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THE NEWSLETTER OF THE CONNECTED AUTOMATED DRIVING IN EUROPE INITIATIVE

#EUGoesDriverless

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TOWARDS A COMPREHENSIVE EUROPEAN ROADMAP FOR CONNECTED AND AUTOMATED DRIVING

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- Use cases and new business models
- Assessment of funding programmes for CAD

EDITORIAL

Dear Reader

All around Europe and the world, pilot projects with vehicles prepared for full automation or self-driving capabilities are being launched. In particular the use case of autonomous on-demand shuttles is popular among policy makers and city planners. The reasons are obvious: Such vehicles may provide a cost-efficient last mile solution to complement public transport, they reduce the number of cars on the road, and thus use road space more efficiently. Furthermore, they show the way towards an IT-enabled future of shared transportation of people, goods, and probably also equipment and services.

The fatal crash that took place in Arizona, earlier this year, dampened this enthusiasm. It seems, if automated driving fails to deliver on its greatest promise to make road traffic safer, then it will not survive. Independent of what actually went horribly wrong in Arizona, the incident is pointing to a general issue: Even if equipped with the advanced systems for environment perception and decision making, automated vehicles continue to follow a bottom-up safety approach. Like humans, such systems may fail. Surely, there are opportunities for making an automated car close to 100% safe: One could equip the infrastructure with sensors that "look around the corner" and tell the car what they see, and one could further advance the artificial intelligence of the control system to develop an intuition on whether a pedestrian standing at the curb will cross a road or not. One could also go for a top-down safety concept, limit the use of automated vehicles to fenced lanes, and apply control from a central traffic manager. Whether and when that would be feasible depends merely on money than on concept.

Aiming at an accelerated development and deployment of high degree automated driving, the EU-funded Coordination and Support Action "Safe and Connected Automation in Road Transport" (SCOUT) has established a comprehensive and structured roadmap that shows the interlinks of technical and non-technical issues and identifies opportunities to leapfrog hurdles. With the help of many stakeholders, and in cooperation with its sister-project, CARTRE, the SCOUT project has assessed a number of use cases and development paths, it has identified societal goals and challenges, and formulated a vision for connected and automated driving. It also analysed the state of play in technologies and business models and identified gaps and risks.

For many societal stakeholders, the future vision of connected and automated driving is embodied in level 4 and 5 automation in different use cases. The technical issues may be solved by smart combinations of sensing with connectivity and intelligent decision-making. But, due to the number and diversity of influencing factors, advanced automated or self-driving cars have not yet reached full maturity, oftentimes miss a viable business case and are not yet allowed on public roads. Hence, the process of roadmap development is particularly troublesome.

The SCOUT consortium managed to grasp the complexity of the action by considering the challenges of connected and automated driving in a comprehensive approach covering technical as well as relevant non-technical issues categorized into human factors, economics, legal, and societal aspects. These issues, however, are strongly interlinked with each measure requiring the out-come of another one before it can start. Any attempts to develop a roadmap thus immediately led to a kind of Gordian knot. Nonetheless, when use cases were clearly distinguished, milestones and goals were well defined, the levers to unlock the innovation process were found.

I am proud to say, that the efforts of the SCOUT project have resulted in a multitude of important insights on the path towards level 4/5 systems such as automated on-demand shuttles, self-driving delivery robots or robotaxis: It is essential to identify minimum viable solutions, listen to users, cut red tape and develop business cases in parallel to technology such that experiences can be gained quickly, and solutions can be adapted in an agile way. These insights will be presented at a number of occasions in the coming months, e.g. the Automated Vehicles Symposium in San Francisco and the 22nd International Forum on Advanced Microsystems for Automotive Applications in Berlin. Moreover, the results are taken into account for the process of building an implementation plan of the Strategic Transport Research and Innovation Agenda (STRIA) on Connected and Automated Driving that the European Commission has launched with the 3rd mobility package, recently.

Gereon Meyer

Scout

Project name: "Safe and Connected Automation in Road Transport" – SCOUT

Project type: CSA

Call: H2020 MG-3.6b-2015, Safe and connected automation in road transport

Starting date: 01.07.2016

Project duration: 24 months

Total budget: 1M€

Coordinator: VDI/VDE Innovation + Technik GmbH

Partners: 12 partners

Project objectives:

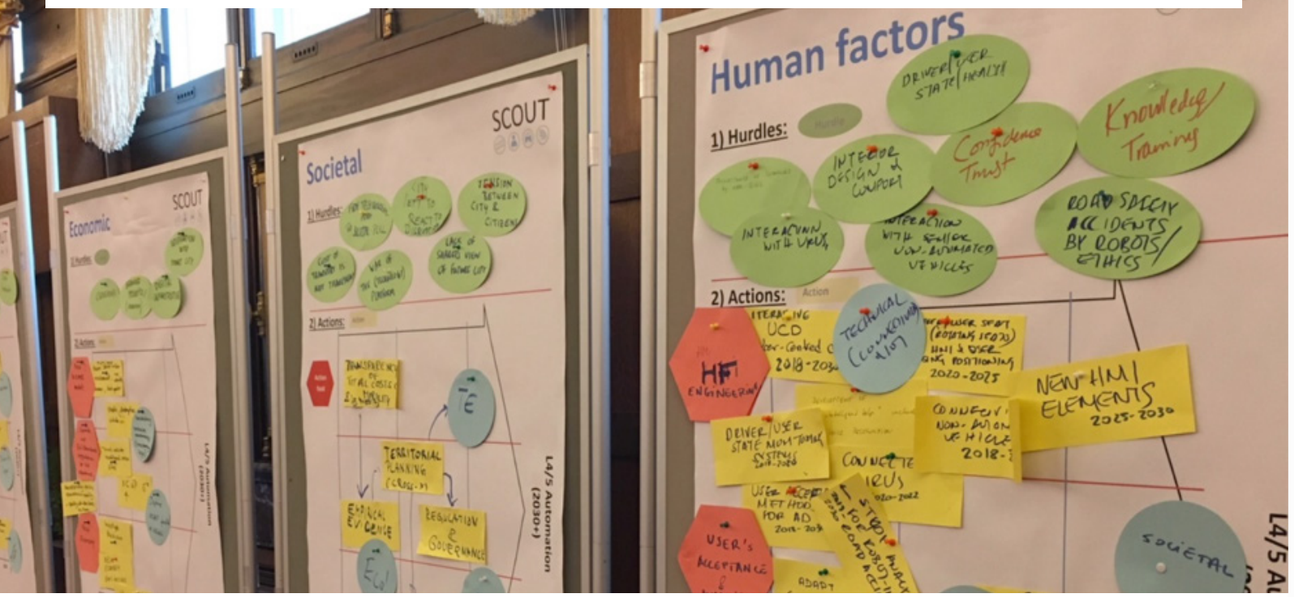
- Capture expectations and concerns regarding connected and automated driving (C&AD) from users, technology, infrastructure and service providers and public authorities
- Explore feasible use cases for C&AD in accordance with the EU strategies for transport and digital markets, societal goals and challenges
- Analyse gaps and risks for the take-up of C&AD from the domains of automotive technology, communication infra-structure & reliability, legal frameworks, standardisation, testing, safety, security and privacy
- Identify sustainable business models for C&AD, also considering telecommunication, data driven services and novel mobility concepts
- Create common cross-sectorial roadmaps and advise policies and regulatory frameworks with support of a stakeholders network
- Communicate and discuss results with the general public
- Monitor international trends to detect opportunities & threats abroad
- Tie-in the results of European funded R&D projects and activities

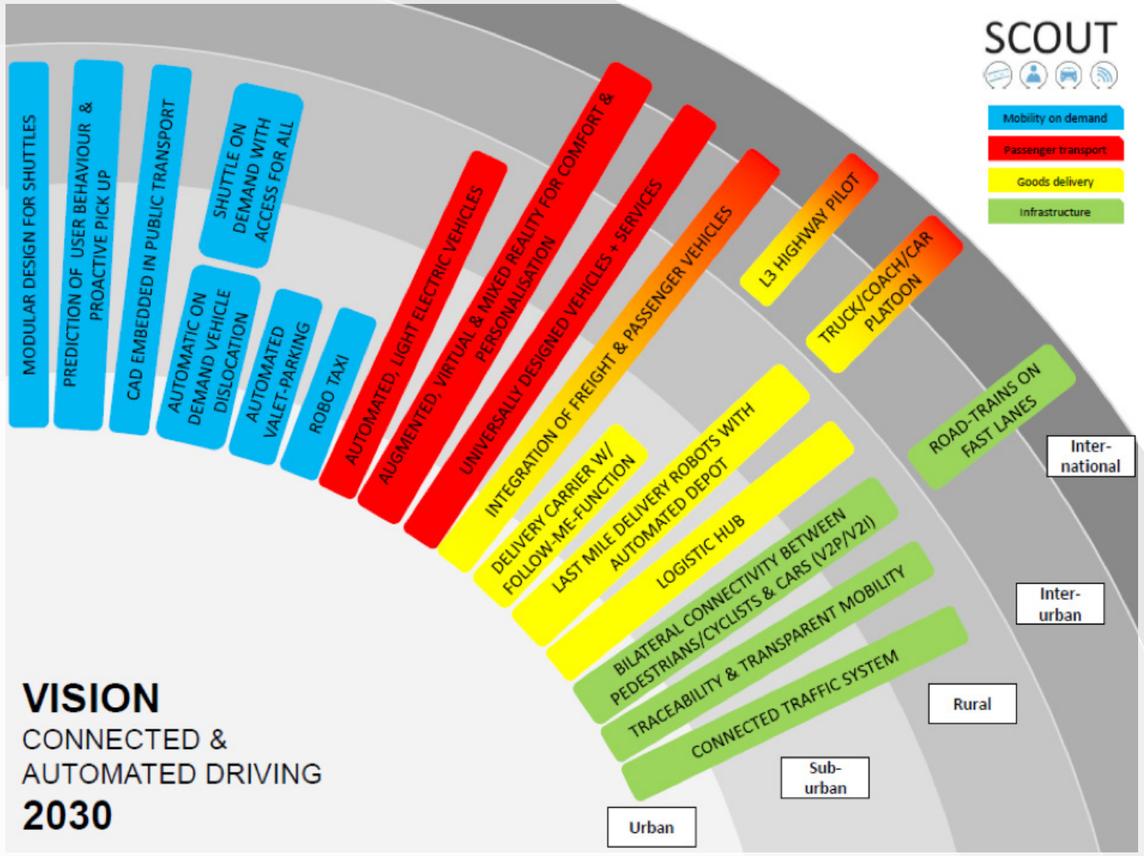
Towards a Comprehensive European Roadmap for Connected and Automated Driving

The main goal of the SCOUT Project has been to help the automotive, the telecommunication and digital sectors to join forces and agree on a common roadmap to accelerate the proliferation of safe and connected high-degree automated driving (SAE 3-5).

A broad range of experts from European associations and technology platforms, companies, research and academic institutions, public authorities and other relevant stakeholders participated in a co-creation process based on user needs and expectations, technical and non-technical gaps and risks, viable business models as well as international cooperation and competition.

As a step towards the development of business models and the roadmap on Connected and Automated Driving (CAD), a vision of CAD in Europe in 2030 was jointly defined in several interactive sessions. Within the approach of the SCOUT project, the vision addresses the question *"Which features will Connected and Automated Driving provide in 2030 and beyond?"*





The vision image displays two different dimensions. The spatial dimension is illustrated by five different spheres starting from urban areas over suburban, rural and interurban areas towards an international environment. The second dimension is related to the field of application clustered into mobility on demand, passenger transport, goods delivery and infrastructure as well as solutions that could be applied in multiple fields. The essence of this vision is Level 4/5 automation realized by vehicle intelligence and connectivity.

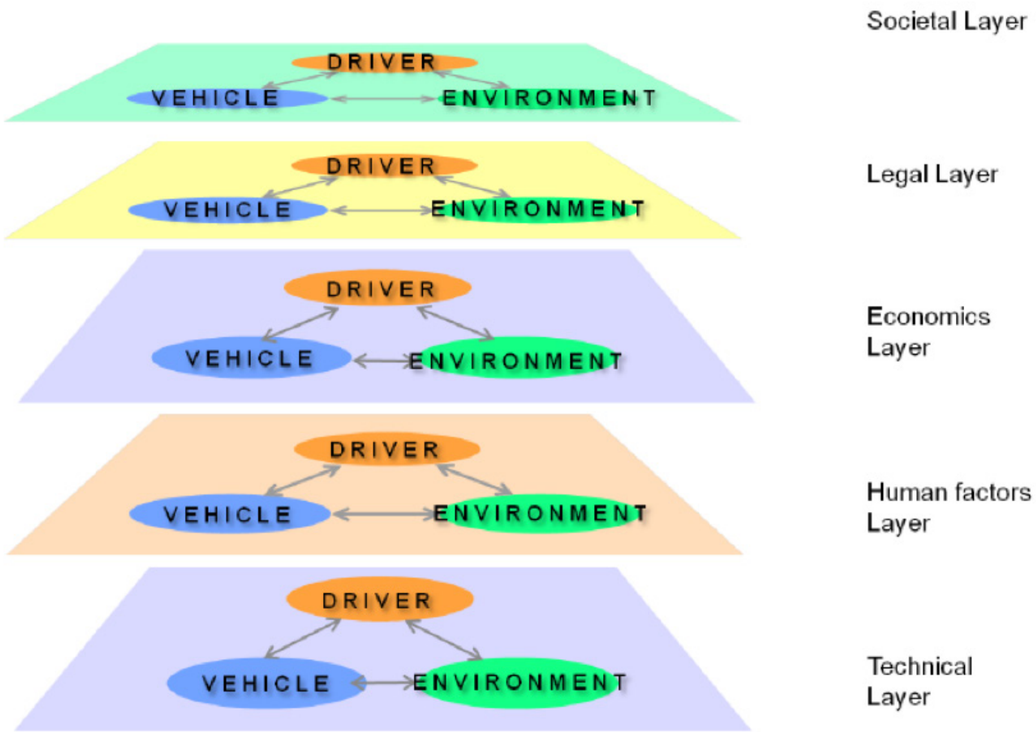
Expectations towards CAD are generally high. Current promises are mixed between reasonable expectations from users and stakeholders who are aware of the reality regarding CAD and excessive expectations of other users and different stakeholders, having a very optimistic view towards the development and deployment of CAD. Sometimes, too high expectations can be far beyond what CAD can offer in the short-term or even mid-term range.

However, CAD will lead to increased safety, free-time and mobility as well as lower emissions, land usage, incidences and presumably lower insurance costs. It can also have great impacts on economy, thinking about new entrants in the value chain, new challenges, new employment and more competition in the automotive world.

But there are still technological challenges remaining amongst those are reliability, robustness and performance and improvement in the overall "driver´s" performance. The successful implementation of CAD will depend on the reliability of the technologies related to CAD, vehicle costs, the introduction and/or adaption of the relevant legal frameworks and, moreover, on the final decision of the users, taking reservations and concerns into account.

Analysing the State-of-the-Art

The SCOUT analysis of the state-of-the-art European ecosystem for connected and automated driving was based on the 5-layer model defined by RWTH Aachen University: technical, human factors, economics, legal and societal layers.



The SCOUT project has come to the following major conclusions:

It is obvious that neither all technical problems are solved nor the legal framework is ready to allow highly automated vehicles on public roads. But it is noticeable that in both layers, there are big efforts taken to path the way for automated driving. Besides that, the users especially as drivers or owners of cars are still cautious to use automated driving functionalities, which needs to be considered during development, since for market introduction, the end customer must accept the technology otherwise nobody will buy it.

It can be stated that there are several sensor technologies available, which differ in the physical measurement principle. Regarding highly automated functions and therewith the need of functional safety, it is wise to combine sensors with different sensor principles to establish redundancy. Most of the current sensor setups consider this. However, there are still very big variations between OEMs and also in current test vehicles. This indicates that there is not only one solution for automated driving, but many different ones adapted to different use cases and dependent on different strategies. To summarize, the development on environment perception will continue constantly in the next years and new sensor technologies will develop to enhance this task.

Two further topics of essential importance are security and connectivity. Technical solutions are ready in both cases, but with a lack of implementation and room for development. Security must be considered as natural part of the safe connected vehicle. For connectivity, there is already a solution available, but not yet used besides some large-scale pilots with the 802.11p standard. In addition, the 5G standard is on the horizon, as another technology to realize not only a connected vehicle, but a connected traffic system. It has to be observed, if only one technology will be able to cover all requirements or if a combination of 802.11p together with a future LTE standard (like 5G) will be the solution to enable all use cases for safe connected and automated driving.

Besides the regulations regarding the technical requirements the topics of liability, insurance, data protection, type approval and some others, have to be solved. Most regulations will “interact” with each other.

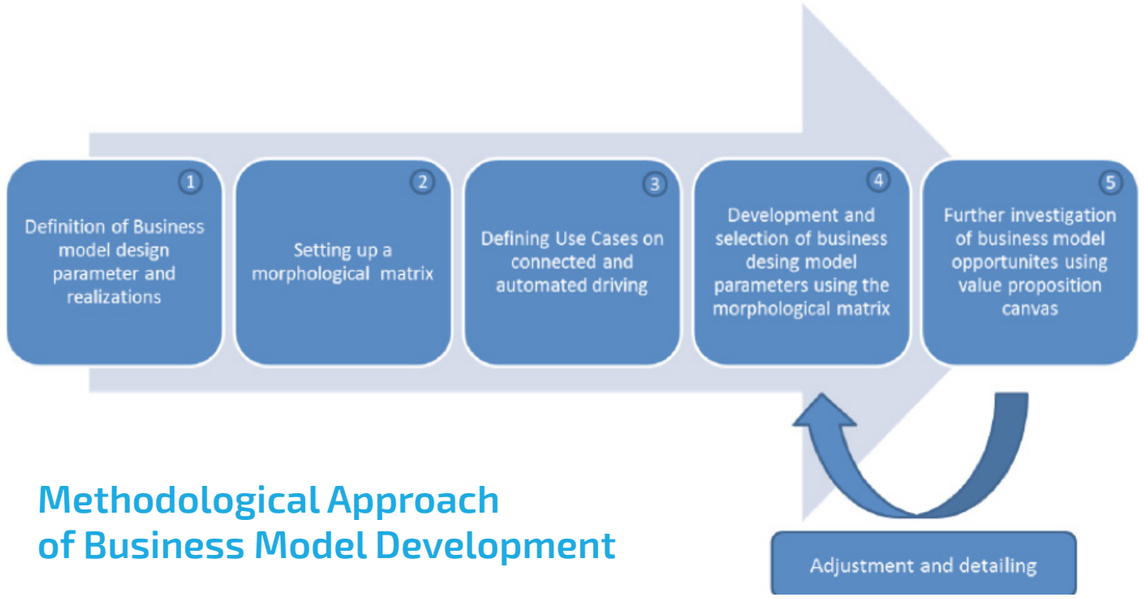
During the development of automated driving functions, especially when focusing on SAE level 3 functions, the human factors must be considered in any case. Human behaviour after a take-over request (TOR) is not investigated entirely and needs more research.

This holistic overview of the state-of-the-art has been essential to create a common roadmap not only for the technical but also for the legal development with all its facets, which is particularly important for describing the path for Level 4/5 automation.

Use cases and new business models

Connected and automated driving (CAD) promises dramatic benefits along the way of its implementation, but there are also hurdles. Also it will be changing the automotive ecosystem, starting with the transformation of traditional value chains and the market entrance of new players from “outside” the automotive sector like software or telecommunication companies going towards changes in user perspectives and therewith changes in mobility behaviour overall.

The biggest challenge especially for OEMs and their suppliers will be the proposed shift from car ownership to mobility as a service; the same shift that e.g. the media went through with changing costumer behaviour from content ownership to on-demand streaming. Furthermore, the entry of new players with new value propositions will challenge the conventional stakeholders.



Methodological Approach of Business Model Development

SCOUT has identified novel business models based on the potential of CAD. Such business models will support the large-scale deployment of automated and connected vehicles in Europe. The business models will recognize Europe's unique selling proposition of services and technologies for CAD taking into account existing resources, activities and sales channels as well as user expectations.

- **Business model for automated on-demand shuttles:** Automatic on – demand shuttles are an early example for Level 4/5 driving. They are currently in practical tests at many places in Europe. First deployment cases have limitations on all five layers, but the tests in practical environments are important to gain practical experience with the technology and its operation in real environments. So the shuttles are still used in confined areas with speed limitation and often in an accompanied mode. But there are already several examples for the deployment on minor public roads, and many plans for the use in regular services which complement public transport on the first and last mile.
- **Business Model for automated valet parking:** as a short term feasible basic scenario for automated driving, this use case considers cars which can be hailed and sent to a parking space with a command from a smartphone supported by infrastructure technology within the garage. Beside the drivers comfort the parking area providers also benefit from an automated parking system. Less parking space is needed for the individual car which means overall more parking lots could be provided at a certain area.
- **Business model for automated truck platooning on motorways:** Truck platooning will significantly improve traffic safety. Additionally, constant distance between trucks and the constant speed reduces traffic jams and accidents and therefore helps to increase the overall traffic efficiency on motorways. This in turn leads to less congestion, lower fuel consumption and less CO2 emissions. This solution also means a relief for the driver, which might decrease the necessary rest time. Less congestion and longer travel times at least lead to higher transport efficiency and therefore decreasing costs.
- **Business model for connected maintenance and safety:** in this use case especially the connectivity aspect is taken into account. Despite the fact that autonomous driving vehicles are proposed to increase driving safety, which causes most of today's accidents, the collection and forwarding of data allows real time reactions. This may result in driving recommendations for the driver or the "driving robot", reduction in energy consumption and traffic optimization, remote or predictive maintenance.
- **Business model for "The car as digital experience center":** Most autonomous vehicles offer the opportunity to use travelling time for different activities. The multimedia equipment of the future connected and automated car allows using the car as a moving virtual office while driving. The driver could also use travelling time as free time for activities such as surfing in the internet, watching videos/TV as well as using social media platforms.

Connected and automated driving is not only about vehicle and infrastructure technology. Especially the overall vision of mobility as a service will not only affect the car manufacturing industry. It will also rearrange the system of urban public transport and could initially have effects on increasing vehicle traffic which require the development of contingency measures in collaboration with public and national traffic management and infrastructure operators. All stakeholders need to work together to utilize the advantages of CAD to increase road transport efficiency.

Co-creation and Validation of the Roadmap

Following the building of the vision and the analysis of the state-of-the-art and business models, first steps of creating the roadmap were taken at an interactive workshop held in Brussels on March 7, 2018.

After a brief presentation of the project objectives and main outcomes, participants split up in groups around five posters devoted to layers of the roadmap towards level 4/5 automated driving, i.e. technical, legal, economic, societal, human factors. On posters the hurdles (existing gaps), actions in a timeline within different fields (to solve those gaps) and links for the proposed actions to other layers were collected. These posters were the basis for a continued stakeholder discussion and comments of participants were used for a further development: which aspects were missing or needed to be adjusted, especially regarding concrete actions and the instruments to be realized, as well as explanations regarding the links drawn between different layers.

The SCOUT project also organized on April 20th an expert workshop to validate the draft cross-sectorial roadmap. That was the

final session of the Interactive Symposium on Research & Innovation for Connected and Automated Driving in Europe, held on 19-20 April 2018 in conjunction with the TRA Conference in Vienna (*https://connectedautomateddriving.eu/2018_symposium/*).

SCOUT members supported the validation session by moderating and taking care of documenting inputs that were given to the posters in the interactive session. All findings were summarized by the moderators, highlighting specific actions on the time to overcome hurdles and turn the vision for CAD in 2030+ into reality, and pointing out links between the different layers of CAD, as these may offer opportunities for acceleration.

Assessment of funding programmes for CAD

A coherent funding strategy for Connected & Automated Driving (CAD) will accelerate progress in its deployment. A study by scout partner found that European funding in Horizon 2020 and the Connecting Europe Facility amounts to approx. €240 million per year together. On the level of the member states Germany (€ 80 million), UK (€23 million) and Sweden (€15 million) provide considerable funding. In comparison, the US spends around USD137 million (€122 million) per year for research related to connected and automated driving. Most funding is undertaken by the Department of Transport; other awarding authorities include the Department of Energy and the National Science Foundation, but there are also effort taken on a state level. Japan invests JPY2.45 billion (€20 million) annually in connected and automated driving related to the major funding programme (SIP-ADUS). In China, the "Made in China 2025" programme, the equivalent to Europe's "Industry 4.0", is a USD300 billion-heavy programme that also partially tackles connected and automated driving.

Events

CAD Webinar Series (X): Designing, testing, verifying and validating: Using FOT/NDS data for improving vehicle automation

9 July 2018 From 12:00 To 13:00

https://connectedautomateddriving.eu/event/cad-webinar-series-x-designing-testing-verifying-and-validating-using-fot-nds-data-for-improving-vehicle-automation/

Methodological Approach of Business Model Development

9-12 July 2018 – San Francisco

http://www.automatedvehiclessymposium.org/home

CAD Webinar Series (XI): The L3Pilot project – A Methodology for Piloting Automated Driving on European Roads

6 Septemebr 2018 From 13:00 T0 14:00

https://connectedautomateddriving.eu/event/cad-webinar-series-x-designing-testing-verifying-and-validating-using-fot-nds-data-for-improving-vehicle-automation-2/

AMAA 2018

11-12 September 2018 - Berlin

The 22nd edition of the International Forum on Advanced Microsystems for Automotive Applications (AMAA 2018) "Smart Systems for Clean, Safe and Shared Road Vehicles" will take place on 11-12 September 2018 at the prestigious Kaiserin Friedrich House in Berlin, Germany.

www.amaa.de

2nd European Conference on Connected and Automated Driving (EUCAD2019)

2 -3 April 2019 - Brussels

Scout

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Interested in the development of automated road transport technologies?

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