SAFETY AND SECURITY:

Progress Made in Implementing Positive Train Control, but Additional Actions Needed to Ensure Timely Completion of Remaining Tasks

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Memorandum

To: DJ Stadtler, Jr.
Executive Vice President/Chief Operations Officer

From: Stephen Lord
Assistant Inspector General, Audits

Date: October 6, 2016

Subject: *Safety and Security: Progress Made in Implementing Positive Train Control, but Additional Actions Needed to Ensure Timely Completion of Remaining Tasks* (OIG-A-2017-001)
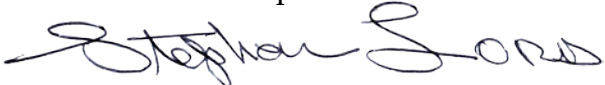
The Positive Train Control Enforcement and Implementation Act of 2015 requires Amtrak (the company) to implement an approved Positive Train Control (PTC) safety system by December 31, 2018.[1] PTC systems can help prevent some types of train accidents resulting from excessive speeds, including the tragic Train 188 accident that occurred in Philadelphia on May 12, 2015.[2] PTC systems can also alert engineers to a misaligned track switch and can protect roadway workers by automatically slowing or stopping trains from entering work zones.

PTC systems are made up of several components installed along tracks and onboard locomotives. The communications systems that support them are built with either transponders[3] embedded in the track or with Global Positioning System (GPS) technology. These trackside components transmit the direction and location of the train through the communications system (including radios and computer servers) to

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[1] The Positive Train Control Enforcement and Implementation Act of 2015, Pub. L. No. 114-73, § 1302, 129 Stat. 568 (codified at 49 U.S.C. 20157), extended the statutory deadline for implementing PTC from December 31, 2015, to December 31, 2018, which was established by the Rail Safety Improvement Act of 2008 (Pub. L. No. 110-432, Div. A, 122 Stat. 4848). The law also authorizes the Secretary of Transportation to approve and provide further extensions of up to two years on a case-by-case basis if certain requirements are met.

[2] On May 17, 2016, the NTSB determined that the accident was likely caused by the engineer's loss of situational awareness after his attention was diverted to an emergency involving another train, and that a fully implemented PTC system would have prevented the accident.

[3] A transponder is a device that provides data to the onboard system, enabling the onboard system to determine the train's location and direction of movement along the track, as well as speed restriction data, for the upcoming territory.

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railroad dispatching offices. PTC systems rely on the dispatching office to transmit safety data—such as permanent or temporary speed restrictions—to ensure that onboard PTC systems can slow or stop trains if a locomotive engineer fails to do so.

This is our third report on the company's progress implementing PTC.[4] In this report, we discuss the progress made in implementing PTC and whether additional opportunities exist to improve PTC program management. Appendix A provides details about our scope and methodology.

SUMMARY OF RESULTS

The company has made significant progress implementing PTC. However, it still must complete a significant number of remaining tasks, including completing system installations on tracks it owns and operates, and installing onboard systems on the 303 locomotives that travel over its long-distance and state-supported routes. Completing these tasks by December 2018 could be challenging given their complexity and the company's current program management approach, which diffuses accountability and leaves the company vulnerable to cost and schedule risks.

The company has completed the installation of PTC systems on track it owns or operates along the Northeast Corridor (NEC) and in Pennsylvania and Michigan, and these systems are operational. This is about 67 percent (about 608 route miles) of its total planned trackside installations (about 901 route miles). The Mechanical department has also completed installation of PTC on almost all of its locomotives that operate in revenue service on the NEC.

The program office still must complete the remaining 33 percent of its planned trackside installations, all of which are outside the NEC (about 293 route miles), and several other key tasks before the December 2018 deadline, including:

- submitting a safety plan to the Federal Railroad Administration (FRA) for approval of the Advanced Civil Speed Enforcement System (ACSES) PTC system used on the NEC and connecting rail corridors

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[4] See *Safety and Security: Progress Made Implementing Positive Train Control, but Significant Challenges Remain* (OIG-A-2015-013, June 19, 2015) and *Railroad Safety: Amtrak Has Made Progress in Implementing Positive Train Control, but Significant Challenges Remain* (OIG-E-2013-003, December 20, 2012). Those reports recommended that the company take actions to improve program management, strengthen accountability, and employ leading practices in its cost and schedule estimates.

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- installing the Interoperable-Electronic Train Management System (I-ETMS) PTC system on segments of the NEC and on other segments between Philadelphia and Harrisburg, and upgrading ACSES technical standards to meet FRA interoperability requirements

- resolving issues of potential radio frequency spectrum interference with ACSES on the northern end of the NEC because an interference-free radio frequency spectrum is critical to the operation of ACSES

- installing I-ETMS on the company's fleet of 311 diesel locomotives[5] that operate on the company's long-distance and state-supported routes

Opportunities exist to ensure the timeliness of PTC implementation by addressing the program management weaknesses we identified in our 2012 and 2015 reports.[6] Specifically, the full cost of all implementation tasks has not been fully estimated and may cost the company hundreds of millions more than is currently budgeted. In addition, program management responsibilities are still divided across several departments, and project schedules do not follow leading practices or company requirements.

To address these program management weaknesses, and to help ensure successful PTC implementation by the legislative deadline of December 31, 2018, we are updating and reissuing three recommendations from our 2015 report that the company agreed to but has not implemented. Specifically, we recommend that the company use leading practices to update cost estimates and enhance project schedules. We also recommend that the company clarify the roles of managers responsible for PTC implementation to ensure that a senior official has clear authority and accountability for the completion of the remaining tasks. The company agreed with all three recommendations and identified actions that would meet the intent of these recommendations once implemented.

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[5] When referring to the company's diesel locomotives, we include the company's cab cars, which are equipped for an engineer to control the movement of a train but do not include a motor.

[6] See *Safety and Security: Progress Made Implementing Positive Train Control, but Significant Challenges Remain* (OIG-A-2015-013, June 19, 2015) and *Railroad Safety: Amtrak Has Made Progress in Implementing Positive Train Control, but Significant Challenges Remain* (OIG-E-2013-003, December 20, 2012). The company agreed with our recommendations.

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BACKGROUND

In 2008, Congress enacted legislation requiring intercity passenger and commuter railroads to install PTC.[7] In 2010, FRA issued regulations that included performance-based safety standards and requirements for developing and implementing PTC systems.[8] In response to these legislative and regulatory requirements, the company submitted its initial plan for developing and installing PTC systems across the national railroad passenger system by the end of 2012. The plan also supports the company's strategic goal of setting the standard for safety and security in the transportation industry to ensure that every customer and employee goes home injury-free every day.

In 2010, FRA approved the initial plan; in January 2016, the company updated and re-submitted the plan to FRA. The updated plan shows that the company plans to complete PTC implementation by the end of 2018. This goal also helps address the concerns of the U.S. Secretary of Transportation and the FRA Administrator that PTC be implemented as quickly as possible to improve safety and save lives.

As part of the plan, the company is implementing three types of PTC systems that overlay the existing signal systems on rail lines it owns or operates.[9] The three systems use different technologies, but are functionally similar in slowing or stopping moving trains:

- **ACSES.** On the NEC and connecting rail corridors in the northeast, the company is implementing the Advanced Civil Speed Enforcement System. ACSES utilizes passive, track-embedded transponders to communicate the location, direction, and speed restrictions for a moving train. ACSES has been in revenue service on parts of the NEC since 2000.

- **I-ETMS.** In Michigan, Chicago, and New Orleans, the company is implementing the Interoperable Electronic Train Management System. I-ETMS is a GPS-based system being developed and implemented primarily by freight railroads.

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[7] Pub. L. No. 110-432, Division A, Stat. 4848, required certain railroads to implement PTC by December 31, 2015. This included Class I railroads that transport more than de minimis quantities of poisonous-inhalation-hazardous materials on rail lines to install PTC.

[8] 49 CFR 236 Subpart I was issued in 2010.

[9] For a brief description of the company's signal systems, see Appendix B.

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- **ITCS.** In Michigan, the company implemented the Incremental Train Control System (ITCS)—also a GPS-based system. ITCS is designed to enforce speed restrictions and train stops, and to enhance safety at grade crossings by slowing the train to the posted speed if the crossing warning system does not activate in time. Installed in 1996, ITCS has been in revenue service in Michigan since 2000.

PTC implementation has been the responsibility of the company's Deputy Chief Engineer for Communications and Signals in the Engineering department. In this report, we refer to the Deputy Chief and his staff as the company's PTC implementation program office (program office). Other company officials in the Finance, Law, Mechanical, Procurement, and Transportation departments also play a supporting role in implementing PTC. In July 2015, the company hired a senior manager for PTC in the Transportation department to act as a liaison between the departments involved in PTC implementation. The general responsibilities of each department or office are listed in Table 1.

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Table 1. *Departmental Implementation Responsibilities*

Department or Office	Implementation Responsibility
Engineering (Program Office)	• implementing PTC along the tracks of NEC, its connecting rail corridors, and other Amtrak property in Michigan, Indiana, and at passenger terminals in Chicago and New Orleans
Finance	• incorporating PTC implementation costs into Amtrak's financial plans
Law	• leading efforts to acquire radio frequency spectrum[a] and obtaining licenses for its use from the Federal Communications Commission • reviewing reimbursement agreements between Amtrak and other railroads
Mechanical	• installing PTC equipment on the company's locomotives and power cars
Procurement	• developing and negotiating contracting instruments that support the PTC program
Transportation	• negotiating reimbursement agreements between Amtrak and its host railroads to reimburse PTC installation and maintenance costs where PTC installation is required solely due to Amtrak operations[b] • overseeing PTC implementation across departmental lines

Source: OIG analysis of PTC implementation documents and statements made by company officials
Notes:
[a] Radio frequency spectrum is a natural resource that is used to enable wireless communications. Spectrum is segmented into bands of radio frequencies typically measured in cycles per second (hertz).
[b] Company officials told us that Amtrak's State-Supported Business Line also has a role in negotiating these agreements.

To assess the company's efforts to manage PTC implementation, we identified leading practices in program management in the private and public sector, and we incorporated them into our analysis. These leading practices were established by the U.S. Government Accountability Office (GAO) and the Project Management Institute. We also applied management control standards from the Committee of Sponsoring Organizations of the Treadway Commission (for private entities) and internal controls standards from GAO (for public entities).

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PROGRESS MADE IMPLEMENTING PTC ALONG TRACKS OWNED OR OPERATED BY THE COMPANY

The company continues to make progress implementing PTC across tracks owned or operated by the company. Table 2 shows the status of efforts to install PTC along the tracks of routes the company owns or operates (about 901 route miles). For a map of trackside installations in the northeast United States, see Appendix C. The company now has PTC systems operational on about 67 percent of its planned trackside installations (about 608 route miles), as shown in Table 2.

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**Table 2. *Status of Trackside PTC Installations by System Type on
Company Owned Tracks***

Route and Location (Operational)	System Type	Approximate Distance (Route Miles)	Status
NEC Washington D.C. to Boston, MA	ACSES[a]	396	Operational[b]
Keystone Line Philadelphia, PA, to Harrisburg, PA	ACSES[a]	104	Operational
Empire Connection Penn Station, NY, to Spuyten Duyvil, NY	ACSES	11	Operational
Michigan Line–West Porter, IN, to Kalamazoo, MI	ITCS	97	Operational
Route Mileage Subtotal–Operational		**608**	
Ongoing/Not Started			
Springfield Line New Haven, CT, to Springfield, MA	ACSES	60	Implementation Ongoing
Hudson Line Poughkeepsie, NY, to Hoffmans, NY	ACSES	94	Implementation Ongoing
Michigan Line–East Kalamazoo, MI, to Dearborn, MI	ITCS & I-ETMS	135	Implementation Ongoing
Chicago Passenger Terminal Chicago, IL	I-ETMS	2	Not Started
New Orleans Passenger Terminal New Orleans, LA	I-ETMS	2	Not Started
Route Mileage Subtotal—Ongoing/Not Started		**293**	
Total Route Mileage		**901**	

Source: OIG analysis of company implementations plans.
Notes:
[a] I-ETMS will be installed on a portion of these routes, as discussed below. This system is not yet operational.
[b] ACSES is not yet operational on three miles of the NEC around Philadelphia, as discussed below.

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The program office has completed implementing ACSES across 393 of 396 route miles of NEC track the company owns or operates from Washington to Boston.[10] It plans to complete the installation of ACSES on the remaining three route miles of the NEC in the terminal area of Philadelphia's 30th Street Station by December 2017.

The program office also completed implementing ACSES on 104 route miles on the Keystone Line in Pennsylvania from Philadelphia to Harrisburg (with the exception of a 1.5 mile segment just outside Philadelphia that is scheduled to be completed by the end of 2017) and on 11 route miles on the Empire Connection between Penn Station and Spuyten Duyvil, New York. The company is not planning to install PTC at the Harrisburg station terminal area, covering about 1.5 miles, because it is being used only by passenger trains traveling at low speeds. In addition, in February 2012, FRA certified the company's GPS-based ITCS system on the Michigan Line as a PTC system.

The program office plans to implement PTC along an additional 293 miles of track by the December 2018 deadline (about 33 percent of the total miles in the implementation plan). Some of these efforts have not started. This includes completing ACSES implementation on the following 154 miles of track:

- **Approximately 60 miles of the Springfield Line in Connecticut and Massachusetts.** ACSES installation is dependent on the completion of major track and signal reconfigurations that the company is performing on behalf of Connecticut. The company is not planning to install PTC at the Springfield passenger station terminal area, covering about 1.5 miles, because (1) it is being used only by passenger trains at low speeds, and (2) the terminal's track structure is complex. The company plans to maintain safe operations in this terminal by continuing to restrict train speeds using traditional signal systems and dispatching orders.

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[10] The company owns or operates 401 route miles of the NEC, but is not planning to put PTC on about 5 route miles of track at Washington Union Terminal; Penn Station, New York; and Boston South Station. The FRA approved an exception for these terminal areas in 2010. The company plans to maintain safe operations at these stations by continuing to restrict train speeds moving through these areas using traditional signal systems and operational rules. Metro North Railroad is responsible for installing PTC on 56 miles of NEC track it operates between New Rochelle, NY, and New Haven, CT. FRA reported that Metro North will implement PTC in these areas by the end of 2018.

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- **About 94 miles of the Hudson Line.** Although the company is performing the work, the funding needed for installing ACSES, about $29 million, has not yet been provided by the state of New York.

These efforts also include installing I-ETMS on about 139 miles of track outside the NEC:

- **About 135 miles of track from Dearborn to Kalamazoo, Michigan.** Amtrak operates this route on behalf of the Michigan Department of Transportation. The plan calls for installing I-ETMS and ITCS trackside and for building a communications network to support them. The program office plans to complete this work in 2017.

- **Two miles of track in the Chicago rail terminal**. The company received an exemption from FRA to implement PTC across the terminal based on the speed restrictions throughout most of the Chicago terminal area. The program office plans to complete this work by December 2017.

- **Two miles of track in New Orleans**. This is pending the approval of FRA of an exemption for the entire terminal because trains using the terminal travel at low speeds. The company plans to submit the expanded exemption to FRA.

KEY REMAINING TASKS TO BE COMPLETED

Before PTC is fully implemented on the NEC in accordance with its FRA-approved implementation plan, the company must complete several tasks, which are discussed below.

Submit a New ACSES Safety Plan

Before FRA will consider ACSES implementation fully operational, the program office is required to submit an updated ACSES safety plan to FRA for approval. In January 2016, FRA informed the company that it could temporarily operate ACSES in "provisional" revenue service[11] until December 31, 2017, or until it submitted a new safety plan for ACSES. FRA is requiring that the company provide a new safety plan because of the number of upgrades the company made to ACSES, which was originally deployed in 2000.

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[11] FRA's current authorization to conduct provisional service does not guarantee that FRA will ultimately certify ACSES.

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Install I-ETMS and Upgrade ACSES to Ensure Interoperability

In July 2016, after more than a year of negotiations, the Transportation department reached an agreement with one of the freight railroads to fund and install I-ETMS on segments of the NEC between Washington D.C. and Philadelphia, and on segments of the Keystone line between Harrisburg and Philadelphia. The freight railroad prefers to use I-ETMS on these line segments and will fund the installation of this additional PTC system on these routes. The work is to be completed by the 2018 deadline and will be overseen by Amtrak. The installation of this additional system will enable Amtrak to meet FRA requirements for the interoperability of PTC systems.

The program office is also developing technical standards and upgrading systems to ensure interoperability. Although most of the other railroads that use the NEC have agreed to use ACSES, the technical standards to ensure interoperability between the company's equipment and the PTC systems of these railroads are still under development. Also, the Engineering department is planning to upgrade ACSES to provide greater interoperability with some of these railroads, making it safer for railroads to enter and leave the NEC. These upgrades will be made at the Zoo Interlocking[12] located north of Philadelphia 30th Street Station along the NEC, totaling about 1.5 miles. Program office officials told us that upgrades to other interlockings will be made for about 940 feet of track north of Union Station in Washington D.C. and about 3,100 feet of track near the Sunnyside Rail Yard in Queens, NY. The program office estimates that this work will be completed by December 2017.

Resolve Potential Radio Frequency Spectrum Issues

An interference-free radio frequency spectrum is critical to the operation of ACSES because it enables the radio network to transmit permanent and temporary speed-limit instructions to a train's onboard computers to slow or stop the train as needed.[13] The company's Law department, with the support of the program office, has been addressing potential issues of radio frequency spectrum interference with ACSES on the northern and southern end of the NEC with the Federal Communications Commission (FCC), which manages the licenses of the bands to be used for PTC systems.

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[12] An interlocking is an arrangement of switches and signals that safely controls train movement across track junctions and crossings.

[13] On August 16, 2016, FRA announced an award of a $2.6 million grant to Amtrak to develop security technology for the wireless network along the NEC.

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In our prior report, we identified a potential interference issue between ACSES radios and local television stations between New York City and Washington D.C. Since our last report, the company provided FCC with an updated interference study and plan that mitigated these issues. As a result, on June 30, 2016, the FCC granted the company permanent authority to operate its wireless base radio stations at higher power levels on the southern end of the NEC, resolving this issue.

However, in our prior report, we also identified the potential radio interference issue on the northern end of the NEC, and this issue is still unresolved. The company and freight railroads use the same radio frequency on the northern end of the NEC between New Haven and Boston, and FCC officials told us that there is a material chance that interference might result in their PTC systems not operating as intended. A Law department official told us that the company's preferred solution to this issue is to swap its current radio frequency spectrum for another frequency; however, the radio frequency the company would like to obtain is under litigation, according to Law department officials. Therefore, this issue is not likely to be quickly resolved.

Complete Installation of PTC Equipment on Locomotives

The Mechanical department is responsible for installing PTC on the company's locomotives. It has completed installation of ACSES equipment on almost all of the locomotives that travel on the NEC and on the Keystone Line, including the following:

- 69 of the 70 new Amtrak Cities Sprinter 64 locomotives used in Northeast Regional and Keystone service

- all 40 of its power cars used in Acela service

- 41 of the 49 of the other locomotives used by the company for revenue service or maintenance on the NEC

- all 18 of the company's dual mode diesel/electric locomotives that operate on the Hudson line although the trackside ACSES equipment is not yet operational on this line

However, 72 percent of the train miles traveled by the company's trains are on tracks owned by other railroads using I-ETMS-based PTC systems. The company operates trains on these railroads via 15 long-distance and 26 state-supported routes outside the

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NEC that must be I-ETMS compatible.[14] Thus, the company must install I-ETMS
components onboard its 303 diesel locomotives that travel these long-distance and state-
supported routes to communicate with the host railroad's system. The company has
installed some I-ETMS components onboard 296 locomotives, but has yet to
commission any of its diesel locomotives for PTC operations in revenue service. The
Mechanical department is facing two key challenges in completing these installations:

- A software problem has caused communication issues between the data radios
  and other onboard equipment. The Mechanical department's program manager
  told us that the equipment manufacturer did not identify this until July 2015 and
  that the manufacturer stated that it did not know how to solve the problem. In
  January 2016, the company contracted with an alternative manufacturer to
  address this issue, which is still unresolved.

- The company lacks a server to enable the onboard equipment to communicate
  with the host railroads' dispatching systems. This server is critical to enabling the
  company's diesel locomotives equipped with I-ETMS to operate over host
  railroads throughout the United States. For example, the server stores host
  railroads' speed restriction information and communicates it to Amtrak trains.
  Contract negotiations are still underway to develop and install a functional
  server. Company officials were unable to provide an estimate as to when the
  server will be installed.

OPPORTUNITIES EXIST TO IMPROVE PROGRAM MANAGEMENT

The company has several opportunities to improve program management processes
and practices. As we previously reported, addressing these weaknesses will help the
company fully implement its approved plan for PTC.

Implementation May Cost Significantly More than Currently Estimated and Budgeted

The company has not yet fully estimated and budgeted implementation costs, which we
recommended in 2012 and 2015. The Finance department reported that the company
spent about $183 million on PTC implementation through June 30, 2016. The company
plans to spend about another $35 million implementing PTC through 2018. The Finance

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[14] In these operating situations, the host railroads for these routes are responsible for implementing the
trackside I-ETMS components and communications systems under the Positive Train Control
Enforcement and Implementation Act of 2015.

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department compiled these estimates from inputs provided by the Engineering and Mechanical departments.

However, these costs estimates are incomplete. The Transportation department estimates that the company may need to reimburse host railroads for PTC installation and ongoing trackside maintenance costs incurred solely for the support of Amtrak operations. Host railroads have formally notified the company they may seek about $350 million in reimbursements for PTC installation costs and ongoing maintenance expenses. The Transportation department is negotiating the amount of these charges with the host railroads to attempt to control costs.

In addition, the following potential costs of completing both ACSES and I-ETMS installation on the NEC are still unknown:

- **Additional costs to implement ACSES on the NEC**. In October 2015, the company' system integrator for ACSES requested a one-year contract extension and a $1.5 million equitable adjustment to its contract. A Procurement department official said the company initially denied the equitable adjustment request but is negotiating with the system integrator to complete the remaining ACSES integration tasks.

- **Potential costs.** The costs to resolve the potential radio interference issues on the NEC discussed above are not known.

More important, the company has not taken steps to include these potential costs in its financial plans although the company's capital-programming policy requires multi-year programs, such as PTC, to include all projected costs over the five-year budget cycle. The company has started a process to identify the potential reimbursable PTC expenses for host railroads required to install PTC on their rail lines solely for the support of Amtrak operations. However, the amount to be set aside for fiscal year (FY) 2015 represents only a small portion of the company's total potential liability. A senior official in the Finance department told us that the company has yet to determine how to pay for these expenses.

Additionally, leading practices in the private and public sectors state that all relevant costs should be identified and included in an activity's cost estimates. Because of the potential magnitude of these costs, not acknowledging these potential liabilities in its financial plans affects the accuracy and usefulness of the company's budgets and federal grant requests. Including some contingency funding in its financial plans could

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help the company minimize its risks, consistent with the company's policy on enterprise risk management.

Management Responsibilities Divided Among Several Departments

The company's matrix-management approach to implementing PTC diffuses program responsibility among several departments, as shown in the following examples:

- Equipment installations on company property are being managed by the Engineering department.

- Equipment installations on locomotives are being managed by the Mechanical department.

- Coordination with host railroads is being performed by the Transportation department.

- Support functions are provided by the Procurement department and Law department.

This approach has been in place since we first reviewed PTC implementation in 2012.

In our prior reports, we recommended centralizing responsibility for PTC implementation with a senior accountable official so the program could be managed across departments. These recommendations were consistent with our prior work[15] on the company's governance structure that identified weaknesses in governance processes as the root cause of the company's challenges in managing capital projects like PTC. Our recommendations were also consistent with private- and public-sector internal control standards that emphasize the importance of establishing an effective organizational structure, assigning clear roles and responsibility, and delegating authority to achieve the organization's objectives—such as completing PTC implementation by December 2018.

Since January 2016, the senior manager for PTC in the Transportation department has helped coordinate the efforts of the departments involved in implementing PTC through weekly implementation status meetings. This coordination function may help facilitate internal communications between departments, but our assessment of the company's matrix management approach is that it limits both the authority and

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[15] *Amtrak: Top Management and Performance Challenges* (OIG-SP-2014-012, September 29, 2014).

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accountability of the officials involved in PTC implementation, which we discussed in
our 2012 and 2015 reports.

Project Schedules Missing Key Events and Critical Tasks

The company has not implemented our prior recommendations to develop an overall
master project schedule to better track the completion of key events and critical tasks.
Instead, it relies on a general schedule developed by the company's system integrator
that lacks many of the characteristics of a high-quality and reliable schedule that follows
leading practices in the private and public sectors. For example, this general schedule
does not capture all the activities necessary to accomplish the project's objectives.
Specifically, the schedule does not identify the tasks required to resolve some key
implementation issues, such as installing PTC equipment on company property outside
the northeast and developing a safety plan for ACSES.

The schedule also does not include the Mechanical department's schedule for installing
and commissioning onboard equipment on the company's diesel locomotives. The
company's January 2016 implementation plan states that installation of I-ETMS
equipment on diesel locomotives will be completed in 2018 before the deadline.
Mechanical department officials told us that they have not yet developed a
comprehensive schedule detailing how this critical work would be completed, when it
will be complete, or how key challenges could be successfully mitigated to ensure that
this deadline is met if the host railroads implement their PTC systems by the deadline.
Thus, it is not clear whether the Mechanical department is on track to complete the
installation and commissioning of these systems on its diesel locomotives to have them
fully PTC operational by the December 2018 legislative deadline.

The schedule also does not identify the project's critical path, which is needed to
determine the project's earliest completion date and to focus attention on the activities
that will lead to the project's success. Leading practices in both the private and public
sectors state that identifying the critical path enables managers to identify the
interrelationships between project activities and to determine the amount of time that a
scheduled activity can be delayed or extended without delaying the project's finish. The
lack of a high-quality and reliable schedule may limit the program office's ability to
effectively gauge progress, identify and resolve potential problems, and promote
accountability at all levels of the project.

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CONCLUSIONS

The company has made significant progress implementing PTC. However, it still must complete a significant number of remaining tasks, including (1) installing systems on tracks it owns and operates, and (2) installing onboard systems on the 303 locomotives that travel over its long-distance and state-supported routes. Completing these tasks by December 2018 could be challenging given their complexity and the company's current program management approach, which diffuses accountability and leaves the company vulnerable to cost and schedule risks. Taking additional steps to strengthen program management—such as updating cost estimates consistent with leading practices, clarifying decision-making authority, and enhancing project management schedules—will help focus management's attention on completing the key remaining implementation tasks by the December 2018 legislative deadline. Given that the existing program management weaknesses result from issues identified in our 2012 and 2015 reports, we are updating and reissuing three recommendations from our June 2015 report that the company agreed to but has not implemented.[16]

RECOMMENDATIONS

We recommend that the Executive Vice President/Chief Operations Officer take the following actions:

1. Re-evaluate and update current program cost estimates, consistent with leading practices, and ensure that these costs are disclosed in the company's financial plans—including the likely costs of reimbursing host railroads—to ensure that sufficient funds are available to complete the installation of the PTC system by December 31, 2018.

2. Clarify the roles and responsibilities of current PTC managers to ensure clear authority and accountability for managing all remaining implementation tasks, and designate an overall senior accountable official with sufficient authority to ensure program success.

3. Enhance the project schedule, consistent with leading practices, by identifying all critical remaining implementation tasks and milestones for completion, and by establishing a process to periodically review the status of remaining actions to measure progress.

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[16] We closed a fourth recommendation made in our June 2015 report regarding the program office's staffing needs because the recommendation is no longer considered actionable.

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MANAGEMENT COMMENTS AND OIG ANALYSIS

In commenting on a draft of this report, the company's Executive Vice President/Chief Operations Officer agreed with our three recommendations. The management response described planned actions that address the intent of our recommendations and provided implementation dates for the recommendations. The company's planned actions are summarized below:

- **Recommendation 1.** Management agrees with the recommendation to re-evaluate and update current program cost estimates, consistent with leading practices, and ensure that these costs are disclosed in the company's financial plans to ensure that sufficient funds are available to complete the installation of the PTC system by December 31, 2018. Management noted several actions it plans to take to ensure that complete implementation costs are identified and that funding is available. Management also stated that it will work closely with the host railroads to ensure that its plan and cost estimates for PTC implementation are as complete and accurate as possible, and will submit a revised master plan, schedule, and associated cost estimates by December 31, 2016.

- **Recommendation 2.** Management agrees with the recommendation to clarify the roles and responsibilities of current PTC managers to ensure clear authority and accountability for managing all remaining implementation tasks, and to designate an overall senior accountable official with sufficient authority to ensure program success. Management also stated that the Senior Manager for PTC is responsible for managing the overall program. However, our analysis shows that program management responsibilities are divided across several departments, which limits the authority and accountability of company officials involved in PTC implementation. Nonetheless, management clarified that the Chief Operations Officer is ultimately the senior accountable official for PTC implementation. Therefore, we will consider this recommendation implemented upon issuance of this report.

- **Recommendation 3.** Management agrees with the recommendation to enhance the project schedule, consistent with leading practices, by identifying all critical remaining implementation tasks and milestones, and by establishing a process to periodically review the status of remaining actions to measure progress. Management noted several actions it plans to take to develop and implement a

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master program schedule, stating that a fully integrated schedule will be completed by December 2016.

For management's complete response, see Appendix D. The company also provided us with technical comments on a draft of this report, which we incorporated as appropriate.

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APPENDIX A

Scope and Methodology

This report addresses the company's ongoing efforts to implement PTC. We focused the scope of our work on the company's progress through July 2016. The principal departments where we performed our work were the Engineering, Finance, Law, Mechanical, and Transportation departments. We conducted our audit work from July 2015 through September 2016 in Washington D.C. and Philadelphia, PA.

Our methodology for assessing the company's progress implementing PTC, its FRA-approved plan, and its project schedule included reviewing documents from the PTC program office in the Engineering department—such as the FRA-approved PTC implementation plan, internal monthly status reports, and reports to FRA. We reviewed documents and discussed implementation with other officials from the Engineering, Finance, Law, Mechanical, and Transportation departments. In addition, we reviewed documents and discussed implementation with officials from FRA and FCC.

Our methodology for determining whether opportunities exist to improve program management included assessing the company's progress addressing our prior recommendations on this issue. To accomplish the work, we reviewed documents and the controls in place for managing implementation, including cost and budget information, and the requirements established by the company for managing capital projects. We also reviewed and incorporated into our analysis several leading practices from the Project Management Institute, the Committee of Sponsoring Organizations of the Treadway Commission, and GAO.[17] We discussed this information with officials from the PTC program office and the Finance, Mechanical, and Transportation departments.

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence

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[17] *Guide to the Project Management Body of Knowledge, Fifth Edition* (Project Management Institute, 2013), *Internal Control–Integrated Framework* (Committee of Sponsoring Organizations of the Treadway Commission, 2013). The leading practices we followed from GAO are listed below.

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obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Internal Controls

We generally reviewed the management controls the program office has in place for implementing PTC. We focused on controls related to decision-making authority, program management plans, and cost estimates. We limited our conclusions and recommendations on controls to those areas. We did not review the company's or the program office's overall system of controls for program management.

Computer-Processed Data

We obtained data on expenditures for PTC implementation from the Finance department that were compiled from data in the company's previous financial system from FY 2008 through FY 2009, and from Amtrak's Financial Information System for FY 2010 through June 2016. We used this information only for contextual purposes; therefore, we did not fully assess its reliability.

Prior Reports

In conducting our audit, we reviewed and used information from the following Amtrak OIG and GAO reports:

- *GAO Schedule Assessment Guide: Best Practices for Project Schedules* (GAO-16-89G, December 22, 2015)

- *Positive Train Control: Additional Oversight Needed as Most Railroads Do Not Expect to Meet 2015 Implementation Deadline* (GAO-15-739, September 4, 2015)

- *Safety and Security: Progress Made Implementing Positive Train Control, but Significant Challenges Remain* (OIG-A-2015-013, June 19, 2015)

- *Amtrak: Top Management and Performance Challenges* (OIG-SP-2014-012, September 29, 2014)

- *Railroad Safety: Amtrak Has Made Progress in Implementing Positive Train Control, but Significant Challenges Remain,* (OIG-E-2013-003, December 20, 2012*)*

- *Cost Estimating and Assessment Guide: Best Practices for Assessing and Managing Capital Program Costs* (GAO-09-3SP, March 2, 2009)

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APPENDIX B

Signal and Train Control Systems

In addition to its PTC systems, the company's signal and train control safety system includes several other systems:

- **The trackside signal system** uses a colored-light display to notify train engineers when and at what speed they are authorized to move the train. This system is installed across the NEC and on connecting rail corridors.

- **The cab signal system** gives engineers an advance display of what each signal will be showing. This system helps the engineer control speed and prepare for route changes; it is installed on locomotives operating on the NEC and on connecting rail corridors.

- **The Automatic Train Control system** alerts the engineer to reduce train speeds to comply with track signals. The system is designed to prevent collisions by applying the train's brakes if an engineer fails to obey a signal. Company officials told us that the system has been in use on the NEC and connecting rail corridors and has been linked to the cab signal system since 1990.

The company is also responsible for installing PTC on its property outside the northeast United States. The signal and train control systems on these properties are similar to those on the NEC, but do not include the Automatic Train Control system.

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APPENDIX C

ACSES-Covered Territory as of July 31, 2016

The geographical areas and line segments in which the company has installed or plans to install ACSES are shown in the figure below. **Green** circles show the company-owned areas where the company plans to install ACSES. **Blue** circles show where Metro-North will install ACSES. **Red** circles show where the company does not plan to install ACSES. *The circles are not to scale.* Also, the route from Poughkeepsie to Hoffmans, New York, is not shown.
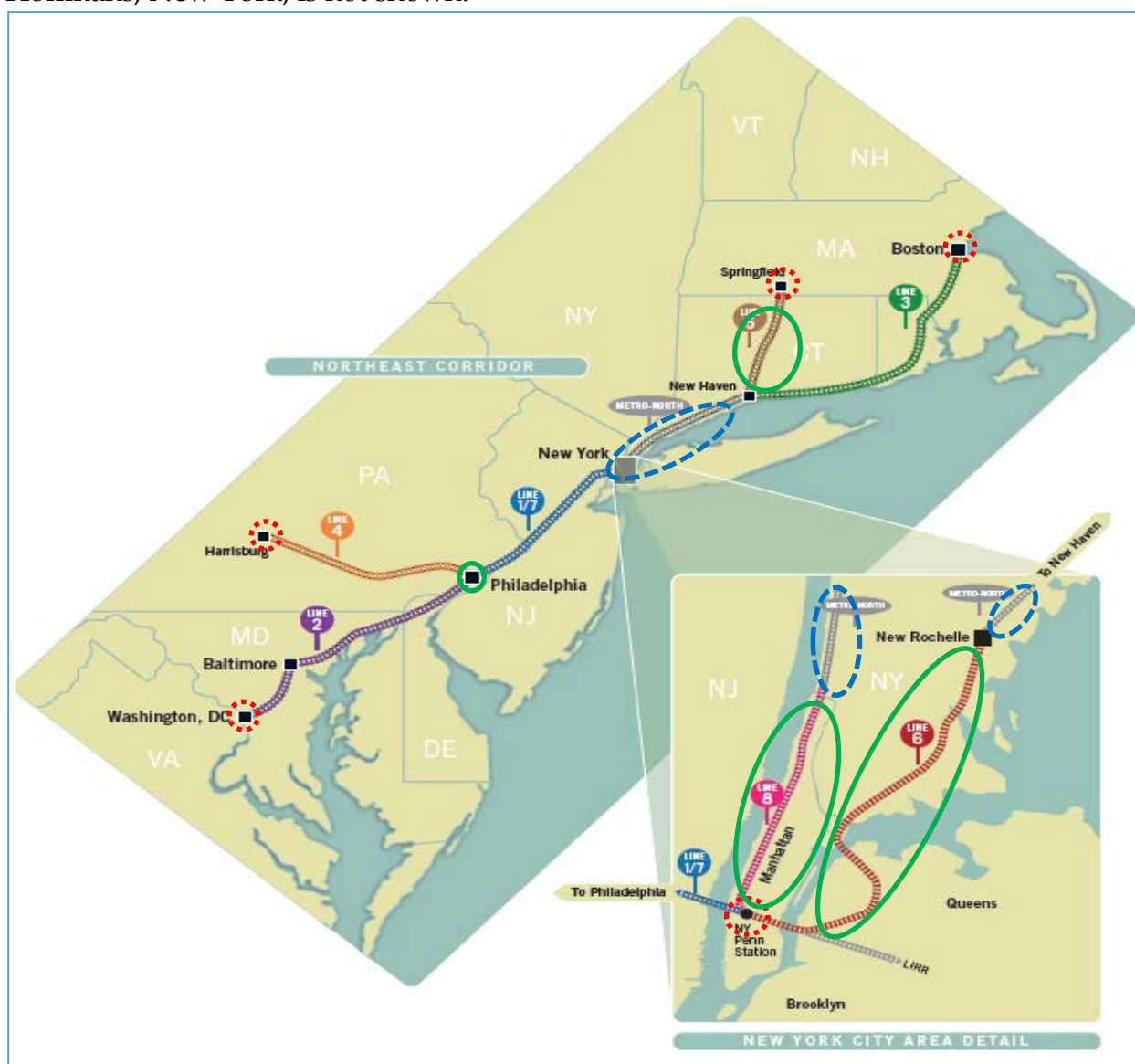
Source: OIG analysis of program office documents

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APPENDIX D

Management Comments from the Chief Operations Officer

AMTRAK

NATIONAL RAILROAD PASSENGER CORPORATION
DJ Stadtler, EVP/Chief Operations Officer
60 Massachusetts Avenue, N.E., Washington, DC 20002
Tel 202-906-3369

Memo

Date:	September 29, 2016	From:	DJ Stadtler
			EVP/Chief Operations Officer
To:	Stephen Lord, *Assistant Inspector General Audits*	Department:	Operations
		Subject:	Safety and Security: Progress Made in Implementing Positive Train Control, but Additional Actions Needed to Ensure Timely Completion of Remaining Tasks
		cc:	Mario Bergeron
			Rodrigo Bitar
			Matthew Gagnon
			Scot Naparstek
			David Nichols
			Gerald Sokol Jr
			Paul Vilter

This memorandum provides Amtrak's response to the Office of Inspector General's recommendations in its September 8, 2016 audit report: Safety and Security: Progress Made in Implementing Positive Train Control, but Additional Actions Needed to Ensure Timely Completion of Remaining Tasks (Project No. 015-2015). Amtrak management agrees with the OIG's recommendations.

Recommendation 1:
Re-evaluate and update current program cost estimates, consistent with leading practices, and ensure that these costs are disclosed in the company's financial plans, including the likely costs of reimbursing host railroads, to ensure that sufficient funds are available to complete the installation of the PTC system by December 31, 2018.

Management Response/Action Plan:
Management agrees with the recommendation. Management is currently re-evaluating the costs associated with PTC including possibly reimbursing host railroads for costs associated with PTC installations that are required solely because of Amtrak operations on a host. The Host Railroad Group is presently reviewing such potential costs in conjunction with the Finance Department.

For those aspects of the PTC implementation Amtrak is aware of, and which it controls at this point, we are committed to complete installation by the mandated date, December 31, 2018. We will have our master plan and schedule with associated cost estimates and critical paths for this aspect of the PTC implementation completed by December 31, 2016.

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We will continue to work closely with the host railroads to ensure our plan and cost estimates for other PTC implementations/expenditures are as complete and accurate as possible.

Recommendation 2:
Clarify the roles and responsibilities of current PTC managers to ensure clear authority and accountability for managing all remaining implementation tasks, and designate an overall senior accountable official with sufficient authority to ensure program success.

Management Response/Action Plan:
Management agrees with this recommendation. Amtrak has hired a Project Manager for PTC who is responsible for the implementation of PTC across internal divisions. Amtrak's Engineering Department, while a large participant in the implementation of PTC, is not responsible for the Mechanical, Operations, Host Railroad, or Transportation responsibilities associated with the installation of PTC. That recently hired project manager has the role of coordinating actions throughout all of those departments and managing the overall program plan. Ultimately, all participating managers in the PTC program are responsible to the Chief Operations Officer and EVP Operations for the successful implementation of the PTC program.

Recommendation 3:
Enhance the project schedule, consistent with leading practices, by identifying all critical remaining implementation tasks and milestones for completion, and establish a process to periodically review the status of remaining actions to measure progress.

Management Response/Action Plan:
Management agrees with this recommendation. The Engineering Division has drafted a master schedule. Mechanical is in the process of drafting a revised master schedule for the commissioning of all Amtrak locomotives as well as the state supported services equipment due to the anticipated delivery of new state supported services equipment. Both schedules will be merged into one master schedule by the overall PTC program manager with all critical paths defined to ensure completion by the implementation deadline. Transportation and Operations tasks such as Crew training and drafting of new Operating Rules will be included in the Master Schedule. Monthly calls are held to review status and develop strategies for correcting should there be any scheduling issues. A fully integrated schedule will be completed by December 2016.

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APPENDIX E

Abbreviations

ACSES	Advanced Civil Speed Enforcement System
FCC	Federal Communications Commission
FRA	Federal Railroad Administration
FY	fiscal year
GAO	U.S. Government Accountability Office
GPS	Global Positioning System
I-ETMS	Interoperable–Electronic Train Management System
NEC	Northeast Corridor
program office	PTC implementation program office
PTC	Positive Train Control
the company	Amtrak

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APPENDIX F

OIG Team Members

Jason Venner, Deputy Assistant Inspector General, Audits

Larry Chisley, Senior Audit Manager

Kathlynn I. Dyer, Operations Analyst

Michelle Navitsky, Auditor

James Simpson, Contractor

OIG MISSION AND CONTACT INFORMATION

Mission

The Amtrak OIG's mission is to provide independent, objective oversight of Amtrak's programs and operations through audits and investigations focused on recommending improvements to Amtrak's economy, efficiency, and effectiveness; preventing and detecting fraud, waste, and abuse; and providing Congress, Amtrak management, and Amtrak's Board of Directors with timely information about problems and deficiencies relating to Amtrak's programs and operations.

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or
800-468-5469

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