Positive Train Control

Association of American Railroads **March 2017**

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. Specifically, PTC as mandated by Congress 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 switch left in the wrong position.[1]
- The Rail Safety Improvement Act of 2008 originally called for 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.[2] In October 2015, the statutory deadline for PTC installation was extended to the end of 2018, with further extensions available up to the end of 2020 to allow time for railroads to adequately test their systems.
- 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 before a stop signal or slowing down for a speed-restricted area, the PTC system would apply the brakes automatically before the train passed the stop signal or entered the speed-restricted area.
- 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 freight 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 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.

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

[2] TIH materials are gases or liquids, such as chlorine and anhydrous ammonia, that are especially hazardous if released into the atmosphere. Class I railroads are railroads with 2015 operating revenue of at least $458 million.

- **PTC development and installation constitute an unprecedented technological challenge**, on a scale that has never been attempted on railroads anywhere in the world. Tasks freight railroads must complete include:

  - ✓ A complete physical survey and highly precise geo-mapping of the more than 60,000 route-miles on which PTC technology will be installed, including geo-mapping of more than 486,000 field assets (mileposts, curves, grade crossings, switches, signals, and much more) along that right-of-way.
  - ✓ Installing PTC technology on approximately 18,500 locomotives.
  - ✓ Installing approximately 29,500 "wayside interface units" (WIU) that provide the mechanism for transmitting information from signal and switch locations along the right-of-way to locomotives and railroad facilities.

PTC locomotive cab display unit

  - ✓ Installing PTC technology on 1,900 switches in non-signaled territory and completing signal replacement projects at 14,500 locations.
  - ✓ Developing, producing, and deploying a new radio system specifically designed for the massive data transmission requirements of PTC at approximately 4,000 base stations, some 32,600 trackside locations, and on some 18,500 locomotives.
  - ✓ Developing back office systems and upgrading dispatching software to incorporate the data and precision required for PTC systems.

- **In all these areas, railroads have made substantial progress.** For example, as of the end of 2016, more than 11,600 locomotives were equipped with PTC, out of more than 18,500 that will require it; more than 3,000 of the approximately 4,000 base station radios have been installed; and more than half of the 125,000 employees requiring training were PTC-qualified.

- Freight railroads have been working tirelessly to meet the PTC mandate. To date, they've spent $8 billion (of their own funds, not taxpayer funds) on PTC development and deployment. The estimated total cost to freight railroads for PTC development and deployment is $10.6 billion, with hundreds of millions of additional dollars needed each year after that to maintain the system.[3]

[3] The cost of PTC installation for U.S. passenger railroads is estimated at an additional $3.5 billion.

- Much of the railroads' efforts to date has been directed toward developing and testing technology that can be scaled to the huge requirements of a national system. 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 "tenant" locomotives must be able to communicate with, and respond to commands from, the "host" PTC system. That's much easier said than done, and ensuring this interoperability has been a significant challenge.
- The many potential failure points in PTC systems must be identified, isolated, and corrected — all without negatively impacting the efficient movement of goods by rail throughout the country. If PTC systems do not work flawlessly, day in and day out, railroad operations on key parts of the freight rail network could be significantly impaired. The damage that would cause to the economy would be enormous.
- In addition, the Federal Railroad Administration (FRA) must review each railroad's PTC safety plan and certify each railroad's PTC systems. Only then can a railroad's PTC installation be completed and placed into operation.

Adequate Time is Needed to Ensure Safe and Effective PTC Installation

- Railroads' aggressive installation of PTC will continue. However, the end of 2015 was not a realistic deadline, considering the tremendous efforts needed to design, test, approve, produce, distribute, and install an incredibly complex technology nationwide and train 125,000 employees in its use.
- That's why railroads applaud Congress for extending the statutory deadline for nationwide PTC installation. The legislation extending the deadline to 2018 requires railroads to outline their installation plans and to report regularly to the FRA on their progress. Railroads can also take up to two additional years beyond the end of 2018 if they need additional time for testing.
- Rushing PTC development foregoing a logical plan for sequencing its installation does not make sense. It would sharply increase the likelihood that the system would not work as it should. Making the PTC deadline more realistic helps ensure that a fully interoperable PTC system will be deployed in a logical manner and thoroughly tested prior to use. The extension is consistent with the fact that PTC should work as well as possible, not as quickly as possible.