

FTA

FEDERAL TRANSIT ADMINISTRATION

Transit Advisory Committee for Safety (TRACS)

Technology Presentations
February 25, 2020
Day 1 - Afternoon

Disclaimer:

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U.S. Department of Transportation
Federal Transit Administration

METROM-RAIL

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FTA TRACS PRESENTATION:
AURA TRAIN CONTROL SYSTEM & INTEGRATED
WORKER PROTECTION FUNCTION

February 25, 2020

www.metrom-rail.com

METROM RAIL HISTORY AND CAPABILITIES



Metrom Rail was the first organization to launch UWB (ultrawide-band RF) technology within the North American rail sector in 2011 and continues to focus on UWB-incorporated safety and train control technologies.

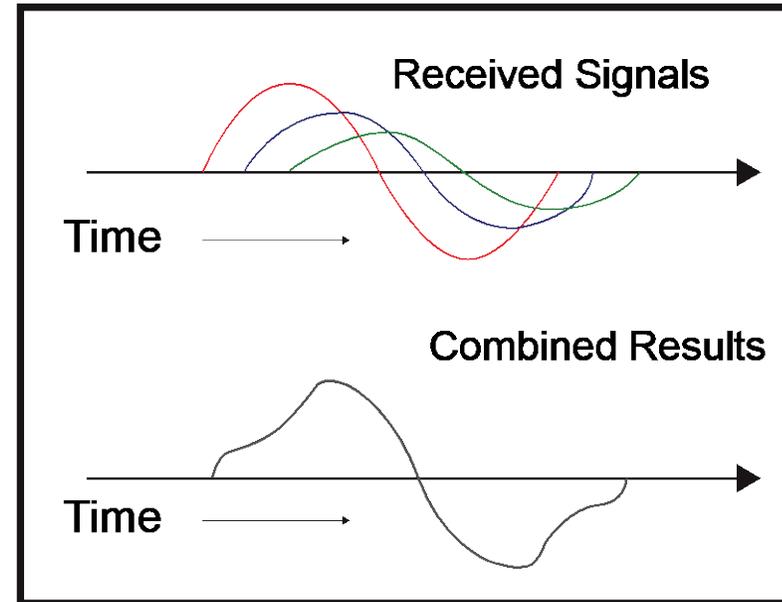
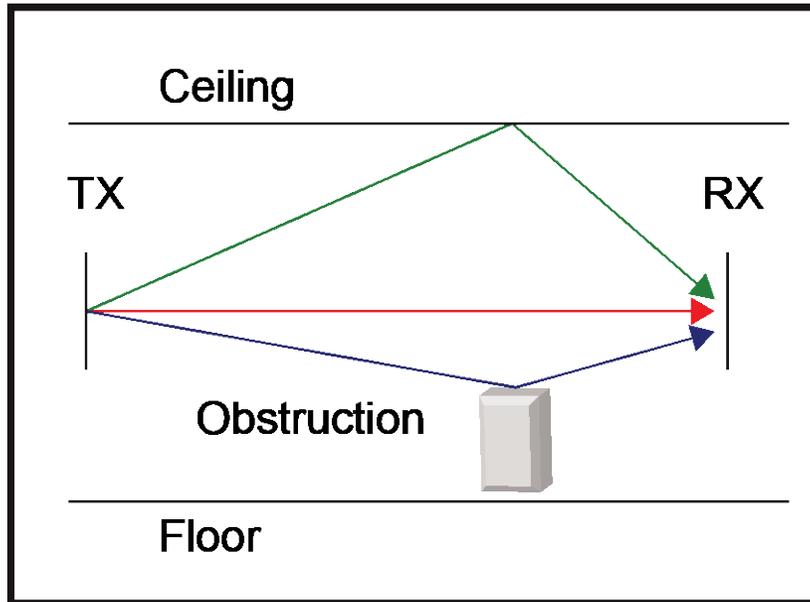
- Metrom Rail originally launched the first UWB-based collision avoidance systems for Class-1 MOW fleets – over 4,000 systems are currently deployed.
- Metrom Rail identified the potential of UWB technology as a core component of a full train control system alternative to traditional and CBTC systems in 2014, leading to the current AURA Train Control System.



TRADITIONAL RADIO TIME-OF-FLIGHT TECHNOLOGIES



Traditional worker protection, collision avoidance, and other related technologies rely on time-of-flight ranging between radios using standard frequencies (220 MHz, 900 MHz, 2.4 GHz). This approach is prone to multipath distortion, resulting in incorrect ranging data & false alarms.



Provided by Cisco, Inc. ©Copyright 2003

This inherent weakness of traditional RF-based approaches was the primary reason why the Metrom Rail team adopted Ultrawide Band RF technology. UWB is a time-of-flight technology that allows ranging down to under 1" of resolution at up to 6,000 ft.



Range Accuracy is a function of RF bandwidth:

Conventional (non-UWB) technologies have <20 MHz Bandwidth

- GPS ~20MHz bandwidth = 15m accuracy
- Bluetooth has <1MHz bandwidth = 1-20m accuracy

UWB technologies have >500MHz Bandwidth

- Sub cm accuracy possible and signal unaffected by multipath

Several Types of UWB:

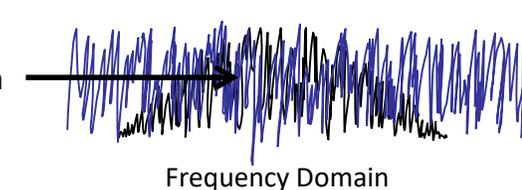
- Non-Coherent (transmit single, infrequent, massive pulse, and threshold detection)
 - Time Difference of arrival DOA gives location
 - Short range (<20m)
 - Require fixed, expensive infrastructure, but very cheap mobiles
- Coherent (transmit trains of pulses and integrate energy from many pulses to increase SNR and extend range)
 - Low Cost Coherent (short range, low accuracy, low power consumption)
 - High Performance Coherent (long range, high accuracy, more expensive, more complex, requires more power)

Device Type	Transmit Power (Watts)
Allowed leakage from a Microwave oven	1.00000 Watt
Typical mobile phone transmit power	0.25000 Watts up to 1 Watt
Class 1 Bluetooth device (100 m range)	0.10000 Watts
Class 2 Bluetooth device (10 m range)	0.00250 Watts
Sunlight reflecting from the head of a pin (on a sunny day)	0.00100 Watts
UWB transmission	0.00005 Watts

Coding and Integration Provides:

- Noise-like spectrum (regulatory compliance)
- Channelization
- Resistance to interference
- Secure (low probability of intercept, LPI)

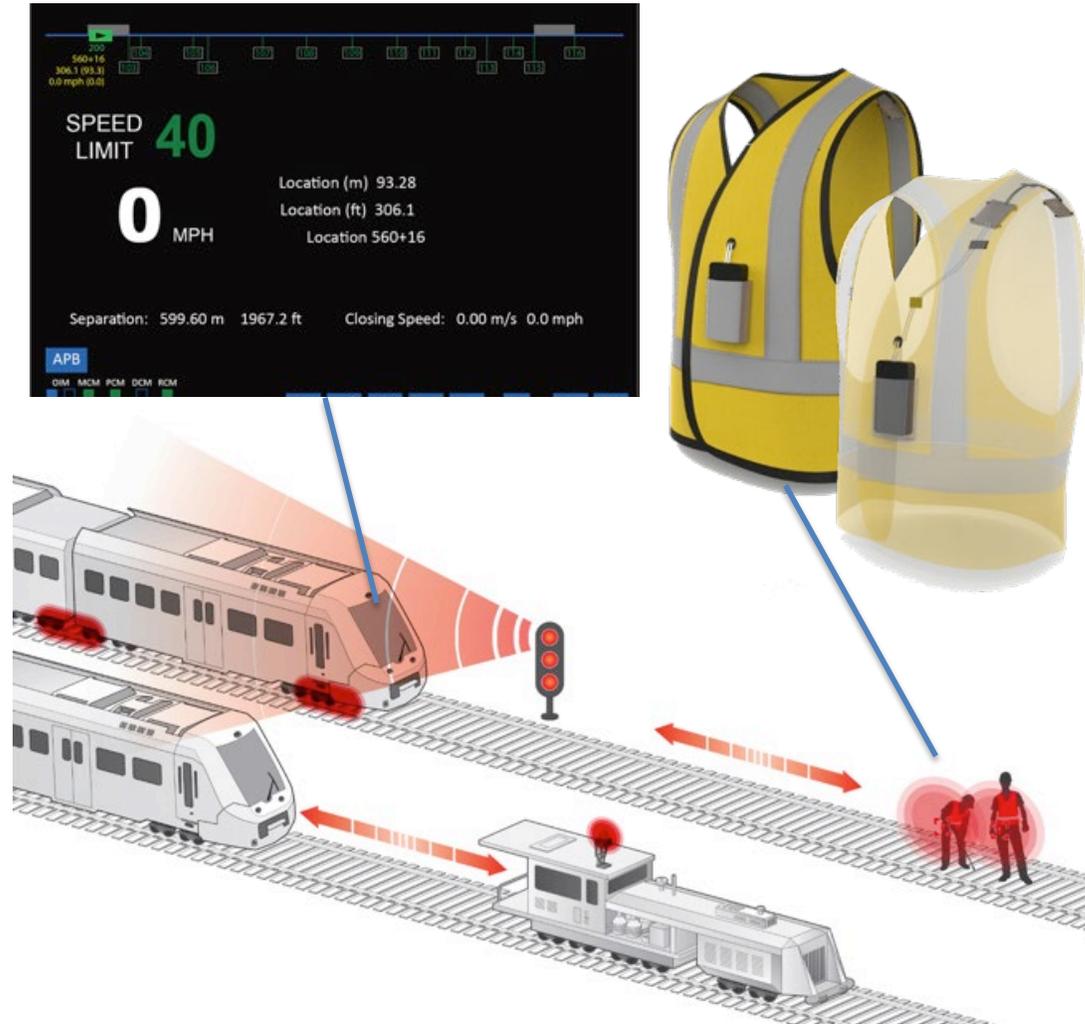
UWB signal
hides within
nominal RF
“noise”



In general, traditional train control & signaling systems lack flexibility & customization capabilities. The AURA System was created to provide an à la carte approach to train control; with the same basic hardware set, agencies can select functions critical only to their operations such as worker protection, signal compliance, collision avoidance, etc.

Key Advantages:

- 100 percent reliability: UWB is not susceptible to false alarms.
- Functional in all environments: UWB signals are enhanced in rural / underground environments, and do not require line-of-sight in subways.
- Proactive functionality: AURA is designed as a proactive system, stopping trains prior to violating operating rules such as entering a work zone without prior authorization.
- Installation is up to 90 percent faster than traditional train control systems.

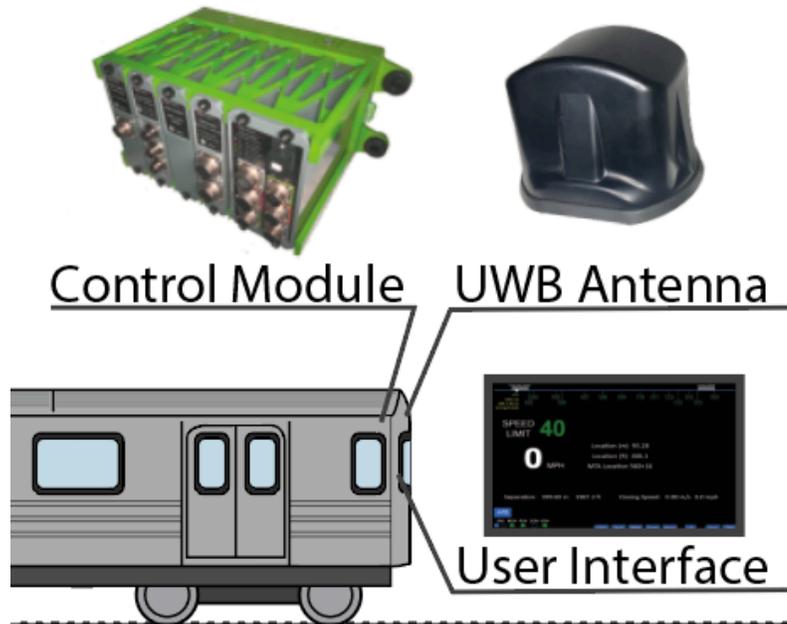


AURA SYSTEM HARDWARE

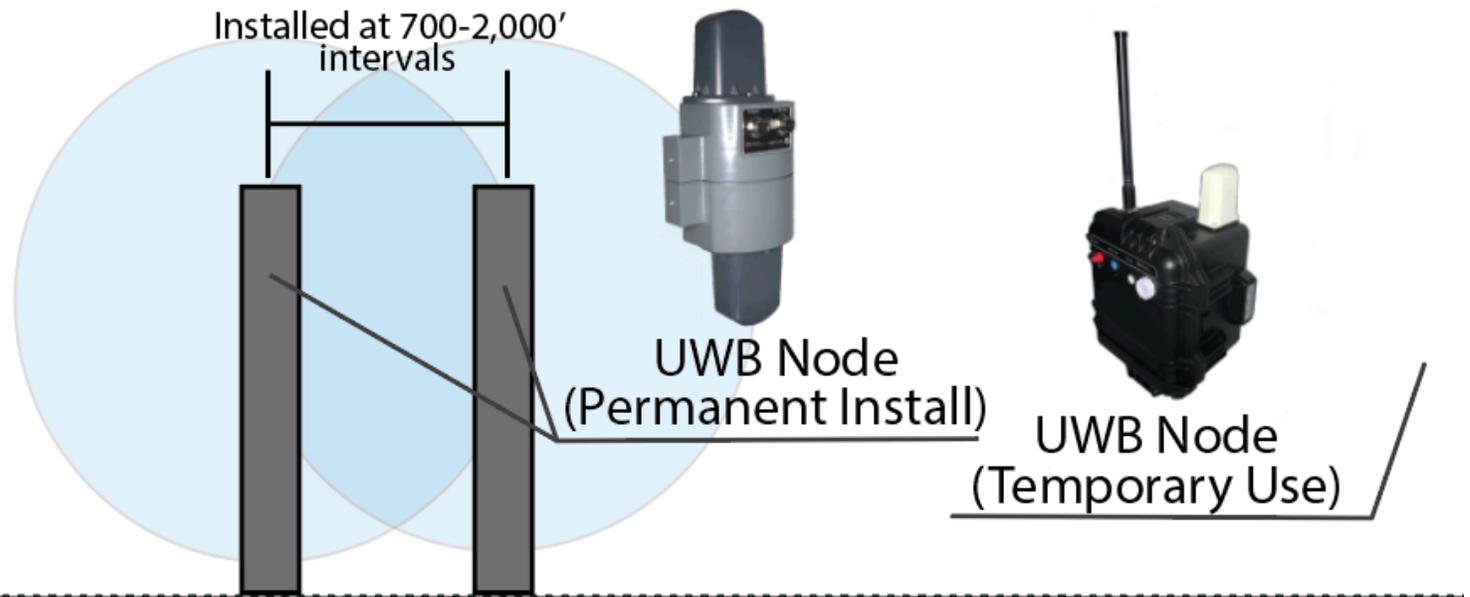


AURA System hardware is modular, simple to install, and is customized to meet the goals of each agency. As the same hardware is used for all functional capabilities of AURA, agencies can initially launch a WPS-focused program and expand later into other functions such as collision avoidance or signal compliance.

Onboard Hardware:



Wayside Hardware:



UWB Integrated Vest:

UWB antennas have been woven into the front and rear of the vest material, ensuring that workers will receive warnings 100 percent of the time without worry about RF-related failures of traditional wearable systems.

- Visual Alarm: **HD LED strobe**
- Physical Alarm: **Vibration**
- Audible Alarm: **High-volume digital speaker**



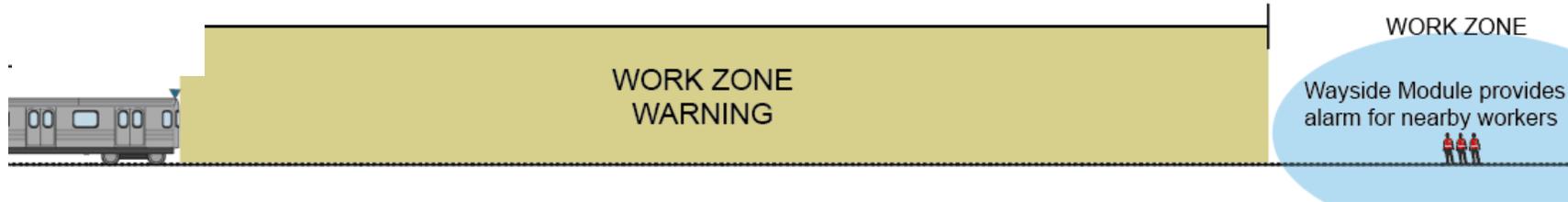
AURA WORKER PROTECTION FUNCTION



AURA can be a passive alarm for operators and workers:

Operator and workers receive an alarm indicating 15 seconds until train arrival.

No assertive action is taken on the part of the AURA System; alarms are for notification only



AURA can proactively activate brakes to prevent entry into a work zone :

Operator and workers receive an alarm indicating 15 seconds until train arrival. All must confirm the alarm to allow the train to proceed.

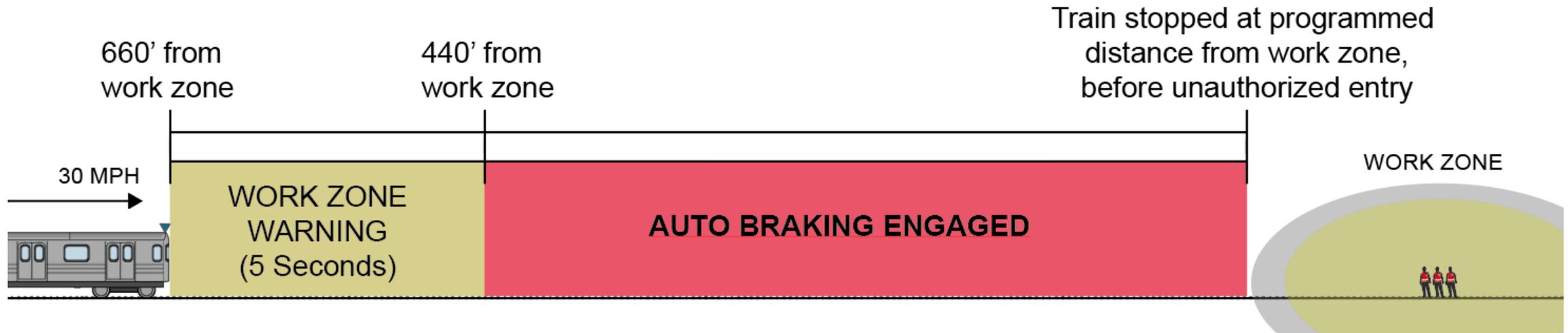
If any alarms are not confirmed, AURA will engage service brakes to bring the train to a stop before violating the perimeter of the UWB-defined work zone.



AURA WORKER PROTECTION FUNCTION - EXAMPLE



Here, a train is approaching a work zone at 30 mph, with a programmed 1,000 ft. work zone diameter – or, 500 ft. radius from the placement of the wayside module.



FTA WORKER PROTECTION TESTING

FTA-2016-007-TRI Safety Research and Demonstration (SRD) Program



Hosted by NYCT Office of Strategic Innovation and Technology, executed on G Line between 4th Avenue and 7th Avenue

Metrom Rail demonstrated worker protection in multiple configurations and speeds:

- Configuration 1: Single Wayside and No Personnel Modules
- Configuration 2: Three Wayside and Three Personnel Modules
- All test runs were successful with over 15 seconds of warning for workers and train operators.

Config	Test Run	Start Time	# of Wayside Modules	# of PMs	Speed (mph)	Warning Time (s)	Pass (yes/no)
1	1	1045	1	0	7	15	yes
	2	1059	1	0	11	16	yes
	3	1108	1	0	20	17	yes
2	4	1127	3	3	27	17	yes
	5	1132	3	3	27	16	yes
	6	1145	3	3	11	17	yes
	7	1200	3	3	6	15	yes
	8	1215	3	3	33	16	yes

NOTE: Amount of warning is the elapsed time from when the worker received the warning to the time the train reaches the work zone.





Lessons Learned:

- Traditional RF-based systems are not capable of providing reliable, repeatable and functionally accurate time-of-flight ranging.
 - UWB has been proven technology through its deployment since 2011 as a Class-I MOW Collision Avoidance System, and as a dynamic train safety & control system through our work with transit agencies across the country.
- As a new solution only commercially available since 2015, we face long-standing industry barriers to entry and an inherent reluctance to adopt new technologies.
 - Transit agency procurement rules dictate that most solutions be deployed for 2-10 years before consideration in programs, creating a natural barrier to innovation for new products.
- In many functional areas, AURA serves both transit and PTC-compliant agencies; one such example is the ability to prevent a train from entering a work zone without prior authorization.

Future Outlook:

- We hope to see more modern solutions introduced into the rail sector; natural reluctance to modernization is a direct result of so few new options for safety or operational systems.
- A focus on AI-driven systems will introduce more efficient operating standards, especially in the case of RF-based technologies that need to optimize bandwidth utilization in real time.



Thank you – We’re happy to field any questions.

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Questions?

Miller Ingenuity

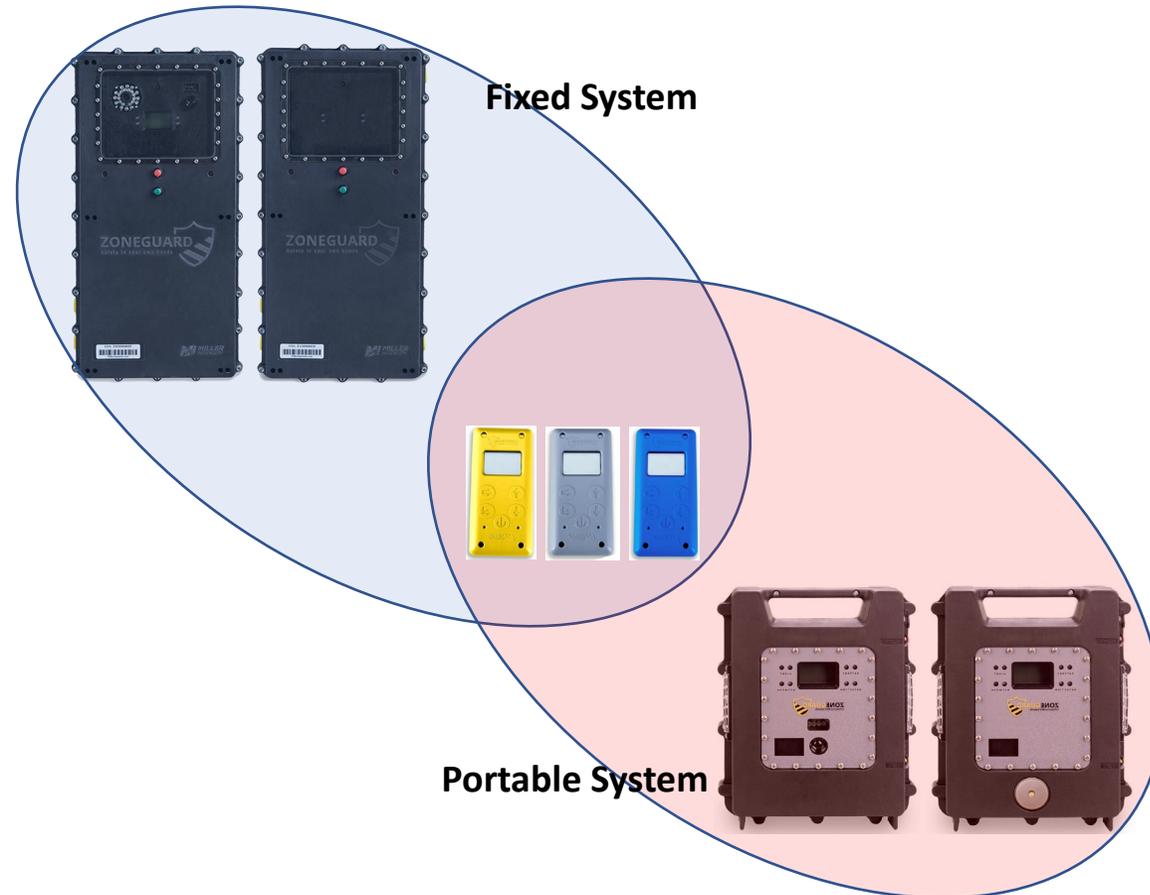
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Safety In Your Own Hands

- ZoneGuard is a hardware and software platform that is used to provide secondary, redundant protection to existing railroad on-track protection rules.
- First Application
 - electronic Roadway Worker Protection (eRWP) system
 - System is used in tandem with federal and state regulations, and customers specific safety rules to provide a secondary early warning device to roadway workers and on-track vehicle operators.
 - Adds a 2nd layer of protection and assists in eliminating human error
- ZoneGuard can be deployed in both portable and fixed installation setups.



TDM



TAM



- ZoneGuard fixed system has 3 main components:
 - Train Detection Modules (TDMs)
 - Train Alert Modules (TAMs)
 - Wearable Devices
- Optional Devices
 - ZoneGuard On-Board Device

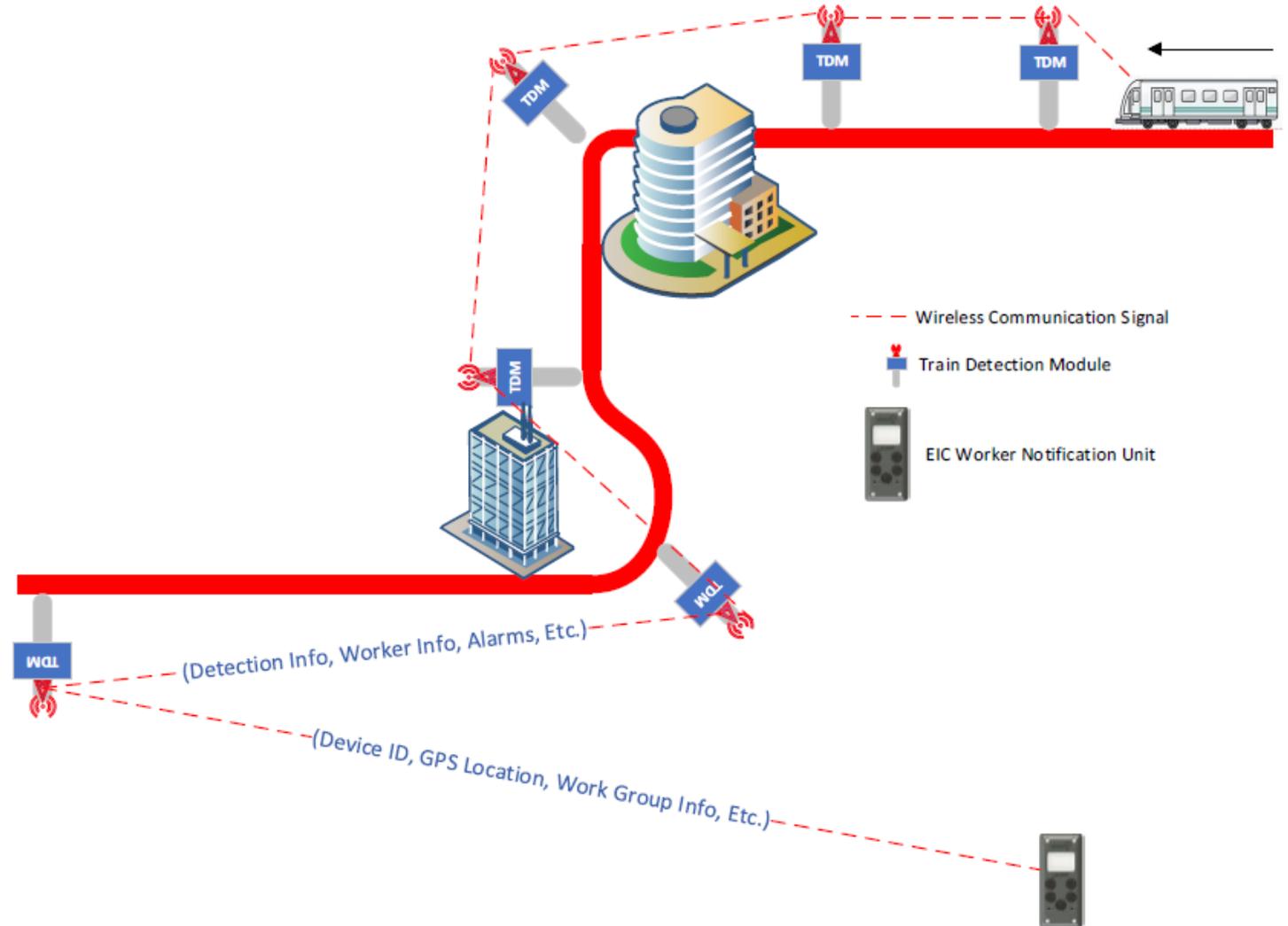
Wearables

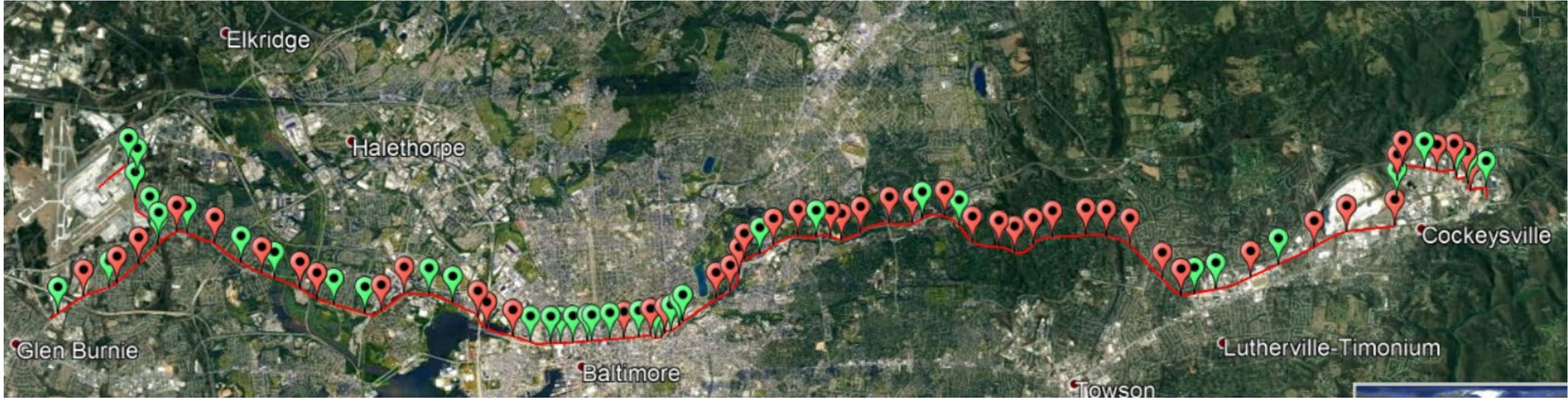


On-Board



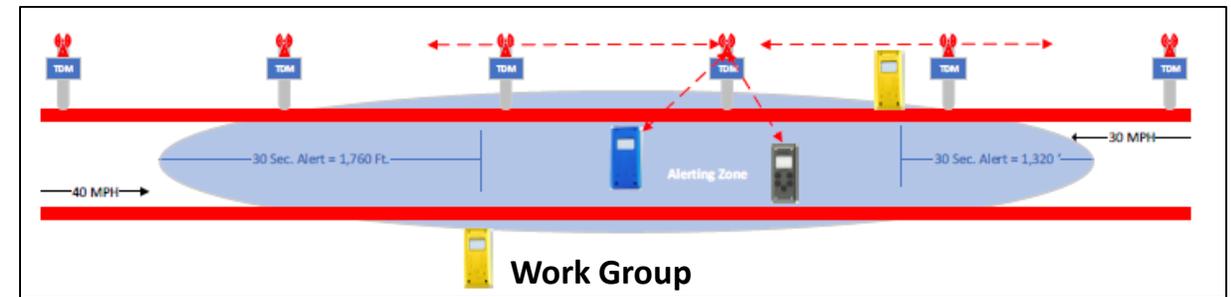
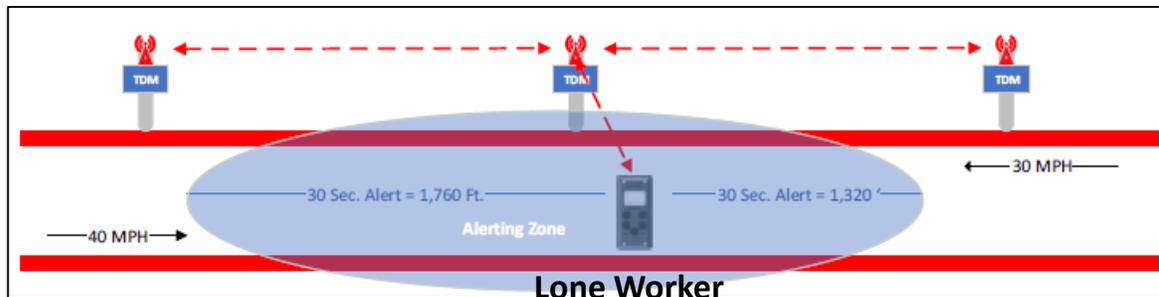
- Installation
 - TDMs installed at regular intervals to provide train detection information
 - TAMs are installed as needed to act as repeaters
 - Forms linear network backbone along a rail line or specific length of track
- Configuration
 - TDMs and TAMs each configured based on installed location, GPS coordinates, track distance between units, and Maximum Allowable Speed, to create a system wide track profile in order to detect and track the location(s) of all on-track vehicles and equipped workers along the right-of-way.
 - Customer Specific Alert Time (15 Sec. Minimum) configured to provide consistent minimum alert times regardless of terrain, track curves, etc.





- As-Installed MTA Light Rail locations
- ~60 miles of track and 112 Installed Devices
 - TDMs shown in Green
 - TAMs shown in Red

- ZoneGuard provides secondary eRWP coverage for the installed area
 - Can ignore traffic moving in yards or sidings while alerting when vehicle is entering the mainline
 - As track vehicles enter and traverse mainline, TDMs continuously detect, track, and share information for on-track vehicle(s) movement throughout the network and with the web portal.
- Workers connect anywhere and move throughout the network.
 - TDMs/TAMs on each side of the worker or work group enable strobe lights to notify operators of active work zone
 - Worker and work group location information is shared with network TDMs and web portal
- Alerts generated to wearables at the minimum configured time, and Acknowledged by workers
 - Warning time required for clearance is calculated based on the MAS for each track segment configured into customers specific ZoneGuard track profile and the locations of workers and vehicles.
 - Workers must acknowledge their personal alerts, system alerts clear after train has passed.
- Optional On-Board Device provides in-cab alerts and precise alarm times
 - Additional audible and visual alert provided to operators
 - Provides TDMs, TAMs, and Web Portal with GPS location and speed of each vehicle to allow for precision tracking and alert times.



Overview

- Dimensions – 23.5” x 11.5” x 4”
- Weight ~18 pounds
- Multiple redundant and diverse sensors used for train detection
- Communications
 - Private data radio network (900MHz)
 - Cellular modem (cloud communications)
 - Optional LEOS Satellite (cloud communications)
 - Optional VHF/UHF radio (train operator alert over voice radio)



Key Components

- RADAR Module
- LiDAR Module
- IR Camera Module
- 3-axis Accelerometer
- Single Board Computer (SBC)
- Global Positioning System
- 900 MHz Radio Module
- Wi-Fi Networking
- 4G Wireless Mobile Technology
- LCD Screen
- Audio Alarm (Siren)
- Interface to EverRRay or Indication Lights
- Status LEDs
- Internal Battery, 12V 20AH
- Intelligent Battery Charger (IBC)
- IP65 Rated Rugged Enclosure

Overview

- Dimensions – 23.5" x 11.5" x 4"
- Weight ~18 pounds
- Communications
 - Private mesh data radio network (900MHz)
 - Optional LEOS Satellite (cloud communications)
 - Optional VHF/UHF radio (train operator alert over voice radio)
- Additional Information
 - Mechanically Identical to TDM
 - Acts as a repeater for extending network between TDMs
 - Single On-Board sensor for detection or reinforcement



Key Components

- 3-axis Accelerometer
- Single Board Computer (SBC)
- Global Positioning System
- 900 MHz Radio Module
- Wi-Fi Networking
- 4G Wireless Mobile Connectivity
- Audio Alarm (Siren)
- Interface to EveRRay or Indication Lights
- Status LEDs
- Internal Battery, 12V 20AH
- Intelligent Battery Charger (IBC)
- IP65 Rated Rugged Enclosure



Watchman/Lookout
Wearable (WLW)



Roadway Worker in Charge
Wearable (RWIC)



Worker Wearable
(WW)

Overview

- Dimensions - 6" x 2.8" x 1.2"
- Weight < 16 oz
- GPS tracking
- Battery powered by internal cell
 - ~ 48 – 60 hours operation on single charge
 - Wireless re-charging (no mechanical connection)
- Four alerting devices
 - Audible alarm, vigorous vibration motor, LED strobe, and Bluetooth-enabled Bone Conduction sensor option
 - Bone Conduction sensor is recommended for very noisy environments where the built-in audible alarm is not easily heard
- Communications
 - Private Data Radio Network (900 MHz)

Key Components

- 900 MHz Radio Module
- Audio Alarm
- Haptic Feedback (Vibrating motor)
- Status LEDs
- LCD Screen
- Bluetooth
- Global Position System (GPS)
- User Interface (LCD Screen and Navigation Buttons on EIC)
- 32 Bit Microcontroller
- Flash Memory
- Real Time Clock
- IP65 rated rugged mechanical design
- Wireless Charging

WArN - RWIC

- RWIC Wearable is only wearable that can directly connect to the network
- RWIC SYNC Process implemented to enforce job safety briefing participation.
- RWIC initiate network connection for WWs and WLWs through SYNC process
- RWIC Wearable includes LCD Screen and additional UI buttons for navigating protection zone options. LCD Screen displays health and warning messages such as:
 - Overall Network Health
 - Signal Strength
 - Alert Messages
 - Worker Protection Status
- RWIC Wearable can turn on and extinguish network alarms (configurable)

WArN - WW

- WW has 2 functions
 - Receive alerts after SYNCed to RWIC
 - Acknowledge personal alerts to report clear
- WW can only connect to a protection zone once prompted by the RWIC.

WArN - WLW

- WLW serves 3 primary functions
 - Receive alerts after SYNCed to RWIC
 - Acknowledge personal alerts to report clear.
 - Generate system alerts from WLW wearable
- WLW can only connect to a protection zone once prompted by the RWIC.

- Miller Ingenuity tool for Monitoring, Troubleshooting, Maintaining, Data Collection and Reporting

- Monitoring

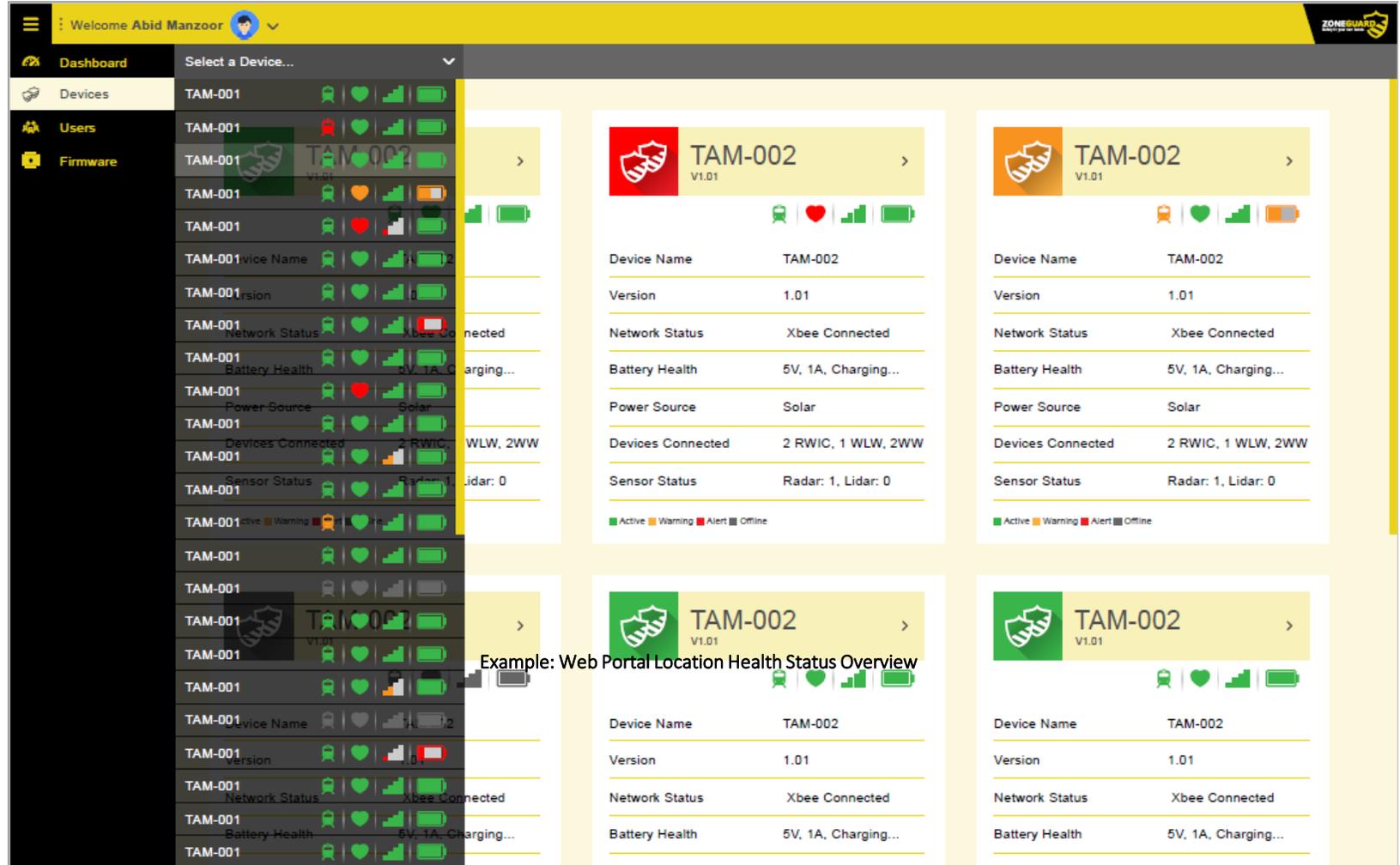
- Communication Network Health
- TDM/TAM Location Status
- Individual location health
- Individual component health

- Maintaining/Troubleshooting

- Remote Firmware Updates
- Remote Configuration
- Configuration/Firmware Repository

- Data Collection/Reporting

- Train and Worker Location Data
- Train Detection Data
- Communication Network Data
- Train Arrival/Departure Information
- Alarm Generation



Welcome Abid Manzoor

Dashboard

Select a Device...

Device ID	Status	Health	Location
TAM-001	Active	Good	Good
TAM-001	Warning	Good	Good
TAM-001	Alert	Good	Good
TAM-001	Offline	Good	Good
TAM-001	Active	Good	Good
TAM-001	Warning	Good	Good
TAM-001	Alert	Good	Good
TAM-001	Offline	Good	Good
TAM-001	Active	Good	Good
TAM-001	Warning	Good	Good
TAM-001	Alert	Good	Good
TAM-001	Offline	Good	Good
TAM-001	Active	Good	Good
TAM-001	Warning	Good	Good
TAM-001	Alert	Good	Good
TAM-001	Offline	Good	Good
TAM-001	Active	Good	Good
TAM-001	Warning	Good	Good
TAM-001	Alert	Good	Good
TAM-001	Offline	Good	Good
TAM-001	Active	Good	Good
TAM-001	Warning	Good	Good
TAM-001	Alert	Good	Good
TAM-001	Offline	Good	Good

TAM-002 V1.01

Device Name	TAM-002
Version	1.01
Network Status	Xbee Connected
Battery Health	5V, 1A, Charging...
Power Source	Solar
Devices Connected	2 RWIC, 1 WLW, 2WW
Sensor Status	Radar: 1, Lidar: 0

Active Warning Alert Offline

TAM-002 V1.01

Device Name	TAM-002
Version	1.01
Network Status	Xbee Connected
Battery Health	5V, 1A, Charging...
Power Source	Solar
Devices Connected	2 RWIC, 1 WLW, 2WW
Sensor Status	Radar: 1, Lidar: 0

Active Warning Alert Offline

TAM-002 V1.01

Device Name	TAM-002
Version	1.01
Network Status	Xbee Connected
Battery Health	5V, 1A, Charging...
Power Source	Solar
Devices Connected	2 RWIC, 1 WLW, 2WW
Sensor Status	Radar: 1, Lidar: 0

Active Warning Alert Offline

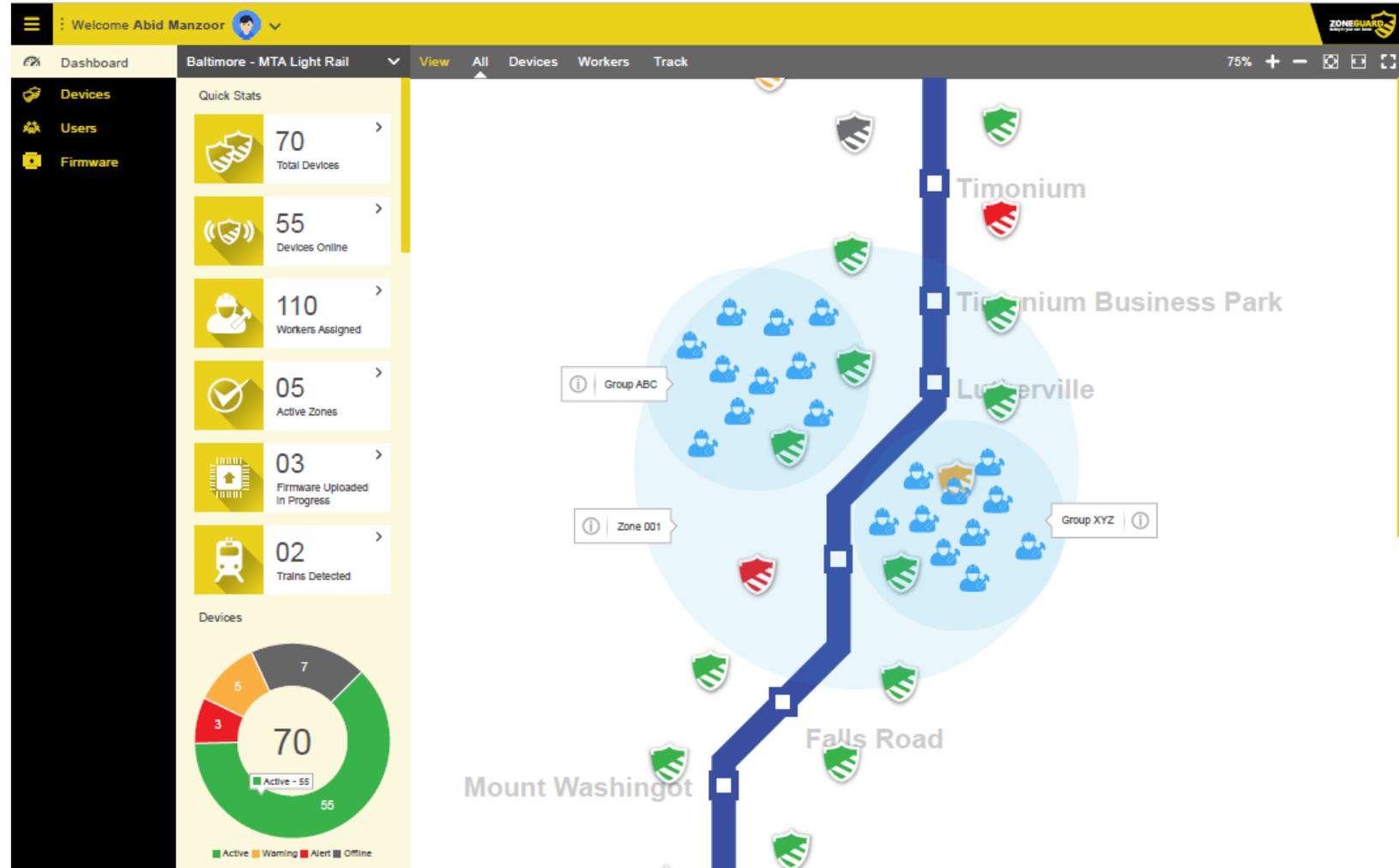
TAM-002 V1.01

Device Name	TAM-002
Version	1.01
Network Status	Xbee Connected
Battery Health	5V, 1A, Charging...
Power Source	Solar
Devices Connected	2 RWIC, 1 WLW, 2WW
Sensor Status	Radar: 1, Lidar: 0

Active Warning Alert Offline

Example: Web Portal Location Health Status Overview

- Can be configured as a customer facing tool
 - Train Location Data and Reporting
 - Lone Worker Location
 - Work Group Location and Data
 - Schedule Adherence
 - Work Block Adherence
 - System Fault Reporting
 - Safety Rule Adherence and Reporting
 - Near miss reporting



PTDM

PTAM



- ZoneGuard portable system 3 main components:
 - Portable Train Detection Modules (PTDMs)
 - Portable Train Alert Modules (PTAMs)
 - Wearable Worker Alert Nodes (WArN wearables)
- Optional Components
 - Battery Backup



Wearables

- Rugged and lightweight for easy and fast deployment around a temporary work zone.
 - 20 hour runtime w/out battery backup
 - 60 - 70 hour runtime w/ battery backup
- PTDMs are placed in gauge at the outer most limits of the work zone
 - Typically at approach/stop boards or at Sight Distance for watchmen
 - Detects on-track vehicles approaching work zone and Generates system alerts to all connected devices including PTAMs and worker wearables
 - Flash side LED lights to alert operators of work zone ahead
- PTAMs serve as repeaters and work zone alarms
 - Placed between PTDMs, where needed, to act as network repeaters over long distances and around track curves, buildings, or other line-of-sight obstruction.
 - Serving as radio network repeaters for all ZoneGuard devices being used in a work zone
 - Provide audible and visual alerts to roadway workers when system alerts have been activated
- Same Wearables as used for Fixed System with similar functionality
 - Unique system roles for RWIC, WLW, and WW
 - RWIC responsible for SYNC of portable system devices.

Overview

- Dimensions – 11.75” (h) x 9.5” (w) x 3.0” (d)
- Weight ~4 lbs
- Redundant and diverse sensors used for train detection work to eliminate missed detections and false alerts
- Private Data Radio Network (900 MHz)
 - Communication Between all devices
 - Over-the-Air Configuration and Firmware Updates
 - Over-the-Air Log Downloads.

Key Components

- IP65 Rated Rugged Enclosure
- LiDAR Module
- 3-axis Accelerometer
- PCB Controller
- Flash Memory
- Global Positioning System
- Internal 900 MHz Radio Module
- LCD Screen
- Device and System Status LEDs
- Internal Battery and Charging Circuitry
- Positive Lock ON/OFF Button
- System Alert Reset Button
- Operator Warning Side LED Bars



Overview

- Dimensions – 11.75” (h) x 9.5” (w) x 3.0” (d)
- Weight ~4 lbs
- TAMs are placed in between the outer TDM locations to act as radio network repeaters in order to propagate network alerts
- Provides audible (siren) and visual (LED board) alerts to nearby workers
- TAMs are typically placed near the work crew for alerting, or as needed to extend network range and operate around curves.
- Private Data Radio Network (900 MHz)
 - Communication Between all devices
 - Over-the-Air Configuration and Firmware Updates
 - Over-the-Air Log Downloads.

Key Components

- IP65 Rated Rugged Enclosure
- PCB Controller
- Flash Memory
- Global Positioning System
- Internal 900 MHz Radio Module
- LCD Screen
- Device and System Status LEDs
- Internal Battery and Charging Circuitry
- Positive Lock ON/OFF Button
- System Alert Reset Button
- Work Crew Warning Side LED Bars



RWICW

- RWIC Wearable is only wearable that can directly synchronize with a protection zone.
- RWIC can initiate network connection for WWs and WLWs
- RWIC Wearable includes LCD Screen and additional UI buttons for navigating protection zone options. LCD Screen displays health and warning messages such as:
 - Overall Network Health
 - Signal Strength
 - Alert Messages
 - Worker Protection Status
 - Network/Device Information
- RWIC Wearable can turn on and extinguish network alarms (configurable)

WW

- WW is connected to protection network through RWICW Sync Process
- WW can receive alerts and acknowledge alerts.
- WW is not able to generate network alerts (configurable).
- WW Wearable includes LCD Screen and additional UI buttons for navigating protection zone options. LCD Screen displays health and warning messages such as:
 - Overall Network Health
 - Signal Strength
 - Alert Messages
 - Worker Protection Status
 - Network/Device Information

WLW

- WLW is connected to protection network through RWICW Sync Process
- WLW can receive alerts and acknowledge alerts, as well as generate network alerts.
- WLW Wearable includes LCD Screen and additional UI buttons for navigating protection zone options. LCD Screen displays health and warning messages such as:
- Overall Network Health
 - Signal Strength
 - Alert Messages
 - Worker Protection Status
 - Network/Device Information

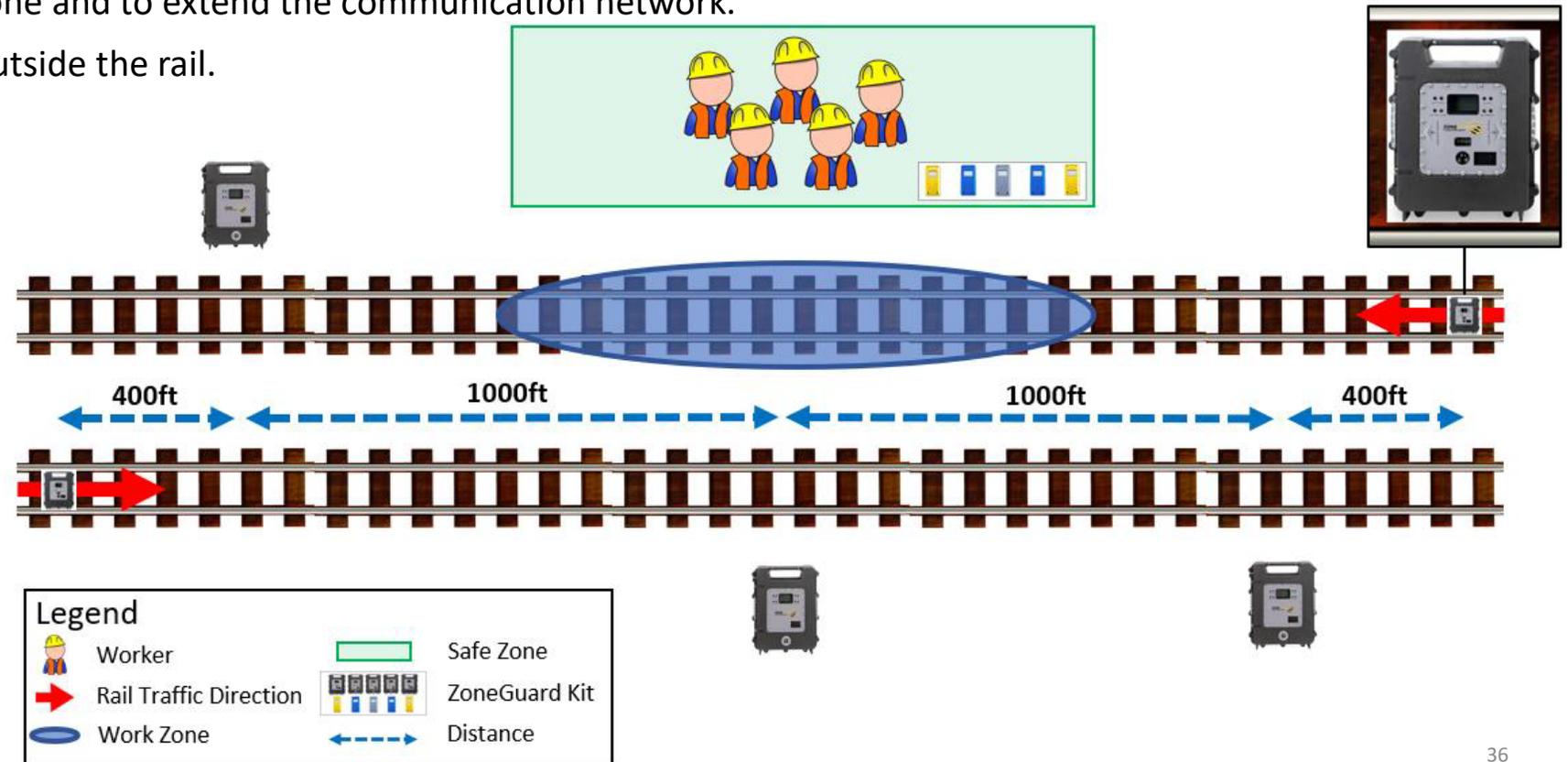
Kits:

- ZoneGuard Portable Setups are provided in kits
 - Kits can be as small or as large as needed to accommodate work-zone sizes
- Minimum kit must consist of 1 PTDM and 1 RWIC
 - Additional PTDMs added to protect additional tracks or both sides of a work zone
 - PTAMs added to allow for longer work zones and to provide alerts to work crew
 - Wearables added per customer to allow for personal alerts to each worker
- Work crews only use kits devices that are required for each unique work location
 - Number of devices required often vary dependent on type of OTP being used.
 - Flagging typically has larger work zone than working with Watchman
- Each kit includes a carrying case with optional charging circuits.
 - Users plug-in the case to charge all equipment
 - Battery backups can be included.



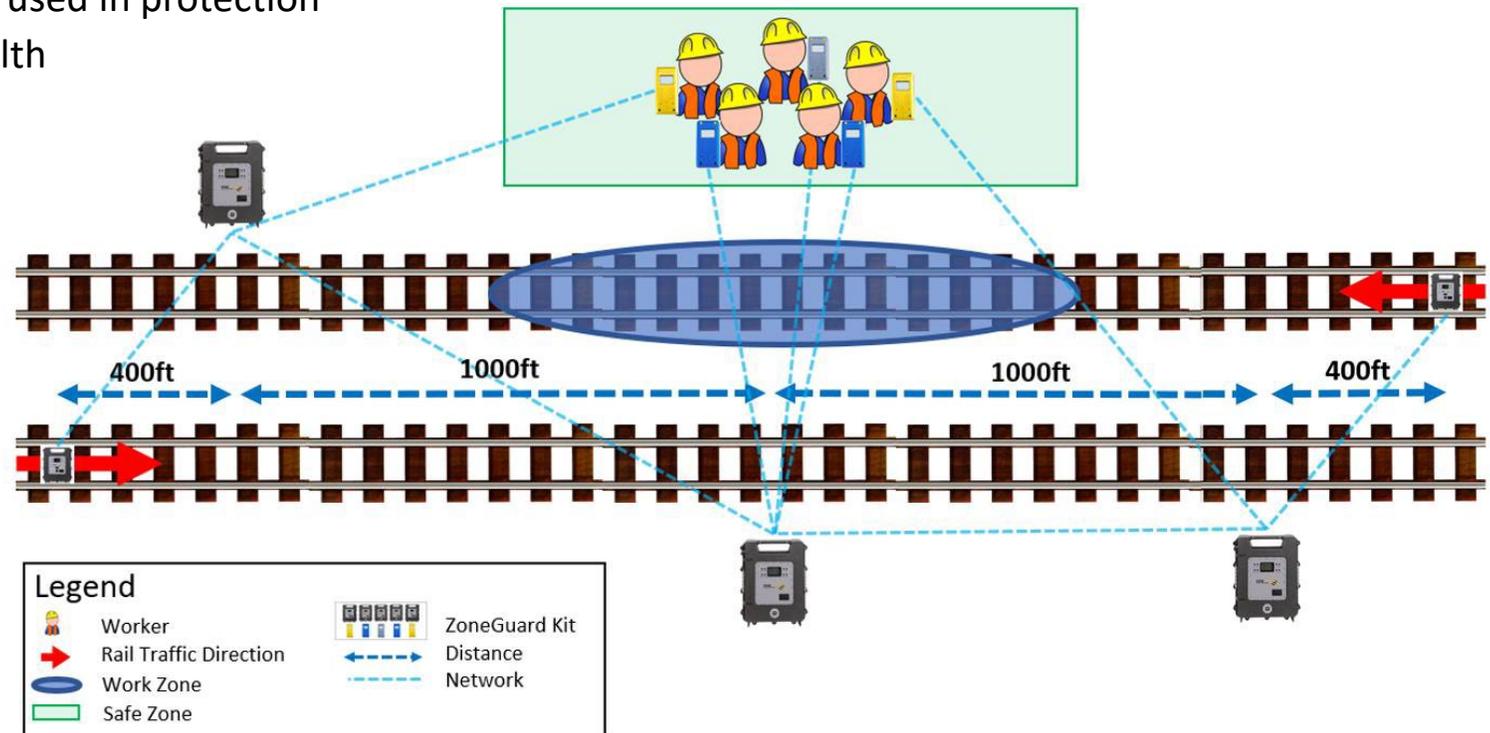
Setup:

- PTDMs are placed directly in the gauge in advance of the work zone and powered on
 - Either at Approach/Stop Boards or at required sight distance for watchmen
- PTAMs are placed as needed and powered on
 - Typically near the work zone and to extend the communication network.
 - Can be placed inside or outside the rail.



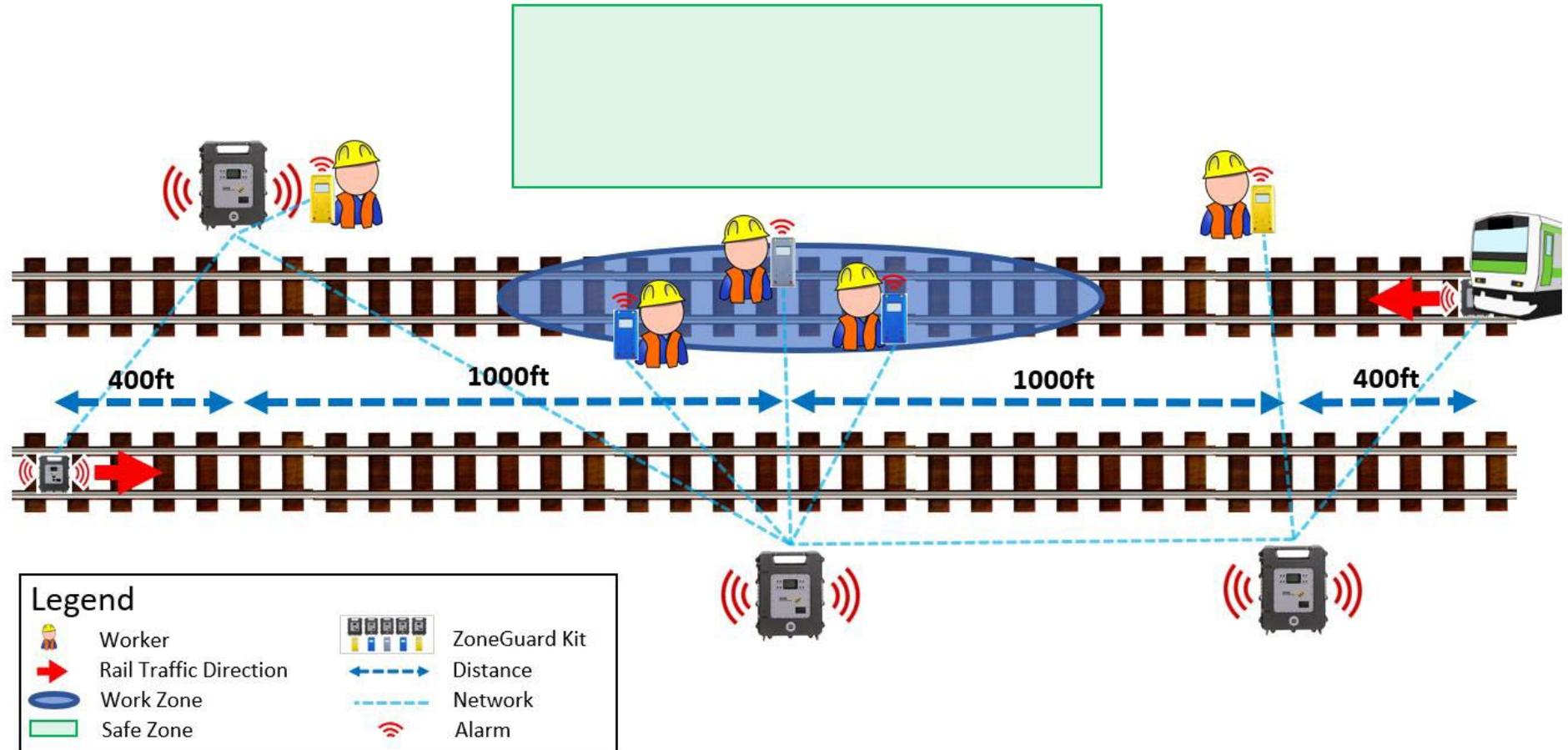
Setup Continued:

- RWIC and each additional wearable to be used are powered on
 - System does not require all equipment to be used, only what is needed based on protection
- RWIC starts SYNC process
 - Tells the system what device(s) are being used in protection
 - Monitors communication and device health



Setup Continued:

- PTDMs detect approaching on-track vehicles
 - Once detected, PTDMs broadcast network alerts to all connected devices



- **Both Systems are currently available and ready to be deployed**
 - Fixed System currently deployed at Maryland MTA Light Rail and in testing/commissioning
 - Portable System full scale deployment at San Diego MTS and San Francisco MTA (MUNI)
 - Deployed on BART (San Fran) for special projects and full scale deployment expected by November 2020
 - On test with Canadian National in Canada.
- **Next Steps & Lessons Learned**
 - Fixed System
 - Migrate the fixed installation system to the Portable TDM and TAM
 - Lower Cost
 - Greater Battery Life
 - Easier Maintenance and Flexibility for end user
 - Portable System
 - Integrate Radar into PTDM for some applications
 - Integrate Portable System into Web Portal
 - Provide reports and work zone information
 - Streamline remote support tools (RWIC Log Dump, Real-Time monitoring, etc)
 - Develop New Applications
 - Blue Flag Protection
 - Shove Track Protection



MillerIngenuity.com/ZoneGuard

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Questions?

Bombardier

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TrackSafe

Innovation in Roadway Worker Protection (RWP)

Presentation to the TRACS committee

February 25, 2020

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Pawel Waszczur

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Wayside Fixed Asset Deployment

Tag In Unit



Provides safety and audible alerts for wayside personnel

- Single cable installation using **PoE**
- Color touch screen
- Long-range UHF **RFID** (902 - 928 MHz) reader
- Radar** module (24 GHz)
- Wireless capability
- NEMA 4X/IP66 & ext. temperature rated

Operator Warning Light



Visually warn rail and equipment operators about personnel on the wayside

- Configurable LED lights
- Adjustable audible alerts
- Radar module used to detect train direction & speed
- NEMA 4X/IP66 & ext. temperature rated

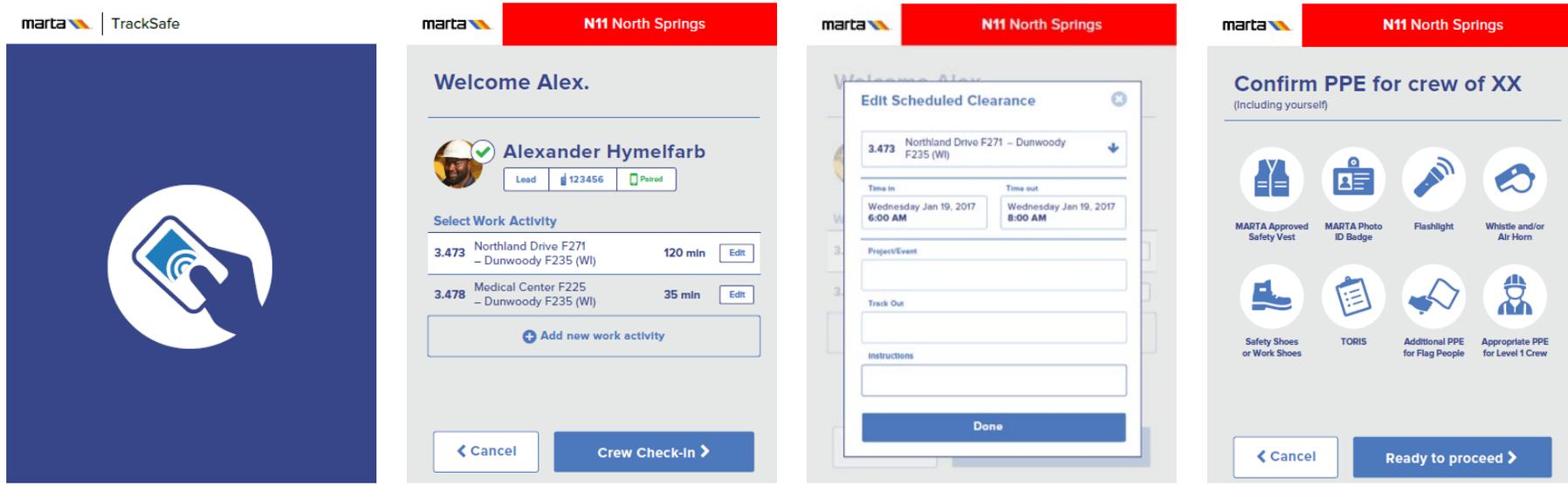
Wayside Access Unit



Provides authorized access to the wayside by verifying worker identification, establishing communications with rail control

- 12" high brightness touch screen industrial HMI PC
- Integrated RFID (13.56 MHz) reader
- NEMA 4X/IP66 & extended temperature rated
- Security enhanced, vandal resistant enclosure

Wayside Access Unit – Check in Process



TAG IN USING RFID CARD

CREW & WORK ACTIVITY

RESTRICTION DETAILS

PERSONAL PROTECTIVE EQUIPMENT

Converting wayside access requests from paper to digital

TrackSafe at MARTA

FTA Call to Action

- Public and private organizations partner to benefit from each others unique expertise to develop a safety solution

Collaboration between 3 parties

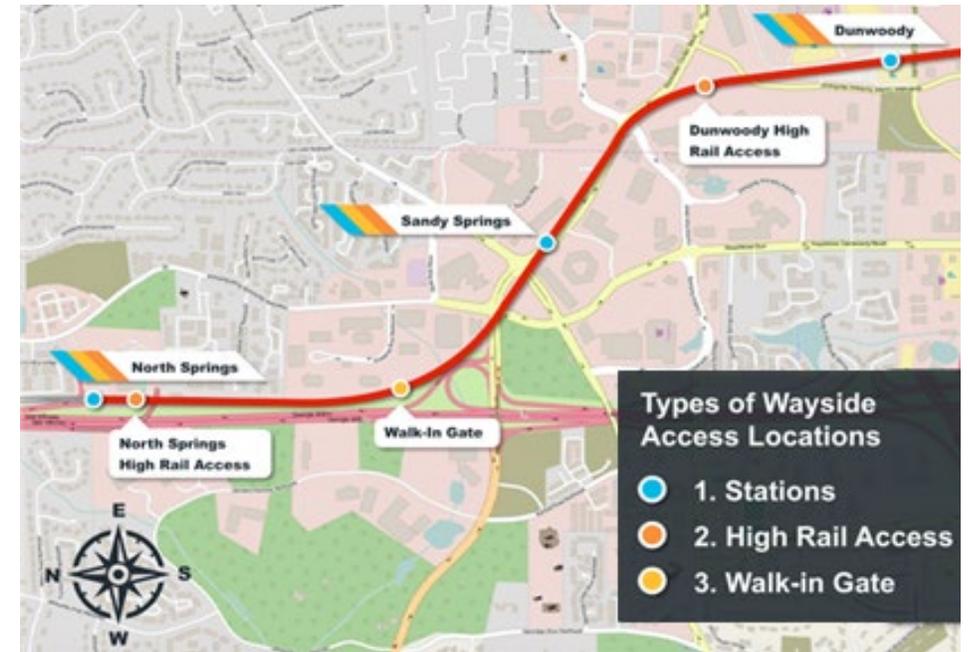
- FTA: serve as the project sponsor
- MARTA: grantee to provide a test environment & operational expertise
- Bombardier: provide engineering & development of a solution

MARTA selects Red Line between North Springs and Dunwoody to test high hazard conditions, such as:

- Curved and tangent track, at grade, in tunnels, on elevated structures and in areas of high background noise

Current status

- Currently in an operational period being used by MARTA track and rail control personnel
- Types of data being gathered
 - Tracking of train movement (detections)
 - Tracking of personnel movement (RFID tagging)
 - Activation of system, alerts and WAU check-in process
 - Overall health of system (system availability, component health)



Lessons learned

Design and deployment

- **Fixed asset deployment**

- Requires extensive investment into infrastructure
- Time and cost factors into installing, testing and commissioning of supporting infrastructure and backbone network

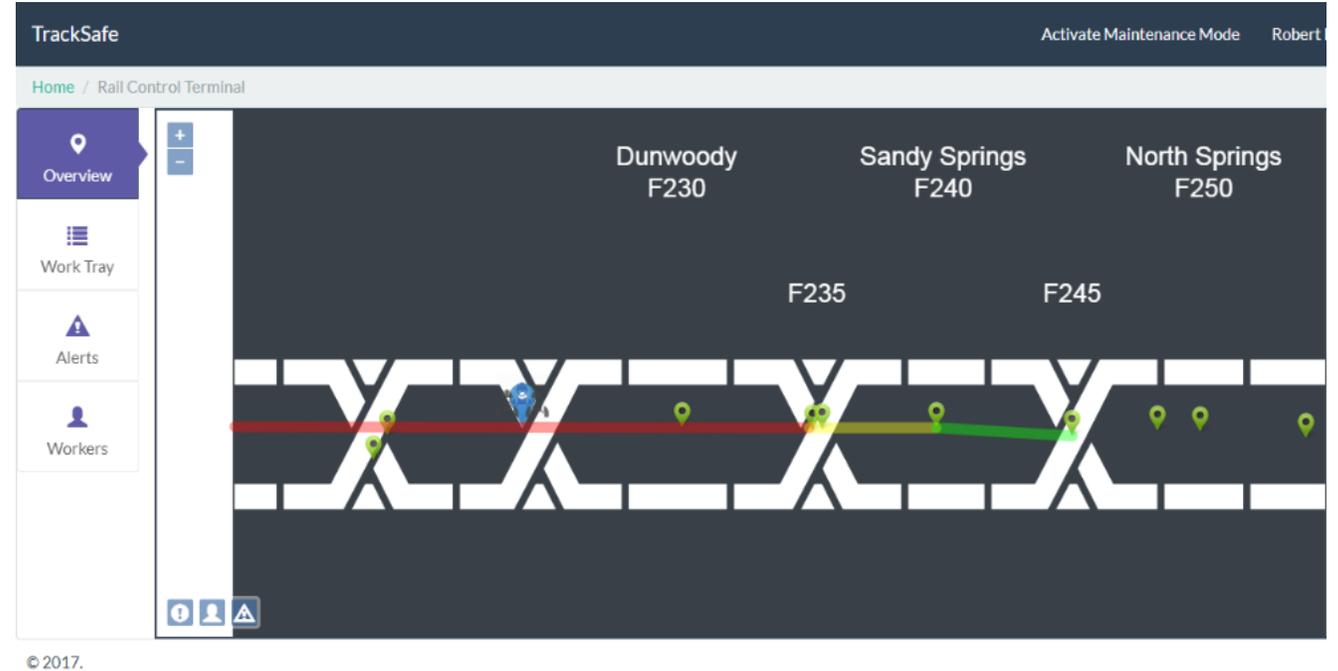
- **Environment and product hardening should not be overlooked**

- Impact of weather (rain/snow), moisture/humidity and vibration on enclosure design and mechanical components
- Protection against dust and water ingress (NEMA 4X/IP66)
- Industrial grade temperature ratings for electronics (-20 to 85°C)
- Impact of EMF and third rail power on RF-based components

- **Build in redundancy**

- Multiple sensors for train detection

- **Shift focus to a more wireless based solution**



RAIL CONTROL SCREEN IDENTIFYING WORKERS ON TRACK WITH AREA OF SAFETY

The Future

Mobile solution

(((o))) Wireless Track Monitoring Sensors

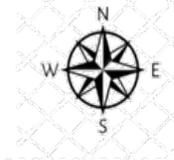
1W

2W

3W

4W

Work Zone



(((o))) Wireless Track Monitoring Sensors

1E

2E

3E

4E

- Portable, mobile solution without the need to place equipment or integrate with any sub-systems onboard a train
- Low-profile track sensors designed to work in harsh track environment in extreme temperatures and in all types of weather
- Designed with security in mind - features to prevent ability to attach to wayside infrastructure to prevent theft
- Geofenced zones to warn workers of boundaries
- Supports CFR, title 49, part 214 – Railroad Workplace Safety



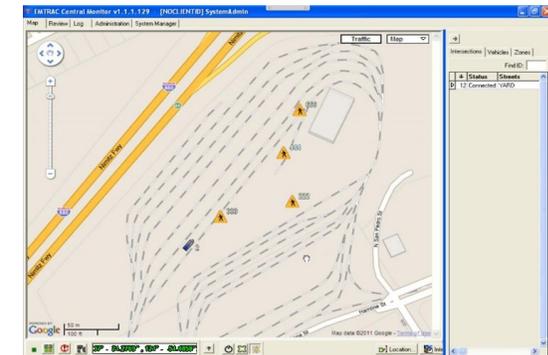
CENTRAL CONTROL UNIT

- 20W 12V solar panel
- 55aH AGM battery
- Integrated solar controller
- Long range gateway radio
- Battery status indicator
- Onboard sirens and LED strobe warning system
- Wireless networking for mobile application



TRACK SENSORS

- 7W 6V Solar Panel
- 10aH NiMH battery pack
- Arduino based CPU with integrated magnetometer and long range client radio
- Battery status indicator





Questions & answers

Questions?

EMTRAC

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FTA

FEDERAL TRANSIT ADMINISTRATION

TRACS Presentation Rail-Worker Safety



EMTRAC

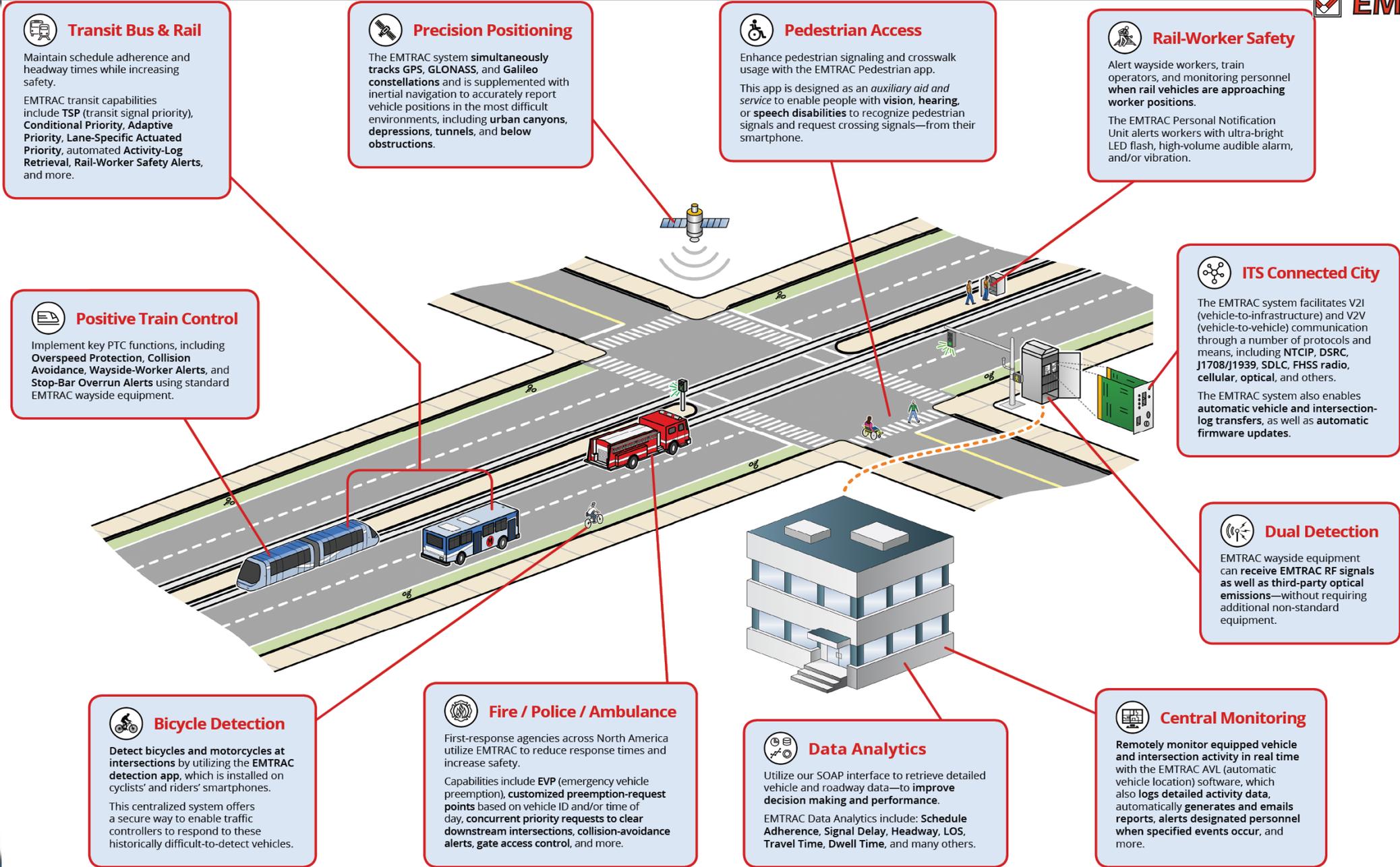
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U.S. Department of Transportation
Federal Transit Administration

EMTRAC ITS Connected City Overview



Transit Bus & Rail

Maintain schedule adherence and headway times while increasing safety.

EMTRAC transit capabilities include **TSP** (transit signal priority), **Conditional Priority**, **Adaptive Priority**, **Lane-Specific Actuated Priority**, **automated Activity-Log Retrieval**, **Rail-Worker Safety Alerts**, and more.

Precision Positioning

The EMTRAC system **simultaneously tracks GPS, GLONASS, and Galileo constellations** and is supplemented with inertial navigation to accurately report vehicle positions in the most difficult environments, including **urban canyons, depressions, tunnels, and below obstructions**.

Pedestrian Access

Enhance pedestrian signaling and crosswalk usage with the EMTRAC Pedestrian app.

This app is designed as an *auxiliary aid and service* to enable people with **vision, hearing, or speech disabilities** to recognize pedestrian signals and request crossing signals—from their smartphone.

Rail-Worker Safety

Alert wayside workers, train operators, and monitoring personnel **when rail vehicles are approaching worker positions**.

The EMTRAC Personal Notification Unit alerts workers with ultra-bright LED flash, high-volume audible alarm, and/or vibration.

Positive Train Control

Implement key PTC functions, including **Overspeed Protection, Collision Avoidance, Wayside-Worker Alerts, and Stop-Bar Overrun Alerts** using standard EMTRAC wayside equipment.

ITS Connected City

The EMTRAC system facilitates V2I (vehicle-to-infrastructure) and V2V (vehicle-to-vehicle) communication through a number of protocols and means, including **NTCIP, DSRC, J1708/1939, SDLC, FHSS radio, cellular, optical**, and others.

The EMTRAC system also enables **automatic vehicle and intersection-log transfers**, as well as **automatic firmware updates**.

Dual Detection

EMTRAC wayside equipment can **receive EMTRAC RF signals as well as third-party optical emissions**—without requiring additional non-standard equipment.

Bicycle Detection

Detect bicycles and motorcycles at intersections by utilizing the **EMTRAC detection app**, which is installed on cyclists' and riders' smartphones.

This centralized system offers a secure way to enable traffic controllers to respond to these historically difficult-to-detect vehicles.

Fire / Police / Ambulance

First-response agencies across North America utilize EMTRAC to reduce response times and increase safety.

Capabilities include **EVP** (emergency vehicle preemption), **customized preemption-request points** based on vehicle ID and/or time of day, **concurrent priority requests to clear downstream intersections, collision-avoidance alerts, gate access control**, and more.

Data Analytics

Utilize our SOAP interface to retrieve detailed vehicle and roadway data—to **improve decision making and performance**.

EMTRAC Data Analytics include: **Schedule Adherence, Signal Delay, Headway, LOS, Travel Time, Dwell Time**, and many others.

Central Monitoring

Remotely monitor equipped vehicle and intersection activity in real time with the EMTRAC AVL (automatic vehicle location) software, which also **logs detailed activity data**, automatically **generates and emails reports, alerts designated personnel** when specified events occur, and more.

EMTRAC System Components

System Components

The core EMTRAC hardware and software may be used across multiple applications—and by multiple agencies—without requiring significant modifications or system upgrades.

Vehicle Computer Unit (VCU)



Onboard unit handles data processing, precision positioning, and wireless communication.

Priority Detector



Wayside unit interfaces with signal controller and agency network, provides up to 16 NEMA-level outputs, and fits all traffic-cabinet styles.

Control Head (optional)



Displays system activity & status, as well as safety notifications, such as *collision avoidance* or *rail-worker* alerts.

Vehicle Interrogator (optional)



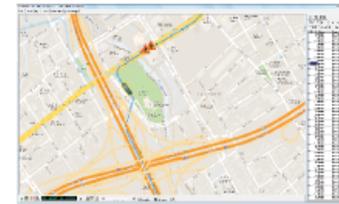
During vehicle downtime, these garage-mounted units wirelessly transfer activity logs and upload system updates to VCUs.

Personal Notification Unit (PNU)



Carried by wayside workers, the PNU alerts of approaching trains via high-volume beep, ultra-bright LED flash, and/or vibration.

System Software

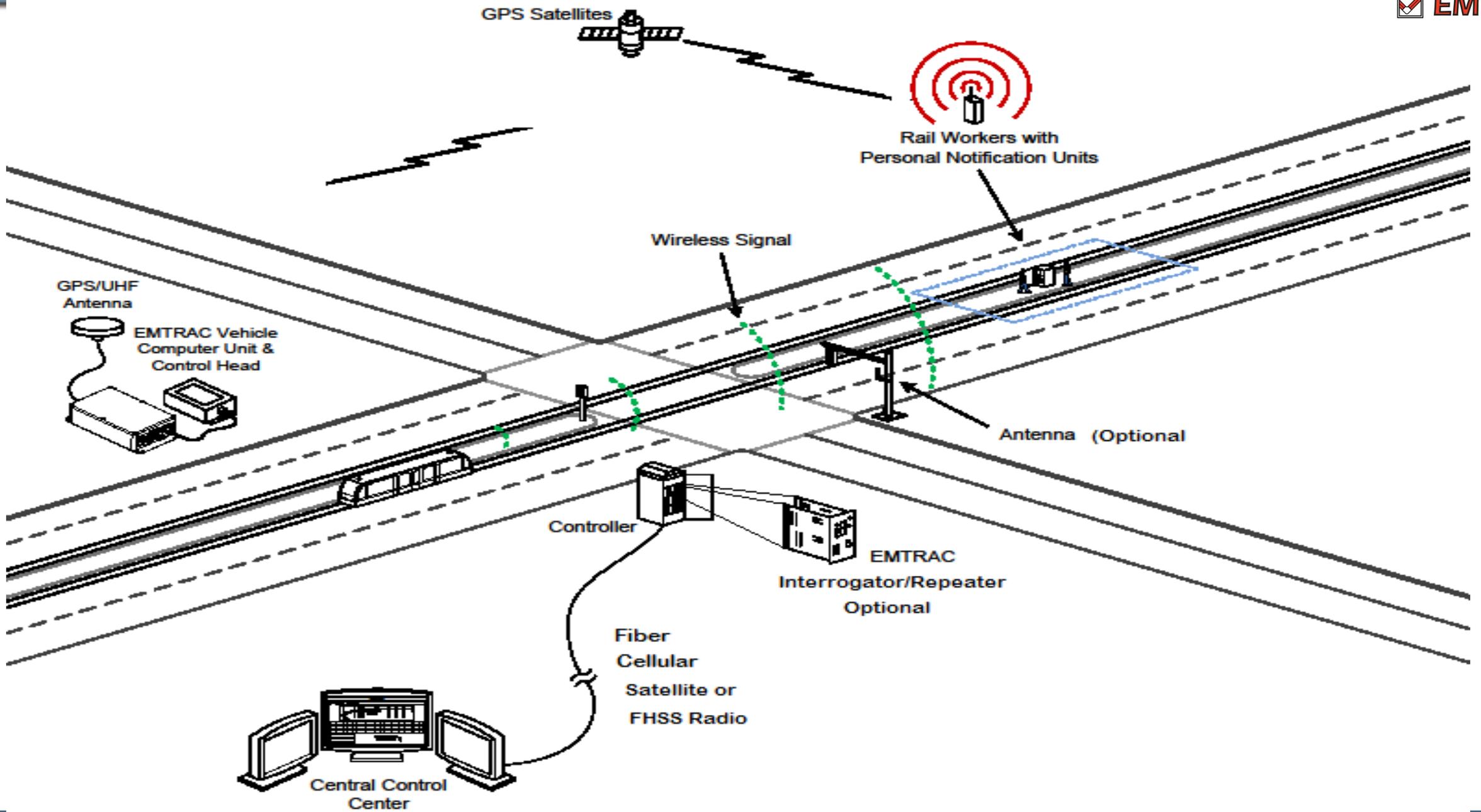


The *Systems Manager* software enables complete system customization. The optional *Central Monitor* provides detailed AVL info.

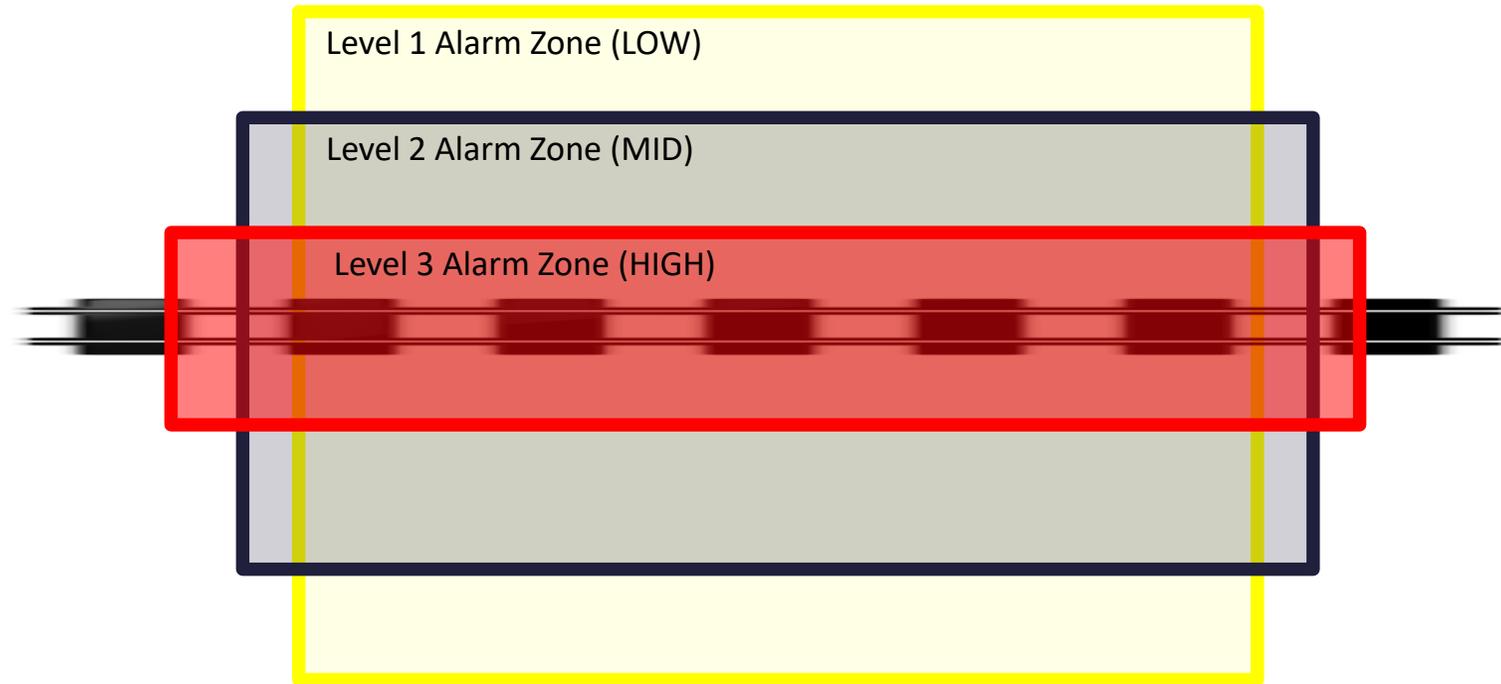
Detection & Signaling Apps



Carried by bicyclists, motorists, and pedestrians, these apps provide reliable vehicle detection and accessible pedestrian-signal access.



Personal Notification Unit Virtual Alarm Zones

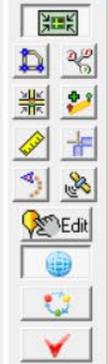


BART Oakland Connector Project



File Vehicles Intersections and Zones Personal Notification Units Tools Help

Test Connect...



Routes

Geofences

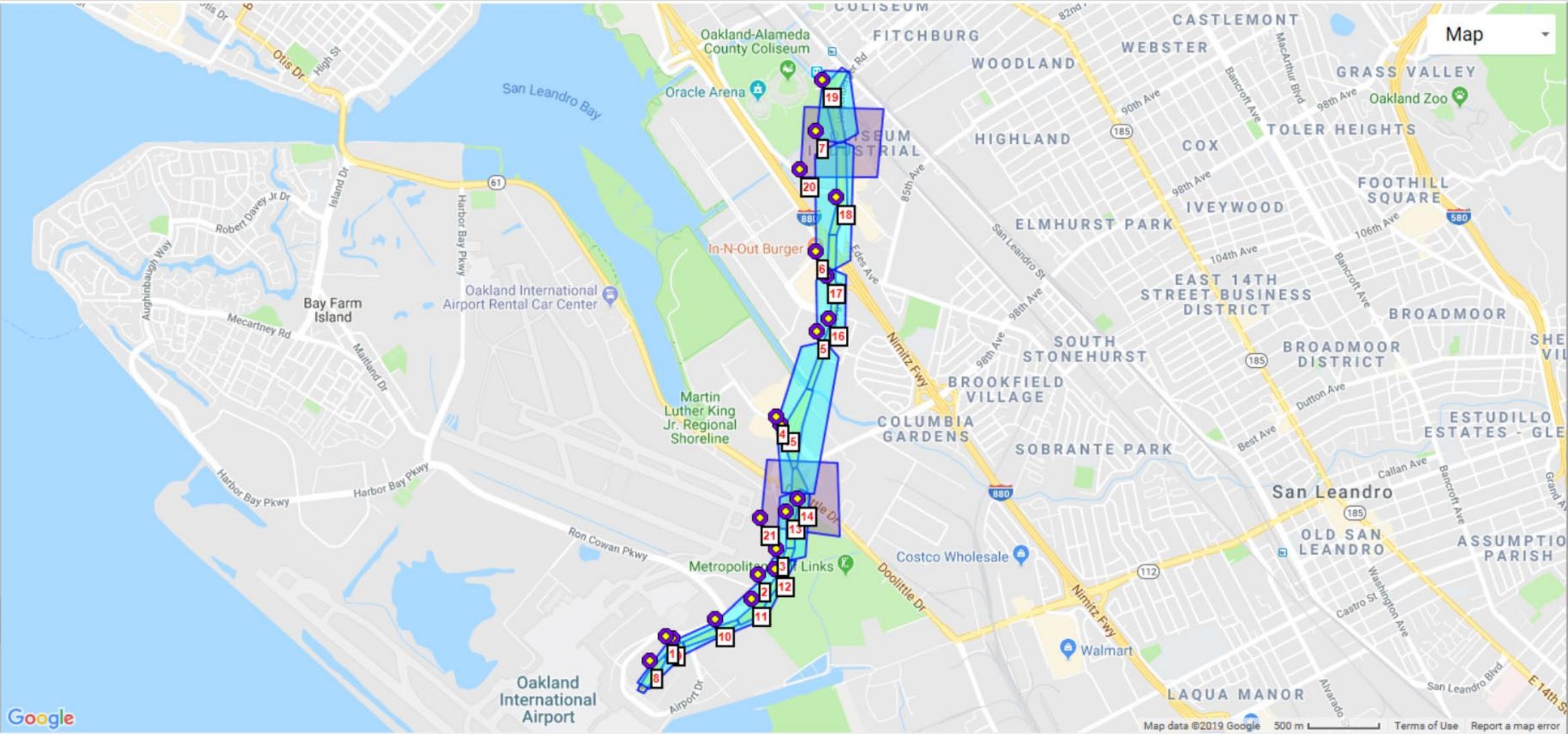
- Track
- Stand.
- Guard
- Restrict
- Caution
- V.Track
- Group

Locate

Default

Basic

Street

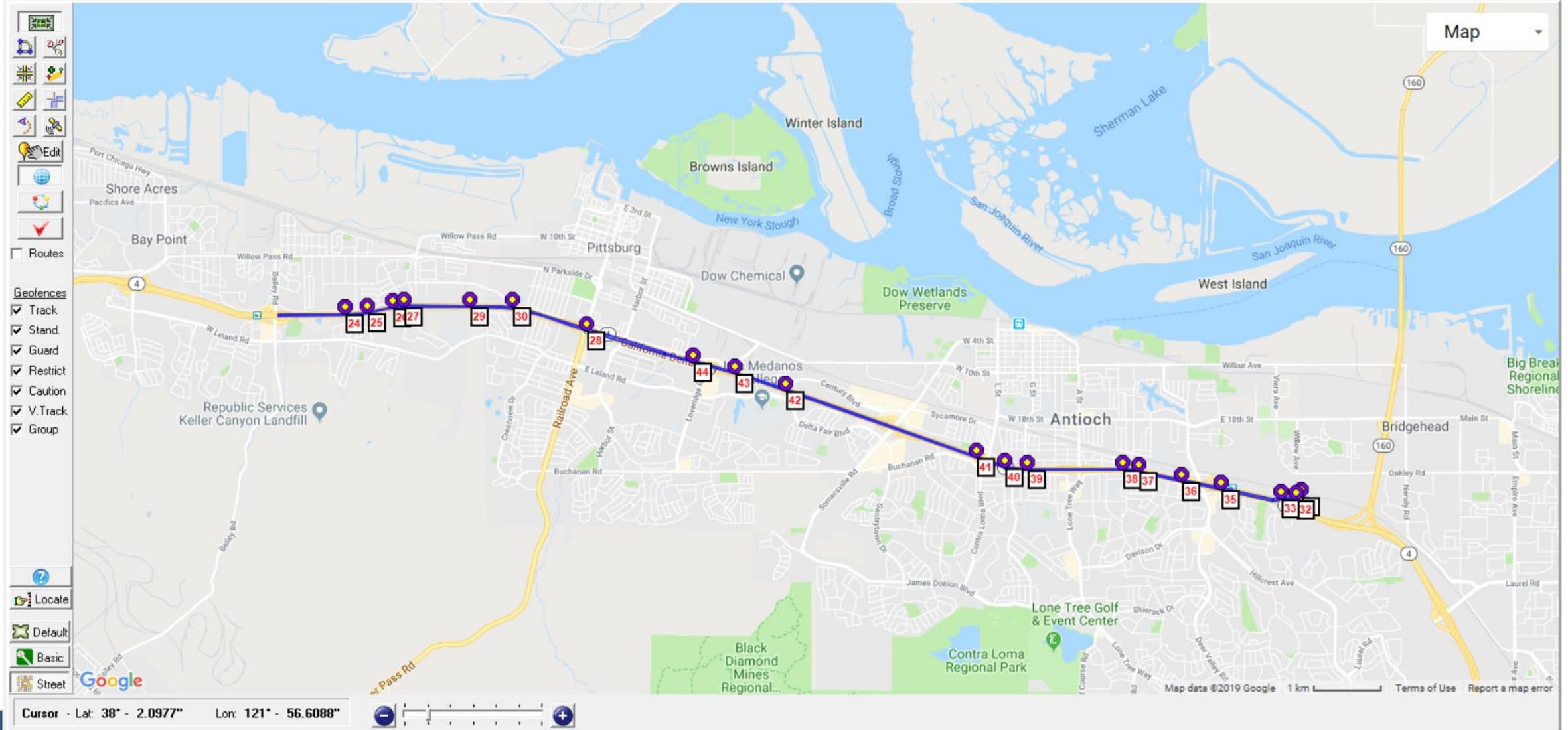


Cursor - Lat: 37° - 43.2190" Lon: 122° - 11.1453"

Current Database: C:\Users\bliev\Desktop\Cop... Emtrac System: Disconnected...

GPS Signal: N/A...

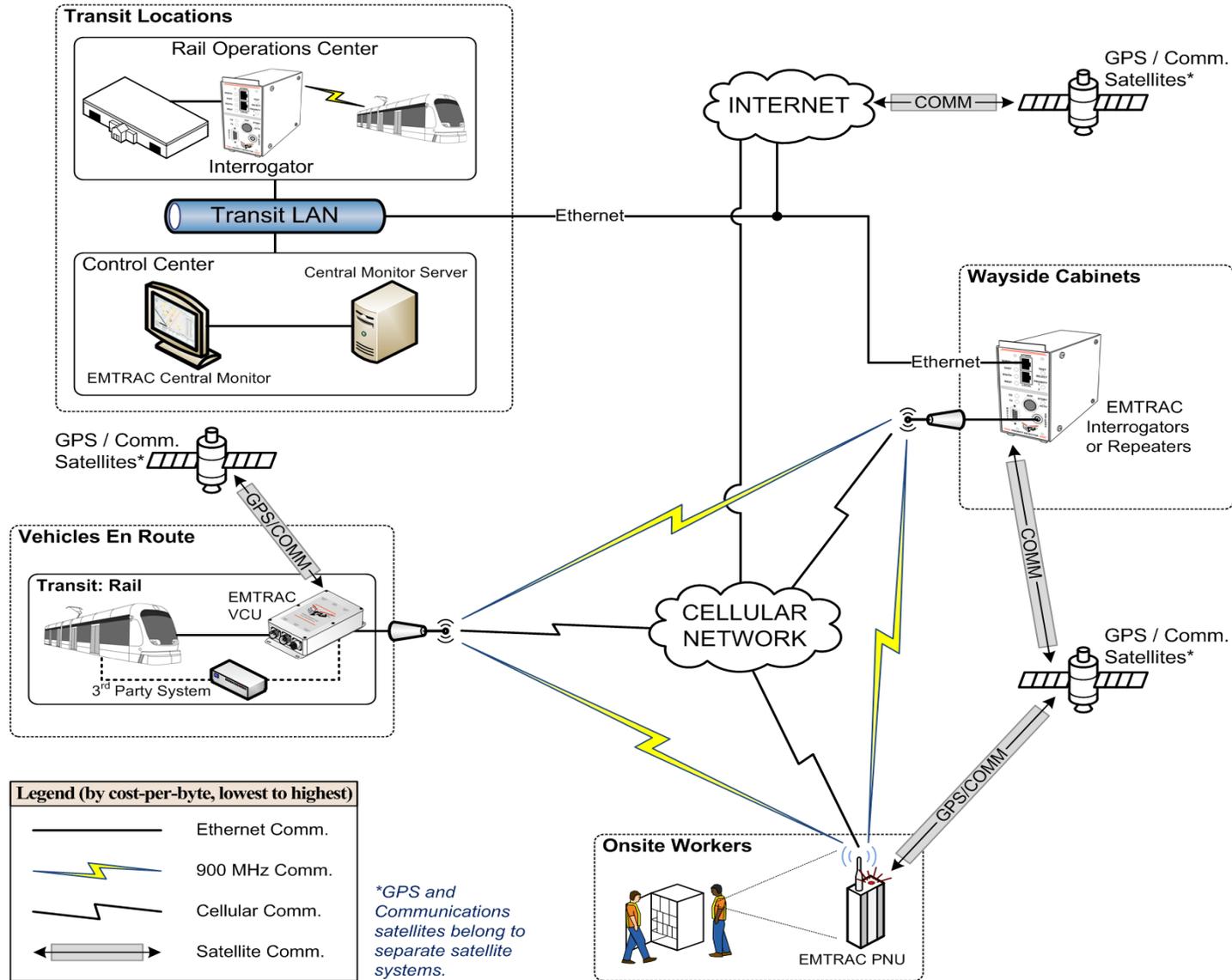
BART eBART Project



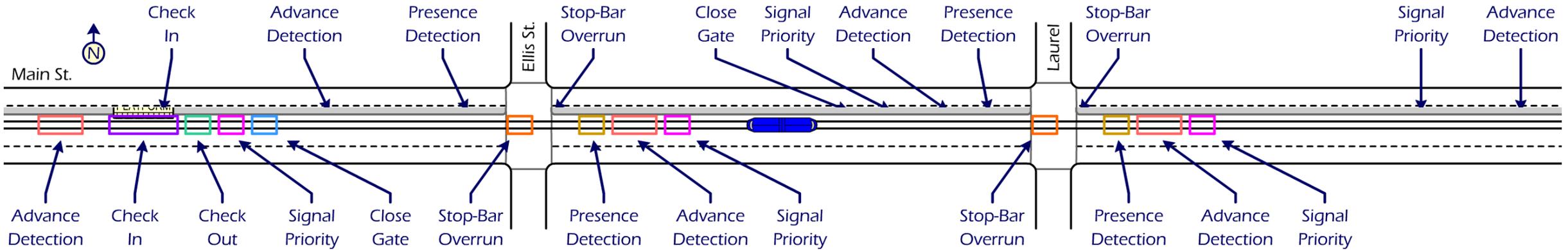
Cursor - Lat: 38° - 2.0977" Lon: 121° - 56.6088"

EMTRAC Rail-System Communications Options

Communication



EMTRAC Rail Features



Wayside Rail-worker Safety

- TWC Detection Overlay and Placement
- Signal Priority
- ETA (Signal Priority and Voice Announcements)
- Automatic Vehicle Location (AVL)
- Speed Zone Monitoring
- Anti-collision

- Track Switch Monitoring and Control
- Scheduling System/ Passenger Counting
- Check In / Check Out
- Advance Detection
- Presence Detection
- Reverse Running
- Embedded Pavement Lighting
- Red Signal Overrun
- Stop Bar Overrun (SBO)
- VCU Maintenance Scheduling and Logging
- Pedestrian Detection

Contact Us

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k.morgan@emtracsystems.com

Questions?

Trapeze Group

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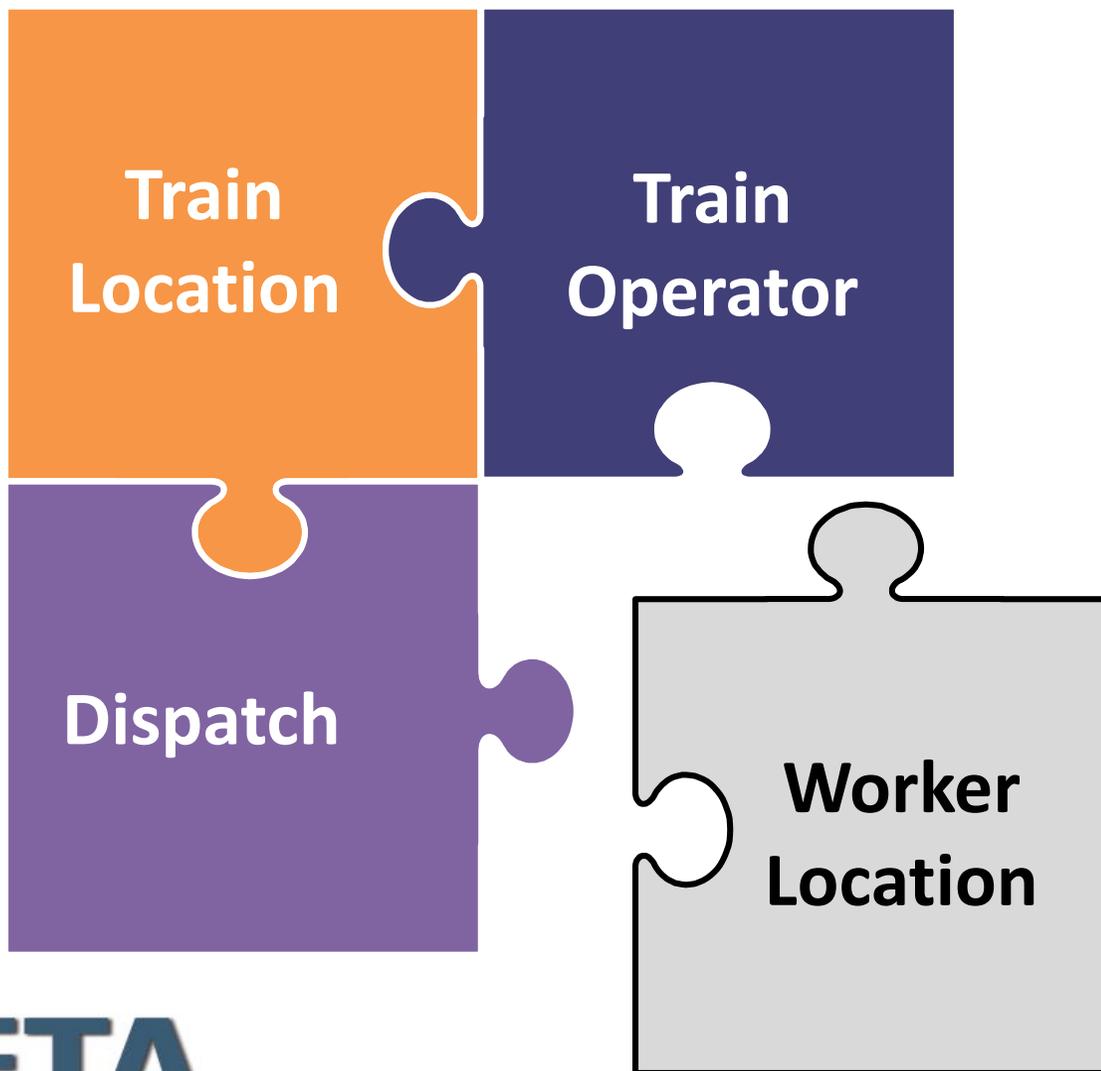
Trapeze Roadway Worker Protection System

Railroad Worker Fatalities at Unacceptable Levels

- Fatality rates **are double** compared to the private sector
 - 15 Workers died in 2013 [*source: (US) NTSB special report*]
 - 4 Workers died in 2018 [*source: (Canada) TSB report*]
- Even more alarming... fatality rate is **double the 10-year average**

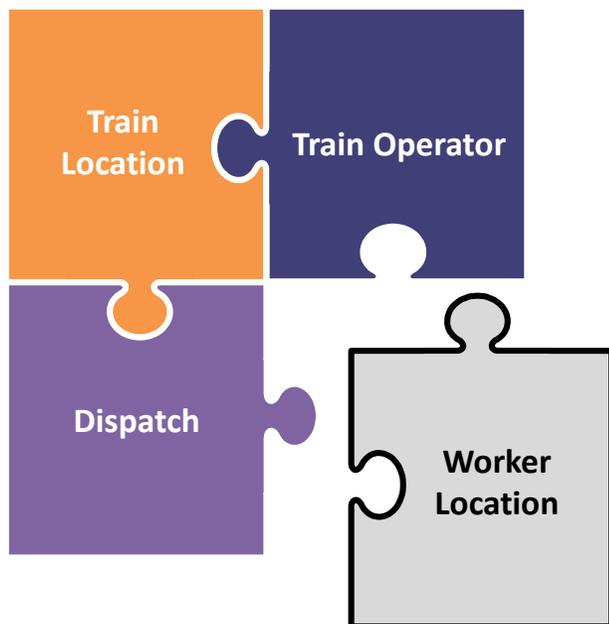
Secondary automated safety technology is necessary to improve safety outcomes!

Safety Puzzle



- What if everyone could know exactly where the workers are?

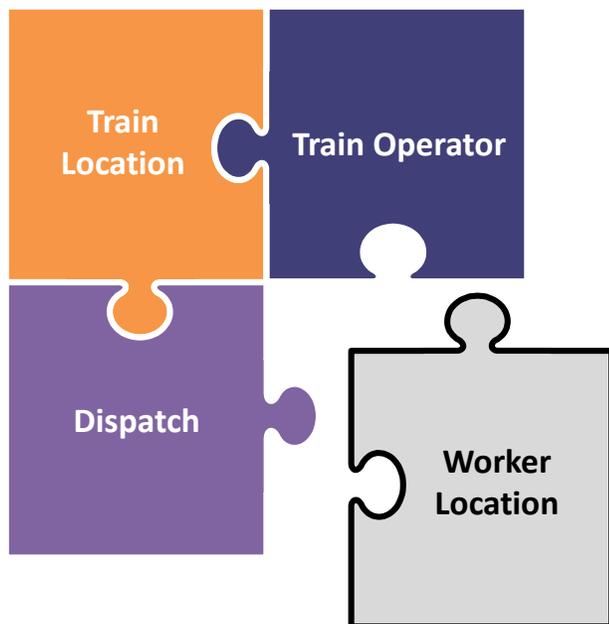
Existing Safety Policy Vulnerable to Human Error



- Confusion/mis-communication
- Improper/incomplete work plans
- Worker deviations from work plan
- Not heeding horn warnings
- Line of sight obscured/unclear
- Safety devices not properly installed/activated
- Watchmen distracted

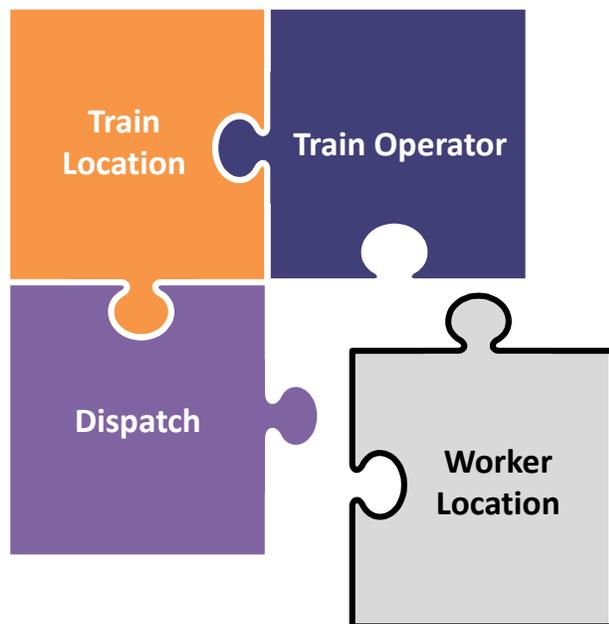
A comprehensive and proactive solution is needed!

Legacy Roadway Worker Protection Systems Inadequate



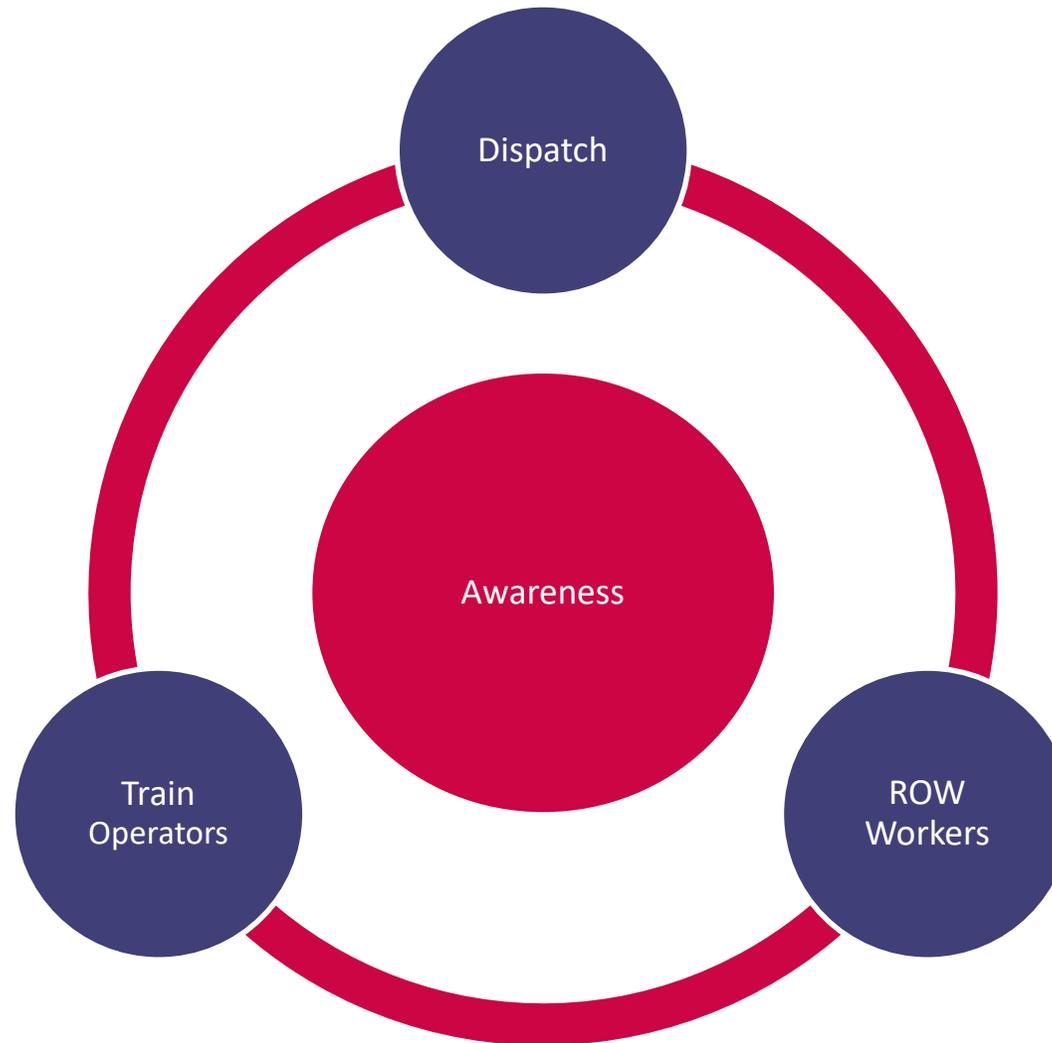
- Workers have been struck while setting up portable safety systems
- Can't monitor Workers in GPS-denied locations (e.g. tunnels)
- Unable to track in 3 dimensions indicating track elevation (e.g. bridges, platforms)
- Only alert Workers and sometimes Train Operators but not Dispatch

Trapeze Roadway Worker Protection System



1. Resilient to human error
2. No Worker safety zone registration required
3. Military-tested technology tracks Workers everywhere
4. Alerts everyone
 - Train Dispatch of Workers fouling the tracks
 - Train Operator of Workers on the Right Of Way
 - Workers on the tracks of approaching trains

Trapeze RWP Patent-Pending Technology



Trapeze RWP Worker Vests



- Alarm sounds, lights flash and vibration on vest when train approaching
- Co-workers see the flashing lights on fellow Workers vests
- Visual alert from flashing Worker vests visible to Train Operator

Trapeze RWP System Benefits

- **Train Control Dispatch:**
 - Awareness of train and Worker locations
 - Automatically alerted of Workers on track
 - Real-time integration with Dispatch systems such as Trapeze TransitMaster and others

- **Train Operator:**
 - Train Operator alerted of Workers on track ahead
 - Visual alert from flashing Worker vests
 - Real-time integration with in-vehicle systems



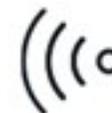
Solution Architecture



**Train Control
Dispatch**



ROW Worker



Train Operator





Thank You

Jamie Rossignoli
Product Manager, Safety Solutions

jamie.rossignoli@trapezgroup.com
(647) 286-6615

Protran Technology

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Protran Technology Safety Solutions

Safety risks with traditional RWP:

- Relying on a lookout or watchman provides a single point of failure
- Worker complacency, boredom, inattention, and fatigue
- No advanced warning to train operators of workers ahead
- No advanced warning to track workers of an approaching train
- Increased equipment/convoy movements on tracks
- Workers being given more responsibilities with less time to complete tasks



Protran Technology Safety Solutions

Protran Technology offers several types of safety solutions for the railroad industry that are designed to help mitigate accidents and save lives.



Protran has over 10 years experience installing, supporting, and improving Roadway Worker Protection (RWP) Systems for many US Transits, including:

- VTA
- SacRT
- RTD Denver
- WMATA
- SEPTA
- MTA MD
- GCRTA
- LAC Metro
- Metro North

Protran Technology Safety Solutions

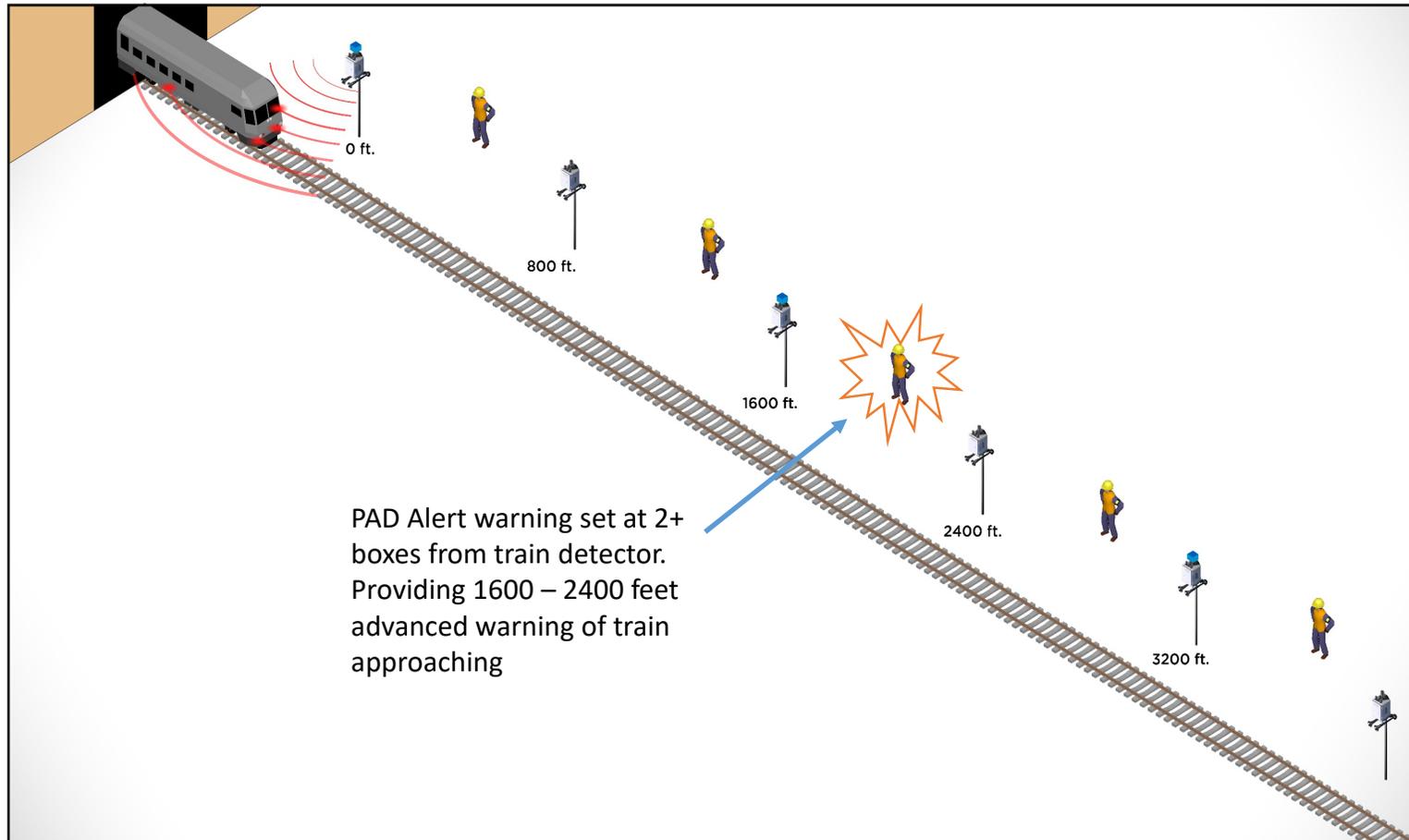
Protran ProAccess RWP & Location Awareness System:

- Permanently mounted wayside based system provides track specific advanced warning to workers and rail vehicle operators
- System provides Worker Location Awareness information on the ROW in Real-time to the Rail Operation Control Center (ROCC)
- Track Specific RWP - Worker PAD will receive an audible & visual advanced warning alert of an approaching train or MOW vehicle on the same track
- Closest wayside units to workers will flash continuously and will “follow” the worker up or down the track providing a visual notification to approaching trains of the workers location
- Data Log of events for all workers moving along the track as they perform work and inspections; can be utilized for operational efficiency metrics in effort to lessen total time workers spend on track
- Configurable system for more advanced warning in areas of poor visibility or high rate near-miss areas
- Self Diagnosing Software alerts ROCC if a wayside unit is not functioning properly; If a unit is down, system is still operational



ProAccess System Overview

PAD Alerts = Train approaching



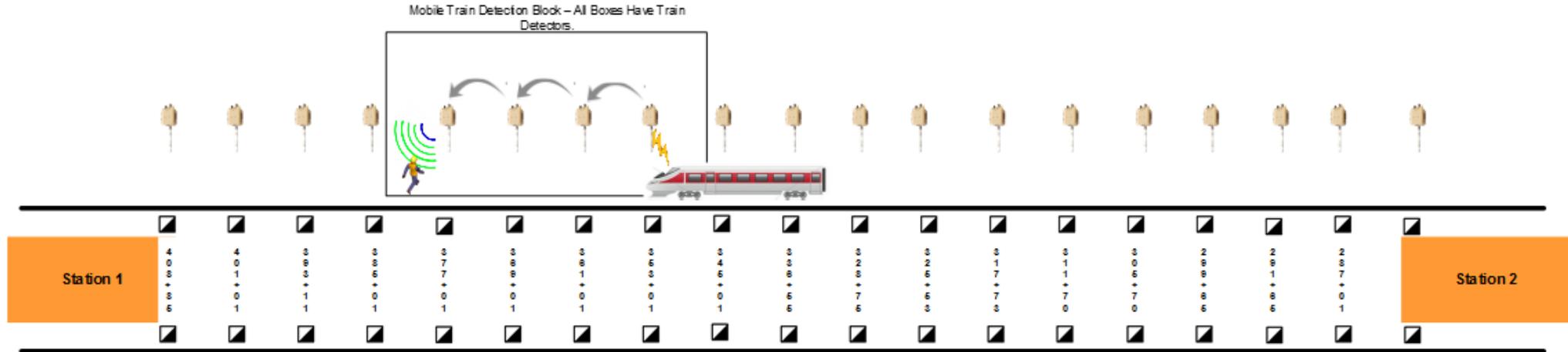
PAD

- Alerts track worker(s) when a train sensor on a wayside box is triggered by an approaching train or MOW vehicle
- Provides 1600+ feet and at least 15 seconds advanced warning to the workers on the track

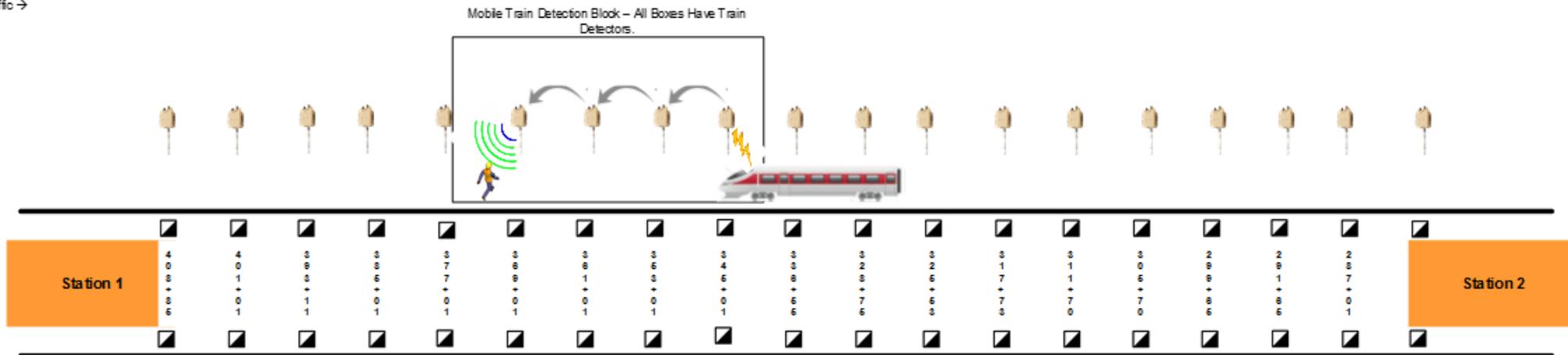
ProAccess System Overview

PAD Alerts = Train approaching

How Train Detection System "Block" Works



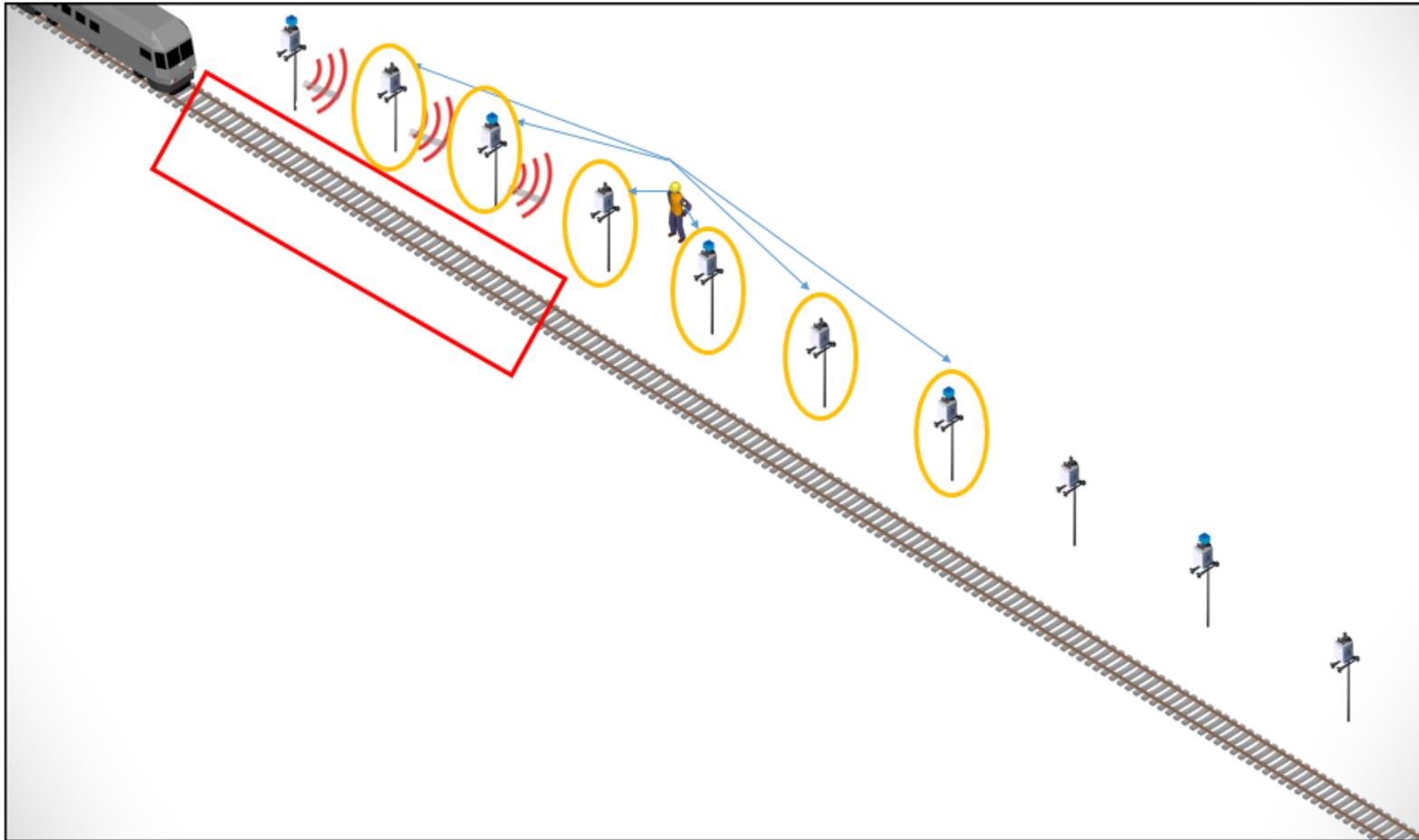
Direction of Traffic →



Direction of Traffic →

ProAccess System Overview

Wayside LEDs = Track Worker on ROW



Wayside LEDs

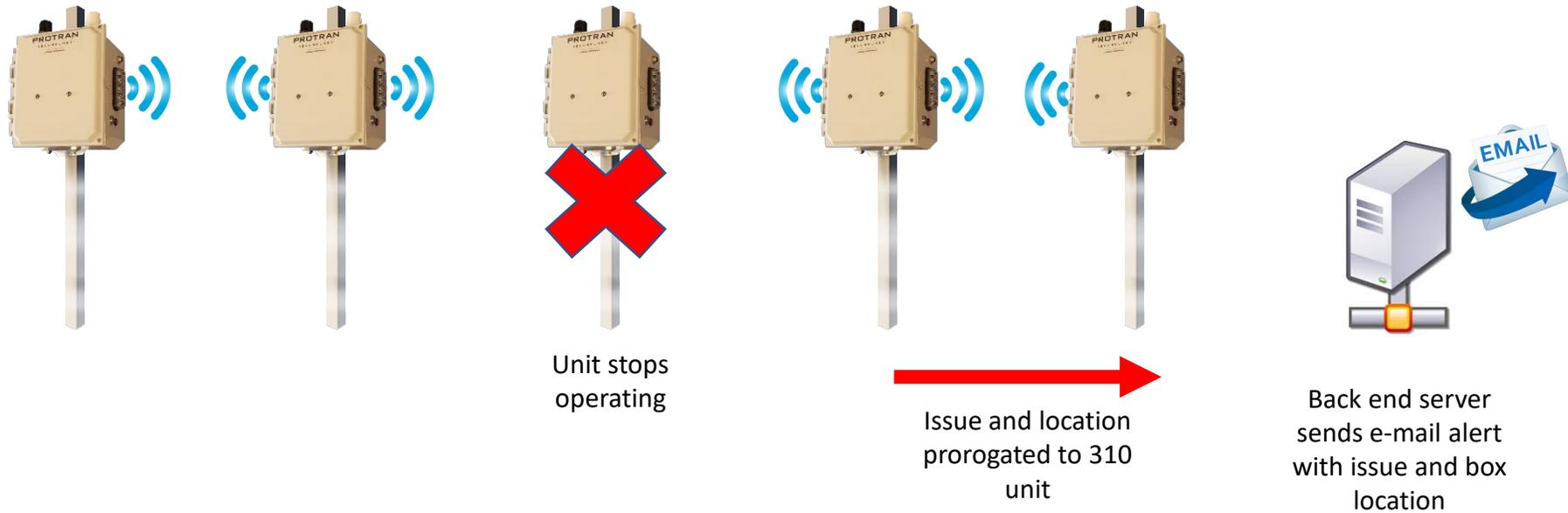
- Wayside mounted LED lights flash when a PAD is in the vicinity.
- The closest box to the Worker PAD +2 boxes Flash in both directions.
- Provides 1600+ feet visual warning of workers ahead to the train operator.

How Light System "Block" Works



Protran Technology Safety Solutions

ProAccess Self Diagnosis Notifications



ProAccess – Future Development “Dashboard” Data Retrieval

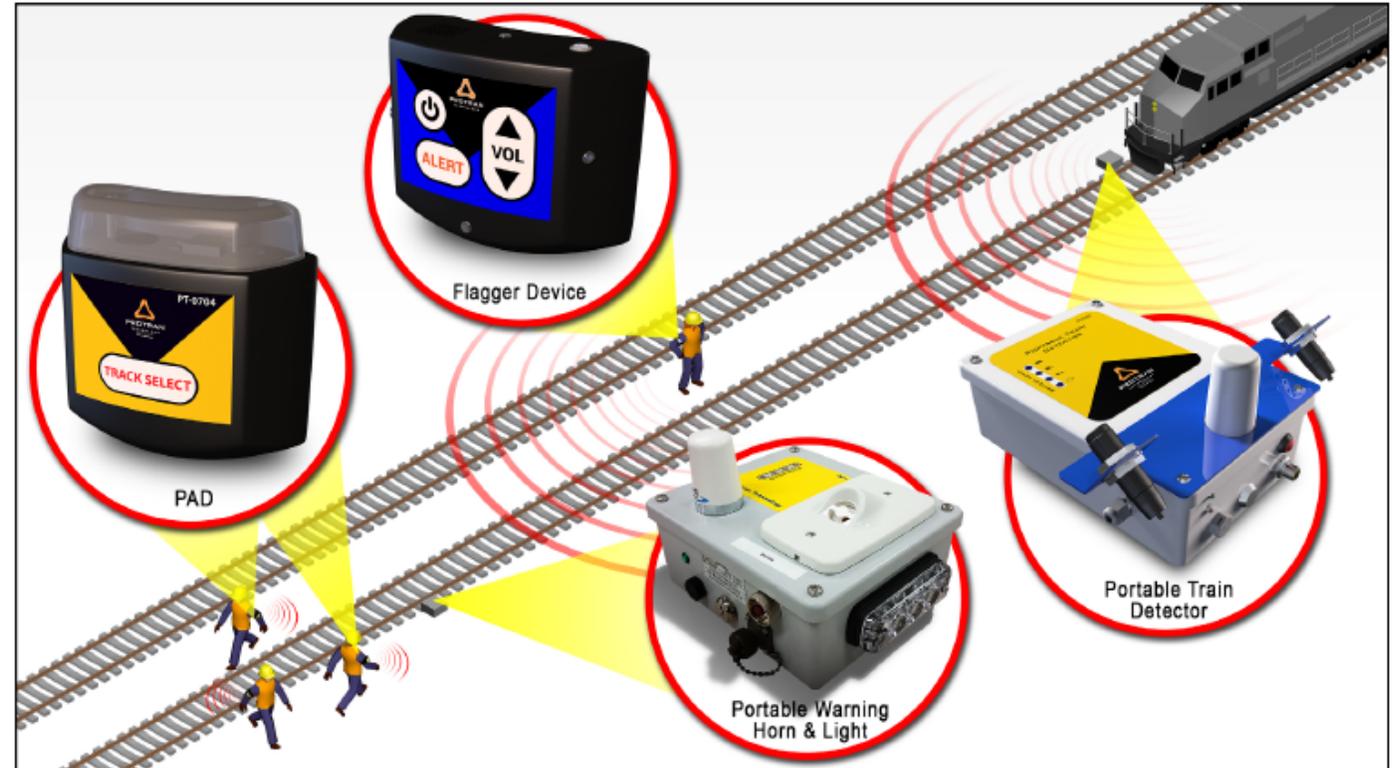


ProAccess development:

ProAccess Dashboard for Operations Management to improve track maintenance in effort to be more efficient and to limit the time on track which improves safety while increasing revenue service.

Portable Roadway Worker Protection Kit:

- Includes a battery operated device that is temporarily mounted on/or next to the track which communicates with a device worn and/or carried by the worker on the tracks
- Provides a visual alert to the vehicle operator of track workers ahead and an advanced audible and visual warning of the train approaching to the workers on the track
- Easy set-up, low maintenance, utilizes “handshake” between detection & alert devices to ensure signal communication
- Multiple use configurations, i.e. track specific alerts, multiple work zones, adjacent track protection, etc...



Ranging Protracker System

Track Walker/Worker – Train Operator – Advance Warning Devices



The Protran Technology Ranging Protracker Train Device provides the train operator an audible and visual alert of personnel on the Right of Way who are wearing the Protracker Personal Alert Device (PAD).

The unit displays the distance between each worker PAD and the Protracker equipped train.

System provides advanced warning to the track workers and displays the alert confirmation from the worker to the train operator.

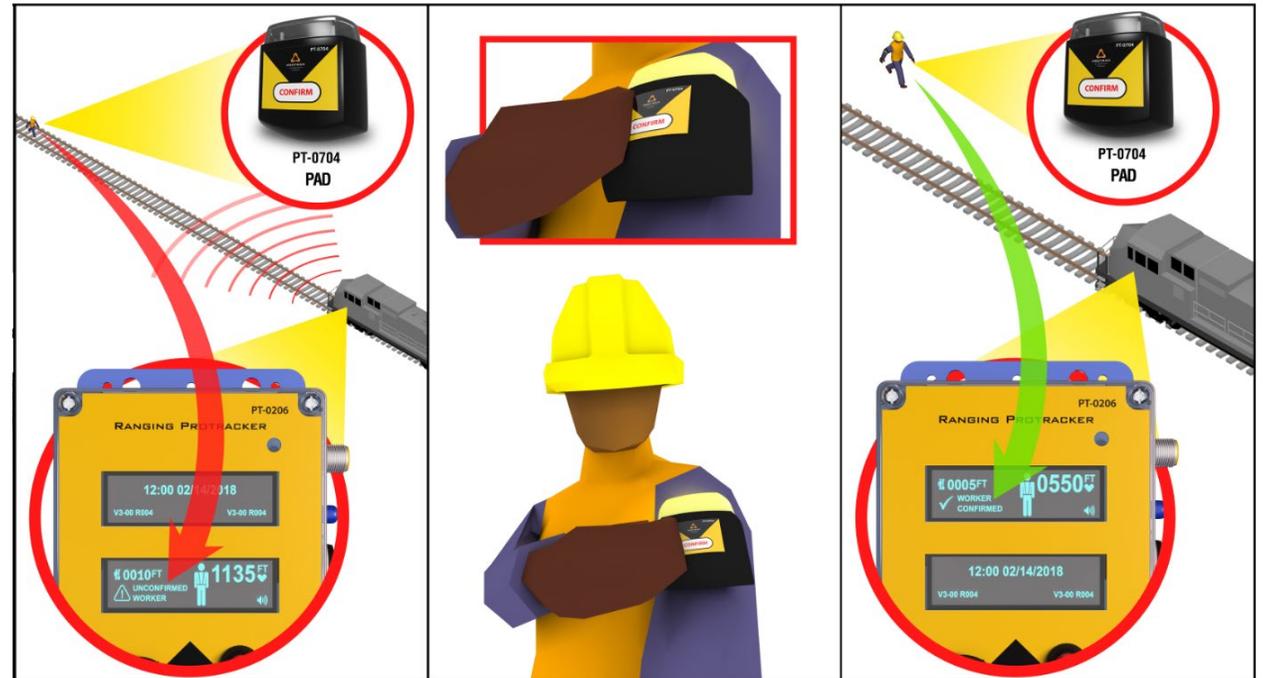
Ranging Protracker Vehicle Based RWP System:

- Includes a device that is permanently mounted on the train which communicates with a device worn and/or carried by the worker on the tracks
- Provides an audible and visual alert to the vehicle operator of the track workers ahead
- Provides an audible and visual advanced warning of the approaching train to the workers on the track
- Offers time based or distance based alerts utilizing redundant 2.4 & 900 dual radio signaling
- Utilizes system radio diagnostics to ensure signal communication and continuous “heartbeat” to confirm proper functionality to operator
- Includes information data logging of all events
- Easy installation & low maintenance system



Ranging Protracker Vehicle Based RWP System:

- Spread spectrum, frequency hopping, dual radio redundant signaling technology
- Train Unit transmits a directional signal from the front of the train as it approaches a work zone
- System alerts both the Train Operator and the Track Worker with ample warning time to clear
- Worker Device receives the signal & relays the worker's distance back to the train operator
- Workers confirm the train alert and acknowledge the approach of the train to the train operator
- All events are data logged including operator alarm acknowledgment & worker alert confirmation



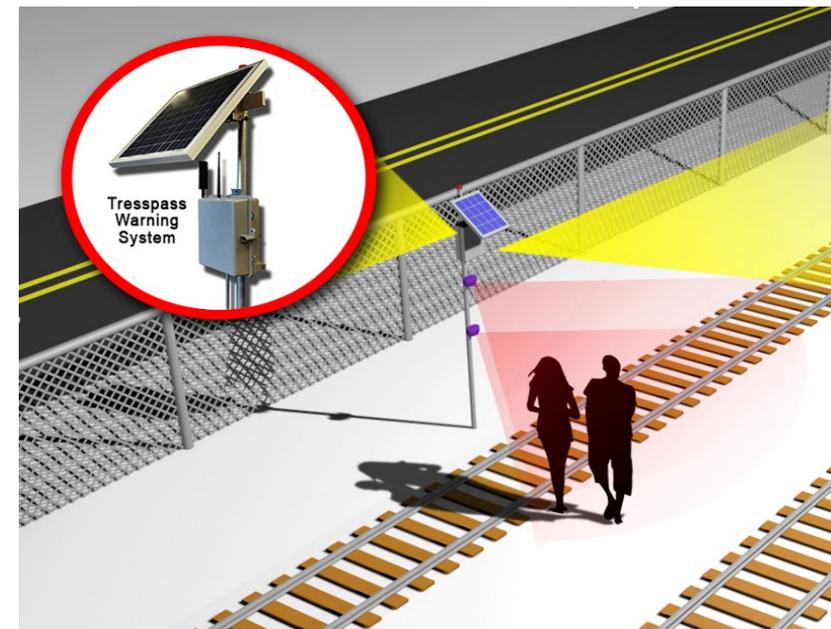
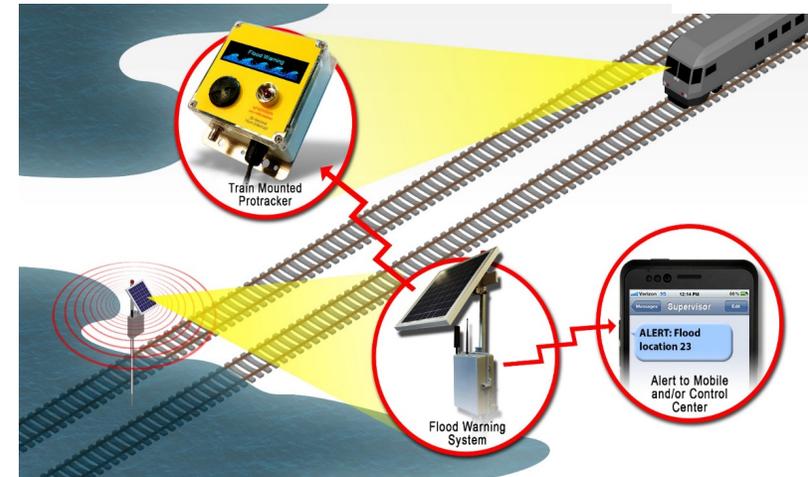


Ranging Protracker RWP System:

- 99% effective
- Redundant protection when implemented with an agency's safety SOPs
- Provides an additional layer of protection to the track worker and vehicle operator
- *Ranging* Protracker RWP System is in revenue service since 2017
- *Original* Protracker RWP System is in revenue service since 2010 (... previous generation model still in service today)



- One of the many benefits of having the Protran Technology vehicle based “Protracker” RWP System is the capability to communicate with many other Protran wayside devices that provide additional warnings to train operators in real-time of various conditions and provide advanced notification to passengers or pedestrians of the approaching train.
- Example: Flood Warning, Trespasser Warning, Pedestrian Warning, and Train Approach Notification Systems
- These devices provide additional layers of safety to rail workers, as well as provide safety solutions to operators, passengers, & pedestrians.



Questions?

For more info visit www.protrantechnology.com

Video links:

ProAccess: <https://www.youtube.com/watch?v=duo2awZwzK4>

Protracker: <https://www.youtube.com/watch?v=mgjGVfGir5M>

Collision Avoidance: <https://www.youtube.com/watch?v=BEtE13-5X1A>

Protran Technology

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- GCRTA
- LAC Metro
- Metro North

Ranging Protracker System

Track Walker/Worker – Train Operator – Advance Warning Devices

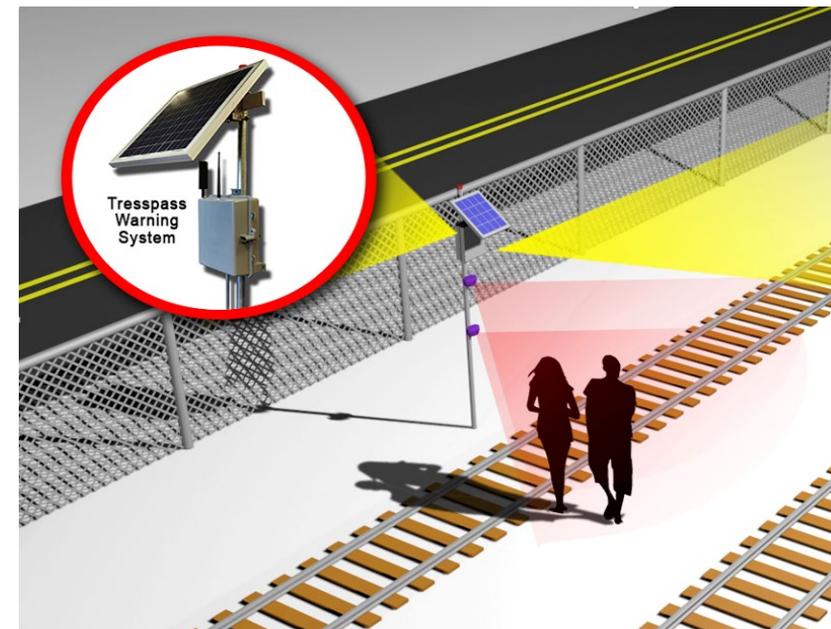
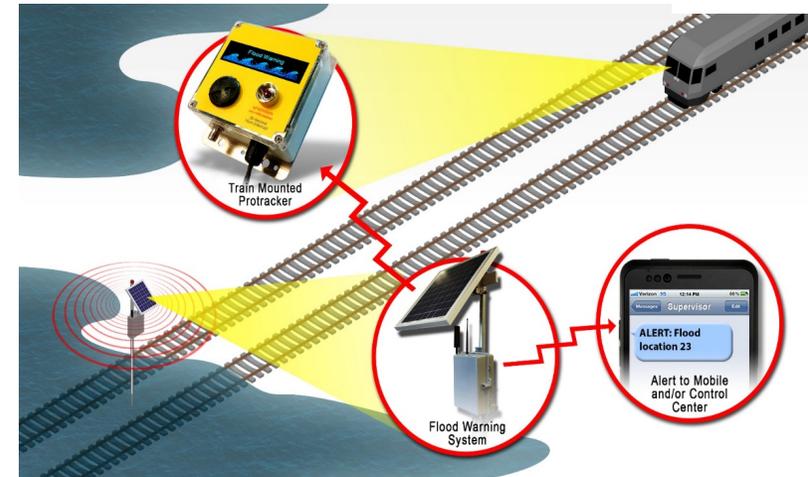


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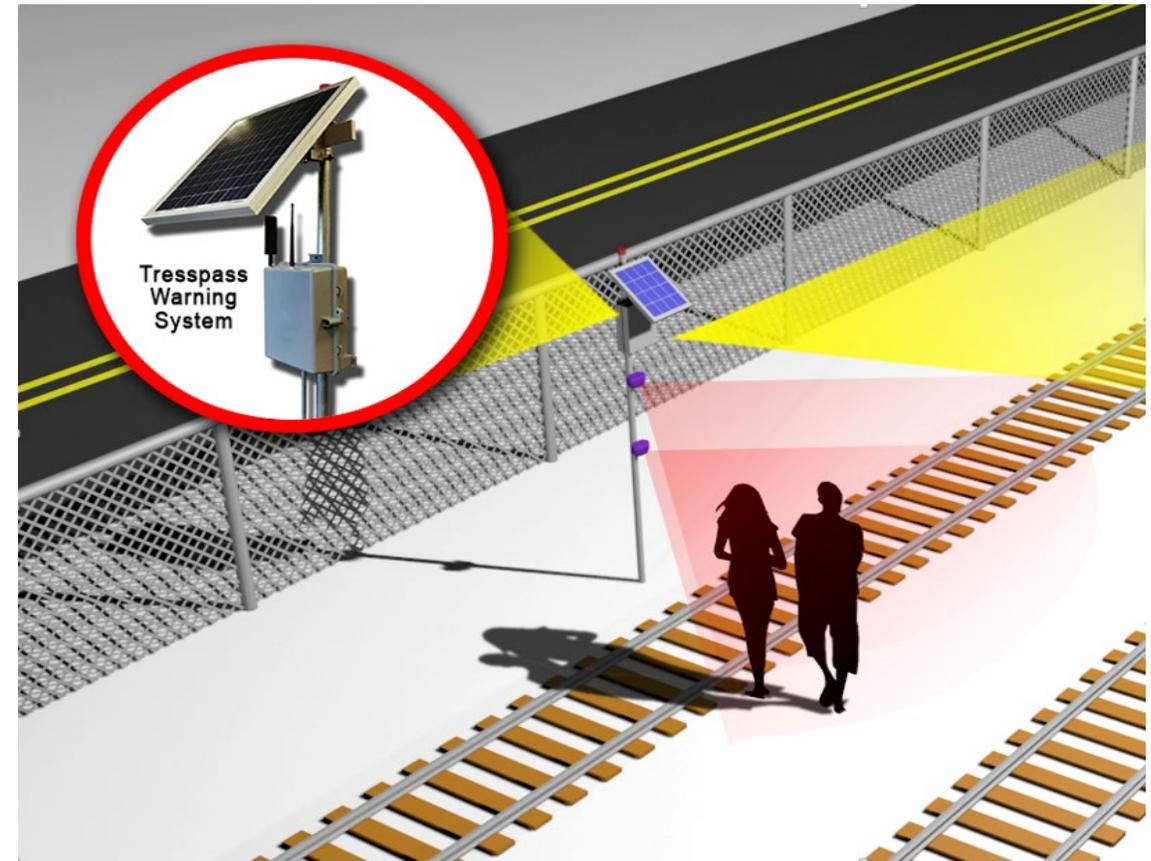
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- Example: Flood Warning, Trespasser Warning, Pedestrian Warning, and Train Approach Notification Systems
- These devices provide additional layers of safety to rail workers, as well as provide safety solutions to operators, passengers, & pedestrians.



Pedestrian Warning / Trespasser Warning System:

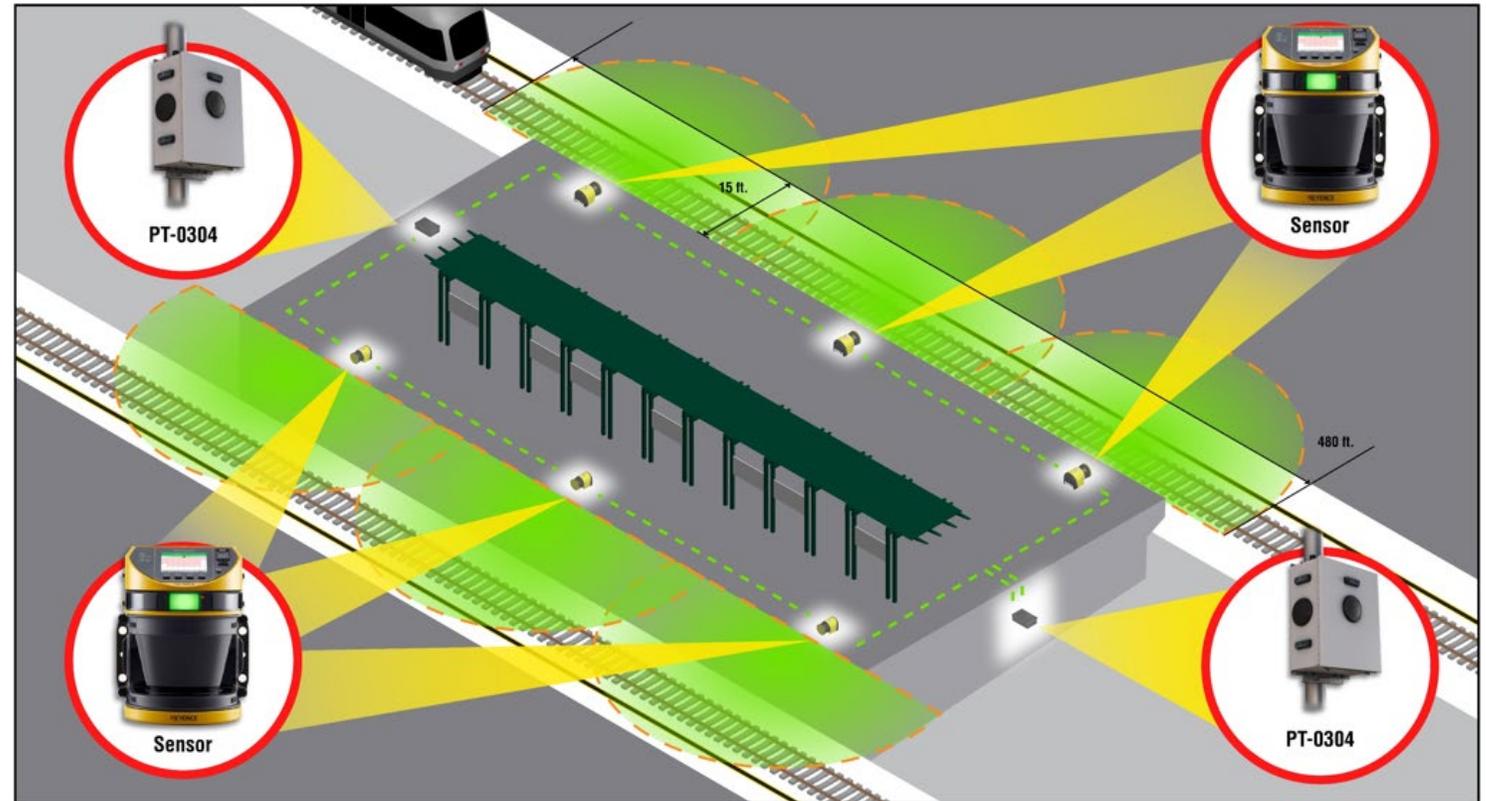
- This system is designed to activate every time a train equipped with a Protran Protracker approaches the wayside mounted Pedestrian / Trespasser Warning unit
- It can be installed at pedestrian rail crossings to provide advanced warning of an approaching trains to pedestrians
- It can be installed at known trespass areas to provide notification of the approaching train and to deter individuals from walking along the tracks
- Customized warning messages can be played in multiple languages and can repeat up to ten times per activation
- Visual flashing LEDs provide a visual warning
- System can be hard wired or Solar power generated



Protran Technology's newest safety solution development is the *Track Intrusion Detection & Alert System*.

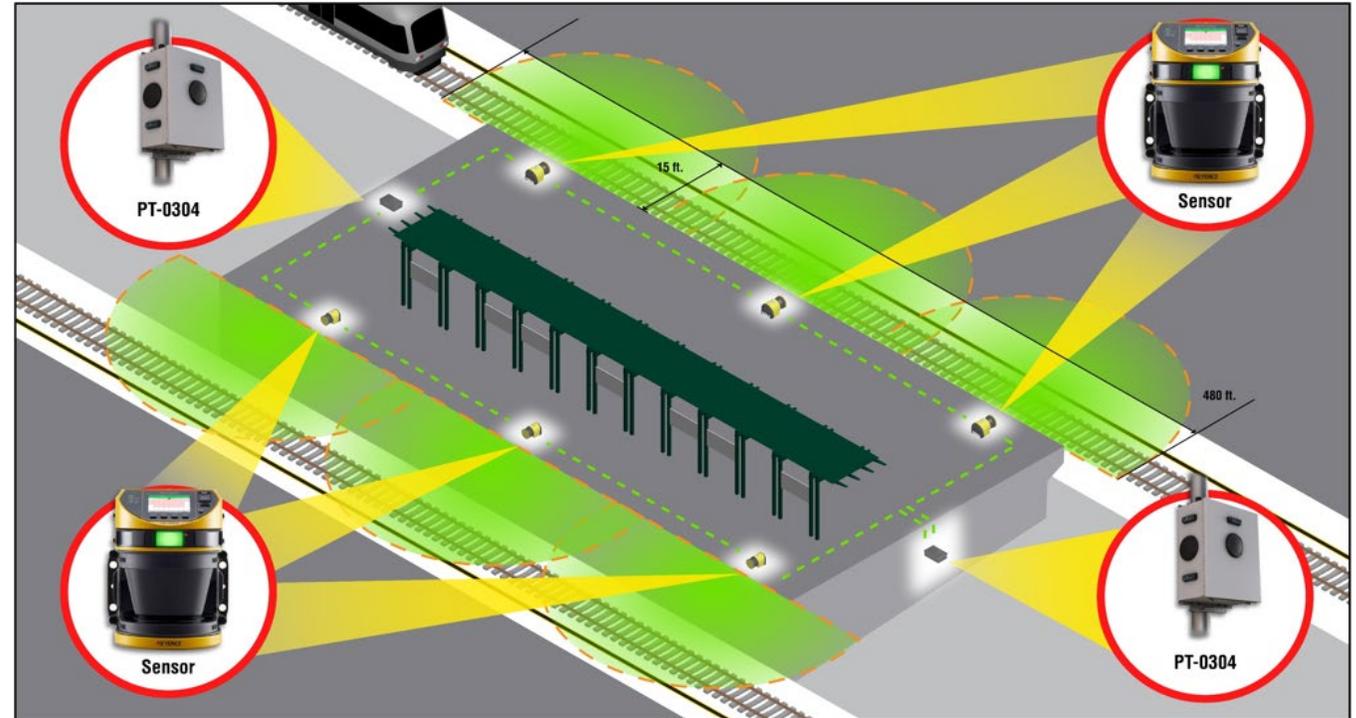
This solution-based development is in direct response to the industry wide need for detection and instant notification to train operators of people and dangerous objects on the tracks at platforms & other specified locations.

* Currently being Piloted in MD, MTA Metro division.



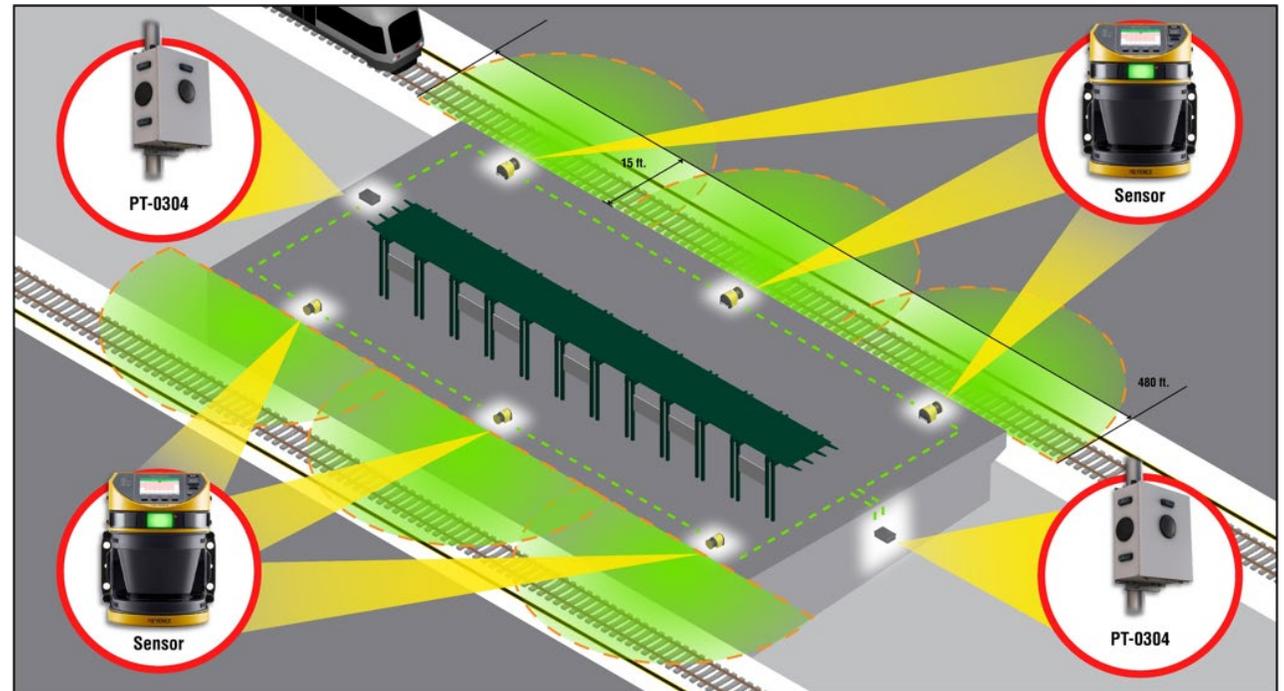
Track Intrusion Detection & Alert System Description:

- Track detection zone at Platform or other designated area
- Sensors are positioned to detect humans walking, sitting, or lying down on the tracks or in the ROW area
- Detection criteria can be programmed to meet specific size parameters to avoid branches or rodents from triggering the detection alert
- Detection criteria can be programmed to detect for a set amount of time (i.e. 3 seconds) before triggering the alert
- Detection will continue to alert while the object in the zone continues to trigger the detection signal
- Detection alert will clear as soon as the object is no longer in the zone (i.e. person exits the detection zone/ track area)



Track Intrusion Detection & Alert System Benefits:

- Instantly alerts the Operator of a train approaching the platform when a Track Intrusion is detected to provide the information necessary to help mitigate accidents
- Image of detected object is instantly captured and saved on the sensors and can be retrieved from the sensor or can be accessible via the Protran unit at the Platform
- Protran unit at the platform data logs detection events
- Protran unit at the platform can announce that a track intrusion has been detected and to clear the tracks
- Protran unit at the platform can provide a service announcement when the train is approaching to inform passengers on the platform
- Detection sensor performance is not affected by light, rain, fog, snow, etc...



Questions?

For more info visit www.protrantechnology.com

Video links:

ProAccess: <https://www.youtube.com/watch?v=duo2awZwzK4>

Protracker: <https://www.youtube.com/watch?v=mgjGVfGir5M>

Collision Avoidance: <https://www.youtube.com/watch?v=BEtE13-5X1A>

Questions?

FTA

FEDERAL TRANSIT ADMINISTRATION

Hotrail Group

Disclaimer:

The FTA does not endorse any product or company discussed in this presentation. This material is being presented purely for technical education and discussion.

Aviation, Boots and the Nevada Plan

Changing the Paradigm in Rail Public Safety



Presented by
Rich Gent
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This is where we need to be (Suicides)

2016

Selections: Railroad - ALL / State - Nevada
Time Frame - From 2016 To 2019

Month			Fatalities	Injuries
At Crossing	Type of Person			
N	Trespassers	July	1	0
		September	1	0
		October	1	0
All			3	0

2017

Selections: Railroad - ALL / State - Nevada
Time Frame - From 2016 To 2019

Month			Fatalities	Injuries
At Crossing	Type of Person			
Y	Trespassers	July	0	1
All			0	1

2018

Selections: Railroad - ALL / State - Nevada
Time Frame - From 2016 To 2019

Month			Fatalities	Injuries
At Crossing	Type of Person			
N	Trespassers	January	1	0
		February	1	0
		September	1	0
All			3	0

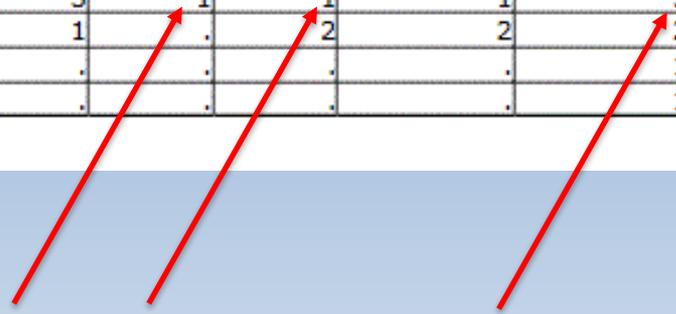
This is where we need to be (trespassers)

TRESPASSER CASUALTIES (DEATHS AND INJURIES) (EXCLUDES HIGHWAY-RAIL INCIDENTS)

Selections: Railroad - All Railroads
 State - NEVADA County - All Counties
 All Regions
 All Job Types / All Locations / All Casualties
 CALENDAR YEAR (January-December) 2019

Last Database Reported Month/Year=11/1919

Counties	Total		Total CY Counts			Month To Month Counts Jan - Dec		% Change Over Time		
	Cases	Pct of Total	CY 2016	CY 2017	CY 2018	CY 2018	CY 2019	CY 2016 to CY 2018	CY 2017 to CY 2018	Month To Month % Change CY 2018 to CY 2019
GRAND TOTAL....	37	100.0	8	3	10	10	16	25.0	233.3	60.0
CLARK	20	54.1	4	2	7	7	7	75.0	250.0	.
WASHOE	10	27.0	3	1	1	1	5	-66.7	.	400.0
ELKO	5	13.5	1	.	2	2	2	100.0	.	.
HUMBOLDT	1	2.7	.	.	.	.	1	.	.	.
PERSHING	1	2.7	.	.	.	.	1	.	.	.



Why do they Trespass

- Don't know it's a law
- Don't think the law makes sense
- They think they can get away with it
- Convenience verses pain

Who's been successful

- Seat belt laws; 25 years of advertising
- Many of the actions which MADD has taken are familiar. These include direct action/support for legislative changes among many other actions.
- More people have been involved in trespass fatalities than the current vaping outrage.
FRA 2019 stats: 573 Vaping: 57 (NY Times)

“Wait a minute, I’m the victim”

Class One Railroad Public Safety Director



A new approach to rail public safety



Actual Sighting



Proof of Concept; drone integration



Training & Deployment



Public Safety Education



A tool in tool box

(Don't use a screwdriver to hammer a nail)



Drone capabilities used to tailor trespass treatments

- Full-color nose camera

- **Why: for current geographical, topographical and sociocultural factors**

- Thermal for low-light and night viewing

- Synthetic Aperture Radar (SAR) for seeing through low visibility

- Other “scientific sensors”



NAR
WHT
RATE
21/117
1138
10C

ACFT
N 51' 30' 9.352"
W 0' 0' 54.761"
1,337 HAT

Why: to see night time activities or hot spots on the ground

38

N 51' 30' 10.684"
W 0' 0' 51.522"
BRG 61
RNG 5116m
RNG 2,762 NM
ELV 6224 F



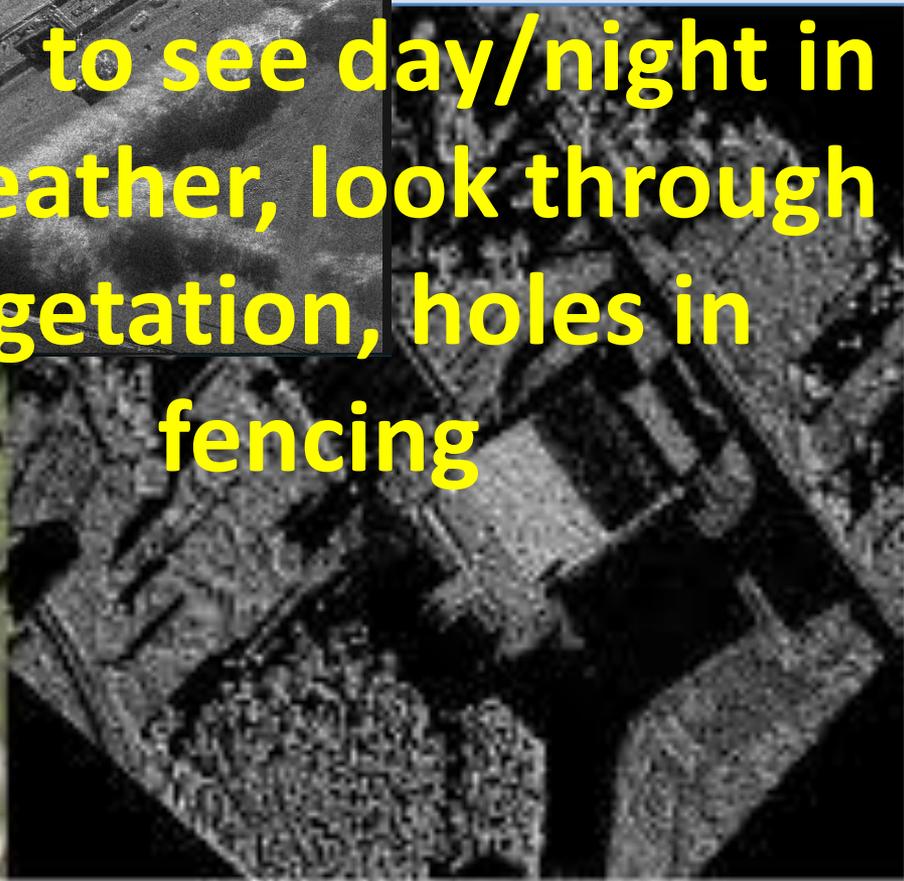
Synthetic Aperture Radar Imagery



Sandia Labs

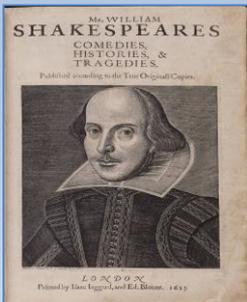
**Why: to see day/night in
all weather, look through
vegetation, holes in
fencing**

LEIDOS, Inc



Other 50 pound head items

- **Hyper and Multi-spectral**
- **Two Color Multi-view**
- **Coherent Change Detection**
- **Light Detection and Ranging (LIDAR)**
- **Time Lapse Viewing**
- **Full Motion Video (FMV)**



State Laws/FAA rules

(all over the place)

- FL/ID/IL/LA/NC/OR/TN/TX/WI Variety: from LE use to fishing
- ID/NC/TX/WI: “No” surveillance
- OR/TN: UAV trespass
- FEDS: FAA beyond our scope (NTIA) and coming soon: FTC
- Senate Bill SB 1272 (Feinstein D-CA) and 2 others
 - Drone Federalism Act of 2017
- Law Enforcement use: Public safety -v- evidence
- FAA Reauthorization Bill (FBI to track and down drones)

So.. What could go wrong?

RailwayAge



News Freight Intermodal Passenger Mechanical M/W C&S Management Safety PTC

Monday, October 06, 2014

“New Drone Company” UAS team up to bring drones to the rail industry

Written by Carolina Worrell, Managing Editor

The Digital Indago™ LE VTOL easily fits in confined, crowded, or otherwise in dangerous situations, enhanced up to 500 feet high, is a Volant UAS says.

to provide an aerial perspective of for assessing volatile or potentially drone, which, can fly for up to 50 minutes and capture imagery and developing training models,

TECH DRONE

Drone startup : ever for flying

by Jonathan Varian @Jr

fine mission

The FAA said on Tuesday that it's fining drone startup SkyPan International \$1.9 million for allegedly conducting 65 drone flights without the required authorization. It makes for the largest civil penalty ever by the FAA on a drone company, the administration said.

Watch a Rogue Drone Crash Into the Crowd at an MLB Game

Fallon PD demos drones in rail trespass

Drone technology prevents disaster along the rail line

Lahontan Valley | November 24, 2016

Steve Ranson
sranson@lahontanvalleynews.com



Drone operator Lacey Szekely maneuvers the Unmanned Aerial Vehicle, while Steve Endacott views its progress. To their right is Fallon Police Capt. Ron Wenger..
STEVE RANSON / LVN

In a mock exercise using an Unmanned Aerial Vehicle, more commonly known as a drone, the city of Fallon recently mounted a search looking for a suicidal man who had trespassed on railroad property.

Use of Rail Auxiliary Teams, Aviation and Rail Public Education in Rail Safety and Security



Public Rail Safety Education



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Solve these problems (drones can be a tool)

- Don't know it's a law
 - 1 educational voice
- Don't think the law makes sense
 - 1 educational voice
 - LE outreach/contact
- Convenience verses pain
 - Environmental obstacles
 - Near persistent law enforcement
- They think they can get away with it
 - Near persistent law enforcement

[Rider Tools](#)[Schedules & Maps](#)[750 FrontRunner](#)

ROUTE
750

FrontRunner

[Commuter Train](#)[Locate](#)[Map and Schedule \(PDF\)](#)

Uses drones for documentation and accident reconstruction



One police agency has a drone monitoring rail tracks.
By **ERIN DOOLEY** and **DAVID KERLEY**
November 26, 2017, 12:33 PM

Why BNSF Railway is using drones to inspect thousands of miles of rail lines
BY [DAVID Z. MORRIS](#)
May 29, 2015 11:18 AM EST

Questions

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Motorola Solutions / Avigilon Video Security & Analytics

Avigilon Artificial Intelligence & Video Analytics
Detect, Verify and Act on Critical Events

Motorola Solutions | Avigilon Video Security & Analytics

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Technology Presentations

Public Comment

Break

