

Road/Railways - Mobility as a Service - Autonomous vehicles:

The EU' s projects for deploying automated vehicles in urban transport

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【概要 : Summary】

The automation of vehicles has the potential to fundamentally change mobility and the transport sector. The future mobility based on Connected and Automated Mobility (CAM), in which all the actors are connected, communicating and interacting in a seamless and automated way will also include the large-scale adoption of Mobility-as-a-Service (MaaS) innovations.

The connected and automated vehicles development is progressing and fully autonomous vehicles are expected to be commercially available by 2030. Since the technologies like automation and MaaS themselves will not change mobility alone, policies and measures need to be implemented in order to ensure a smooth transition and a development towards sustainable transport.

In order to point out key strategies for the EU' s policy on connected and automated driving, the European Commission presented its strategy for mobility of the future in its Communication on the road to automated mobility (COM(2018) 283 final) in May 2018. The comprehensive EU strategy aims to coordinate the cooperation of the EU, Member States, industry, social partners and civil society to ensure that the EU embraces the opportunities offered by driverless mobility, while anticipating and mitigating the implied challenges. The Commission now

calls upon all parties concerned to support the approach for delivering safe, efficient, socially responsible and environmentally friendly driverless mobility for EU citizens. Through the Horizon 2020 research and innovation programme, the European Commission financially supports projects in relation to highly automated vehicles, testing in large-scale pilots/trials, as a necessary step before market uptake. The article gives a non-exhaustive overview of the several projects in the field of automated mobility in the EU, its Member States and cooperating countries. Among other projects, the so-called SHared automation Operating models for Worldwide adoption ("SHOW") is presented as the latest example and a major key initiative in a longer row of projects for automated vehicles (AVs).

In order to meet the new challenges in urban traffic to reach an effective and sustainable urban transport through technical solutions, the SHOW project is the biggest and more holistic real life CCAV urban demonstration initiative so far. It will include real-life urban demonstrations in 20 European cities as well as twin actions beyond Europe.

【記事 : Article】

1. Background of automated or autonomous vehicles

Road transport will undergo significant changes in

future with the utilisation of electric vehicles as well as connected and automated vehicle technologies. Connected and Automated Mobility (CAM) includes and defines the concept of a future mobility, which will enable all the actors to communicate and interact in a seamless and automated way. Fully autonomous or driverless cars are expected to improve the flow of traffic, increase road safety and reduce the number of accidents considerably.

Since automated and autonomous driving at the highest level does not need a driver's intervention to function anymore, the further development in the transportation ecosystem could support the introduction of robotic taxis, automated shuttles and delivery drones for urban environments.

These automated vehicle technologies will also enable a move from a personal vehicle ownership transport model to the use of the Mobility-as-a-Service (MaaS) model. Based on the Mobility-as-a-Service (MaaS) innovations, the traveller can find mobility solutions, which are consumed as a service, which implies a shift away from personally owned modes of transportation.

Autonomous vehicles are already tested on public roads for some time. The connected and automated vehicles development continues steadily and fully autonomous passenger cars are expected to be commercially available by 2030. This automation of vehicles has the potential to fundamentally change the transport sector and to enable a paradigm change in mobility. The large-scale adoption of MaaS travel options might also cause a shift away from personally owned modes of transport towards on demand pay-per-use mobility solutions. Further automation of vehicles in all transport modes is expected to also provide opportunities to improve traffic flows, increase safety for users and reduce environmental impacts of transport. However, the new transport technologies will not spontaneously improve the transport situation. It needs adequate policies to achieve environmental friendly and safer transportation. Therefore, the European Commission has intensified its commitment to allow a fast

deployment of self-driving technologies in Europe and to support the development of a EU framework for connected and automated driving.

2. European Commission's measures for AV deployment

Since the technologies like automation and MaaS will not lead to a spontaneous improvement in mobility, policies need to be implemented to solve the challenges of congestion, transport emissions and road fatalities. Furthermore, the long transition phase towards automated mobility needs to be managed properly and those autonomous vehicles need to be properly introduced in the European transport system. The connections between vehicles and traffic management, between public and privately owned data, between collective and individual transport and between all transport service providers and modes need to be strengthened. In order to point out key strategies for the EU's policy on connected and automated driving, the European Commission presented the "Communication on the road to automated mobility: An EU strategy for mobility of the future" (COM(2018) 283 final) on 17 May 2018.

The objective is to bring down the number of road fatalities, reduce harmful emissions from transport and reduce congestion. The deployment of driverless mobility is expected to contribute significantly to achieving these key objectives. Ultimately, it is expected to lead to achieving the so-called Vision Zero, i.e. no road fatalities on European roads by 2050. However, this target will require the cooperation of the EU, private players, Member States, regional and local authorities. They need to work together on a common vision of connected and automated mobility. Currently, automated vehicles are not yet ready to operate without human supervision, and automated vehicles that can drive themselves in a limited number of driving situations of SAE autonomy levels 3 and 4 are being tested. However, there are still technical challenges to be solved to ensure that the automated vehicles are fully able to sense and understand its environment and take the right

action. While demonstrations and testing are taking place also in the EU Member States, the European Commission supports these efforts through research funding programme and deployment projects. The Commission is also making available up to EUR 450 million under the Connecting Europe Facility to support digitisation in transport in support to automation. Also the EU's framework programme for research and innovation "Horizon 2020" supports research and innovation on automated vehicles. Within the Horizon 2020 research and innovation programme, the European Commission contributes to Europe's effort towards highly automated and connected driving systems. Since 2015, the EU budget allocated to topics launched under the Automated Road Transport and Mobility for Growth calls with a funding of EUR 142 million and the EU's contribution is expected to reach EUR 250 million until the end of 2020. Horizon 2020 Automated Road Transport aims to promote a wide market introduction of highly automated vehicles that are nearing automation SAE level 4 for self-driving vehicles. They will be tested in large-scale pilots/trials, as a necessary step before market uptake.

3. European projects for automated road transport

The Innovation and Networks Executive Agency (INEA) is an agency established by the European Commission in order to run the Connecting Europe Facility and parts of Horizon 2020. INEA is responsible for the management and implementation of many projects in the field of automated and intelligent transport.

The **ADAS&ME** project develops Advanced Driver Assistance Systems (ADAS) that incorporate driver/rider state, environmental context and adaptive interaction. The project ran from 2016 to February 2020, with a EU funding of EUR 8,998,950. The goal is to automatically transfer the control between vehicle and user, thereby improving efficiency, environmental impact and safety for all vehicle types including conventional and electric cars, trucks, buses and motorcycles. Test sites are

located Spain, Belgium, France, Germany and Sweden.

The **ARCADE** project with a EU funding of EUR 3,000,000 is running from Oct. 2018 to Sept. 2021. It aims to build consensus across stakeholders from all sectors for a harmonized deployment of Connected, Cooperative and Automated Driving (CAD) in Europe and beyond.

The **Automate** project, which ran from Sept. 2016 to Aug. 2019, had a support of EUR 4,918,426. The overall objective of Automate is to develop, evaluate and demonstrate this "TeamMate Car" concept as a major enabler of highly automated vehicles. Test sites are located in Germany, France and Italy.

The **AVENUE** project with a EU funding of EUR 15,599,780 is running from May 2018 to April 2022 and aims to demonstrate that autonomous vehicles will be a key element of the future public transportation services. The project will assess the road behaviour and safety of the autonomous vehicles in public transportation and complex road situations. It will also demonstrate the economic, environmental and social advantages of autonomous vehicles for both the exploiting companies and the users, opening the way for their full scale adoption and integration in public transportation services. Test sites are located in Switzerland, France, Denmark and Luxembourg.

The **BRAVE** project, from June 2017 to May 2020 with a EU funding of EUR 2,990,539 aims to improve safety and market adoption of automated vehicles. It takes into consideration the needs and requirements of the users, other road users, concerned drivers and vulnerable road users, as well as relevant stakeholders (i.e. policy makers, standardization bodies, certifiers, insurance companies). It aims at assuring safe integration of key enabling technology advancements. After 18 months, the project has issued a Multidisciplinary study of the requirements and expectations of drivers and other stakeholders regarding the use of automated vehicles. Test sites are located in France, Germany, Slovenia, Spain and Sweden.

The mission of **CoExist**, with a EU funding of EUR 3,474,068, which ran from May 2017 to April 2020 was to systematically strengthen the capacities of road

authorities and other urban mobility stakeholders in preparation for the transition towards a shared road network with an increasing share of connected and automated vehicles (CAV) at higher automation levels. Test sites are located in Germany, Sweden, The Netherlands and the UK.

The multi-brand platooning project **ENSEMBLE**, with a EU funding of EUR 19,802,512 and running from June 2018 to May 2021, will implement and demonstrate multi-brand truck platooning in the EU. ENSEMBLE aims at realising pre-standards for interoperability between trucks, platoons and logistics solution providers, to speed up market pick up of system development and implementation and harmonise legal frameworks in the Member States. Seven differently branded trucks in one or more platoon(s) under real traffic conditions across national borders will be determined.

HEADSTART runs from January 2019 to Dec. 2021 and is funded with EUR 5,999,028 by the EU. It aims to define testing and validation procedures on specific functionalities of Connected and Automated Driving (CAD) functions, including key technologies such as communications, cyber-security and positioning. The tests will be in both simulation and real-world fields to validate safety and security performance according to the key users' needs. Test sites are located in Germany, Spain, Sweden and The Netherlands.

The **ICT4CART** project, with a EU funding of EUR 7,996,572, and running from Sept. 2018 to August 2021, consists of 21 partners from 9 EU countries, united in their vision to build a sustainable future for connected and automated vehicles. ICT4CART's goal is to provide an ICT infrastructure architecture to address existing gaps in the area of connected and automated driving. This high-level architecture will ensure performance and resilience for different groups of applications according to the needs of higher levels of automation (L3 & L4). Test sites are located in Austria, Germany and Italy.

The **INFRAMIX** project receives a EU funding of EUR 4,899,404 and ran from June 2017 to May 2020. It aims to design, upgrade and adapt both physical and digital

elements of the road infrastructure, ensuring an uninterrupted, safe and efficient traffic in the transition period with automated and conventional vehicles. This also includes ways of informing all types of vehicles about the road operator's control commands and proposing new visual signs and electronic signals. INFRAMIX ensures that the proposed adaptations will not jeopardize safety, quality of service and efficiency. Therefore, INFRAMIX will develop a co-simulation environment, combining the modelling of the vehicle behaviour with the traffic simulation to examine different mixed traffic scenarios. Test sites and located in Spain, between Barcelona and the French border (Mediterranean Corridor), and in Austria.

The **interACT** project with a EU funding of EUR 5,527,581 ran from May 2017 to April 2020. It intended to develop novel, holistic interaction concepts for automated vehicles that enable their integration in mixed traffic environments in a safe and intuitive way. It improves software algorithms and sensor capabilities for assessing intention recognition and behaviour prediction of surrounding road users. It also developed a "Cooperation and Communication Planning Unit" to integrate planning algorithms, providing synchronised and integrated communication protocols. Test sites are located in Germany, Italy and Greece.

The European research project **L3Pilot** with a EU funding of EUR 35,960,979, runs from Sept 2017 to August 2021 and tests the viability of automated driving as a safe and efficient means of transportation on public roads with 1,000 drivers and 100 vehicles across ten European countries, including cross-border routes. **L3PILOT** is a large-scale test of a comprehensive array of different automated driving functions for passenger cars.

The project focuses on large-scale piloting of SAE Level 3 functions, with additional assessment of some Level 4 functions. Test sites are located in Belgium, France, Germany, Italy, Luxembourg, Spain, Sweden, The Netherlands and the UK.

LEVITATE runs from Dec. 2018 to November 2021 with a

EU funding of EUR 5,022,215. It will develop a wide-ranging evaluation framework to assess the impact of connected and automated transport (CAT) on all aspects of transport and individual mobility as well as at societal level. This framework will be used to evaluate the impacts of connected automated vehicles (CAVs) on individuals, the mobility system and society using a wide range of indicators. The project addresses the needs of municipalities, regional authorities and national governments that wish to prepare for the connected and automated systems.

The **Managing Automated Vehicles Enhances Network (MAVEN)** project aims to improve traffic efficiency and safety with management functions at both vehicle and infrastructure level. It was funded with EUR 3,149,661 and ran from September 2016 to August 2019. The project has developed new solutions for platoon planning that also includes a tactical level. This is where platooning, lane changes and optimal speed for approaching an intersection are the main targets. The project has developed a patented algorithm for dynamic traffic light controllers to support automated vehicles approaching an intersection with a predictable countdown, while maintaining high traffic efficiency. Test sites are located in Germany and The Netherlands.

TransAID is the first European project developing hierarchical traffic management procedures to allow the smooth integration of automated vehicles in traffic systems, especially around those areas of the road where vehicle automation reaches its limits, i.e. when facing a situation, which cannot be handled by the systems without help. The project is funded with EUR 3,836,354 by DLR DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT and runs from Sept. 2017 to August 2020. Test sites are located in Germany.

The introduction of automated vehicles to the market raises also questions regarding the trustworthiness of the automated systems. In this connection the user's perception and acceptance is important. The project **TrustVehicle** aims to investigate critical scenarios, especially in mixed traffic situations and under harsh weather conditions, in order to improve

trustworthiness. For a user-centric approach, the driver's impressions and feelings are crucial for L3AD driving since he/she should be able to resume vehicle control if needed. Therefore, they should be strongly considered in the whole development process of the different components of the automated system. Questionnaires and tests on the driver simulator are some of the measures taken within TrustVehicle. The project is EU funded with EUR 4,998,904 and ran from June 2017 to May 2020. Test sites are located in Finland, Sweden and Turkey.

The **VI-DAS** project is EU funded with EUR 6,225,246 and ran from Sept. 2016 to Aug. 2019. It had the aim to take the automotive industry one step closer towards autonomous driving, to increase road safety and to position Europe as the leader in the autonomous driving field. VI-DAS brought together leading international firms and institutions. Test sites are located in the Czech Republic and The Netherlands.

Furthermore, there are other projects like the large-scale pilot project **AUTOPILOT**. It started in January 2017 and the project receives a EU funding contribution of EUR 19,924,984. AUTOPILOT focuses on the autonomous vehicle in a connected environment, enabling the emergence of connected ecosystems supported by open technologies and platforms. Furthermore, the **5G-Car** project to unlock the potential of automated driving started in June 2017 as a large research and innovation project developing the 5G connectivity technologies for automated cars. It receives a EU funding contribution of EUR 7,995,413.75. It is expected to evaluate the existing and future spectrum usage for that purpose and contribute to the standardisation efforts in the field.

4. New EU's "SHOW" project for deploying AVs in urban environments

Under the Horizon 2020 programme, a major key initiative for automated vehicles (AVs) is the so-called SHared automation Operating models for Worldwide adoption ("SHOW"), which was launched on 1 January 2020. The project will run until 31 December

2023. Under coordination of the UITP (Union Internationale des Transports Publics, International Association of Public Transport), the SHOW project brings together 69 partners from 13 EU Member States. It has a total budget of EUR 36,367,553.83, out of which the EU contribution is EUR 29,980,398.57. The SHOW project is expected to support the deployment of shared, connected and electrified automation in urban transport within a four-year period. The project aims to estimate and evaluate the role of autonomous vehicles (AVs) in making urban transport more effective, sustainable and user friendly. The SHOW project aims to further support the transition towards seamless and safe sustainable mobility by promoting automated transport in combination with public transport. The SHOW project aims to support the development of effective and persuasive sustainable urban transport, through technical solutions, business models and priority scenarios for impact assessment. Under the project a shared, connected, cooperative, electrified fleets of autonomous vehicles will be deployed in coordinated Public Transport (PT), Demand Responsive Transport (DRT), Mobility as a Service (MaaS) and Logistics as a Service (LaaS) operational chains in real-life urban demonstrations in 5 Mega, 6 Satellite and 3 Follower Pilot projects, taking place in 20 cities across Europe. The concept covers all urban automated mobility needs and all stakeholders' demands. The SHOW project will deploy a fleet of 74 AVs of all types including buses, taxis, MaaS connected automated cars and cargo vehicles for all transport users in both mixed traffic and dedicated lines operating under traffic speeds ranging from 18 to over 50km/h. By deploying this fleet of 74 L4/L5 AVs of all types and for all transport operators in both, dedicated lanes and mixed traffic, connected to a wide range of supporting infrastructure (5G, G5, IoT, etc.) and operating under traffic speeds ranging from 18 to over 50km/h, the project aims to cover all urban automated mobility needs and a wide range of stakeholders. Project pilots will last for 24 months, with real service seamless operation in each pilot

site lasting at least 12 months. The SHOW project's AV fleet is expected to transport over 1,500,000 passengers and 350,000 units of goods. Thereby, the SHOW project will be able to look at different aspects of AVs and how they can best contribute to sustainable mobility. With over 20 cities hosting demonstration projects, SHOW is the biggest ever project for AVs in urban environments. Alongside transport also other industries such as telecom will be involved. Being the biggest ever holistic real life CCAV urban demonstration initiative, it is user led (by UITP) and realised by the Consortium partners, including major stakeholder associations. With the SHOW project's launch, UITP will lead the next steps of deploying autonomous vehicles and will cover all urban automated mobility needs. The SHOW project will also be twinning with 11 organisations the US, South Korea, Australia, China, Taiwan and Singapore.

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