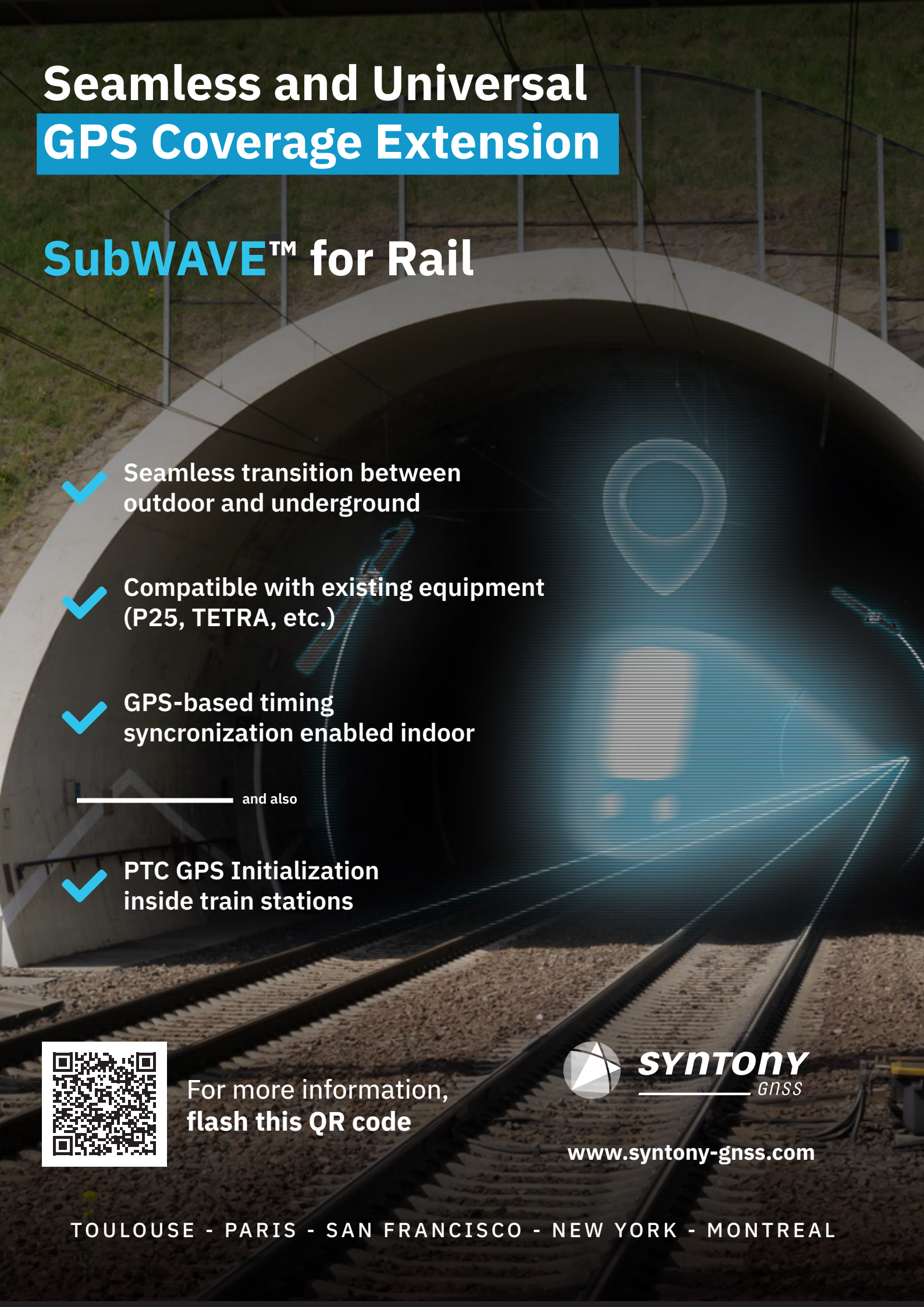

Seamless and Universal GPS Coverage Extension

SubWAVE™ for Rail

- Seamless transition between outdoor and underground
- Compatible with existing equipment (P25, TETRA, etc.)
- GPS-based timing syncronization enabled indoor

and also

- PTC GPS Initialization inside train stations

For more information, **flash this QR code**

SYNTONY GNSS

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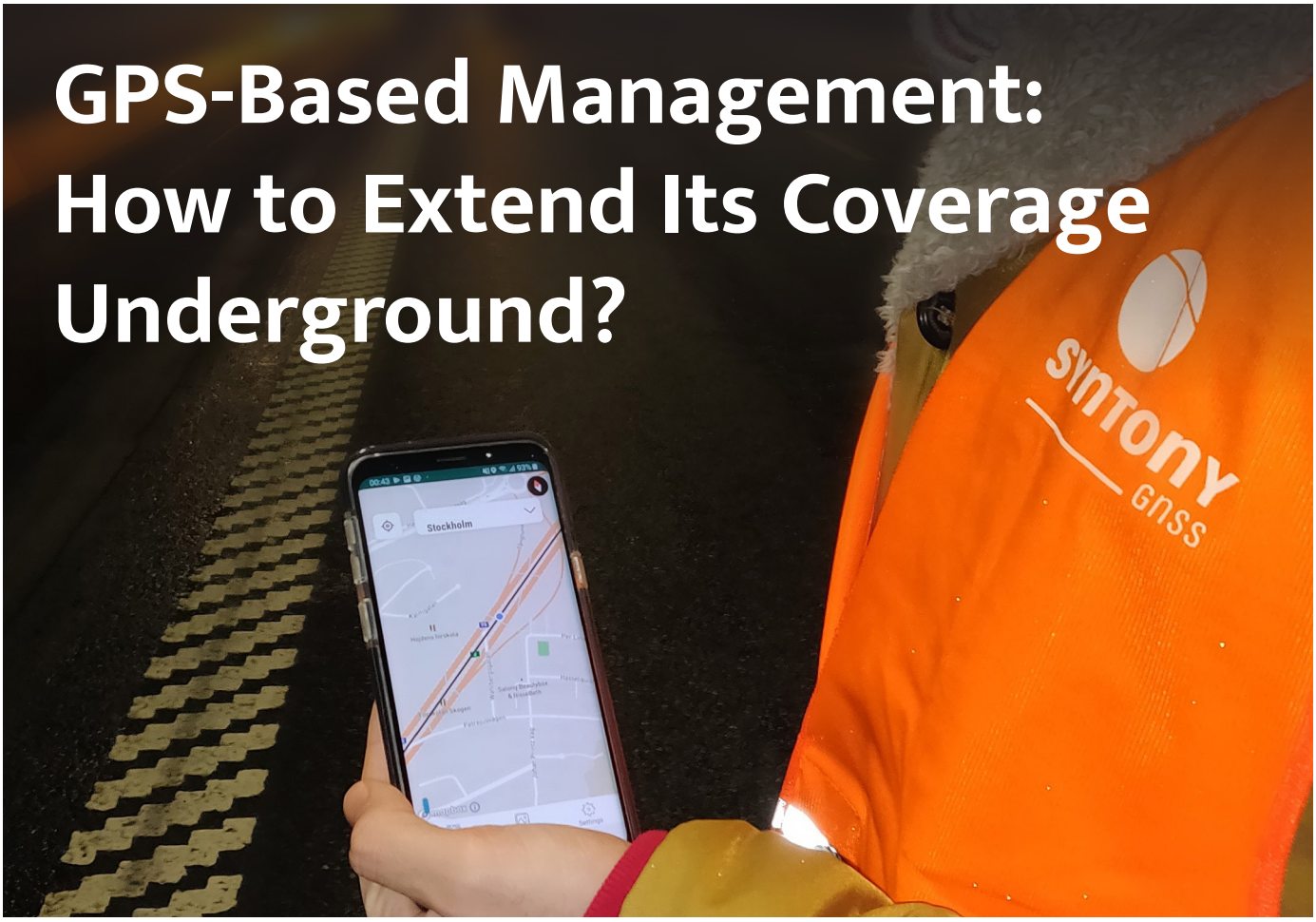

When operating a large network used by thousands of collaborators, knowing the position of every asset is essential.

For traffic management of course, and even more for safety reasons. Therefore, GPS offers the largest RF coverage to the outdoor world and is a global standard for location. GPS is universal and cheap and the data is easily sharable to optimise management. One problem remains though when entering a tunnel: the signal cannot penetrate underground, and all GPS-related technologies then become unusable.

Extending GPS Coverage

To meet the expectations of indoor location problematics, many solutions have been developed, from Wi-Fi signals in urban areas to creating a network of antennas using beacons. While those solutions answer some specific use cases, none of them completely answer all indoor problematics at once: compatibility with existing systems and receivers, scalability, compliance with all location-related use cases, and so on.

GPS had already solved that issue a long time ago: the only remaining challenge was to extend its coverage to underground areas: GNSS expert Syntony has been working on a GPS coverage extension solution: SubWAVE™. Thanks to high-precision GNSS simulators, it is now possible to emulate synthetic GNSS signals in real-time, providing all GPS receivers with seamless indoor location.

Safety for Everyone

One of the main advantages of GNSS coverage extension underground is the ability to keep an eye on the location of workers and trains to prevent potential accidents. With SubWAVE™, GPS positioning is guaranteed even when entering a tunnel. This continuity of service allows operators to use outside technologies for location within their entire network, increasing everyone's safety.

Meanwhile, workers' locations can be monitored as well, on the whole network, with GPS positioning. Both train conductors and workers can be aware of a close encounter and take appropriate measures.

In addition, since most rescue forces around the world use GNSS technologies to monitor their teams on the ground, rail tunnels equipped with SubWAVE™ GNSS coverage extension will get back on the grid. This universally accessible solution enables more efficient intervention time, saving precious lives and efforts.

Traffic Management and Maintenance Is Improved

Knowing the exact position of every train on the network, tunnels included, drastically improves traffic management. Immediately, operators can remotely spot a stopped train, even if it is in the middle of a block. Providing precise positioning on moving blocks also allows denser traffic, with a better return on investment at stake. In addition, by passing along this information, passengers can access better and more accurate information to plan their journeys, hence increasing their satisfaction.

GPS coverage extension is also a major maintenance asset. One example is track geometry operations, which can be drastically improved by positioning geometry cars and defaults with GPS co-ordinates. Indeed, GPS positioning offers accuracy, and more importantly, it is easily sharable with the teams going on intervention. Using a simple navigation app (i.e. a Google Maps-like indoor app) would cover most maintenance use-cases (e.g. maintenance defaults spotting, etc.).

Those operations can be automated with GPS-driven trains monitoring the network autonomously, reducing the risk of human errors. Using SubWAVE™, GPS positioning of those trains is accessible in real-time to all other assets in the tunnels, guaranteeing safe and optimised operations.

Finally, the lack of a GPS signal inside train stations generates safety challenges with regard to PTC navigation systems. The SubWAVE™ technology is also used to create reliable point of initialisation for locomotives inside the station, and doesn't have the drawbacks of GPS repeaters.

About SubWAVE

GNSS simulation technology transferred to the transportation industry.

SubWAVE™ is a GNSS simulator operating in real-time which uses existing telecom infrastructures (e.g. leaky feeders) to broadcast synthetic GNSS signals. Depending on the geometry of infrastructures, different modes can be offered by SubWAVE™, each answering different sets of needs.

SubWAVE™ Modes

- Zone mode: a static position is provided for an entire area – every asset in that area computes the same co-ordinates, corresponding to the configured SubWAVE™ zone.

- Continuous mode: the receiver's position moves as the user does, along the axis of the leaky feeder cable (whether it is a straight or curved cable). Augmentation software enables high-accuracy positioning.

Adapting GNSS Simulators to Real Environments

One single SubWAVE™ simulator can cover up to 12 different SubWAVE™ zones, or six SubWAVE™ continuous/extended areas.

It has been designed to match existing telecommunication infrastructures, using existing leaky feeder cables (or antennas) to emit synthetic GPS over the area.

Compatibility with All GPS-Enabled Systems

Systems that were already working outside, using the genuine GNSS signals, will now work transparently when going inside. For example, radio communication sets like TETRA or P25 (which are GPS-enabled), only need a GPS signal to provide positioning. SubWAVE™ brings this emulated GPS signal, in real-time and with a seamless transition between outside and inside. Without changing anything in the TETRA/P25 system, adding SubWAVE™ underground will extend GPS coverage to previously unreachable areas where the corresponding assets were not able to provide a position because of the absence of GNSS signals.

A Proven System

SubWAVE™ has been providing GPS in the metro of Stockholm since 2017. It is currently being implemented by major road tunnel operators, as well as large subway operators in Europe and the US.

About Syntony GNSS

Syntony GNSS designs and manufactures positioning, navigation, and timing (PNT) solutions and products. Specialised in simulating global navigation satellite system (GNSS) signals from all available constellations (GPS, Galileo, GLONASS, QZSS, NavIC IRNSS, BeiDou), Syntony also develops high-end and low-consumption receivers.

The company is headquartered in Toulouse, France, and has offices in Paris, San Francisco, New York, and Montréal. Its products also benefit from a large distributor network all around the world.

Request more information about Syntony's products and solutions at **contact@syntony.fr**.

Or visit **https://solutions.syntony-gnss.com/gps-coverage-extension-rail**