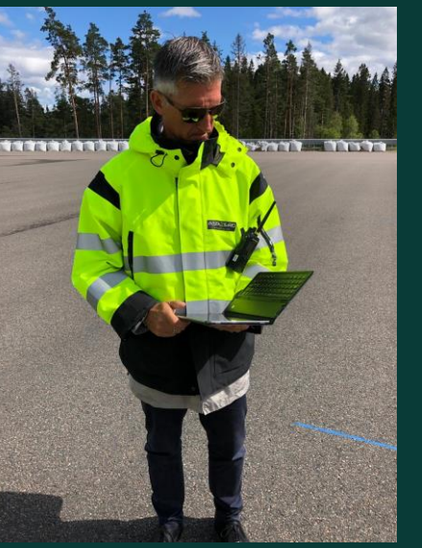
Type Approval and Compliance Testing of vehicle safety advanced functionalities

From conventional vehicles to AVs

Fabrizio Minarini

European Commission - Joint Research Centre



SIP-ADUS Workshop

Tokyo 13 November 2019

European Commission

Joint Research Centre

The European Commission's science and knowledge service

Our mission is to support

EU policies with independent evidence

throughout the whole policy cycle

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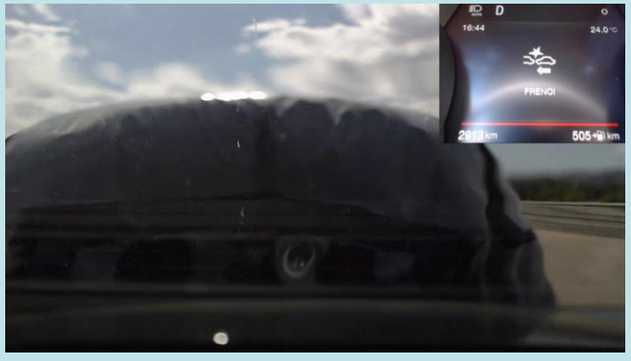
Our main areas of work on vehicle safety

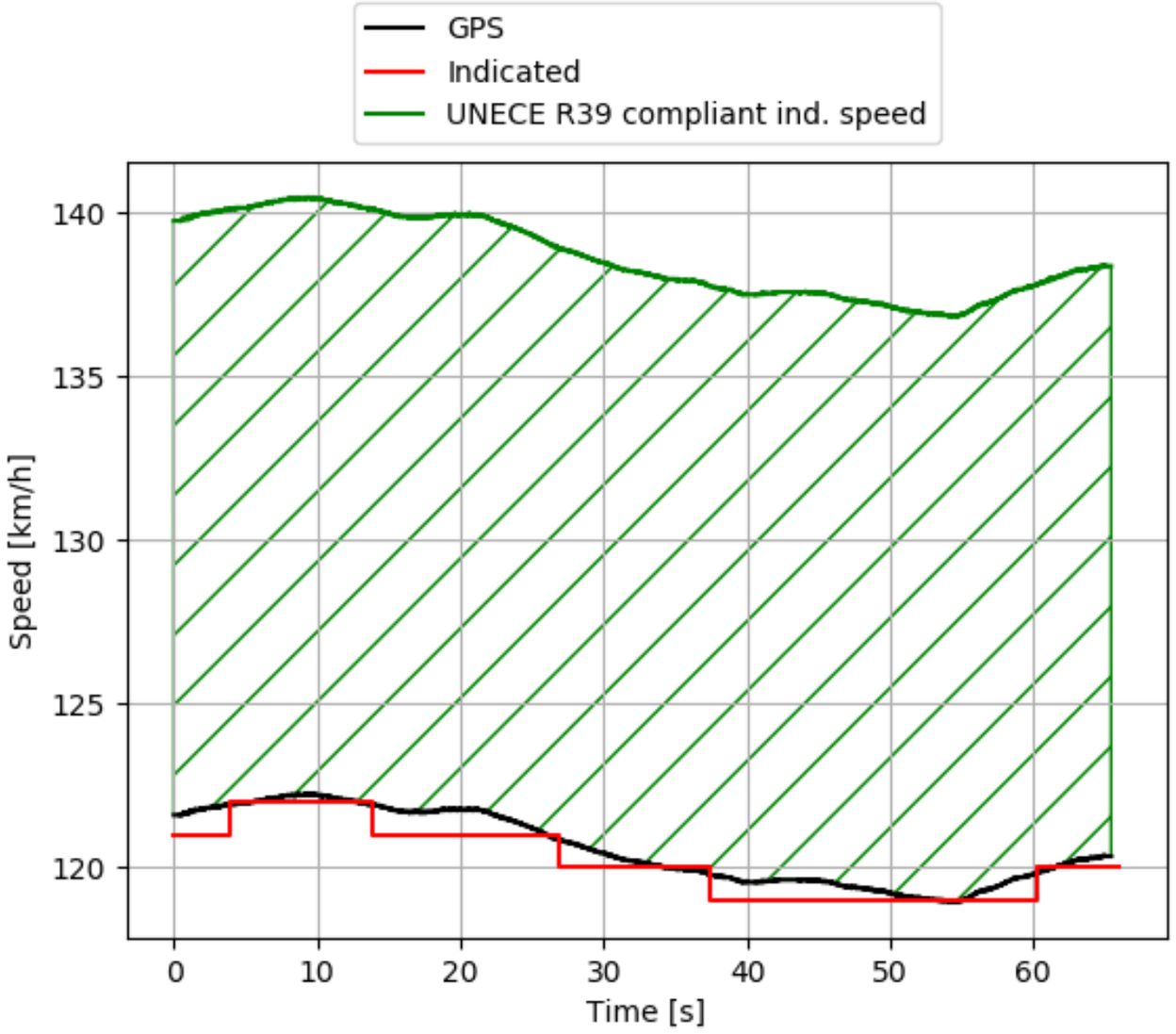
- Autonomous Vehicle safety assurance research
- Compliance and conformity Testing of motor vehicles
- Input the new EU type approval legislative framework
- Input to UNCE WP29 – WP1

In 2019

- 3 safety test campaigns
- 7 Vehicles
- AEB – LDW – ACC – Odometer
- 1 Campaign end November (Truck-Car)



Example of Market Surveillance test: non-compliance of the odometer



Test at 120 km/h according to UNECE R39 shows non-conformity

Indicated speed (red line) should fall within the green area to be compliant with R39

$$0 \leq (V_1 - V_2) \leq 0.1\ V_2 + 4\ \text{km/h}$$

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Examples of current Issues when testing AEB

Examples of current Issues when testing AEB

AAA Warns Pedestrian Detection Systems Don’t Work When Needed Most

EU type approval framework for automated/autonomous vehicles (AVs)

From current tests based on fixed parameters
To a more comprehensive and fail safe approach

In the EU:
6 workshops
by DG GROW-JRC

Multi-Pillar Approach

International:
Input to WP29 IWG
FRAV – ACSF - VMAD

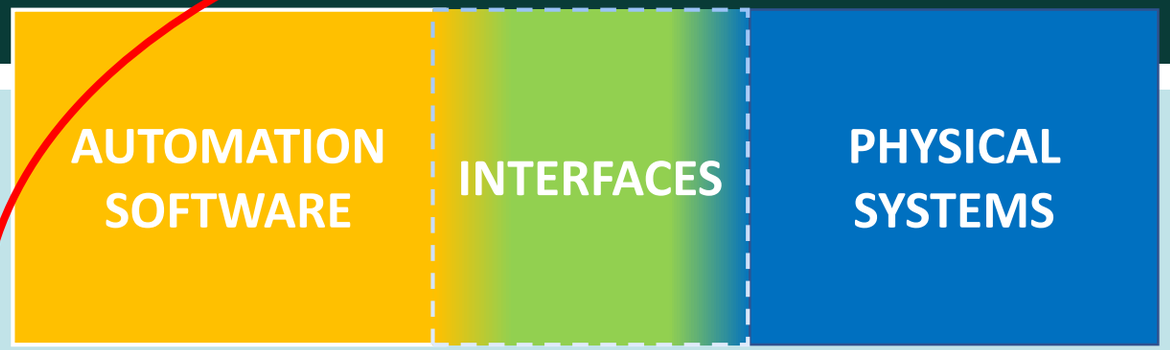
Contributions to discussions and
Informal documents

What is a safe AV?

Focus on the vehicle

In any environmental condition should be able to comply with:

- traffic rules,
- safety envelop of the selected safety functionality avoid crash: foreseeable; preventable
- failures mitigation strategies.



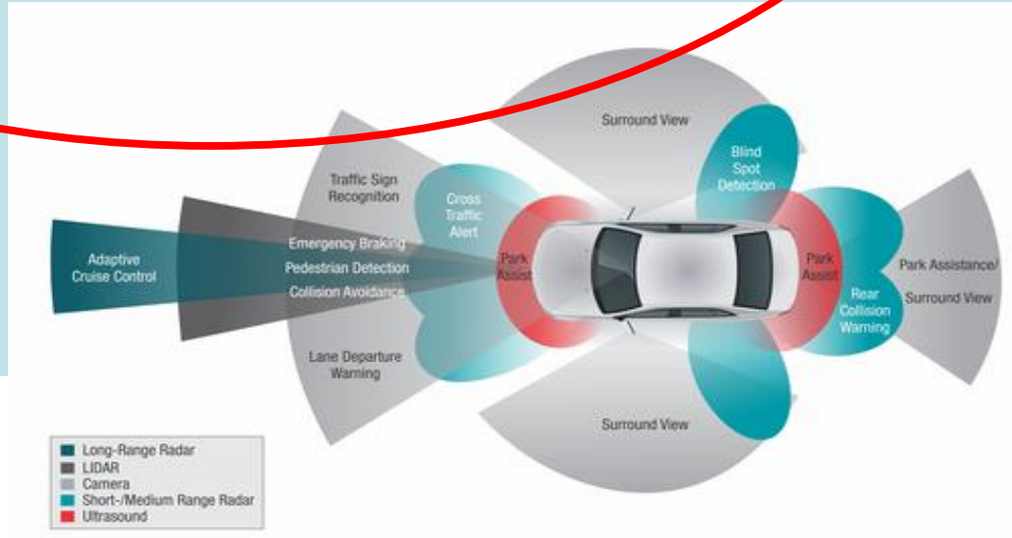
Nominal Safety

Functional Safety

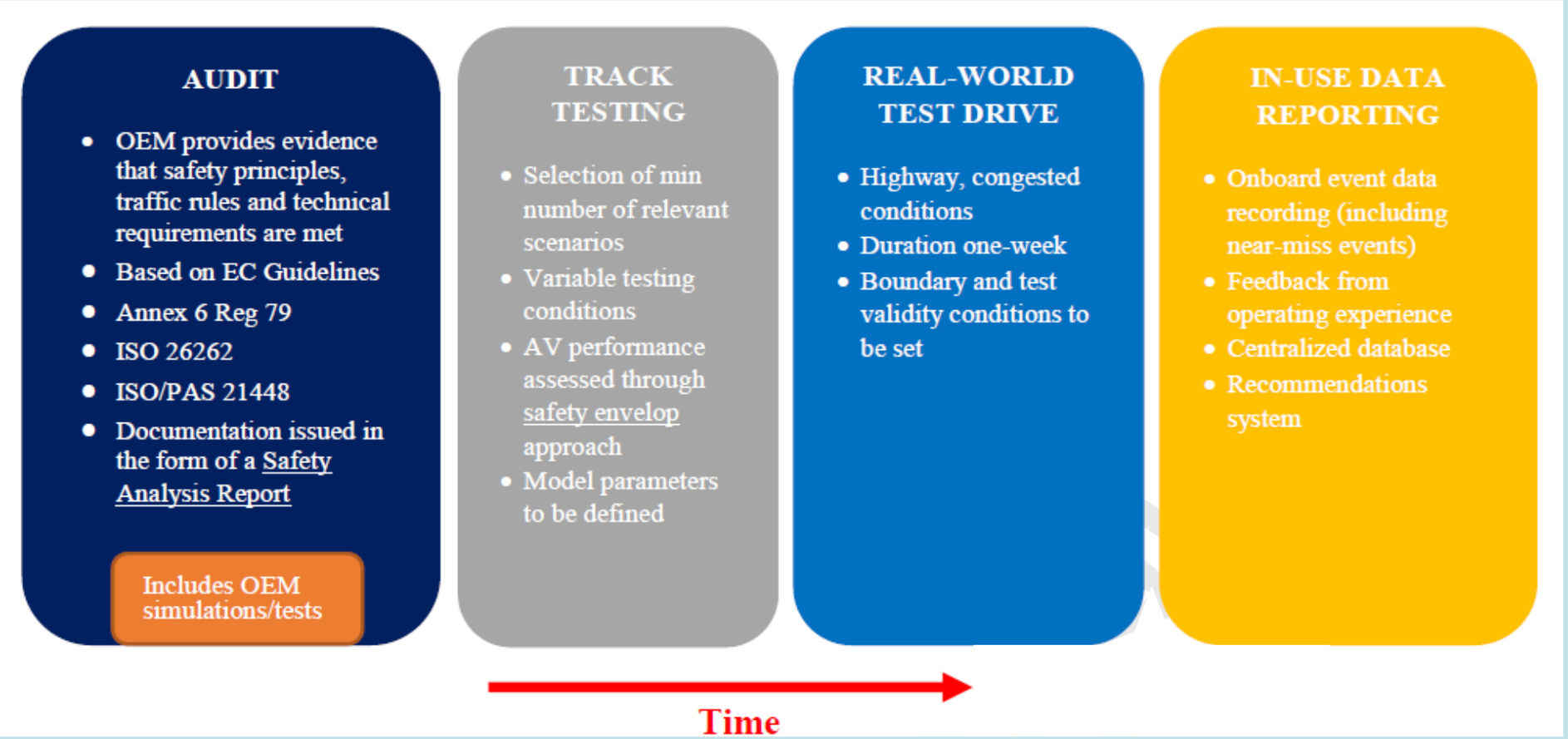
Miscommunication

Interactions with humans

Environmental factors



Multipillar Approach



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1st Pillar Audit: assess the process for a safe design

- Performed on EC guidelines
- Detailed demonstration of safety
- Presented in the form of a Safety Analysis Report (SAR).
- SAR could cover the following elements:
  - System performance in the automated driving mode
  - Driver/operator/passenger interaction
  - System architecture design information
  - results from simulations and virtual testing.
  - Transition of the driving tasks
  - Event data recorders
  - Cybersecurity

Certificato Omologazione CE
EC Type- Approval Certificate

per impianto di scarico non originale / for non-original exhaust system

e_{24} 00080 G

Modello e versione scarico: Type and version of exhaust: ADV-B26

Marcatura: Marking: Incisione Laser / Graved by Laser

N° Approvazione: Approval N°: e24*134/2014*134/2014G*00080*00

Rilasciato da: Issued by: NATIONAL STANDARD AUTHORITY OF IRELAND

Luogo e data Omologazione: Place & date of Type-approval: Dublin, 27/06/2017

Rapporto N°: Report N°: 17-00017-CM-MIL-00

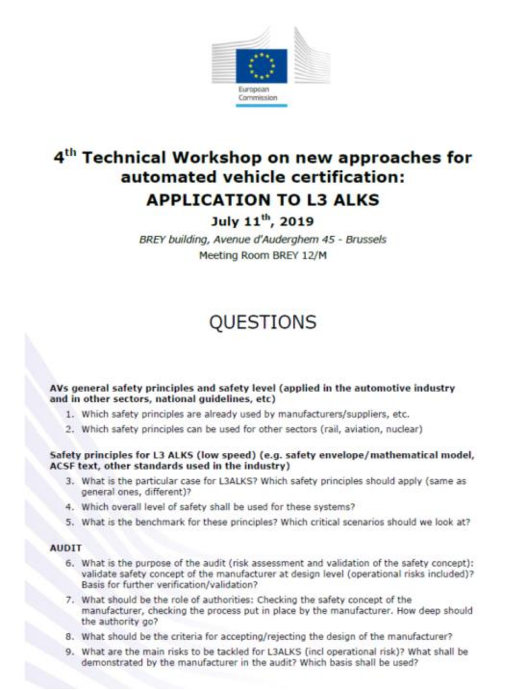
Rilasciato da: Issued by: TÜV SÜD AUTOSERVICE GMBH, Westendstraße 199, D-80686 München

Data rilascio: Date of Issued: 09/05/2017

Identificativo Omologazione: Approval Identification: e_{24} 00080 G

Manutenzione / Maintenance

Esclusione di responsabilità / Exclusion of Certain Liability



4th Technical Workshop on new approaches for automated vehicle certification:
APPLICATION TO L3 ALKS
July 11th, 2019
BREY building, Avenue d'Auderghem 45 - Brussels
Meeting Room BREY 12/M

QUESTIONS

AVs general safety principles and safety level (applied in the automotive industry and in other sectors, national guidelines, etc)

1. Which safety principles are already used by manufacturers/suppliers, etc.
2. Which safety principles can be used for other sectors (rail, aviation, nuclear)

Safety principles for L3 ALKS (low speed) (e.g. safety envelope/mathematical model, ACSF text, other standards used in the industry)

3. What is the particular case for L3ALKS? Which safety principles should apply (same as general ones, different)?
4. Which overall level of safety shall be used for these systems?
5. What is the benchmark for these principles? Which critical scenarios should we look at?

AUDIT

6. What is the purpose of the audit (risk assessment and validation of the safety concept): validate safety concept of the manufacturer at design level (operational risks included)? Basis for further verification/validation?
7. What should be the role of authorities: Checking the safety concept of the manufacturer, checking the process put in place by the manufacturer. How deep should the authority go?
8. What should be the criteria for accepting/rejecting the design of the manufacturer?
9. What are the main risks to be tackled for L3ALKS (incl operational risk)? What shall be demonstrated by the manufacturer in the audit? Which basis shall be used?

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2nd Pillar: Test Track scenarios and testing

- Road geometry
- Interaction with other road users
- Driving parameters (speed, …)

+

Testing conditions

- Environmental conditions
  - weather, temperature, visibility
  - asphalt conditions
  - road signs, road marks
- Failures
  - sensors
  - environment
- Miscomunications

= Random selection

NOT ON FIXED PROTOCOLS

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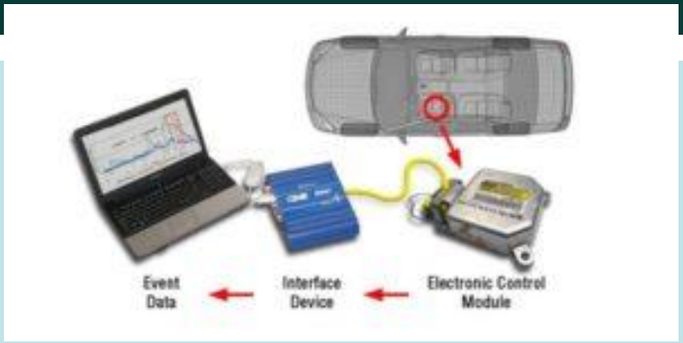
3rd Pillar Real World test drive

Driving experience for final verification that the AV is capable of handling real-world driving ensuring the required level of safety:

- To interpret and adapt to the surrounding environment;
- To respects the safety envelope boundaries
- To properly manage the interaction with other road users;
- The hand-over the driving task to the driver (L3)

4th Pillar: in use data reporting

- Continuous feed-back for system Improvement
- Implementation of an in-use reporting and establishment of a centralized repository for the collection, sharing and analyzing of the data:
  - Systematic updating of the SAR
  - Software modifications and improvements
  - New regulatory requirements or changes to the certification basis



5th Pillar: Coordinated action at global level

1. World-class scientific cooperation
   - need to share our data, models, and expertise.
   - Joint international cooperation projects

2. Regulation and standardisation
   - Need of harmonised approaches at global level
   - Economies of scale and ensure interoperability.

3. Large scale experimentations
   - Proving grounds, public roads, Living Lab

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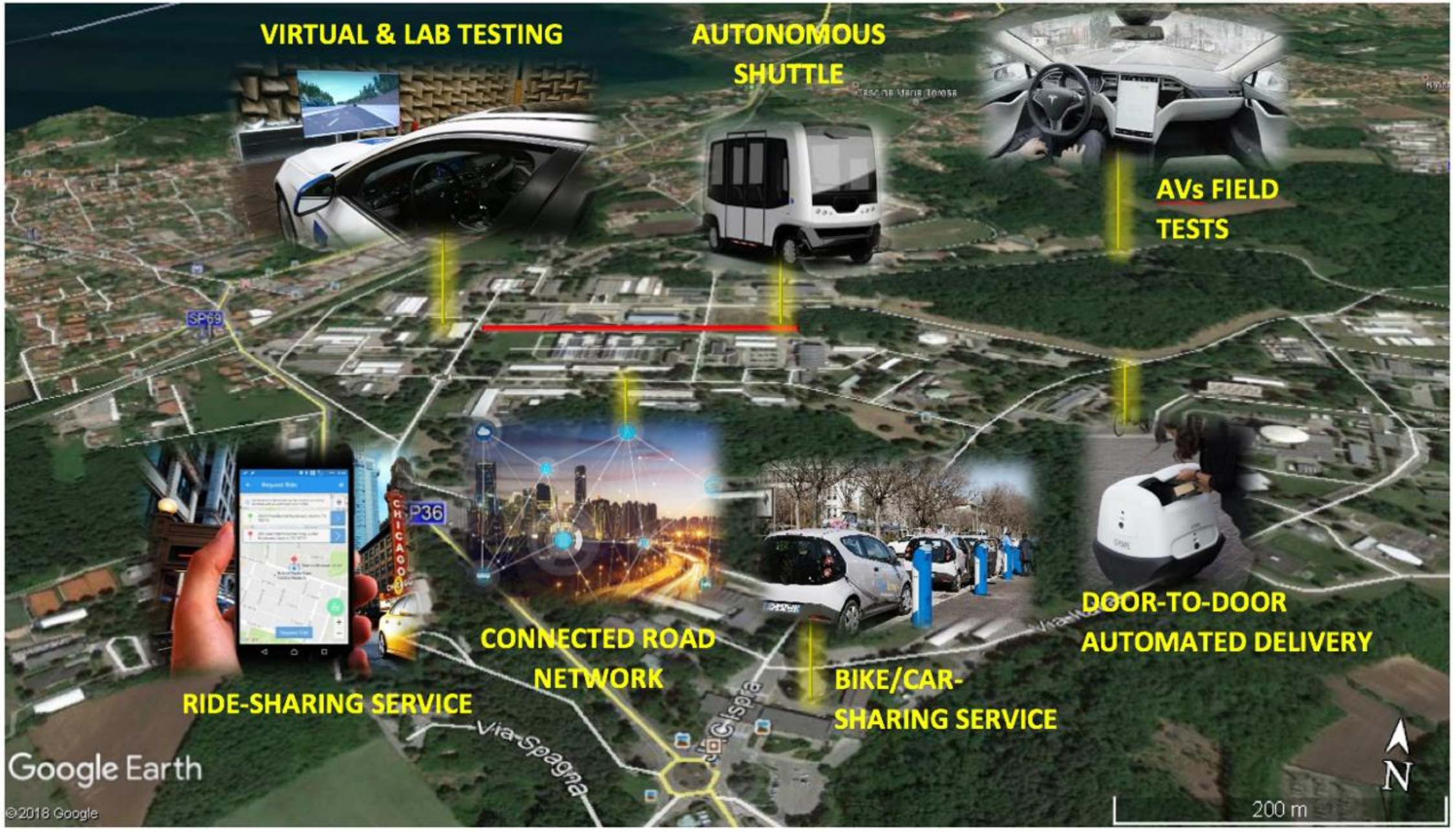

Open call for expression of interest available at https://ec.europa.eu/jrc/en/research-facility/living-labs-at-the-jrc

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Thanks

Questions?

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