

**Embracing connected train
technology via real-time
diagnostics to improve
PATH's customer experience,
reliability, and safety**

May 1, 2024



Port Authority of New York & New Jersey

- Our mission: keep the region moving
 - Since 1921
 - 100+ years
- Multimodal agency: Air, Rail, Land, and Sea
- Bistate transportation infrastructure essential to economic growth
- 5 major lines of business:
 - Aviation
 - PATH
 - Bridges & Tunnels
 - Ports
 - World Trade Center
- Commitment to maintaining highest level of safety & security, improving customer experience, and ensuring operational excellence



PATH System Overview



KEY FACTS

Operates	24/7/365
Adult Fare	\$2.75
2019 Annual Total Ridership	82.2M
2023 Annual Total Ridership	50.5M
Stations	13
Trans-Hudson Tunnels	4
Route Miles	43.1
Passenger Cars (PA-5)*	350
Maintenance Cars	74
Age of the System	115

Summary of PATH Pilot

- Born via NYC Transit Tech Lab
- Overall goal: Improve fleet reliability and operational efficiency
 - Institute remote and real-time data capture and analysis
 - Decrease dependency on outdated PTE and proprietary software
 - Improve car availability by improving in service troubleshooting and reducing turnaround time
 - Leverage alerts of alarms for controlled removals from revenue service
- Additional Value
 - Automate on-time performance calculation with actual arrival and departure timestamps
 - Pinpoint location where failures occur to correlate with potential wayside deficiencies
 - Leverage high resolution cameras for security, training, and customer experience initiatives
- Future
 - Enable predictive maintenance via historical failure data to identify indicators of failure (future)

Wi-Tronix: Inspired by technology, motivated by safety



**Founded in
2004**

Led by founders
160+ employees
Based in suburban
Chicago



**14,000+ rail
vehicles**

Fleet agnostic
monitoring & analytics
Integrating and
normalizing data on
diverse fleets & data
sources



**60+ customers
4,000+ users**

4,000+ users across
freight, passenger, and
light rail markets in the
US, Canada, Mexico,
and Australia
Customized Insights



**Siemens
investment**

2017 investment capital
for growth and
international outreach



**Innovators at
our core**

Leadership team with
100+ years of rail
industry expertise

A single platform built to monitor vehicle data and video in real-time



Remote Monitoring

Securely store, retrieve, and analyze data from anywhere, anytime, from any device.



AI-powered Analysis

Automatically upload and analyze locomotive data to improve proactive planning and operational safety.

- ✓ *Solves today's challenges*
- ✓ *Expands value over time*



Cloud Computing Solutions



Maintenance Support

Identify maintenance needs before they occur with locomotive engine and vehicle control systems data.



Safety / Risk Compliance

Reduce at-risk behavior and ensure compliance to both internal best practices and federal regulations.



Energy / Fuel Optimization

Experience real-time locomotive operational, crew, and fuel usage monitoring and reporting.

Cloud-connected Edge hardware

Impacts of a connected solution on PATH

Real-time remote visibility to synchronized camera and vehicle telemetry data

Application:

- Violet IoT Platform with antenna
 - Connected to LON Vehicle bus
- 4 cameras

Key metrics:

- 125+ different vehicle signals captured
 - 12M+ data points per day
- 11k+ thumbnails captured per day
- Dwell time alert active (min and max time)
- 25+ nodes across 10 subsystems

Forward facing camera



Operator cab camera



2 Passenger compartment cameras

Impacts and insights

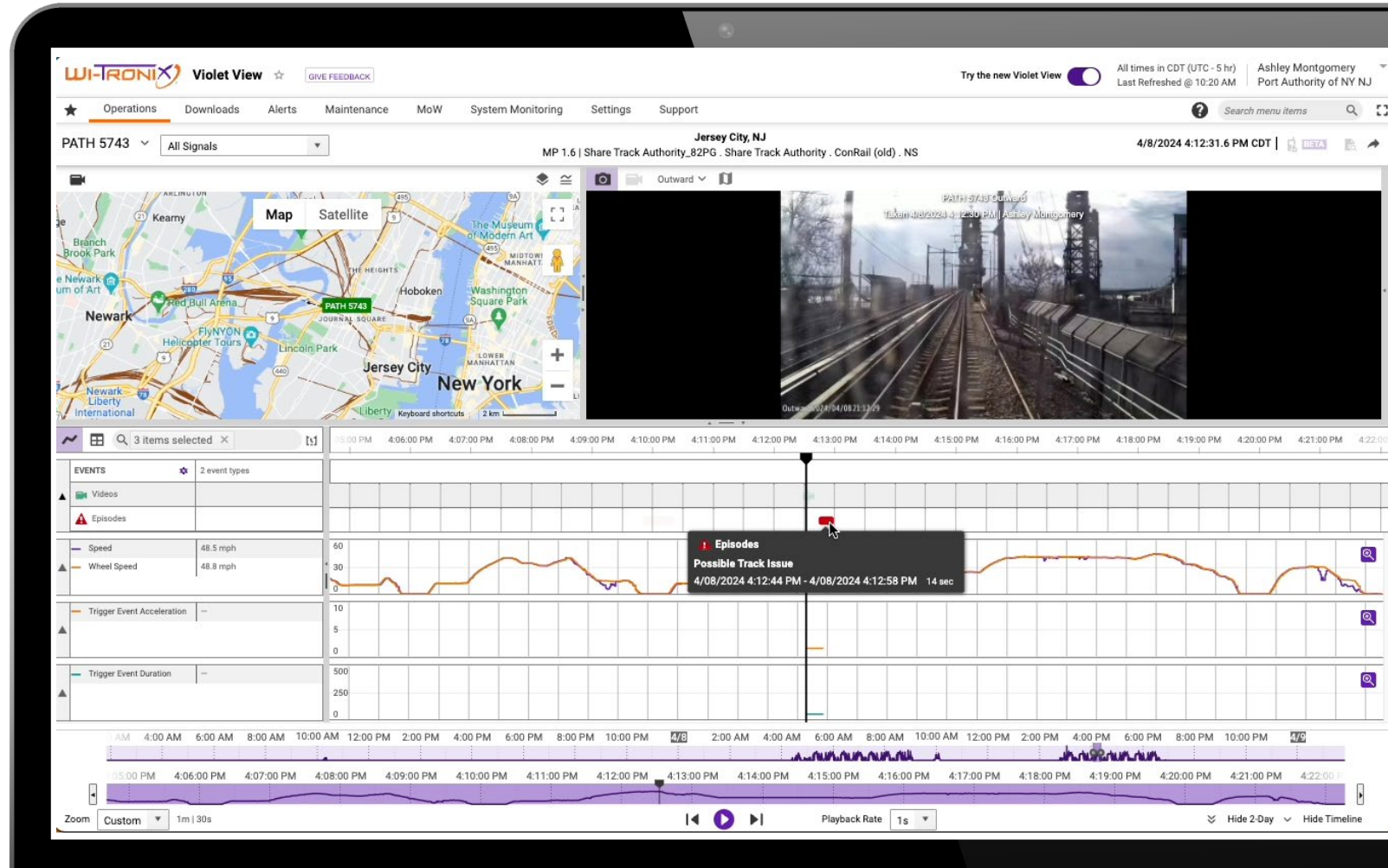
Demonstrated real-time remote visibility to synchronized camera and vehicle telemetry data with basic OTP analysis

- Remotely view train in real-time on map
- Rich vehicle telemetry insights + vehicle imagery – all time synchronized
- Web based data signals via a user-friendly UI = operational efficiency benefits
 - ✓ PATH indicated ability to “replay” events is a benefit in understanding and aids prevention and MTTR
- OTP improvement potential via station dwell times (door/leave)
 - ✓ Station Dwell Alert implemented
 - ✓ OTP Analysis of 1 train run
 - ✓ Identified some causes of delay
- Data captured enables future condition based and predictive maintenance



Case Study 1: Possible Track Issues

Onboard accelerometers detect G-forces exceeding certain trigger thresholds, alerting to possible track issues

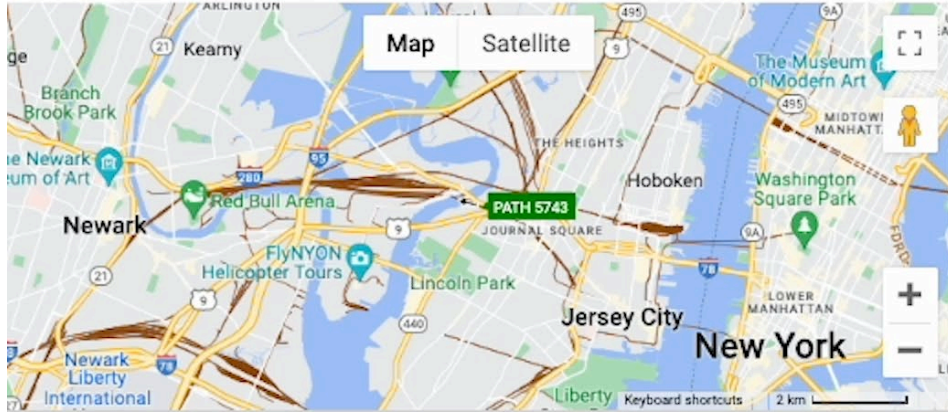


PATH 5743 All Signals

Jersey City, NJ

MP 1.6 | Share Track Authority_B2PG . Share Track Authority . ConRail (old) . NS

4/8/2024 4:12:31.6 PM CDT |



EVENTS 2 event types

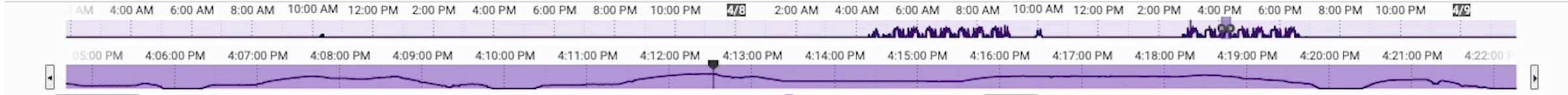
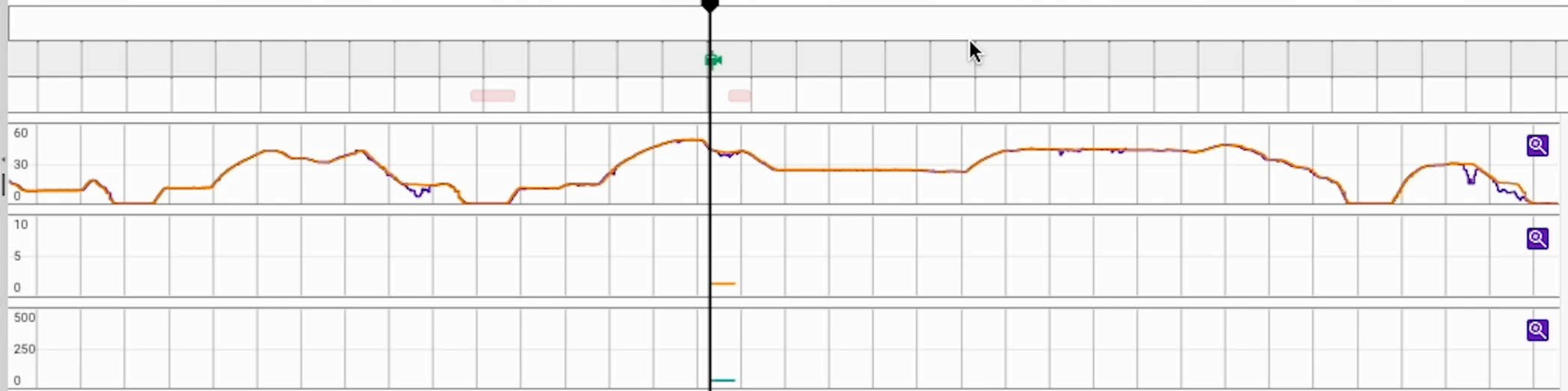
- Videos
- Episodes

Speed 48.5 mph

Wheel Speed 48.8 mph

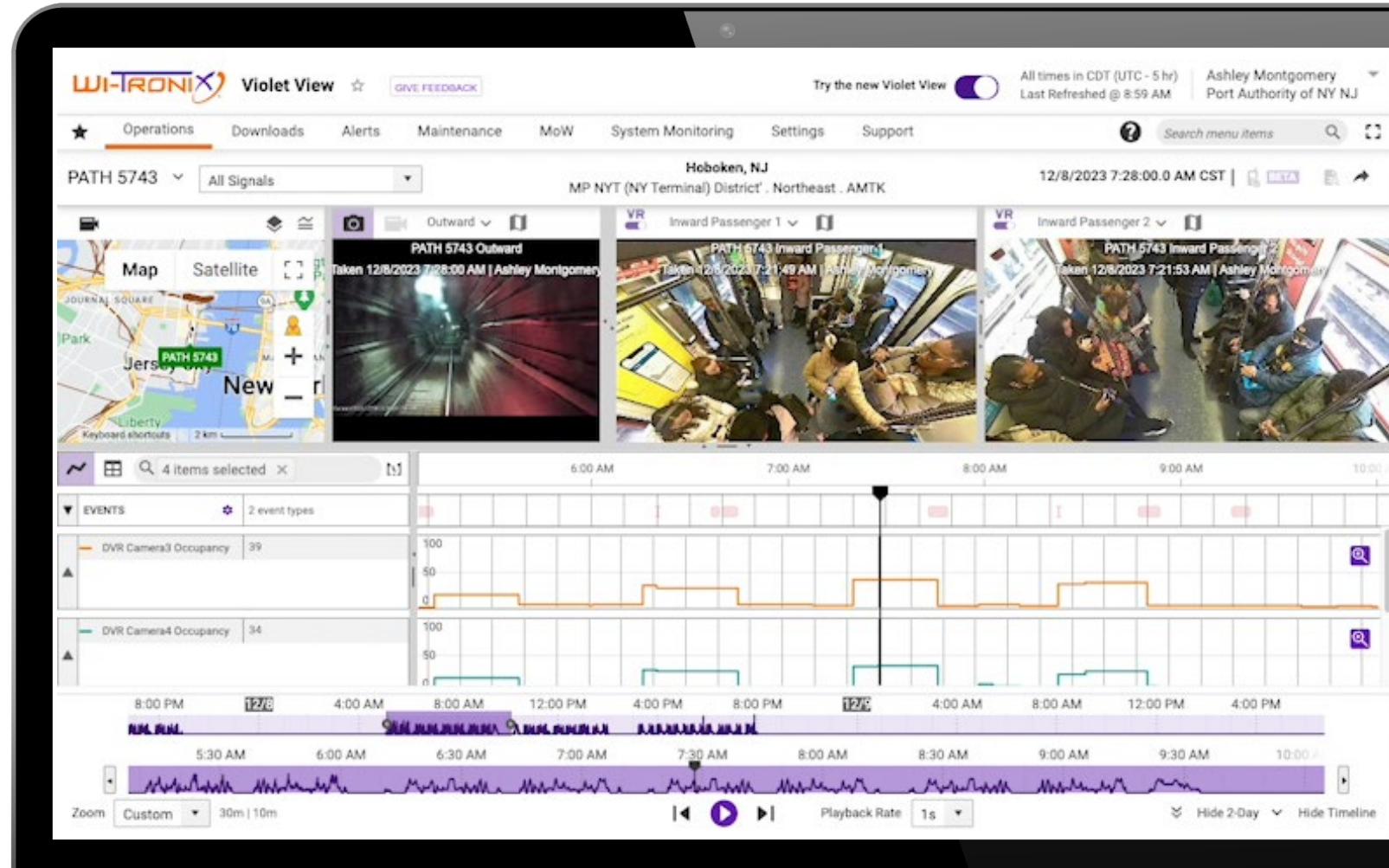
Trigger Event Acceleration -

Trigger Event Duration -



Case Study 2: AI-Based Passenger Counting Via Cameras

Inward cameras identify
passengers onboard and report
current occupancy on the train



PATH 5743

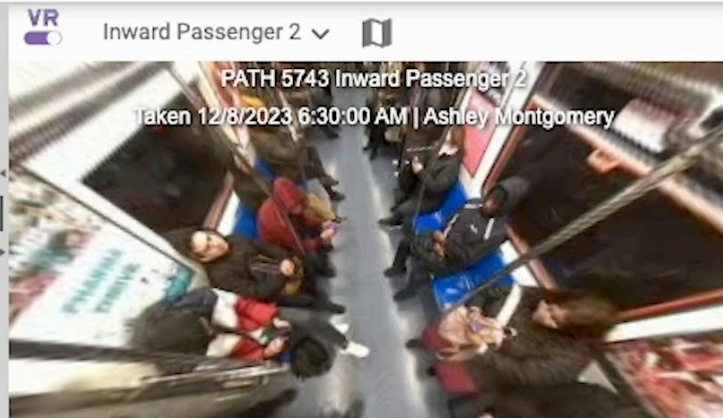
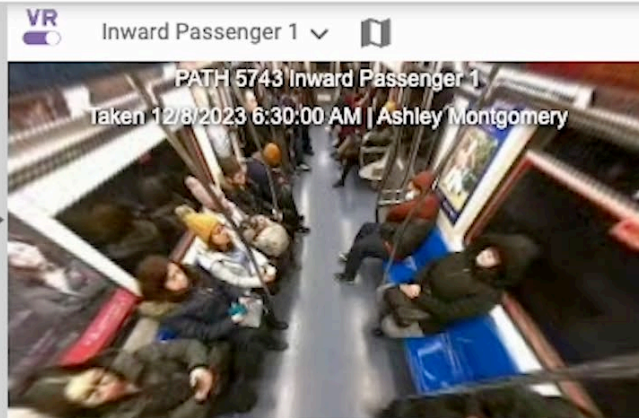
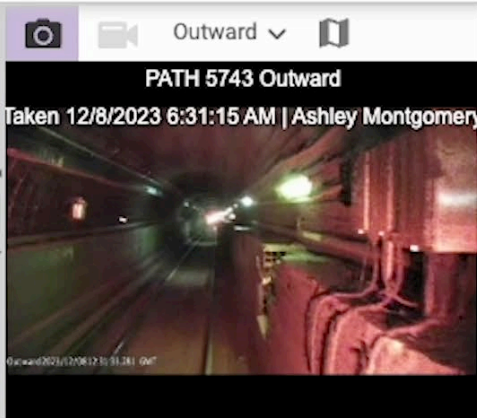
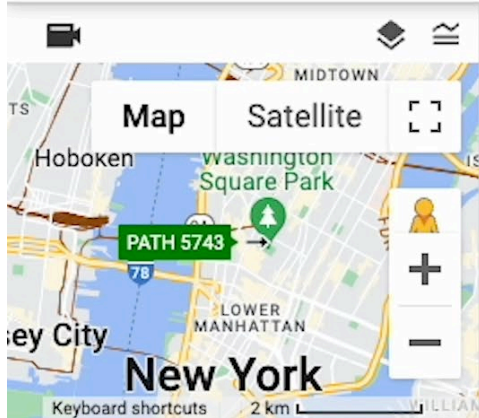
All Signals

New York City, NY

MP Share Track Authority_82PG . Share Track Authority . ConRail (old) . NS

12/8/2023 6:31:15.0 AM CST

BETA

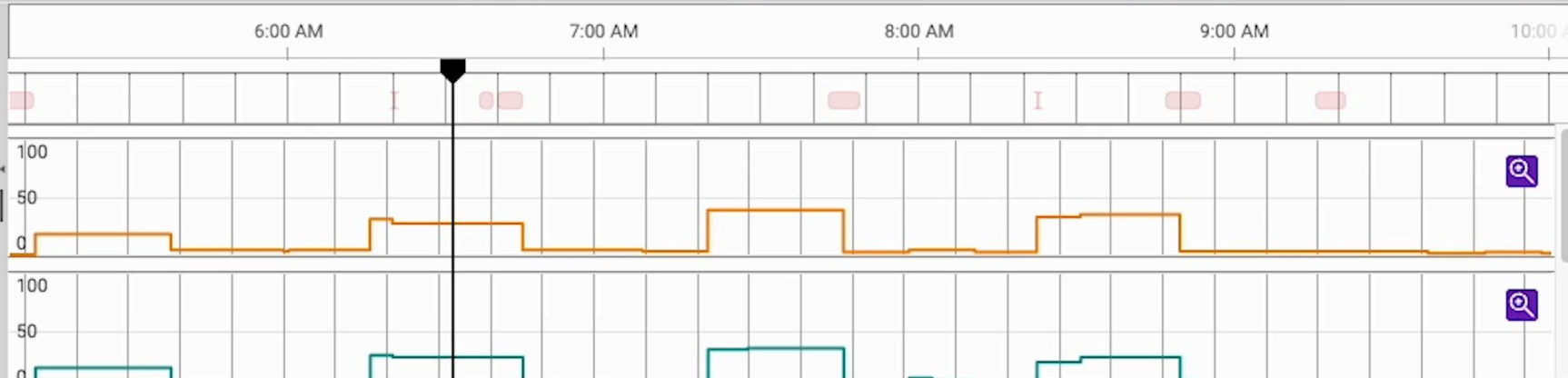


4 items selected

EVENTS 2 event types

DVR Camera3 Occupancy 27

DVR Camera4 Occupancy 27



8:00 PM 12/8 4:00 AM 8:00 AM 12:00 PM 4:00 PM 8:00 PM 12/9 4:00 AM 8:00 AM 12:00 PM 4:00 PM

5:30 AM 6:00 AM 6:30 AM 7:00 AM 7:30 AM 8:00 AM 8:30 AM 9:00 AM 9:30 AM 10:00 AM

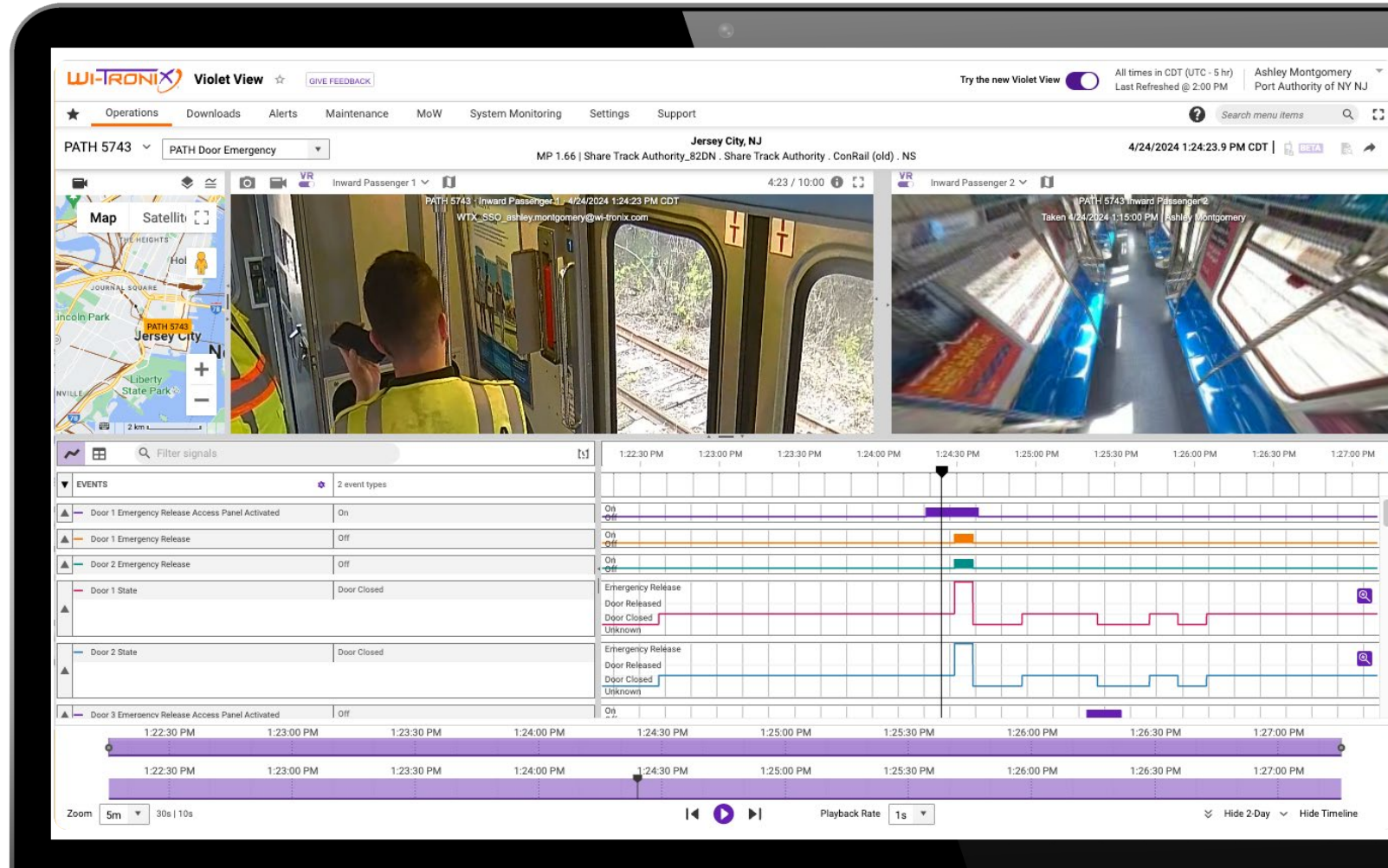
Zoom Custom 30m | 10m

Playback Rate 1s

Hide 2-Day Hide Timeline

Case Study 3: Passenger Door Emergency testing in shop

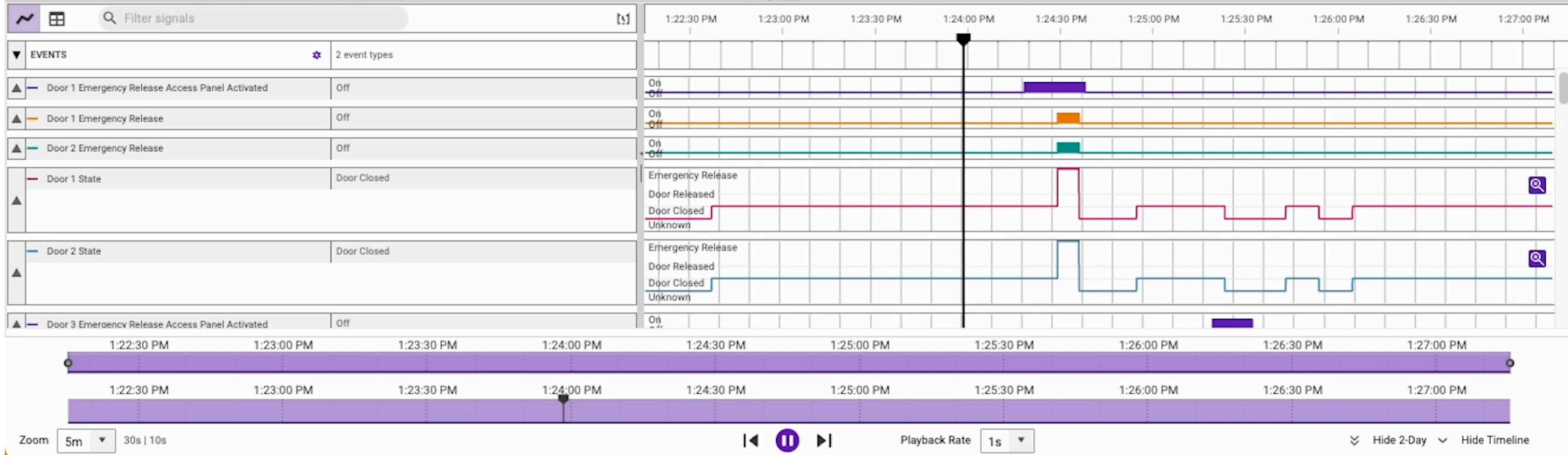
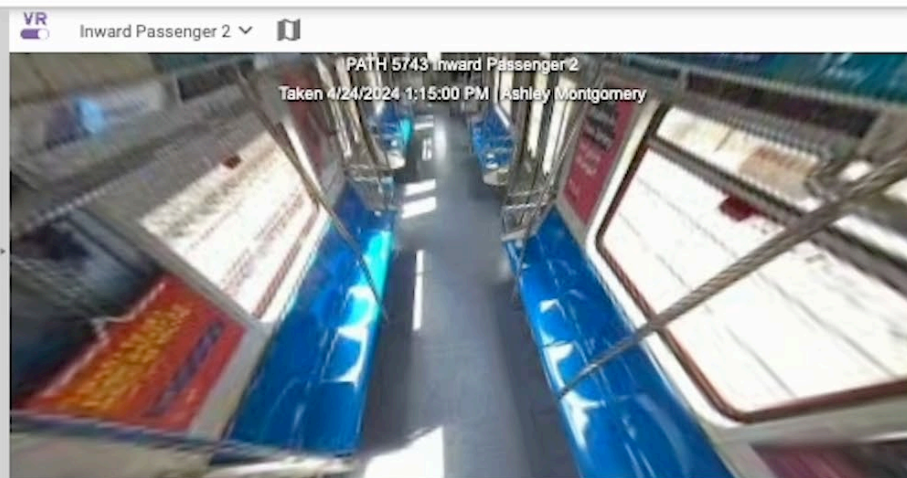
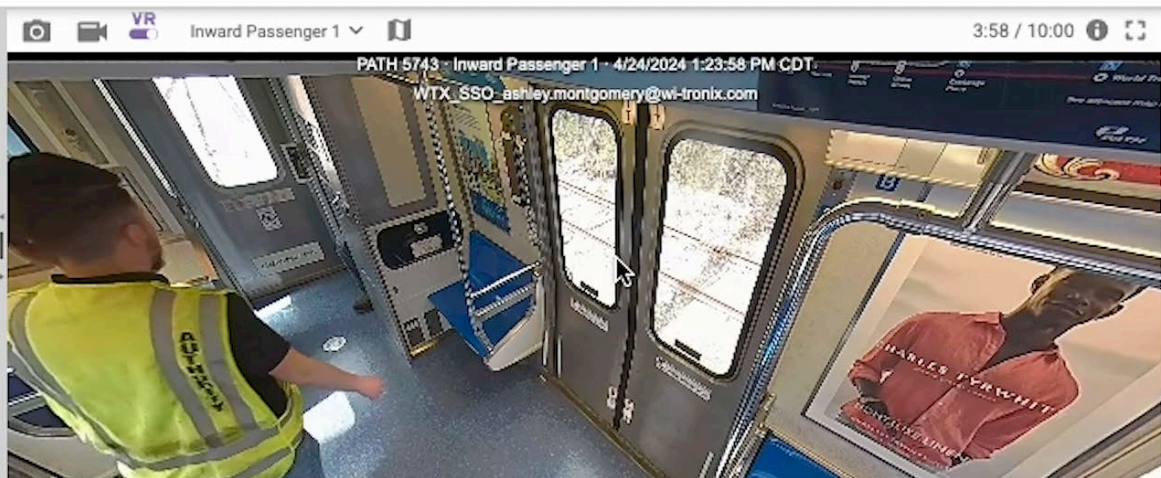
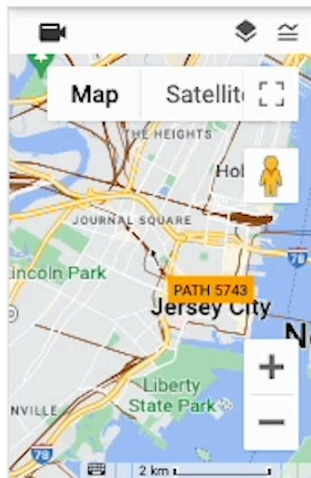
Status of doors and emergency release access panel reported in real time to identify who, where, when, and what doors were triggered



PATH 5743 ▾ ▾
Jersey City, NJ

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49 CFR 229.136 Regulation Overview



Locomotive Image and Audio Recording Devices for Passenger Trains | FAST Act

WHY: Improve public safety with video to support incident investigations

WHO: Controlling rail vehicles in commuter & intercity passenger service

WHAT:

- Forward and in cab video recording on Crashworthy Memory (at least 12 hours)
- Self-monitoring
- Annual validation process
- Enables random downloads to improve operational safety
- Post accident accessibility of system recording
- FRA approval process

WHEN:

- Nov 12, 2023: Regulation Effective
- Oct 12, 2024: Installs after this date must meet compliance
- Oct 12, 2027: Deadline for all units equipped

FAST ACT

Compliance Made Easy: Camera Requirements

Locomotive Image and Audio Recording Devices
§ 229.136 (b)(2)(ii-v), § 229.136(c)(1)(i-iv)

WI-TRONIX

Benefits of a cloud-based platform

Software

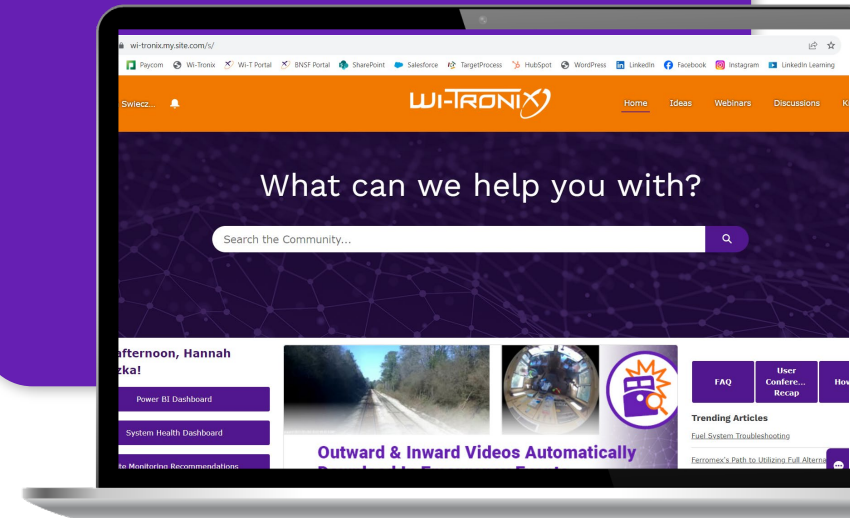
- ✓ Modernized web portal
- ✓ Access 2-year history from anywhere (including mobile)
- ✓ No proprietary software required
- ✓ Unlimited user licenses

Agility

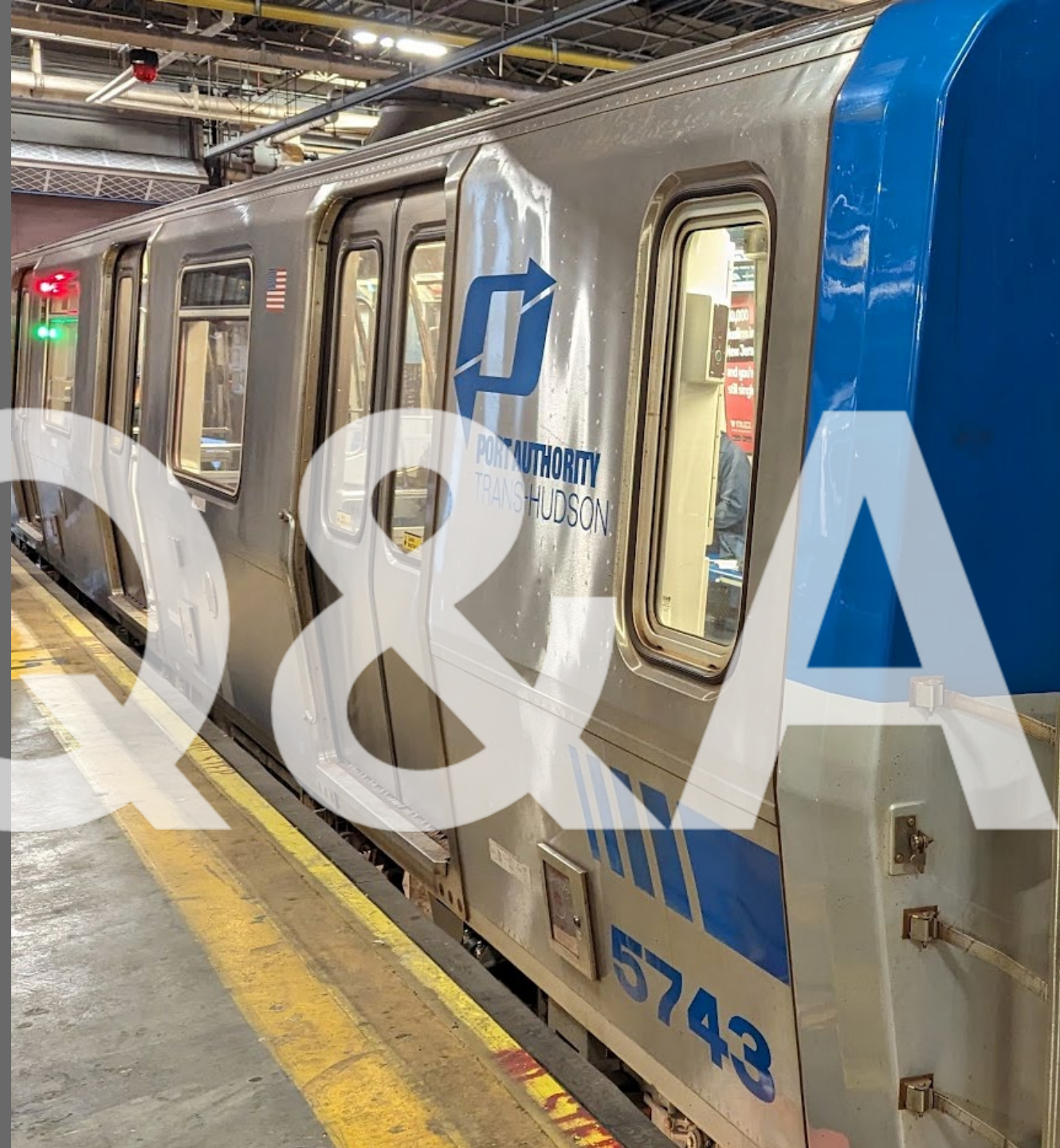
- ✓ Ongoing development (Back Office deployments every two weeks, onboard every 4 weeks)
- ✓ Back Office availability with a goal of 99.9%

Support

- ✓ Integrated asset configuration management with over-the-air updates
- ✓ 24/7 US based help desk
- ✓ Customer success manager
- ✓ Online community



panel discussion



thank you

Lisa Matta

VP Product Management, Wi-Tronix

Emmanual Ramos

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Port Authority of NY & NJ

