AI SEE

ARTIFICIAL INTELLIGENCE ENHANCING VEHICLE VISION IN **LOW VISIBILITY CONDITIONS**

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STATUS: 05.04.2022

HOW CAN WE ENSURE THAT **AUTOMATED VEHICLES DRIVE RELIABLY** EVEN IN ADVERSE WEATHER CONDITIONS?

- Develop a **robust and fault-**tolerant novel sensing technology and associated AI

- Enable automated driving in **all relevant weather & lighting conditions** (snow, heavy rain, fog)

- Permit safe driving **24h / 365-days**

Source: ibeo

THE CHALLENGE

○ Currently commercialization of automated vehicles is difficult due to their **inability to drive under any relevant weather and lighting conditions.**

○ Testing takes place in **small designated areas with good weather conditions.**

○ Prototypes **struggle or completely fail** in adverse weather.

Source: ibeo

○ AI-SEE will **prepare the broad market entry of automated vehicles** building a robust and safe perception system operating in all relevant weather and lighting conditions.

○ It will extend the **Operational Design Domain (ODD) of today´s systems** that assist the driver or provide conditional automation to full self-driving capabilities**.**

○ Through extensive testing in adverse weather under real traffic scenarios the project will make **prototypes functional in real driving conditions**.

Source: Basemark

Night   Fog   Day   Rain   Snow

Night   Fog   Day   Rain   Snow
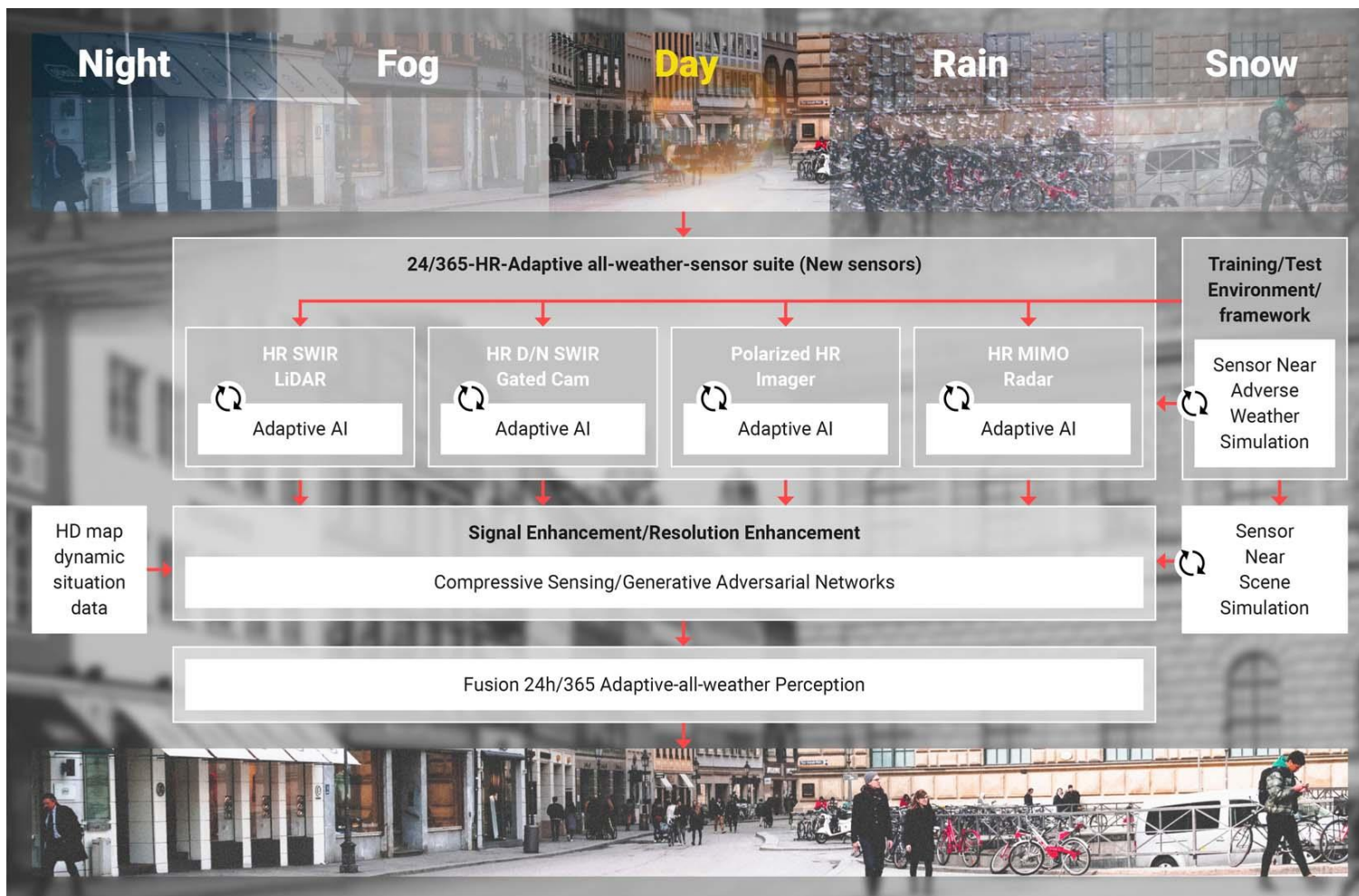
EXTEND THE **OPERATIONAL DESIGN DOMAIN (ODD) OF AUTOMATED VEHICLES** TO ALL WEATHER AND VISIBILITY CONDITIONS EXPERIENCED 365 DAYS OF THE YEAR

THE CONCEPT

- High resolution adaptive all-weather sensor suite with novel sensors

- AI platform for predictive detection of prevailing environmental conditions including signal enhancement and sensor adaptation

- Novel simulation path which allows to realistically simulate adverse weather near the sensor to adapt and test the system on both real and artificially generated road scenes

- High definition maps with dynamic layers adaptable to changing weather conditions

24 / 365 HIGH RESOLUTION ADAPTIVE ALL WEATHER SENSOR SUITE

The all-weather multi-sensor suite will include the development of:

○ **a gated SWIR-camera** that will enable a post-processing pixel-level depth estimation

○ **a short-wave infrared (SWIR) LiDAR** with a novel SPAD receiver architecture

○ **a PolCAM - active polarimetric imager** with congruent LiDAR data

○ **a high resolution 4D MIMO Radar prototype** with a dense point cloud

○ **a high definition dynamic map** to support environment perception

ALL WEATHER MULTI-SENSOR PERCEPTION SYSTEM
SUPPORTED BY AI

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Source: AstaZero

ALL WEATHER MULTI-SENSOR PERCEPTION SYSTEM
SUPPORTED BY AI

The AI platform will include the development of:

○ **Multisensory data fusion approach:** Deep Sparse Multi-Scale Convolutional Neural Networks

○ **Predictive detection** of prevailing environmental conditions and sensor adaptation

○ **Signal enhancement** via Generative Adversarial Networks (GAN)

○ **Sensor-near simulation models** of all active sensors

○ **Synthetic inclement weather datasets** for AI

AI-SEE will take up the results of the predecessor EU-funded project DENSE.

The environment perception system developed in DENSE will be improved to simulate sensor output under adverse weather and to adapt and test the system on artificial data.

Source: AstaZero

TESTING CAMPAIGNS & DATA COLLECTION

TESTING CAMPAIGNS

- **Testing campaigns** for sensor and perception validation in real traffic scenarios and in the partners' fog and rain chambers will be carried out.

- The **testing will ensure** that the prototypes will be functional in real driving conditions.

DATA COLLECTION

- **Sensor framework** mounted in the North: automatic data recording triggered by inclement weather.

- **Outdoors measurement** in series of test drives in Northern Europe.

THE IMPACT

SUSTAIN JOBS & FOSTER ECONOMIC GROWTH
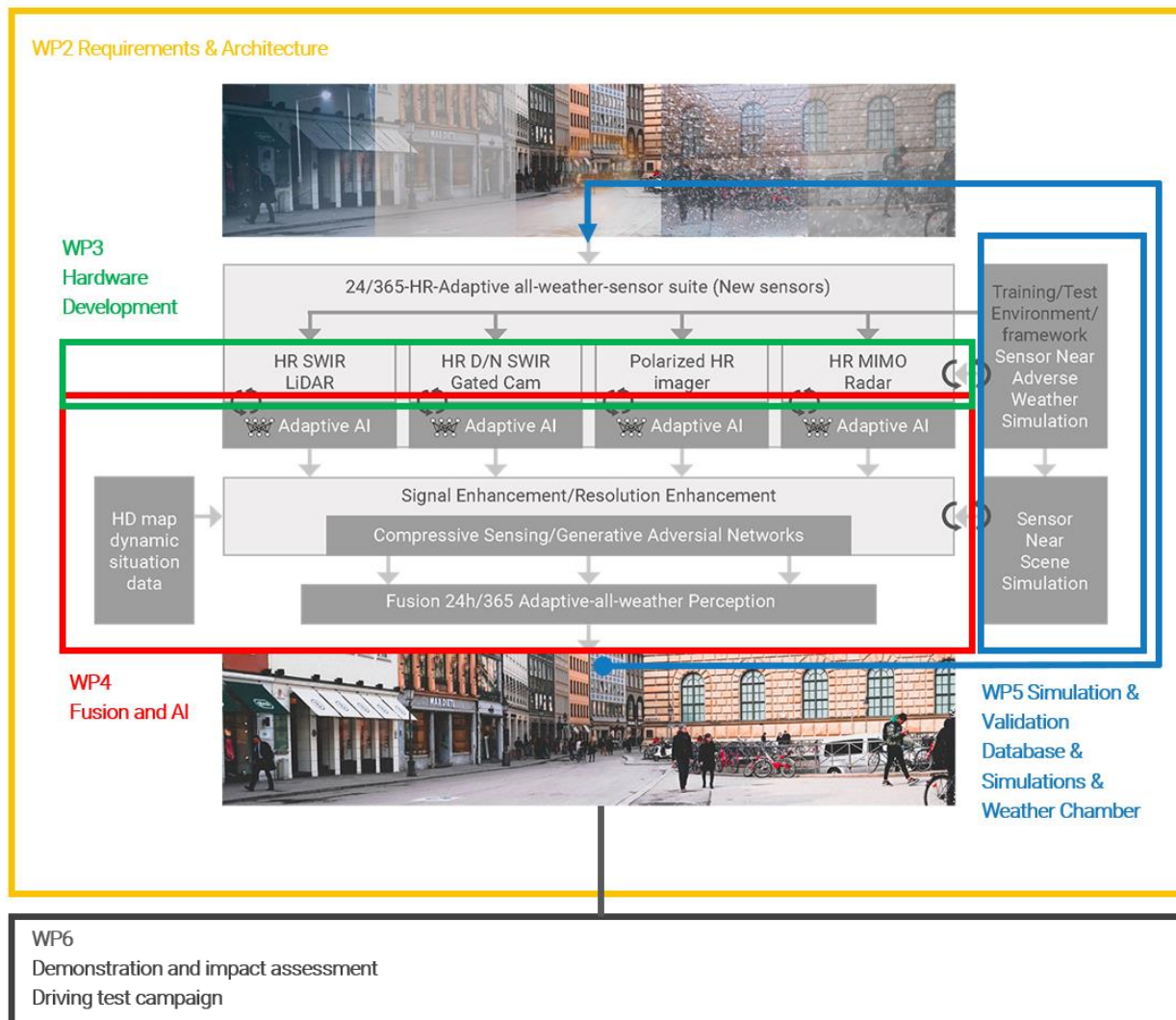
REDUCE HIGH COSTS FOR AI & LIDAR DATA

STRENGTHEN EUROPE'S LEAD IN AUTOMOTIVE

SHORTEN THE TIME TO MARKET

THE STRUCTURE

THE STRUCTURE

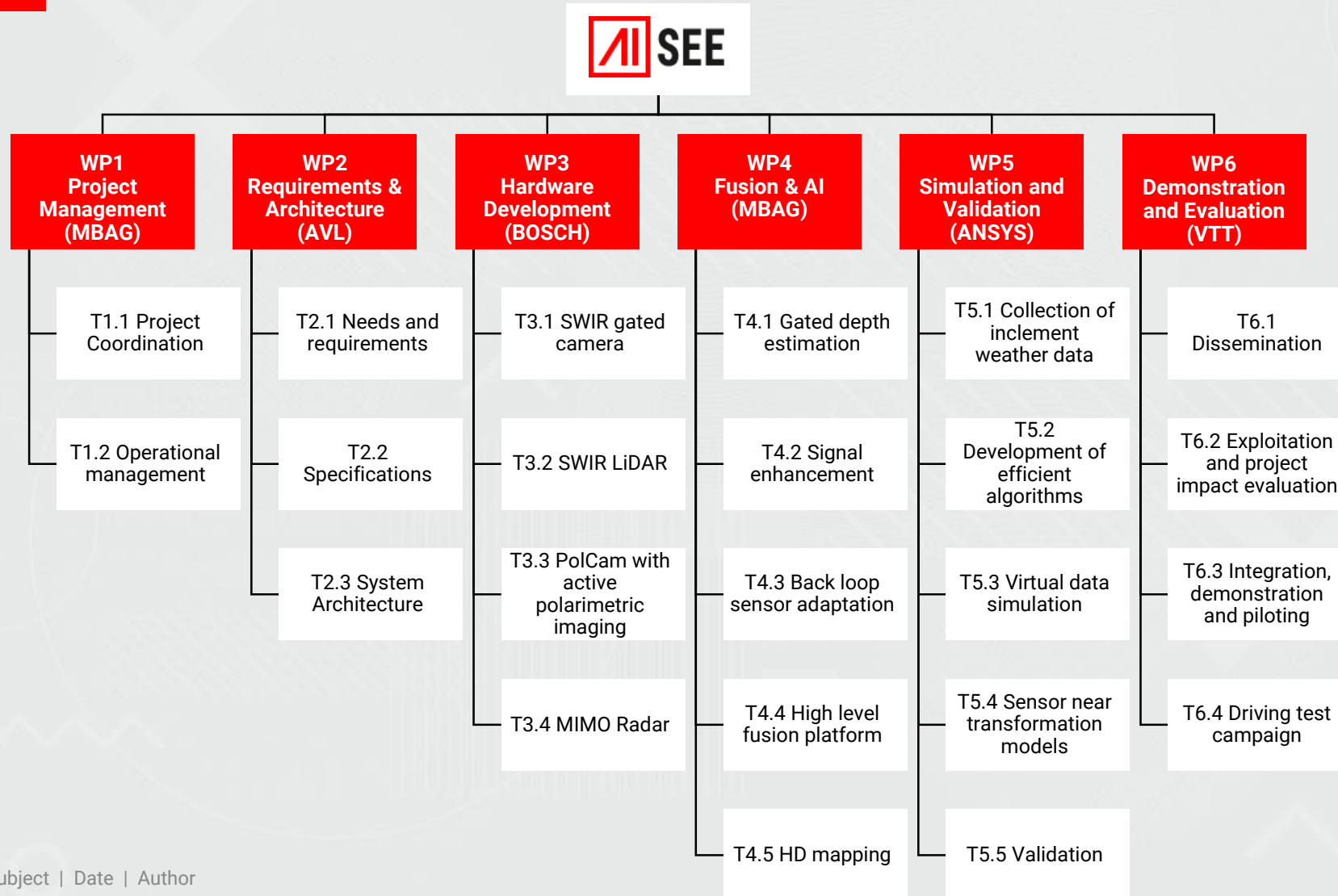**WP1- Project Management**

| WP2 Requirements & Architecture | WP3 Hardware Development | WP4 Fusion & AI | WP5 Simulation & Validation |

WP6 - Demonstration, Exploitation and Evaluation

THE STRUCTURE

AI SEE

WP1 Project Management (MBAG)
- T1.1 Project Coordination
- T1.2 Operational management

WP2 Requirements & Architecture (AVL)
- T2.1 Needs and requirements
- T2.2 Specifications
- T2.3 System Architecture

WP3 Hardware Development (BOSCH)
- T3.1 SWIR gated camera
- T3.2 SWIR LiDAR
- T3.3 PolCam with active polarimetric imaging
- T3.4 MIMO Radar

WP4 Fusion & AI (MBAG)
- T4.1 Gated depth estimation
- T4.2 Signal enhancement
- T4.3 Back loop sensor adaptation
- T4.4 High level fusion platform
- T4.5 HD mapping

WP5 Simulation and Validation (ANSYS)
- T5.1 Collection of inclement weather data
- T5.2 Development of efficient algorithms
- T5.3 Virtual data simulation
- T5.4 Sensor near transformation models
- T5.5 Validation

WP6 Demonstration and Evaluation (VTT)
- T6.1 Dissemination
- T6.2 Exploitation and project impact evaluation
- T6.3 Integration, demonstration and piloting
- T6.4 Driving test campaign

FACTS & NUMBERS

COORDINATOR

Dr. Werner Ritter
Mercedes Benz AG

20 PARTNERS

OEMs, Automotive Suppliers,
Research Institutes,
Engineering Companies

43 MONTHS RUNTIME

01.06.2021 - 31.12.2024

6 COUNTRIES

Austria, Canada, Finland,
Germany, Israel, Sweden

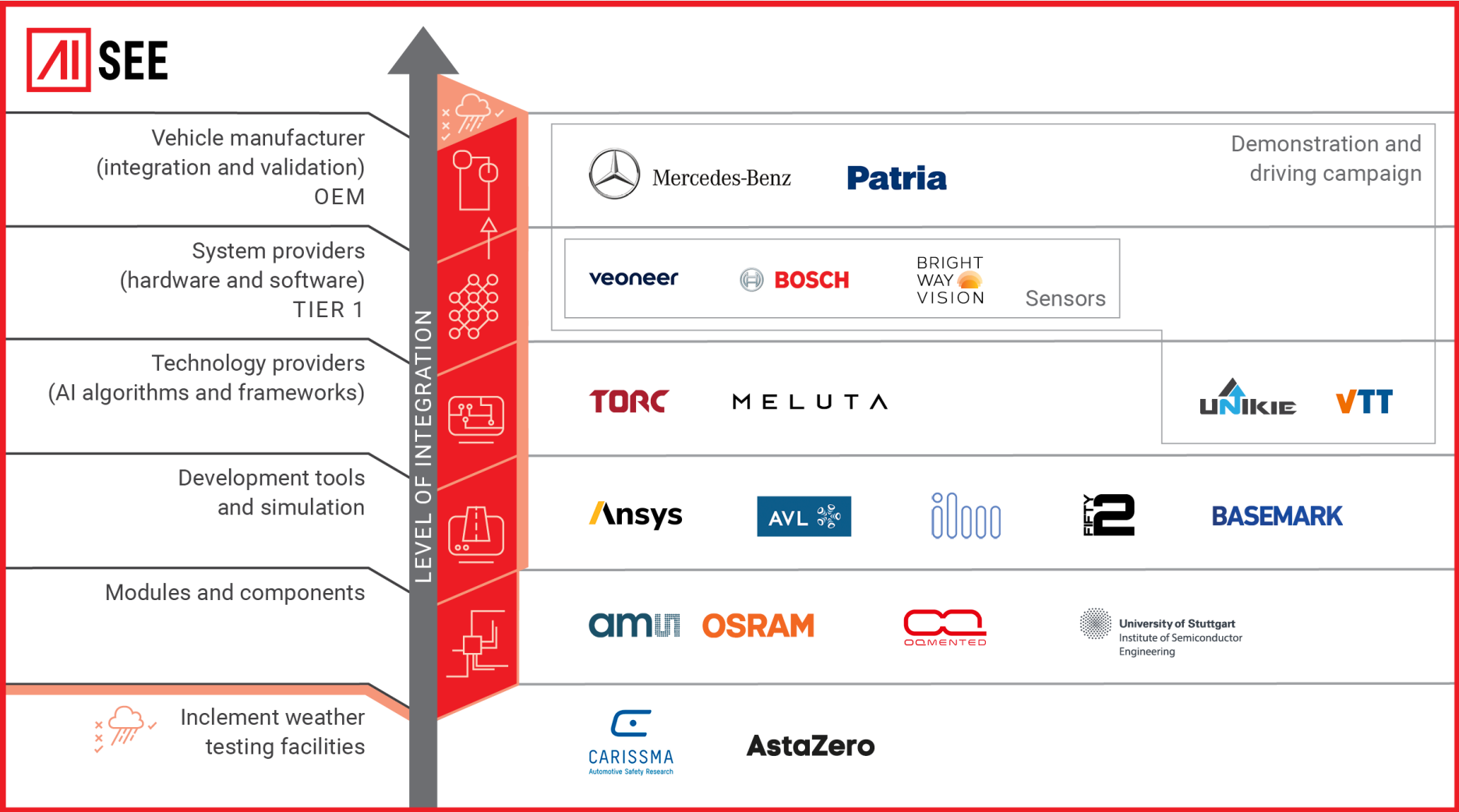### €20M

Total costs

€10M

Funding budget

CONSORTIUM OVERVIEW

OEMs

Mercedes-Benz · Patria

SYSTEM PROVIDERS (HARDWARE & SOFTWARE)

BOSCH · BRIGHT WAY VISION · veoneer

TECHNOLOGY PROVIDERS

TORC · MELUTA · UNIKIE · VTT

DEVELOPMENT TOOLS & SIMULATION

Ansys · AVL · iOOOO · FIFTY2 · BASEMARK

MODULES & COMPONENTS

ams OSRAM · OQMENTED · University of Stuttgart Institute of Semiconductor Engineering

INCLEMENT WEATHER TESTING FACILITIES

CARISSMA Automotive Safety Research · AstaZero

CONTACT US

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THANK YOU VERY MUCH

FOR YOUR ATTENTION!