

E-GNSS IN RAIL SIGNALLING

ROADMAP

EUSPA

EUSPA- FUNDAMENTAL ELEMENTS

INDUSTRY & USER DRIVEN INITIATIVES

EUSPA R&D ACTIVITIES

ESA ACTIVITIES

ERA & RAIL STAKEHOLDERS WITH
EXTERNAL EUSPA AND ESA SUPPORT

EUSPA/ERA

Coordination of the roadmap with rail (e.g. EUG/CER) and GNSS stakeholders and support user and industry initiatives (e.g. UNIFE/UNISIG or Shift2Rail) from GNSS perspective through H2020, consultancy and involvement of experts and institutions from GNSS fields (ESA, JRC, ESSP...). EUSPA also coordinates the user consultation platform for validation of user requirements and progress towards adoption of GNSS in rail signalling with participation of railway users and industry experts

ESA

Support GNSS and Rail stakeholders in coordination with EUSPA in the field of user requirements, architecture and system concept design, and laboratory testing, especially in connection with receiver development

SHIFT2RAIL

Finalisation of GNSS-based Train Positioning architecture and support with testing and certification activities (through S2R Members and Open call projects).

R&D LANDSCAPE

X2RAIL2

Based on definition and quantification of GNSS parameters relevant for the signalling application in railway environment carried out within NGTC, the X2Rail2 project defined Architecture of the train positioning subsystem provided as input to the EUSPA CBA

X2RAIL5

Activities will continue and close research started in X2RAIL-2, and so, in two parallel work streams. Once maturity is reached, the project will work on identifying commonalities and synergies for an option for a possible single solution.

- Development of Virtual Balise Train Positioning System demonstrators, to define and develop VB Train Positioning system prototypes able to use different technology solutions.
- Development of Stand-Alone Fail-Safe Train Positioning System demonstrators to assess the feasibility of the solution

ERSAT GGC

Contribution to the certification process enabling EGNSS adoption through delivery of a certified enhanced functional ERTMS Architecture that includes the SIL 4 train positioning function also based on the Galileo constellation and the EGNOS Augmentation.

CLUG

Mission analysis/needs identification and a preliminary feasibility study of an on-board multi-sensor localisation unit consisting of a navigation core (IMU, tachometer, etc.) brought in reference using GNSS, track map and a minimal number of reference points;

RAILGAP

Implementation of tools for designing high integrity and accuracy ground truth and digital trackside map indispensable for train positioning with EGNSS and other sensors

HELMET

Development of a shared high integrity and high accuracy platform for Train signaling and other applications such as connected and driverless cars or UAV for surveillance of roads and railways.

RADIUS

Development of a drone-based technology to monitor the physical status and electronic functionality of both non-safety-critical and safety-critical railway signalling assets and to execute specific maintenance activities

Continuation of EUSPA funded R&D program within the Horizon Europe framework focused on closing the gaps towards EGNSS use in railway signalling

STARS

The assessment of the E-GNSS performances achievable in the railway environment

CBA

Independent cost benefit analysis based on final technical architecture and operational scenarios

Availability of certifiable EGNSS train positioning service for ERTMS

CERTIFICATION AND GNSS SERVICE DEVELOPMENT

Development of the rail certification roadmap

Integrity concept design and EGNSS service definition and development aimed towards delivering a Rail EGNSS service enabling the achievement of the required safety levels in ERTMS

ERGO – Panel of experts in Rail for EGNSS operational use

Validation of user needs and requirements for rail signalling and train control applications
Validation of integrity concept, EGNSS-based rail safety service definition and service provision scheme tailored for the rail community

Implementation of EGNSS in rail mission studies/ERGO conclusions and development of the EGNSS Rail service

SYSTEM STUDIES, LABORATORY TOOLS AND TECHNOLOGY SUPPORT

- Activities for development of laboratory tools such as a GNSS simulation testbed and comprehensive multipath, EMI and intentional interference (spoofing and jamming) models to support testing of equipment in railway environments under nominal conditions and fault injection
- GNSS receiver technology support activities focusing on advanced integrity algorithms and techniques, hybridisation, and resilience against intentional interference
- System studies focused on broad PNT solutions (SBAS/GBAS/hybrid/ARAIM), in particular SBAS, to support attainment of required integrity performances for GNSS positioning in ERTMS (EGNOS Evolutions – EGNOS Next)
- Activities for demonstrating technologies in the field (Space4Rail initiative)
- Continuation of cooperation with EUSPA including facilitation of R&D initiatives focused on the associated changes in ERTMS

RECEIVER DEVELOPMENT

Preparation of the Rail Fundamental elements call focusing on receiver development

EUSPA Fundamental Elements programme -Receiver prototype development, based on the requirements identified in frame of R&D activities carried out within EUSPA, S2R or ESA R&D programmes

Continuation of the Fundamental elements programme depending on resources availability, focused on prototype operational testing and validation + development of the final receiver/antenna

USER INVOLVEMENT

Performance tests in frame of R&D and joint activities with UNISIG (H2020 2nd call STARS):

- Definition of railway environment regarding future use of E-GNSS
- Validation of E-GNSS performance in geofenced rail environment (focus on EGNOS & integrity)
- Analysis of multipath and its impact on safety

Finalisation of user requirements linked with GNSS

Finalisation of train positioning subsystem architecture using GNSS

ERA/EUG/S2R Implementation of technical solution into ERTMS specifications

Change Request 1368

Decision on inclusion of EGNOS corrections in the technical specification for interoperability

2019

2020

2021

2022

2023

2024

2025

THE EUROPEAN UNION AGENCY FOR THE SPACE PROGRAMME IS WORKING TOGETHER WITH RAIL AND SPACE STAKEHOLDERS TO ENABLE THE USE OF SATELLITE-BASED LOCALIZATION FOR RAILWAY SIGNALLING

At the heart of this multi-stakeholder initiative lies the European Train Control System (ETCS), which is now being adopted both in Europe and beyond, as one of the components of the European Rail Traffic Management System (ERTMS). At present, in ETCS the positioning of the train is based on "balise", a physical element mounted at specific intervals along the railway track. The goal is to ensure that wherever possible, the physical balises can be replaced by virtual ones, based on precise, GNSS-based positioning without any operational or safety implications on the ETCS. The roadmap below summarises the main projects currently running and planned, as well as the involvement of the various stakeholders interested to achieve the objective of E-GNSS enabled ETCS together with the EUSPA.