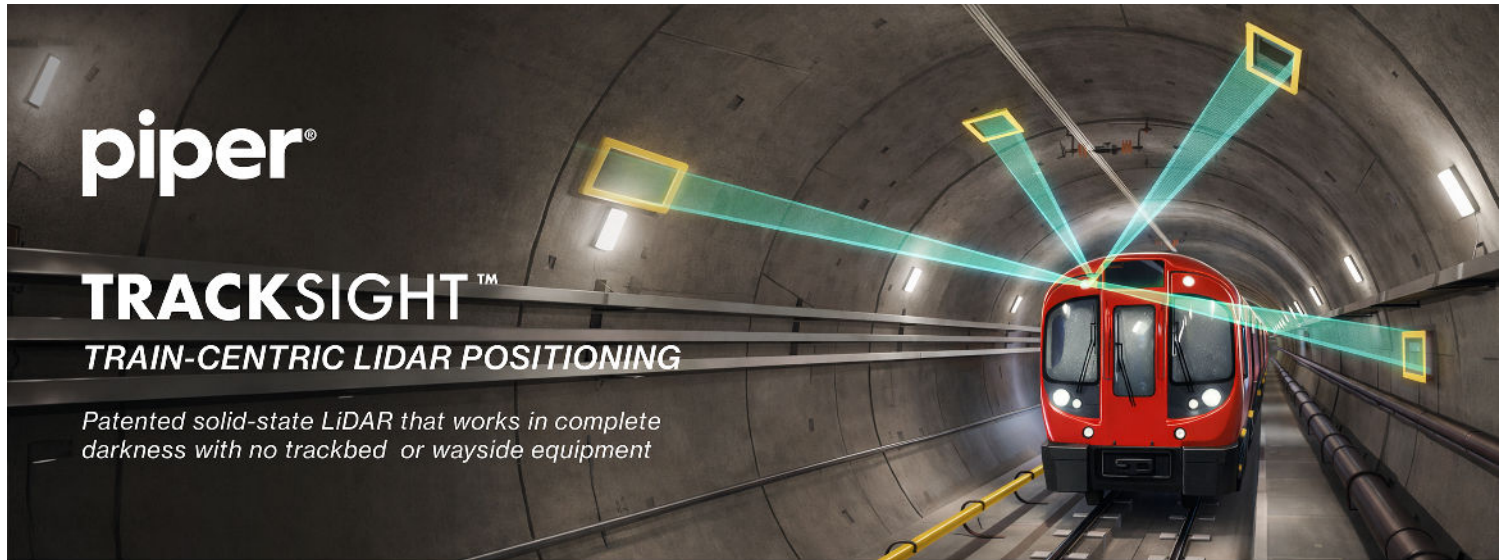


**piiper**<sup>®</sup>

# TRACKSIGHT™

## TRAIN-CENTRIC LIDAR POSITIONING

*Patented solid-state LiDAR that works in complete darkness with no trackbed or wayside equipment*



### THE CHALLENGE WITH TRADITIONAL POSITIONING

#### *Why transit operators need a better approach*

Understanding the precise location of hi-rail and rail-bound vehicles on a track is paramount to ensuring safe operation of the railway system. One of the main challenges for transit operators today is installing and maintaining trackbed or wayside equipment for these solutions. Typically, this process is tedious to complete, requires expensive equipment, and can be hazardous for workers.

GPS provides useful coverage above ground but fails in tunnels and cannot reliably be used for track determination. Trackbed transponders require expensive, disruptive installation in the most hazardous parts of the railway environment. AI and camera-based systems cannot currently be certified to the safety integrity levels that vital train control applications demand.



**TrackSight™ LiDAR** — compact solid-state LiDAR unit that is easily mounted to the front of the train.

### TRACKSIGHT™ — HOW IT WORKS

#### *Patented "fingerprint" localization · two operational modes · fully deterministic*

TrackSight™ is Piper's patented solid-state LiDAR positioning system. A compact sensor mounted on the train continuously scans the environment ahead and compares real-time imaging against an onboard database to determine precise position, speed, and track identity — even in total darkness, using tunnel features, reflective markers, and track geometry as reference points.

#### **FULLY DETERMINISTIC**

TrackSight™ does not rely on AI or machine learning — making it safety-certifiable to CENELEC SIL-4 (Safety Integrity Level 4).

#### **Survey Mode**

The onboard LiDAR surveys the rail territory, capturing scans and storing associated data points of distance and reflectivity as "fingerprints" — each supplemented with a georeference point and stored in the onboard computer.

#### **Navigation Mode**

Real-time LiDAR scans are matched deterministically against the fingerprint database. Position, speed, and track identity are calculated continuously — with no AI or machine learning.

### KEY CAPABILITIES

#### **Precise Train Positioning**

Works underground and above ground

Pinpoints train location in real-time using tunnel features, reflective markers, and track geometry — including in total darkness where GPS is unavailable.

#### **Obstacle & Worker Detection**

Continuous forward hazard monitoring

Calibrates its field of view to detect obstacles and personnel in the track ahead, alerting operators with sufficient stopping distance to prevent collisions.

#### **Sensor Fusion Ready**

Compatible with UWB and GPS-RTK

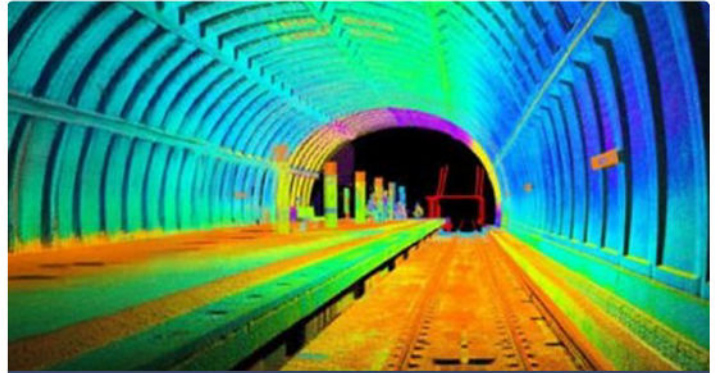
Produces positioning data in the same format as Piper's UWB and GPS-RTK systems — enabling seamless sensor fusion and redundancy with no software changes from CBTC suppliers.

## INTEGRATION & INTEROPERABILITY

Compatible with CBTC, PTC, ATP, and ERTMS · no software changes required from existing suppliers

TrackSight™ can operate independently to localize trains and provide certain Automatic Train Protection (ATP) functionality. It can also be integrated with a higher-level train control system to provide localization data for onboard Positive Train Control (PTC), Communication-Based Train Control (CBTC), as well as European Rail Traffic Management (ERTMS) systems.

The data structure is compatible with the positioning data provided by Piper's other systems — UWB and GPS-RTK. Installed alongside those systems, TrackSight™ provides consistent and redundant positioning data. No software changes are required from CBTC suppliers. Piper's platform integrates with existing signaling infrastructure and evolves alongside your train control modernization program.



**TrackSight™ Scan** — real-time point cloud imaging inside a rail tunnel. Used for train localization and track identification.

### SIL-4 Certifiable

Highest safety integrity level in the industry

TrackSight™ is designed and developed in compliance with CENELEC SIL-4 (Safety Integrity Level 4) requirements — the prerequisite for integration with CBTC and ATP train control systems. Piper holds the world's first SIL-4 certification for a UWB-based system and seeks equivalent certification for TrackSight™.

### Part of Piper's Multi-Sensor Platform

UWB · TrackSight™ LIDAR · GPS-RTK

TrackSight™ is one of three complementary positioning technologies on Piper's unified platform. All three produce positioning data in a consistent format — enabling seamless sensor fusion. Underground: UWB + TrackSight™. Above ground: GPS-RTK.

## BENEFITS OF TRACKSIGHT™

### ● No trackbed or wayside infrastructure

All equipment is mounted on the train. No excavation, no wayside installation — dramatically reducing capital and maintenance cost.

### ● Works in total darkness

Uses tunnel features, reflective markers, and track geometry as reference — no lighting or external infrastructure needed underground.

### ● SIL-4 certifiable — no AI

Fully deterministic — not reliant on AI or machine learning. This distinction is what makes safety certification achievable.

### ● Faster, safer deployment

Vehicles can be retrofitted quickly and returned to service immediately. Eliminates hazardous trackbed work for installation crews.

### ● Obstacle and worker detection

Continuously monitors the track ahead for hazards and alerts operators with sufficient stopping distance to prevent collisions.

### ● Interoperable with existing systems

Compatible with CBTC, PTC, ATP, and ERTMS. Consistent data format means no software changes required from existing suppliers.

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*The patented technology paves the way for operators, rolling stock manufacturers, and train control providers to migrate to train-centric designs that can substantially reduce the cost and complexity associated with signaling modernization.*

Robert Hanczor  
CEO, Piper Networks

### PATENT AWARDED

U.S. Patent: *Transit Location Systems and Methods Using LiDAR* — covering Piper's process for localizing rail-bound vehicles within transit networks using advanced LiDAR technology that requires no integration with wayside equipment.



**Small form factor** — Piper's TrackSight™ LIDAR unit with UWB sensor mounted to vehicle.