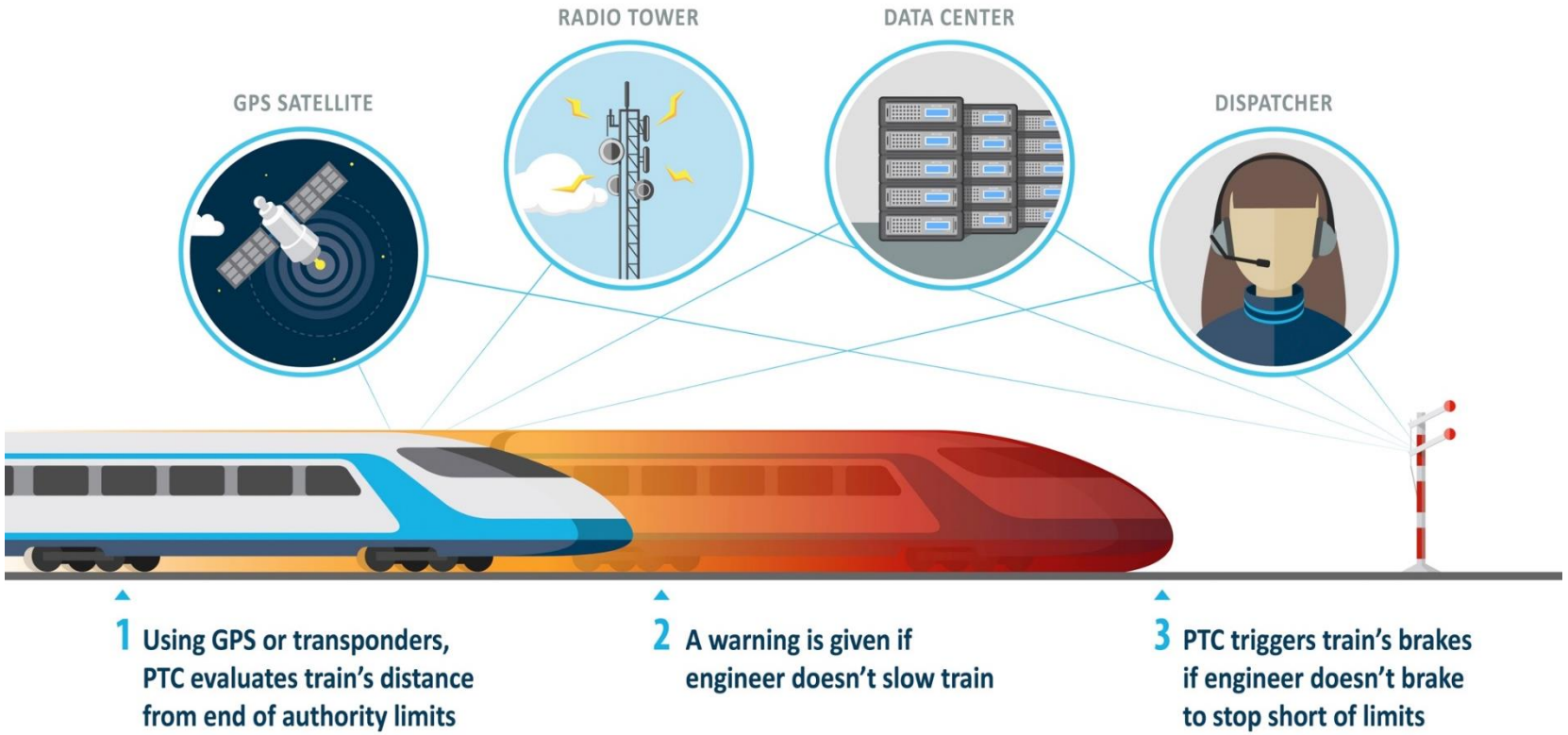
OVERVIEW:
POSITIVE TRAIN CONTROL (PTC)

June 2018

WHAT IS PTC?

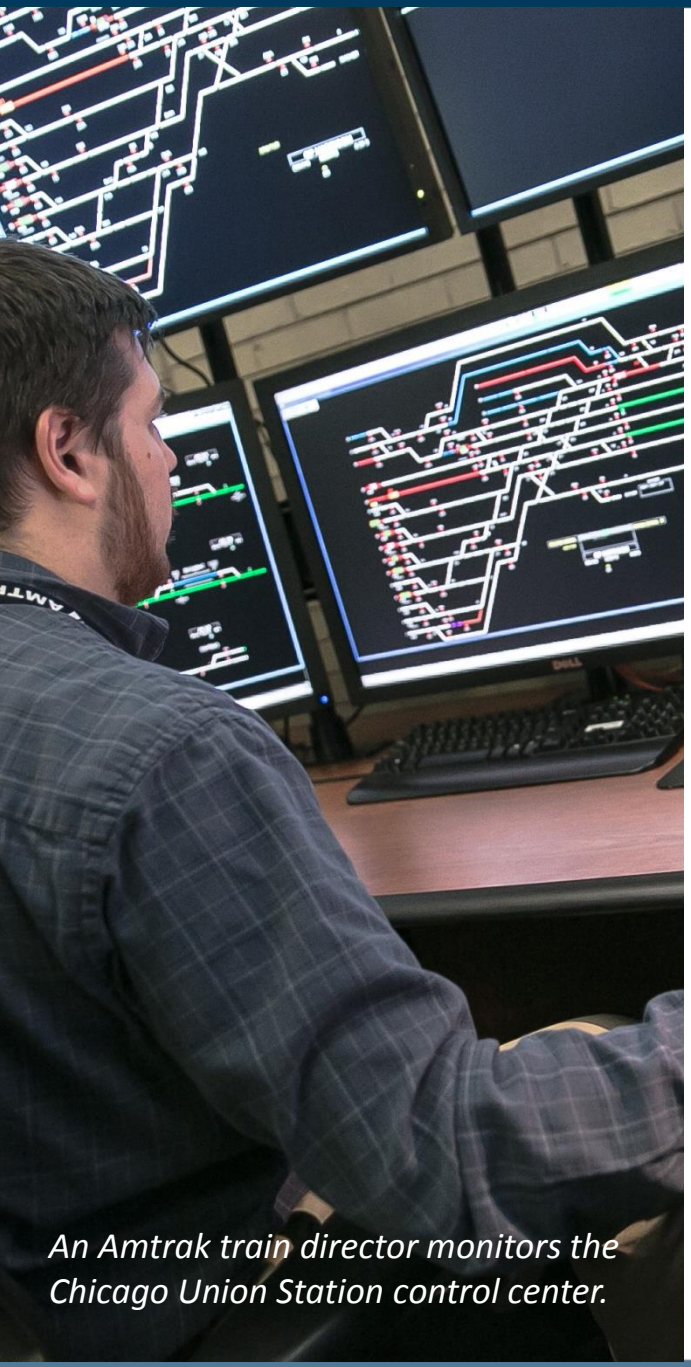
PTC is a technology capable of automatically controlling train speeds and movements, should a train operator fail to take appropriate action in the prevailing conditions.

HOW IT WORKS



For example, PTC can force a train to stop before it passes a signal displaying a stop indication, or before running through an improperly lined switch, averting a potential collision.

WHAT DOES PTC DO?



An Amtrak train director monitors the Chicago Union Station control center.

PTC systems that meet the standards set by FRA regulations are required to reliably and functionally prevent:

- ✓ Train-to-train collisions;
- ✓ Over speed derailments;
- ✓ Incursion into an established work zone; and
- ✓ Movement through a main line switch in the improper position.
- ✓ Other functions are applicable within the requirements as specific conditions warrant.

WHAT IS THIS HISTORY OF PTC?

How did we get here…

1920s-1940s
Primitive automatic train stop systems enter service in some places.

1960s – 1970s
Interest in PTC grows.

1990s – 2000s
Amtrak installs PTC to support Acela Express service, interest in PTC continues to grow as passenger and transit ridership rise.

SEPT 2008
Chatsworth collision; Congress passes bill requiring PTC by December 2015.

2008 – 2015
While some railroads make progress on PTC installation, others do not – costs and technical challenges are cited as reasons.

MAY 2015
Frankfurt Junction derailment in Philadelphia – deemed "PTC preventable."

OCT 2015
Congress extends PTC implementation deadline to Dec. 31, 2018:

- All Class 1 railroads, intercity passenger railroads, and commuter railroads required to implement PTC (where called for by FRA regulation).
- Possibility of up to two additional years if certain requirements are met.
- FRA starts collecting progress implementation data from railroads shared that data with the public.

DEC 2017
Amtrak Tacoma incident, deemed PTC preventable.

JUNE 2018
Activation on BNSF subdivisions is Amtrak's first host-owned territory implemented with PTC.

AMTRAK AND PTC

- **For Amtrak's purposes, there are 2 approaches for the use of PTC**
  - ✓ PTC that we own/operate on our infrastructure
  - ✓ PTC that is chosen by other host carriers that we "work with" and that our locomotives communicate with
- **Amtrak's PTC = ACSES, ITCS**
  - ✓ Approved by FRA, provide all elements of PTC
  - ✓ In use on the NEC (ACSES) and Michigan Line (ITCS)
- **Freight carriers' and some other commuter RRs' PTC = IETMS**
  - ✓ Class I freight carriers and many commuter trains use the Interoperable Electronic Train Management System (I-ETMS).
  - ✓ I-ETMS provides all the elements required for PTC

An Amtrak technician resetting a PTC transponder in Pennsylvania along the Northeast Corridor.

WHO IS RESPONSIBLE FOR PTC INSTALLATION?

Component	*Responsible Party*
PTC Infrastructure	Rail infrastructure owner/operator
Infrastructure system back office server	Rail infrastructure owner/operator
Testing	Rail infrastructure owner/operator, Equipment owner/operator
Locomotive and onboard systems	Equipment owner/operator
Back office servers	Shared; host railroads require back office server, Amtrak and other operators also needs one to communicate with multiple host servers

PTC Regulation – What Happens on Dec. 31, 2018

Track Segments will fall into one of five (5) categories:

1. Track is equipped for PTC operation and FRA has certified the Railroad Safety Plan.

2. Track is equipped for PTC operation. Trains are operating in Revenue Service Demonstration (RSD) mode with PTC protection waiting for FRA Safety Certification.

3. Track is not equipped for PTC operation but the railroad has met the criteria to apply for an “Alternative Schedule” (Extension). Amtrak will perform a risk analysis for tracks in this category.

4. Track is not equipped for PTC operation and the railroad has failed to meet the criteria to apply for an “Alternative Schedule” (Extension). **It will be against Federal Regulations to operate service.**

5. Track qualifies for a Main Track Exclusion Addendum (MTEA). PTC is not required by regulation. Amtrak will perform a risk analysis for tracks in this category.

CONCLUSION

- ✓ Responsibility for PTC is shared among parties, sometimes making implementation challenging, but everyone is working towards the same goal.
- ✓ Installing PTC is one component of Amtrak's overarching commitment to the safety of our passengers and employees.
- ✓ Continued Congressional support is needed to ensure that PTC is funded.

APPENDIX:
Technical Systems

TRACKSIDE SIGNAL SYSTEM

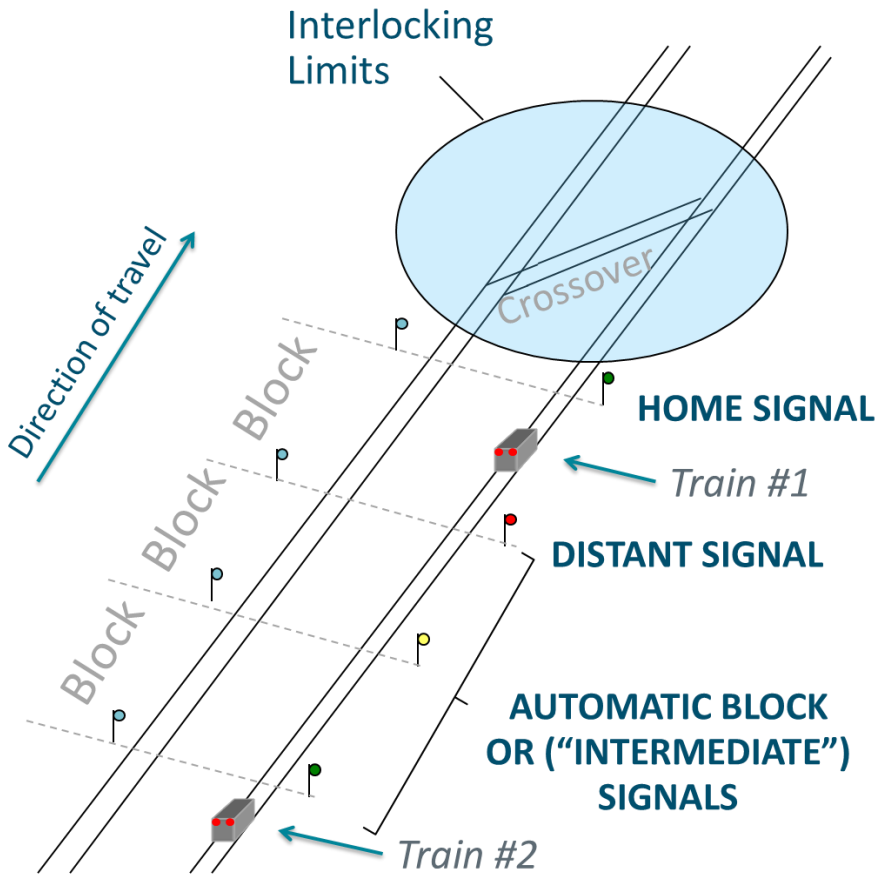
ABS, CTC and Interlockings

Intermediate (ABS) signals operate automatically:

- ✓ Detect presence of a train using “track circuits”
- ✓ Activates two signals behind the train to protect it:
  - Approach signal
  - Stop signal

Interlockings are controlled remotely by dispatchers:

- ✓ This system of remote control is called “**Centralized Traffic Control**,” (**CTC** for short)
- ✓ Complex of signals and switches electronically “interlocked”
- ✓ Impossible to “line” an unsafe route



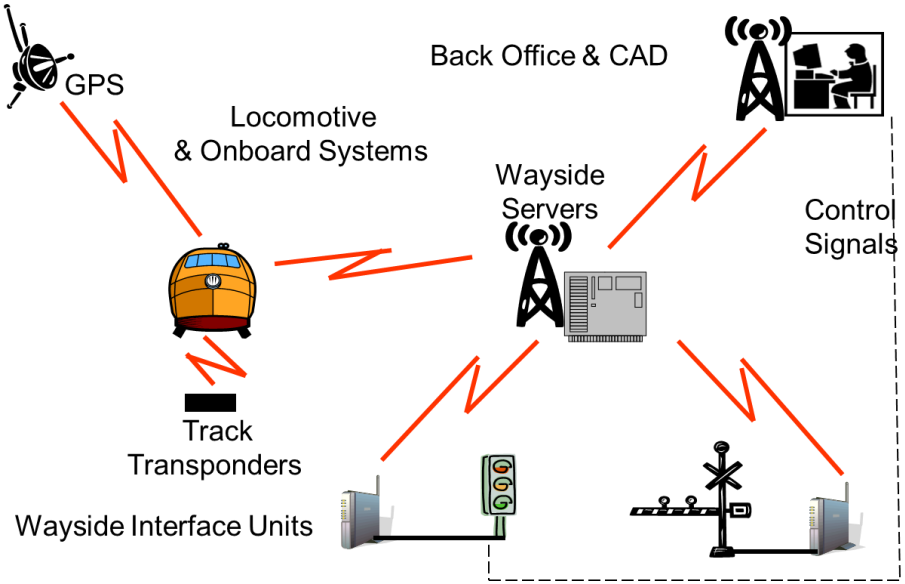
Clear signals permit engineers to operate the train at maximum authorized speeds.

I-ETMS ARCHITECTURE

Interoperable Electronic Train Management System (I-ETMS):

I-ETMS is designed to:

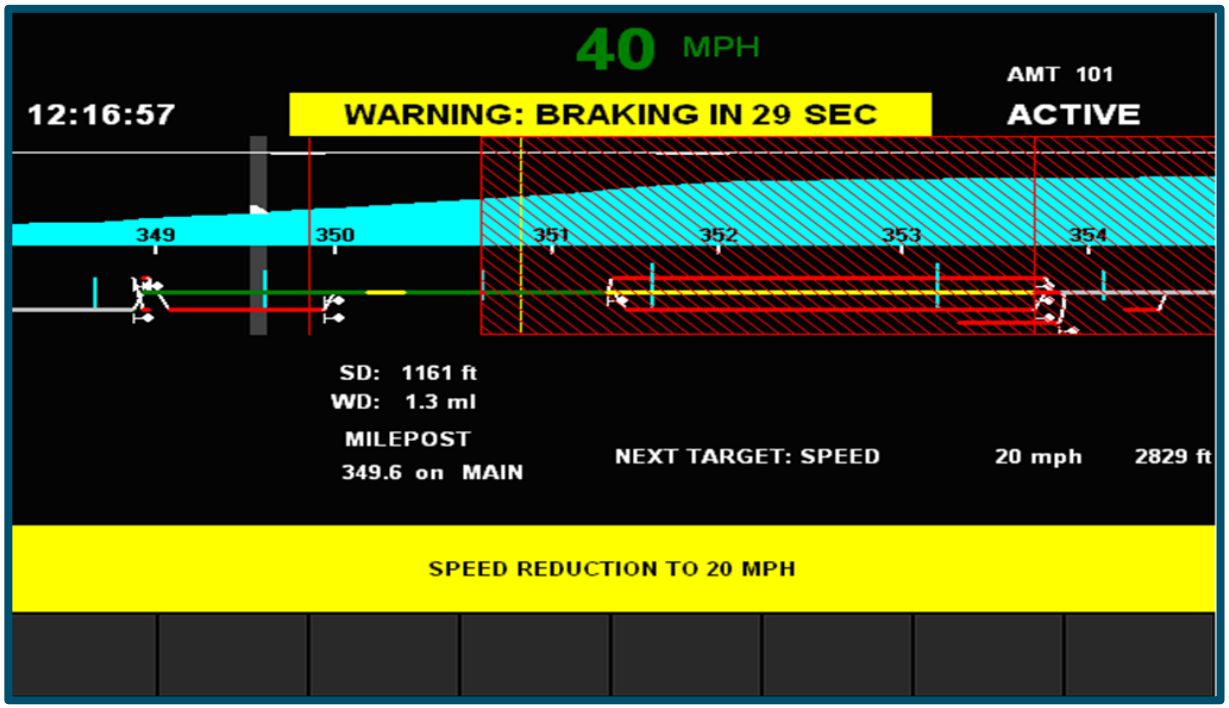
- ✓ Prevent train-to-train collisions
  - Enforcing stop signals
  - Enforcing "authority limits" (i.e., track a train has permission to occupy)
- ✓ Prevent trains from derailing through excessive speed
- ✓ Prevent trains from entering work zones without proper authorization
- ✓ Prevent movement through an improperly set switch in the main track
- ✓ Provide warning and enforcement at a derail or switch providing access to a main track
- ✓ Provide warning and enforcement in the event of a highway-rail grade crossing warning device malfunction
- ✓ Provide warning and enforcement for a mandatory directive associated "After Arrival Of" train movements



SOURCE: FEDERAL RAILROAD ADMINISTRATION

I-ETMS adds an overlay system to enforce the existing signal indications and civil speed restrictions

PREDICTIVE SPEED ENFORCEMENT

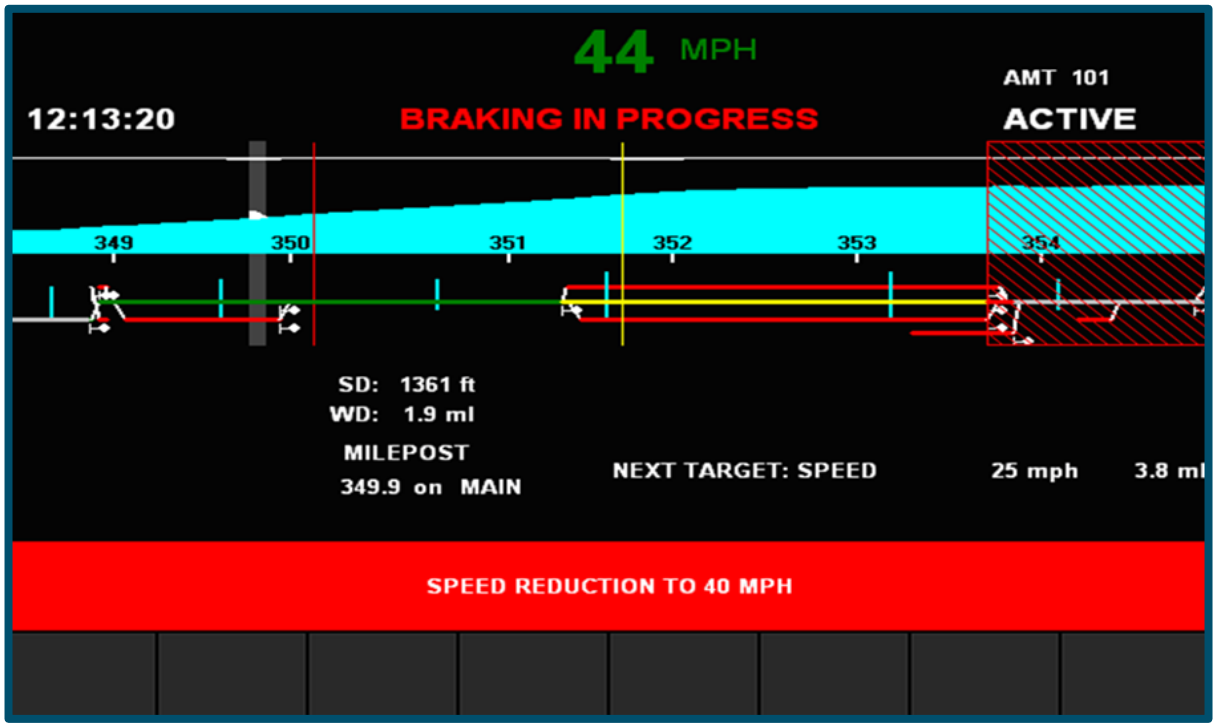


If a train comes within Warning Distance of a speed restriction, and I-ETMS predicts train speed will exceed speed limit by 5mph or more when the train enters the restriction, a "Speed Reduction To XX mph" message will display along with the time remaining to enforce braking.

If the engineer takes no action, computer will apply the brakes at the appropriate time, bringing the train to a stop.

Engineer will not be able to recover from a "penalty application" until the train has stopped.

REACTIVE SPEED ENFORCEMENT



If a train exceeds maximum speed allowed for the track by 3 mph, I-ETMS will display a warning to indicate the train is over speed and a "*Maximum Speed Is xx MPH"* message.

If the train exceeds the maximum speed allowed for the speed of the current location by at least 5 mph, I-ETMS will apply the brakes and display the "Maximum Speed Is xx MPH" message.

If a penalty brake application occurs, the train MUST be stopped before recovery is permitted.

FOR ADDITIONAL INFORMATION VISIT:
media.amtrak.com