ROAD & AUTOMOTIVE MARKET SEGMENT SESSION MOM'S

Meeting Date	04.12.2025	**Location**	Prague
Meeting Called By	EUSPA		
Minutes Taken By	Name: Patricia Lopes Bautista, EY		
Representatives & Speakers	**EUSPA Representatives** **Katarzyna Porzuc, Market and Innovation Officer** **F. Javier de Blas, GNSS Services Manager** **User Community Representatives (UCRs)** Paulus Spaanderman, Founder and CEO, InnoMo, Car2Car Communications Consortium **Speakers / Moderators** Andrea de Cándido, Policy Officer, European Commission, DGRTD Pere Molina Mazón, Field SW developer, Automotive Business Unit, Hexagon/Novatel Andras Varadi, Research Director, Commsignia, Car2Car Communications Consortium Paulus Spaanderman, Founder and CEO, InnoMo, Car2Car Communications Consortium Javier Ibañez Guzmán, Technical Manager, Renault/Ampere Curtis Hay, Technical Fellow, General Motors Oliver Wick, Technology scouting, BMW Ulf Bartholomaeus, Electronic Architect, Aumovio Alastair Gregory, Lead SW Architect, Aumovio Stephanie Leonard, Global Head of Government and Regulatory Affairs//TISA President, TomTom – TIPSA Johanna Tzanidaki, AYA Consulting - Moderator		
Distribution (in addition to attendees)	UCP Plenary session, EUSPA, Public		

AGENDA

Agenda Items	Presenter
1. Welcome and introduction to the Road & Automotive session	Katarzyna Porzuc, EUSPA
2. CCAM policy context	Andrea de Candido, European Commission
3. Navigating the automation challenges and the contribution of GNSS/Galileo - *The EU Space Programme update – Galileo and its differentiators (HAS, OSNMA, EWSS)*	F. Javier de Blas, EUSPA
4. State of the market - *Accurate and safe positioning on the road: our approach*	Pere Molina Mazón, Hexagon/Novatel
5. State of the market – *Where is everyone? Enhancing traffic safety and efficiency with cooperative ITS through precise positioning*	András Váradi and Paul Spaanderman, Car2Car Communications Consortium
6. User needs and requirements discussion	Javier Ibañez-Guzmán*, Renault-Ampere* Curtis Hay*, General Motors* Oliver Wick*, BMW Group* Ulf Bartholomäus*, Aumovio* Stephanie Leonard*, TomTom*

SUMMARY

Summary

The Road and Automotive panel of the User Consultation Platform (UCP) 2025 took place on 4th December 2025 as a hybrid event in Prague, gathering approximately 25–30 participants on site and 15–20 remotely per session.
The event was structured in two main parts: the morning session focused on the use of GNSS for Cooperative, Connected, and Automated Mobility (CCAM) and the implementation of Galileo differentiators, while the afternoon session was dedicated to SATCOM for CCAM and the development of IRIS2. The sessions featured in-depth presentations from EUSPA, the European Commission, industry representatives, and user community experts, covering the latest policy context, market state, and technical advances.

For the GNSS session, presentations from Hexagon/Novatel and Car2Car Communications Consortium addressed the state of GNSS in automotive applications, highlighting the shift to multi-constellation, multi-frequency receivers, and the importance of integrity and safety in positioning solutions. PPP (Precise Point Positioning) and PPP-RTK were identified as preferred approaches for automotive use.
OEMs and Tier 1 suppliers (Renault/Ampere, General Motors, BMW, Aumovio, TomTom) discussed critical requirements for GNSS integration in CCAM, emphasizing the need for absolute positioning, high accuracy, integrity, and resilience against vulnerabilities such as jamming and spoofing.
This broad coverage generated interest from the participants and helped start good interactions via the chat and live.
The session identified several key needs and areas for action regarding GNSS in automotive and CCAM applications:

- **Absolute Positioning and Integrity:** Reliable, lane-level absolute positioning is essential for ADAS and CCAM applications. Galileo's HAS and OSNMA offer strategic advantages in improving accuracy and robustness, but high integrity remains a critical requirement.
- **Market Adoption and Receiver Capabilities:** Automotive-grade antennas supporting Galileo's E6B signal are not yet available, prompting OEMs to invest in R&D for compatible hardware. Adoption of OSNMA and HAS is increasing, driven by regulatory requirements and industry pilots, but further market penetration is needed.
- **Resilience and Redundancy:** GNSS faces inherent limitations, including vulnerability to jamming and spoofing. OSNMA helps counteract spoofing, and redundancy through sensor fusion and dead reckoning remains essential.
- **Accuracy and Convergence Times:** Sub-meter accuracy is becoming necessary for higher levels of automation, with HAS offering globally available, decimetre-level accuracy. However, convergence times is also important, as solutions must manage delays without compromising user experience.
- **Data Integrity and Security:** Systems such as smart tachographs rely on GNSS for authentic and secure Position, Velocity, and Time (PVT) data. Environmental challenges, interference, and time drift impact performance, highlighting the need for robust security frameworks.

MINUTES OF MEETING

Agenda Item 1 - Welcome and introduction to the road and automotive session. Katarzyna Porzuc, EUSPA

Katarzyna Porzuc, Road and Automotive Segment Leader at EUSPA, welcomed all participants to the User Consultation Platform (UCP) session. This session marked the fifth edition of the UCP dedicated to road and automotive users. This year, the focus was on CCAM, a topic of significant relevance and interest.

She provided an overview of the day, highlighting a packed agenda. She explained that the session would begin with a keynote address, followed by discussions on the role of satellite navigation in automotive Positioning, Navigation, and Timing (PNT), the current state of the market, and solutions for PNT. The morning would also cover perspectives on cooperative transport systems and include a user needs and requirements panel featuring OEMs and Tier 1 suppliers. The format was designed to be interactive, encouraging questions from both in-person attendees and online participants.

Ms Porzuc also introduced the afternoon session, in which attention would shift to SATCOM and its role in CCAM. The discussion would explore supply and demand dynamics, with presentations from IRIS2 and the SpaceRISE consortium. Participants would engage in conversations about future SATCOM services for vehicle connectivity.

Finally, Ms Porzuc introduced the keynote speaker, Andrea De Candido.

Agenda Item 2 – CCAM policy context. Andrea de Candido, European Commission

The sub-session started with a presentation on Moving Towards Automated Mobility at EU level Through Research. The presentation was given by Andrea de Candido, who represented the European Commission's Directorate-General for Research and Innovation (DG RTD).

Mr de Candido explained what the Commission was doing to support automation and why the space sector played an important role in this effort.

Mr de Candido provided the policy context, noting how the automotive sector has become a strategic focus for the European Commission. Until last year, CCAM was considered a niche area, but it is now viewed as a cornerstone for the future prosperity of the automotive segment. Automation is no longer limited to high-end vehicles; the future of automotive is moving toward automation and autonomous driving. He introduced the Automotive Dialogue, a strategic initiative led by the European Commission to address the challenges and opportunities facing Europe's automotive industry during its transition toward electrification, digitalization, and automation.

He emphasized that the Commission had been investing in research in this domain for over 20 years. Despite this, the number of autonomous vehicles remains limited and significant barriers still prevent large-scale industry investment.

Mr de Candido outlined these barriers: regulatory fragmentation across Member States, including differing criminal law approaches in case of accidents; lack of market generation; and the need to combine multiple elements; regulatory, societal, infrastructure, economic, and OEM agreements. Public transport operators, for instance, remain cautious due to reputational concerns.

To address these challenges, key initiatives include establishing test beds across Europe to deploy autonomous fleets under clearly defined rules, enabling initial scaling without full type approval. Member States involved will prepare regulations to facilitate future implementation. The Commission is also working to boost the regulatory framework and remove barriers to private investment.

Mr de Candido introduced ECAVA, an initiative to bring industry stakeholders together to agree on steps and standards. Working groups will focus on SDV, AI, software platforms, and autonomous tracking. Horizon Europe's CCAM Partnership will support large-scale demonstrations starting in 2027, moving from targeted research to deployment-oriented projects across passenger, commercial, and public transport use cases. Funding will include €100 million from the EC and matching contributions from industry.

He also mentioned the CCAM Technology Observatory, led by JRC, which will monitor the state of the art in CCAM technologies in Europe and globally to guide funding priorities. A common European project on clean, connected, and

autonomous vehicles is expected to start within a year. The dialogue explicitly includes the space segment, recognizing its importance for future mobility ecosystems.

Mr de Candido concluded by stressing that the future of mobility will differ significantly from today. The Commission is working toward a smooth transition and the long-term prosperity of the automotive sector, while considering societal evolution and road safety. Autonomous mobility is seen as a key factor in reducing mortality and road fatalities.

Agenda Item 3 – Navigating the automation challenges and the contribution of GNSS/Galileo. F. Javier de Blas (EUSPA)

F. Javier de Blas, GNSS Services Manager at EUSPA, provided an update on the Galileo programme, outlining the current status of its service portfolio and planned evolutions. He explained that the portfolio of services has been evolving over time to meet user needs and enhance performance.

The Open Service (OS) continues to provide the navigation basis, offering navigation and timing capabilities. The High Accuracy Service (HAS) delivers PPP clock and orbit corrections plus code biases and is progressing toward full-service capabilities. This includes the E6B component and internet-based access. To support adoption, EUSPA is publishing a user reference algorithm, mathematical model formulation, software implementation, and test vectors, making HAS easier to integrate for interested entities.

Phase 2 of HAS will focus on improving performance by adding phase biases and ionospheric corrections to the correction set, ensuring global availability and reducing convergence times for European users to under 100 seconds. Efforts are also underway to increase robustness, with HAS incorporating authentication services based on digital signatures. Market adoption of compatible receivers is being closely monitored.

The OSNMA service reached its initial declaration in July 2025, providing authentication for navigation messages. Looking ahead, the Signal Authentication Service (SAS) will enable authentication within the E6C component, making Galileo the only GNSS constellation capable of authenticating the full PVT solution.

The Public Regulated Service (PRS) continues to strengthen governmental capabilities in terms of robustness, with initial operational capability targeted soon and full operational capability under development to arrive shortly after. The Search and Rescue (SAR) service also remains a key component of the portfolio.

Looking to the future, the Galileo Services portfolio will be further expanded with SAS in the E6 band and move toward the Emergency Warning Satellite Service (EWSS), supporting the distribution of alert messages by the Galileo constellation in a compatible manner with existing national and mobile capabilities. The second generation of Galileo will be driven by user needs whilst maximizing synergies across different programmes to deliver integrated solutions for the community.

Additional developments include a timing service, GoSOL, and CIP for monitoring and forecasting ionospheric activity, contributing to weather services. These initiatives aim to strengthen Galileo's role in supporting automation and ensuring reliable positioning, navigation, and timing for future mobility ecosystems.

Q&A

A short Q&A session took place after the 3rd Agenda Item regarding the evolution of the Galileo programme.

Q (online): *Will Galileo services become a guaranteed service with liability regarding continuity, availability, accuracy, and integrity, which is essential for commercial and safety-critical applications such as autonomous driving? In my view, this can only be achieved with a multilayer PNT including LEO PNT.*

A (Javier de Blas): In terms of commitment, Galileo publishes its commitments through the Service Definition Documents. It is expected that services for the community will go beyond these commitments as regulations establish the boundaries. We acknowledge these needs and assess how they can be addressed, and we are happy to incorporate these comments.

Civil aviation is a clear example of a critical safety-of-life application that uses GNSS with additional capabilities, based on our commitments. This suggests that current commitments may be sufficient, but we remain open to incorporating additional needs and reflecting them in future commitments when possible. The European Union is aware of the need for a broader PNT ecosystem, and projects and analyses are ongoing that point toward LEO PNT. These needs are not being ignored; the Union is working toward this, although we cannot comment on the exact future structure. There is no doubt that clear plans will be developed to move forward.

Q (online): *For OSNMA, are GNSS receivers being updated to apply OSNMA to all frequencies?*

A (F. Javier de Blas): Regarding OSNMA adoption, we are publishing adoption rates and the number of receivers on our website. For example, the smart digital tachograph regulation is driving implementation, and this is already being incorporated in the domain. We are monitoring implementation and launching grants to facilitate OSNMA integration. Adoption is increasing as pilots progress, with examples in drones, various transport modes, and civil aviation. For civil aviation, a draft standard is under approval, and once finalized, implementation will be enforced beyond 2030, for civil aviation receivers to incorporate OSNMA.

In terms of frequencies, OSNMA currently authenticates the Open Service (OS). It does not authenticate GPS signals, although this is under assessment by the Programme to be incorporated in subsequent evolutions of the service.

Q (online): *What are the plans for HAS regarding landing rights, commitments, and service guarantees?*

A (F. Javier de Blas): Guarantees are defined in the Service Definition Documents. Galileo is not a commercial provider, so there is no SLA. The Union does not offer GNSS as a commercial service but publishes performance commitments and informs users when deviations occur. If there are areas of interest where improvements are needed, we are open to feedback.

Regarding landing rights, when data is received from satellites, each country must provide approval. For frequency management, discussions take place on the relevant international fora. For the E6 band, there have been discussions, particularly with the US, led by the European Commission. At the national level, each country decides whether to authorize or restrict the use of a given frequency or signal in its territory whereas HAS is available worldwide. EUSPA monitors these developments, and EC leads the international cooperation activities in this regard.

Q: *We have eCall and have struggled to move it from one version of the technology to another. How do you address this?*

A (F. Javier de Blas): Regarding eCall capabilities, Galileo supports the provision of any required capabilities, but this is driven by regulation. To our knowledge, the eCall scheme is supported, and being regulatory-driven, early awareness of additional needs or evolutions helps us accommodate them effectively. Normally, regulatory requirements are considered in future evolutions, and we expect a level of organizational synchronization at EU level

Agenda Item 4 - State of the market - Accurate and safe positioning on the road: our approach. Pere Molina Mazón. Hexagon/Novatel

Pere Molina Mazón provided a Tier 2 perspective on accurate and safe positioning in the automotive sector and presented Hexagon/NovAtel's approach. He began by outlining the state of play for GNSS in automotive applications, noting significant improvements in GNSS measurement engines and antennas. Single-frequency solutions are no longer sufficient; modern GNSS receivers now support multi-constellation and multi-frequency (more than three), offer low SWaP characteristics, and some are safety-certified. However, the E6/L6 signal still requires further development, and antennas remain a limiting factor.

Safety was highlighted as a critical requirement. Integrity must be ensured at the solution level and beyond, and safety is considered a shared responsibility among users, solution providers, and the space segment. He discussed the trade-off between integrity and availability and noted that non-ASIL (QM) receivers are not necessarily problematic. External

means can enhance safety, such as Galileo OSNMA and secure navigation messages through data or correction services.

Pere emphasized that PPP (Precise Point Positioning) is the preferred approach for automotive applications. While RTK offers excellent accuracy, it has drawbacks compared to PPP-RTK, particularly in automotive contexts. SSR-based approaches align with national and wider public programs, including Galileo HAS and QZSS CLAS.

Hexagon's approach integrates multiple inputs, GNSS, sensors such as IMU and wheel speed, and correction services like PPP-RTK, into a production-grade positioning engine. He stressed that GNSS should not be the sole or primary positioning system, as it is inherently complex and subject to various error sources, including ground and satellite errors, solar disturbances, correction network issues, intentional interference, receiver faults, and multipath effects in urban environments. Certified solutions must account for all these factors.

Hexagon's solutions are implemented over the internet, and while RTK and PPP deliver similar performance, RTK faces challenges related to communication and station geometry. Pere concluded that a mixed approach leveraging both technologies is often the most effective solution.

Agenda Item 5 - State of the market – Where is everyone? Enhancing traffic safety and efficiency with cooperative ITS through precise positioning. András Varadi and Paul Spaanderman. Car2Car Communication Association

Paul Spaanderman introduced the Car2Car Communication Consortium, which provides specifications, guidelines, and best practices to enable interoperability among stakeholders. He explained that the organization is currently at a crossroads—working upward to develop specifications and downward to verify compliance with those specifications. Achieving interoperability requires attention to very detailed technical aspects, and C2C-CC is expanding its scope to include all stakeholders, such as infrastructure providers, while also broadening its reach globally.

Paul noted that automated driving involves different "flavours," meaning certain applications and systems must be developed before progressing to more advanced levels.

András Varadi focused on sensor sharing and explained that C2C-CC is based on ETSI wireless standards. The goal is to agree on which products will be available on the market so that all stakeholders can communicate effectively. He outlined three generations of cooperative systems:

1. **Communication** – Awareness driving: "Where am I?"
2. **Sensor** – Perception: "What do I see?"
3. **Actions** – Cooperative driving.

C2C-CC is working on interoperability and ensuring vehicles can communicate reliably with each other. As data needs increase, the focus is on improving reliability and precision. Vehicles must remain compatible and useful for future applications, which requires backward compatibility.

András highlighted the importance of tightening confidence ranges, using techniques such as dead reckoning to achieve 95% confidence levels. The required precision is defined by the basic system profile. Models are being created to incorporate all V2X information, and new requirements for ADAS are under development. These include achieving three-sigma confidence (99%) and mandating lane-level accuracy, with targets of below 50 cm at 99.7%. Supporting technologies such as RTK/RTCM and Galileo HAS were identified as key enablers. While relative positioning using internal sensors is achievable, corner cases—such as emergency braking by a vehicle ahead—require information exchange to achieve absolute positioning measures, which remain challenging at an acceptable cost.

Situation mitigation strategies were outlined:

- **Information** if on the same roadway (95% confidence)
- **Awareness** if on the same or adjacent lane (95%)
- **Warning** if on the same lane (95+%)
- **Vehicle action** if on the same lane (99+%)

Dynamic confidence ellipses were discussed, illustrating how application logic depends heavily on the quality of positioning data, associated metadata, and system boundaries. For example, Vehicle A may achieve maximum awareness without lane-level precision, while Vehicle B, with higher-quality data, can provide maximum warning.

Finally, András highlighted new requirements for ADAS, including three-sigma confidence (99%) and mandated lane-level accuracy. OEM findings indicate that achieving greater precision often reduces reliability, presenting an ongoing challenge for system design.

Q (Moderator): *It seems like there are multiple organizations working on standards. What is the role of C2C in this context?*

A: C2C aims to develop a profile not only for vehicles but for all stakeholders on the road. While ETSI is responsible for creating standards, C2C focuses on building the profile on top of those standards, ensuring interoperability and practical implementation.

Currently, C2C is very specific to Europe. The organization is actively engaged in discussions with other bodies to push development and deployment across the region. Looking at the broader landscape, deployment is beginning to take shape, and these conversations are critical to aligning efforts.

Most OEMs agree that solutions are needed, and the approach to achieving them will become clearer next year as these collaborative efforts progress.

Agenda Item 6 - User needs and requirements discussion

Johanna Tzanidaki, panel moderator, opened the session by explaining its focus on user needs and requirements for implementing CCAM applications, with particular attention to the role of Galileo differentiators. The discussion aimed to provide a platform for panellists to share specific challenges and expectations when integrating GNSS into CCAM solutions.

The panel would explore how Galileo's differentiators could address these needs and enhance performance. Key objectives included identifying critical requirements for successful implementation, highlighting existing gaps, and gathering user perspectives on how GNSS capabilities can support CCAM deployment.

The session emphasized collaboration between stakeholders to ensure that user requirements are clearly understood and incorporated into future developments, ultimately improving the reliability, accuracy, and integrity of positioning services for connected and automated mobility.

6.1 Javier Ibañez-Guzmán*, Renault (Ampere)*

Javier Ibañez-Guzmán emphasized the transition from the known to the unknown in the context of automated driving. He noted that all ADAS applications require reliable positioning systems. To enable these applications, it is essential to know the exact location—not only the road and lane but also the precise position within the lane.

While significant progress has been made in computer vision, absolute positioning remains indispensable. Errors in positioning information tend to propagate, and as they do, their influence becomes increasingly critical. Therefore, knowing the absolute position is fundamental for system integrity and safety.

Mr Ibañez-Guzmán highlighted vulnerabilities in GNSS signals and stressed that Galileo's High Accuracy Service (HAS) provides additional information, improving accuracy and robustness. However, safety can only be guaranteed with high levels of integrity, which requires absolute positioning. He warned that if GNSS signals are jammed, the entire system fails.

Key aspects highlighted by Mr Ibañez-Guzmán:

- Absolute positioning is critical for ADAS and CCAM applications.
- Positioning errors cascade across functions, amplifying their impact.

- GNSS faces inherent limitations and vulnerabilities.
- High accuracy is essential to enable scalability.
- Galileo offers strategic advantages in addressing these challenges.

6.2 Curtis Hay, *General Motors*

Curtis Hay presented GM's autonomous driving features, highlighting *Super Cruise*, which was introduced in 2017 and is now being expanded across all GM models. Super Cruise is an advanced Level 2 system that supports automated lane changes and relies on a combination of sensors, as no single sensor can provide perfect accuracy.

Mr Hay explained why GM is interested in Galileo's High Accuracy Service (HAS). The key advantage is globally available clock and orbit estimates, which are essential for lane identification. While HD maps are generally accurate to 10 cm at two sigma and provide excellent road geometry, leveraging these maps fully requires knowing the precise lane position of the vehicle.

Currently, GM requires positioning accuracy of less than two meters for its applications. However, as automation advances, sub-meter accuracy will become necessary at a reasonable cost. Galileo HAS offers globally available, decimetre-level accuracy in a consistent manner, making it highly attractive for future developments.

Mr Hay noted that automotive-grade antennas supporting E6B are not yet available in the market, so GM invested in research and development to design its own E6B-capable antenna and low-noise amplifier (LNA).

He shared testing results conducted with u-blox receivers. Static tests showed that accuracy initially starts relatively poorly, with convergence times of 200–300 seconds. However, once the convergence time for Galileo HAS corrections is achieved, the system maintains stable levels of accuracy throughout the operation.

Super Cruise can accommodate these longer convergence times during local driving, minimizing consumer exposure to delays. In dynamic tests using an open-sky patch antenna, SBAS without HAS produced unstable and unpredictable results, whereas HAS delivered stable solutions despite longer convergence times. Mr Hay concluded that HAS presents a clear opportunity for GM to enhance positioning reliability and accuracy in its automated driving systems.

6.3 Oliver Wick, *BMW Group*

Oliver Wick explained his role as a technology scout at BMW, responsible for the company's technology radar, which identifies emerging technologies and evaluates whether they should be transferred into BMW's portfolio.

He highlighted BMW's interest in LEO PNT, noting that it is primarily government-driven at this stage. BMW sees potential requirements for LEO PNT in specific use cases, not only for positioning, navigation, and timing (PNT) but also for internal applications that could generate added value for OEMs and enable premium features. Examples include wheel diameter estimation, smart windows, and solar compensation for air conditioning systems.

Mr Wick emphasized that the first step is creating a requirements specification catalogue. BMW participates in various organizations and consortia, such as 5GAA and German automotive groups, to consolidate requirements for different technologies. These activities aim to ensure alignment across the industry.

Mr Wick presented a compilation of the automotive industry requirements, gathered through desk research. He noted that BMW has higher requirements for Time to First Fix (TTFF) compared to standard specifications. Economic considerations are also critical, with a need for neutral organizations to avoid increasing costs for automotive manufacturers.

While resilience is a key benefit of LEO PNT, Mr Wick expressed scepticism about discovering entirely new use cases beyond those already identified.

Discussing the benefits promised by ESA for LEO PNT, Mr Wick listed improved resilience, a higher number of satellites, better line-of-sight due to lower orbital height, and potential for indoor navigation with the right frequencies. He

concluded by stressing the importance of collaboration with EUSPA and other organizations to support the integration of LEO PNT technologies into vehicles.

6.4 Ulf Bartholomäus, Aumovio

Ulf Bartholomäus presented developments in vehicle security and the implementation of OSNMA in smart tachographs, which are mandatory for European commercial vehicles. He outlined the primary purpose of tachographs: improving road safety, ensuring fair competition, strengthening enforcement, and maintaining driver wellbeing.

Key features of the system include monitoring driver activities, recording events and faults, and providing PVT (Position, Velocity, Time) data. Mr Bartholomäus emphasized that data integrity is critical, with the tachograph security framework relying on PNT to ensure authenticity and integrity of results. Trusted and accurate time relative to UTC is also essential for system reliability.

He then discussed challenges in implementing OSNMA:

- Satellites and Signal: Limited number of visible satellites with OSNMA and reliability of data streams.
- Infrastructure: Service availability on satellites, connection bandwidth, and lack of OTA (over-the-air) updates.
- Environment: External interference sources, weather conditions, and signal reflection or absorption.
- User & Receiver: Antenna placement, dynamic driving conditions, and interference sources.

Mr Bartholomäus noted that OSNMA has disadvantages regarding time to authenticated fix, which is significantly longer than the standard time to first fix. If the time drift of the trusted real-time clock exceeds 163 seconds, OSNMA can no longer be trusted.

Findings from implementation tests revealed environmental challenges such as obstacles, interference, and even unintentional jamming, all which impact OSNMA performance.

6.5 Stephanie Leonard*, TomTom*

Stephanie Leonard presented TomTom's work on Emergency Warning Satellite Service (EWSS) and explained how TomTom Hazard Warnings originated from OEM requests to unbundle services and address latency concerns. She highlighted the types of hazards covered:

- **Traffic hazards**, such as jam tail warnings, which occur when traffic builds up suddenly and can lead to crashes and fatalities—one of the most severe scenarios.
- **Road hazards**, including obstacles and dangerous conditions.
- **Weather hazards**, which are particularly relevant for EWSS. Extreme weather events and natural disasters are becoming increasingly critical in Europe, where such events are on the rise.

Ms Leonard outlined the major data sources required to provide timely and accurate warnings: location traces, vehicle sensor data, community reporting and confirmation, and third-party data such as weather information. Weather data is obtained from multiple providers, with Europe divided into tier 1 and tier 2 sources.

She explained that delivery channels use Morton areas to optimize data consumption and bandwidth, reducing data plan costs by ensuring vehicles only receive information relevant to their current location.

EWSS Requirements:

- Logistical: Access to data and availability of Galileo chipsets capable of receiving EWSS messages. While implementation is straightforward, it depends on chipset availability from manufacturers.
- Alternative Data Sources: Potential use of open-source data, which requires discussion with EUSPA.
- Technical: Extremely precise location referencing (e.g., OpenLR, currently not supported), latency of 2–5 minutes from event occurrence to vehicle update, and live updates. Location accuracy should be within 100 meters.
- Functional: Introduction of a new alert code to instruct vehicles not to drive under certain conditions.
- Legal: Compliance with data protection regulations, clarity on licensing terms, and proper indication of data sources for commercial use.

Ms Leonard noted that a workshop is planned for January to advance TomTom's integration of EWSS. Key next steps include determining how to access data and implement map matching effectively.

Q&A session:

Q (online – Mr Marten Ström): *is there a schedule for the missing aspects of HAS SL1? Will this happen when full-service capability (SL2) is reached or before?*

A (F. Javier de Blas): We are working on defining a set of activities prior to declaring the full-service capability. A call for interest was organized, inviting all interested parties to participate in a testing campaign. Several entities joined and benefited from early access to products.

For Phase 2, we plan to anticipate the release of documentation, including the Interface Control Document (ICD) and related definitions. We may share data sets and invite entities to early activities, enabling early access to capabilities. As noted, Service Level 2 (SL2) is expected to be available during 2027. If there are specific inputs that could facilitate early analysis downstream, we are open to considering them.

In principle, we are analysing the possibility of sharing documentation and data sets ahead of time. Results from different domains have been positive, reinforcing our plans to move forward.

Q (from Ms Tzanidaki to Mr Hay): *what are the expectations for the higher levels of automation?*

A (Mr Hay): The economics for Super Cruise are strong, with high customer demand for Level 2 as a retail feature. There is significant financial runway to continue developing Super Cruise. The automotive industry is highly competitive, and differentiation through innovation creates strong pressure to advance automation.

However, moving from Level 2 to Level 3 represents a major leap, and initial volumes of higher-level automation will be small. As automation progresses, the need for GNSS and positioning accuracy will intensify.

Q (follow up by Mr Egon Warkentin): Is the technical hurdles the only challenges you face or are they also other challenges to introduce further levels of automation? For example, infrastructure, is this key?

A (Mr Hay): Dependence on infrastructure often means dependence on cellular carriers. Receiving PPP corrections through terrestrial networks (TN) or non-terrestrial networks (NTN) introduces challenges. Software updates can cause errors or even stop systems from functioning, which negatively impacts OEMs. This reliance on cellular correction services remains a significant concern.

A (Mr Spaanderman): Experiences from C2C and Toyota show similar issues. The deployment of 5G is progressing slowly because operators find it too costly. Trusting data from infrastructure networks is becoming problematic for OEMs. As a result, attention is shifting toward alternative solutions such as additional sensors and vehicle-to-vehicle data exchange.

For higher automation levels (L3 and L4), projects like Hi-Drive, a major EU project, are identifying gaps and working to address them. C2C is approaching these challenges in an agnostic way: achieving required performance levels in various scenarios using any technology that is available and cost-effective for automotive applications. Dead reckoning and redundancy remain essential components of this strategy.

Q (from Ms Tzanidaki to Mr Ibañez-Guzmán): *From an industry-wide perspective, how do you see the adoption of Galileo differentiators—such as OSNMA and HAS—evolving within passenger vehicle platforms?*

A (Mr Ibañez-Guzmán): It is very important to guarantee safety and ensure continuous service for the system. In this context, having absolute positioning information is critical. Another key aspect is the level of trust: the trust the vehicle

places in the driver and the trust the driver places in the vehicle. These two elements need to converge to enable safe and reliable automation.

Q (Mr Norbert Schindler): *Electronic tolling systems based on GNSS are already in place in nine countries, with millions of users relying on GNSS to calculate travel distances. Singapore is one example. The challenge is that these systems require vehicles to be equipped with dedicated devices. Given that most vehicles already have telematics, how can we leverage existing onboard technology instead of introducing aftermarket devices?*

A (Mr Spaanderman offering OEM perspective): There needs to be an agreement to share data. Ultimately, OEMs need a clear benefit to participate, which often requires a B2B approach.

A (follow up Egon Warkentin): Ownership of the system is always a key question. In the case of tolling, the authority owns the system, so it is the authority that decides which tools to use.

Q (from Ms Tzanidaki to Mr Bartholomäus): *Can you provide insights on how Galileo differentiators can help mitigate jamming?*

A (Mr Bartholomäus): Jamming is a growing concern, especially for higher levels of automation and specific Operational Design Domains (ODDs). For example, cameras on streets show that there is roughly one jammer for every 100 vehicles. Border areas also experience frequent jamming and spoofing attacks. OSNMA helps counteract spoofing by authenticating navigation messages, which adds a layer of protection.

Regarding USB-related jamming, each device operates on different frequency bands, and these bands can interfere with each other. USB interference is typically EMC-related, and filtering is difficult, making it a potential source of GNSS disruption.

To address jamming, the connected car industry is working on broadcasting alerts so vehicles can be notified of jamming events and adjust their ODD accordingly. Additionally, the V2X industry is exploring the use of alternative frequencies to protect vehicles and maintain service continuity.

Q (from Ms Tzanidaki to Ms Leonard): *Are there any compatibility issues between EWSS and the TPEG weather standards?*

A (Ms Leonard): There are many extensions of TPEG. A few years ago, work was done to translate CAP, the data format typically used for extreme weather events, into TPEG. This conversion provides a good enough interpretation for current needs. The main challenge, however, lies in location referencing.

Q (follow up by Mr Spaanderman): *Is this issue linked to differences in mapping technologies or formatting?*

A (Ms Leonard): Not exactly. EWSS supports elliptical areas, but these are not sufficient for precise hazard localization. To achieve the required accuracy, we need OpenLR.

Q (from Ms Tzanidaki to Mr Wick): *From the benefits expected from GNSS differentiators, what are the main ones?*

A (Mr Wick): We do not anticipate entirely new use cases emerging from GNSS differentiators. The key benefit lies in improving resilience, which is critical because future regulatory requirements for higher levels of automation remain uncertain. For example, in China, regulations have undergone significant changes recently, illustrating how unpredictable regulatory frameworks can be.

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