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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

September 7, 1994

HAND-DELIVERED

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20554

Re: Ex Parte Filing in PR Docket No. 92-235

Dear Mr. Secretary:

Transmitted herewith for filing as an ex parte presentation on behalf of the Association of American Railroads is a copy of a letter dated July 13, 1994, from the Honorable Jolene Molitoris, Administrator of the Federal Railroad Administration (FRA) to the Honorable Reed Hundt, Chairman of the Federal Communications Commission; and a copy of the FRA's report to Congress dated July, 1994, entitled "Railroad Communications and Train Control."

Copies of these documents have been made available by the Association of American Railroads to the Chief of the Private Radio Bureau and members of the Private Radio Bureau staff in connection with PR Docket No. 92-235.

Any questions regarding this matter should be directed to the undersigned.

Sincerely,

Thomas J. Keller

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U.S. Department
of Transportation
Federal Railroad
Administration

Office of the Administrator

400 Seventh St., S.W.
Washington, D.C. 20590

JUL 13 1994

The Honorable Reed Hundt
Chairman
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Dear Chairman Hundt:

The Federal Railroad Administration (FRA), on behalf of the Secretary of Transportation, is responsible for carrying out various statutory responsibilities concerning railroad safety and other matters affecting railroad operations.

The FRA is familiar with the proposal of the Federal Communications Commission (FCC) in the pending Notice of Proposed Rulemaking (NPRM), 7 FCC Rcd. 8105 (1992). Because the railroad industry in the United States is a major user of radio communications equipment operating on frequencies that are the subject of the FCC's spectrum refarming proceeding, the FRA has a significant interest in these proposals.

In September 1992, as part of the Rail Safety Enforcement and Review Act (PL 102-365), Congress required an assessment and review of the potential for advanced train control systems providing positive train separation which would be interoperable and compatible over all railroads in North America. This report will be forwarded to Congress during July 1994.

FRA's work on this study confirmed that voice and data radio capabilities are essential to railroad safety, a point that the Commission has long recognized. That dependence will increase as the railroads play a growing role in the national transportation system.

Railroads provide over one billion ton miles of transportation service each year. The significant growth of intermodal service is resulting in higher train speeds and more frequent train movements. The importance of commuter rail service is continuing to grow as streets and highways become more congested and Clean Air Act requirements begin to influence local transportation planners through the Intermodal Surface Transportation Efficiency Act. Further, the Department of Transportation is committed to promoting high speed rail as a

viable alternative for major corridors and to establishing world class passenger service through the National Railroad Passenger Corporation (Amtrak).

Though most freight railroads are privately owned, they constitute an important national asset, because they offer environmentally sound and fuel-efficient alternatives to increased congestion in other modes of transportation. Utilizing this important transportation capacity safely will require a heavier reliance on communication and control functions using radio frequencies as key linkage. Publicly-sponsored commuter and passenger service will depend even more heavily on those functions, because of the critical nature of safety requirements and the density of rail operations in major urban areas.

FRA is aware that the Commission is exploring options for more efficient use of available radio frequency spectra, and we appreciate the importance of this effort for all users, including transportation operators. However, we are concerned that the proposed refarming plan as initially conceived would have the following unintended consequences: (1) increase interference to railroad users by placing nonrailroad users on very closely spaced adjacent channels interleaved with railroad channels; (2) complicate frequency management by interjecting third parties, and (3) unnecessarily limit capacity for data communications.

Voice radio interference and spectrum management. Adjacent channel interference and congestion of available frequencies are an important public safety concern because railroads rely upon radio communication to send train movement authorities, emergency warnings, and requests for emergency response. Having ready access to this communication medium and avoiding conflicting transmissions that can lead to confusion or operational error is very much in the interest of communities through which railroads operate as well as rail passengers.

FRA urges caution in the migration to more narrow channel centers, with each step taken only as technology and its application are demonstrated to be ready. Further, appropriate consideration should be given to utilization of existing rail equipment, including radio retransmission facilities located along 145,000 miles of the National rail system. Premature expenditures on replacement of equipment will result in higher charges to rail shippers or reductions in capital outlays for other safety-relevant purposes, such as renewal of track or replacement of rolling stock.

The Association of American Railroads provides a useful service in managing assigned railroad frequencies, making adjustments as necessary to meet the changing needs of the industry. This

ensures a high degree of compatibility of railroad radio equipment and prompt adjustments when new service is established or existing railroads merge. Railroads must be given the tools required to service the public interest. The Commission's continued authorization of the Railroad Radio Service is imperative.

Data radio capacity. Loss of life and property continues to occur on the railroads as a result of the fact that positive train control systems are not widely deployed. FRA is encouraged that the railroads are actively exploring implementation of communication-based technologies that provide positive train control at a more affordable cost and as a part of systems that can also make the railroads more efficient. The Commission has fostered these developments by allocating 6 channel pairs in the 900 mHz band for use by Advanced Train Control Systems.

The railroads are now beginning to actively utilize these frequencies for business purposes that will be critical to offsetting the costs of safety applications. Concern is arising that capacity may be a limiting factor. As a result, railroads are exploring the use of the 160 mHz frequencies for data, as well as voice, to supplement the ATCS frequencies.

FRA is advised by the Institute for Telecommunications Sciences that there is significant reason to be concerned by the refarming proposal to the extent it would eventually narrow band widths to 5 kHz and interleave nonrailroad users. This could prevent railroads from using two or more adjacent channels to transmit large quantities of data needed for train control and other purposes. Should this occur, the railroads might elect not to invest in communication-based train control systems; and the infrastructure costs of more traditional systems would likely be prohibitive for most applications. Consequently, the industry would continue to experience collisions, overspeed derailments and other accidents preventable through positive train control.

FRA is currently working with the Union Pacific Railroad and the Burlington Northern Railroad on a test program to demonstrate positive train control using communication platforms in both the UHF and VHF spectra. FRA will also be promoting positive train control through the next-generation high speed rail program. It is a priority goal of the FRA to promote widespread application of positive train control by the year 2000. The availability of highly capable data radio will be critical to these efforts.

Finally, I want to extend my thanks to the staff of the Commission for briefing FRA staff and helping us to gain a better understanding of the important effort in which you are engaged. It is our hope that our comments will assist the Commission in moving forward in such a way that progress can be made both with respect to transportation safety and the efficient use of radio frequency spectra.

Sincerely,

Jolene M. Molitoris

Jolene M. Molitoris
Administrator

cc: Ralph Haller
Chief, Private Radio Bureau

Joseph Levin
Chief, Policy and Plans Branch

Doron Fertig
Economist, Policy and Plans Branch

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U.S. Department of Transportation

Federal Railroad Administration

Railroad Communications and Train Control

Report to Congress

RECEIVED

SEP - 7 1994

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

Office of Safety

July 1994

US Department
of Transportation

**Federal Railroad
Administration**

Administrator

**400 Seventh St., S.W.
Washington, D.C. 20590**

JUL 8 1994

The Honorable Albert Gore, Jr.
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

Pursuant to the authority delegated to me by the Secretary of Transportation, the Federal Railroad Administration (FRA) submits the enclosed report on "Railroad Communications and Train Control," as required by the Rail Safety Enforcement and Review Act, Public Law 102-365. This report responds to the Congressional mandate to assess safety requirements relating to radio communications, existing advanced train control systems (ATCS), and potential Federal regulations requiring ATCS compatibility and positive train control (PTC) to prevent collisions in the railroad industry.

During the preparation of this report, FRA began discussions with railroads, rail labor, and suppliers, in a cooperative approach to address the real safety challenges confronting the industry. These discussions have already produced positive action on the testing of PTC systems, and I am confident that such cooperative effort will be able to move PTC technology forward towards FRA's high-priority goal of combining private and public sector efforts to foster deployment of contemporary PTC systems on high-risk rail corridors by the year 2000.

On behalf of the FRA, I am pleased with the encouraging vision for the future outlined in this report. I look forward to working with Congress to advance our shared objective of improving safety in the railroad industry.

A copy of this report has also been sent to the Speaker of the House of Representatives.

Sincerely,

Jolene M. Molitoris

Jolene M. Molitoris

Enclosure

U.S Department
of Transportation

**Federal Railroad
Administration**

Administrator

**400 Seventh St., S.W.
Washington, D.C. 20590**

JUN 8 1994

The Honorable Thomas S. Foley
Speaker of the House of Representatives
Washington, D.C. 20515

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Sincerely,

Jolene M. Molitoris

Jolene M. Molitoris

Enclosure

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Executive Summary

INTRODUCTION

Recent tragedies in the railroad industry have again focused attention on the prospects for improving railroad safety through enhanced radio communication and implementation of advanced train control systems (ATCS). ATCS has the potential to prevent future accidents such as the collision between multiple-unit commuter trains at Gary, Indiana, on January 18, 1993, in which seven passengers died, and the collision between trains of the Union Pacific and Burlington Northern railroads at Longview (Kelso), Washington, on November 11, 1993, in which five employees lost their lives.

The Clinton Administration is strongly committed to improving safety on all modes of transportation, and this objective is one of the seven core goals of the Department of Transportation's Strategic Plan announced by Secretary Federico Peña in January 1994. In this report, the Federal Railroad Administration (FRA) expands on a Congressional mandate to evaluate ATCS and enhanced radio communications and finds that positive train control (PTC)--which, as a component of ATCS, can enforce speed and movement restrictions--is nearing a point at which it can begin to be used on railroads to eliminate injuries and deaths caused by train-to-train collisions. FRA recommends a series of steps to encourage the implementation of PTC systems on high-risk rail corridors by the year 2000.

Both through the Association of American Railroads (AAR) and through individual companies' efforts, the railroad industry has made great strides towards the development of ATCS over the last twelve years. The AAR has developed technological standards to ensure that equipment from different suppliers will be compatible, and certain railroads have implemented basic ATCS technologies for purposes such as replacement of landline communications. However, ATCS systems are not yet available in off-the-shelf form, nor is much of the research and development necessary to full implementation completed.

In a departure from the past, FRA is working with railroad management, labor, and suppliers in a collaborative effort that does not at this time require a formal regulatory proceeding but still advances FRA's safety agenda. Consultations leading to this report have already fostered concrete action on PTC: in May, the Burlington Northern Railroad and the Union Pacific Railroad announced a joint venture to pilot-test a basic PTC system on their high-density lines in Washington and Oregon, including the site of the Longview, Washington, collision. FRA will monitor and support this effort, and AAR will work with the railroads to ensure that the new system will work with other ATCS-type train control systems.

FRA reviewed the costs and benefits of PTC, using accident prevention estimates developed with the AAR and the Brotherhood of Railroad Signalmen and cost estimates provided by the AAR. That analysis reveals that a requirement of *universal* PTC cannot be justified at the present time based on accident avoidance alone. However, implementing PTC on major corridors is an important safety objective. FRA's near-term goal is to identify corridors--such as those which carry high traffic levels, passenger service, or hazardous materials--on

which PTC is important and justifies the cost. Should the results of this work indicate that application of PTC to certain corridors would be cost beneficial, FRA would propose to require its implementation on those routes.

Development of ATCS and PTC provides an important opportunity to improve railroad safety, increase railroad productivity, and promote the development of new technologies with commercial applications. FRA will continue its collaborative effort to ensure that the safety technology of PTC and ATCS evolves and moves closer to full implementation. FRA is confident that this new partnership will produce real advances towards PTC implementation. In addition, FRA will progress its corridor risk analysis to determine if PTC is warranted on particular categories of rail lines and propose any needed regulatory action to ensure this is accomplished.

THIS STUDY

In September 1992, as part of the Rail Safety Enforcement and Review Act (PL 102-365), Congress required the Secretary of Transportation to conduct an inquiry into the Department's railroad radio standards and procedures. The Act required an investigation into the effectiveness of radios in emergency situations; the effect of interference on safe operation; ways in which technologies such as digital radio can be implemented to enhance safety; and the status of ATCS. Congress also required an assessment of potential regulations mandating that locomotives be equipped with radios allowing crews to communicate with dispatchers and crews on other trains, and that radios be made available at intermediate terminals; and a review of the potential for ATCS to provide positive train separation which would be compatible nationwide.

On behalf of the Secretary, FRA conducted an inquiry which included extensive field surveys, lengthy consultation with railroad management, labor, and suppliers, a review of ATCS by the Institute for Telecommunications Sciences, and opportunity for public comment.

POSITIVE TRAIN CONTROL SYSTEMS

Over the last decade, ATCS has been seen as the ultimate extension of the use of radio in rail operations. Under ATCS, dispatchers would communicate with road crews via digital radio signals to an on-board computer terminal, eliminating the need for voice-communicated orders. The on-board terminal would be continuously updated with information including speed limits, work in progress on the right-of-way, the location of the preceding and following trains, and road and motive power conditions. ATCS would provide capability for positive train control (PTC), through use of an on-board computer and communications links to a control center. Under ATCS, the brakes would be applied automatically if necessary to keep trains apart, enforce a permanent or temporary speed restriction, or stop the train short of a switch not properly lined for that train or other known obstruction (such as on-track maintenance equipment). At some point after much development and implementation, ATCS

could replace existing signal and train control systems and facilitate the more efficient use of existing rail lines.

It is possible to develop PTC technology that provides varying levels of operation, depending on how much or how little of the current signal and control system is to be retained. It is also important to ensure that PTC equipment is interoperable--that different systems installed on different railroads can be used together, due to modern practices in which many locomotives operate over other railroads' lines. A PTC system that is overlaid on existing signal systems and provides enforcement of occupancy and speed restrictions can be referred to as "basic PTC." A PTC system that is "vital" (has failsafe characteristics), and is capable of replacing fixed block signal systems, can be referred to as "enhanced PTC."

Beginning in 1982, the AAR and the Railway Association of Canada (RAC) began investigating ATCS and formulating standards for ATCS throughout the industry. The FRA has found that the AAR is well advanced in its pursuit of standardized ATCS goals and specifications, and that those specifications are at a high state of readiness.

As conceived by the AAR and RAC, "ATCS" is much broader than train control. The ATCS communication platform can be used to replace landlines (pole line elimination), carry work orders for placing and picking up cars at shipper locations, report information on the "health" of an en-route locomotive to a maintenance facility, and perform other nonsafety functions. However, many of these beneficial aspects of ATCS have already been implemented through lower-cost separate systems, none of which has the capability to include positive train control.

The Potential of Communication-Based PTC

Contemporary PTC systems have the potential to improve management of train operations in a variety of ways and at lower cost than conventional automatic train control systems. Depending upon the technology employed, PTC technologies can:

1. **Ensure positive train control.** This capability would override the engineer's controls by braking the train when necessary to enforce speed restrictions, avoid collision with other trains, or ensure that the train will stop short of a known obstruction. In ATCS, an on-board computer would compare the location and speed of the train with a constantly-updated database of train orders, work orders, and speed restrictions, and would apply the brakes to stop or slow the train if the engineer made an error.

2. **Maintain flexible blocks.** With advanced PTC capabilities, railroads will not have to rely on fixed-length blocks and signals to keep trains separated safely. Different trains have different stopping requirements, and routes that carry mixed traffic (heavy commodity traffic; light, fast, intermodal traffic; or high speed passenger trains) currently require all trains to maintain the minimum separation of the trains that take

the longest distance to stop. Trains can be more closely spaced without impairing safety, because each train's braking capacity is taken into account.

3. **Enhance train management.** Under an advanced PTC system, train location is known at all times at the central dispatching center. As a result, train pacing, planning of meets and passes, and dispatching of trains from terminals can be managed with greater precision, improving fuel and crew utilization and gaining valuable time available for roadway work between trains.

4. **Improve accuracy in train communications.** Some forms of advanced PTC would be implemented with on-board computers and digital radio contact. Through this system, train orders and track warrants that are now sent by voice radio--spoken by the dispatcher and copied down by the crew--would be transmitted from the central dispatch computer directly to the displays of the on-board terminal, without the potential for misunderstanding or miscopying.

5. **Maintain constant communication.** Certain forms of PTC technology will require a virtually seamless digital radio contact (current radio contact still has some gaps caused by terrain and other factors), and this capability together with digital transmission of movement authorities will facilitate more efficient operation of trains. An important side benefit is the availability of another means of sending emergency messages, should voice radio communications not be established.

6. **Provide information to the locomotive engineer.** In certain PTC technologies, the on-board computer would give road crews a complete, continuously updated picture of the track ahead, including switch positions, work in progress, and speed limits. Like automatic cab signals, which would also be displayed, this kind of information will assist the engineer in sound train handling.

The Cost/Benefit Analysis of PTC

Working together, the AAR, the Brotherhood of Railroad Signalmen, and FRA developed an estimate of accidents preventable through PTC systems. FRA and AAR then utilized AAR estimates of cost as a basis for cost/benefit analysis of requiring the universal application of PTC. These reviews indicated that the savings from PTC would not cover the costs of installation.

FRA, AAR, and labor representatives identified 116 accidents between 1988 and August 1993 (5.67 years) which could have been prevented by a PTC system. Using the agreed-upon assumptions and the standard values that FRA uses to evaluate avoided fatalities, FRA estimated that the savings from PTC would be approximately $34.5 million per year.

AAR has estimated the cost of universal PTC at $843 million for a system providing only a warning to the crew (without automatic braking) to $1.1 billion for a system replacing current signals altogether. A PTC system providing enforcement of movement limitations using information largely gathered from existing signal systems (where available) was estimated at $859 million.

While a *universal* PTC requirement could not at present be warranted on the basis of cost and safety benefits alone, the benefits of PTC may justify the costs in certain corridors with certain characteristics, including the presence of passenger trains, hazardous materials, or higher levels of congestion. Similarly, further development of PTC technology may result in cost reductions or increases in benefits that may make universal application practical in the future. Thus, FRA will continue to support PTC research, development, and implementation in a number of ways.

Positive Train Control and FRA's Technology Goals

Secretary Peña has made promotion of technological development one of the seven core goals of the Department of Transportation. Assisting and leading the development of PTC technology is a major way in which DOT can make use of technological innovation to improve the Nation's infrastructure and increase American economic competitiveness.

Enhanced PTC technology can advance each of the three primary goals of the FRA's Research and Development program:

1. **Improve railroad safety.** PTC enforcement capability promises virtually to eliminate main line collisions, overspeed derailments, and accidents involving roadway workers and their equipment operating under specific authorities.

2. **Improve railroad productivity.** After decades of downsizing to avoid the costs of excessive track capacity, recent growth in rail traffic has begun to strain the capacity of certain high-traffic rail corridors. Enhanced PTC makes possible more precise scheduling of train movements, effectively increasing capacity. Increased capacity will make possible additional rail commuter service in regions where freight traffic is heavy and excess rail lines are not available for dedicated use, and reduce delays to the host railroad's freight operations, holding down the costs passed on to commuter service funding agencies. Freight railroad companies will also have additional flexibility to accommodate the growth of time-sensitive intermodal freight service.

3. **Facilitate the introduction of high speed ground transportation in the United States.** By continuously maintaining automatic oversight of train movements, increasing track capacity, and allowing dispatchers safely and efficiently to handle trains going at vastly different speeds, PTC will improve the financial feasibility of upgrading existing corridors to handle high speed service safely.

Development of next-generation PTC technologies will also provide opportunities for defense-related industries to team with established rail suppliers and convert defense technology to commercial production. Once demonstrated and accepted, communication-based PTC technology will have a potential market including every railroad in North America and elsewhere in the world, and related technology will have applications for every mode of transportation and the military.

FRA Actions:

This study has determined that the AAR/RAC ATCS specifications provide a sound basis for further development. Although cost/benefit analysis does not presently support requiring the installation of basic or advanced PTC on all railroads, this study has found significant potential benefits of PTC systems and advanced PTC research and has identified the need to take several actions. Specifically, FRA will--

- ***Conduct a risk assessment to determine which conventional rail corridors may warrant application of PTC technologies; and develop proposed safety standards consistent with the findings.***

  FRA will begin a risk assessment study to determine which corridors could benefit most from PTC. For FY 1995, FRA has requested $400,000 for the first year of a two-year effort to develop a model to evaluate PTC safety needs on major rail corridors. While requiring universal application of PTC would not be cost beneficial under present conditions, certain corridors may reap greater benefits from PTC application than the national rail system as a whole. For instance, lines carrying heavy passenger or hazardous materials traffic may experience greater risk with respect to frequency or severity of a preventable accident.

- ***Monitor and provide technical support for implementation of a basic PTC system test bed on heavily used freight and Amtrak lines in the States of Washington and Oregon.***

  FRA will take an active role in monitoring and providing support for the test of basic PTC technology by the Union Pacific Railroad (UP) and Burlington Northern Railroad (BN) on approximately 600 miles of railroad in the States of Washington and Oregon, some of which is jointly operated. This system will use radio communications to integrate PTC into current traffic control systems and automatic block systems. Unlike ATCS, however, it will use the Global Positioning System to determine train location, and both UHF and VHF data radio will be employed.

- ***Support Amtrak's enhancement of its automatic train control system for the Northeast Corridor (NEC); issue performance criteria for operations to 150 miles per hour.***

Beginning with NEC territory from New Haven to Boston, Amtrak is modifying its cab signal/automatic train control system to provide additional cab signal aspects, enforce civil engineering speed restrictions, and enforce positive stop at key control points. The Amtrak system differs from ATCS in three crucial ways: it will be an enhanced cab-signal system, using nine signals to authorize movement, rather than orders transmitted to an on-board computer; it will be based on electronic codes transmitted through the rails, rather than by radio; and the positive train stop and civil engineering speed enforcement features will be based on passive wayside transponders. One of FRA's main interests in this application of PTC technology will be its impact on safety and traffic capacity in a high-speed passenger corridor that also handles large numbers of commuter trains and some freight. FRA is the funding agency for the Northeast Corridor Improvement Project, which will support this signal system enhancement.

FRA is also responsible as a regulator for the safety of signal and train control systems and must specially approve such systems for high speed operations. FRA will commence a proceeding to specify performance criteria for the new NEC signal system incorporating PTC technology.

- ***Promote and develop advanced PTC technology as an element of the Next-Generation High Speed Rail Program.***

Working in partnership with State and private interests, FRA will invest strategically in a demonstration of advanced PTC technology on a specific high speed rail corridor. The demonstration project will apply communications-based technology that is interoperable with PTC systems planned for freight rail corridors to mixed freight and high speed passenger service, verifying safety performance characteristics and refining system features that can enhance corridor capacity and traffic flows.

The first phase of this effort will be the demonstration of communication-based PTC enforcement, and improved on-board information delivery and display, suitable eventually to permit high speed operations, and initially involving parallel operation of an existing signal system with suitable attributes. In later phases of the project, flexible block capabilities may be explored.

- ***Work with other DOT agencies and the Advanced Research Projects Agency (ARPA), Department of Defense, to promote integration of defense technology into PTC systems.***

FRA will aggressively pursue opportunities for partnership among ARPA, DOT agencies, the railroad industry, rail suppliers, and defense industries to explore and help advance innovative technologies that can enhance the capability and affordability of interoperable PTC systems.

- ***Work closely with the AAR to ensure that AAR's open architecture approach for universal compatibility remains effective and that standards meet safety needs.***

  In today's railroad industry, where many locomotives and trains run across company boundaries, the safety benefits of PTC will be lost if incompatible systems are applied by different railroads. FRA will promote the use of flexible industry standards so that all systems will improve safety on all railroads.

  FRA will continue to work with AAR committees and task forces considering further development of ATCS or successor industry standards.

- ***Extend FRA's partnership with the Federal Highway Administration (FHWA) on highway-rail grade crossing safety to work together more closely in planning for interoperability between PTC technology and Intelligent Vehicle Highway Systems (IVHS).***

  PTC technology can and should be made compatible with IVHS technology so that trains and road vehicles can use the same equipment to detect each other at grade crossings as they do to detect other trains and vehicles. The Vehicle Proximity Alerting System (VPAS), being developed as part of IVHS by FHWA, has this potential to interface with ATCS. The VPAS is intended primarily for use by priority vehicles such as school buses and emergency vehicles, at passively equipped grade crossings; it would also provide reinforcement to standard warnings at crossings equipped with active warning devices.

  FRA and FHWA will seek to combine IVHS and ATCS research on this subject. The FRA's Office of Railroad Development and FHWA are working to evaluate proximity alerting technologies, and are planning to use the Transportation Test Center to evaluate invehicle train warning technologies at grade crossings. For FY 1995, the Department's budget request of $12.5 million for technology development in the area of positive train control and grade crossing technologies (under the appropriation for next-generation high speed rail) includes an emphasis on linking IVHS and ATCS for use on high speed rail systems.

- ***Analyze and evaluate developing technology pertinent to PTC to determine its impact on safety.***

  As railroads and suppliers have already begun to develop technology related to ATCS, FRA should evaluate these emerging technologies and analyze their impact on safety. For FY 1995, FRA has requested $250,000 for the analysis of microprocessor-based train control, and $400,000 for the analysis of ATCS technology already in place. A clear focus on software and hardware issues will help lay the foundation for performance standards and support development of PTC technology.

Time Line:

The FRA's goals for PTC research and implementation are as follows:

FY 1994:

- Monitor and support development of BN/UP test bed.

FY 1995:

- Initiate a project to test enhanced PTC technology that is interoperable with industry-standard technology on a high speed rail corridor. Select corridor, determine technical approach, and begin system implementation.

- Begin two-year project to evaluate which conventional rail corridors are prime candidates for implementation of PTC by developing a risk assessment model.

- Initiate and complete a proceeding for an order or rule of particular applicability for NEC system cab/signal automatic train control system with added PTC features.

- Evaluate results of the AAR findings and report on ATCS (expected in December 1994); provide assessment to AAR Board of Directors.

- Complete initial evaluation in conjunction with FHWA of VPAS using the Transportation Test Center to perform evaluation of candidate technologies.

- Study the safety impact of PTC technology and microprocessor-based train control.

- Provide continuing support for AAR standards development to ensure interoperability.

FY 1996:

- Continue development of project to test enhanced PTC technology on a high speed rail corridor, completing basic safety verification of enforcement features linked to existing signal system.

- Complete two-year project to evaluate which conventional rail corridors are prime candidates for implementation of PTC.

- Complete evaluation of BN/UP test bed, report on the lessons of those tests, and work with the AAR to incorporate promising approaches into AAR positive train separation framework (ATCS or successor specifications).

- Continue partnership with FHWA to ensure proper interface of IVHS and PTC technology.

- Continue technical evaluations of PTC technology and systems.

- Provide continuing support for AAR standards development to ensure interoperability.

FY 1997:

- Complete demonstration of an enhanced PTC system on the selected high speed corridor. Implement in revenue service in FY 1998.

- Review conventional rail corridor risk analysis and, as appropriate, commence rulemaking to require PTC on identified categories of rail lines. Include development of generic performance criteria for improved train control systems applicable to high speed and conventional rail service. Complete rulemaking in FY 1998.

- Demonstrate IVHS and PTC interface for highway-rail crossing safety in cooperation with selected railroads and trucking companies.

- Provide continuing technical support for the development and implementation of PTC technologies nationwide, including development of AAR industry standards to ensure interoperability.

By forming partnerships within the Federal Government and with industry, development and demonstration of PTC technology can be achieved. As the technology becomes operational, its value will be recognized. With wide deployment, PTC systems should become more affordable, and barriers to further deployment should fall.

FRA believes that private and public sector efforts can be combined to foster deployment of contemporary PTC systems on high-risk rail corridors by the year 2000. ***FRA will make it a high agency priority to accomplish this objective.***

RADIO COMMUNICATIONS

FRA found that railroad radio communications are generally good and have been improving since FRA's last major review of this issue in 1987. However, compliance with FRA standards and procedures for voice radio communications is poor, and the inflexibility of

FRA regulations may discourage compliance. Further, employee representatives continue to report problems with radio equipment; and railroad companies fail to treat communication systems as an integral part of safety planning and execution, resulting in lower levels of maintenance.

FRA Actions:

As a result of the findings of this study, FRA will--

- ***Revise the Radio Standards and Procedures to make the regulations more flexible and to promote improved compliance.***

- ***Include in the proposed rule requirements that railroads provide suitable communications capabilities between trains and dispatchers, and between locomotive engineers and ground employees, and that back-up systems be established for critical functions.***

- ***Propose as a part of that rulemaking that each lead locomotive be equipped with an operative radio or suitable alternate communication equipment.***

- ***Work with a major railroad and its employees to implement transmission of movement authorities by digital data radio, in lieu of voice radio communications.***

Time Line:

FY 1995:

- Initiate negotiated rulemaking to revise the radio standards and procedures, including requirements for communication plans and compliance with those plans.

- Work with a major railroad and its employees to pilot-test the transmission of movement authorities from the central dispatch computer to the on-board terminal.

FY 1996:

- Complete rulemaking to revise the radio standards and procedures.

- Complete system implementation of data radio to transmit movement authorities on a major railroad.

FY 1997:

- Conduct compliance reviews on major railroads to verify compliance with revised requirements.

- Identify additional opportunities for transmittal of movement authorities by more secure means.

These steps, taken together, will help ensure that radio communications are treated as an integral part of railroad safety planning and execution.

THE MANDATE

Section 11 of the Rail Safety Enforcement and Review Act (Public Law 102-365; September 3, 1992), entitled "Railroad Radio Communications," provided as follows:

(a) SAFETY INQUIRY.--The Secretary shall, within 18 months after the date of enactment of this Act and in consultation with the National Railroad Passenger Corporation, freight and commuter railroads, rail equipment manufacturers, and railroad employees, conduct a safety inquiry regarding the Department of Transportation's railroad radio standards and procedures. At a minimum, such inquiry shall include assessment of --

(1) the advantages and disadvantages of requiring that every locomotive (and every caboose, where applicable) be equipped with a railroad voice communications system capable of permitting a person in the locomotive (or caboose) to engage in clear two-way communications with persons on following and leading trains and with train dispatchers located at railroad stations;

(2) a requirement that radios be made available at intermediate terminals;

(3) the effectiveness of radios in ensuring timely emergency response;

(4) the effect of interference and other disruptions of radio communications on safe railroad operations;

(5) how advanced communications technologies such as digital radio can be implemented to best enhance the safety of railroad operations;

(6) the status of advanced train control systems that are being developed, and the implications of such systems for effective railroad communications; and

(7) the need for Federal standards to ensure that such systems provide for positive train separation and are compatible nationwide.

(b) REPORT TO CONGRESS.--The Secretary shall submit to Congress within 4 months after completion of such inquiry a report on the result of the inquiry along with the identification of appropriate regulatory action and specific plans for taking such action.

CHAPTER I

Introduction

Preface

This report responds to the mandate of the Congress, contained in section 11 of the Rail Safety Enforcement and Review Act, to conduct a safety inquiry on railroad communications and train control and to report the results of that inquiry. The statutory mandate specifically references the "... radio standards and procedures," FRA's regulations for voice radio communications (49 CFR Part 220). The scope of those regulations is defined as the use of radio communications in connection with railroad operations. Based upon this reference and the specific areas identified by the Congress for assessment, FRA has focused this effort on the safety of train operations.[1]

Railroads provide approximately 37 percent of the freight transportation service in the United States, logging over one trillion ton miles each year. Railroads also provide about 14 billion annual passenger miles of intercity and commuter service each year. Despite occasional, individually significant accidents, the railroad companies provide this service with a high degree of safety.

As America becomes more densely populated and its existing highway system struggles with limited capacity, the Nation will need rail transportation even more in the next century. Whether the railroad companies are able to meet this challenge will depend on a wide variety of factors, two of which are central to the subject of this report: First, the railroad companies must provide service safely. Second, the railroad companies will need to direct capital investments to purposes that permit them to earn a reasonable return.

Although these two objectives may conflict, FRA does not believe that this conflict is inevitable. Rather, FRA believes that strategic investment in highly capable technology will benefit both railroad safety and railroad profitability.

In particular, the railroads' ability to serve the Nation depends on investment in technologies that will facilitate effective flows of information and preserve critical safety margins even under worst-case conditions. Rail transportation has several characteristics that have historically caused railroads to place a premium on effective and secure communications:

- The size and weight of rail equipment impart destructive potential.

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[1]Radio and other means of communication also have safety value with respect to other aspects of railroad work, particularly the coordination of maintenance and inspection of railroad track and structures and railroad signal and train control systems with on-track movements. The fact that the present study did not address all of these issues in detail should not be taken as an indication that they are unimportant.

- This potential is magnified by the long stopping distances inherent in operation of heavy rolling stock using the steel wheel and steel rail.

- Operations are conducted over an extensive network of rail lines spanning lightly developed rural and wilderness areas as well as highly developed urban and suburban areas.

- Railroads must contend with over 280,000 highway crossings at grade and countless other locations where pedestrians and vehicles may come into conflict with rail movements.

- Like other modes of transportation, the railroad companies face challenges presented by natural disasters and often rapidly changing weather conditions.

In recent decades, the need for more highly capable communications has increased as --

- The number of railroad employees has declined (e.g., elimination of train order operators), including a major reduction in the number of railroad officers available to provide direct supervision.

- Train speeds have risen in response to service requirements, particularly for highly competitive intermodal service.

- Density of track occupancy has risen due to downsizing of plant and unexpectedly strong demand for rail service.

- Elements of prior systems, such as pole lines, have outlived their useful life and required replacement by alternatives that require less cost to maintain.

Railroad communications pertain to safety functions and business purposes. Although this report will address only the former, a great many railroad functions that rely on effective communications are in fact safety-relevant.

Safety Inquiry Approach; Report Objectives

Section 11 of the Rail Safety Enforcement and Review Act (RSERA), enacted September 3, 1992, required the Secretary, in consultation with the National Railroad Passenger Corporation, freight and commuter railroads, and rail equipment manufacturers, to conduct an inquiry and provide a report to the Congress regarding "the Department of Transportation's railroad radio standards and procedures...." The report mandate addressed the use of three technologies: voice radio communications, digital data communications, and advanced train control technologies.

In order to address these objectives, FRA --

- Conducted a field investigation of current railroad voice communications technology and practice, including assessments at dispatching offices, observations while train riding and, visits to yards are terminals.

- Held three Roundtable discussions on advanced train control technologies as part of the Administrator's outreach program. Participants included railroad management and employee representatives, rail suppliers, and other Department of Transportation agencies involved with communication and navigation technologies.

- Followed up the Roundtable discussions by meeting with representatives of the Association of American Railroads and the Brotherhood of Railroad Signalmen to examine train accident data for the purpose of identifying those events that might be prevented by positive train control (PTC) technologies.

- Published a notice of special safety inquiry (59 FR 11847; March 11, 1994), conducted a public hearing on March 29, 1994, which focused on voice radio communications, and received written comments (comment closing date: April 11, 1994).

- Contracted with the Institute for Telecommunications Sciences (ITS), Department of Commerce, for a technical evaluation of Advanced Train Control Systems under development by the Association of American Railroads/ Railway Association of Canada.

- Met with various parties interested in this issue to gather information and views.

- Consulted with other agencies within the Department of Transportation and with staff of the Federal Communications Commission regarding pertinent issues.

FRA's approach to preparation of this report was collaborative and benefitted greatly from the time and effort invested by all participants. The conduct of this study resulted in acceleration of deliberations by the major railroads, through the Association of American Railroads, regarding future investments in next-generation, communication-based train control technologies. Further, the impetus created by the roundtable process has helped to spur development of a test bed for "positive train separation" technology by two major western railroads. These developments are reviewed in Chapter IV.

Report Structure

This chapter introduces the approach and objectives of the report and describes functional safety requirements that are pertinent to the scope of the congressional mandate. ***Chapter II*** is devoted to historical background that describes (i) the origins, characteristics, and uses of communication and signal systems within the framework of railroad operating rules, and (ii) the role of the Federal Government in regulating those systems for the purpose of safety. ***Chapter III*** describes current voice radio capabilities, deployment, and uses and identifies