

pipper®

SECURETRACK™ MAINTENANCE OF WAY SAFETY SOLUTIONS

Advanced protection for maintenance vehicles,
track workers, and work zones



THE CHALLENGE

Maintenance of Way operations are among the most hazardous activities on any railroad. Fleets of rail-bound and hi-rail vehicles operate within defined work limits, often in constrained track space, with multiple vehicles moving bidirectionally and track workers on foot in close proximity. Historically, safety in these environments has relied on movement authorities, radio communication, physical protections, and operator vigilance — effective controls, but ones that offer limited margin when visibility is restricted, GPS is unreliable, or work groups reconfigure frequently.

The consequences of failure are severe. Equipment collisions sideline vehicles, consume maintenance resources, generate operational disruptions, and — most importantly — put workers at risk.

Piper's SecureTrack addresses this challenge with a technology-based safety overlay that continuously and independently verifies where every vehicle is, what authority it is operating under, and what hazards or other vehicles are nearby — then delivers timely, escalating alerts to operators, Employees-in-Charge, and dispatch in real-time.

SECURETRACK: A MULTI-LAYER SAFETY PLATFORM Helix™ LCCAS · Work Zone Management · Roadway Worker Protection (RWP)

Helix™ LCCAS

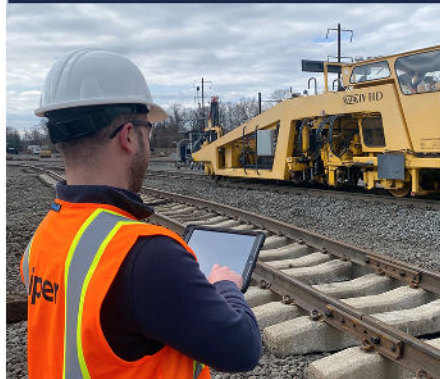
Limits Compliance & Collision Avoidance



Multi-sensor vehicle protection using GPS-RTK, UWB, TrackSight™ LiDAR, and IMU. Continuous limits compliance, collision avoidance, and obstacle detection — all generated locally on the vehicle, independent of radio or dispatcher intervention.

Work Zone Management

EIC App · Digital Movement Authorities



Employees-in-Charge manage work gangs, set territory limits, create consists, and apply protection rules via the Piper Fleet Manager App on ruggedized iOS tablets. Integrates directly with Rail Control Center dispatch systems — movement authorities flow digitally, eliminating paper-based processes.

Roadway Worker Protection

Wearable RWP · UWB + GPS + 915MHz



Workers carry ruggedized wearables using GPS, UWB, and 915MHz radio for precise localization even in tunnels and elevated territory. Train operators receive visual and audible alerts when a worker is detected within 500 yards. Piper's Virtual Tunnel algorithms prevent false alerts outside the designated work zone.

HELIX™ LCCAS — LIMITS COMPLIANCE AND COLLISION AVOIDANCE

At the core of SecureTrack — multi-sensor, vehicle-centric protection across all rail environments



Helix™ Multi-Sensor Device — GPS-RTK, UWB, LiDAR, and IMU in a single roof-mounted unit.

At the core of SecureTrack is the Helix™ Limits Compliance and Collision Avoidance System — a modular, vehicle-centric safety overlay incorporating Ultra Wideband (UWB), GPS-RTK, solid-state LiDAR, and Inertial Measurement Unit (IMU). All alerts are generated locally on the vehicle, independent of radio calls or dispatcher intervention, while telemetry and safety events are shared with dispatch and fleet managers in real-time.

WORLD'S FIRST SIL-4 CERTIFIED UWB SYSTEM

Piper's UWB positioning technology has achieved the world's first CENELEC Safety Integrity Level 4 (SIL-4) certification for a UWB-based system, independently assessed by TÜV SÜD — the highest safety integrity level in the industry. Currently deployed on over 800 maintenance vehicles across the United States.

LCCAS CAPABILITIES

Limits Compliance

GPS-RTK continuously calculates distance to work zone ends with centimeter-level accuracy. Progressive visual and audible alerts via the in-cab VOD as the vehicle approaches authority limits. Seamlessly transitions to UWB or TrackSight™ when GPS is unavailable.

Obstacle and Worker Detection

Piper's patented TrackSight™ solid-state LiDAR continuously scans the fouling envelope using Virtual Tunnel algorithms — distinguishing true hazards from fixed wayside infrastructure and dramatically reducing false alerts. Operators alerted with sufficient stopping distance.

Collision Avoidance Between Vehicles

UWB peer-to-peer ranging enables independent monitoring of front and rear vehicle separation — no GPS required. Proximity alerts issued to both operators if safe separation thresholds are breached, including in tunnels and yards.

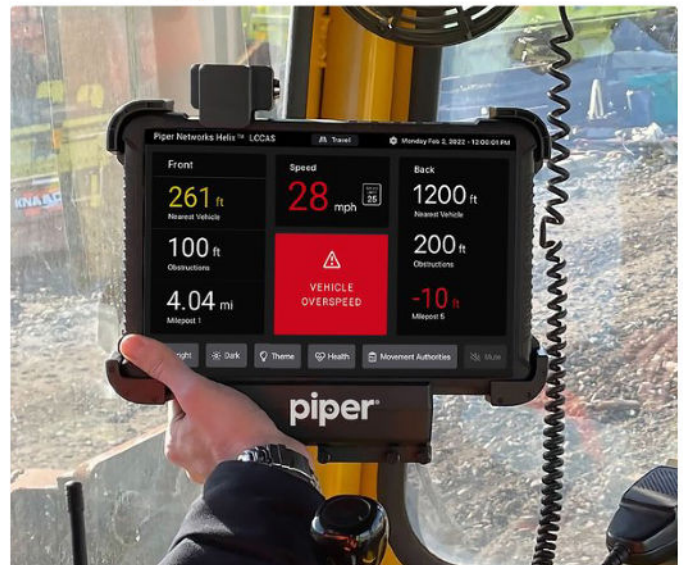
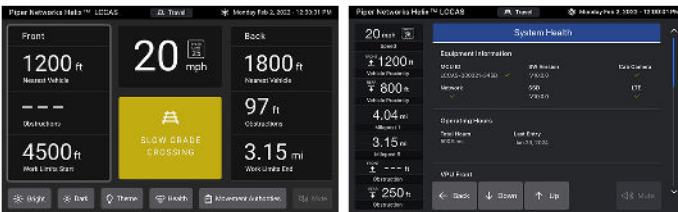
Collision Detection & Event Recording

An onboard IMU detects collision events in real-time and automatically notifies the Employee-in-Charge and dispatcher. Synchronized HD video from outward-facing and in-cab cameras is securely recorded for post-event analysis.

VEHICLE OPERATOR DISPLAY (VOD)

Intuitive in-cab situational awareness — speed, limits, proximity, and obstruction alerts in one display

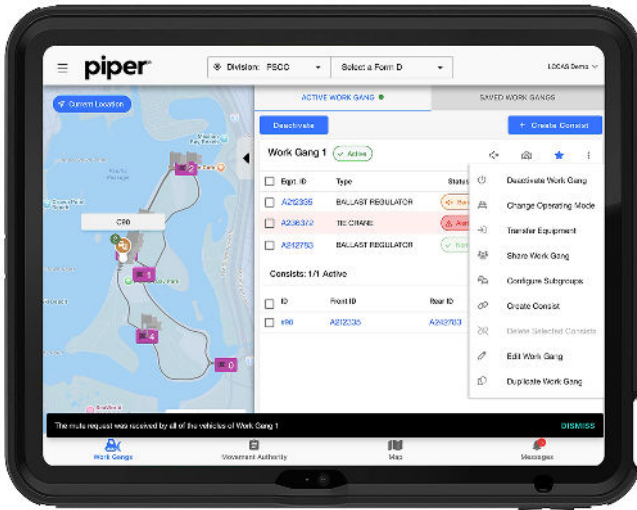
The Helix Vehicle Operator Display (VOD) is the single in-cab interface for all SecureTrack functions — providing operators and Employees-in-Charge with real-time speed, work zone status, vehicle proximity, and system health in one display. Available in ruggedized IP67 8-inch and 10-inch configurations to fit any cab layout, the VOD also provides access to Movement Authorities and operational mode selection. Progressive audible and visual alerts are designed to inform without overwhelming, minimizing alert fatigue across long shifts.



Helix VOD — in-cab display mounted on MoW vehicle, Northeast Corridor.

WORK ZONE MANAGEMENT

Digital movement authorities · EIC App · Real-time dispatch integration



Fleet Manager App — EIC view showing active work gang, vehicle positions, and movement authorities on live network map.

SecureTrack's work zone management capability integrates directly with Rail Control Center dispatch systems to create, manage, and monitor work zones in real-time. The system adapts to each operator's protection rules and supports both fixed and moving work zones.

The Piper Fleet Manager App (FMA), running on ruggedized iOS tablets, gives Employees-in-Charge full visibility and control of their work gang in real-time. EICs can create and manage work gangs, assign vehicles, set work territory limits, create consists, apply protection rules, and view live telemetry from all equipped vehicles. Dispatchers are notified in real-time and can view and approve requests, monitor multiple work gangs simultaneously, and deliver movement authorities digitally — eliminating manual paper-based processes.

The Rail Control Center defines work zone boundaries, which the Helix Event Manager (HEM) server distributes to all equipped vehicles and EIC devices. As vehicles enter the work zone, the VOD transitions to yellow, then red once inside, prompting the operator to stop until EIC authorization is confirmed following multifactor verification of safe worker clearance.

ROADWAY WORKER PROTECTION (RWP)

Centimeter-level worker localization · GPS + UWB + 915MHz · Tunnels, elevated, and congested RF environments

Piper's Roadway Worker Protection solution goes beyond traditional RWP by providing centimeter-level worker localization even in congested RF environments, elevated tracks, and tunnels — environments where conventional solutions struggle.

Workers carry compact, ruggedized wearable devices utilizing three complementary radio technologies: GPS for above-ground localization, Ultra Wideband (UWB) for precise positioning within the wayside network, and 915MHz radio for long-distance communication with approaching trains. The system alerts train operators visually and audibly when a worker is detected within 500 yards of the train's forward movement. Piper's Virtual Tunnel algorithms ensure the system does not respond to workers outside the designated work zone — allowing trains to proceed unencumbered where no workers are present.

Wearable devices feature long-life rechargeable batteries, IP-65 protection from water and dust, and unique encoded IDs for worker accountability. Optional Piper Smart Flags — physical blue flag lights with integrated GPS-RTK and UWB — can be installed on the tracks as an additional protection layer.



Object and Worker Detection — TrackSight™ LiDAR scanning the fouling envelope ahead.



CASE STUDY: AMTRAK — MAINTENANCE OF WAY LCCAS

Amtrak selected Piper's SecureTrack LCCAS to protect and monitor their Maintenance of Way fleet across five operating corridors: the Northeast Corridor, Detroit–Chicago, New Orleans, Miami, and Los Angeles. The program objective was to supplement existing procedural controls with a system that could continuously and independently verify position, limits, and separation — without requiring extensive new infrastructure or disrupting day-to-day operations.

Piper deployed the system on 462 rail-bound MoW vehicles, with the program subsequently expanded to include 342 hi-rail vehicles and comprehensive UWB positioning in tunnels. The full deployment was completed ahead of schedule and on budget. The system integrates directly with Amtrak's AMTEC Computer Aided Dispatch system, with movement authorities and work zone limits flowing digitally from dispatch to vehicles and EICs, and vehicle position, alerts, and system health flowing back in real-time.

Since deployment, MoW collisions have dropped substantially across the network.

PROGRAM HIGHLIGHTS

- 462 rail-bound MoW vehicles deployed
- Five operating corridors including the NEC
- Integrated with Amtrak AMTEC CAD system
- 342 hi-rail vehicles — full fleet coverage
- Completed ahead of schedule and on budget
- Substantial reduction in MoW collisions since deployment

"Since deployment, MoW collisions have dropped substantially across the network. SecureTrack gives dispatchers and Employees-in-Charge a shared, authoritative real-time picture of every vehicle across the territory."



460 installations — Piper and Amtrak teams celebrate milestone deployment of SecureTrack LCCAS across the Northeast Corridor.

BENEFITS OF PIPER SECURETRACK

Always-on protection, independent of radio

Local sensor processing and in-cab alerts operate independently of radio communication or dispatcher intervention. Protection is continuous even when communications are degraded.

Seamless dispatch integration

Two-way integration with Rail Control Center dispatch systems ensures operators, EICs, and dispatchers share a single, authoritative real-time view of MoW activity across the territory.

SIL-4 certified equipment

Piper's UWB positioning system holds the world's first SIL-4 certification for UWB-based train positioning. Equipment tested to AREMA C&S 11.5.1 and IEEE 1478.

Multi-sensor redundancy

GPS-RTK, UWB, LIDAR, and IMU work together to deliver reliable performance across all MoW environments, including tunnels, yards, and GPS-challenged territory.

Scalable from single vehicles to entire fleets

SecureTrack deploys on individual vehicles or across fleets of hundreds. The rapid-deploy kit configuration enables fast compliance for agencies with immediate safety requirements.

