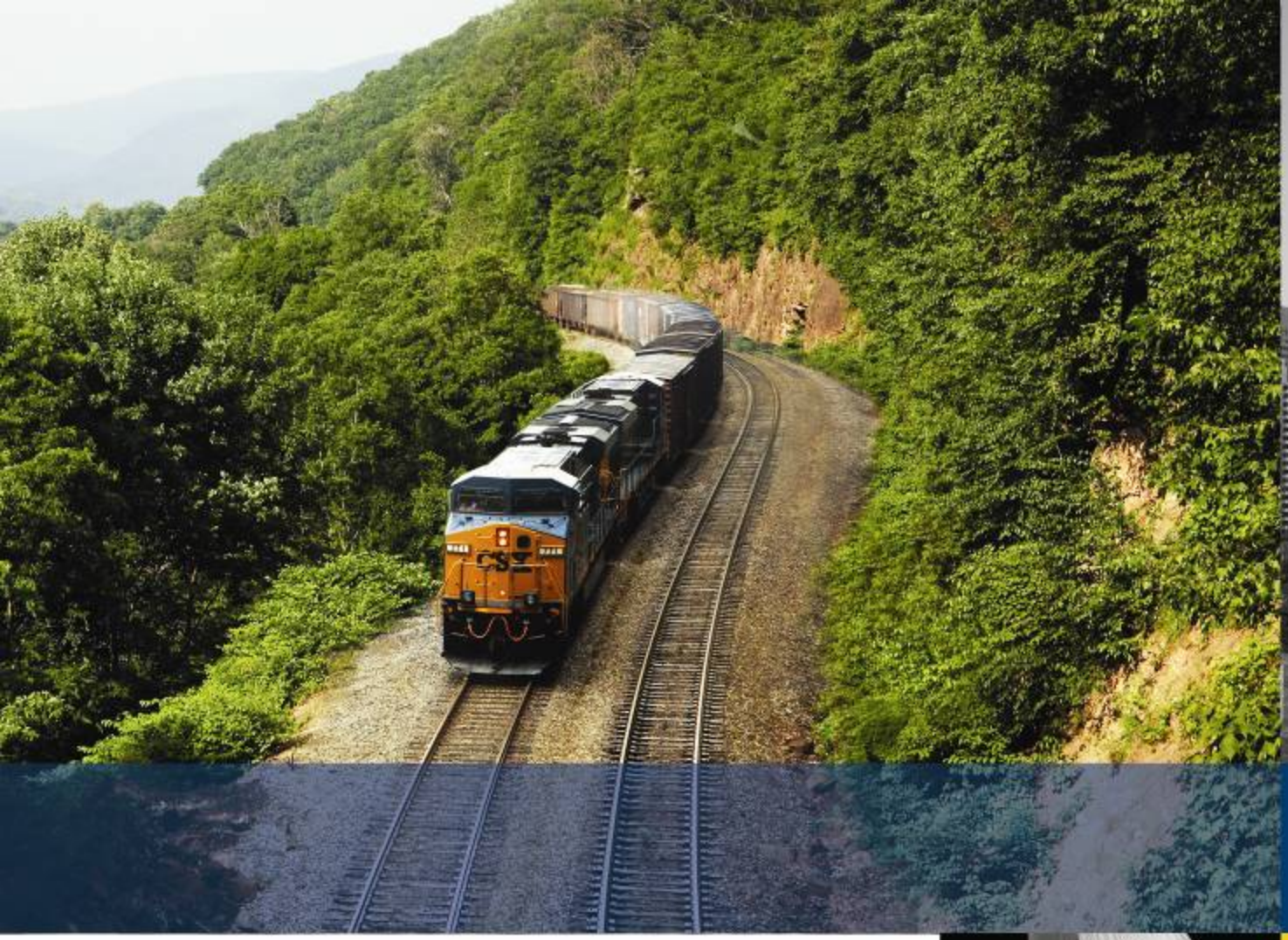


CSX
How tomorrow moves

Positive Train Control

Ken Lewis
CSX - Director PTC

Agenda

- Regulatory Background
- PTC Overview
- CSX Project Status / Challenges
- CSX PTC in Revenue Service
- Industry Progress

Regulatory Background

Railroad Safety Improvement Act mandated PTC implementation by the end of 2015

- Oct 16, 2008 - Railroad Safety Improvement Act signed into law
- July 21, 2009 – FRA Published Notice of Proposed Rule Making (NPRM)
- Jan 15, 2010 – FRA Published Final Rule
- Apr 16, 2010 - Deadline for Railroads to Submit PTC Implementation Plans to FRA
- Dec 31, 2015 - Deadline for PTC Implementation

PTC Extension signed into law October 29, 2015

- Extends deadline to December 31, 2018
- Railroads must submit revised PTC Implementation Plan (PTCIP) by January 27, 2016
  - Railroads may submit an Alternative Implementation Schedule and Sequence (up to two additional years)
- Railroads must report progress annually
- DOT/FRA will conduct reviews at least annually and can assess civil penalties for failure to comply with revised implementation plans

Request for Alternative Schedule and Sequence

- Railroad can request up to two (2) additional years for full PTC system implementation
- Request submitted with revised PTCIP
- Must provide for completion of the following on or before December 31, 2018
  - Acquisition of all spectrum
  - Installation of all PTC system hardware
  - Completed all required PTC employee training
  - Initiated RSD or implemented PTC on a majority of subdivisions

PTC Overview

PTC legislation requires specific functionality

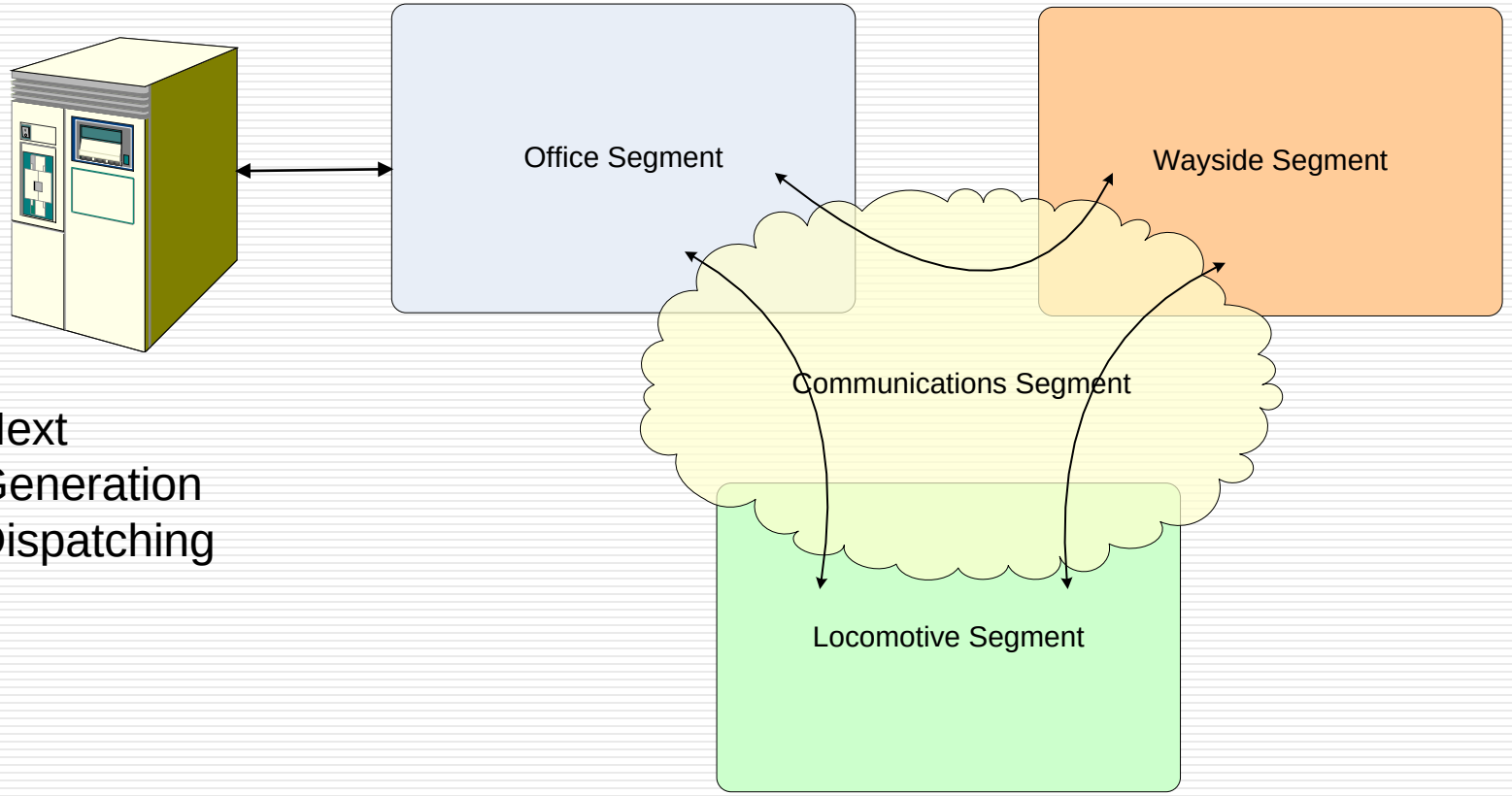
- PTC gauges upcoming signals, authorities, switches, operating conditions, locomotive position & speed
- PTC designed to warn engineer of need for action
- If the engineer fails to act, PTC system will engage locomotive brakes and bring train to full stop

If railroaders do their jobs correctly, PTC should never engage the brakes

PTC is required per federal regulation by Dec 31, 2018

- PTC Functionality
  - Prevent train to train collisions
  - Prevent over speed derailments
  - Prevent movement through mis-aligned switch
  - Protect on track workers
- PTC required on:
  - passenger routes
  - lines with one or more TIH cars and traffic greater than 5 MGT annually
- PTC Footprint
  - 3,200 locomotives
  - ~ 13,000 track miles

PTC Segments



Next Generation Dispatching

PTC System Overview

Track Database

Speed Restrictions

Work Zones

Train Consist

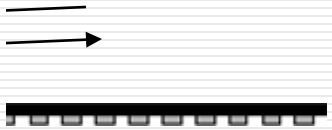
Movement Authorities

- Speed Restrictions
- Switches
- Work Zones
- Signals

Initialization

Warning Curve

Braking Curve



Predictive Braking

CSX Project Status / Challenges

Why is PTC so challenging?

- Scale of changes and increase in workload
- Huge capital requirements
- Interoperability
- Locomotive fleet age and mix
- Wayside plant age and mix
- Equipping switches in un-signaled territories
- Compressed timeline
- Unproven technology
- Heavy reliance on suppliers

Scale of PTC investment is significant: $2.2B

3,200 Locomotives

7,500 miles of signal replacement

About 5,000 wayside interface units (WIUs)

Software Development, GIS enhancement, Systems Integration, Communications, etc

PTC legislation requires industry interoperability

Class I Railroads

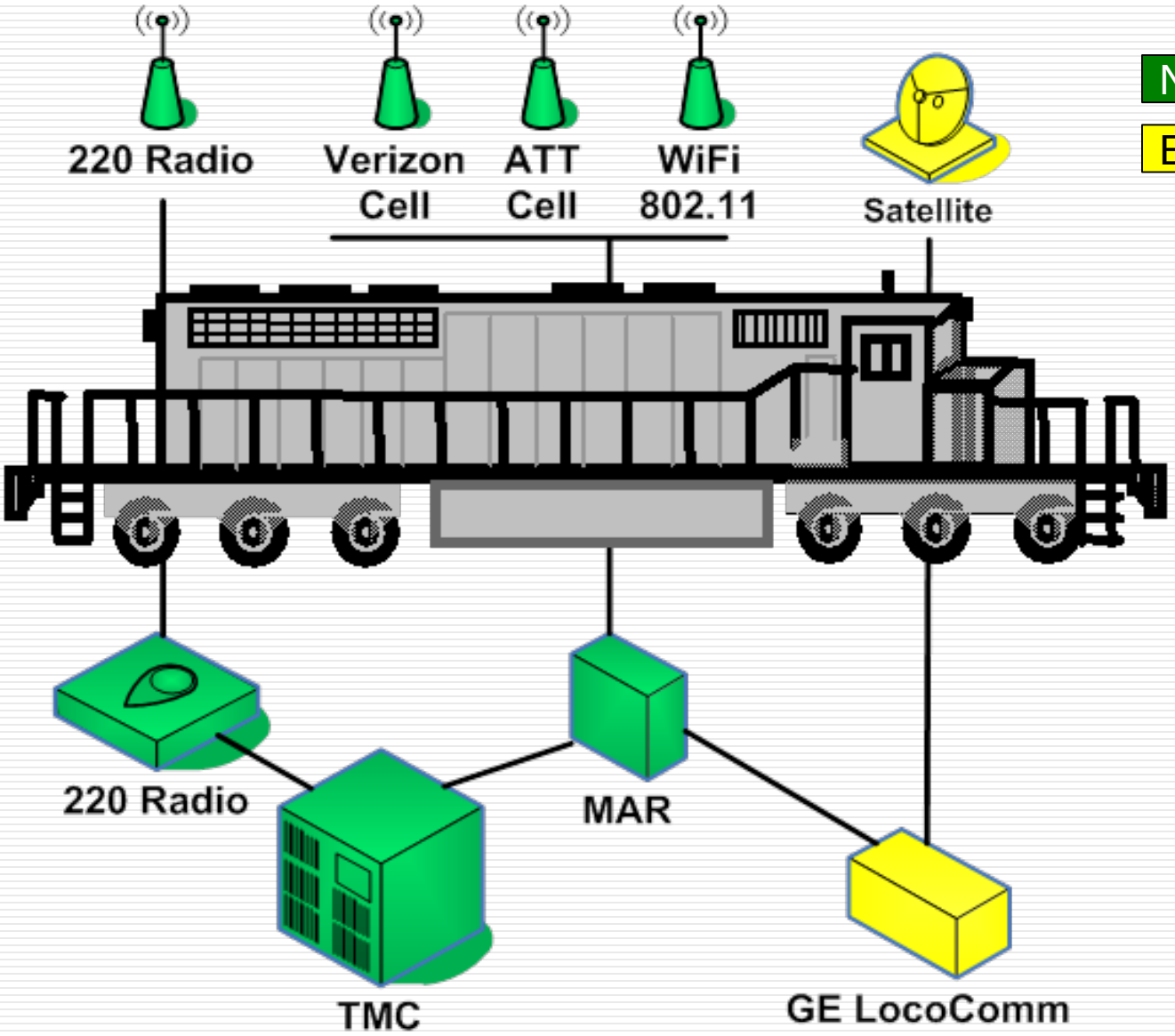
- BNSF Railway
- CN
- Canadian Pacific
- CSX (How tomorrow moves)
- Kansas City Southern Lines
- Norfolk Southern
- Union Pacific

Passenger Railroads

- Amtrak
- Massachusetts Bay Transportation Authority
- MARC
- Metropolitan Transportation Authority
- Metra (The way to really fly.)
- NJ TRANSIT
- SEPTA
- TRI-RAIL
- VRE

- Interoperability requirement applies to Class I and passenger railroads
- Class Is agreed to develop standard platform
- PTC must be able to recognize and stop non-CSXT locomotives

Locomotive and Communications Segment



New PTC Equipment

Existing ERAD-ATS

Wayside installs must be tailored to existing plant . . .

. . . which varies from location to location . . .

. . . including some very old equipment

GIS - Fli-Map Survey / Track Database Creation

Flight Parameters

- Altitude: 320 feet
- Laser Swath: 300 feet
- Speed: 35 mph

Data Collected

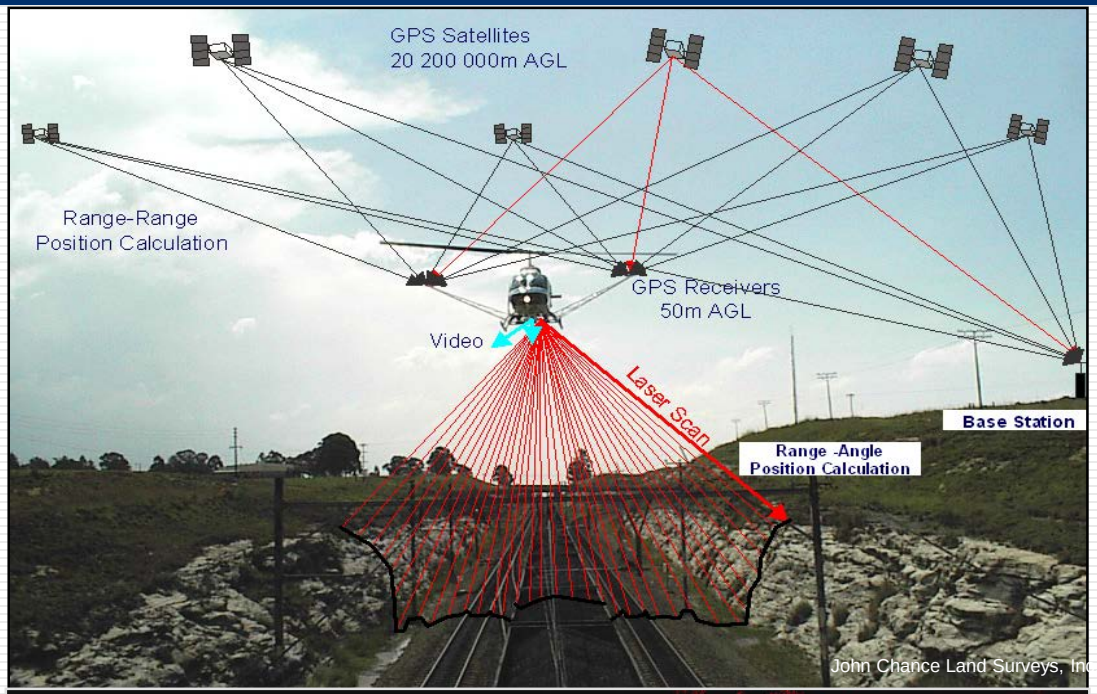
- GPS coordinates
- Video, forward & down
- Digital stills, forward & down
- Digital line scan data

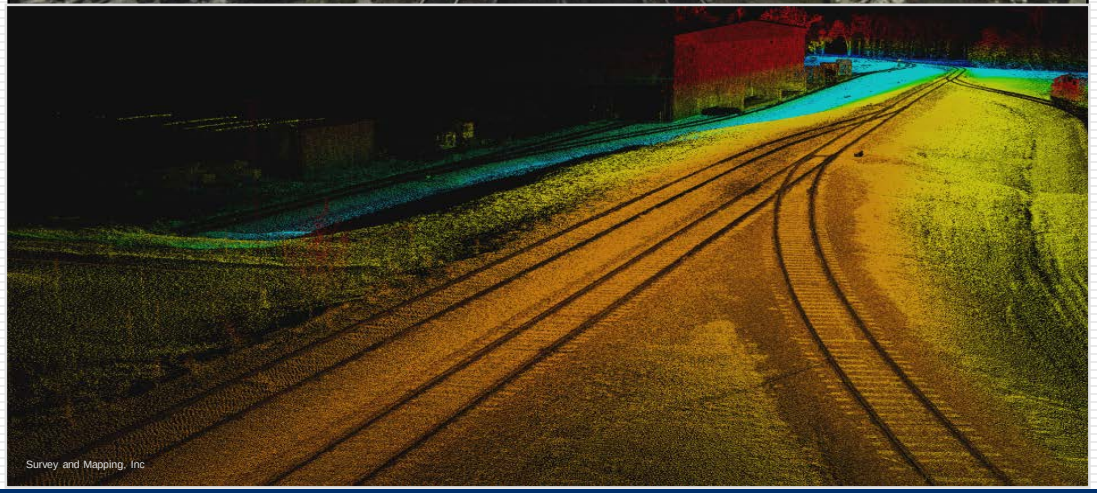
Other Methods Used

- Hi Rail
- Handheld Devices

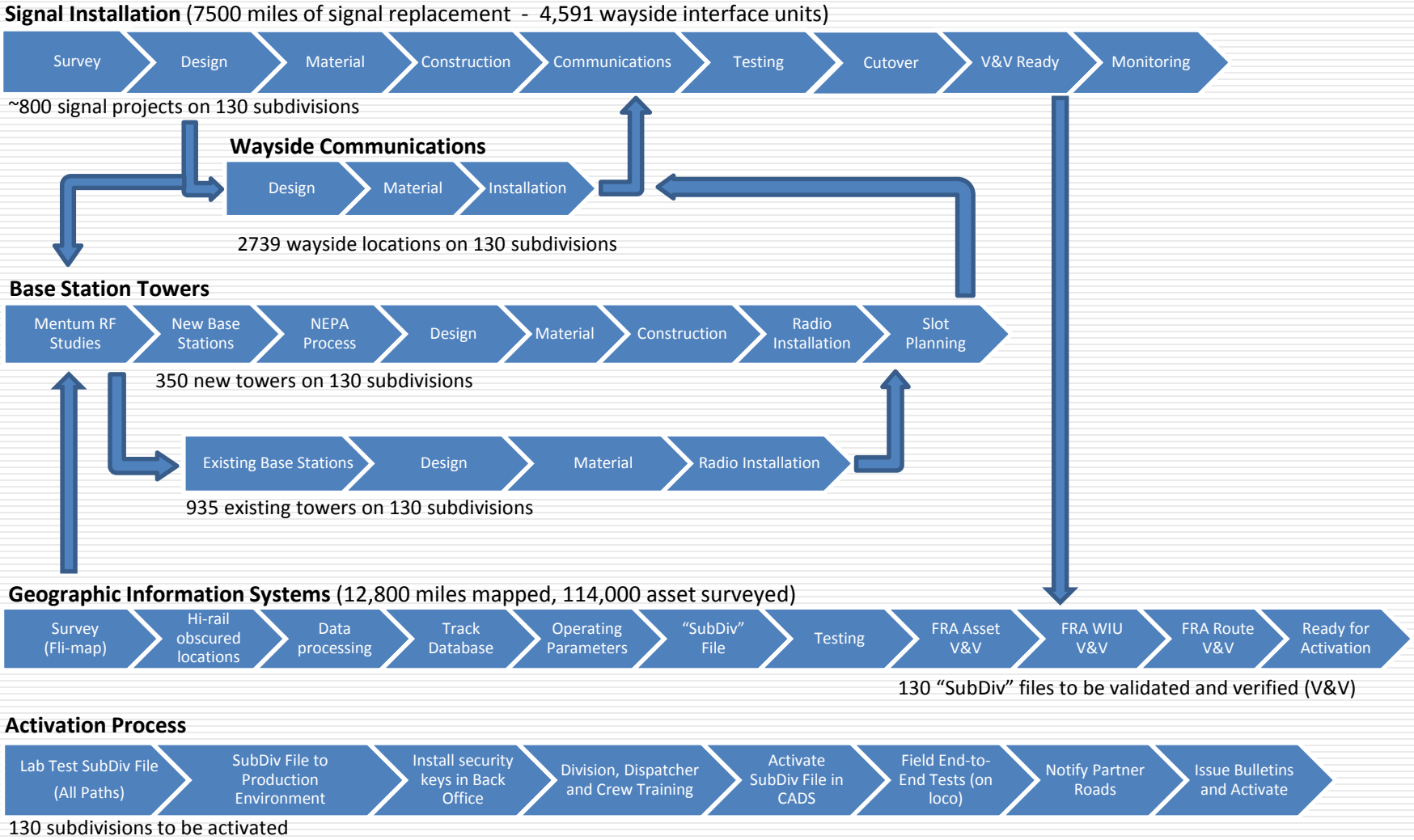
Multi-Step Process

- Survey
- Process -> Track DB
- Track DB -> “SubDiv” Files



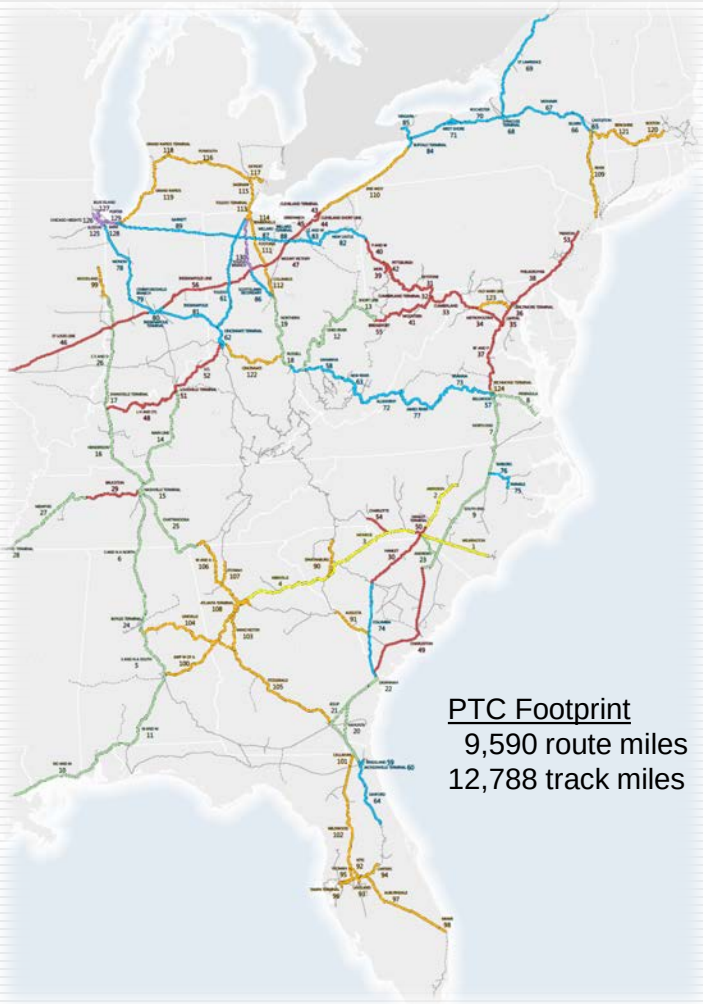


Typical PTC Subdivision Process

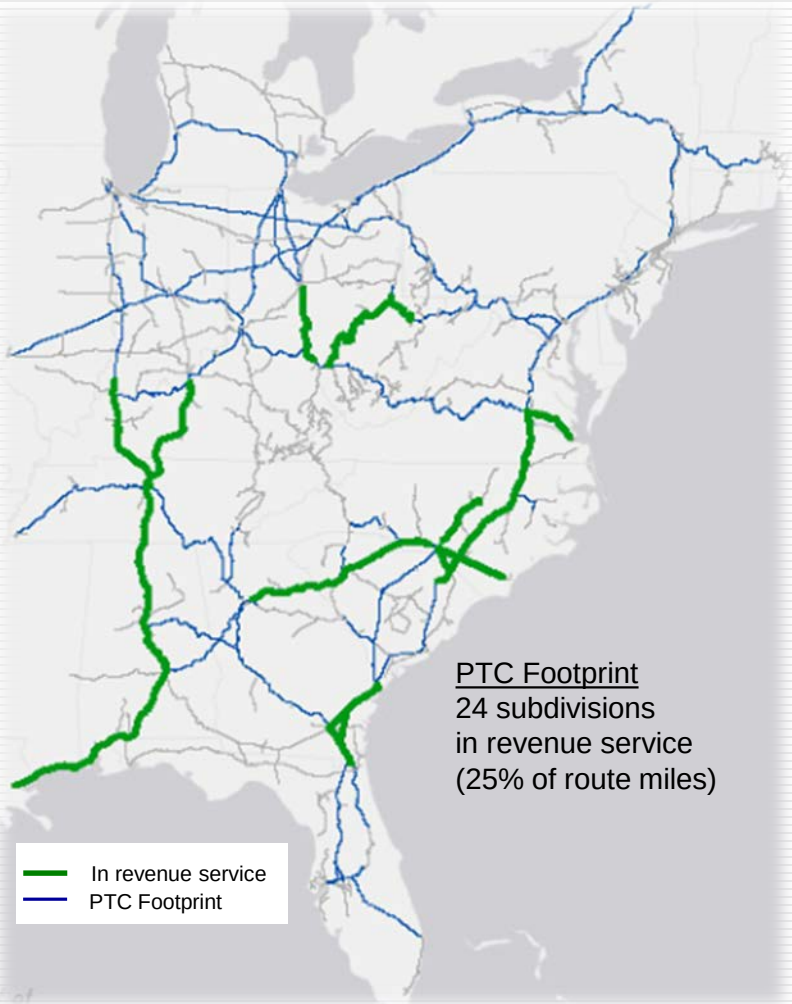


CSX PTC in Revenue Service

PTC is in revenue service on 25% of planned route miles



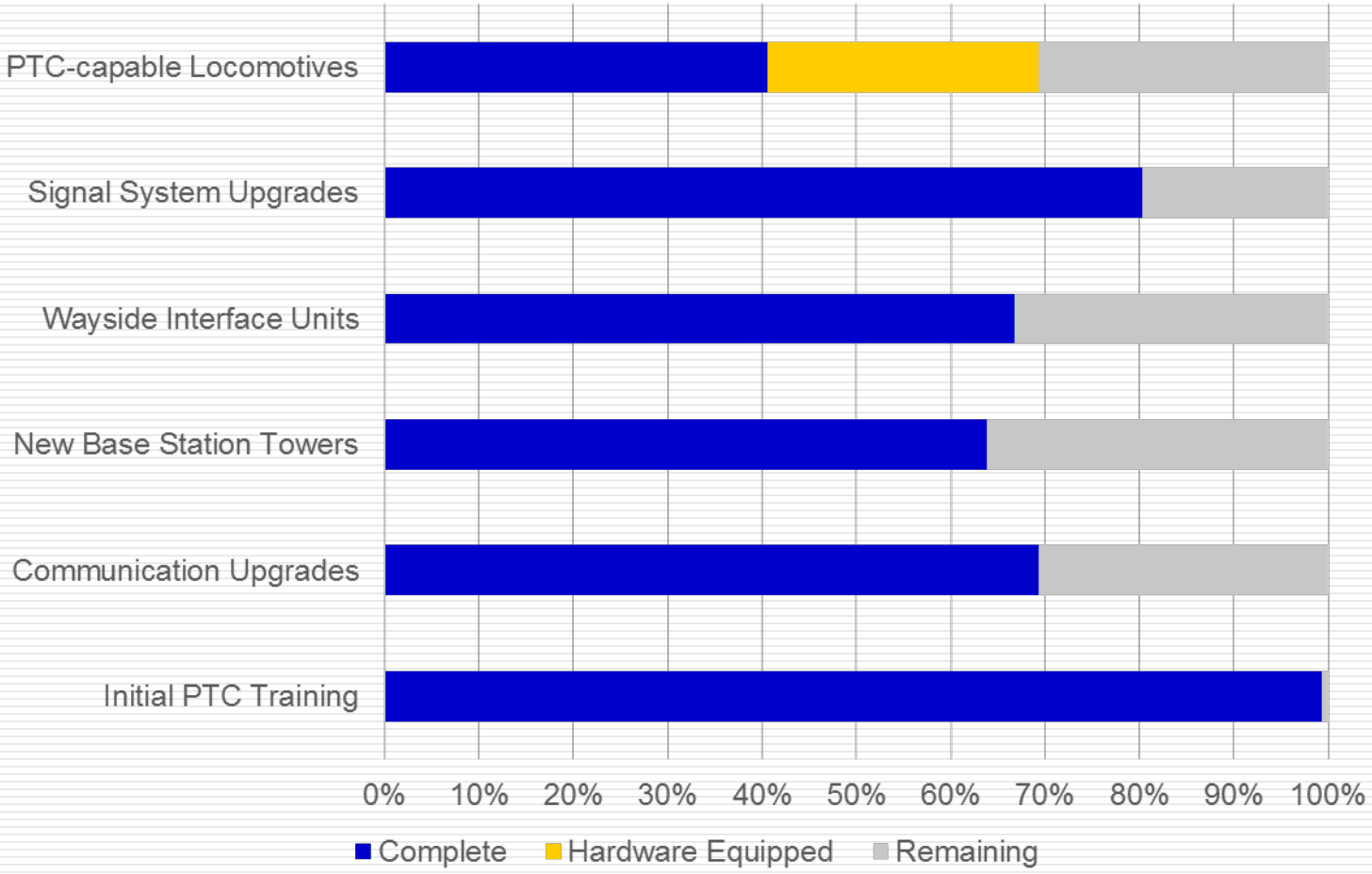
PTC Footprint
9,590 route miles
12,788 track miles



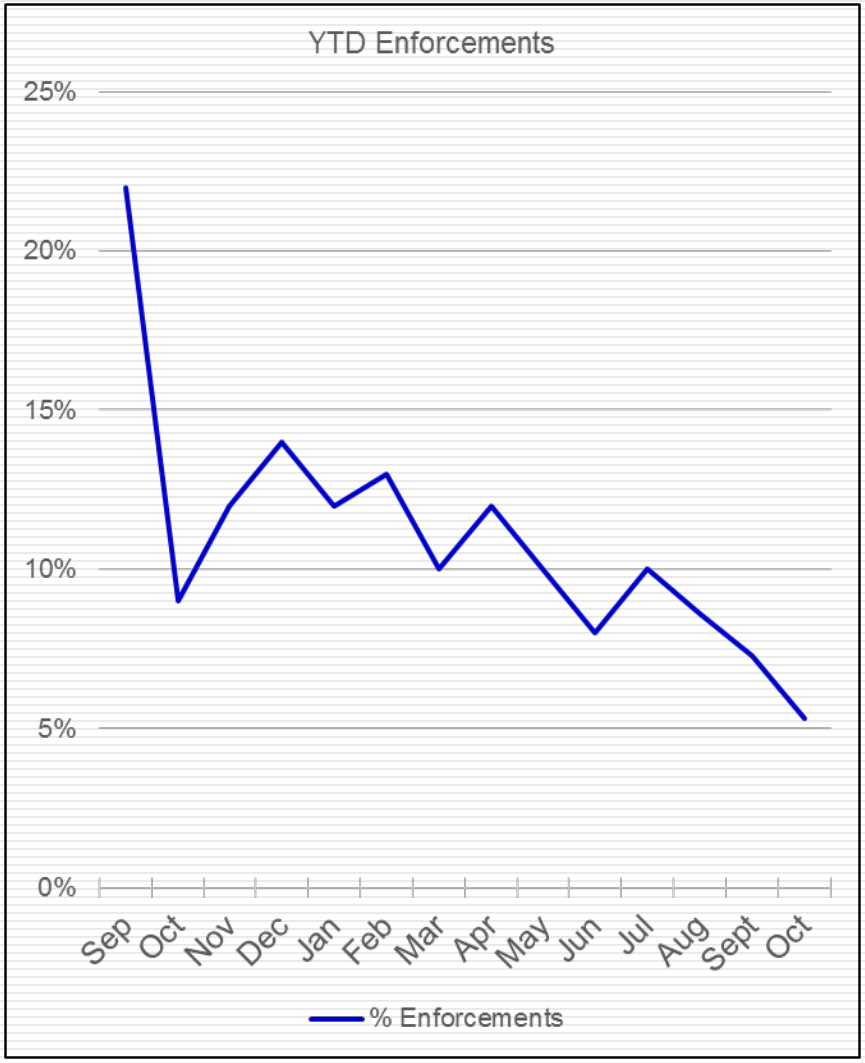
PTC Footprint
24 subdivisions
in revenue service
(25% of route miles)

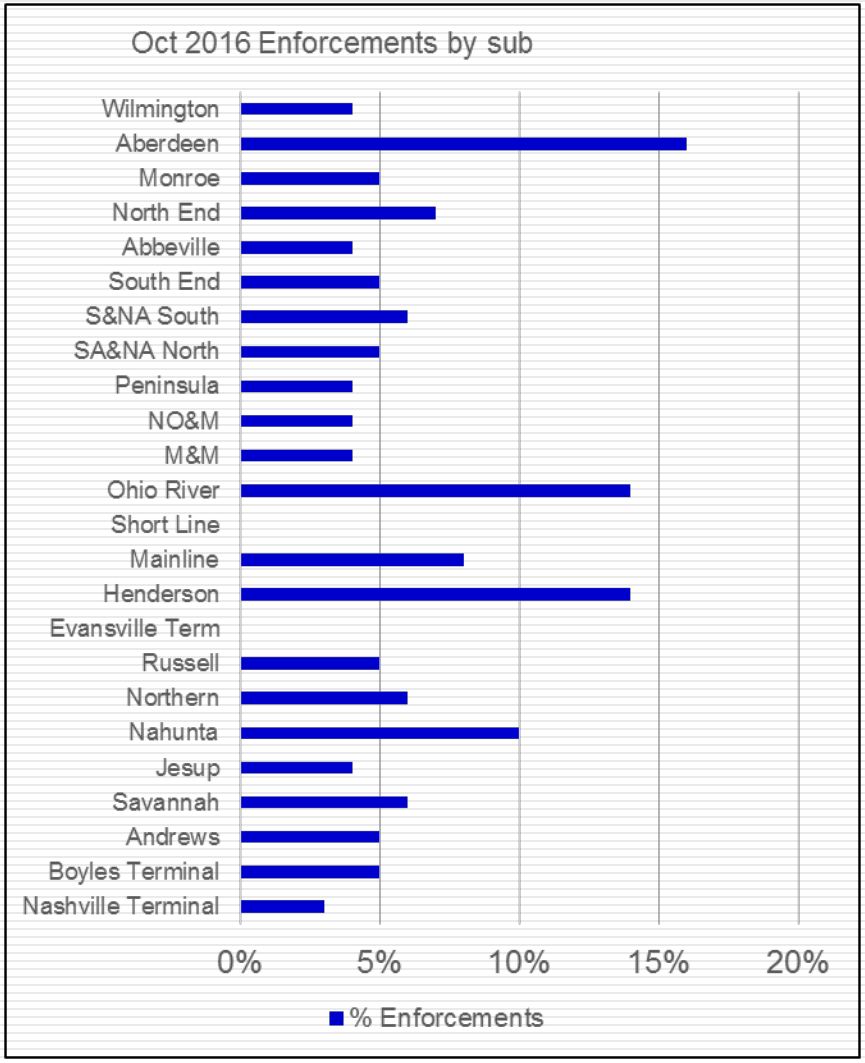
CSX received conditional safety plan approval and certification of I-ETMS system on September 26, 2016
CSX is the second Class I railroad to get approval

Progress on key metrics through 10/30/16



Undesired enforcements trending down but still higher than desired

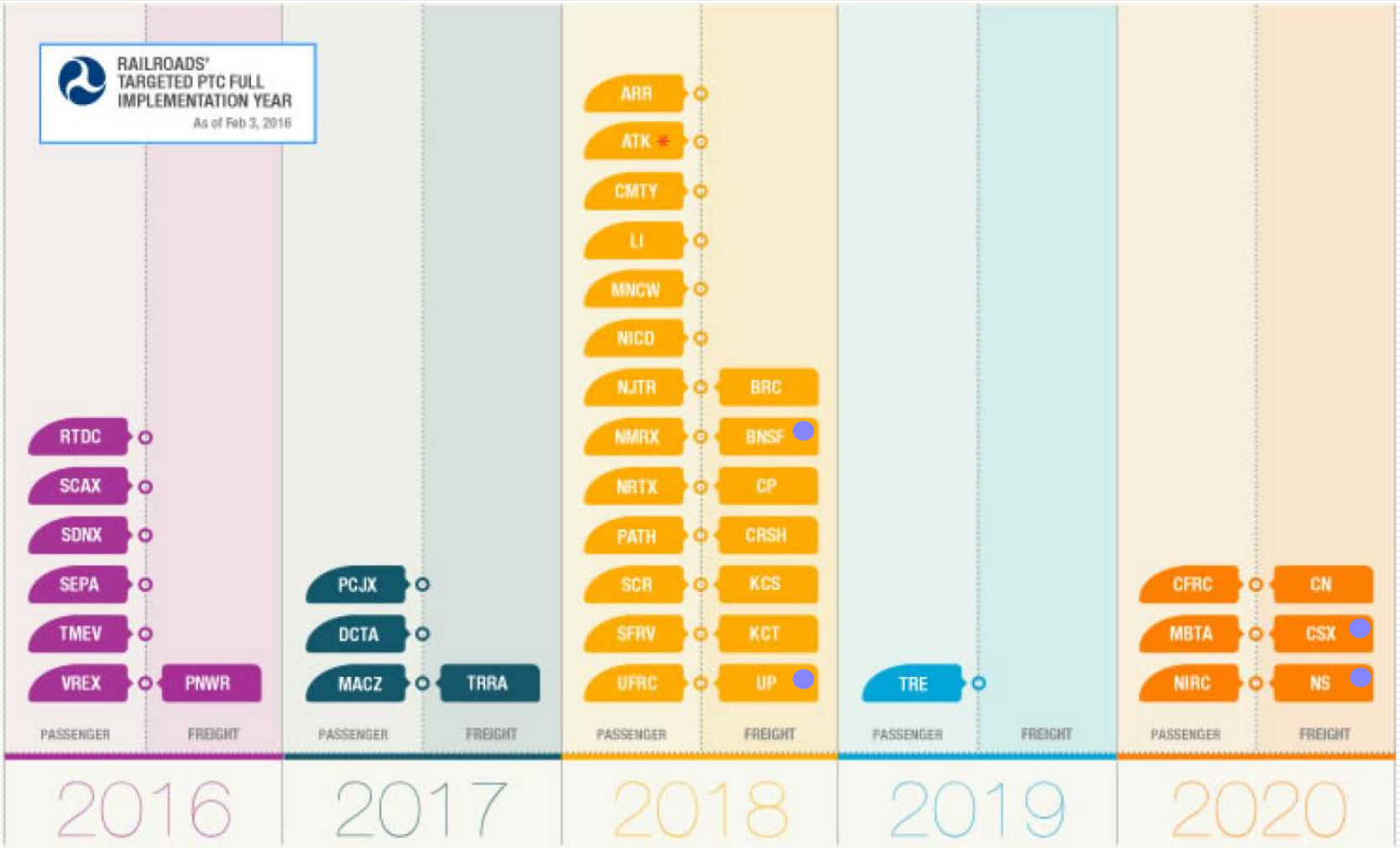




All data through October 30, 2016

Industry Progress

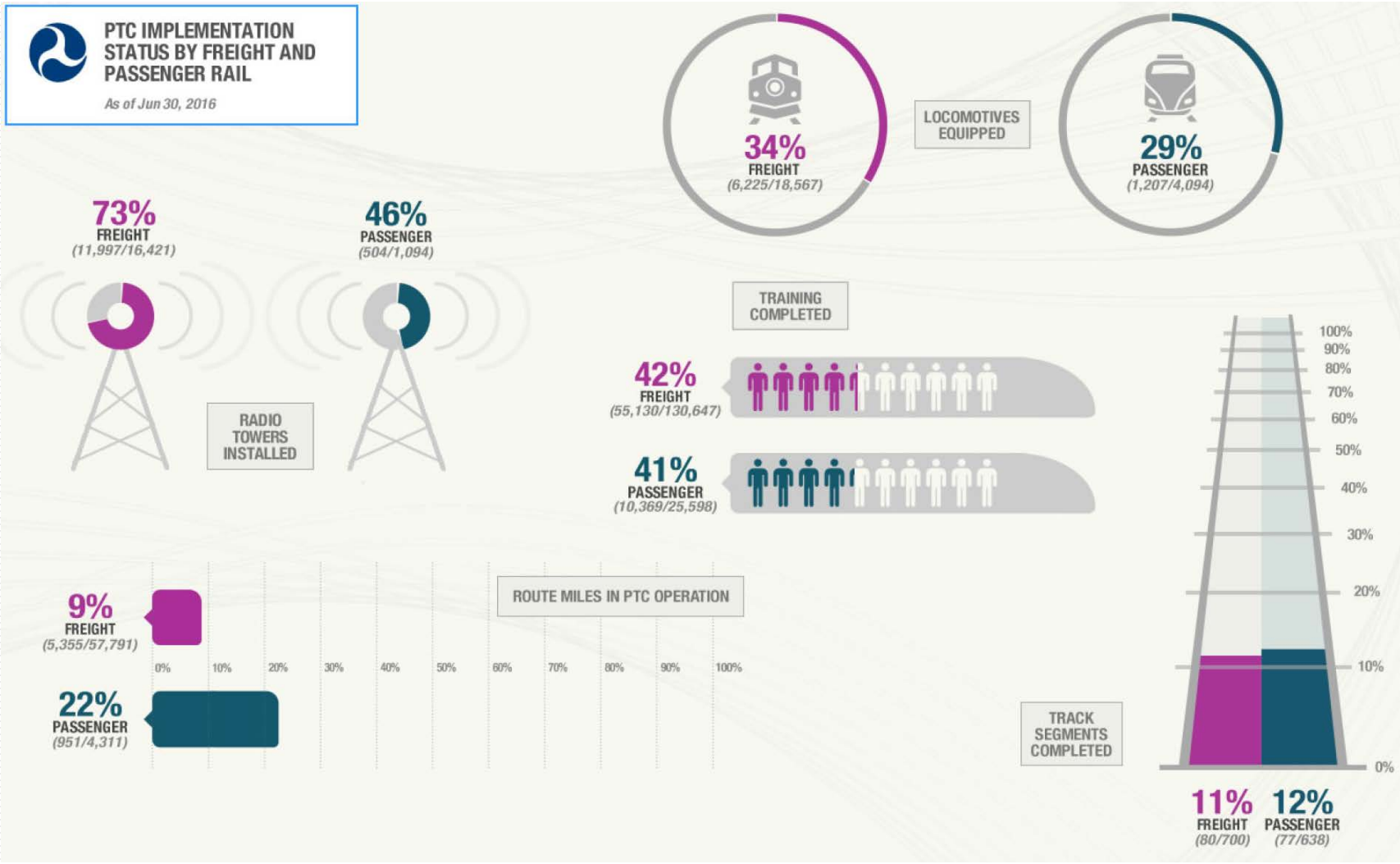
FRA published mid-year status report to Congress



Source: FRA Status Update on PTC Implementation August – 2016

● Major Class I (CSX annotation)

FRA's Freight and Passenger Comparison



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Questions?