Next Steps for R&I and international cooperation in CCAM

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THE AUTONOMOUS

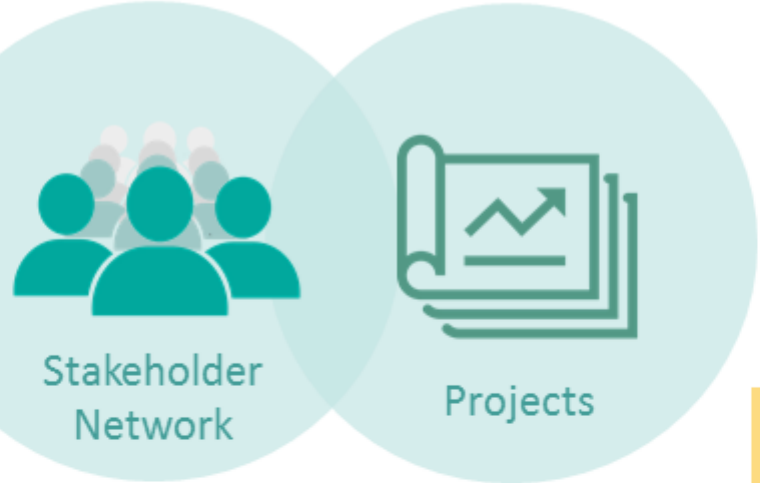
Workshop V
Safety, Research & Innovation
29 September 2021

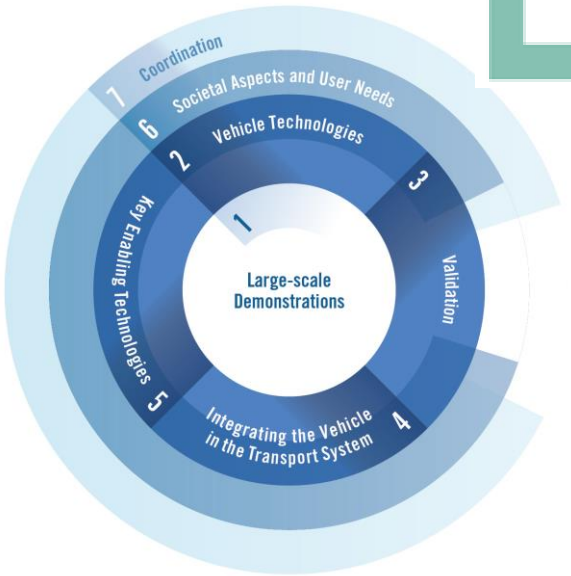
ARCADE is funded by
the European Union Horizon 2020
Work Programme

ARCADE CSA

- Oct 2018 – Sep 2021
- 23 partners from 11 States
- 50+ associated partners
- 2000 subscribers

Joint Stakeholder workshops
EU R&I Projects concertation workshops
Trilateral EU-US-Japan ART Working Group
EU CAD Conferences and Symposia





CCAM Clusters

Roadmaps

R&I Project
Regulations & Policies
Strategies & Action Plans
Standards
Evaluation Methodologies
Data sharing

Knowledge base

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https://knowledge-base.connectedautomateddriving.eu/

ARCADE is funded by the EU Horizon 2020 Work Programme

European Partnership on CCAM

Promote and facilitate pre-competitive research and innovation on CCAM by bringing together the actors of the whole CCAM value chain.

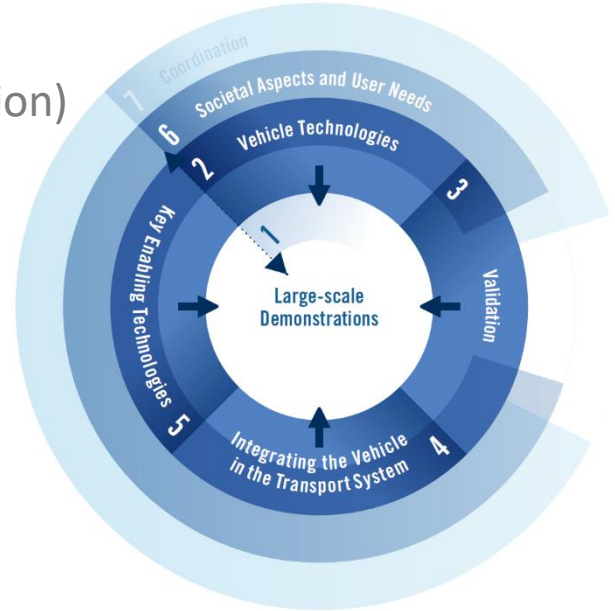
Objectives

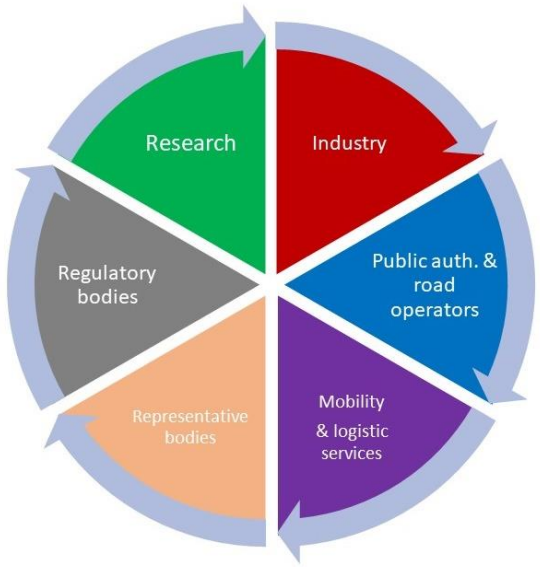
- Better align EU R&I efforts in the field of CCAM
- Develop and implement the CCAM Strategic Research and Innovation Agenda (SRIA)
- Implement large number of demonstrations of inclusive and user-oriented CCAM solutions for mobility of people and goods across Europe by 2030.

Budget

- 1 Billion € (50% EC contribution)

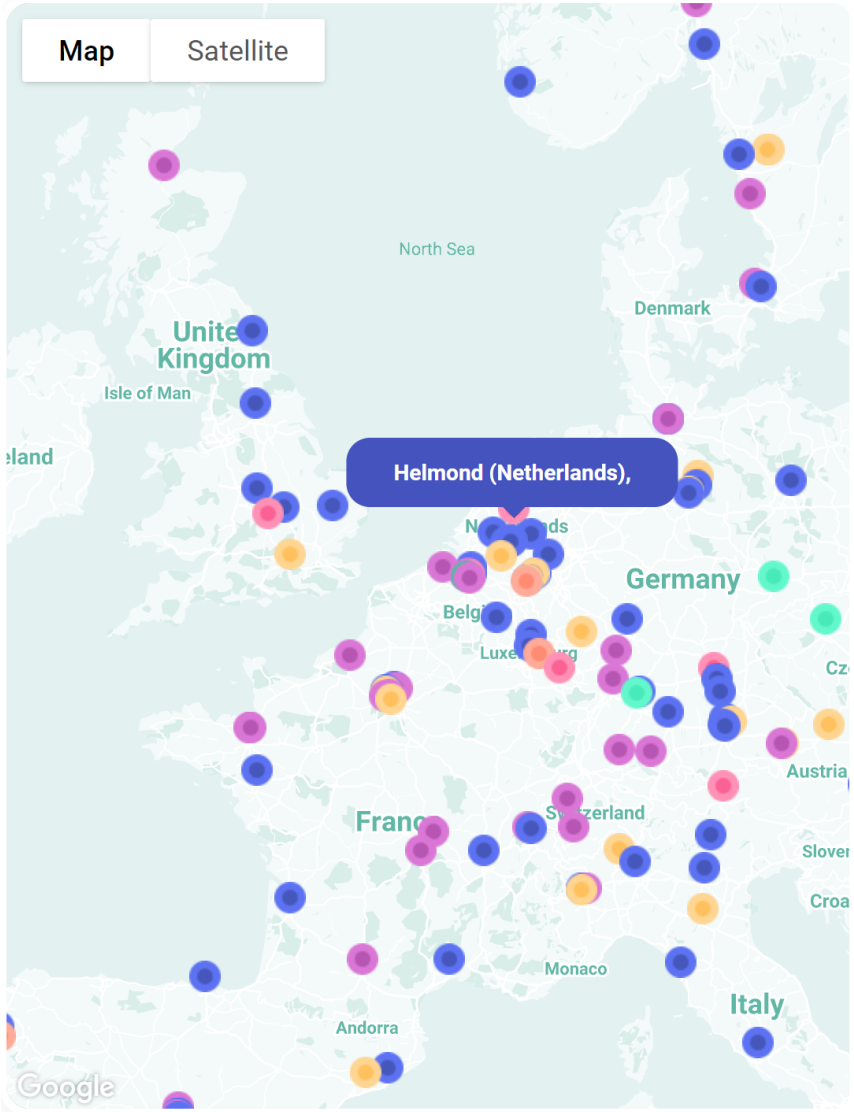
https://www.ccam.eu





Industry	- Automotive industry, including supply chain - ITS solutions, telecom providers, connectivity - Data handling and storage industry, ...
Public authorities & road operators	- Cities and regions - Transport authorities, road authorities and operators - Member States
Mobility & logistic services	- Public transport providers - Mobility and logistics service providers - Insurance, maintenance, ...
Representative bodies	- Road users - Stakeholder associations - Road safety, society, the environment, ...
Regulatory bodies	- National, European and international
Research	- Universities - Public research institutes - Private research institutes

Mapping the European CCAM R&I Landscape



← BACK TO THE MAP

Helmond (Netherlands),

Linked projects :

CoEXist — PROJECT NAME: CoEXist — DATES: 01/05/2017 - 30/04/2020

FABULOS — PROJECT NAME: FABULOS — DATES: 01/01/2018 - 31/12/2020

FUNDING: EU H2020

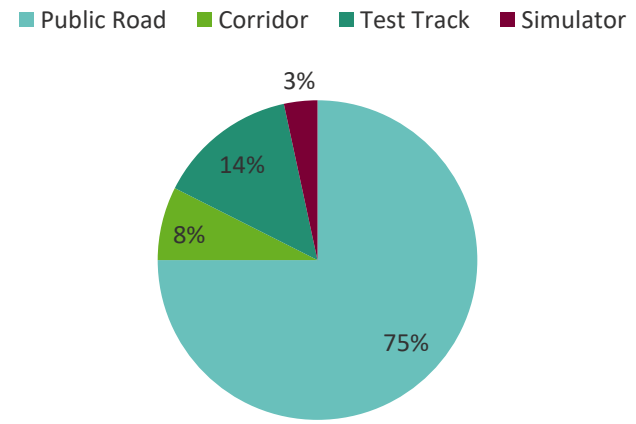
DESCRIPTION: Pre-Commercial Procurement of Future autonomous bus urban level Operation Systems

Go to project's website

inLane — PROJECT NAME: inLane — DATES: 01/01/2016 - 30/06/2018

MAVEN — PROJECT NAME: MAVEN — DATES: 01/09/2016 - 31/08/2019

~150 mapped sites



Source: ARCADE Knowledge Base (Status April 2021)

HE Cluster 5 – First calls on CCAM

For CCAM – 11 topics (budget € 162 mio)

- First call open: 24 June 2021 – Call deadline: 19 October 2021
- Second call open: 14 October 2021 – Call deadline: 12 January 2022

For more information on the open topics, please go to the:
EC funding & tenders portal

Main objective

- Accelerate the implementation of innovative connected, cooperative and automated mobility (CCAM) technologies and systems

CCAM topics will cover a broad range of R&I actions

- Vehicle technologies (to improve the performance and safety of AV in complex environmental conditions)
- Tools for the safety validation of AVs
- Physical/Digital Infrastructure and connectivity supporting AVs
- Integrating CCAM services in traffic management systems
- Key Enabling Technologies for CCAM (AI, Cybersecurity)
- Understanding user needs and impacts of CCAM
- European demonstrators for integrated shared automated mobility solutions for people and goods

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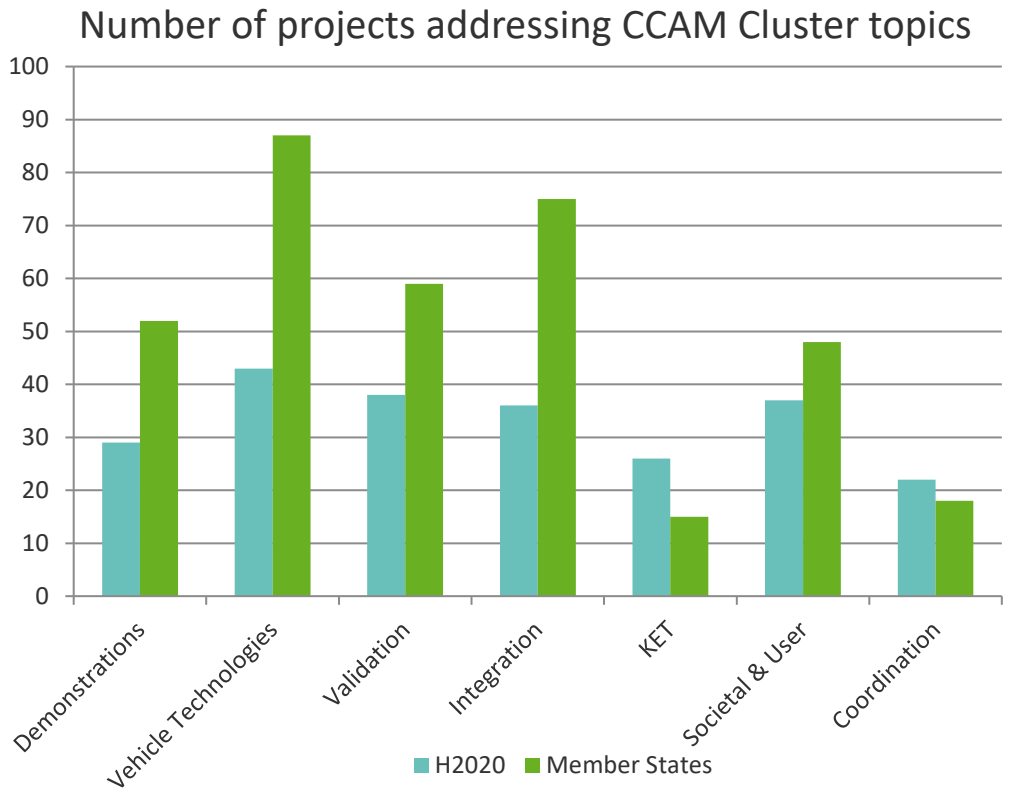
Source: European Commission, DG RTD

EU funded R&I Projects Meta-Analysis



280 R&I Projects listed in the Knowledge Base

- **62 EC Horizon 2020 funded**
- **140 EU Member State initiatives**
- **Classified by Thematic area & Use cases**

Meta-Analysis of Horizon 2020 R&I Projects

- **Identify overall findings and gaps**
- **Provide recommendations for future R&I topics in the SRIA developed by the CCAM Partnership**

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Results will be published soon
https://www.connectedautomateddriving.eu/projects/

Meta-Analysis Highlights: Next Steps for R&I (1/3)

Field Operational Trials

- Further research needed on conditions for the introduction at large scale (deployment scenarios), impact of possible regulations and policies, acceptance in real conditions (i.e. without any safety agent on-board) which is key to thoroughly explore the possible business models.

Physical and Digital Infrastructure (PDI)

- Further developments for **Road infrastructure classifying schemes** could include connections between ISAD classes, SAE Levels, ODD concept and liability issues.

Connectivity and Cooperative Systems

- Need for a **more standardized** and well defined use of MEC to provide low latency and high reliability
- An emerging issue in **cross-operator setups**, where service continuity is important, is **synchronization**. Traditional state-of-the-art methods, e.g. GNSS and NTP/PTP, are not sufficient.

Fleet and traffic management in a CCAM eco-system

- Combination of new developed measures and integration with existing traffic management centers is key in order to address future topics like individual advice generation, but also to include more macroscopic strategies as possible countermeasures.
- Capability to assess the impact of fleet and traffic management measures on the traffic system is pivotal.

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Meta-Analysis Highlights: Next Steps for R&I (2/3)

Environment perception technologies

- Improved quality and availability of data to extend the perception ODD, e.g. for weather recognition, simulation data and test environments as well as increased hardware performance
- High-reliable GNSS-localization system. The enhancement of on-board sensor systems with accurate HD-Map information requires accurate and reliable positioning.

Safe and reliable on-Board decision-making technologies

- While the fail-safe hardware is one important aspect, the corresponding software framework and toolset, aligned between many stakeholders is a future challenge to be tackled.
- Alignment of an overall SW architecture including interface definitions and iinteroperability requirements
- Standardization of spatial V2V protocols sharing maneuver information to support onboard perception

Human Machine Interaction (HMI) development for on-board CCAM technology

- Involve end-users. Promote active exploration of concepts/ideas in interactive prototypes in realistic settings
- Explore further driver state technology and adapted design strategies (both system and driver-initiated adaptation) based on e.g. the attention state in order to find tailored automated support..
- Expand research on interaction between AV and other road users in more complex settings (more actors in real world, remote control/monitoring)
- Public dataset or ground truth for training and validating (and comparing) different approaches towards the development of a driver state monitoring system

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Meta-Analysis Highlights: Next Steps for R&I (3/3)

Cybersecure components and systems

- Develop Protection Profile (PP) documents for components of the connected vehicles system, not currently covered. PP documents serve as a useful reference for risk-analysis that is well-accepted by industrial players

AI for situational awareness

- Need to gather and approve good development practices for training and validation of AI-based functionalities for AV

Future-proof methodologies and tools for validation

- Design and orchestration of exhaustive testing is needed to reveal vulnerabilities and allow for the improvement of security assurance methods.
- Building V2X test-beds allows for a broad set of testing activities overcoming the limitations of computer-based simulation or field-testing.

Socio-economic and environmental impact analysis and target-based assessment of CCAM benefits

- Lack of proper Impact assessment methodology to compare advanced CCAM services (e.g. combining external sensors with on-board perception)

Ethics

- Ethical implications of automated decision-making need to be assessed, giving rise to novel risk & liability analysis models

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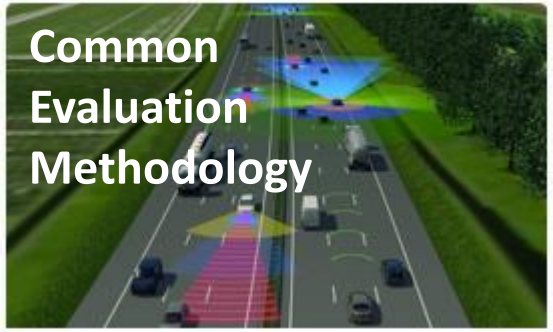
ARCADE Workshop series 2020 - 2021



23 NOV 2020 - 23 NOV 2020
ONLINE

Workshop on Common Evaluation Methodology for automated driving tests

- ~ 80 participants
- Experience from assessment projects Levitate, Headstart, L3Pilot, SAM
- First step towards the development of a EU-CEM

25 FEB 2021 - 25 FEB 2021
ONLINE

Workshop on Data sharing for Automated Driving

- ~ 80 participants
- Data sharing experiences from large scale projects (UDRIVE, AUTOPILOT, L3Pilot)
- Break-out sessions on principles for industry data sharing, in-vehicle data selection and analysis, GDPR

11 MAY 2021
ONLINE

Workshop on Edge Cases for Automated Driving

- ~ 70 participants
- 5 approaches to edge cases: BMW for testing & validation, JARI (SAKURA project) for SOTIF, VVMethods Safety Argumentation , MOSAR Scenario library , edges enabling large scale adoption (Easymile)

08 JUL 2021
ONLINE

International workshop on "Vehicle Technologies for Connected, Cooperative & Automated Mobility"

- ~ 300 participants & 20 industry speakers
- Sessions on Environment perception, decision-making and artificial intelligence, safety aspects in CCAM such as human-machine interaction, human factors, life-on-board and inclusiveness

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Supported the EU CCAM Platform, the CCAM Partnership and Strategic R&I Agenda development process

https://www.connectedautomateddriving.eu/events/

Main Take-Aways

Common Evaluation Methodology

- CEM should at least provide a checklist for practical steps in the study design and a common glossary of terms.
- Need accepted scenarios and cooperate on how to construct future scenarios as impacts depends on them
- Towards EU scenario database -> need data exchange principles for comparing or combining scenario sets

Data Sharing

- Develop effective and efficient means for de-identification and data minimising techniques including use of ‘deep fakes’
- Need standardisation of metadata, e.g. for Operational Design Domains, scenarios, functionality and services;
- Define requirements for data sharing in real-time and for in-vehicle selection of data

Edge cases

- Research needed on validity and transferability of edge cases. Sharing and harmonizing edge cases needs collaboration. We should learn from other domains (medicine/vaccine and aviation) how to work with edge cases to build public trust
- Need clear definitions on what is reasonably foreseeable and what is acceptable risk from societal perspective
- Edge cases could be narrowed down based on grouping dynamic driving tasks, subtasks, sensor and physical principles

Vehicle Technologies

- Next steps of collaboration & homologation preparation include virtual data qualification to leverage more simulation, scenario database industrialization & scalability, and developing standards for positive risk balance demonstration
- Transparency is key in safety assurance. Driving Safely is driving at a societally acceptable risk balance and proving it
- Exception approvals in the EU, a more harmonized approach is required: Ideally, exemption approval from one country bound by cross-border agreement should automatically apply to other countries

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Thank you

https://connectedautomateddriving.eu/

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