



441 G St. N.W.
Washington, DC 20548

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April 30, 2020

The Honorable Roger Wicker
Chairman
Committee on Commerce, Science, and Transportation
United States Senate

Positive Train Control: Railroads Generally Made Progress, but Several Must Meet Compressed Schedules to Meet Implementation Date

Dear Mr. Chairman:

Positive train control (PTC) is a communications-based system designed to automatically slow or stop a train in certain cases where it is not being operated safely. Over a decade ago, a federal law was enacted requiring the implementation of PTC by 42 railroads—including 30 commuter railroads, Amtrak, and several Class I and Class II/III freight railroads—to prevent train-to-train collisions and other types of accidents.¹ The National Transportation Safety Board stated in 2018 that since the enactment of this law, it had investigated 22 rail accidents that could have been prevented by PTC. By statute, railroads were required to implement PTC by December 31, 2018, unless they met certain statutory requirements and requested an extension.² Few railroads completed implementation by year-end 2018, so the Federal Railroad Administration (FRA) granted nearly all of the 42 railroads required to implement PTC an extension up to December 31, 2020. However, FRA is not authorized to grant further extensions.

Over the years, we have periodically reported and testified on railroads' progress implementing PTC.³ We have consistently identified the challenges arising during the complex and lengthy implementation process, which involves nearly all major rail lines and almost every aspect of railroads' operations. In July 2019 we reported that most railroads had completed the earlier

¹Certain railroads were required to implement PTC by December 31, 2015. Rail Safety Improvement Act of 2008, Pub. L. No. 110-432, div. A, 122 Stat. 4848 (2008). In 2015, Congress extended this original deadline. Positive Train Control Enforcement and Implementation Act of 2015, Pub. L. No. 114-73, § 1302, 129 Stat. 568, 576-582 (2015), codified at 49 U.S.C. § 20157. Freight railroads are classified by operating revenues. As of 2017, Class I railroads have annual operating revenues of \$447.6 million or more. Class II railroads have annual operating revenues of less than \$447.6 million but more than \$35.8 million, and Class III railroads have annual operating revenues of \$35.8 million or less.

²The Federal Railroad Administration was required to grant railroads an extension if they met specific statutory requirements and requested an alternative schedule and sequence (i.e., an extension). 49 U.S.C. § 20157.

³See GAO, *Positive Train Control: As Implementation Progresses, Focus Turns to the Complexities of Achieving System Interoperability*, [GAO-19-693T](#) (Washington, D.C.: July 31, 2019); GAO, *Positive Train Control: Most Passenger Railroads Expect to Request an Extension, and Substantial Work Remains Beyond 2018*, [GAO-19-135T](#) (Washington, D.C.: Oct. 3, 2018).; GAO, *Positive Train Control: Most Railroads Expect to Request an Extension, and Substantial Work Remains Beyond 2018*, [GAO-18-692T](#) (Washington, D.C.: Sept. 13, 2018); and GAO, *Positive Train Control: Many Commuter Railroads Still Have Significant Additional Implementation Work and Opportunities Exist to Provide Federal Assistance*, [GAO-18-367T](#) (Washington, D.C.: March 1, 2018).

stages of implementation, such as equipment installation, and were in various stages of testing their PTC systems to demonstrate that their systems met requirements.⁴ However, we found that some railroads still had much work remaining to fully implement PTC, including achieving interoperable PTC operations with tenant railroads.⁵ Interoperability for PTC systems is a critical step as U.S. railroads often operate some or all of their trains as “tenants” on the track of another railroad, known as the “host.” Interoperability ensures, for example, that a train from a tenant railroad can move safely and seamlessly across a host railroad’s track. More recently, FRA identified eight railroads that it considers “at-risk” of not fully implementing a PTC system on all required track by December 31, 2020.⁶

The Chairman of the Senate Committee on Commerce, Science, and Transportation asked us to review railroads’ current implementation status—including their progress in achieving interoperability—and any challenges railroads face implementing PTC. In response, we examined (1) railroads’ progress implementing PTC between March 31, 2019, and December 31, 2019; and (2) challenges selected railroads face in completing PTC implementation by December 31, 2020, as well as steps these railroads and FRA have taken to plan for and mitigate the effects of these challenges.

To describe railroads’ progress implementing PTC, we analyzed all 42 railroads’ most recently available quarterly PTC progress reports railroads submitted to FRA, which reflected progress as of December 31, 2019. We analyzed the reports to determine the extent to which each railroad had initiated different stages of PTC testing and steps to achieve interoperability with other railroads. We categorized the implementation status of tenant-only railroads based on the furthest stage of implementation their host railroad(s) reached.⁷ We compared the status of each railroad as of December 31, 2019, to its status as of March 31, 2019, based on the reporting in our July 2019 testimony.⁸ To ensure consistency and comparability, we used the same method that we used in July 2019 to categorize railroads’ status. Based on our review of these data for anomalies, outliers, or missing information and our previous assessment of such quarterly reports for our three most recent PTC testimonies, we determined that these data were sufficiently reliable for our reporting purposes of describing railroads’ progress in PTC implementation.⁹

To inform our second objective on challenges selected railroads face, we selected representatives from 10 commuter railroads and two Class II/III freight railroads to interview. These 12 railroads included the eight railroads that FRA identified in February 2020 as “at-risk” of not fully implementing PTC by December 31, 2020.¹⁰ We also selected four additional railroads that FRA did not find to be at-risk, but which we found had relatively more work to complete compared to other railroads based on testing and interoperability progress as of

⁴[GAO-19-693T](#).

⁵Full implementation by railroads includes, but is not limited to, equipment installation, testing, interoperability, and system certification by FRA.

⁶FRA’s at-risk analysis was based on railroads’ self-reported progress at year-end 2019.

⁷Host railroads apply for and receive system certification on behalf of their tenant railroads.

⁸[GAO-19-693T](#).

⁹See [GAO-18-367T](#), [GAO-18-692T](#), and [GAO-19-693T](#).

¹⁰These railroads are Alaska Railroad, The Belt Railway Company of Chicago, Florida East Coast Railway (including its tenant railroad, Brightline/ Virgin Trains USA), Kansas City Terminal Railway, New Jersey Transit, New Mexico Rail Runner Express, Northeast Illinois Regional Commuter Railroad Corp. (Metra), and TEXRail. See FRA, *FRA Publishes Railroads’ Fourth Quarter 2019 PTC Implementation Status Updates*, (Washington, D.C.: Feb. 27, 2020).

September 30, 2019.¹¹ We also interviewed industry associations for commuter and freight railroads, and three vendors that provide equipment, software, or support services to railroads implementing PTC. We selected vendors that provide services to multiple railroads, that vary in terms of the type of PTC systems they support, and that we had interviewed for prior work. We reviewed applicable laws and FRA regulations, presentations, reports, and guidance, and we interviewed FRA officials in headquarters. We also reviewed our prior products related to PTC.¹²

We conducted this performance audit from February 2020 to April 2020 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 obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

The 42 railroads subject to the statutory mandate to implement PTC are primarily implementing one of three systems to meet the mandate: the Interoperable Electronic Train Management System (I-ETMS), the Advanced Civil Speed Enforcement System II (ACSES), and Enhanced Automatic Train Control (E-ATC). All three of these systems use different technologies and interact with existing technology differently, but are capable of delivering functionality that meets FRA's PTC requirements.¹³

We have previously reported that railroads must go through multiple stages to meet technical needs and requirements for each stage to complete PTC implementation.¹⁴ With less than a year left to complete PTC, FRA and most railroads have completed equipment installation and are now focused on the testing stages below.

- **Field testing:** testing of all components of the PTC system to demonstrate that they function correctly both individually and with each other. Railroads must successfully complete field testing to progress to later stages of testing.
- **Revenue service demonstration (RSD):** an advanced form of field testing during which the railroad operates PTC-equipped trains in regular service under specific conditions to test and validate the performance of the whole PTC system under normal, real-world operations. A railroad may enter RSD progressively by first beginning RSD on a small portion of a track segment. After completing some testing on that portion, the railroad will then expand RSD to the full segment of track, and eventually to its other segments.
- **Interoperability testing:** Interoperability is achieved when the locomotives of any host railroad and tenant railroad operating over the same track segment can successfully

¹¹We selected railroads that either (1) had less than 25 percent of required route miles in revenue service demonstration (RSD)—an advanced stage of testing—or (2) for railroads that have to interoperate with more than one tenant, had achieved interoperability with less than 25 percent of required tenants. We used data as of September 30, 2019, since they were the most recent data available when we initially selected railroads to interview.

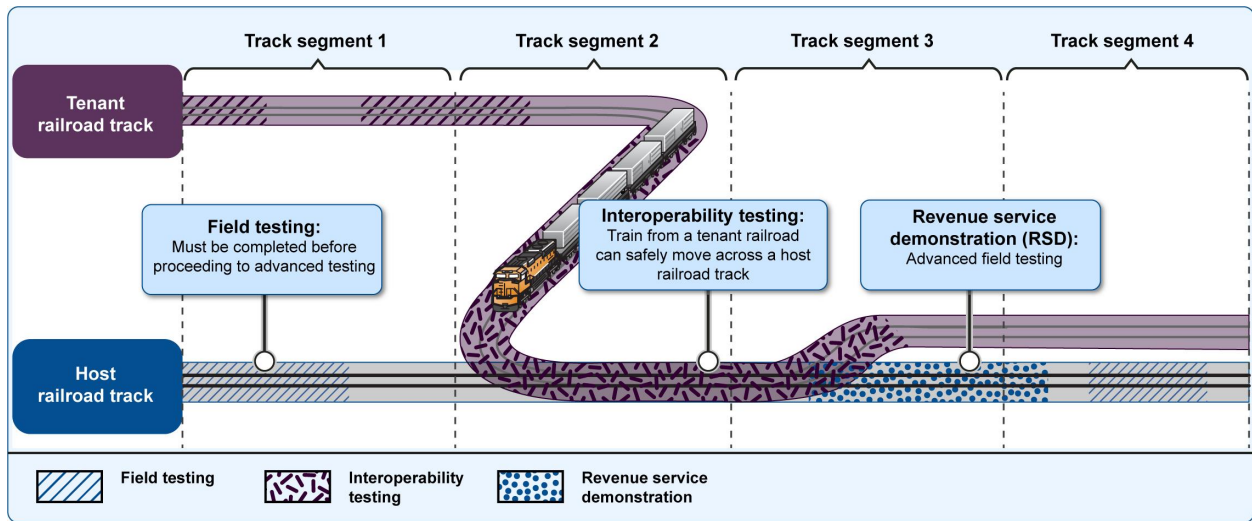
¹²See [GAO-18-367T](#), [GAO-18-692T](#), [GAO-19-135T](#), and [GAO-19-693T](#).

¹³For example, to determine a train's location, ACSES and E-ATC rely on equipment embedded on the track, while I-ETMS uses Global Positioning System information. ACSES and E-ATC both supplement existing train control systems to provide all required PTC functionality, while I-ETMS was designed as a new system to provide this functionality.

¹⁴As mentioned below, stages of PTC implementation include equipment installation, testing—to include field testing and revenue service demonstration testing—interoperability testing, and system certification.

communicate with and respond to the other railroad's PTC system, allowing uninterrupted movements over property boundaries.¹⁵ To achieve interoperability, railroads have to complete a series of steps similar to the steps railroads must take to implement their own PTC systems, including field testing and RSD.¹⁶ Many railroads will complete much of the implementation for their own PTC systems before beginning interoperability testing, but railroads may begin interoperability work concurrent to their own implementation regardless of the implementation stage they are in on their own track (see fig. 1).

Figure 1: Example of a Host Railroad Conducting Interoperability Testing with a Tenant Concurrent to Other Types of Testing on Its Own Track



Source: GAO. | GAO-20-516R

Using results from testing, along with other information about its PTC system, a host railroad must create and submit a safety plan to FRA for review and approval. The safety plan documents, among other things, the design and performance of the PTC system as validated through testing, and the railroad's risk assessments and hazard mitigation analyses. When FRA approves a safety plan, it certifies the system and authorizes the railroad to operate its PTC system in revenue service. As we have previously reported, FRA may impose conditions on its approval of the safety plan to ensure safety, resulting in a conditional certification.¹⁷ According to FRA officials, FRA may consider a railroad with conditional certification fully implemented as long as the conditions do not relate to noncompliance with the core functionality required for a PTC system by statute and the FRA-certified PTC system is interoperable and governing operations on all PTC-mandated route miles.

¹⁵49 U.S.C. § 20157. See also [GAO-19-693T](#).

¹⁶For certain PTC systems, railroads also have to ensure that their PTC back office servers, which contain information on track features and speed restrictions, are linked and can communicate to achieve interoperability; railroads call this process "federation." However, depending on the PTC systems, federation can occur at different points in the interoperability process. For I-ETMS, for example, railroads must complete federation before conducting lab or field testing. Because ACSES relies on transponders to communicate certain information to locomotives, railroads can complete federation either before or after lab or field testing.

¹⁷[GAO-19-693T](#).

FRA is responsible for overseeing railroads' PTC implementation, issuing governing regulations, and providing direct assistance to railroads implementing PTC. FRA provides technical assistance to railroads, addresses questions, and reviews and approves railroads' documentation, including test and safety plans. FRA has a national PTC staff director, two PTC senior test monitors, designated PTC specialists in the eight FRA regions, and approximately a dozen engineers and contractors and other staff responsible for overseeing technical aspects of implementation. FRA also has oversight tools, which include authority to impose civil penalties when a railroad fails to meet certain PTC requirements.¹⁸

FRA monitors railroads' progress by reviewing the quarterly and annual reports railroads are required to submit to FRA.¹⁹ Using these reports, FRA has periodically identified railroads it determines are at-risk of not meeting PTC requirements by specified deadlines. In evaluating railroads' risk of noncompliance with the extended implementation deadline for its February 2020 at-risk list, FRA considered four aspects of railroads' progress in achieving PTC implementation, such as status at the end of 2019 in key implementation areas and unresolved technical issues.²⁰

Over the past decade we have made five recommendations to FRA to improve its oversight of railroads' PTC implementation efforts.²¹ FRA has made several improvements that have enabled us to close all of these recommendations. For example, in March 2018 we recommended that FRA identify and adopt a method for systematically communicating information to railroads.²² In response, FRA began holding regular collaboration sessions in summer 2018 with all railroads implementing PTC to consistently communicate information, such as stages of testing and FRA's process to review safety plans.

Most Railroads Were In Advanced Stages of PTC Implementation by December 2019, but More Than Half Made Limited Progress throughout Most of 2019

Based on railroads' self-reported implementation progress as of December 31, 2019, more than three-quarters of railroads were in RSD or working to achieve interoperability, which are the last two stages of PTC implementation before full implementation. However, a handful of railroads remained in the early stages of PTC implementation (see fig. 2).

¹⁸49 U.S.C. § 20157(e)(1)-(4).

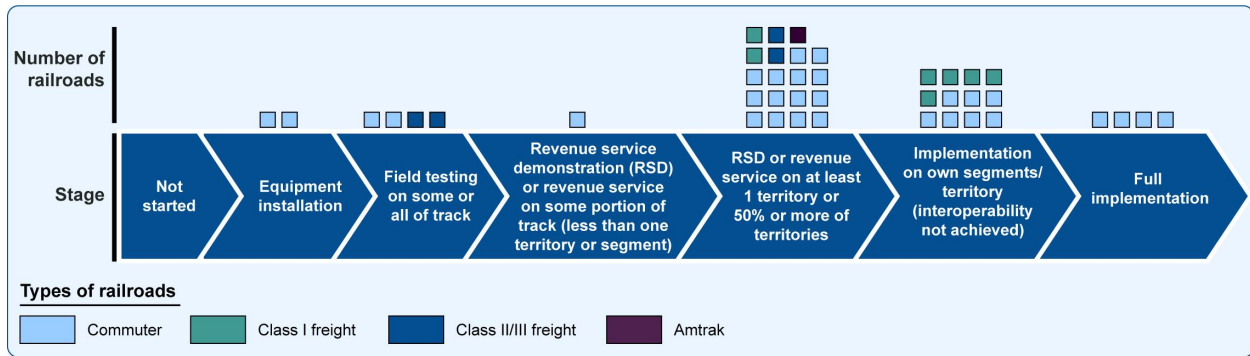
¹⁹To effectively monitor each railroad's progress implementing PTC, FRA requires the submission of quarterly progress reports under its investigative authorities. See e.g., 49 U.S.C. §§ 20107, 20157(c)(2), 20902; 49 C.F.R. § 236.1009(h). In addition, each railroad is required to annually report to FRA on PTC implementation progress in areas such as spectrum acquisition, installation progress, and the total number of route miles where RSD has been initiated or PTC is in operation. See 49 U.S.C. § 20157(c)(1); 49 C.F.R. § 236.1009(a)(5).

²⁰To identify railroads that, according to FRA are at risk of not meeting the extended December 31, 2020 deadline, FRA considered (1) a railroad's percent of mandated route miles currently governed by a PTC system including RSD; (2) the percentage of a host railroad's tenants that have achieved interoperability; (3) any unresolved technical issues that could affect implementation; and (4) a host railroad's expected date to submit a safety plan to FRA, as required to obtain certification.

²¹See [GAO-18-367T](#); GAO, *Positive Train Control: Additional Oversight Needed as Most Railroads Do Not Expect to Meet 2015 Implementation Deadline*, [GAO-15-739](#) (Washington, D.C.: Sep. 16, 2015); and GAO, *Rail Safety: Federal Railroad Administration Should Report on Risks to the Successful Implementation of Mandated Safety Technology*, [GAO-11-133](#) (Washington, D.C.: Jan. 14, 2011).

²²[GAO-18-367T](#).

Figure 2: Railroads' Positive Train Control (PTC) Implementation Status as of December 31, 2019



Source: GAO Analysis of railroads' progress reports to the Federal Railroad Administration as of December 31, 2019. | GAO-20-516R

Notes: Full implementation means a railroad has implemented a Federal Railroad Administration-certified PTC system on all its own required territories and has achieved interoperability with any railroads that operate on its tracks. Generally, because host railroads apply for and receive system certification on behalf of their tenant railroads, for tenant-only railroads—railroads that only operate over a host's track—we took into account the implementation status of their host(s). For example, if a tenant-only railroad has completed all PTC implementation steps through interoperability but its host(s) are not fully implemented, we did not categorize the tenant-only railroad under “full implementation.”

Revenue service demonstration or revenue service on at least one territory was one of the statutory criteria a railroad could use to receive an extension beyond the December 31, 2018 deadline. 49 U.S.C. § 20157(a)(3)(B). Though that deadline has passed, we maintain this category for consistency with our previous analysis.

The four railroads that have reached full PTC implementation did so by the December 31, 2018 deadline.

The implementation status of railroads within each of these stages varied. For example, of the four railroads still in field testing at the end of 2019 (the third stage in fig. 2), two—both commuters—were in field testing on less than 25 percent of their route miles, while the two Class II/III railroads were in field testing on nearly all of their route miles. Similarly, railroads in RSD (the fourth and fifth stage in fig. 2) were conducting this advanced testing on between 20 percent and 100 percent of their route miles. Five of the railroads in this category reported reaching “extended RSD” on all their segments or route miles, which means that they had successfully conducted the number of RSD tests FRA required, but had not yet completed the other requirements for full implementation, such as system certification, and so continue to operate their trains in RSD.

While some railroads made forward progress during the last 9 months of 2019, more than half of railroads remained in the same stage during this period and no additional railroads reached full implementation (see table 1).

Table 1: Change in Railroads’ Positive Train Control Implementation Stage March 31, 2019, to December 31, 2019

	Number of Class I Railroads	Number of Commuter Railroads	Number of Class II/III Railroads	Amtrak	Total
Moved from “Not Started” to “Equipment Installation” or “Field Testing”	-	1	-	-	1
Moved from “Field Testing” to Revenue Service Demonstration (RSD) on a portion of track	-	5	2	-	7
Moved from RSD on a portion of track to RSD or Implementation on all own territories	3	3	-	-	6
Remained fully implemented	-	4	-	-	4
No Change in implementation stage	4	17	2	1	24

Source: GAO analysis of railroad’s quarterly progress reports for January 1, 2019, through March 31, 2019, and October 1, 2019, through December 31, 2019. | GAO-20-516R

For the 24 railroads that remained in the same implementation stage during the last 9 months of 2019, their progress within that stage varied. For example, just over half of the 10 commuter railroads that remained in RSD increased the percentage of their route miles in RSD by between 30 and 57 percent.²³ However, none of the four railroads that remained in the field testing stage increased the percentage of their route miles in field testing during this time. Some of these railroads did make more progress in 2020. In March 2020, two of these railroads reported that they had reached RSD on the entirety of their route miles, and a third railroad had been approved to start RSD.

Regardless of the stage of implementation they were in on their own PTC systems, we found that most railroads had begun work on interoperability by the end of 2019 and reported progress in achieving interoperability with their tenant railroads. Overall, railroads reported to FRA that they had begun work on interoperability for more than 98 percent of host-tenant relationships, and the majority of these relationships had reached the testing stage as of December 31, 2019. Moreover, six additional host railroads reported that they had achieved interoperability with at least one tenant, resulting in 17 of the 31 (6 Class I, 10 Commuter, and Amtrak) railroads that must achieve interoperability with one or more tenants having done so with at least one tenant, as of the end of 2019.²⁴

While railroads reported overall progress achieving interoperability, progress varied across different types of railroads (see table 2).

²³About a third of these railroads had 100 percent of their route miles in RSD as of March 31, 2019, and so maintained all of their route miles in RSD through December 31, 2019.

²⁴The remaining 11 railroads required to implement PTC are not included in this count because (1) five of the railroads do not have any tenants or have tenants that are not required to implement PTC, and (2) six of the railroads operate only as tenants on other railroads.

Table 2: Status of Interoperability for Host-Tenant Relationships as of December 31, 2019

	Total host-tenant relationships required to achieve interoperability	Percentage of tenants not started	Percentage of tenants installing	Percentage of tenants in testing	Percentage of tenants complete
All	218	1.4	18.3	39.4	37.6
Class Is	119	1.7	16.8	25.2	50.4
Commuters	57	1.8	22.8	43.9	31.6
Class II/IIIs	25	0	28	72	0

Source: GAO analysis of railroads' quarterly progress reports for October 1, 2019 – December 31, 2019. | GAO-20-516R

Note: We based the total required relationships on the number of relationships railroads reported in their self-reported progress reports. This number may vary from the Federal Railroad Administration's (FRA) publicly reported total because FRA bases its report on railroads' positive train control (PTC) implementation plans and because the number of tenants required to implement PTC may change over time as, for example, railroads request exemptions for specific tenants.

Though Class I railroads were closer to achieving interoperability with their tenants overall, none of the seven Class I railroads had achieved interoperability with all of its tenants by the end of 2019, while five commuter railroads had done so. Class I railroads generally have more work to do to achieve interoperability because they have more tenants they must interoperate with. For example, Class I railroads must each achieve interoperability with between four and 26 tenant railroads. In contrast, the five commuter railroads that have achieved interoperability with all of their tenants each have four or fewer tenants.

Selected Railroads Report Continued Challenges, Including Compressed Schedules, but FRA and Selected Railroads Are Developing Mitigation Strategies

Selected Railroads Have Addressed Some Challenges, but Software and Vendor Challenges Are Becoming More Acute As Schedules Are Compressed

According to some selected railroads, railroads—with the support of FRA—have addressed some of the software challenges we identified in our prior reports. For example, representatives from a railroad association and one vendor reported that a vendor developed a solution for memory limitations with onboard computers for I-ETMS. The solution has allowed railroads using I-ETMS—which includes all the Class I railroads—to move forward with interoperability.²⁵ Additionally, Amtrak has developed a solution to meet requirements to secure wireless communications on the Northeast Corridor, which runs from Washington, D.C. to Boston,

²⁵In July 2019 we reported that the memory available on the locomotive equipment, which is needed to store its railroad's track data, was insufficient to store and exchange multiple railroads' track data, which prohibited railroads with large track data files—mainly the Class I freight railroads—from being able to interoperate. See [GAO-19-693T](#).

Massachusetts, and includes Amtrak, eight commuter railroads, and freight railroads.²⁶ One railroad we spoke to told us that it is now working to test and deploy this solution.

While FRA, selected railroads, and vendors we spoke to told us that they have taken steps to help address other challenges we have previously identified, software and vendor issues remain critical challenges for PTC implementation, especially as railroads work toward interoperability.

- **Software issues:** As we have previously reported, software issues have routinely surfaced in lab testing, field testing, and RSD and have required vendor revisions before PTC implementation can continue.²⁷ Such issues can take time for railroads' vendors to work through. Most of the railroads we spoke to (8 of 12) reported continued software challenges, and several emphasized that PTC software often requires customization to a railroad's unique operating environment, which can make achieving interoperability more complex. As we have previously reported, PTC software presents particular challenges along the Northeast Corridor, as software for ACSES is being supplied by multiple vendors and has been developed to accommodate railroads' different configurations.²⁸ One commuter railroad on the Northeast Corridor told us that getting a stable and effective version of software has been a major challenge. Specifically, it took longer than anticipated for the railroad to receive software with no critical defects, such as being able to recognize a stop message for a speed restriction, which contributed to a delay of at least 3 months in the railroad entering RSD. Another commuter railroad noted that it has delayed its implementation schedule to give the vendor more time to work through issues.
- **Vendor issues:** As we have previously reported, the limited supply of vendors and PTC expertise, coupled with high demand for services as railroads work simultaneously to implement PTC by the end of 2020, poses problems.²⁹ We also reported that software and vendor issues can be interrelated, as a small pool of vendors develops and updates the software that supports railroads' PTC systems. The majority of railroads (7 of 12) noted that vendor issues continue to be a challenge. For example, one railroad told us that it had difficulty getting the vendor to give full attention to the railroad's needs, given the vendor's many other clients. One vendor noted it is particularly difficult for vendors to give railroads that started later than others the time and resources they may need, given that vendors had existing contracts in place and limited resources. Vendors we interviewed also acknowledged that there is limited PTC expertise industry-wide and said they have taken steps to address the high volume of work they face in helping implement PTC. These steps include increasing communication with railroads to prioritize work, and leaning heavily on lab testing and automation to help speed work in the field.

Railroads we interviewed reported that the challenges above, which have been persistent and interrelated throughout railroads' PTC implementation, have grown more acute as many selected railroads have compressed their implementation schedules in order to complete required tasks needed to reach full implementation within the next 8 months. For example, five

²⁶In July 2019 we reported that FRA requires PTC wireless railroad communications to be encrypted, and that Amtrak had received a grant in August 2016 to develop encryption software for railroads operating ACSES along the Northeast Corridor. As of our reporting in July 2019, the software was in lab development with an estimated implementation date of January 2020, but Amtrak had reported delays and risks that it had to overcome to meet that date. See [GAO-19-693T](#).

²⁷[GAO-19-693T](#), [GAO-19-135T](#), [GAO-18-692T](#).

²⁸[GAO-19-693T](#).

²⁹[GAO-19-693T](#).

of the railroads we interviewed—including three at-risk railroads—have had to compress their schedules to meet the extended deadline due to delays, such as in receiving software or having to reinstall equipment because of recalls. Two at-risk railroads told us their schedules are compressed due to unique circumstances that caused their railroads to start implementing PTC later than other railroads. In July 2019 we reported that scheduling testing across railroads was a particular challenge to achieving interoperability.³⁰ Two vendors we interviewed said it remains difficult for railroads to find time for on-track PTC testing due to railroads' busy and often conflicting schedules. In addition, within the context of compressed schedules, the recurring challenges above create risks that could affect some railroads' ability to fully implement PTC by the extended deadline. For example, one at-risk commuter railroad representative, in discussing the current setting for implementing PTC, said that "losing a day is like losing a week."

As a result, railroads face limited time to customize their PTC systems by the deadline, which could cause delays and other effects on operations as railroads implement PTC. Five selected railroads and two vendors told us that it is difficult to balance the work needed to meet the requirements of full PTC implementation with the work needed to optimize the system to the railroads' operations within the limited time left until the deadline. For example, a representative from one at-risk railroad noted that, since the PTC system is designed to slow or stop an over-speed train and to prioritize safety, their trains have experienced excessive braking, or slowing of trains that were not over speed during testing. This representative expressed concerns that such excessive braking could result in delays for passengers, freight, and the traveling public at highway-grade crossings when the PTC system is on.

Similarly, a representative from a different at-risk commuter railroad told us the railroad has experienced challenges getting trains turned around quickly enough between trips when operating PTC, which could affect the railroad's schedule.³¹ In these examples, the PTC system may be providing required safety benefits but having unintended effects on schedules. According to both representatives, such side effects of PTC can be overcome by working through software issues to optimize the system which, as mentioned above, requires vendor resources and time, both of which are limited. Currently, railroads can resolve these issues by "cutting out" of the PTC system—essentially turning PTC off to maintain on-time operations. However, after December 31, 2020, this will not be an option.

Furthermore, unforeseen issues, in particular the Coronavirus Disease 2019 (COVID-19) global pandemic, could delay railroads' implementation and put railroads at risk of missing the extended deadline. Prior to the World Health Organization's March 11, 2020 designation of COVID-19 as a global pandemic, one railroad and two vendors noted that extreme, unpredictable events like COVID-19 posed a risk to supply chains and could ultimately jeopardize railroads' ability to meet the deadline. In April 2020, FRA officials told us that the global pandemic has presented challenges for railroads, such as a reduction in the ability of vendors to travel for on-site testing or assistance due to social distancing protocols. In addition, as of April 7, 2020 a railroad association representative reported that many vendors have notified railroads of the potential for significant delays due to COVID-19. Furthermore, one commuter railroad in a metropolitan region significantly affected by COVID-19 as of early April

³⁰[GAO-19-693T](#).

³¹These challenges are a result of the length of time it takes for a railroad's PTC system to "initialize," or prepare for the upcoming route. This requires information on the railroad's locomotive equipment as well as route and track condition information. To travel through multiple railroads' territory on a single route, initialization also requires that the railroad's PTC system have route and train information from—and provide information to—all of the railroads it crosses. Obtaining this information can result in longer wait times to turn a train around.

noted that due to 10 to 15 percent of its workforce being sick or quarantined, it has implemented a rotating schedule for workers, which could affect productivity.

FRA officials told us that railroads and vendors are addressing some of these challenges by, for example, observing testing from a remote location and operating PTC test labs remotely to continue work. FRA officials also said that some railroads are taking advantage of available staff and track time caused by reduced operations and ridership to make progress on PTC implementation and testing. In early April 2020, FRA officials and a railroad association representative reported that no railroads had yet indicated that COVID-19 effects would result in an inability to meet the extended deadline. A representative from the previously-mentioned commuter railroad noted, however, that progress over the next 3 months and the unfolding effects of COVID-19 will be critical to determining whether the railroad will be able to meet the deadline.

Selected Railroads Expect to Meet the Extended PTC Deadline, but Some Are Developing Mitigation Strategies for Compressed Schedules and Other Challenges

FRA, vendors, associations, and railroads we interviewed were generally optimistic that railroads will be able to overcome the above challenges and achieve full PTC implementation by December 31, 2020. However, all acknowledged that these challenges pose risks and said they are closely monitoring schedules and working together to mitigate those risks. Representatives from two industry associations and two vendors noted industry-wide efforts to coordinate on interoperability or seek efficiencies. For example, one industry association told us that railroads implementing the E-ATC system worked together to jointly address FRA's comments on one railroad's safety plan. This safety plan will form a baseline for future E-ATC safety plans, saving both railroads' and FRA's time and resources going forward. Furthermore, railroads continue to apply lessons learned from testing completed by other railroads to help accelerate their implementation efforts. Representatives from one at-risk railroad that uses I-ETMS said that as more interoperability testing has been completed, some testing that used to take 2 days can now be done in 1 day. A representative from one commuter railroad told us that the railroad was able to progress from field testing in March 2019 to full implementation on all its own required track by March 2020 by hiring an internal team with PTC experience, including PTC testing; this railroad also used a dedicated crew for testing that knew the PTC system well and could thus work with the vendor to conduct testing quickly.

In addition to industry-wide efforts, FRA has taken several steps and led specific efforts to address challenges and mitigate risks over the last year, which are described in more detail below. These steps are consistent with the recommendation we made to FRA in March 2018 that the agency develop an approach to use the information it gathers on railroads' PTC implementation progress to prioritize the allocation of its resources to address the greatest risks.³² As a result, we closed this recommendation as implemented in March 2020. Specifically:

- FRA has focused on how it can assist railroads to meet key milestones in PTC implementation schedules. FRA officials said they specifically prioritized getting as many railroads as possible into RSD in 2019—as RSD is a key stage of testing needed prior to full implementation—and in 2020 they continue to work to get remaining railroads to and through this stage.

³²[GAO-18-367T](#).

- Over the last year, FRA officials told us they had identified specific regions—each home to at least one of the FRA-identified at-risk railroads—that need additional attention and targeted resources accordingly. For example, the FRA Administrator chairs monthly meetings with all railroads operating on the Northeast Corridor to discuss progress and interoperability. FRA also trained some inspectors in three regions to support PTC testing and implementation where railroads have substantial testing to complete during 2020.
- As noted above, FRA also reinstated its practice of identifying railroads that are at-risk of not fully implementing PTC on all required lines by December 31, 2020, and FRA officials told us they plan to work even more closely with these railroads going forward.

More recently, FRA has begun efforts to monitor the impact of the COVID-19 global pandemic on PTC implementation. On March 13, 2020, FRA opened an emergency docket for railroads and the industry to raise issues and seek relief from regulatory requirements while they shift resources to address the COVID-19 global pandemic. As of early April 2020, FRA officials said they had not received any requests to waive PTC implementation requirements. FRA officials told us they also hold regular meetings with railroads and associations to collect information, such as the number of railroad staff who test positive for COVID-19. According to FRA, it will continue to use these efforts to monitor the effects of the global pandemic on PTC implementation.

Some railroads we interviewed said they have individually started identifying strategies to mitigate potential risks to their railroad implementing PTC by the end of 2020. Representatives from four railroads we interviewed discussed the steps they have taken to lower the risk they would not finish implementing PTC by the extended deadline. For example, one railroad has prioritized the delivery of critical software needed to meet PTC requirements over other software to update other dispatch functions to be delivered later, possibly after 2020. In addition, FRA is working with railroads to develop alternative solutions to technical problems that could help railroads achieve the functionality required for full PTC implementation. For example, one aspect of the software that ensures a train moves seamlessly between its own and another railroad's territory—helping to resolve what are known as boundary issues—is not likely to be in place for certain railroads by the end of 2020, based on our interviews with selected railroads and FRA. As such, railroads and FRA have identified an interim solution that involves railroads' use of some manual processes that would allow for the same functionality when trains cross boundaries. FRA officials said this interim solution complies with regulations and allows for railroads to be considered fully implemented with conditionally certified safety plans by December 31, 2020, while railroads and vendors continue to work on a long-term solution.

With mitigation steps underway, seven selected railroads, including at-risk railroads, said they are confident they can fully implement PTC by the end of 2020. However, representatives from four railroads we interviewed said they had discussed or started to develop contingency plans, based on their own or their tenants' progress.³³ According to some of these railroads, they would likely suspend certain rail operations, or substitute with bus or other service, if they are unable to meet the statutory requirements by the extended deadline. The FRA Administrator has publicly stated that he will enforce the extended implementation deadline (which is no later than December 31, 2020) and will recommend that the Secretary of Transportation assess the maximum civil penalty against a railroad that did not meet its deadline. However, some railroads

³³Officials from the remaining selected railroad did not comment on its confidence implementing PTC by December 31, 2020, but also did state it was developing contingency plans.

we interviewed said some ambiguity on enforcement remains. For example, some railroads told us FRA has not explained how it would handle certain situations, such as where a host or tenant is not fully implemented. As a result, representatives from two railroads told us ambiguity exists for specific circumstances that they may face and thus need to plan for, as the end of 2020 nears. According to FRA, the agency has repeatedly stated that it can assess civil penalties against a host railroad or its tenant railroad if the tenant's operations are not governed by a PTC system after the statutory deadline or have not been granted an exception.³⁴

The plans to mitigate risks associated with some challenges mean that some aspects of PTC implementation will likely continue beyond the end of 2020, as railroads fine tune PTC systems and address remaining conditions set by FRA as part of its approval of railroads' safety plans. For example, according to FRA officials, the interim solution to address the boundary issue described above would allow railroads to be considered fully implemented by the extended deadline, but would require additional work to test and deploy the software to address boundary issues in 2021 or beyond. Furthermore, as railroads have limited time left to develop solutions and optimize their PTC systems, their use of these PTC systems may cause some operational disruptions, like delayed passenger trains or reduced schedules, until the railroads can complete this work. Two railroads and one vendor reported that changes to PTC systems to improve efficiency of operations will have to wait until after full PTC implementation. Therefore, completing the implementation requirements by the end of 2020 will be but the first step for full PTC operations, as this operating environment becomes the new normal for FRA and railroads.

Agency Comments

We provided a draft of this report to the Department of Transportation. The Department of Transportation reviewed the draft and did not have any comments.

GAO Contact and Staff Acknowledgments

We are sending copies of this report to the appropriate congressional committee, the Secretary of Transportation, and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions concerning this report, please contact me at (202) 512-2834 or by e-mail at repkoe@gao.gov. Contact points for our Office of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report were Nancy Lueke (Assistant Director); Katherine Blair Raymond; Chris Ferencik; Delwen Jones; Emily Larson; Joanie Lofgren; Shannin G. O'Neill; Madhav Panwar; Malika Rice; Maria Wallace; Crystal Wesco; and Elizabeth Wood.

Sincerely yours,



Elizabeth Repko

³⁴Certain tenant railroads can receive an exception to implementing PTC. 49 C.F.R. § 236.1006(b).

Acting Director, Physical Infrastructure Issues

(Job code 104112)