HUMATICS RAIL NAVIGATION SYSTEM

PRECISION POSITIONING FOR RAIL & TRANSIT VEHICLES

Humatics' Rail Navigation System is a drop-in replacement for traditional railway odometry sensors such as tachometers, transponders, and doppler radars. Humatics' systems consist of industrial-grade ultra-wideband (UWB) beacons and Inertial Measurement Units (IMU) providing position, speed, and acceleration to vital and non-vital carborne systems for signaling, train control, train management, and passenger information.

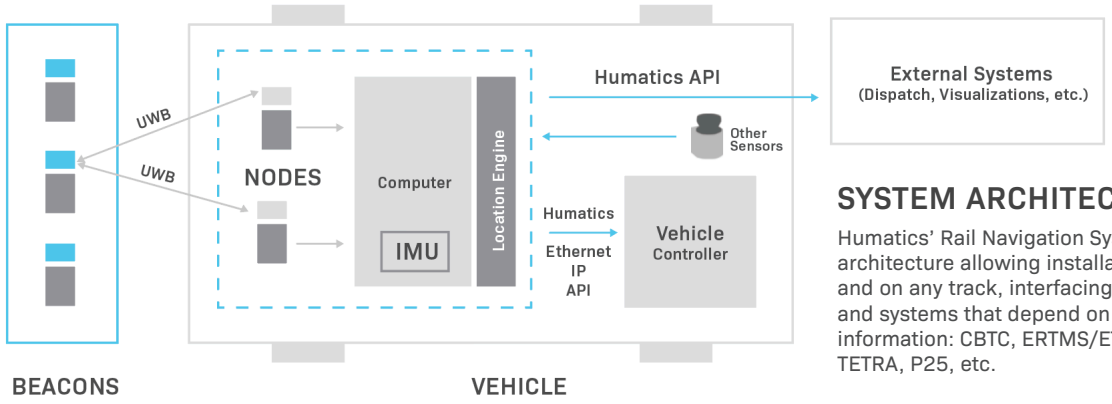
Humatics' Rail Navigation System operates similarly to satellite positioning serving as "terrestrial satellites" and works by continually ranging from carborne beacons to a constellation of UWB beacons. Given this architecture, UWB ranging is especially well-suited to augment GNSS positioning on sections of track with poor or no signal reception such as urban canyons and tunnels.

BENEFITS

1. Alternative to GNSS in tunnels, stations, depots, and urban canyons
2. Precise sub-10cm safety-critical positioning at high speed in all weather conditions
3. Longest-ranging ultra-wideband radio technology on the market

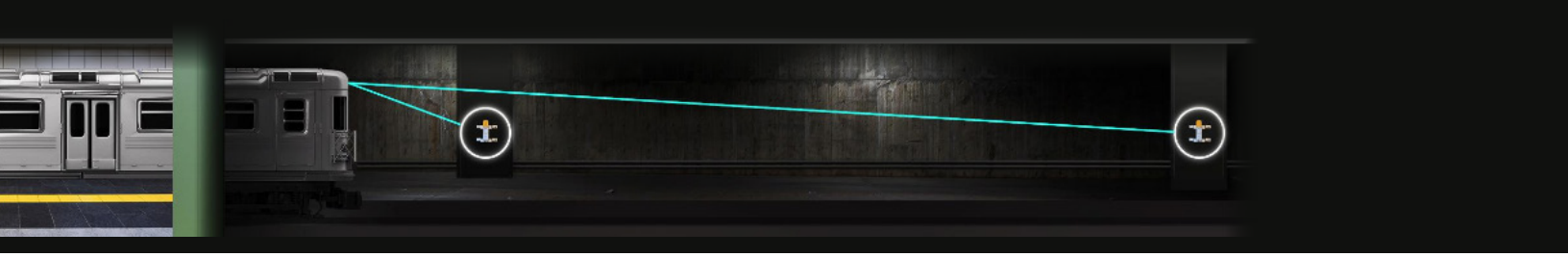
Through its high-availability and ultra-precise UWB localization network, Humatics enables safety-critical train positioning in all conditions, unlocking a variety of applications including automatic train operations, platooning, advanced driver assistance, platform door control, roadway worker safety, and emergency location services.

Humatics' engineering team develops system architectures to meet your functional requirements and Reliability, Availability, Maintainability, Safety (RAMS) targets. In the process of doing so, we balance the tradeoffs between positioning precision and cost of deployment. Alternatively, Humatics provides a robust UWB ranging API if your team prefers to integrate our UWB radios into your own navigation solution.



SYSTEM ARCHITECTURE

Humatics' Rail Navigation System has a simple architecture allowing installation within any vehicle and on any track, interfacing into vehicle controllers and systems that depend on safety-critical positioning information: CBTC, ERTMS/ETCS, PTC, TCMS, CAD/AVL, TETRA, P25, etc.



APPLICATIONS

SIGNALING & TRAIN CONTROL
Replace legacy odometry systems such as wheel sensors and track-mounted transponders. Interfaces with Communication-Based Train Control (CBTC), European Train Control System (ETCS/ERTMS), Positive Train Control (PTC), and transit CAD/AVL systems.

DRIVER ASSISTANCE SYSTEMS
Integrate with the onboard Train Control & Management System (TCMS) and Driver Machine Interface (DMI) to provide situational awareness and enable precision stops at platforms. Provide zero-speed signal and train type information to SIL-4 door controllers.

AUTOMATIC TRAIN OPERATION (ATO)
Train-to-train UWB ranging provides the ultra-precise high-frequency relative positioning information necessary for vehicle platooning. In addition, train-to-train UWB communication enables the synchronization of braking and traction between trainsets.

HI-RAIL VEHICLES AND ROADWAY WORKER PROTECTION
UWB provides the ranging and communication infrastructure for roadway worker protection systems. The positioning precision allows for making the safety-critical distinction between workers and vehicles on and off the tracks.

YARD AND DEPOT MANAGEMENT
Track buses and railcars in yards and indoor maintenance facilities. Humatics industry-leading 300m ranging distance and robustness to interference means large depots require fewer UWB beacons to achieve precise vehicle positioning.

SPECIFICATIONS

PERFORMANCE
Provides position, speed, acceleration, direction, and associated uncertainties
10 seconds dead reckoning with IMU
Proven to track vehicles traveling over 55 mph (designed for >200 mph)
Variable update rate up to 200Hz
Flexible sensor fusion with GNSS, Lidar, Eurobalise, and other commonly used odometry technologies
Diversified and redundant architecture to meet project RAMS requirements

RELIABILITY
Wayside Beacon MTBF > 600,000 hours
Carborne Node MTBF > 165,000 hours
Carborne Computer MTBF > 52,000 hours

STANDARDS	
IEC 62278 / EN 50126	Specification and demonstration of reliability, availability, maintainability and safety (RAMS)
IEC 62279 / EN 50128	Software for railway control and protection systems
IEC 62280 / EN 50159	Safety-related communication in transmission systems
IEC 62425 / EN 50129	Safety-related electronic systems for signaling
IEC 62443	Industrial Automation and Control Systems (IACS) cybersecurity
IEEE 1474.1, 1474.4	Communications-Based Train Control (CBTC)
AREMA	Communications and Signals Manual
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests
NFPA 130	Fire protection and life safety requirements for underground, surface, and elevated fixed guideway transit and passenger rail systems.
IEC 61373	Rolling stock equipment – Shock and vibration tests
IEEE 1478	Environmental Conditions for Transit Railcar Electronic Equipment
EN 50121	Railway applications. Electromagnetic compatibility

UWB	
Range:	Line of sight, up to 300 meters
Ranging Precision:	Architecture-dependent, can be as low as +/- 2cm
Operating Spectrum:	4 - 4.9 GHz
Unique beacon IDs and channel codes protect transmission and enhance security	
Real-time diagnostics available for ease of maintenance	
FCC Part 15 Compliant	

IMU
Triaxial Accelerometer, Dynamic Range of +/- 40g
Triaxial Gyroscope, Dynamic Range of +/- 2000 degrees/second

CARBORNE EQUIPMENT	
Interface:	Ethernet IP
Navigation Computer Input Power:	5-48 VDC, nominal 37.5V
Power Consumption :	< 15 Watts @37.5V
Ambient Operating Temperature:	-40C to +70C
Mechanical Shock & Operating Vibration:	IEC 61373 Compliant
Ingress Protection:	IP 67

WAYSIDE BEACONS	
Input Power:	5-48VDC
Power Consumption:	< 5 Watts
Ambient Operating Temperature:	-40 to +70C
Mechanical Shock & Operating Vibration:	AREMA Communications and Signal Manual (C&S) Compliant
Ingress Protection:	IP 67