



EU SPACE FOR RAIL

Driving the digitisation of the rail sector

#EUSpace 





Driving the digitisation of the rail sector with the power of the EU Space Programme



Urbanisation, population growth, new technologies and an increasing demand for sustainability are all factors contributing to a new era of mobility – an era that will be defined by intermodality and advanced transport solutions.

However, building such a complex, intermodal future requires the close cooperation of all stakeholders and service providers, including freight and passenger services. The European Union has positioned rail as the backbone for transporting people and goods. It's also supporting a number of large projects aimed at delivering a smarter, more efficient rail infrastructure and ensuring that rail becomes the transport mode of choice and one that helps the EU achieve its climate objectives.

In addition to building the physical rail infrastructure, these projects are working to bring Europe's rail sector into the Digital Era – a process that depends on EU space technology, including Global Navigation Satellite Systems (GNSS) and Earth Observation.

More efficient signalling, better information and increased capacity

GNSS is already being integrated into the new digital applications that provide real-time travel information to passengers and monitor the condition of freight and other cargo assets. GNSS can also help make railway signalling more efficient. For example, as part of the European Rail Traffic Management System (ERTMS), GNSS can provide reliable, on-board localisation. This can help achieve dynamic capacity management, improve performance and cost efficiency and bolster the competitiveness of European railways.

In the future, GNSS-based localisation could also help increase the capacity of the railway network by enabling moving blocks or virtual coupling, both of which can reduce the infrastructure cost associated with the signalling used on low traffic density and capillary lines.

Towards safety and integrity

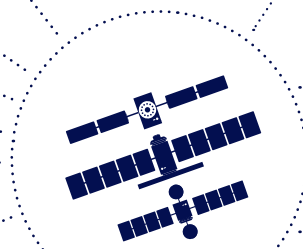
GNSS' use in the rail sector has been limited to non-safety applications, such as asset management and passenger information services. However, this could soon change as new technological studies have demonstrated that, when both augmented and complemented by other sensors, GNSS can meet the rail sector's stringent requirements for safety and integrity.

The EU Agency for the Space Programme (EUSPA), together with European rail and space stakeholders, has developed a roadmap for the adoption of GNSS in rail signalling and to ensure its use is established in ERTMS specifications.



Galileo, EGNOS and Copernicus support:

- Fail-safe train localisation in railway signalling (ERTMS)
- Cost-efficient regional lines
- Digital and automated train operations
- Asset monitoring
- Competitive, digital and green rail freight
- Reliable passenger information systems
- New prediction models for rail infrastructure maintenance
- Increased capacity of existing infrastructure
- Enabling technology for integration with other modes of transport (MaaS)



The EU Space Programme's direct benefits to rail

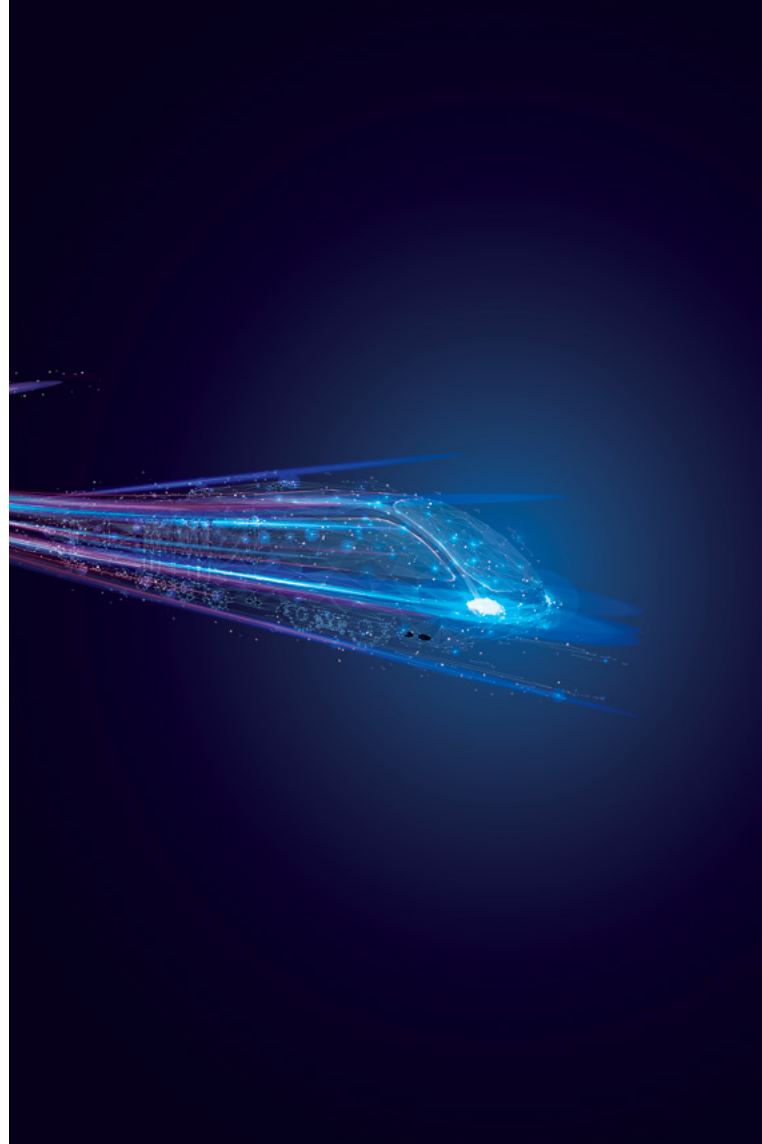
- Helps infrastructure managers mitigate vegetation encroachment and facilitates efficient workforce planning
- Detects ground displacements, identifies trends and sends alerts in case of risks
- Enables visibility of rail cargo in transit
- Improves availability and accuracy and delivers integrity for safe train localisation
- Reduces the need for physical balises and helps reduce operational costs
- Supports driver advisory systems and increases performance (punctuality, timetable stability, energy saving, capacity)
- Optimises line capacity by reducing headway between trains

The added value of EU Space Technology

GNSS is already a cornerstone of railway digitalisation, playing an important role in non-safety related applications (e.g., asset management). In the future, GNSS will also be used for safety-related applications, such as Command and Control Systems. Such use is expected to increase railway network capacity and decrease operational costs, making rail both more efficient and attractive.

The European Geostationary Navigation Overlay Service (**EGNOS**) helps further improve the accuracy and integrity of train localisation. EGNOS' adoption by the ERTMS will enable safe use of GNSS, reducing the sector's dependence on expensive trackside infrastructure. Currently, a number of EU-funded projects are developing solutions capable of delivering the expected level of performance for rail applications using GNSS with EGNOS augmentation.

Copernicus contributes to the overall safety of the rail network by providing railway infrastructure managers with information on risk exposure in relation to vegetation encroachment, landslides and floods. Thanks to its capacity to detect millimetre-scale ground movements, in the future, EO will also play an increasing role in monitoring track deformation and infrastructure health.



EGNOS and Galileo synergies

Together, Galileo and EGNOS ensure integrity, improve availability and enhance accuracy for safety-critical applications such as railway signalling.

ERTMS is a major industrial project that aims to replace Europe's different national train control and command systems with a single, coordinated solution. Its deployment will enable the creation of a seamless European railway system with aligned signalling, which is essential to increasing the competitiveness of European railways.

Galileo, Europe's flagship global satellite navigation system (GNSS), and EGNOS (SBAS) will actively contribute to the evolution of the ERTMS. The R&D projects currently happening within both EUSPA and Europe's Rail Joint Undertaking will ensure that European GNSS is fully adopted within the ERTMS. When it is, EU citizens will benefit from reduced railway operational costs, improved safety on regional and low-density lines and accurate passenger information services.

Space technology for a greener future

The use of space technologies also contributes to achieving the objectives set out by the [European Green Deal's Sustainable and Smart Mobility Strategy](#). The European Commission not only recognises the benefits of rail as a safe and smart mode of transportation, but also as a sustainable one.

Responsible for less than 0.5% of all transport-related greenhouse gas emissions across the EU, rail is one of the most sustainable forms of passenger and freight transport. No wonder the Green Deal sees an increase in rail as being vital to becoming climate neutral by 2050.

EU Space puts rail at the heart of an intermodal world

Although Galileo, EGNOS and Copernicus each offer the rail sector a unique tool set, EU Space offers even more benefits when used in synergy. Compared to legacy solutions, the synergistic use of these programmes can increase safety while also reducing the cost of infrastructure management.

Enhancing rail's attractiveness:

- Passenger information systems
- Rail freight visibility

Streamlining maintenance:

- Condition-based maintenance
- Infrastructure monitoring (used to monitor trackside vegetation, landslides and track deformation)
- Predictive maintenance

Improving safety:

- Enhanced Command and Control systems
- Trackside personnel protection systems

Optimising train driving:

- Driver Advisory Systems (DAS)
- Fleet management

EU Agency for the Space Programme

EUSPA provides safe and secure European satellite navigation services and promotes the commercialisation of Galileo, EGNOS, and Copernicus data and services. It also coordinates GOVSATCOM, the EU's governmental satellite communications programme, and is responsible for the Programme's Space Surveillance and Tracking (SST) Front Desk operations service. By fostering the development of an innovative and competitive space sector and engaging with the entire EU Space community, EUSPA contributes to the European Green Deal and digital transition, the safety and security of the Union and its citizens while reinforcing its autonomy and resilience.

The EU Space Programme

The EU Space Programme, composed of Galileo, EGNOS, Copernicus, GOVSATCOM, Space Situational Awareness and IRIS², is the first integrated space programme created by the European Union to support its space policy, address societal challenges such as climate change and technological innovation, support the EU internal market – and more.

Galileo

Galileo is Europe's Global Navigation Satellite System. It provides accurate, reliable and precise positioning, navigation, timing and safety services. Galileo is designed to provide Europe and European citizens with independence and sovereignty while creating a multitude of services and applications across sectors, ranging from aviation and maritime to agriculture and location-based services.

EGNOS

The European Geostationary Navigation Overlay Service (EGNOS) is Europe's regional satellite-based augmentation system (SBAS) used to improve the performance of global navigation satellite systems like GPS and soon, Galileo. EGNOS uses a set of geostationary satellites and a network of ground stations to increase the accuracy of existing Global Navigation Satellite Systems.

Copernicus

Copernicus is the European Union's Earth Observation programme, looking at our planet and its environment to benefit all European citizens. It offers information services that draw from satellite Earth Observation and in-situ (non-space) data.

IRIS²

The IRIS² Satellite Constellation is the European Union's answer to the pressing challenges of tomorrow, offering enhanced communication capacities to governmental users and businesses while also ensuring high-speed internet broadband to cope with connectivity dead zones.

GOVSATCOM

The EU GOVSATCOM initiative will ensure the long-term availability of reliable, secure and cost-effective governmental satellite communications services for EU and national public authorities managing security critical missions and infrastructures.

Space Situational Awareness

To mitigate collision risks between EU Space satellites and other spacecraft and debris, the EU established a set of capabilities through the Space Situational Awareness (SSA) component of the EU Space Programme. An integral part of SSA is Space Surveillance and Tracking (SST). SST uses a network of ground- and space-based sensors and other infrastructure to survey, track and protect EU Space assets from artificial space objects orbiting Earth (mostly debris from launchers or satellites).

Interested in learning more about EU Space for rail?

Download the EUSPA EO and GNSS Market Report here:



Linking space to user needs

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