USER CONSULTATION PLATFORM 2020

MINUTES OF MEETING OF THE PUBLIC TRANSPORT MARKET SEGMENT PANEL

Meeting Date	01.12.2020	**Time**	14:00-17:30
Meeting Called By	GSA	**Location**	Online event
Minutes Taken By	Karel Callewaert (VVA) with the minutes from Virginia Antón (ESSP)	**Next Meeting Date**	UCP 2022
Attendees	**Daniel Lopour (GSA), Panel moderator** **User Community Representatives** Marti Jofre (Factual Consulting), **Panel Users' Chair** Speakers: Michel Massart (European Commission) Josep Laborda (Factual Consulting) Marti Jofre (Factual Consulting) There were 58 participants present in the UCP2020 Public transport market segment panel.		
Distribution (in addition to attendees)	UCP Plenary, GSA, Public		

Agenda Items	**Presenter**
Welcome and introduction	Daniel Lopour (GSA)
GNSS and Copernicus in public transport - GNSS applications and GSA activities in Public transport - Copernicus services overview and applications for Public transport - R&D initiatives overview: ARIADNA project	Daniel Lopour (GSA) Michel Massart (European Commission) Josep Laborda (Factual Consulting)
Update of user requirements	Marti Jofre (Factual Consulting)
Update on new servicers and R&D strategy - OSNMA update and requirements on authentication - R&D/innovation questionnaire	Daniel Lopour (GSA)
Preparation of session conclusions	Marti Jofre (Factual Consulting)
Final Q&A	

Summary

The first edition of the *Public Transport* market segment panel took place during the third User Consultation Platform (UCP) on the 1st of December 2020, as an online event.

During the session, user requirements for Public Transport applications were presented across four different transport modes, namely bus, train, tram and other applications (e.g. bikesharing, MaaS, etc.). For each transport mode, applications were split across non-critical and critical applications. User requirements were presented under three categories: Availability, Accuracy and Reliability.

All user requirements and needs were validated with the panel and during the subsequent Q&A, a number of applications were proposed to be further investigated:

- Periodic maintenance
- Passing over switches
- Use of GNSS for lubrication (noise-cancelling material, also environmental concern)

Minutes of Meeting

Welcome and introduction

At the start of the panel session, an introduction and video welcome were given by Fiammetta Diani of the GSA, focusing on the importance of this session and the UCP as a whole as well as highlighting the changing role and responsibility of the GSA towards the EUSPA. Afterwards, Daniel Lopour (GSA) briefed the panellists on the recent activities undertaken by the GSA in the market development within the Public Transport segment and welcomed, on this turn, all participants to this first edition of the Public Transport panel.

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.

GNSS and Copernicus in Public Transport

<u>GNSS applications and GSA activities in Public Transport</u>

Daniel Lopour presented the wide range of activities undertaken by the GSA trying to link space to user needs, from operations and security to service development and market development. Following this introduction, an overview was given of the different services provided by Galileo and EGNOS:

- Galileo initial services since December 2016
- Several services: Open Service, Public Regulated Service, Search and Rescue, High Accuracy Service, Signal Authentication Service.
- Galileo is progressing to Full Operational Capability
- EGNOS, already available, provides approximately 1m accuracy for free. It is compliant to aviation standards by providing corrections and integrity (Safety of Life Service). EDAS also provides EGNOS corrections through Internet. Additional services under study (maritime, rail).

Galileo's added value focuses on availability and accuracy. Daniel Lopour explains how this improves the service for Public Transport especially in urban environments. Thanks to multi-constellation,

multi-frequency and mitigation of multipath, Galileo is considered an essential enabler for urban-level public transport:

- Galileo contributes to improve availability and accuracy. Multi-constellation, multi-frequency, mitigation of multipath.
- Galileo value proposition for public transport: superior performance in urban environments.
- Projects:
    - Galileo Signal Priority (GSP) project: Transit Signal Priority using EGNOS/EDAS
    - Vehicle Remote Tolling (VeRT): EGNOS and Galileo to provide new applications for the road sector.
    - ARIADNA: foster adoption of EGNSS for Public Transport.
- Success stories:
    - Prague: Tender in progress to equip entire tramway fleet (>800 trams)
    - Madrid: Galileo deployed in EMT bus service (>2000 buses)

Finally, Daniel Lopour presented a position paper produced by the GSA which focuses on the added value of EGNSS for Public Transport and invited all public transport operators to provide feedback and contribute to this paper. With this position paper the aim is to introduce EGNSS and its added value to all players across the industry value chain and to promote the uptake of EGNSS solutions across the European users whilst also improving the application performances in general.

<u>Copernicus services overview and applications for Public Transport</u>

Michel Massart took the floor to introduce the services offered by Copernicus that are applicable to Public Transport. Of the six existing services, especially the Atmosphere and Land Monitoring services are suited to contribute to the improvement of Public Transport market segment. Following the introduction, several examples were shown how specific applications provide their contribution:

- Land Monitoring Service: use to check the accessibility to public transport, useful also to make comparison between cities.
    - Urban Atlas: Copernicus and Earth observations satellites help us to analyse where and how cities are growing.
    - Another example: River Water Level Monitoring to improve inland waterway navigation of passenger vessels in rivers and on lakes (both European and African examples).
    - Upcoming European Ground Motion Service – for land management, urban and rural planning, monitoring of infrastructure and soil.
- Atmosphere Monitoring Service examples:
    - CAMS Air Control
    - Pollution monitoring
    - VITO tool: web application to calculate road traffic emission scenarios in support of regional air quality management for the Flemish Government.

<u>R&D initiatives overview: ARIADNA project</u>

Josep Laborda provided the panel with an overview and main objectives of the ARIADNA project, namely:

- Raise awareness on the technological enhancements and benefits of EGNSS & Copernicus in

public transport and urban mobility.

- Support decision making and integration of EGNSS & Copernicus in the urban mobility market
- Create business opportunities to facilitate EGNSS deployment

Following an overview of the activities, Josep Laborda concluded with a presentation of the results of a first survey undertaken by the ARIADNA consortium:

- Geolocation data is the most used Space Data for planning/operating mobility services.
- Lack of awareness on Galileo and some misunderstandings.
- Strong beliefs that Geolocation Data will help improve existing & enable new mobility services during the COVID-19 crisis & recovery phase
- Plans to modernise or upgrade their transport solutions to be more efficient/sustainable as part of a post-COVID-19 recovery plan.
- Space Data is needed or useful, for implementing a strategy for more sustainable cities and transportation.

Update of user requirements

Following a short break, Marti Jofre took the floor to present the user requirements for Public Transport applications across four subsegments, namely bus, tram, train and other applications. For the ease of the presentation, requirements were grouped under three categories, namely Availability, Accuracy and Reliability.

<u>Requirements for bus applications</u>

- Non-critical applications:
    - Fleet Management & Passenger information
    - Traffic signal prioritisation
    - Bus driver advisory systems and In-vehicle signage
- Critical applications:
    - Driving monitoring
    - Emergency Electronic Break
    - Cooperative intersection or other cooperative ITS
    - Autonomous shuttle

	Non-critical	Critical
GNSS Sensitivity	Likely urban and light indoor scenarios	Likely urban and light indoor scenarios
Pos fix availability	95-99.9%	> 99.9%
Time to First Fix	< 30 s	< 30 s
Continuity	Low	Medium-high
Position fix rate	1 Hz	1-10Hz
Horizontal Accuracy	1-10m	< 1m
Vertical Accuracy	10m	10m
Time Accuracy	1s	1us – 1s
Position Integrity	Low	Medium-high
Robustness to spoofing	Medium	High
Robustness to interf.	Medium	High
Time to Alert	10-30s	10-30s

Questions & answers

What about the availability of the signal when you enter a tunnel?

The signal would normally get lost, unless the tunnel is very short. In reality, the GNSS signal should be combined with odometers, inertial measurement units and other positioning sensors to maintain an idea of the position under these situations.

Requirements for Train applications

Daniel Lopour clarified that the Rail segment is discussed on the 2nd of December and that this presentation will not cover any signalling applications.

- Non-critical applications:
    - Fleet Management & Passenger information
    - Train Energy Charging
- Critical applications:
    - Door Control Supervision
    - Level crossing protection

	Non-critical	Critical
GNSS Sensitivity	Likely urban and light indoor scenarios	Likely urban and light indoor scenarios
Pos fix availability	Medium	High
Time to First Fix	< 120 s	< 120 s
Continuity	Low	high
Position fix rate	1 Hz	1 Hz
Horizontal Accuracy	10-100m	< 1m
Vertical Accuracy	N/A	N/A
Time Accuracy	1s	1s
Position Integrity	Low	High
Robustness to spoofing	Medium	High
Robustness to interf.	low	High
Time to Alert	>30s	10-30s

Requirements for tram applications

- Non-critical applications:
  - Fleet Management & Passenger information
  - Tram Energy Charging
- Critical applications:
  - Door Control Supervision
  - Level crossing protection
  - Emergency Electronic Break

	Non-critical	Critical
GNSS Sensitivity	Likely urban and light indoor scenarios	Likely urban and light indoor scenarios
Pos fix availability	Medium	High
Time to First Fix	< 120 s	< 120 s
Continuity	Low	high
Position fix rate	1 Hz	1 Hz
Horizontal Accuracy	1-10m	< 1m
Vertical Accuracy	N/A	N/A
Time Accuracy	1s	1s
Position Integrity	Low	High
Robustness to spoofing	Medium	High
Robustness to interf.	low	High
Time to Alert	>30s	10-30s

During the subsequent discussion, the following points were brought up by the panel:

- Suggestion to add the following applications:
  - Periodic maintenance
  - Passing over switches
  - Use of GNSS for lubrication (noise-cancelling material, also environmental concern)
- It was explained how a machine circulates over the Prague network to spray the rails with this specific lubrication (mainly on junctions and tight curves). For this application, GNSS plays a role to efficiently distribute the lubrication since it is both expensive and could contribute to an environmental concern. It is a non-critical application requiring an accuracy of several meters.
- GNSS applications linked with insurance were also discussed. For these applications, both time and position are important. OSNMA, a service suggested to be used for insurance-critical applications to authenticate the signal was also mentioned. It was emphasized that the application requires legal authentication of the position and time stamps of the GNSS information.

Requirements for other applications

- Non-critical applications:
  - Car, bike or scooter sharing
  - Dynamic ridesharing
  - Electromobility
- Critical applications:
  - Positive toll
  - MaaS (Smart Ticketing)

	Non-critical	Critical
GNSS Sensitivity	Likely urban and light indoor scenarios	Likely urban and light indoor scenarios
Pos fix availability	High	Medium
Time to First Fix	< 30 s	< 120 s
Continuity	Medium	Medium
Position fix rate	1 Hz	1 Hz
Horizontal Accuracy	1-10m	1-10m
Vertical Accuracy	10 m	10 m
Time Accuracy	1s	1s
Position Integrity	Medium	Medium
Robustness to spoofing	Medium	Medium
Robustness to interf.	Medium	High
Time to Alert	>30s	>30s

The following points were raised and discussed during the discussion:

- Higher the accuracy the better for applications such as bike and scooter sharing, mainly for the parking of such free-float transport modes.

- Inclusion of geofencing as an application as this is linked with such free-floating applications and their access to certain parts of the city. These vehicles can have their speed automatically controlled based on where they are driving (e.g. speed limit enforcement).
- An application linked to the Green Deal implementation, namely city tolls based on your vehicle and its usage in cities with low emission zones.
- Intermodality is more and more common: combination of micromobilty with public transport. This is a challenge when changing the mode of transport and it is important to have a reliable position. From the user perspective it is key to have multiconstellation, multifrequency receivers.

Update on new services and R&D strategy

The panel was provided with an overview of the new services and the R&D strategy.

Galileo High Accuracy Service (HAS)

A service 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. Both levels providing open format corrections to Galileo and GPS. Accuracies are in the order of 20cm (horizontal) and 40cm (vertical).

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 positional accuracy is sufficient.

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

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

Presentation on the White Paper on EGNSS downstream funding priorities and tools. Focus on Horizon Europe, being the next programme (continuation of FP7 and H2020).

Questions on future of EGNSS R&D:

What are the emerging EGNSS applications that are using synergies with Copernicus?
Josep Laborda presented some findings form the ARIADNA surveys with examples from use of Copernicus for planning where extreme weather events occur. Karel Callewaert echoed the words by Josep Laborda and explained how the Copernicus services can contribute to better planning of the transport service linking it with urban population. Nico Thom explained the use of satellite data for the monitoring of infrastructures and ground movement linked to their use from public transport.

What financing tools could be used to support further market uptake?

Acceleration was discussed in detail. As an example, in ARIADNA, the consortium interacts with SMEs, universities etc. and liaising with these stakeholders reveals that they are talking about the technical requirements and acceleration allows them to improve their technical understanding and improve their products and services. Coaching on benefits of Galileo is key.

What large implementation projects are emerging in your market segment?
The seamless integration of all modes of transport at city level with projects ongoing in most cities across Europe was mentioned.

Preparation of 2020 Public Transport UPC session output

Marti Jofre presented the PPT prepared during the panel session, summarizing the highlights of the session. Besides an overview of the main user requirements per transport mode (i.e. bus, train, tram and other applications) the PPT also included a slide with the key points discussed within the panel.

Michele Tozzi volunteered to present the outcomes during the UCP Plenary Session of the upcoming European Space Week.

Conclusions

It was concluded that the first edition of the Public Transport market segment was a success. Around 50 participants attended the panel session in which Public Transport applications were presented and discussed across four subsegments (i.e. bus, train, tram and other applications). Besides the discussion of the user requirements, there was also an overview of existing and future EGNSS and Copernicus services and how these can contribute to the improvement of Public Transport.

The main outcomes of the session are summarized below:

- Current requirements have been validated.
- Multiconstellation and multifrequency receivers can meet most of the requirements for non-critical applications and can be an enabler for critical applications that require hybridisation with other sensors.
- Suggestion to explore additional use cases for Tram and Smart Mobility segments.

Other Notes & Information
With the contribution of:       

Annexes & Attachments