

# ZUKUNFTSTAG

INNOVATIONS- UND WIRTSCHAFTSREGION SÜD

**#bettertogether**



# Simulations and Models for Future Mobility Solutions

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# Content

- Motivation: ESRIUM Project
- Infrastructure-assisted ADAS/AD functions
- Simulation-based development using digital twins
- Real-life implementation and tests
- Future extensions: ESERCOM-D Project





# EGNSS-enabled Smart Road Infrastructure Usage and Maintenance for increased energy efficiency and safety on European road networks

## Our challenge

ESRIUM is an international project fostering safer and more efficient roads towards a smarter, safer, greener transport system. The key innovation will be an EGNSS-based digital map of road surface damage and road wear. The road wear map will contain unique information for the road operators to enhance road maintenance planning and to provide route recommendations to automated vehicles.

## Our solution

The imbalanced usage of the road surface contributes to its degradation, leading to safety risks especially for connected and automated vehicles. The problem becomes even worse with harsh weather conditions. Our solution consists of an EGNSS-based digital map of road damages and safety risks that will allow for route adjustments through I2V communication free of charge. These recommendations will lead to a more balanced use of the road surface and to a longer lifetime of the road infrastructure.



ESRIUM regularly captures the status of the road surface through a sensors, cameras and EGNSS-based localisation devices to send them to the platform operator.

The data platform operator extracts relevant information from the raw data, integrates it into the digital map and automatically generates safety warnings.

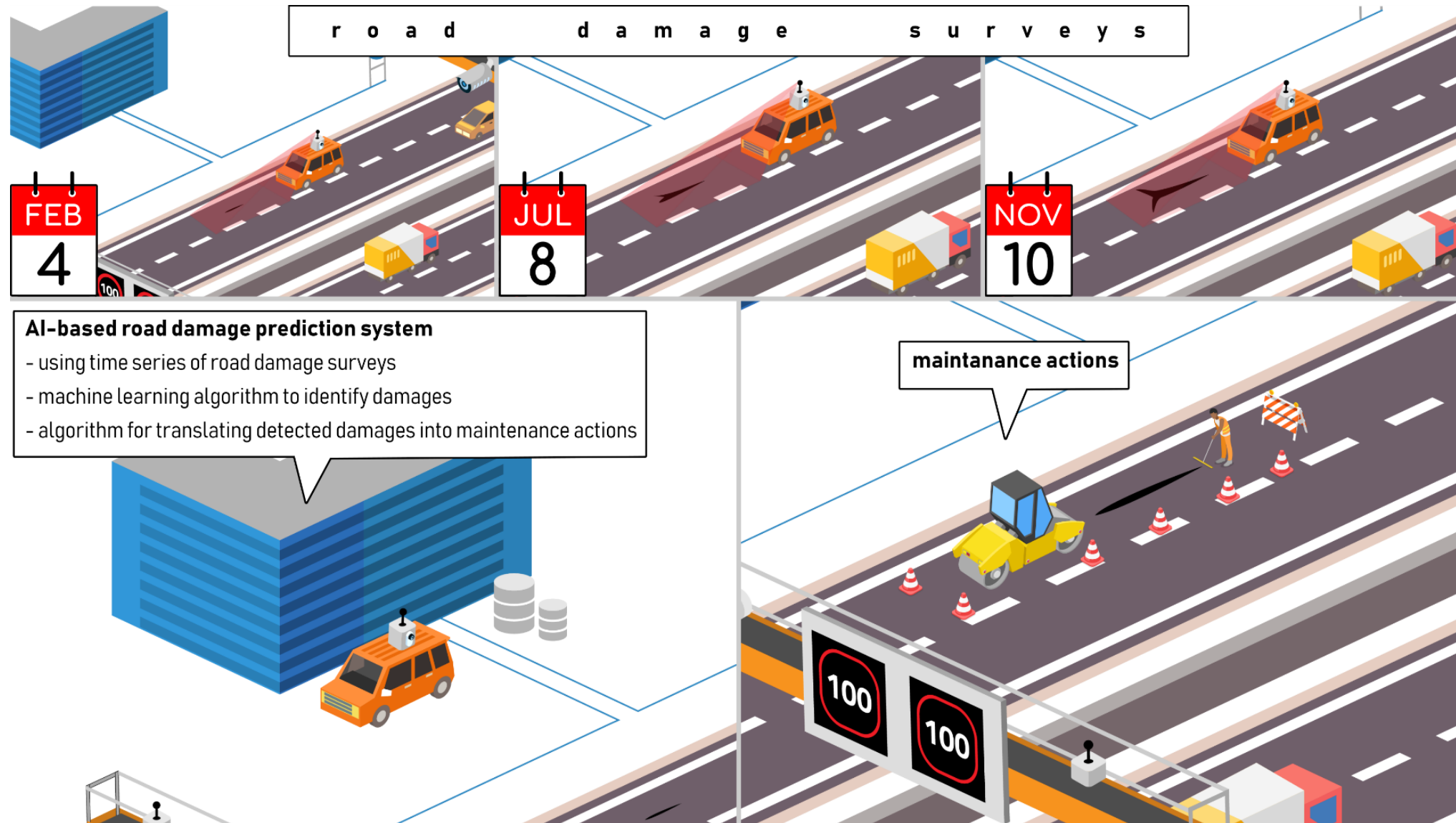
Road operators can communicate route recommendations to CAV drivers and truck fleet operators to better manage traffic and avoid safety risks, while optimising road maintenance planning.

## Our team

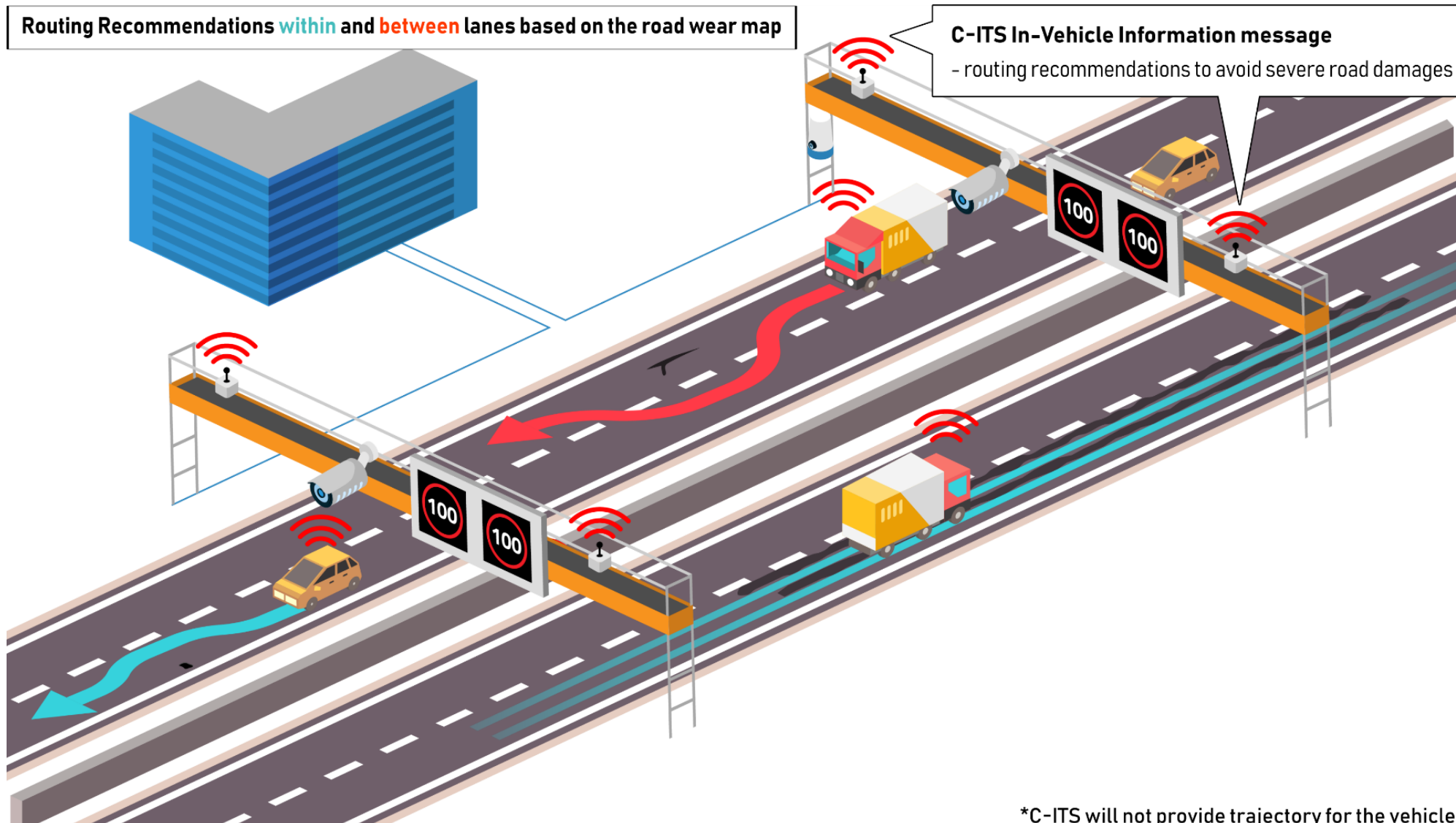


ESRIUM has received funding from the European GNSS Agency under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004181.

# AI-based road damage prediction for road maintenance



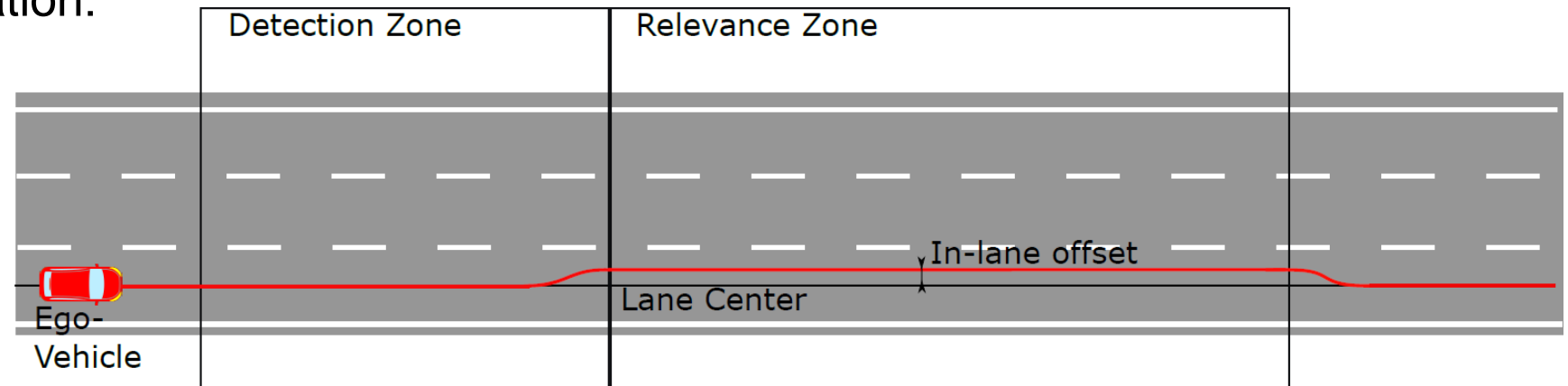
# Routing recommendations provided via C-ITS messages



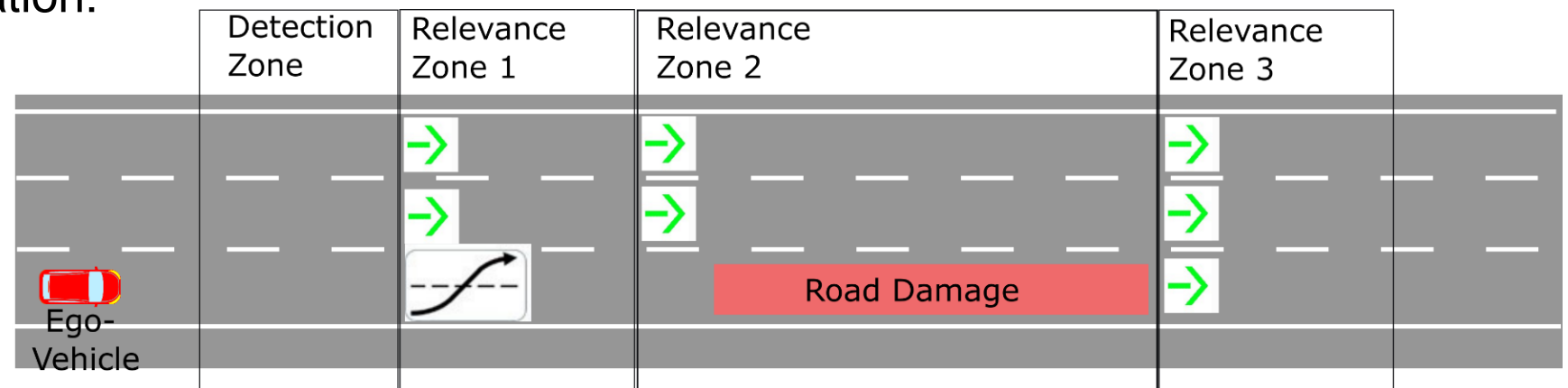
\*C-ITS will not provide trajectory for the vehicles

# Use case scenario specification

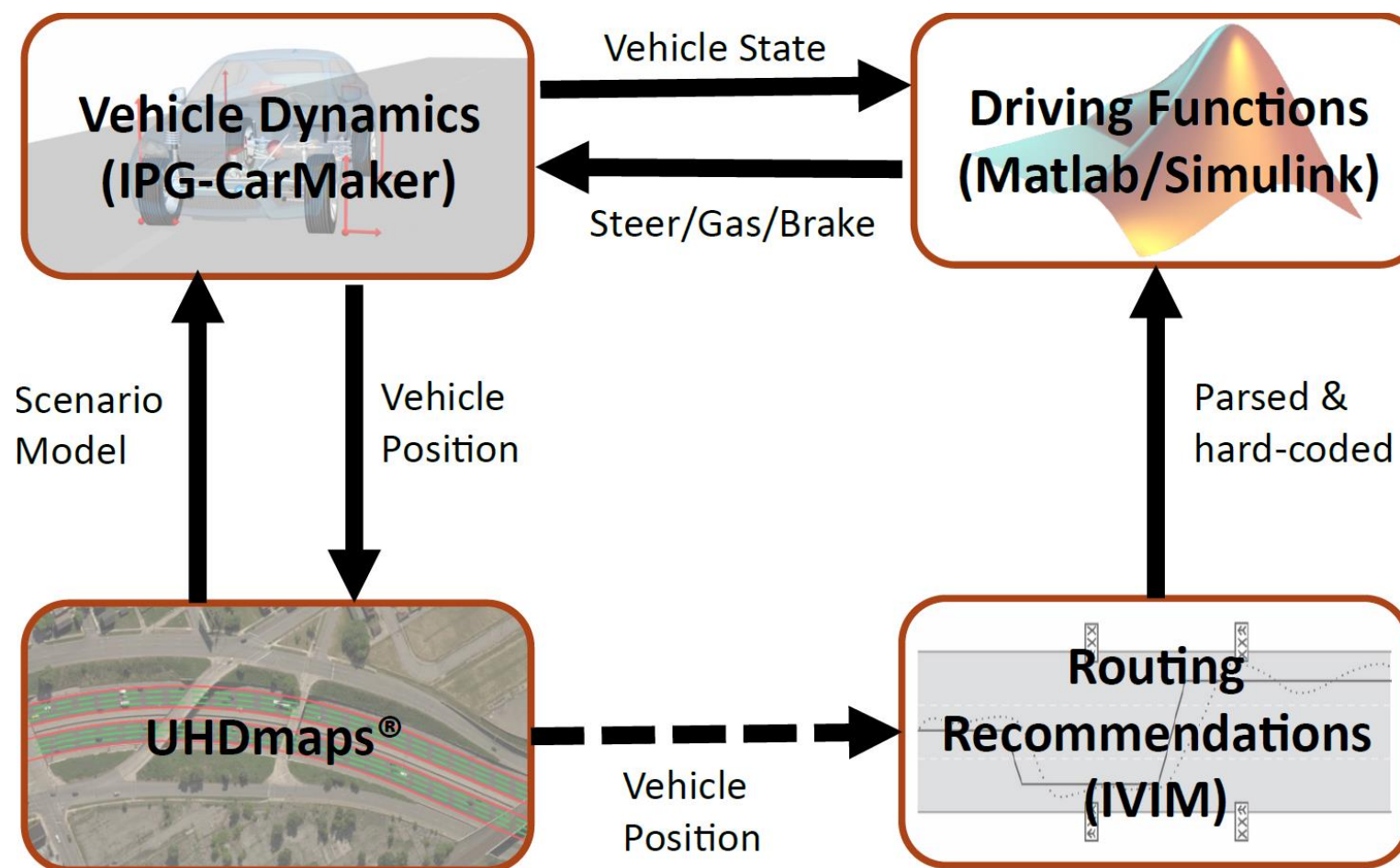
- In-lane offset recommendation:



- Lane change recommendation:



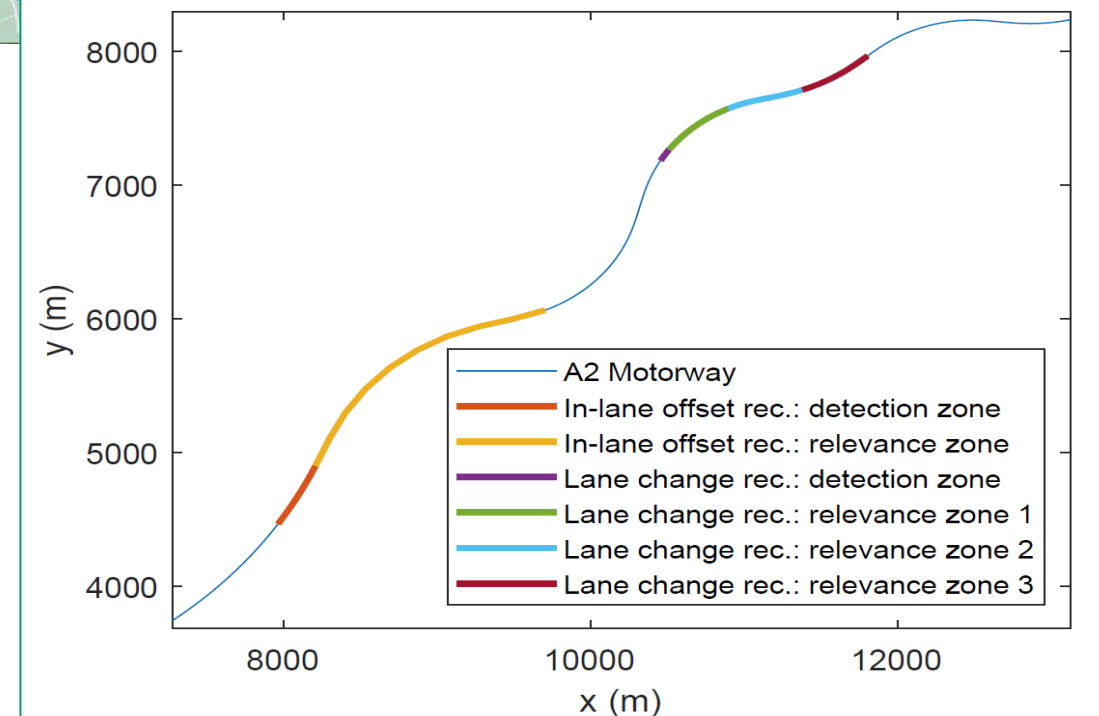
# Co-simulation architecture





## Test Site & Scenario Flow

- **Test Site:** Stretch of the A2 Motorway between Graz and Lassnitzhöhe
  - 3 lanes
  - about 8 km
  - 2 RSU (roadside units)
  - several traffic sensors
- **Test Scenario Flow:**
  - Automated vehicle starts near Raaba
  - First an IVIM with an in-lane offset recommendation is received
  - Second an IVIM with a lane change recommendation is received

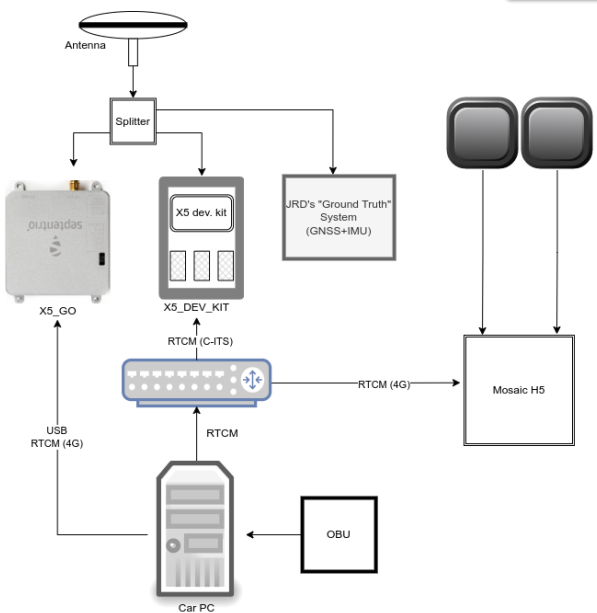
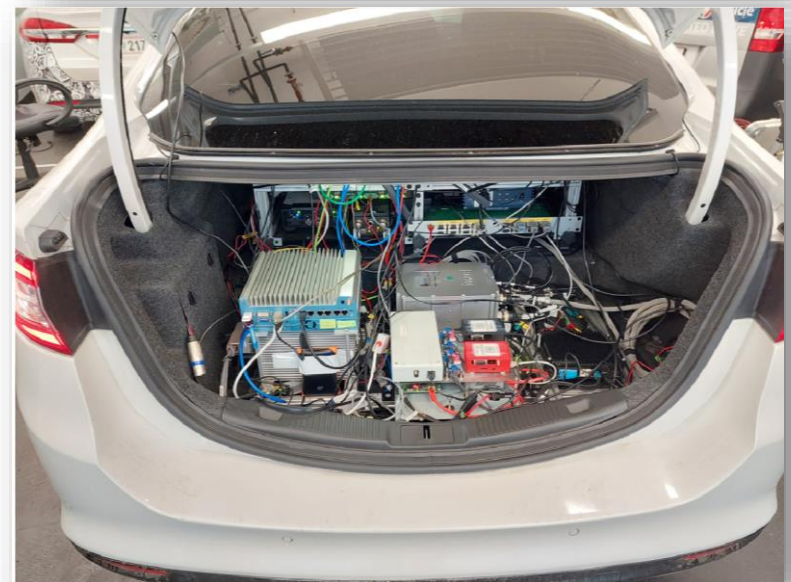
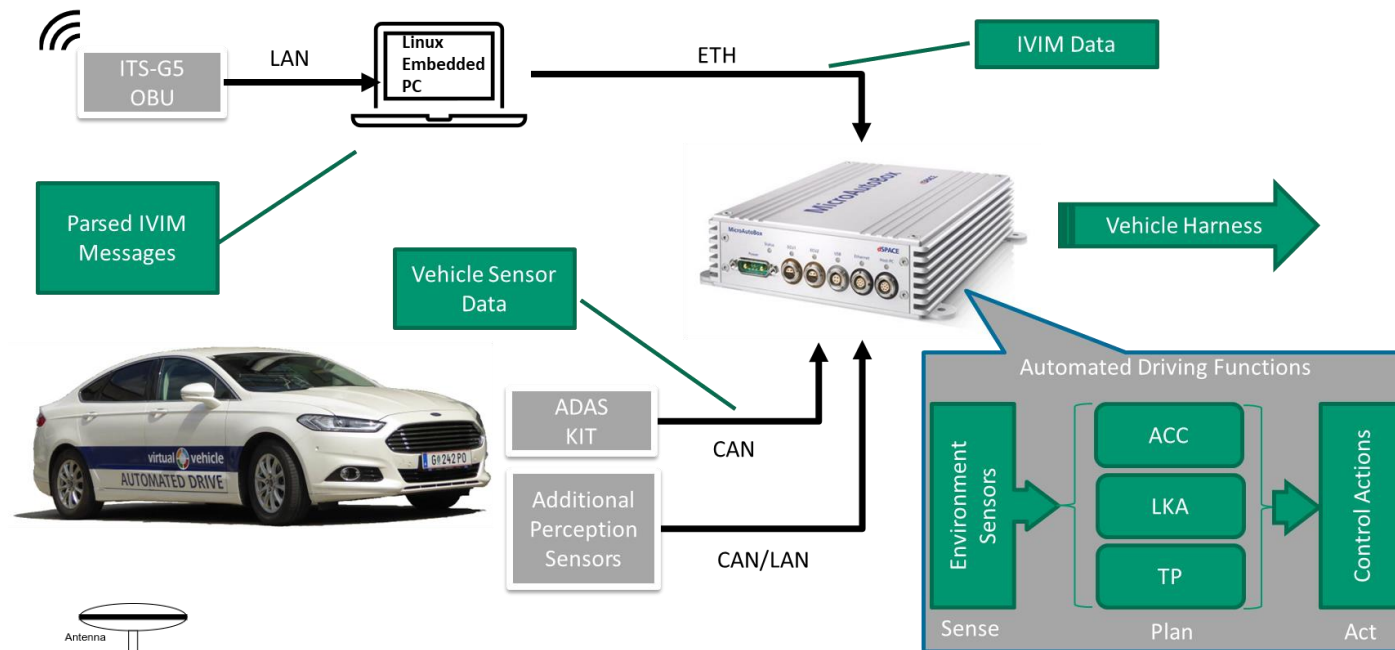




# Simulation utilizing UHD Digital Twin



# Test Vehicle HW-Setup and Interfaces





# Real-life Implementation and Demonstration



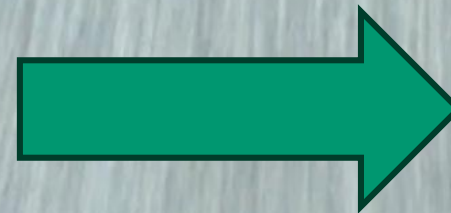
This project has received funding from the European Union Agency for the Space Programme under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004181.

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## The way forward: ESERCOM-D



# Egnss enabled Standardized European Road COndition Monitoring and Distribution

**Coordinator:** JOANNEUM RESEARCH

**Duration:** 36 Months (Start 01.10.2024)

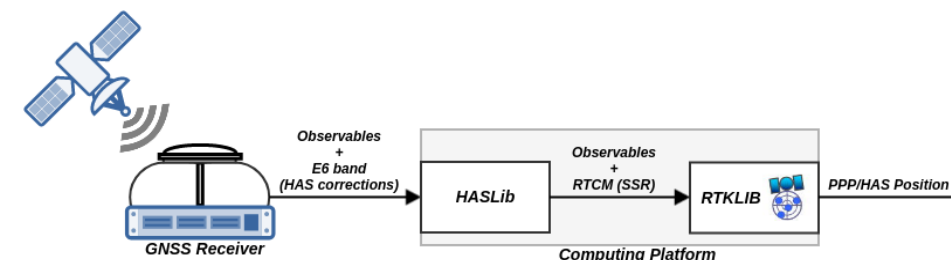
**Budget:** 2,5 M €

**HORIZON-EUSPA-2023-SPACE-01-42**



## Specific Objectives

- **O1** Standardization gaps identified and linked to the relevant data value chain
- **O2** Digital twin case study at one road operator
- **O3** Road wear sensor system operational at TRL 7
- **O4** Technical quality verified
- **O5** EGNSS-based localization systems providing accurate, reliable and authenticated position
- **O6** Derived standardization concepts
- **O7** Impact assessment and user acceptance
- **O8** Sustainable impact of ESERCOM-D outcomes widely spread
- **O9** Proof of solutions of standardization schemes



# What Exactly and Why ?



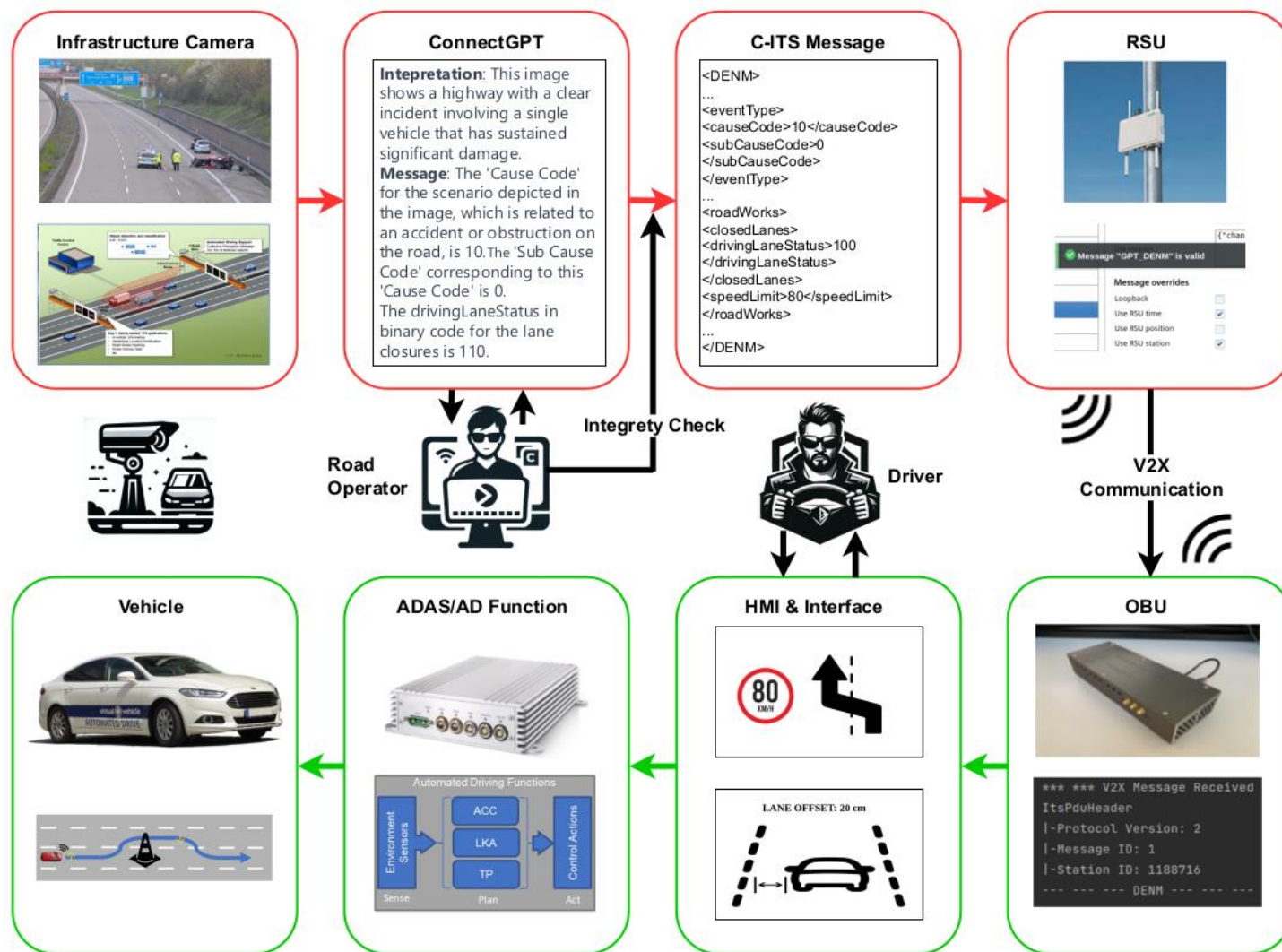
## ■ Responsibilities for Virtual Vehicle in ESERCOM-D

- Development of an automated pipeline utilizing LLMs to generate standardized safety messages on the infrastructure side.
- Implementation of a functional prototype of the system for real-life demonstrations on a motorway utilizing RGB cameras.
- Integration and demonstration of the overall system solution including an automated driving vehicle (developed in the ESRIUM project) reacting to infrastructure routing recommendations.

## ■ Benefit

- Closing the loop in the operation of infrastructure-assisted automated driving systems by automating the safety message generation.
- Know-how & experience building in the utilization of LLMs in safety-critical systems in the context of connected automated mobility.
- Contributions towards standardization of the infrastructure routing recommendations using standardized ETSI messages.

# Proposed ConnectGPT pipeline



**Infrastructure Camera**  
Monitoring the highway

**ConnectGPT**  
A GPT model for traffic scene interpretation and message generation

**C-ITS Message**  
Including different message types

**RSU (Roadside Unit)**  
Sending C-ITS messages

**OBU (On-board Units)**  
Receiving C-ITS messages

**HMI (Human Machine Interface)**  
Visualization of received messages





***Danke für Ihre Aufmerksamkeit!***