UCP 2023 MINUTES OF MEETING OF THE ROAD & AUTOMOTIVE MARKET SEGMENT PANEL

Meeting Date	07.11.2023	**Time**	10:00-17:00
Meeting Called By	EUSPA	**Location**	Seville (hybrid event)
Minutes Taken By	EY Belgium	**Next Meeting Date**	N/A
Attendees	**Katarzyna Porzuc, EUSPA, Session moderator** **Marco Bolchi, EY Belgium, Panel coordinator** **User Community Representatives (UCRs)** Antonio Granado, Dirección General de Tráfico (DGT) Dr Johanna Tzanidaki, ERTICO - ITS Europe Dr Paul Verlaine Gakne, Hexagon Dr Ilaria Martini, u-Blox Dr Javier Ibanez-Guzmán, Renault Dr Joanna Balasis-Levinsen, European Environment Agency (EEA) Miguel Ortiz, Université Gustave Eiffel Nuno Duro, Spotlite Ramsundar Kandasamy, Valeo Roberto Giuliani, Anas Sampo Hietanen, MaaS Global Sebastian Schlebusch, Dott Sergio Pérez Gámez, Kapsch Dr Valentín Alfaya, Ferrovial		
Distribution (in addition to attendees)	UCP Plenary, EUSPA, Public		

Agenda Items	Presenter
1. Welcome and introduction to Road and Automotive session	Katarzyna Porzuc, EUSPA
2. Status of the EU Space Programme	Carmen Aguilera, EUSPA
3. Standardisation update	Miguel Ortiz, Université Gustave Eiffel
4. ITS and Infrastructures, Tolling	Sergio Pérez Gámez, Kapsch
5. ITS and Infrastructures, Traffic Management	Antonio Granado, Dirección General de Tráfico
6. ITS and Infrastructures, Copernicus for infrastructures, end-user perspective	Roberto Giuliani, Anas Dr Valentín Alfaya, Ferrovial
7. ITS and Infrastructures, Copernicus for infrastructures, products	Dr Joanna Balasis-Levinsen, European Environment Agency

8. ITS and Infrastructures, Copernicus for infrastructures, intermediate user perspective	Nuno Duro, Spotlite
9. User requirements. Discussion & validation	Marco Bolchi, EY Belgium
10.CCAM, Research and Innovation perspective	Dr Johanna Tzanidaki, ERTICO – ITS Europe
11. CCAM, Automotive value chain user perspective, OEM	Dr Javier Ibanez-Guzmán, Renault
12. CCAM, Automotive value chain user perspective, Tier 1	Ramsundar Kandasamy, Valeo
13. CCAM, Automotive value chain user perspective, Tier 2	Dr Paul Verlaine Gakne, Hexagon
14. CCAM, Automotive value chain user perspective, receiver manufacturer	Dr Ilaria Martini, u-Blox
15. User requirements. Discussion & validation	Marco Bolchi, EY Belgium
16. MaaS, platform provider perspective	Sampo Hietanen, MaaS Global
17. Maas, service provider perspective	Sebastian Schlebusch, Dott
18. User requirements discussion	Marco Bolchi, EY Belgium
19. Minutes of Meeting and Wrap up	Katarzyna Porzuc, EUSPA

Summary

The Road and Automotive session provided an opportunity for the participants to share their insights and requirements, shaping the future of EU Space Services for the Road and Automotive segment. The session was divided into three panels, each of them focusing on a different application: ITS and infrastructures, Cooperative, connected, and automated mobility (CCAM) and Mobility as a Service (MaaS). Each of the panels provided a current view of the status of the development of the applications and encourages discussion between presenters and audience. After each panel, a discussion on user needs and requirements took place, providing the possibility to obtain user feedback for what concerns the major applications and respective requirements associated to concrete use cases.

The final objective of the session was to gather a picture of the needs and requirements of the stakeholders of the Road and Automotive segment in order to take into account for the future evolution of the EU Space Programme.

1 MINUTES OF MEETING

Agenda Item 1 - Welcome and introduction to the Road & Automotive / Katarzyna Porzuc, EUSPA

Ms Porzuc welcomed the participants of the EU Space Week and the 2023 User Consultation Platform for the Road and Automotive segment. Ms Porzuc introduced the concept of the UCP as a way for EUSPA to collect user needs and requirements to guide the evolution and activities of the EU Space Programme and to identify existing gaps that Research and Innovation programmes in EUSPA's charge could fill in.

Ms Porzuc introduced the main objectives of the three panels included in the session and presented the three applications, indicating to the audience that each of the panels would be followed by a discussion session, embracing the collaborative spirit of the UCP.

Agenda Item 2 – Status of the EU Space Programme / Carmen Aguilera, EUSPA

Following the introduction to the session, Ms Aguilera, also representing EUSPA, offered an overview of the status of the Space Programme Components; EGNSS (Galileo and EGNOS), Copernicus and GOVSATCOM. She highlighted that this was the first time that almost all the components of the EU Space Programme were being covered. However, Space Situational Awareness was not going to be covered in the Road and Automotive session as it had its own.

In terms of navigation, the Galileo and EGNOS Programmes were discussed in detail:

- Galileo High Accuracy (HAS): provides decimetre accuracy via signal in space and internet. However, prospective users need to take into consideration that in order to get connection via internet, the user needs to register.

  Regarding the service area, despite it being global, different performance levels are achieved depending on the region. Nevertheless, Ms Aguilera assured the audience that EUSPA is already working on improvements. Some of them regarding accuracy, convergence time at receiver level and other needs coming from the road and automotive segment.

- Galileo Authentication Service (OS-NMA): Ms Aguilera confirmed the service will be commercially available in 2024. She explained that this service provides the user with the capability to know that the signal being used is provided by Galileo and it is not spoofed. She highlighted the importance of this for liability critical applications.

  In this context, Ms Aguilera informed the audience that several guidelines have already been published for users to start testing the service and for manufacturers to start developing receivers.

On a final note, Ms Aguilera highlighted the importance of EGNOS for critical safety applications and informed the audience that Galileo Open Service had been updated to offer a shorter time to first fix.

Regarding Copernicus and Earth Observation, Ms Aguilera made an emphasis on the importance of the combination of space and in-situ monitoring networks.

Concerning GOVSATCOM and IRIS2, Ms Aguilera explained GOVSATCOM, the European programme for secure communications, mainly for governmental users, and IRIS2, which will be a bigger secure communication programme that will offer services for both governmental and commercial users.

Ms Aguilera reminded the audience that IRIS2 is still under development, so the session would be a perfect opportunity for the participants to inform EUSPA of possible use cases and requirements, especially regarding the development of connected cars and connected infrastructure.

Finally, regarding the evolution of the services offered, Ms Aguilera presented some examples of projects managed by EUSPA, already focused on the improvement of certain aspects (E-GIANTS, IDEEAS), and presented the idea of defining and operational service concept for space weather impact on EGNSS, asking the audience if this would be something interesting for the Road and Automotive segment.

The slides of this agenda item can be found as Attachment 1 in section 3.

Agenda Item 3 – Standardisation Update / Miguel Ortiz, Université Gustave Eiffel

Mr Miguel Ortiz introduced the importance of standardization for the downstream space sector.

As the downstream applications market is vast, Mr Ortiz highlighted the need for standardisation to address several issues, some of them being:

- Federate experts, industries, and operators
- Strengthen downstream activities
- Develop common international downstream standards
- Support large space deployment of space services and applications
- Enhance interoperability
- Promote fair comparison of performances

Mr Ortiz also provided the example of EN 16803 standard for performance assessments of GNSS terminals that records real signals and replays them in a lab using different kinds of devices to ensure a correct analysis of the performance.

Another two examples provided by Mr Ortiz, of standardization bodies in this case, were CEN-TC5-WG1 at European level and ISO TC20 SC14 WG8 at international level. He emphasized on the latter and the four pillars on which it focuses: NT/GNSS, remote sensing/Earth Observation, SatCom, and space weather.

Mr Ortiz concluded with the idea that standards should be developed with space applications in mind to allow for the use of different space services.

The slides of this agenda item can be found as Attachment 2 in section 3.

ITS and Infrastructures

Agenda Item 4 - ITS and Infrastructures, Tolling / Sergio Pérez Gámez, KAPSCH

Mr Sergio Pérez presented a series of use cases related to GNSS tolling:

- GNSS-based tolling: vehicles have On Board Units (OBUs) that transmit the position to centralised systems. This allows for free flowing of vehicles without stopping at the tolling booth.
- Road User Charging: the main goal is to replace the field tax and to continue providing the income that the state needs to maintain the roads.
- City based road pricing: support cities that want to charge drivers for entering the city centre.
- Pass through detection: detection at specific toll points that replace existing solutions.

Mr Pérez introduced the Kapsch geo location platform which receives GNSS signals and other data from the devices, regardless of whether these devices are produced by Kapsch or third parties. On this line of thinking, Mr Pérez informed the audience that Kapsch is already looking at the integration of their platform with connected vehicles.

Mr Pérez explained the functioning of the system, which needs to be fed the appropriate data such as type of road, vehicle class or type of user to find the correct rating information. The following step is a reconstruction of the trip, assigning the GNSS data to the road lanes and the other dimensions. Finally, the rate is calculated, and this is what is provided to the toll service provider.

Following this, Mr Pérez provided the audience with a few examples of countries that have already adopted GNSS technologies for tolling, such as Bulgaria, and of the tests being conducted by Kapsch in Norway. Mr Pérez also added that in this context, it is important to take into consideration that the heavy goods transport market is ahead of the light vehicles market.

On a final note, Mr Pérez presented the user requirements that are needed for tolling:

- Horizontal accuracy: less than 30m
- Vertical: not relevant
- Timing: less than 1 second
- Coverage: 95%. There is a need to close the gaps when building back the vehicle’s trip
- Availability: same for all scenarios
- It would be good to have interference detection built in the OBU.
- OS-NMA: good addition as it is expected than once the system becomes global people would try to avoid paying.

Q&A

- For which use cases do you foresee that the authentication would be required the most?
    - (**A**) For trucks is not strongly needed. In the future when there are country wide road user charge schemes with millions of users, authentication will be needed.
- How do you plan to face the problem of jamming by truck drivers?
    - (**A**) There are some enforcement gantries scattered along the network. If a truck is caught and there is no GNSS information, there will be a fine for jamming the device.
- Do you foresee issues from using a mobile app as a platform?
    - (**A**) The mobile app is only used as a proof of concept at this moment, in the case of Kapsh. In Norway a partnership was formed with a company that provided an app that you install in a device, not specifically dedicated for this.

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

Agenda Item 5 - ITS and Infrastructures, Traffic Management / Antonio Granado, Dirección General de Tráfico

Mr Antonio Granado started his presentation with a short introduction of DGT, which is the Spanish public administration body in charge of road safety and traffic management on interurban roads. In order to carry out their functions, they use ITS, GNSS and EO.

Mr Granado presented a series of use cases in which DGT uses satellite services and information:

- DGT 3.0. IoT platform: a public cloud that allows interconnection between all the agents involved in the road management process which includes both public administrations and private companies. Mr Granado highlighted how data integration can be used to make decisions and to share information with other users.
- V16 Signal: this system allows the user to send a signal to a traffic control centre in real time in case a car breaks down on the road. This allows to reduce action times.
- Tow Truck location information.
- Location of intelligent road cones: Mr Granado explained that when using road cones to signal works on the road, the first cone is geopositioned. In this way, information about road maintenance can be sent to the users.
- Road management during natural disasters: Mr Granado used as an example the eruption of the Cumbre Vieja volcano (La Palma, Canary Islands). In this case, they used satellite information, also including contribution from Copernicus, to obtain real-time information about lava movements and the state of the roads. This information was then integrated in the Spanish NAP (National Access Point) for traffic and mobility so it could be disseminated to all users.

- Mr Granado introduced the project for the implementation of a corporate SCADA in DGT with floating car data integration which will aim to improve the identification of issues regarding the state of the road.

Regarding the use of satellite information by public administrations, Mr Granado identified a series of needs: integration of procedures, better knowledge of existing data sources and their applications, better data quality in the cross-referencing with DGT information systems, introduction of the possibility of developing joint actions/ innovation projects.

Q&A

- What service are you using in emergency situations?
    - (**A**) Positioning service is used. Every 90 seconds the authorities receive data which allows to reduce response times.
- In the case of telemetry data of free-floating cars, are you considering or coordinating the data sets from a national perspective? For example, micromobility services that have some other telemetry data?
    - (**A**) The scope is mainly interurban roads, but there are contacts with urban mobility stakeholders to coordinate in these cases.
- In the La Palma use case, where you using periodic bulletins or real time information? What was the structured used? Were you sharing this information with others?
    - (**A**) This was a big emergency and real time information was needed. Regarding the integration with Copernicus, there was the possibility to integrate it but, at the time there was a lack of awareness regarding the services available. There was a combination of real time information and periodical information received by Copernicus.
- Which data from Copernicus satellites did you use? Also, any other data?
    - (**A**) Copernicus EMS relying on Cosmo-SkyMed Images was used. The main issue faced was the need for quickness and immediate integration of information.
- Are you developing services with in-house funding or other funding for example ESA funding?
    - (**A**) DGT is a public administration, so it has a governmental budget.

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

Agenda Item 6 - ITS and Infrastructures, Copernicus for infrastructures, end-user perspective / Roberto Giuliani, ANAS & Dr Valentín Alfaya, Ferrovial

This agenda item was addressed by Mr Roberto Giuliani from ANAS and Dr Valentín Alfaya from Ferrovial.

ANAS

Mr Giuliani presented the main objective of adapting the road infrastructure to climate change, while also emphasising how essential EO technology is for cost reduction and limiting hydrogeological risk to the Italian territory.

He highlighted various use cases:

- Ground displacement: assess risks and adapt road projects by providing InSAR maps to check ground movements at mm level.
- Monitoring bridges and viaducts: co-design R&D project financed by Italian Space Agency based on a multi-layer technology approach (EO data: DInSAR, image geodesy, Cosmo SkyMed, Cosmo Second Generation; GNSS receivers, UAV, Machine learning)
- IRIDE: New Italian EO satellite programme (EO, SAR, and optical imaging with different frequency ranges), participating as pilot user for lots including landslide monitoring and critical infrastructure monitoring and uses.

Mr Giuliani emphasised how critical ground motion phenomena is for the design and construction of new road sections, which needs to be supported by geological and geomorphic data. In addition, to improve the quality of the data and the results, there is also a need to complement the PS chromatic scale with indicators that characterize soil factors contributing to ground motion.

Other user needs for applications presented by Mr Giuliani were:

- Identification and quantification rates and displacement trends of active landslides. On this, Mr Giuliani reflected on how current technologies do not permit to measure fast landslide displacement, but only landslides with moderate velocities.
- Evaluation of trends of deformations to be supported by a predictive analysis.
- Monitoring bridges and viaducts.
    - In this case, DInSAR interferometry is used but it is not an absolute value. There is a need to integrate other space technology domains through multiscale and multifrequency approaches.
    - Interaction between the ground displacement and the infrastructure needs for buffer zones to detect the interaction.
    - Important to detect the difference between distinct parts of the same infrastructure.
    - For these cases, Mr Giuliani explained how it could be an opportunity to merge satellite interferometry and structural engineering skills. However, to develop this there is a need for small scale funding and for public administration to open calls for tender in order to carry on developing innovative applications (PoCs, demo pilot projects) and to design a new generation of user driven EGMS.

Q&A

- Are there any inspiring use cases where EO helped you in planning some maintenance works and at the same time saved expenses by avoiding sending people to the site?
    - (**A**) In the case of the first use case, the intention is to limit having on site visits in the

planning phase. EO also helps to understand the historical aspects of an area.

- Are you planning to integrate meteorological data to find about possible landslides brought by heavy rain?
    - (**A**) The integration of weather conditions to understand the effects of intense rain as the cause of landslides is very important. Anas is already engaged in a smaller project with an Italian innovative SME, based on space technology, mostly telecom, taking advantage of a well-known telecommunications phenomenon; the attenuation of electromagnetic waves in case of precipitation, to conduct a PoC in a specific area that is monitored due to the risk of landslides. Research into how to integrate these predictions is being carried out but focusing for the moment on areas in which the risk is known and for the moment is focused on areas already known for hydrogeological risk.

FERROVIAL

Dr Alfaya presented ADAPTARE, an assessment tool for identifying climate risks developed by Ferrovial and the University of Cantabria. Dr Alfaya explained that this platform is able to provide potential risk scenarios, integrating hazards, vulnerability exposure, sensitivity to climate risks which include flooding and massive ground movements, wind, or extreme temperatures. The assessment is done for both technical and economic evaluations. Dr Alfaya explained how the platform is based on interactions between space data and climate models.

Dr Alfaya also made several suggestions regarding the tools and platforms related to space data and services and linked to climate resilience. He highlighted the importance of providing more user-friendly interfaces for non-experts and making the platforms more accessible to regular users, who might not have extensive technical knowledge.

However, Dr Alfaya also raised some concerns, mainly the lack of decision-making tools regarding climate resilience at business level and the insufficient information and operational assistance to help users manage the few existing tools.

Q&A

- Do you have insights on what has been the impact of the use of this platform?
    - (**A**) Much more resilient infrastructures have been designed. This has been welcomed by the customers, mainly institutional organizations.

The slides of this agenda item can be found as Attachment 5 in section 3.

Agenda Item 7 - ITS and Infrastructure, Copernicus for infrastructures, products / Dr Joanna Balasis-Levinsen, EEA

(Due to time constraints, the agenda item was brought forward)

Dr Joanna Balasis-Levinsen represented the European Environment Agency (EEA), responsible for implementing the European local components of Copernicus services related to land monitoring.

Dr Balasis-Levinsen highlighted that all products related to the Copernicus Land Monitoring Service (CLMS) are harmonized and regularly updated, and that all products and related manuals are provided free of charge to the public.

She also provided the audience with several examples of the products offered by the EEA related to the CLMS:

- Corine Land cover: relevant applications related to roads could include infrastructure planning (what type of land and what types of materials should be used).
- Corine Land Cover + Backbone: which Dr Balasis-Levinsen announced will be soon updated to potentially include vegetation
- Urban Atlas
- HR Impervious Built Up for models of run-off/flood scenarios
- HR Vegetation parameters
- European Ground Motion Service (EGMS) which provides information on infrastructure deformation and landslides.

Agenda Item 8 - ITS and Infrastructure, Copernicus for infrastructures, intermediate user perspective / Nuno Duro, Spotlite

Spotlite is a platform that monitors infrastructures from space, using a combination of satellite data and in situ sensors. The platform collects data from Copernicus satellites, as well as other satellites, by using multi-spectrum and radar data.

Mr Duro presented the three models offered by the platform: ground motion monitoring, vegetation monitoring, asset management. The first two are more related to EO data and processing EO data.

Following this, Mr Duro shared several use cases to demonstrate Spotlite's work:

- Surface displacement: the platform collects historical data and provides regular updates on the displacements. Mr Duro explained that with their own visualization tools and based on the information they establish different thresholds for different sectors. On the basis of these thresholds, they can provide early alerts for possible problems thus, being able to act before the events take place.
- Landslide susceptibility: for this service, Mr Duro explained that they use multiple sources, such as medium-high resolution sources. This service offers a classification of each slope depending on the customer's needs and offers a preview of the evolution.
- Vegetation monitoring: by using multispectral data, this service detects trees, their height, and their vitality index, also offering species detection. This service uses very high-resolution imaging for the periodical monitoring of areas for maintenance. Mr Duro added that it can also detect vegetation between lanes.

Finally, Mr Duro explained to the audience that they use SAR and multispectral Copernicus satellites, sentinel-1 mainly and sentinel-2 to complement.

Q&A

- What business model do you adopt?
    - The business model is price per km, but it can change depending on the service provided and country.
- Have you thought about a solution for fast landslides/collapse and debris?
    - (**A**) Preventive solutions are being developed. In many cases minor movements in the slopes can be detected before they fall.

Agenda Item 9 - User requirements. Discussion & validation

Mr Marco Bolchi, introduced the items under discussion. The objective of this being the update of the values proposed for the different user requirements and parameters.

For GNSS a series of questions were posed to obtain the audience's feedback on a series of items, and, for Earth Observation, a series of graphs were presented to discuss the level of technological and market maturity of the applications.

GNSS

Q1. How can you achieve the necessary level of trust in the position of the vehicle?

- (**A**) The assumption that the GNSS system is subject to failures is made, so probabilistic models are used to correct the inefficiencies/inaccuracies of the detection. The advantage is that the vehicles can only move inside the roads, so the road and the movement of the vehicle are matched. For this metadata is used, so the values calculated by the GNSS device need to be correct. There are some gaps that cannot be covered, so a more complex software is being developed, however this will still be an issue when scaling up.

Q.2 What is the relevance of authentication of the position of the vehicles? + Q3. Do you see R&I gaps for the uptake that funding programmes could address?

- (**A**) Technologies are already available, there is a need for a push from the administration to make this technology compulsory for all the vehicles sold. Build up a regulatory framework to ensure that this is covered.

EO

The technological and market maturity per application was assessed with the audience:

<u>Application: Determination of surface ground movements</u>
The application was deemed to be technologically operational and market mature.

During the discussion, the audience agreed that the application's technological maturity is sufficient, although there is still a need for further development in specific cases.
Regarding market maturity, the audience agreed.
One significant obstacle towards the development of this application that was identified by the audience was the potential users' lack of awareness of relevant products.

Comments from the audience:

(1) Need for proper knowledge about the use of satellite technology for this application. Sometimes there is some scepticism about the efficiency of measurement, not just for the ground but for particular target point.
Maybe the technology has reached a great maturity. There is no problem with the resolution and the revisit time, if it is known a priori the potentiality of what can be used, it is known that satellite for real-time data cannot be used, as it is not the proper tool.
It is the proper technology to monitor large areas. It is also useful for having historical movements, model the deformations in time and develop predictive analysis (this could be an interesting compliment for the use of EO).

(2) Space data will be much more useful for the prediction of massive movements in coming years. For small scale (viaduct or critical infrastructure) it may be better to use a combination of space data with onsite sensing, IoT, or even monitoring via drones, depending on the purposes. Technology is mature enough but must sometimes be combined with onsite data.

(3) There are some cases in which the technology could still be developed (ex. Frost–induced heave monitoring)

Q .1 What could EUSPA do to address this issue?

- **(A)** In general, the audience's response was to support awareness raising, providing specific examples:
- It is important to focus on opportunities to work together. Funding opportunities focused on user driving evolution of this service. It could be a good opportunity to finance the proof of concept, to see the potential of Copernicus for the next LEO missions.
- This should start from the needs of the operator. It could be an action that EUSPA could push for, small scale demonstration projects to put together the user to the technology provider.
-

<u>Application: Geotechnical and structural monitoring during construction</u>

This application was deemed to be technologically operational and market mature.
However, the audience didn't fully agree with the level of technological and market maturity that had been set.

- Major blocking points identified were lack of awareness, and skills.

Comments from the audience:

There are some particular activities on geotechnical structural monitoring with high level of

attention, like mining and tunnelling. Understanding how the interaction of activities in a geological area could cause some landslides and ground movement is important.
High level of maturity of the application.
Helps avoid remedial works that could be more costly for the company.

a. Follow up question EUSPA: Is the application really mature in terms of market adoption? Is it present on the activities?

(1) The ground motion detection application is not fully mature yet. There is a lack of awareness. The potential is big, but people are not aware of it.

(2) Regarding market maturity and resolution there is a massive usage of the land monitoring tools EEA offers, but they are based on medium-resolution satellite images. What about the high-resolution products? It is possible to reach a higher order of magnitude. There are challenges in its adoption as commercial data is being offered.

(3) From the service provider's point of view. The initial threshold of the knowledge needed is still quite high. Customers don't have a real idea on how to use the products. Engagement events are suggested, mainly focusing on how to read and interpret the data. It happens that people have the products and they can't exploit them properly.

(4) One member of the audience commented that when it comes to high-resolution, there is a huge commercial gap from sentinel-1 to higher resolution. If one wants to provide services with very high resolution, they need to task the acquisition of a large amount of satellite images and pay for their processing purchase, the costs of this is much higher than multispectral. This price difference usually makes it not worth it.

- Comment from EEA to the previous reply: Sentinel-1 can be used as a screening tool and then it is possible to know if high resolution imagery is needed for a certain area.

Ground motion products may seem complex to use. The process needs to be broken down and end users need to be targeted in a way that they can use the products without a processing background. The EEA has published guidelines on the CLMS website explaining how to start using EGMS data in QGIS, hoping to break down this initial barrier.
In companies a difference in awareness between departments can be appreciated. Sometimes there is a feeling that the application's maturity is not there.

- <u>Vegetation monitoring</u>

This application was deemed to be at a demonstration level regarding technological maturity and at an initial market level regarding market maturity.
The audience agreed with both the level of technological and market maturity identified.
When discussing blocking factors for further development, the participants agreed on the need to develop new use cases.

Comments from the audience:

(1) Ground displacement is more mature, is more automated. For vegetation monitoring, is automated but still needs work to be done. Agreed with the levels proposed.

(2) This is usually used to detect problems with the vegetation close to the infrastructure. It could be interesting to match this application to agriculture and monitor the growth of vegetables.

This could be an interesting application also for road monitoring.

(3) This seems to be more focused on the kind on vegetation that should be removed. There are many other interesting applications. Could be interesting to monitor biomass production, reduction of erosion of the slopes. This is something that is very difficult to follow up on site. This application for infrastructure could be very useful.

(4) The combination of low vegetation combined with soil build-up on the verges prevents water run-off. Trees and bushes are another domain. This relates to removal of vegetation, while it would be interesting to monitor health of the "good" vegetation.

- Application: assessing weather impact and climate risk

This application was deemed to be technologically operational regarding technological maturity and in between the incubation and initial market phases when it comes to market maturity.
The audience didn't object regarding the level of technological maturity identified but differed when it came to market maturity (see audience's comment below).
Regarding blocking factors to the development of the application the audience agreed on the need to develop new use cases.

Comments from the audience:

(1) Ferrovial is the only private manager of infrastructures using this technology. Technologically, is mature enough but regarding the market not at all. Ferrovial is the only company using such a tool in term of climate monitoring and forecasting.

Additional questions

- Are there any priorities you would like to add for funding programmes?

An in-house developed platform is being used to monitor activity impact and monetize it. To connect land use with ecosystem services, it is essential to monitor this area for possible improvement. Leveraging space services and data can help in monitoring numerous ecosystem services.

SESSION BREAK.

DISCUSSIONS ON GNSS AND EO REQUIREMENTS PER APPLICATIONS

Agenda Item 9 - Research and innovation perspective. / Dr Johanna Tzanidaki, ERTICO – ITS Europe

Dr Johanna Tzanidaki represented a public-private partnership organization, ERTICO – ITS Europe. She presented a use case, the 5G-MOBIX project which is focused on developing and testing automated vehicle functionalities using 5G and other technological innovations.

Dr Tzanidaki explained that this project had been tested in two corridors, Greece-Turkey, and Portugal-Spain. Dr Tzanidaki described the crucial role of Satcom in ensuring the continuity of service for CCAM and added that non-terrestrial elements should be integrated, and satellite latency is much better than cross-border latency delays.

On a final note, Dr Tzanidaki suggested there is no business case to have 5G in non-inhabited areas and stressed the importance of connectivity in ensuring road safety, especially with no drivers. She also disclosed that satellite information has been included in the SRIA 2025 of the CCAM Partnership as one of the next priorities.

Q&A

- Q. Micromobility is not part of this. How to cope with this in the future?
    - (**A**) Cycling industries are active in the CCAM platform (cluster 4). It is a very important perspective, because of the multimodality and the need to include traditional mobility. ERTICO has been discussing how to include connected and non-connected micromobility into the overall understanding of the new system. However, it is very difficult because vehicles follow the road, but bicycles and other micromobility elements can go in any direction, which is very hard to consider.
- Q. Do you include the concept of shared mobility?
    - (**A**) CCAM Partnership doesn't go into policy, but ERTICO looks into the governance elements. There is support for shared economy and shared mobility

The slides of this agenda item can be found as Attachment 6 in section 3.

Agenda Item 10 - Automotive value chain user perspective, OEM / Dr Javier Ibañez-Guzmán, Renault

During his presentation, Dr Ibañez-Guzmán highlighted the importance of position information for autonomous vehicles. He explained that all functions of autonomous vehicles are linked by positioning, which primarily relies on GNSS, alongside visual SLAM, LiDAR, Fusion, and Horizon maps. However, these applications only offer localization in relative terms, thus, without GNSS is impossible to know where one is in global terms.

In order to illustrate his point, Dr Ibañez-Guzmán used the example of the intelligent speed assistance part of ADAS. The application needs to correct the information on how fast the car is allowed to go and for that it needs to know exactly where the car is.

On this line, Dr Ibañez-Guzmán, explained that the main issue of GNSS is signal propagation in urban environments. In order to solve these, the system must be precise, accurate, and assure integrity and continuity of the data. He highlighted that this is something essential to take into consideration as error propagation can compromise safety.

In addition, Dr Ibañez-Guzmán, provided examples of two projects: ESCAPE and ERASMO. The former focuses on the use of vehicle on board information and maps, and the later on the use of cameras to detect the vehicle's surroundings, which offers the possibility of good accuracy and an estimate for the protection levels and level of integrity.

Q&A

- Do you have minimum accuracy requirements?
    - (**A**) Before machine learning 15-20 cm. Now the system is sufficiently intelligent that

it doesn't need too much precision, but it needs to know that it is correct.

Agenda Item 11 - Automotive value chain user perspective, Tier1: Ramsundar Kandasamy, Valeo

Mr Ramsundar Kandasamy represented Valeo an automotive supplier that produces sensors for Advanced Driving Systems (ADAS) such as LiDAR, cameras, and radars.

He presented the Telematics Control Unit (TCU), a telematic control unit/connectivity box that allows the vehicle to be considered a connected vehicle and allows it to access all cloud services and V2X. Currently, the TCU hosts the GNSS positioning system, however, Mr Kandasamy explained to the audience that this might change in the near future. Overall, the TCU provides the interfaces to the external world and the vehicle.

Mr Kandasamy explained that the positioning system includes the GNSS chipset, IMU, PVT and Odometry, which make up the key software. This is used in applications such as eCall, navigation, V2X, automated driving, positioning as a service, stolen vehicle tracking, fleet management. In order to provide for this, Mr Kandasamy added that they use multi constellation and single frequency.

Mr Kandasamy presented the possible evolutions for the GNSS integration into TCUs, as due to technology advances, there has been a deviation where the clients are asking for a separate TCU, which provides the GNSS functionality. The main reason for this is the application that is using GNSS, autonomous driving.

The possible solutions that Mr Kandasamy presented were:

- Fit GNSS inside the TCU but running on a dedicated subsystem that can guarantee the functional safety aspects of the system.

- Split the hardware and software into two components. Move the software into any other high-performance computer.

As Mr Kandasamy stated, the location of the GNSS is important for ADAS, as it provides a fusion of absolute and relative positioning.

Regarding the user requirements, for this application, Mr Kandasamy presented the following:

- Functional safety integrity requirements:

For the ASIL levels, each function would be assigned a level.

Regarding the ASIL decomposition, Mr Kandasamy explained that the AD positioning unit has the highest integrity level requirements because it is life critical, and the ISO standards specify that it must be ASIL D. For this, one can make use of two ASIL B systems to create one ASIL D system, which is the case of auxiliary positioning.

Mr Kandasamy added that for the moment, correction is still quite new to the industry.

- Functional and performance requirements. Operational:

In order to transition from Society of Automotive Engineers (SAE) Level 2 of automation to Level 4, Mr Kandasamy explained that the system needs to ensure that the car is on a particular lane. Only if it is on a particular lane, it can operate freely in its operational design domain (e.g. when the car is going to exit a highway, it needs to inform the driver to take over. For this, it needs to know that it is in the further right lane and that if the driver doesn't take over, it can park in the safety lane).

Accuracy needs to be between 20-30 cm. This can be dependent on the road type and the associated lane width.

Regarding future developments, he mentioned the following points on the Galileo services;

- HAS: Focus on accuracy and correction data. Convergence time would need to broadcast on E6 which would add redundancy to the system. As of now it cannot be used as standalone for safety critical applications.
- OSNMA: to provide high level of resilience to spoofing.

Other technologies that can be important for automated driving are LEO PNT, as well as non-terrestrial networks and SatCom.

Q&A

- What is the main barrier preventing the use of HAS for safety critical applications?
    - (**A**) Normally when there is a requirement for a subsystem with a specific integrity level it spreads down. Only if the lowest level has the corresponding level it can work.
- Will Level 5 of automation be achievable?
    - (**A**) Level 3 is commercially available in some places. The main difference between 4 and 5 is that Level 5 there is no steering wheel. In theory already Level 4 means Level 5.
- Can you elaborate on the use of the 5G communication protocol?
    - (**A**) There is a long-lasting debate on Cellular vs ITS G5 for V2X communications. Both solutions are useful as there are advantages for each of them.
- There is a need for high-definition maps to fully automate the driving. However, do you make sure that the map meets the standards? Can you elaborate a bit on the role of HD maps?
    - (**A**) HD maps provide a priori information. The theory is that for autonomous driving HD maps are needed, which are very expensive and have to be updated very frequently. There is a need for HD maps, but on the other hand normal maps can be used together with GNSS and perception sensors to provide an alternative solution to the use of HD maps.

Question from Mr Javier de Blas, EUSPA:
Can you identify potential requirements for the evolution of HAS? EUSPA wants to understand whether as part of the positioning engine including the integrity function, HAS could be sufficient for the users, or if it is expected that the necessary integrity would be provided at individual level by each system component.

- (**A**) At the beginning there was no positioning engine vendor that could go commercial and provide integrity. Now there are a few.

  If there is a provider that can work with HAS and still provide a certain level of integrity this will be a game changer. How capable is a PVT engine to provide such level of integrity without having correction data? A provider that could satisfy the integrity requirements put by the OEMs with HAS cannot yet be identified.

Comment from Dr Ilaria Martini, u-Blox:
There is a strong interest in using HAS. What is not feasible to be obtained from the HAS point of view will require some robustness from the positioning engine from the receiver, which has to be complemented by the HAS service provider.

Agenda Item 12 - Automotive value chain user perspective, Tier2: Dr Paul Verlaine Gakne, Hexagon

Dr Paul Verlaine Gakne represented Hexagon, a provider of sensor and software solutions for positioning, autonomous technologies, and location intelligence.

Dr Verlaine Gakne presented the use case of automotive correction services, and he highlighted the requirements needed for the correct functioning of the service, i.e. high accuracy, use of multi frequency multi receiver antenna and high availability. With safety in mind, Dr Verlaine Gakne suggested completing this solution with other sensors to increase availability and improve position accuracy and reliability. He also added that in the case of anti-jamming and anti-spoofing, GNSS resilience should be boosted by OS-NMA;

He also presented PPP-RTK, which considered suitable for automotive applications as it offers fast convergence and accuracy, integrity, ASIL compliance.

With regard to future trend and innovations, he mentioned the development of a new LEO PNT constellation.

Finally, Dr Verlaine Gakne presented the use case of autonomous platooning in controlled environments.

Q&A

- Can you elaborate on how your solution improves safety against spoofing?
  - (**A**) Hexagon focused on spoofing detection and mitigation at different levels, embedded in the receiver design. Multiple layers and metrics are used together to detect spoofing.

Agenda Item 13 - Automotive value chain user perspective, receiver manufacturer: Dr Ilaria Martini, u-Blox

Representing a receiver manufacturer, Dr Ilaria Martini presented the needs and the challenges for autonomous transportation applications. Regarding the accuracy needs, she stated that all

autonomous driving functions need accuracy lower than 1 meter. She identified the following challenges:

- Targeting an integrity risk requested by ISO standards being up to $10e^{-7}$. This is inferred by the interpretation of ASIL functional safety standards (SOTIF standard).

Regarding the specific requirements, she identified the following:

- Autonomy: implies that ADAS from Level 2 to Level 5 is being addressed, which means that the accuracy needs to be up to cm level in the most demanding use cases.
- Sensor fusion: GNSS is an essential element because GNSS provides absolute positioning.
- Cooperative positioning and integrity monitoring needs to follow several standards.

She presented the u-Blox Safe positioning solution (SafePoint) which addresses autonomous driving and will be extended to other sectors such as industrial and performance robotics. The solution provides a GNSS based end-to-end solution. U-blox is currently investigating the possibility to separate the engines of the solution can be accommodated in different platform across use cases.
Dr Martini presented the use case called u-safe. It's an end-2-end positioning solution targeting Level 2+ automated vehicles and up. Currently it is promoted for the automotive sector but will cover many other automation use cases in the future.

When it comes to safe and reliable positioning, the concept of integrity needs to change with respect to what has been done in aviation, as the requirements for the automotive segment are different and more stringent. Moreover, GNSS modernization might imply additional faults that where not foreseen before or are not a problem for civil aviation.

Correction services play an important role correcting the location signal for the following errors:

- Space errors coming from the satellites directly;
- Atmospheric errors caused by the ionosphere; and
- Local errors because of multipath, interference and NLOS requiring a robustness algorithm that needs to be developed into the receiver itself.

Single Epoch positioning bound (SEPB) estimates is an offline process solution based on a single epoch. The approach allows to get rid of the temporal correlation effect.

In order to mitigate local threats such as multipath, spoofing and interference, a solution needs to exploit the doppler frequency, increasing the correlation period of the incoming signal allowing to eliminate reflected signals and spoofed signals.

Q&A

- When you're estimating the integrity solution are you also including other data?
    - (**A**) End to end safety cases including different sensors and parts.
- When you do fault detection and exclusion and then you use loosely coupled?
    - (**A**) Doing loosely coupled however, this is still in the R&D phase.

- Elaborate how you derive integrated risk 10e-7 from the standards?
    - (**A**) Deriving figures from the standards is complicated. Figures in most cases come from discussions with the customers and different stakeholders.
- How to assess that your device is delivering certified or good value?
    - (**A**) This is the outcome of a process that is not following any official standards for the moment. In aviation, there are minimum performance standards which provide which kind of tests one needs to perform to be compliant. In the automotive sector, one needs to follow several processes, measurement campaigns to get confidence from the data collection, and analytical analysis to show that all the algorithms are robust from the statistical and analytical point of view.
- Do you also use simulations?
    - (**A**) In some cases yes, for example in case the measurement campaign doesn't contain all the elements

Agenda Item 14 - CCAM User Requirements Discussion & validation

Mr Marco Bolchi l asked the audience for their input and opinions on the role of GNSS for vehicle positioning and the operational requirements that had been identified by EUSPA.

Q1: Addressing requirements for the protection level. There seems to be a consensus around 2m level, can you confirm this?

- **(A)** There is a variety of needs from different customers. This is also strongly related to the ODD. This can change depending on the specific scenario.

Q2: Strategies by OEMs and suppliers vary in relation to the needs. Those different strategies influence the role and the expected performance of GNSS? Or is GNSS independent from the strategies and thus the requirements are the same?

- **(A)** The only source of absolute position is the GNSS. There are other solutions for relative, but they always divert.
- **(A)** It is always being used as a redundant system. There are places where the perception system takes the lead, and places where the perception cannot help you so then the lead is given to the GNSS.

Q3: Could you elaborate which functions you see going to the high level for the automotive environment?

(A) PPP solutions would provide and accurate and safe correction service essential for the further development of CCAM. Regarding satellite communications for CCAM the following discussion emerged:

Q1: What are the most important requirements with regard to satellite connectivity?

(A) In general, there is a big momentum towards satcom. The automotive industry is focused on the possibility of Tesla including features enabled by Starlink. However, it is complicated to establish the interest of the mass market on this.

Q2: Do you see gaps that can be addressed by R&I and how could EUSPA support on this?

- **(A)** Tier1, sees Tier2 partners working on the HAS capabilities. However, it seems that the technology is still too new for a massive commercial development. Support from EUSPA to contact proper partners would be welcomed.

Comment from EUSPA: in the coming months EUSPA is planning to launch a call for proposals under Fundamental Elements programme, addressing HAS and OSNMA implementation in CCAM and the automotive value chain is invited to participate.

- **(A)** Establish permanent links to the other entities in charge of R&I, such as CCAM Partnership.

MaaS

Agenda Item 15 MaaS service provider perspective: Sebastian Schlebusch, Dott

Sebastian Schlebusch from Dott presented the localisation needs for micromobility applications and discussed several considerations relating to micromobility infrastructure. A summary of his points:

- To locate micromobility vehicles and for geofencing purposes, centimetre or decimetre accuracy is not required, but it is necessary to ensure parking compliance.

- Latency and the need to balance energy consumption with accuracy can lead to some delay in locating vehicles, but this is acceptable within reason.

- Micromobility infrastructures can generate a lot of data from the city via vehicle sensor usage.

- Real or perceived lack of safety is a barrier to the adoption of micromobility services. To address this, information sharing between users and administrators is key.

Mr Schlebusch also identified specific challenges facing the implementation of micromobility infrastructure:

- Parking accuracy has been improved with sensor/camera fusion technology, especially AI-validated end-of-ride photos.

- Lack of centimetre accuracy means that pavement riding cannot be easily detected. However, computer vision technology can help evaluate whether users are on the pavement

or in an adjacent cycling lane.

Q&A

- Could you tell us what is the cost range of the sensors embedded in the systems?
    - (**A**) The unit costs around EUR 800-1000 per scooter including the IoT. Not sure about the sensors on their own. Dott has kick started projects to develop their own IoT. First batch of 2000 will be deployed early 2024.
- Does Galileo offer a real increase of localization precision compared to GPS?
- (**A**) Dott uses GNSS rather than GPS as the former offers better accuracy. According to the use of micromobility, what is your experience with big companies that push for the use of micromobility to contribute to tackle pollution?
    - (**A**) This is a growing tendency.
- Geofencing functionalities. Is it static or dynamic?
    - (**A**) The way in which it has been implemented so far is more static. It can be adjusted by Authorities with an implementation period of 1-2 working days.

Agenda Item 16 MaaS platform provider perspective: Sampo Hietanen, MaaS Global

Sampo Hietanen, the founder of MaaS global, stated that the company's main idea is to integrate all modes of transportation and their concerns on a unified platform called Whim. He emphasised the importance of two key considerations while creating this platform:

- Accurate positioning is fundamental to ensure seamless functioning of the service.
- The platform's tracking of modes and movements must be extremely reliable, enabling cost-effective MaaS development.

Q&A

- Have you been trying to put down ideal requirements for the accuracy and availability of positioning information?
    - (**A**) It has been tried. But new ideas always end up coming up, and innovations that could be added. In terms of reliability, it is essential to know that information is always being received.

Agenda Item 17 - Maas User Requirements Discussion & validation

As in the previous panels, Mr Bolchi inquired about the user needs and requirements specific for MaaS.

Regarding the accuracy user requirements, the audience agreed on the following:

- For locating a vehicle roughly 5 meters accuracy is enough.

- For parking accuracy, everything below one meter accuracy is good but the more precise, the better.
- For geofencing, the required accuracy would be around 5 meters as well, and regarding the signal convergence time, it would be from 3 to 5 seconds max. Anything longer than that could put a constraint on the user experience.

Q&A

- R&I and what can EUSPA do?
    - (**A**) HAS seems like something Dott could use. But integrating it in the new IoT sensors on the scooters is up to the sensor providers.

2 CONCLUSIONS

The Road & Automotive UCP session was successfully closed by Ms Katarzyna Porzuc from EUSPA.

These results are summarised below:

- **Standardisation** is key for the development of downstream space applications, including in the Road and Automotive segment.
- While the positioning user requirements for GNSS based tolling are currently met, OS-NMA could play a key role in the future by authenticating the position of cars and trucks trying to avoid paying tolls.
- **Traffic management** uses ITS, GNSS and EO information, allowing for example to reduce emergency response times coming from emergency services.
- **Copernicus,** mainly Sentinel-1 and 2, together with other commercial EO data, can help road authorities to adapt their **infrastructure** so they become **resilient to climate change**. Additionally, it can improve their daily **infrastructure monitoring and maintenance** activities while reducing costs and limit the hydrological risk. However currently, there is a **lack of awareness** among the community regarding the services at their disposal and a lack of knowledge when it comes to the use of the tools. Combined with the lack of decision-making tools these issues hold back the uptake at the user level.
- As automated functions currently rely mostly on relative positioning technologies, **GNSS** proves to be crucial for **CCAM applications,** as it is the **only absolute location source** for the vehicle. However, the main issue of GNSS is signal propagation in urban environments and in order to solve these issues, the system must be precise, accurate and assure integrity and continuity of data. Regarding the application of **HAS**, the industry shows a strong interest.
- Satellite communications (**SATCOM**) will play an **essential role in providing continuity of service** for the connectivity of CCAM applications in remote areas.
- The development of **proper anti-spoofing and anti-jamming systems** and other tools to mitigate threats is fundamental to the safe deployment of CCAM. OS-NMA could be particularly effective in boosting the resilience of GNSS in these cases.

Further development and incorporation of **HAS** could prove beneficial **for micromobility and MaaS applications** as they allow for the offering of improved services increasing the end user experience and compliance to local. Key results of this working session were highlighted during the plenary UCP session on 8th November 2023, moderated by Ms Carmen Aguilera.