

**UCP 2023 MINUTES OF MEETING OF THE PUBLIC TRANSPORT MARKET SEGMENT PANEL**

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|--|---|--------------------------|------------------------|
| <b>Meeting Date</b>                            | 07.11.2023  | <b>Time</b>              | 14:00-17:00            |
| <b>Meeting Called By</b>                       | EUSPA   | <b>Location</b>          | Seville (hybrid event) |
| <b>Minutes Taken By</b>                        | Catarina Sales  | <b>Next Meeting Date</b> | N/A                    |
| <b>Attendees</b>                               | <p><b>Jacopo Ovarelli, EUSPA, Session moderator</b><br/> <b>Daniel Lopour, EUSPA</b><br/> <b>Catarina Sales, Factual Consulting, Writer of MoM</b><br/> <b>Ana M. Melendez, FDC, Zoom keeper</b></p> <p><b>User Community Representatives (UCRs)</b><br/> Umberto Guida, UITP<br/> Jochen Wendel, INIT<br/> Nikos Tsampieris, ERTICO – ITS<br/> Luis Roda, EMT Valencia</p> <p>Complete list of attendees is in Annex 1: List of Attendees.</p> |                          |                        |
| <b>Distribution (in addition to attendees)</b> | UCP Plenary, EUSPA, Public  |                          |                        |

| <b>Agenda Items</b>  | <b>Presenter</b>                   |
|--|------------------------------------|
| 1. Welcome and introduction to Public Transport session  | Daniel Lopour, EUSPA               |
| 2. EU Space Programme Components current state and future services for users   | Carmen Aguilera, EUSPA             |
| 3. The future of mobility: towards more sustainable, resilient and human-centric urban mobility systems                | Umberto Guida, UITP                |
| 4. GNSS applications in public transport operations – an application overview  | Jochen Wendel, INIT                |
| 5. Added value of EGNSS for Public Transport Operators and users – innovative use cases from R&D                       | Nikos Tsampieris, ERTICO - ITS     |
| 6. GNSS usage in a city transport network: Sensing, capturing, and exploiting environmental and vehicular data systems | Luis Roda, EMT Valencia            |
| 7. Minutes of Meeting and Wrap up  | Catarina Sales, Factual Consulting |

| <b>Summary</b>  |
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| The Public Transport session of the User Consultation Platform (UCP) 2023 took place on 7 <sup>th</sup> November 2023 as a hybrid event, with in-person venue in Seville, Spain. The panel gathered around 28 participants (10 remotely and 18 physically). |

The panellists gave in depth presentations of their applications, how they use satellite technologies (mainly GNSS) and what their specific needs and requirements are. This broad coverage generated interest from the participants and helped start good interactions with all the attendees with many questions and comments.

## **1 MINUTES OF MEETING**

### **Agenda Item 1 - Welcome and introduction to the Public Transport. Daniel Lopour / EUSPA**

Daniel Lopour from EUSPA welcomed all participants to the User Consultation Platform (UCP) session. He provided a brief overview of the session's objectives, state of art and how UCP is a tool that allows EUSPA to have a closer contact with the user community.

In concrete, the UCP aims at identifying the needs and requirements at application level relevant for EU Space programmes - EGNOS, Galileo, Copernicus, GOVSATCOM, Space Situation Awareness (SSA) and others. Being the Public Transport sector more focused on GNSS use.

User needs and requirements from different market segments, including Public Transport, can then be taken as inputs for the provision of user driven space-based services by the EU Space Programme.

Then, it was explained that the session was divided into three parts:

- i. Informative part: in which participants were mainly briefed about the state-of-art of EU Space Programme Components current state and future services for users.
- ii. Presentations carried out by the Public Transport community:
  - The future of mobility: towards more sustainable, resilient and human-centric urban mobility systems.
  - GNSS applications in public transport operations – an application overview.
  - GNSS usage in a city transport network: Sensing, capturing, and exploiting environmental and vehicular data systems.
- iii. Open discussion: in which all participants were invited to express their needs and discuss and validate the users' requirements.

During this slot, Mr. Lopour presented the role that Galileo programme can have in Public Transport:

1. Ensures a much more accurate final position thanks to the availability of more constellations (multi-constellation);
2. Increases its robustness against jamming attacks thanks to its multi-frequency;
3. And mitigates multipath effects.

It was also highlighted the importance of considering the benefits of including Galileo in the PT procurements. As an example of this, it was presented the success example of Galileo receivers in all trams of Prague which is expected to be operational by end of this year.

Furthermore, it was emphasized that the ITxPT standard specifications SOP03-GNSS Location recommend the adoption of multi-constellation GNSS receivers, including Galileo, rather than solely relying on GPS. Subsequently, EUSPA presented its ambition to deploy Galileo receivers in every public transport vehicle in the EU.

The slides of this agenda item can be found as Attachment 1 in section 4.

**Agenda Item 2 – EU Space Programme Components current state and future services for users. Carmen Aguilera / EUSPA**

The presentation started with a brief presentation of EU Space Programme (EGNOS, Galileo, Copernicus, GOVSATCOM, Space Situational Awareness (SSA) and others). Then, the six Copernicus services (Atmosphere, Maritime, Land, Climate Change, Security and Emergency) were presented, followed by Galileo and EGNOS Services.

The potential use of Copernicus in public transport was mentioned, such as its application in monitoring transport infrastructures.

Later, the focus was put on the Galileo programme and its services. It was mentioned that most of the receivers in the market are already Galileo enabled, which means that no additional expense or cost is needed to benefit from using Galileo. It is of particular importance for PT the improvement of the TTFF thanks to Galileo. About the new services, the new OSNMA service will be operational by Q1 2024, providing robustness and ensuring users that the signal received is from Galileo itself. About Galileo HAS, which provides PPP corrections to the users, it is commented the possibility for the interested users to register at the GSC website (<https://www.gsc-europa.eu/>) to have access to the service. And last, Galileo SAR provides assistance in case of distress.

At the end, the remaining EU Space Programmes were introduced:

- EGNOS and its services (Open Service, Safety of Life Services and EGNOS Data Access Services);
- GOVSATCOM and IRIS2: where GOVSATCOM is focused on governmental users and IRIS2 (Infrastructure for Resilient, Interconnectivity and Security by Satellite) focused on governmental users and commercial ones;
- Space Surveillance and Tracking (SST) where EUSPA is the current front desk and provides space safety services (Collision Avoidance, Re-entry Analysis and Fragmentation Analysis).

There were no questions from the audience.

The slides of this agenda item can be found as Attachment 2 in section 4.

**Agenda Item 3 - The future of mobility: towards more sustainable, resilient and human-centric urban mobility systems. Umberto Guida / UITP**

Mr. Guida explained that UITP is a global association or network that encompasses all stakeholders involved in public transport and sustainable transport modes. Their key priority is the transformation of the labour market.

In terms of mobility, one of the urban mobility challenges is to personalize the mobility services keeping the current quality standards. The concept of personal mobility is changing to a more global “shared mobility”. Regarding the future of mobility, geolocalisation plays a key role.

Several GNSS applications on public transport were showed:

- Information and services for travellers being present at the bus stops, in personal navigation applications and on-board vehicles;
- Vehicles and fleets operation being present in fleet monitoring and management, remote diagnostic and predictive maintenance and location-based operation;
- Shared and on-Demand Responsive Transport (DRT)
- Automated shuttles and buses.

Later, it was again highlighted that most of the receivers in the market are Galileo enabled and the new fleets usually have Galileo-enabled receivers installed.

Every equipment installed in a bus includes a GPS receiver, which complicates the architecture and the relationship with these signals - ITxPT plays a crucial role in promoting interoperability among IT systems that incorporate GNSS components in the Public Transport sector.

The importance of geolocalisation comes out as one of the main highlights. Also, it is of high importance the integration of data coming from different sources and sensors.

**Question (Q): Do you think about the potential use of Copernicus in Public Transportation?**

Mr. Guida from UITP answered: One of the uses can be infrastructure monitoring, which holds great significance for agencies and authorities. Another important use is contingencies identification: in case of contingency, operators can plan services and actions in response, making life of users easier and reducing stress.

**Comment by Qbuzz:**

Mr. Van der Mark from QBuzz expressed a keen interest in the precise positioning service provided by Galileo HAS for use in their bus fleet. He asked for official documentation about this. Mr. Guida from UITP commented that they have a project running about autonomous shuttles and they are going to check the performance. He expects to share the results by the first quarter of 2024.

The slides of this agenda item can be found as Attachment 3 in section 4.

**Agenda Item 4 - GNSS applications in public transport operations – an application overview. Jochen Wendel / INIT**

Mr. Wendel presented INIT company, emphasizing its main objective of providing IT systems for Public Transport. He highlighted the crucial role of location data in these systems, supplied by GNSS or Copernicus. Furthermore, he pointed out that all bus systems are interconnected with location information.

With respect to research projects, INIT has eleven projects running (for instance: JULIA, MAVIS / ASSISTIVetravel, MobileDataFusion / Uhoch3, regioKArgo) and most of them are using GNSS data.

He presented some conclusions:

- GNSS localization and spatial data are at the core of public transport operations.
- Location Based Services (LBS) play an important role in this sector.
- New applications required reliable and accurate positional data.
- Standardized open-data and services are needed (or need to be expanded).
- Public transit can be a valuable input / enabler for future applications (e.g., smart cities).

**Question (Q): What are type of applications that can be benefited from new Galileo services (HAS or OSNMA)?**

Mr. Wendel from INIT answered: Maybe, OSNMA could benefit the approval of the payment on ticketing applications and High Accuracy Service (HAS) could benefit automated driving applications.

The slides of this agenda item can be found as Attachment 4 in section 4.

**Agenda Item 5 - Added value of EGNSS for Public Transport Operators and users – innovative use cases from R&D. Nikos Tsampieris / ERTICO - ITS**

Mr. Tsampieris gave a brief overview of ERTICO- ITS whose main mission is deploying innovation to make mobility smarter, safer, and cleaner, mainly in connected, cooperative and automated mobility, urban mobility, clean and eco mobility, as well as transport and logistics.

GNSS has some advantages such as facilitating the planning of new infrastructure, enhancing the monitoring of existing ones, reducing CO2 emissions, and ensuring safety.

He presented the 5GMOBIX project, which has a strong GNSS component, and SHOW project whose objective is to deploy shared, connected and electrified automated vehicles in thirteen countries. The importance of connectivity in Public Transport was emphasized: all assets need to be connected and connections shall be uninterrupted. To collect PTA/PTO needs, FACTUAL has launched a survey and ERTICO helped to disseminate it – Mr. Tsampieris highlighted some of the results.

Several use cases and applications were presented. An example of the use of Copernicus for monitoring real-time air quality was highlighted.

**Question (Q): What are the next steps for the use cases presented?**

Mr. Tsampieris answered: In the coming months results will be showcased as part of Julia project.

The slides of this agenda item can be found as Attachment 5 in section 4.

**Agenda Item 6 GNSS usage in a city transport network: Sensing, capturing, and exploiting environmental and vehicular data systems. Luis Roda / EMT Valencia**

Mr. Roda from EMT Valencia was the last speaker talking about use of GNSS in an urban transport network. EMT Valencia's primary activity involves organizing and providing public collective passenger transport services in the city of Valencia, operating primarily 487 buses with 1721 employees, transporting to over 100 million passengers annually.

EMT Valencia has collaborated with EUSPA on various projects, including ARIADNA, GALILEO4Mobility, and a recent innovative pilot project conducted on behalf of EUSPA, EMT, and the City of Valencia, aimed to demonstrate how COPERNICUS/GALILEO system data (Space Services and Data for Green and Smart Cities) can support municipal decision-making, ultimately enhancing the quality of life for citizens. Future collaborations are anticipated.

EMT Valencia has presented multiple projects related to the use of satellite GNSS geolocation in its urban transport network. These projects align with the Recovery, Transformation, and Resilience Plan, funded by the European Union – NextGeneration EU, promoting sustainable, safe, and connected mobility through digitization and energy efficiency.

In efforts to enhance air quality in urban environments, EMT Valencia is actively working on the Sensing, Data Capture, and Exploitation System for Vehicular and Environmental Data – NextGeneration EU project.

This initiative aims to capture and detect external and internal environmental data (NO<sub>2</sub>, O<sub>3</sub>, CO, temperature, humidity, noise, and PM 2.5), as well as vehicular data, in 250 hybrid buses and 20 electric buses. The objective is to improve public transportation, focusing on achieving enhanced air quality in urban areas through the measurement and optimization of urban transport, among other goals.

A major challenge for Public Transport Operators/Authorities (PTO/PTAs) is limited budgets, necessitating the phased implementation of various Intelligent Transport Systems (ITS) such as Fleet Management System, Ticketing, User Information Systems, etc. Integrating these systems requires planning over time, avoiding dependency on manufacturers and ensuring compatibility through standardization and synchronization (ITxPT) of all onboard equipment protocols in all tenders/procurements conducted.

An additional challenge involves convincing PTOs/PTAs of the added value of new technologies, including EGNSS, in real-use cases.

From EMT Valencia's perspective, one of the most significant added values of Galileo is the authentication service (OSNMA). This service allows the use of Galileo information as legal evidence

for various liability purposes, including insurance costs, accidents, incidents, ticketing systems, salaries, customer assistance, user complaints, penalties in contracts, reliability, and maintenance.

**Question (Q): What do you think are the main constraints for PTO and PTA when you start to implement GNSS solutions?**

Mr. Roda from EMT Valencia responded: The primary challenge lies in budget constraints. Typically, budgets are allocated by system, such as fleet management, and may vary on an annual basis. This is why EMT Valencia places a strong emphasis on standardization to address this issue.

The slides of this agenda item can be found as Attachment 6 in section 4.

**DISCUSSIONS ON GNSS AND EO REQUIREMENTS PER APPLICATIONS**

**Agenda Item 7 User Requirements Discussion & validation. Catarina Sales/ Factual Consulting**

Mrs. Sales from Factual Consulting remembered again the main objectives of the Public Transport session as part of the User Consultation Platform (UCP).

**Comment regarding EO requirements by EMT Valencia:**

Mr. Roda from EMT Valencia mentioned that Galileo and Copernicus system data are fantastic for verifying if things are working correctly. These data can be complemented with other sensors and information from various sources. For instance, Earth Observation (EO) could enhance GNSS data in planning systems and the measurement of KPIs.

**Comment regarding GNSS requirements by EMT Valencia:**

From the PTO's perspective, particularly concerning Fleet Management Systems, Mr. Roda from EMT Valencia mentioned that right now, the current accuracy levels achieved with Galileo+GPS are sufficient for a PTO, considering the size of the buses (12/18 meters) in relation to bus stops (10/20 m) and their representation on maps with varying degrees of accuracy depending on the source (City Council, Google, EMT Fleet Management System, etc.). Each visualization tool has its uses, limitations, and advantages. Future applications, such as autonomous and collaborative vehicles, traffic light priority, ticketing, or dynamic parking, will require a higher degree of precision. Greater availability, granularity, and update frequency will be necessary.

However, he emphasized that the most crucial performance parameter for them is the authentication of the signal. An authenticated signal (TimeStamp / GeoStamp) not only provides more robustness but can even serve as legal evidence of the correctness of the GNSS position for liability issues such as

insurance, accidents, incidents, ticketing systems, salaries, customer assistance, user complaints, penalties in contracts, reliability, and maintenance.

**Comment regarding GNSS requirements by EMT Valencia:**

Regarding the concept of autonomous vehicles, Mr. Roda emphasizes that autonomy also implies collaboration, and it is crucial to consider this collaborative aspect. He gives the example of a network with high-service-frequency autonomous buses, highlighting that this will only work if they are interconnected among themselves and with the city's infrastructure (traffic light priority, electric recharge systems, ticketing, and information systems).

**Comment regarding GNSS requirements by Qbuzz:**

Mr. Van Der Mark from Qbuzz mentioned that payment systems rely on location, especially for passenger information, where a higher resolution is needed.

**Comment regarding GNSS requirements by EMT Valencia:**

Regarding accuracy for PTO, Mr. Roda from EMT Valencia mentioned that the required accuracy for Fleet Management Systems can vary depending on the department within a company (e.g., marketing department versus the quality department in the same company). Therefore, having a Data toolbox (EGNSS, IoT, Sensing, vehicles, City Hall data, Open Data, etc.) from different sources to adapt to each specific need is considered the best option.

In this Toolbox, Tools availability, granularity, and update frequency are the more important facts to meet different needs.

EGNSS/Copernicus data should be combined with other datasets to be useful and demonstrate its potential. Future developments would require more planning, coordination, resources, and scope definition.

**Main conclusions were summarised by Mrs. Melendez from FDC:**

- All speakers have stated that they use GNSS data in their applications which entails the key role of GNSS in the public transport domain.
- Galileo High Accuracy Service (HAS) and OSNMA have some advantages for PTO and PTA providing an accurate position and authenticated signal respectively.
- EO, despite its limited current use in the sector, has the potential to contribute to transportation network planning and optimization when integrated with other data sources, such as GNSS.



- ITxPT standard specification ‘SOP03-GNSS Location’ includes the adoption of multi-constellation GNSS receivers instead of only GPS as a recommendation and plays a crucial role in fostering interoperability among IT systems incorporating GNSS components in the Public Transport sector.
- One of the main problems for PTOs is the continuous change of the budget for each system on yearly basis.

The slides of this agenda item can be found as Attachment 7 in section 4.

#### **Validation of requirements**

Although the GNSS and EO requirements outlined in the draft version of the Report on User Needs and Requirements were not extensively validated, the participants were invited to comment and give suggestions, and no responses were received. Consequently, it is deemed that the GNSS and EO requirements outlined in the draft version of the Report on User Needs and Requirements are in accordance with the needs and expectations of Public Transport users.

## **2 CONCLUSIONS**

The Public Transport UCP session was successfully closed by Jacopo Ovarelli from EUSPA. Key results of this working session were highlighted during the plenary UCP session on 8<sup>th</sup> November, 2023 by Carmen Aguilera from EUSPA.

These results are summarised below as well:

- For bus applications, GNSS is the core for fleet management systems and real-time passenger information systems and gaining prominence for driving monitoring and driver advisory systems. Meter accuracy and 99,9% availability are key.
- For autonomous shuttles, GNSS is integrated with other technologies (Ultrasonic, inertial motion)
- EO has a potential role in transportation network planning and optimization, particularly in areas such as traffic and climate monitoring.

## **3 OTHER NOTES & INFORMATION**

None.

## **4 ANNEXES & ATTACHMENTS**

Annex 1: List of Attendees

Attachment 1: PRESENTATIONS