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BEFORE THE U.S. SENATE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

HEARING ON POSITIVE TRAIN CONTROL

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On behalf of CSX Transportation, Inc. (CSX) and the Association of American Railroads (AAR), thank you for the opportunity to appear before you today to discuss positive train control (PTC).

CSX operates a freight rail network spanning approximately 21,000 miles, with service to 23 eastern states, the District of Columbia and two Canadian provinces. We are part of a 140,000-mile U.S. freight rail network that serves nearly every industrial, wholesale, retail, agricultural, and mining-based sector of our economy. Whenever Americans grow something, eat something, mine something, make something, turn on a light, or get dressed, CSX or another freight railroad is probably involved somewhere along the line.

In this testimony, I will describe what positive train control is, the steps CSX and other freight railroads have taken to develop and implement this new technology, and explain why — despite railroads' best efforts — the existing statutory deadline for nationwide PTC implementation is unrealistic and should be extended.

What is Positive Train Control?

"Positive train control" (PTC) describes technologies designed to automatically stop a train before certain accidents caused by human error occur. The Rail Safety Improvement Act of 2008 (RSIA) requires passenger railroads and Class I freight railroads to install PTC by the end of 2015 on main lines used to transport passengers or toxic-by-inhalation (TIH) materials.[1] Specifically, PTC as mandated by the RSIA must be designed to prevent train-to-train collisions, derailments caused by excessive speed, unauthorized incursions by trains onto sections of track where maintenance activities are taking place, and the movement of a train through a track

[1] TIH materials are gases or liquids, such as chlorine and anhydrous ammonia, which are especially hazardous if released into the atmosphere.

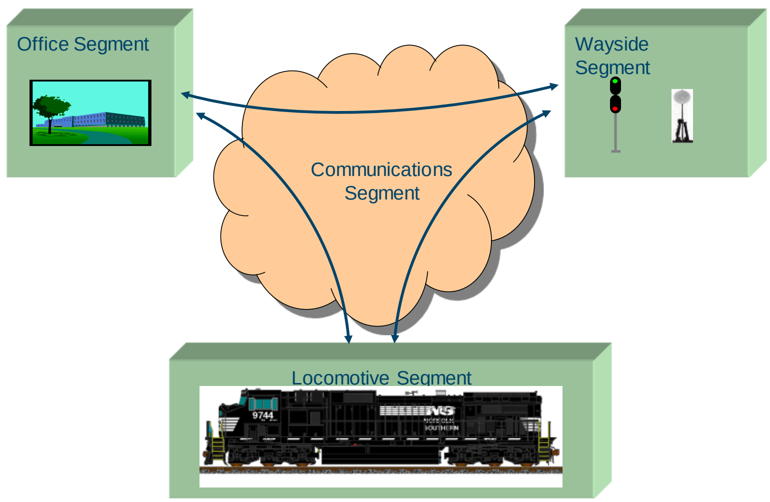
switch left in the wrong position.[2] The PTC systems that will be installed to meet the statutory mandate are overlay systems, meaning they supplement — rather than replace — existing train control systems.

Positive Train Control is an Unprecedented Technological Challenge

A properly functioning PTC system must be able to determine the precise location, direction, and speed of trains; warn train operators of potential problems; and take immediate action if the operator does not respond to the warning provided by the PTC system. For example, if a train operator fails to begin stopping a train when approaching a stop signal, or slowing down for a speed-restricted area, the PTC system would apply the brakes and stop the train automatically, before the train passed the stop signal or entered the speed-restricted area.

PTC System Interactions

Each segment requires highly complex technologies and information processing capabilities.



Such a system requires highly complex technologies able to analyze and incorporate the huge number of variables that affect train operations. A simple example: the length of time it takes to stop a train depends on train speed, terrain, the weight and length of the train, the number and distribution of locomotives and loaded and empty freight cars on the train, and other

[2] A switch is equipment that controls the path of trains where two sets of track diverge.

factors. A PTC system must be able to take all of these factors into account automatically, reliably, and accurately in order to safely stop the train.

The development and implementation of PTC systems constitute an unprecedented technological challenge for railroads (See Attachment A). Tasks involved include:

- A complete physical survey and highly precise geo-mapping of the approximately 60,000 miles of railroad right-of-way on which PTC technology will be installed, including geo-mapping of nearly 440,000 field assets (mileposts, curves, grade crossings, switches, signals, and much more) along that right of way.
- Installing PTC technology on more than 22,900 locomotives.
- Installing over 35,000 "wayside interface units" (WIU) that provide the mechanism for transmitting information to locomotives and the train dispatching office from signal and switch locations along the right of way.
- Installing PTC technology on over 3,300 switches in non-signaled territory and completing signal replacement projects at more than 14,500 locations.
- Developing, producing, and deploying a novel radio system and new radios specifically designed for the massive data transmission requirements of PTC at 4,000 base stations, 31,000 trackside locations, and on 22,900 locomotives.
- Developing back office systems and upgrading dispatching software to incorporate the data and precision required for PTC systems.


PTC locomotive cab display unit

In all of these areas, railroads have made substantial progress. As of the end of 2014, 13,000 locomotives were at least partially equipped with PTC, out of the 22,900 that will require PTC installations; some 19,000 WIUs are deployed, out of 35,000 that will ultimately be required; and close to 1,500 of the 4,000 base station radios were installed. These statistics represent the incredible effort railroads have made toward installing the nationwide, interoperable PTC network. However, there is no question that much more work remains to be done.

More Time is Needed to Ensure Safe and Effective Implementation

CSX and other freight railroads have been working tirelessly, and spending tremendous amounts of money, to meet the PTC mandate. As of the end of 2014, CSX has invested some $1.2 billion on PTC. We expect to spend another $300 million this year. Our current estimate for the total cost of PTC on our railroad is at least $1.9 billion. Freight railroads together have so far spent well over $5 billion — of their own funds, not taxpayer funds — on PTC development and deployment, and expect to spend at least $9 billion by the time PTC is fully operational nationwide. This does not include the hundreds of millions of additional dollars needed each year to maintain the railroads' PTC systems when they are complete.

Despite these huge expenditures, PTC's complexity and the enormity of the implementation task — and the fact that much of the technology PTC requires simply did not exist when the PTC mandate was passed and has had to be developed from scratch — more time is needed for full implementation.

Much of the railroads' efforts to date has been directed toward development and initial testing of technology that can meet the requirements of the legislation and which can be scaled to the huge requirements of a national system. For example, production and installation of the new radios was possible only after a long period of development and testing. Essential software and hardware for many PTC components are being deployed, and rigorous testing of these components are being performed. Only after this work is completed and the technology has been installed can the task of testing each of the individual parts, and the system as a whole, be completed.

This task is made particularly complex by the need to ensure that PTC systems are fully and seamlessly interoperable across all of the nation's major railroads. It is not unusual for one railroad's locomotives to operate on another railroad's tracks. When that happens, the "guest" locomotives must be able to communicate with, and respond to commands from, the "host" PTC system. Put another way, a CSX locomotive has to behave like a Norfolk Southern locomotive when it's traveling on NS's tracks; a BNSF locomotive must be compatible with Union Pacific's PTC system when it's on UP tracks, and so on. That's much easier said than done, and ensuring this interoperability has been a significant challenge.[3]

It is also critical that the many potential failure points and failure modes in PTC systems are identified, isolated, and corrected — all without negatively impacting the efficient movement of goods by rail throughout the country. This is incredibly important. The PTC systems the railroads ultimately develop must work flawlessly, day in and day out, or risk seriously impairing operations on key parts of the U.S. freight rail network. The damage that would cause to our nation's economy would be enormous.

In addition, the Federal Railroad Administration must review each railroad's PTC safety plan and certify each railroad's PTC systems after the development and testing of the components are complete. Only then can a railroad's PTC installation be completed and placed into operation.

Railroads knew when the PTC mandate was passed in 2008 that the technological challenges related to PTC would be immense. But railroads have also faced significant non-technological barriers to timely PTC implementation.

Most notably, one such challenge involves regulatory barriers to the construction of antenna structures. As part of PTC implementation, railroads must install over 35,000 wayside

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[3] *Some have questioned why railroads don't all simply implement identical PTC systems, thereby ensuring interoperability. That's not possible because a railroad's PTC system must function within the parameters of that railroad's existing communication and dispatching system. These existing systems vary from railroad to railroad.*

antenna structures nationwide to transmit PTC signals. Approximately 97 percent of these structures are relatively small poles, between 6 and 60 feet high, installed on railroad rights-of-way alongside railroad tracks. The remainder, approximately 3 percent, are larger base stations similar to traditional telecommunication towers. Depending on the location, these larger structures may or may not be located on a railroad's right-of-way.

The railroad industry had been working with the Federal Communications Commission (FCC) for years to license the wireless spectrum necessary for PTC. Despite this work, an issue arose in early 2013 that neither the rail industry nor the FCC foresaw: the FCC's requirement that the railroads submit the poles that support PTC antennas for historic preservation and tribal review. The FCC's historic preservation review process requires railroads to provide information (height, location, etc.) on each antenna structure to historic preservation officers within state governments and Native American tribes so that the states and tribes can determine if the installations will negatively impact areas of historic, cultural, or religious significance.

It quickly became clear that the FCC's existing process was inadequate for a deployment on the scale of PTC and in the time frame mandated by the RSIA. In fact, in May 2013, the FCC asked the railroads to stop filing applications for review while the agency developed a new process for PTC antenna structures. In the meantime, railroads were asked to cease the installation of these structures, creating a huge impediment to timely PTC implementation.

To its credit, the FCC was willing to work with the railroads to find a workable solution. (The rail industry is also grateful to members of this committee for the attention they gave this issue.) As far as the railroads are concerned, the current approval process, put in place in May 2014, is functional, and installation of antenna structures is now going forward. That said, the

2013 construction season and part of the 2014 construction season was essentially lost for PTC wayside antennas, setting the railroads back significantly in their implementation plans.

Despite these setbacks, railroads' aggressive implementation of PTC will continue. However, it is simply not possible to complete a nationwide, interoperable PTC system by the end of 2015. Adjusting the implementation deadline would more accurately reflect railroads' considerable efforts to design, test, approve, produce, distribute, install and train 100,000 employees on the use of this incredibly complex technology. Rushing PTC development and installation and foregoing a logical plan for sequencing its implementation would sharply increase the likelihood that the system would not work as it should, which is an outcome that serves no one's purpose.

An example of a PTC antenna structure near other railroad signals.

Some have suggested that the railroads have somehow not tried hard enough to meet the existing statutory deadline. That is simply not true. I have been intimately involved in the PTC development and implementation process at CSX since it began, and I know how much we have devoted to PTC. I'm proud of CSX's and other railroads' efforts, and I'm sure that those involved in PTC at other freight railroads would say the same thing. We in the railroad industry are fully committed to PTC, but it must be done correctly. That's simply not possible by the end of this year.

The "Business Benefits" of Positive Train Control

Some have claimed that railroads will achieve billions of dollars in "business benefits" from PTC because PTC will allow trains to be more tightly spaced, thereby reducing train delays and increasing a rail line's capacity without the need to install new track. Any industry that invests billions of dollars in a new technology will try to leverage those investments into operational improvements, even if the main purpose of that technology is to enhance safety. That said, the rail industry has yet to identify any substantial "business benefits" for the foreseeable future attributable to PTC deployment as mandated under RSIA.

That's mainly because of the urgency to comply with an extremely challenging statutory deadline, railroads have not had the luxury of developing and implementing supplemental PTC technologies that, in addition to safety benefits, have the most promising potential operational benefits. It is far less likely that the first-generation PTC systems being deployed now will yield meaningful business benefits compared with second- or third-generation PTC systems that might come a decade or two later.

Moreover, many of the business benefits some have claimed will be achieved by PTC actually have little or nothing to do with PTC. For example, many of the claims that PTC will reduce train delays and allow more trains to move over a rail line presuppose the use of "precision dispatching." This term refers to the use of complex computer algorithms to analyze a variety of factors (such as the priority levels of different trains, train crew availability, and the location and schedules of other trains) to decide in what order and when trains on a railroad's network should travel. But there is no direct relationship between the use of precision dispatching and PTC implementation: the development of precision dispatching has begun and would continue if PTC did not exist.

In fact, it's possible that PTC could actually make existing rail operations less efficient, especially if it is put into place without adequate testing. As I noted above, the PTC systems railroads are developing have essentially had to be created from scratch — they don't exist anywhere in the world. By necessity, a fully functioning PTC system is enormously complex, and the failure of a single part within that complex system means the entire PTC system will not work as it should. If that happened, the affected rail line would be substantially operationally degraded until the failure was corrected. It goes without saying that the inefficiencies this would create, and the damage it would cause to our economy, are best avoided. That's another key reason why the PTC development and implementation process should not be rushed.

Conclusion

Since enactment of the RSIA, CSX and other railroads have devoted enormous human and financial resources to develop a fully functioning PTC system, and progress to date has been substantial. However, despite railroads' best efforts, the immense technological hurdles are such that a safe, reliable, nationwide, and interoperable PTC network will not be completed by the current deadline. Railroads remain committed to implementing PTC as early as possible and are doing all they can to address the challenges that have surfaced, but more time is needed to ensure safe and effective implementation on the nation's vast freight and passenger rail networks.

Attachment A

PTC Data[4]

Table 1. Equipping Locomotives with PTC

Railroad	ARR	BNSF	CN	CP	CSX	KCS	NS	UP	**Total**
# to be equipped	54	6000	1,000	1000	3900	614	3811	6532	**22,911**
# partially equipped to date	27	671	238	225	1825	301	1993	4394	**9674**
# fully equipped	17	2389	72	146	812	0	0	0	**3436**

Table 2. Railroad Signal Personnel Hired or Retained Due to PTC

ARR	4
BNSF	447
CN	117
CP	35
CSX	554
KCS	36
NS	659
UP	569
Total	**2421**

[4] The data in this Attachment is based on estimates as of December 31, 2014, current PTC implementation plans on file with FRA (including amendments to plans that have been approved by FRA), and the regulations in existence on December 31, 2014.

Table 3. Integrated WIU Installation

Railroad	ARR	BNSF	CN	CP	CSX	KCS	NS	UP	**Total**
# integrated WIUs required to be deployed	55	6648	1036	591	5250	658	5486	11399	**31123**
# integrated WIUs deployed to date	14	4171	85	423	1915	363	1805	8700	**17476**
# integrated WIUs remaining to be deployed	41	2477	951	168	3335	295	3681	2699	**13647**

Table 4. Stand-alone WIU Installation

Railroad	ARR	BNSF	CN	CP	CSX	KCS	NS	UP	**Total**
# stand-alone WIUs required to be deployed	2	417	488	114	894	148	487	1615	**4165**
# stand-alone WIUs deployed to date	0	262	0	6	122	56	51	1167	**1664**
# stand-alone WIUs remaining to be deployed	2	155	488	108	772	92	436	448	**2501**

Table 5. Signal Replacement Projects

Railroad	ARR	BNSF	CN	CP	CSX	KCS	NS	UP	**Total**
# locations of signal replacement required	0	4707	177	63	2100	391	2851	4252	**14541**
# locations replaced to date	0	2579	125	52	1134	304	975	3262	**8431**
# locations remaining to be replaced	0	2128	52	11	966	87	1876	990	**6110**

Table 6. Switches in Non-Signal PTC Territory

Railroad		ARR	BNSF	CN	CP	CSX	KCS	NS	UP	**Total**
# non-signaled switch locations needing power & WIUs	# needed	45	417	227	225	700	133	617	974	**3338**
	# equipped with power to date	7	262	0	41	130	54	38	58	**590**
	# remaining to be equipped with power	38	155	227	184	570	79	579	916	**2748**
	# equipped with WIUs to date	6	262	0	41	130	54	38	58	**589**
	#remaining to be equipped with WIUs	39	155	227	184	570	79	579	916	**2749**
# non-signaled switch locations needing switch position monitors	# needed	0	0	227	248	700	133	617	974	**2899**
	# equipped to date	0	0	0	117	130	54	38	58	**397**
	# remaining to be equipped	0	0	227	131	570	79	579	916	**2502**

Table 7. Communications Deployment

Railroad		ARR	BNSF	CN	CP	CSX	KCS	NS	UP	**Total**
# Base station 220 MHz radios	# needed	35	731	181	112	1285	85	736	847	**4012**
	# installed	8	521	26	18	395	0	242	282	**1492**
	# of future installations needed	27	210	155	94	890	85	494	565	**2520**
# Wayside location 220 MHz radios	# needed	84	6015	1751	663	5299	806	4763	11877	**31258**
	# installed	19	4098	184	28	2160	0	1147	4136	**11772**
	# of future installations needed	65	1917	1567	635	3139	806	3616	7741	**19486**
Locomotive 220 MHz radios	# needed	54	6000	1000	1000	3900	614	3811	6532	**22911**
	# installed	16	2389	72	75	812	0	10	1855	**5229**
	# of locomotives remaining to be equipped	38	3611	928	925	3088	614	3801	4677	**17682**

Table 8. Status of PTC GIS Projects

Railroad		ARR	BNSF	CN	CP	CSX	KCS	NS	UP	**Total**
# PTC assets to be* mapped and extracted for GIS consumption		2800	88447	25630	16468	114731	9641	52000	130000	**439717**
# track miles required to be GIS mapped	# miles mapped to date	600	19886	257	1515	21565	0	10904	21150	**75877**
	# miles to be mapped	0	2164	4043	696	0	2227	0	0	**9130**
# track miles required to be data processed	# miles processed to date	600	16318	257	1183	21565	293	10904	21150	**72270**
	# miles remaining to be processed	0	5732	4043	1028	0	1934	0	0	**12737**
# track miles GIS data to be converted to PTC subdiv files	# converted to date	130	14888	257	1162	5809	154	608	300	**23308**
	# remaining to be converted	470	7162	4043	1049	15756	2073	10296	20850	**61699**

*The calculation of assets to be mapped includes the following: integer mileposts; signals; crossings; switches; interlockings/control point locations; permanent speed restrictions; the beginning and ending limits of track detection circuits in non-signaled territory; clearance point locations for every switch location installed on the main and siding tracks; and inside switches equipped with switch circuit controllers.

Table 9. Status of PTC Dispatch System Projects

Railroad	Date System will be PTC-capable
ARR	Completed
BNSF	Completed
CN	1st quarter 2015
CP	March 2015
CSX	Completed
KCS	1st quarter 2015
NS	Completed
UP	Completed

Table 10. PTC Investment

Railroad	PTC investment through December 31, 2014 ($)
ARR	103,000,000
BNSF	1,230,000,000
CN	105,400,000
CP	196,945,493
CSX	1,178,000,000
KCS	82,400,000
NS	814,349,713
UP	1,496,700,000
Total	**5,206,795,206**

Table 11. Training

Railroad	Category 1	Category 2	Category 3	Category 4	Category 5	Total
ARR	110	9	199	250	30	**598**
BNSF	1234	728	12018	7054	859	**21893**
CN	857	240	2550	1120	200	**4967**
CP	550	100	1600	900	250	**3400**
CSX	1315	445	14085	900	1275	**18020**
KCS	202	44	1526	493	130	**2395**
NS	2150	445	12000	6275	1780	**22650**
UP	2324	710	13546	8450	914	**25944**
Total	**8742**	**2721**	**57524**	**25442**	**5438**	**99867**

Categories of employees requiring training (49 C.F.R. 236.1041):

(1) Persons whose duties include installing, maintaining, repairing, modifying, inspecting, and testing safety-critical elements of the railroad's PTC systems, including central office, wayside, or onboard subsystems;
(2) Persons who dispatch train operations (issue or communicate any mandatory directive that is executed or enforced, or is intended to be executed or enforced, by a train control system subject to this subpart);
(3) Persons who operate trains or serve as a train or engine crew member subject to instruction and testing under part 217 of this chapter, on a train operating in territory where a train control system subject to this subpart is in use;
(4) Roadway workers whose duties require them to know and understand how a train control system affects their safety and how to avoid interfering with its proper functioning; and
(5) The direct supervisors of persons listed in paragraphs (a)(1) through (a)(4) of this section.