

USER CONSULTATION PLATFORM 2020

MINUTES OF MEETING OF THE RAIL MARKET SEGMENT PANEL

Meeting Date	02.12.2020	Time	09:00-13:45
Meeting Called By	GSA	Location	Online event
Minutes Taken By	Juliette Marais (ESSP) based on the minutes from Virginia Antón (ESSP)	Next Meeting Date	UCP 2022
Attendees	<p>Daniel Lopour (GSA), Panel moderator Juliette MARAIS (Uni. Eiffel), Panel coordinator</p> <p>User Community Representatives Gabriele Ridolfi (ERTMS User Group), Panel Users' Chair</p> <p>Speakers: Cristina Ananasso (European Commission) Michael Roth (DLR) Valentin Barreau (SNCF) Alessandro Neri (Radiolabs) Juliette Marais (Uni. Eiffel) Silvia Porfili (GSA)</p> <p>Altogether, 99 rail/space community members attended the rail session.</p>		
Distribution (in addition to attendees)	UCP Plenary, GSA, Public		

Agenda Items	Presenter
GNSS applications and GSA activities in Rail	Daniel Lopour (GSA)
R&D initiatives overview <ul style="list-style-type: none"> - SIA project (15 min) - CLUG project (15 min) - HELMET project (15 min) 	Michael Roth (DLR) Valentin Barreau (SNCF) Alessandro Neri (Radiolabs)
Copernicus services overview and applications for Rail transport	<i>Cristina Ananasso (EC)</i>
Overview and update of user requirements	Juliette Marais (Uni. Eiffel)
Update on new servicers and R&D strategy <ul style="list-style-type: none"> - EGNSS Rail service mission studies and receiver development - Galileo HAS update - OSNMA update and requirements on authentication R&D/innovation questionnaire	Silvia Porfili (GSA) Daniel Lopour (GSA)
Preparation of session conclusions	Juliette Marais (Uni. Eiffel)

Final Q&A	
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Summary

The *Rail Market segment* panel of the third User Consultation Platform (UCP) took place on 2 December 2020 as an online event. The panel gathered up to 77 participants with comprehensive coverage in terms of value chain.

As introduced by Daniel Lopour, non-safety relevant applications represent an important part of EGNSS users when R&D mainly deals with safety-relevant ones.

Since 2019 and the Vienna workshop, some important progresses have been made, in particular with a proposal of Change request to the CCS TSI, as well as ongoing or recently selected projects.

The presentations of ongoing or just finished projects allowed sharing information about recent progresses before discussion. Debates and Q&A have highlighted the remaining challenges:

- The use of EGNOS is required in order to reach both accuracy and integrity requirements. However, its reception, and a concept for railway particularities are investigated and identified as a main topic for R&D.
- The need of the map for localization is increasing. It is investigated for different services: track-constrained localization, integrity check or in order to build predictive satellite visibility maps. Discussions have addressed the need for common specifications, cost target, integrity and update of the map, or stability in time. Daniel Lopour informed that a R&D project is about to start to work on the generation of railway maps and ground truth.
- The environments crossed by trains are complex with an infinite number of configurations. One of the main issue remains to deal with the local effects. The community expressed the need for a receiver capable of facing these environments and answering the railway specific needs.
- Finally, rail will need standards for performance evaluation and certification.

Applications of GNSS in the rail domain cover a large diversity of domains: service to passenger, information for a better operation of the system (monitoring of vehicles, of assets, of defaults on tracks...), trackside worker protection and signalling in the framework of ERTMS in Europe but also for applications outside Europe. The report on user needs already list most of these applications, except train supervision, enhanced odometer or speed measurement that are requested by the UCP to be added.

Railway operation relies on a complex set of operations. Localization is not always used in the deployed solutions and is at the stage of investigation. The definition of the requirements can be difficult because dependent of the architecture or solution that will be selected. For some applications with ongoing progress, the UCP requested to postpone to next editions (ex: Train integrity). For some others, the participants proposed to refine the definitions for the next edition (ex: odometer calibration or level crossing protection).

Participants finally conclude on the interest of such events to share progresses and requirement expressions. Despite the variety of applications and requirements, the community wishes a single solution capable of answering multiple applications if possible. The mutualisation work will help reaching this solution.

Minutes of Meeting

Election of the users' chairperson

Gabriele Ridolfi (ERTMS Users Group) was elected as chairperson.

Welcome and introduction

After a video introduction from Fiammetta Diani – GSA, Daniel Lopour welcomed the participants and introduced the agenda and objective of this session. The session is composed of several parts: first one about the current status of rail R&D projects and main achievements of this year in Rail; Second part is devoted to the review of rail GNSS requirements definition; last one focused on new services and R&D strategy.

Next year, GSA will become EUSPA encompassing both EGNSS and Copernicus. Thus, an additional objective of this year UCP is to try to enlarge the user community including Copernicus users to find synergies with EGNSS.

UCP documents will be updated with the user needs collected through the different sessions for a future edition.

GNSS applications and GSA activities in Rail

Daniel Lopour presented the wide range of activities trying to link space to user needs, from operations and security to service development and market development.

GSA aims at positioning EGNSS as a leader in segments where its features make a difference. Rail segment is a very important segment in this context. In a longer term, the objective is to have a complete market uptake in the regulated market segments, which include rail. This will lead to increase the competitiveness of EU downstream industry.

Daniel Lopour provided an overview of the main European players implementing GNSS for asset management applications, mainly tracking devices for freight wagons and containers. This is part of non-safety critical applications, which represent today an important part of EGNSS users.

In safety-related applications, GSA aims at introducing EGNSS within ERTMS as soon as possible. GSA supports activities in this objective: ERSAT EAV, RHINOS, STARS, ERSAT GGC. These projects have already concluded with good results. Additional projects are starting now (e.g. CLUG, HELMET).

A major step was reached during the conference in Vienna in 2019 supported by ERA S2R and GSA that set the basis for the first concrete step towards GNSS in ERTMS. This resulted in a Change Request proposal (CR1368) to the CCS TSI (Control Command and Signalling - Technical Specifications for Interoperability) whose objective is to ensure availability of EGNOS correction data in ETCS onboard through the EURORADIO. The proposal supports GNSS augmentation service in ERTMS with a technology-neutral approach. EGNOS corrections are the first step and a pre-requisite for safe use of GPS/Galileo-based localization in ERTMS in Europe.

The CR1368 documents prepared by GSA, ESA, ESSP and EUG were delivered to the EUG in 2020 and are currently being analysed. These documents aim to facilitate possible inclusion of GNSS augmentation in the TSI2022 as the first step towards GNSS adoption within fail-safe train localization in ETCS.

Daniel Lopour concluded thanking all the players including namely ESA, ESSP, Shift2Rail, ERA, EUG, CER and UNIFE as well as all the rail and space stakeholders for their effort aimed at introduction of EGNSS into ERTMS in the future.

R&D initiatives overview

On-going projects have then been invited to present their updates.

SIA project: System for vehicle infrastructure Interaction Assets health status monitoring

SIA main objective concerns the development of four ready-to-use new services (iWheelMon, iRailMon, iPantMon and iCatMon) providing prognostic information on the health status of the railway's most demanding assets in terms of maintenance costs (wheel, rail, pantograph and catenary). These new end-to-end EGNSS services will help to reduce the 15% of railway maintenance costs, 25% of maintenance unscheduled events and 15% of derailments associated to the rail-wheel interface. In terms of EGNSS localisation techniques, SIA has developed a positioning algorithm testing tool and a low-cost positioning solution that will provide high accuracy and high availability in the railway environment.

Questions & answers

How accurate is the information used?

For the onboard solution: 100% availability, 20 meters accuracy. For the back-office solutions they achieve decimetre accuracy (track-selective)

Is the solution is based on hybridization and PPP, how good is the convergence time?

A filter is used to provide a faster convergence.

Is the map used to improve the post-computed position? If so, is it a costly process in terms of computation effort?

Map is an essential component in the post-processing solution and is not very costly. The process is offline with each journey (from start to stop) processed separately.

Does SIA make use of augmentation info?

EGNOS was investigated for the online positioning

CLUG project: Certifiable Localisation Unit with GNSS

Valentin Barreau, from SNCF, introduced the CLUG project (started in January 2020 for 2 years) which builds on the use of GNSS coupled with other sensors (such as IMU and odometer) to provide a continuous and accurate train localisation that could be integrated in the future ERTMS. It aims at the removal of balises and points to ERTMS Level 3 and moving block as a final target. Main objectives deal with mission requirements, architecture definition, definitions of process for prototypical certification of the location unit and demonstration.

The CLUG concept relies on the development of a Train localisation on board based on a multi-sensor that will use GNSS but also IMU (Inertial Measurement Unit), Tachometer, or digital map. The project will address different concepts such as Digital map definition, the fusion algorithm, the integrity concept and the certification.

A special action is devoted to EGNOS augmentation that is required to meet performance requirements for safety critical operations (accuracy and integrity). Performance based on DFMC service EGNOS v3.2, however, is not sufficient for railway needs. Indeed, rail needs a different integrity concept from aviation and railway performance requirements are more stringent. EDAS will take an important role in the dissemination of corrections in addition to the GEO broadcast.

CLUG project started a measurement campaign in November 2020 and delivered first results that will soon be available on the project website.

Questions & answers

The panel of applications is large, did you define different requirements for each of them or a unified set of requirements?

For the user's requirements we collected the requirements of each application separately, since not only the performance requirements, but also safety requirements may differ. For some applications, such as ATO, the requirements depend on the implementation project and could only be defined here as an example. A localization system definition and design, however, combines the requirements as much as possible.

Map is used for the integrity process. Does it mean that you assume that map is safe? And if yes, how? How and how often the map is considered to be updated so that it can be used for integrity process?

Integrity is based on SBAS + digital map. No ARAIM is used. The map is assumed to be safe.

HELMET project: High integrity EGNSS Layer for Multimodal Eco-friendly Transportation

Alessandro Neri, from Radiolabs, presented the HELMET project. The HELMET project intends to exploit the synergies between rail and road. The main objective of HELMET is to develop innovative EGNSS applications capable of impacting eco-friendly and green transportations modes (connected and driverless cars, train signalling, UAV for surveillance of roads and railways).

The concept relies on the assumption that Railways and Highways are very often close to each other and share the same electromagnetic (EM) environment and similar requirements. This proximity allows the augmentation network and communication network to be shared between rail and road.

The project designed a multimodal architecture, including SBAS, GPS and Galileo Ground Services in order to reach decimetre accuracy. The project also proposes some mitigation measures to the hazards in the urban scenario, mainly to multipath EM interference

Questions & answers

Sensor fusion has been specifically mentioned in HELMET. What type of algorithms are employed?

Kalman filter is used, in addition they are considering to use ARAIM concept used in avionics. Computational complexity is a challenging part. FDE is the key.

It was remarked, that similarities have been observed during the presentations. Requirements for the receiver must be well defined. Digital map has been also a recurrent topic. Additionally, it was discussed, that Digital maps are already used and are quite stable along time. In presence of new infrastructure or temporary obstacles, the stability in time of satellite visibility maps was questioned.

Copernicus services overview and applications for Rail transport – European Commission

Cristina Ananasso, from the European Commission, introduced the Copernicus programme and how to take benefit of Copernicus in rail.

Copernicus is an Earth Observation programme focused on providing services. All the data and the products are open and free. Some examples of Copernicus services could benefit to railway stakeholder such as: On demand mapping (rapid mapping, risk and recovery mapping), early warning and monitoring (Floods, fires, draughts).

Update of user requirements

Juliette Marais introduced the objective of the session. A report on rail user needs has been published already and updated after the last UCP in 2018. The report aims to be a living document, to be updated regularly with the progress of R&D activities and the development of technology. The objectives of the UCP are to update the list of applications, to add new requirements and to update existing requirements.

As first step, the application list was updated. A list of Applications is already identified in the RUR and described. A poll has been proposed in order to identify the interests of the participants regarding this list. **Track integrity** and **train length monitoring** were the most voted applications in the poll, followed by **odometer calibration** and **track identification**. Every proposed application collected some votes and it was decided to not remove any of them. It was suggested to include train supervision and speed measurement, furthermore it was agreed to consider enhanced odometry.

Further discussion focused on general assumptions relating to requirements. About continuity, it was explained that although the current concept of balises does not require continuity, the PNT solution must guarantee continuity, for instance if GNSS positioning is used for odometry.

It was mentioned that same continuity to odometry must be requested to a system that substitutes odometry. The key is how to apportion this requirement among the different components. It was agreed to keep continuity at least for ETCS related applications. Considering the discussion, an identified further task will be to define it considering railway needs.

Stakeholders agreed that PNT solution shall be available over the whole EU Rail network. It was also discussed that we should even enlarge coverage further than European coverage for business opportunities.

The participants validated the assumption that general availability of the application is defined regardless of the environment where the train is running. Additionally, it was also agreed that it is not necessary to distinguish the type of environment.

Modifications to requirements compiled the Report on User Needs and Requirements (RUR):

Requirement ID	Proposed change
GSA-MKD-USR-REQ-RAI-0220	Accuracy is not the target of such an application but more the probability of being in the right track
GSA-MKD-USR-REQ-RAI-0070	PNT accuracy can be defined along track only (as long as track identification is ensured)
GSA-MKD-USR-REQ-RAI-0860	To be decommissioned
GSA-MKD-USR-REQ-RAI-0870	To be decommissioned
GSA-MKD-USR-REQ-RAI- 920	To be decommissioned
GSA-MKD-USR-REQ-RAI- 985	To be decommissioned
GSA-MKD-USR-REQ-RAI-0986	To be decommissioned
GSA-MKD-USR-REQ-RAI-0640	The PNT solution shall provide the train position with a horizontal accuracy of 10m or even more along track.
GSA-MKD-USR-REQ-RAI-0985	To be decommissioned
GSA-MKD-USR-REQ-RAI-0986	The PNT solution shall have a update rate of 60s
GSA-MKD-USR-REQ-RAI- 0990	To be decommissioned
GSA-MKD-USR-REQ-RAI-0995	To be decommissioned
GSA-MKD-USR-REQ-RAI-0996	The PNT solution shall have a update rate of 30min
GSA-MKD-USR-REQ-RAI-1020	To be decommissioned
GSA-MKD-USR-REQ-RAI-1025	To be decommissioned

New requirements to be added to the RUR:

- Enhanced odometry application
- Speed measurement
- Train Supervision

Actions:

- Level crossing protection: work on the context description and to evaluate its relationship with other applications. Remove the sentence “This function must be integrated with the ERTMS system to ensure interoperability”. To re-open at next UCP
- Train Integrity and train length monitoring are postponed to wait R&D progress.
- To clarify the scope and definition of odometer calibration

Update on new servicers and R&D strategy

EGNSS Rail service mission studies and receiver development

Silvia Porfili presented the two mission studies launched this year:

Two projects are running in parallel: EGNSS-R and IMPRESS. They aim to assess the feasibility of an EGNSS based safety service for the rail sector beyond 2020 to improve the efficiency of train localization within the future ERTMS evolution.

- Tasks:
 - To identify user needs, service performance and operational requirements.
 - Define the user-level integrity concept
 - Define the EGNSS-based rail safety service (integrity concept at user level)
 - Analyse the success criteria of the new service
 - Define the concrete implementation steps and a timeline
 - Validate the EGNSS-based rail service concept with the rail stakeholders.

A group of experts has been created (ERGO).

For the development of an EGNSS receiver for rail, the Fundamental Elements funding scheme launched a call for two projects (evaluation closed recently) to develop a DFMC GNSS receiver and antenna for use within a safe train positioning platform suitable for railway safety-related applications.

Galileo HAS update

The Galileo HAS Service is intended to improve further the accuracy of Galileo. Galileo HAS will be devoted for applications requiring submeter accuracy. Within its main characteristics, there are two service levels with different coverage (Global vs European coverage), both levels providing open format corrections to Galileo and GPS. Accuracies are in the order of 20cm (horizontal) and 40cm (vertical). Corrections will be delivered by the Galileo constellation itself and through Internet.

Galileo HAS addresses both traditional and emerging markets and applications. The main target of HAS are emerging applications such as autonomous vehicles, drones or robotics, and other applications where 20cm position accuracy is sufficient.

For rail, some applications have been initially identified to benefit from Galileo HAS. They are cold movement detection, odometer calibration, door control supervision, infrastructure surveying, gauging surveys and structural monitoring.

Three phases are foreseen in the development of HAS: phase 0 – testing, phase 1 – initial service, phase 2 – full service capability.

Participants are invited to fulfil the following survey:

https://ec.europa.eu/eusurvey/runner/HAS_SurveyUCP2020

OSNMA update and requirements on authentication

OSNMA is a function of Galileo providing a digitally signed navigation message as a confirmation of the source of the message (I/NAV on E1B). There will be a public testing (next year - 2021) and the users are invited to participate. The objective is to get user's feedback, support market and products

development and accommodate fine-tuning (upstream and downstream) for the next service provision phase.

R&D/innovation questionnaire

What are the emerging EGNSS applications that are using synergies with Copernicus?

SIA project proposed an application to obtain or validate map data. Monitoring vegetation along the track has been mentioned.

What financing tools could be used to support further market uptake of applications in your market segment? (e.g. Grant, Innovation procurement, acceleration)

No comments

What large implementation projects are emerging in your market segment?

Ubiquitous indoor/outdoor will require massive deployment for beacons for instance

Conclusions

Despite the remote edition, the railway stakeholders have demonstrated a strong interest and participation to the discussions. Project presentations have shown that the activity in R&D for further development was still progressing and on-going work will still feed the requirements in the next editions. The third edition of the Rail UCP session is successfully closed by the GSA. Daniel Lopour thanked all the participants of the session.

Key results of this working session were highlighted during the plenary UCP session on December 7th, 2020 by Gabriele Ridolfi.



Other Notes & Information

With the contribution of:



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