhaps) accelerated safety, capacity, and efficiency benefits in subsequent deployments by industry?
- PTC: Is FRA adequately supporting ongoing research in functionality and interoperability of PTC components? We note that the former Association of American Railroads (AAR)–FRA–Illinois Department of Transportation North American Joint PTC project has moved from Illinois to the Transportation Technology Center (TTC), while Amtrak continues developments in both Illinois and Michigan and some efforts continue in Alaska. Is FRA working closely with AAR, Amtrak, Alaska Railroad, and their system engineers to get the most out of these endeavors?

Recommendation 1. Until a formal project evaluation process is implemented for project selection, the committee recommends that each project profile identify the customers and stakeholders, including those internal to the agency such as the Office of Safety and the Railroad Safety Advisory

Committee, particularly noting those activities intended to support regulatory rule makings, and secure tangible evidence of support from the relevant stakeholders before proceeding.

DEVELOPMENT OF A PROJECT EVALUATION PROCESS

A revised version of a project evaluation process was presented at the November meeting, and several committee members provided informal feedback. (At the March meeting, it was not made clear whether that feedback was considered during revisions of the process.) As a management tool, such a process can provide useful direction for the program. The work is encouraging but needs improvements and should be accelerated.

Many different criteria are proposed, all of which contribute to a ranking evaluation, but there are no pass/fail criteria. Many of the criteria selected could be used as pass/fail tests, leading to an evaluative ranking for elements that can be used to differentiate the projects that pass. An example of a pass/fail test would be clear support from stakeholders who would be required to act if the research produced positive results. Unless the research results are intended to support FRA's regulatory function, lack of stakeholder support should cause the project to fail the test, not merely to get a low mark.

The success of the process will depend on how rigorously it is applied across all types of projects.

Recommendation 2. Development of a project evaluation process should be accelerated, and the enhanced process should be put into practice. Stakeholder identification and involvement should be an important element. Sensitivity analysis should be conducted to demonstrate how certain variables drive the outcome. The process should be benchmarked against some sample industry processes (including AAR's process) to determine best practices. Not all evaluators should be the researchers themselves. When the process is put into practice, FRA staff should keep track of (new) projects that have been evaluated to determine whether the forecast dimensions of achievement are being realized. Using the process may slow down initiation of projects, which in turn may place some projects out of step with the budget cycle and have budget implications for future years, but this is

to be expected when a formal appraisal system is put in place where previously there was none. Once the process is put into practice, the committee would like to see evidence concerning how it affects decision making with regard to project selection and cancellation.

REVIEW OF RESEARCH PRIORITIES FROM 2006 WORKSHOP PROCEEDINGS

In April 2006, at FRA's request, the prior committee held a Workshop on Research to Enhance Rail Network Performance. The committee, in consultation with FRA, selected three critical issues—safety, capacity, and efficiency—as organizing themes for the workshop, with the synergy among them providing a perspective on technology progress applicable to the overall rail system. Summaries of the workshop content are contained in TRB's *Conference Proceedings on the Web 3: Research to Enhance Rail Network Performance* (the full text of the report is available at http://onlinepubs.trb.org/onlinepubs/conf/CPW3.pdf).

The current committee continues to look for a better correlation between FRA's research activities and outcomes and the workshop results, particularly priority areas identified by the committee on the basis of stakeholder input. We recognize that some initiatives are being addressed actively (see below). As for priority areas not yet being addressed, the committee encourages FRA to include targeted work in these areas in future budget cycles.

Proceedings on the Web 3 contains the committee's consensus selection of recommended research directions for FRA's R&D Program, starting with the highest priority, as follows:

Priority Research Direction	**Committee's Comments on Current FRA Research**
PTC and related technologies	FRA gave a particularly good overview presentation on PTC technology components being researched. The current focus on lower-cost options that provide some improvement is encouraging, but FRA's PTC research needs a broader scope, including stronger collaboration with industry efforts. Research is still greatly needed on more adaptive safe braking algorithms for vital PTC aimed at achieving *both* safety and capacity goals.

Performance-based standards, use of benefit–cost and risk-based analysis, and improved accident/incident data	One example project discussed by FRA is the Generalized Train Movement Model, an update of ASCAP, which is developing movement algorithms for risk assessment. This model is critical in enabling PTC deployments.
Highway–rail–intersection safety and trespasser casualty mitigation	A new 5-year plan for grade-crossing research is being started, and FRA's focus is on low-cost improvements. As mentioned above, the committee encourages FRA to integrate recent research results and deployment activities to utilize scarce resources effectively.
Human resource management	FRA gave presentations on human–systems integration (HSI) for railroad applications and on CTIL. In conjunction with rethinking the CTIL investment as the committee recommends, FRA might add computerized train-handling assistance to its human–machine interface research agenda. The committee is interested in HSI for railroad applications. (See future activities, below.)
Network capacity analysis	FRA did not present any related research. In future work, FRA might explore possibilities for integration of PTC safe braking performance studies, train length and weight estimation, and advanced train position determination as part of this and the PTC enabling research activity.
Energy efficiency and environmental issues	The committee noted that nothing was said about climate change and its implications for the rail industry. The committee encourages FRA to review the recent TRB publication *Special Report 290: Potential Impacts of Climate Change on U.S. Transportation* for its possible applicability to FRA R&D priorities. (*Special Report 290* is available at http://onlinepubs.trb.org/onlinepubs/sr/sr290.pdf.)

In *Proceedings on the Web 3*, the committee endorsed the continuation or completion of the following FRA research:

Research Project or Area	**Committee's Comments on Current FRA Research**
Completion of the Nationwide Differential Global Positioning System Network	This work is now being managed by the Research and Innovative Technology Administration. Funds have been requested for maintenance and operation but not for system expansion and completion. The committee emphasizes the ongoing importance of this key enabling technology.
Continued development and deployment of PTC technology	As noted above, FRA should increase its collaboration with AAR and Amtrak, specifically the work actually being done by four major Class I railroads, which are working with the same vendor.
Continuation of ongoing fundamental research on key railway materials and components, including materials and designs for equipment, wheel–rail dynamics, braking technologies, and wayside detection devices	Presentations were given on a number of ongoing projects in this area. Undetected rail defects are the railroads' primary concern with regard to track, and nondestructive testing of rail needs to improve. Not much work is being done on defects in wheels and axles. The committee urges increased FRA collaboration with the AAR research ongoing at TTC.
Confidential Close Call Reporting System (C3RS) demonstration project	The committee is pleased to see that research begun in 2002 on the C3RS has evolved into ongoing pilot operations on two railroads. Several other railroads have expressed interest in setting up additional sites. The results so far appear promising, and the research should be encouraged.
Tank car safety and hazardous materials risk research	See comment above under Stakeholder Involvement in the R&D Program. There is concern that the FRA-sponsored R&D does not adequately address some of the important failure modes of tank cars in accidents.

FUTURE COMMITTEE MEETINGS AND ACTIVITIES

Although the committee is supportive of the vision and direction of the program, it was largely disappointed in the uneven quality and preparation of many of the presentations at the March meeting. A significant quantity of material did not appear to be ordered in terms of priority or strategic questions, leaving the committee to assimilate much detailed material without understanding FRA's purpose in presenting it. The committee can be most helpful to FRA when it operates at a strategic level. Some of the presentations about projects may have been interesting to individual members, but they provided the committee with little or no opportunity to add value. Future presentations should indicate why information on projects or groups of projects is being presented to the committee, what the key issues are, what is new since the project was previously discussed with the committee, and what looks promising. If presentations on particular projects are necessary, they should provide more relevant information; the "quad-chart" format that we saw last year was helpful in providing relevant information in a succinct manner, and we encourage staff to return to that format.

At the fall interim meeting, the committee will plan to spend a day in a workshop setting on HSI for railroad applications. The purpose of the workshop will be to share perspectives among the committee, FRA staff, and invited railroad industry representatives on the concepts, cost-effectiveness, and risk-reduction benefits to be derived from taking a system development perspective that is driven less by available technology and more by the needs and requirements of the work environments and personnel who staff those positions. In the military and some other industries, the dimensions of HSI include the following factors: manpower and personnel (including identification of personnel needs, recruitment, selection, and job design), training, occupational health, system safety, human factors associated with system design, and habitability (physical design of working environments).

Anticipated outcomes of the workshop will include the following:

- Clarification of FRA's strategy and role in supporting industry needs with standards and product improvements to be implemented,
- Improved industry understanding of the cost-effectiveness of taking a broad perspective on human considerations in system design,
- Introduction of the scope of methods and tools that are available to accomplish HSI objectives, and
- An interim letter report to summarize the presentations and discussion.

ROLE OF ACADEMIC RESEARCH IN RAILROAD ENGINEERING AND TRANSPORTATION

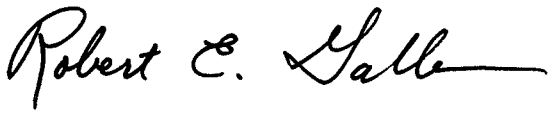
At the request of the committee, FRA briefly reviewed the portion of its program that is being conducted at universities. The earmarks that have funded this research until recently no longer exist. The committee encourages FRA to play a larger role in supporting rail research and education at academic institutions for the following reasons:

- Technical problems being addressed by FRA could be exposed to a broader segment of cutting-edge engineering and technology talent in all disciplines at universities possessing the relevant expertise.
- By supporting faculty and graduate student research in rail transportation, FRA could help educate a new generation of railroad engineering and technology professionals, enlarging the candidate pool for industry positions at a time when the workforce is aging.
- Faculty with funded research in railroad problems are more likely to teach related courses, thus leveraging their knowledge in the classroom and further expanding the audience of young people exposed to the possibility of careers in the railroad industry.

CONCLUSION

On behalf of the committee, I again thank the FRA staff who continue to work so cooperatively with the committee. We look forward to a continued cooperative association with Magdy El-Sibaie and FRA R&D staff in performing additional reviews of FRA's R&D activities. Much remains to be done, but the benefit of doing it well will be great.

Sincerely yours,



Robert E. Gallamore
Chair, Committee for Review of the FRA Research and Development Program

Enclosures

Enclosure 1

Committee Roster
with November 15–16, 2007, and March 5–6, 2008, Meeting Attendance Noted

Chair

Dr. Robert E. Gallamore
Rehoboth Beach, Delaware
November 15–16, March 5–6

Members

Dr. Christopher P.L. Barkan
Associate Professor and Director
University of Illinois, Urbana-Champaign
November 15–16 via teleconference, March 5–6

Mr. Vernon W. Graham
Vice President, Engineering Operations
Canadian Pacific Railway Company
November 15–16

Mr. Craig Hill
Vice President, Mechanical and Value Engineering
BNSF Railway Company
November 15–16, March 5–6

Mr. Anson C.R. Jack
Deputy Chief Executive, and Director, Policy, Research, and Risk
Rail Safety and Standards Board, United Kingdom
November 15–16, March 5–6

Mr. Charles R. Lynch
Vice President, Operations Manager South
Gannett Fleming Transit & Rail Systems
November 15–16, March 5–6

Mr. James W. McClellan
Vice President
Woodside Consulting Group
November 15–16, March 5–6

Ms. Audrey L. Milroy
Systems Engineering, Subject Matter Expert
QTEC, Inc.
November 15–16, March 5–6 via teleconference

Dr. Richard W. Pew
Principal Scientist
BBN Technologies
November 15–16, March 5–6

Dr. Ian P. Savage
Distinguished Senior Lecturer
Northwestern University
November 15–16, March 5–6

Mr. Patrick B. Simmons
Director, Rail Division
North Carolina Department of Transportation
November 16, March 5–6 via teleconference

Mr. David R. Solow
Chief Executive Officer
Southern California Regional Rail Authority
November 15–16 via teleconference, March 5–6

Mr. James Stem
Alternate National Legislative Director
United Transportation Union
November 15–16, March 5–6

Mr. Gerhard A. Thelen
Vice President, Operations Planning and Support
Norfolk Southern Corporation
November 15–16, March 6

Liaison Representative

Mr. Roy A. Allen
President
Transportation Technology Center, Inc.
Nov. 15 via teleconference, March 5–6

Enclosure 2

Invited Speakers and Guests at November 15–16, 2007, and March 5–6, 2008, Meetings

Federal Railroad Administration

Jo Strang, Associate Administrator for Safety (November 15)

Magdy El-Sibaei, Director, Office of R&D (November 15, March 5-6)

Claire Orth, Chief, Equipment and Operating Procedures Research Division, Office of R&D (November 15)

Gary Carr, Chief, Track Research Division, Office of R&D (November 15, March 5-6)

John Punwani, Program Manager/Train Occupant Protection (Locomotives) (March 5-6)

Eloy Martinez, Program Manager/Occupant Protection (Passenger) (November 15)

Thomas Raslear, Program Manager/Human Factors (November 15)

Michael Coplen, Program Manager/Human Factors (November 15)

Mike Jones, Program Manager/Human Factors (March 6)

Leonard Allen, Program Manager/Intelligent Railroad Systems (March 5-6)

Terry Tse, Program Manager/Train Control (November 15 via teleconference, March 6)

Luis Maal, General Engineer, R&D Facilities and Test Equipment (March 5-6)

Francisco Gonzalez, III, Program Manager/Hazardous Materials (March 5-6)

Charles Nurse, Director, Office of Acquisition and Grant Services (March 6)

Volpe National Transportation Systems Center

Mike Coltman, Division Chief, Structures and Dynamics (November 15, March 5-6)

Jeff Gordon, Structures and Dynamics Division (March 5)

Transportation Technology Center, Inc.

Semih Kalay, Vice President, Research and Development (March 6)

David Davis, Chief, Research Products (March 6)

Dingqing Li, Senior Principal Engineer and Government Program Manager (March 6)

Ruben Pena, Deputy Director – D.C. Office (March 6)

Alan Polivka, Assistant Vice President, Communications and Train Control Technologies (March 6)

Harry Tournay, Senior Scientist (March 6)