

Seamless and Universal
GPS Coverage Extension

SubWAVE™

for Rail

GPS Coverage Extension to supp

As the **standard of location worldwide**, GPS positioning is used outdoor by rescue forces to **locate emergency calls**, and by the public to benefit from **guidance**.

With SubWAVE™, it is now available underground as well.

Improving Management

With GPS signal available underground, workers, vehicles and equipments are easily trackable. This real-time view of the assets positions in the network enables real flow optimization.

Safety of the workers is improved as well since SubWAVE™ leverages their GPS-enabled PMR

devices. Collision with trains can be avoided and non-responding worker rapidly located and rescued. As for equipment, GPS tracking can save precious time to find them, and even offer them an efficient anti-thief protection.

Even outside, GPS signal can be weakened by canopies of depots

or stations. This interruption of GPS service may induce lack of compliance towards safety regulations. With SubWAVE™, those specific areas can be provided with a continuity of service to enable PTC active management, both improving traffic and complying with regulations.



Seamless outside/inside transition

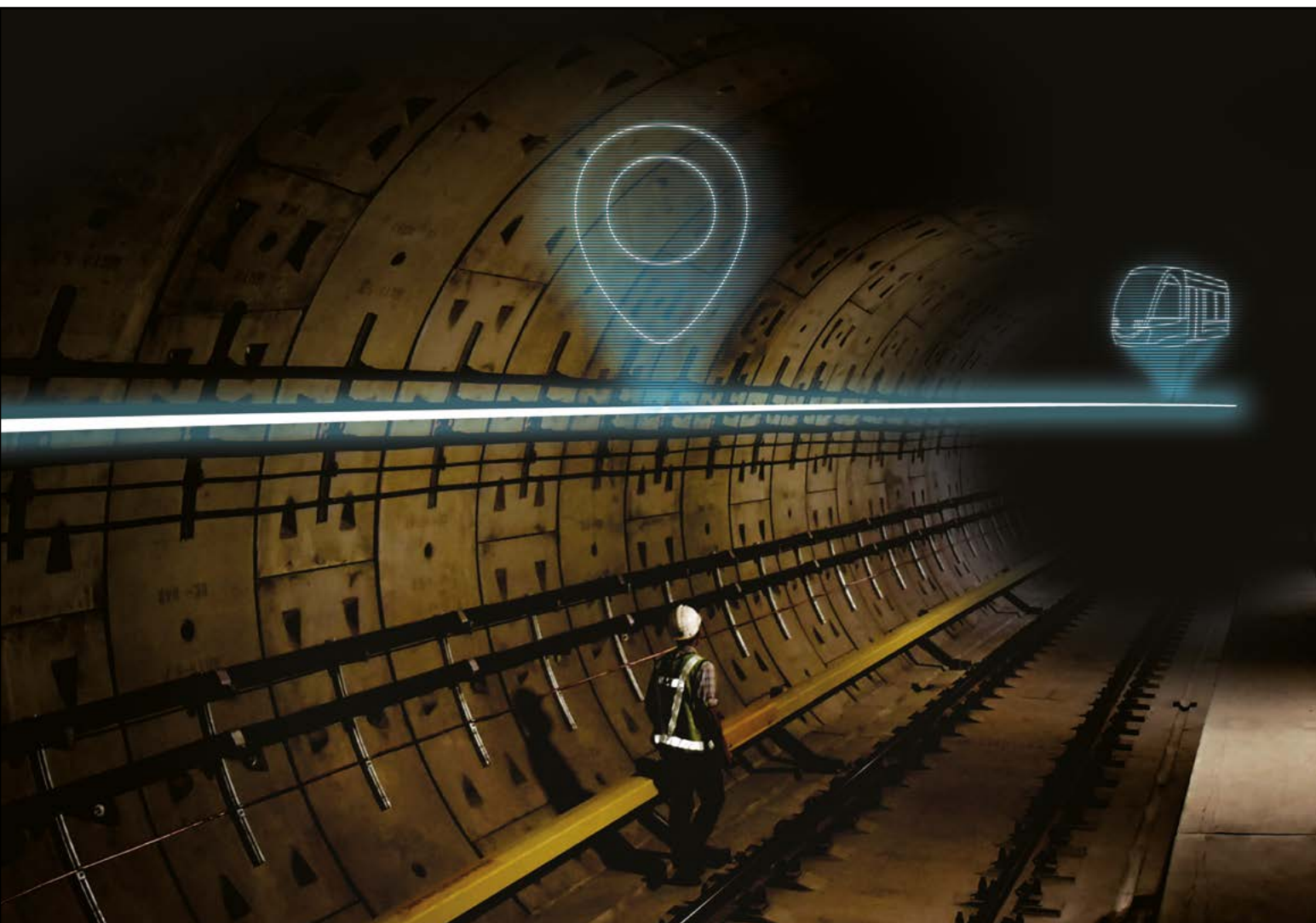


Locate vehicles, workers and equipments



PTC active enabled in depots with poor GPS coverage

Support underground operations



Increasing Performance

With GPS emulated underground, SubWAVE™ allows efficient monitoring of traffic flows. Knowing the exact position of every train in real-time, both underground and outside, traffic can be drastically optimized. Any unexpected slowdown or stop is immediately spotted and precious time to adjust is saved.

Moreover, GPS is the backbone of autonomous applications outdoor. Extending its coverage underground, SubWAVE™ enables autonomous driving trains, both for public transport or maintenance operations.

Those maintenance operations benefit as well from GPS

positioning, since spotted default like rail geometry can be precisely located with GPS coordinates, sharable with any GPS-enabled equipment.



Optimizing & monitoring flows



GPS-based Rail Geometry Maintenance



Enabling autonomous driving applications

Underground GPS Coverage to support

As the **standard of location worldwide**, GPS positioning is used outdoor by rescue forces to **locate emergency calls**, and by the public to benefit from **guidance**.

With SubWAVE™, it has become available everywhere.

Extended **Safety** for all

To enhance rescue forces response to emergencies, many safety regulations enable dispatch centers to collect the caller's information. Latitude, longitude and altitude are some of them, and GPS provides them natively on every smartphone, used 80% of the times in emergency calls.

By emulating GPS underground, SubWAVE™ can provide this crucial piece of information to dispatch centers, and help saving precious time and lives.

Moreover, rescue forces are constantly positioned with GPS, to help dispatch centers affect

resources with efficiency. With SubWAVE™, this monitoring is extended underground and rescue forces can even benefit from guidance to optimize their ETA, enhancing their response time.

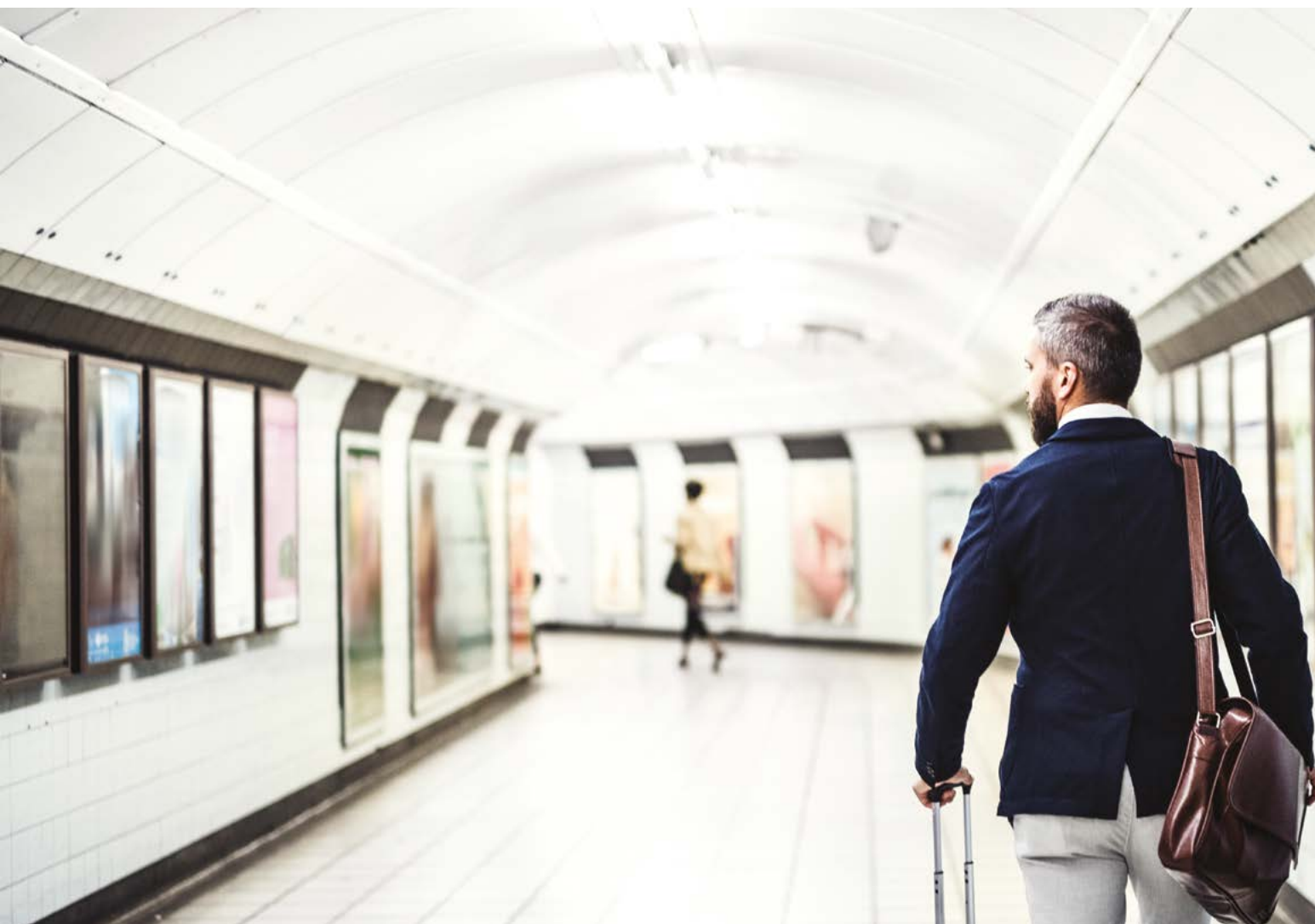


Emergency calls location



Rescue forces optimized action

rt passenger safety & experience



Enhanced Passenger Experience

GPS positioning of trains underground not only enhances traffic management: it offers precious information to share with passengers.

This feed of information can be used by passengers to better plan their journey, particularly if they

use multimodal transportation services: they can include underground trains with the same precision as if they were outside.

And with GPS available indoors, all the usual services used by the public outdoor becomes available underground. Native guidance

apps like Google Maps or Waze can be used without any additional software to install, and provide efficient itinerary considering all the parameters available.



Passenger information in
real-time



Guidance services with
native apps

SubWAVE main benefits



SubWAVE™ is a real-time GPS emulator providing signal in facilities out-of-range from natural GPS.

Using telecom network to broadcast, SubWAVE™ emulates GPS signal matching real coordinates, computable by standard chipsets.

Since almost every portable device has a GPS positioning feature, SubWAVE™ allows majority of trackers to keep working underground.

Zone-based or continuous along a path, SubWAVE™ enables efficient positioning, everywhere.

Extension of Universal technology



- ▶ Real-time GPS emulation allowing continuity of GPS service where it cannot naturally get



- ▶ Seamless transition between outdoor and underground Receivers will not even notice they switched to Synthetic GPS

Easy implementation



- ▶ Use of existing telecom infrastructure GPS signal is broadcast through leaky feeders used for coms, or antennas



- ▶ Compatible with existing equipment P25, TETRA equipment, or even smartphones equipped with standard GPS chipset

Built to evolve with your requirements



- ▶ Software-defined-radio architecture allowing remote updates New GNSS constellations, algorithms enhancing precision, etc.

Success Story



Coordinating Safety Forces in entire Stockholm transportation network with GPS

SubWAVE™ has revolutionized the coordination and efficiency of safety and emergency responses within Stockholm's extensive transportation network. Utilizing the GPS technology, the Stockholm public transport operator (SL) can precisely position and deploy its response teams both above and underground, ensuring rapid and appropriate action during incidents.

SubWAVE™ extends real-time GPS coverage to areas previously unreachable by standard signals, such as subway stations and tunnels. This innovation not only facilitates the swift movement and monitoring of assets but also significantly enhances the safety measures in place throughout the transportation network.

With SubWAVE™, the GPS functionality is no longer hindered by physical barriers, allowing continuous location tracking

of teams engaged in critical operations.

Moreover, the implementation of SubWAVE™ has made it possible to align with emergency call regulations, such as the E112, which mandates the use of GPS data to pinpoint the location of emergency calls. Now, every call made from Stockholm's subway system can be accurately located, enabling first responders to perform more effectively.

This capability is crucial for emergency situations where every second counts, helping to save lives and optimize resource deployment.

The integration of SubWAVE™ into Stockholm's transportation infrastructure exemplifies a forward-thinking approach to public safety.

It ensures that emergency forces, including rescue teams and other critical third parties, have reliable



access to accurate GPS data.

This not only enhances the performance of first responders but also instills a greater sense of security among the public, knowing that help is just a precise location report away.

Through SubWAVE™, Stockholm has set a new standard in emergency preparedness and response, saving time, money, and, most importantly, lives.

They trust us

BOLIDEN



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MADRID



SANDVIK





For more information

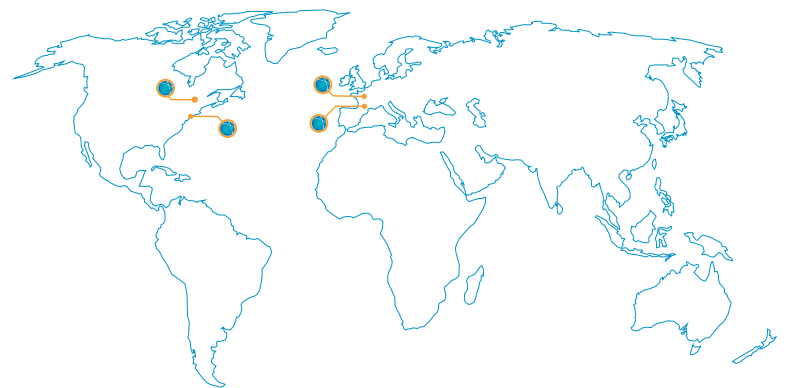
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