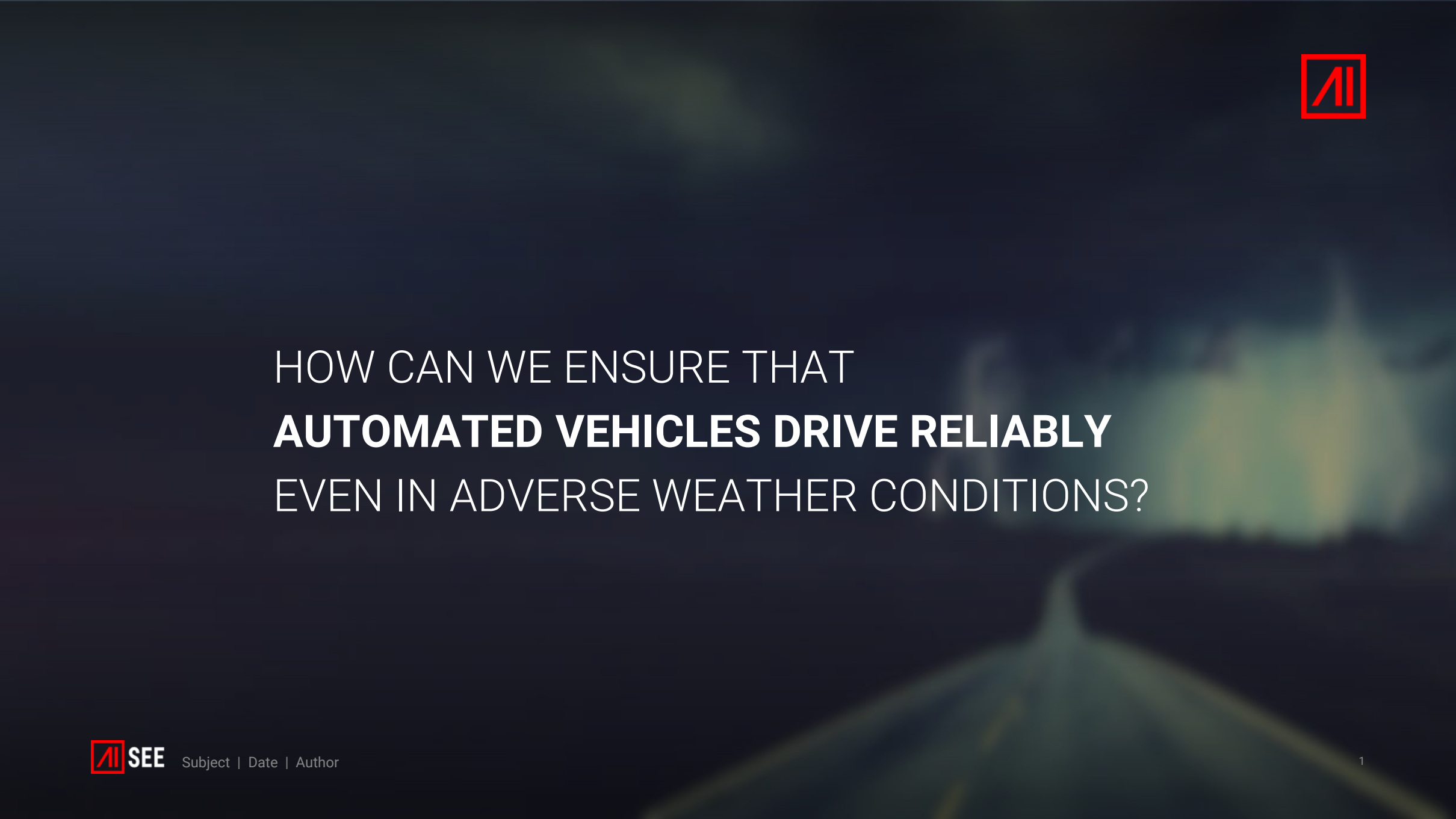
ARTIFICIAL INTELLIGENCE ENHANCING VEHICLE VISION IN **LOW VISIBILITY CONDITIONS**

Add your company name here
Add your name here

STATUS: 05.04.2022


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

THE GOAL

THE GOAL

- 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**

THE CHALLENGE

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

THE INNOVATION

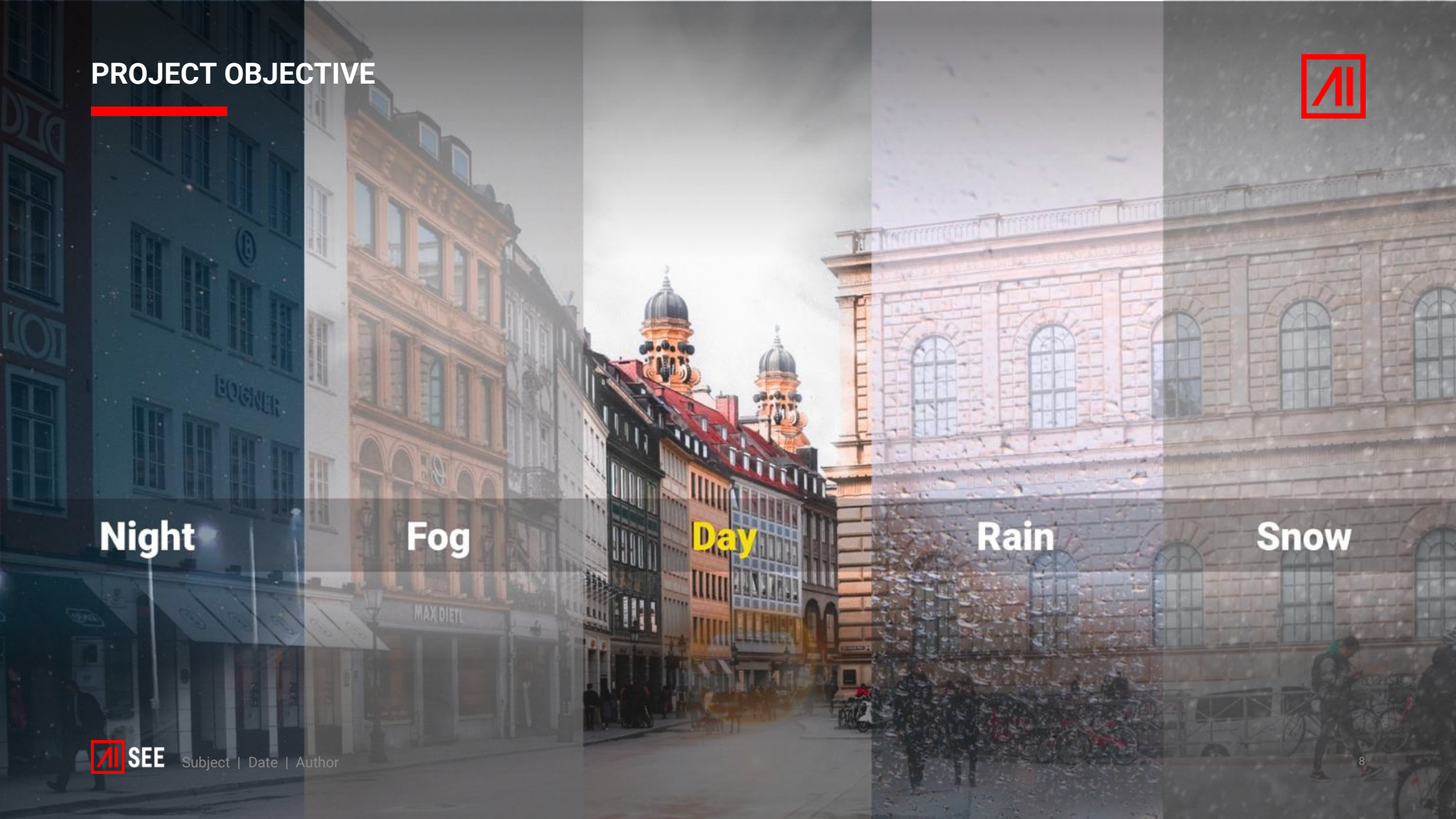
Source: Basemark

THE INNOVATION

- 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

PROJECT OBJECTIVE



PROJECT OBJECTIVE

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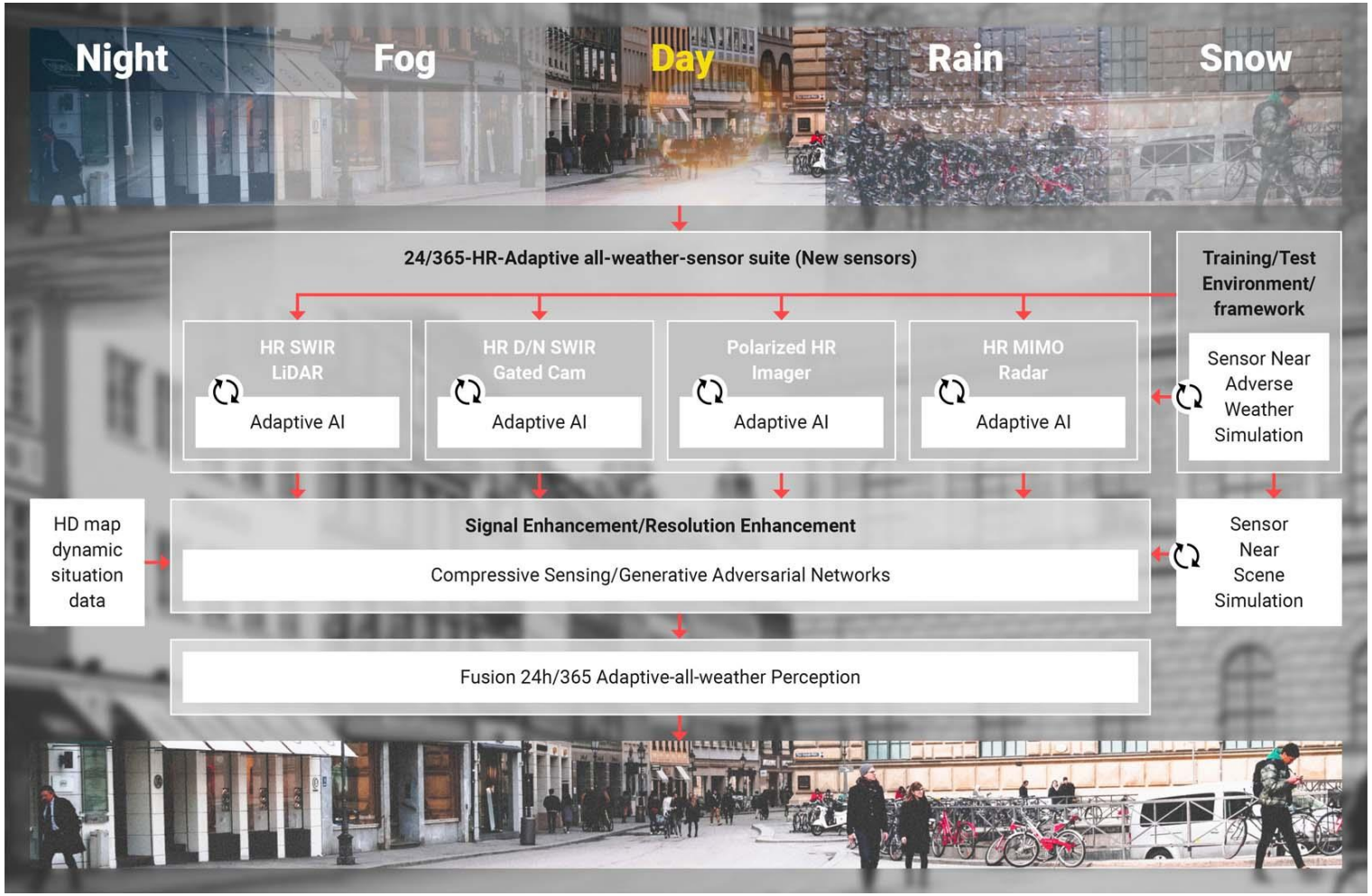
EXTEND THE **OPERATIONAL DESIGN DOMAIN (ODD) OF AUTOMATED VEHICLES** TO ALL WEATHER AND VISIBILITY CONDITIONS EXPERIENCED 365 DAYS OF THE YEAR

THE CONCEPT


Night
Fog
Day
Rain
Snow
24/365-HR-Adaptive all-weather-sensor suite (New sensors)
HR SWIR LiDAR
Adaptive AI
HR D/N SWIR Gated Cam
Adaptive AI
Polarized HR Imager
Adaptive AI
HR MIMO Radar
Adaptive AI
Training/Test Environment/ framework
Sensor Near Adverse Weather Simulation
HD map dynamic situation data
Signal Enhancement/Resolution Enhancement
Compressive Sensing/Generative Adversarial Networks
Sensor Near Scene Simulation
Fusion 24h/365 Adaptive-all-weather Perception

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

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

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

FROM **DENSE** TO AI-SEE

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.

TESTING CAMPAIGNS & DATA COLLECTION

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.

Source: AstaZero

THE IMPACT

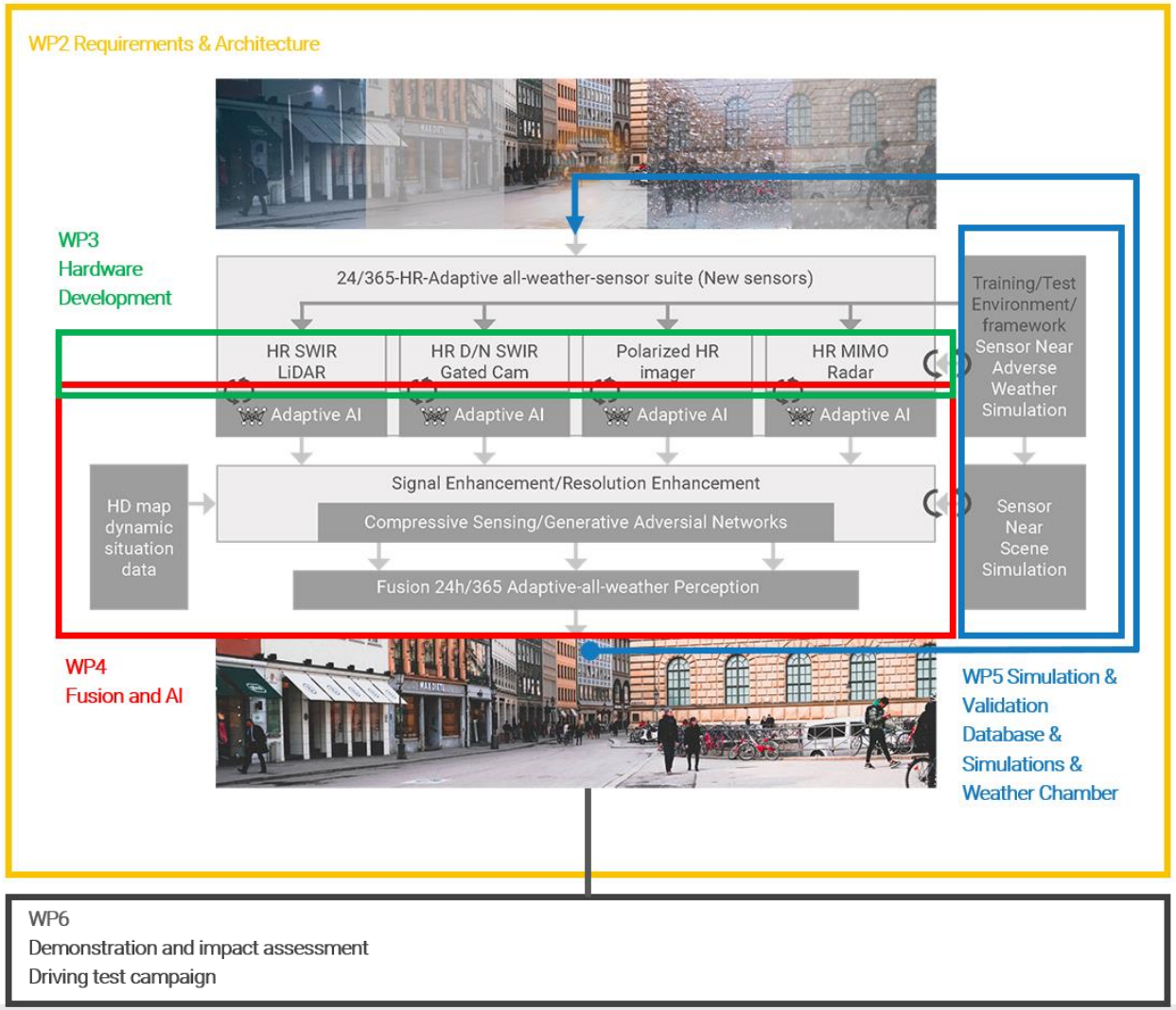
SUSTAIN JOBS & FOSTER ECONOMIC GROWTH

REDUCE HIGH COSTS FOR AI & LIDAR DATA

STRENGTHEN EUROPE'S LEAD IN AUTOMOTIVE

SHORTEN THE TIME TO MARKET

THE STRUCTURE



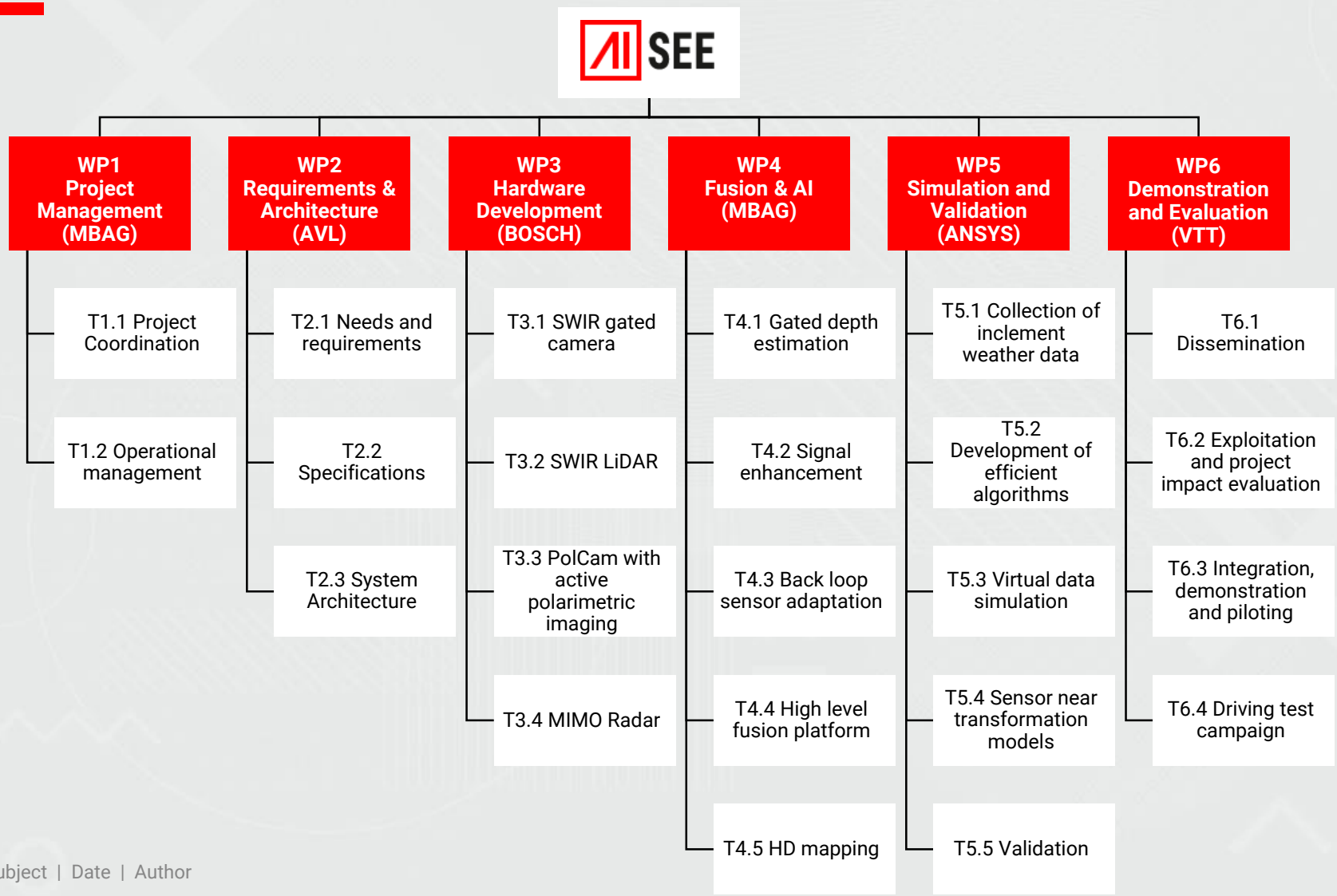
THE STRUCTURE

WP1 - Project Management

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

WP6 - Demonstration, Exploitation and Evaluation

THE STRUCTURE



FACTS & NUMBERS

COORDINATOR

Dr. Werner Ritter
Mercedes Benz AG

21 PARTNERS

OEMs, Automotive Suppliers, Research Institutes, Engineering Companies

36 MONTHS RUNTIME

01.06.2021- 01.06.2024

6 COUNTRIES

Austria, Canada, Finland, Germany, Israel, Sweden

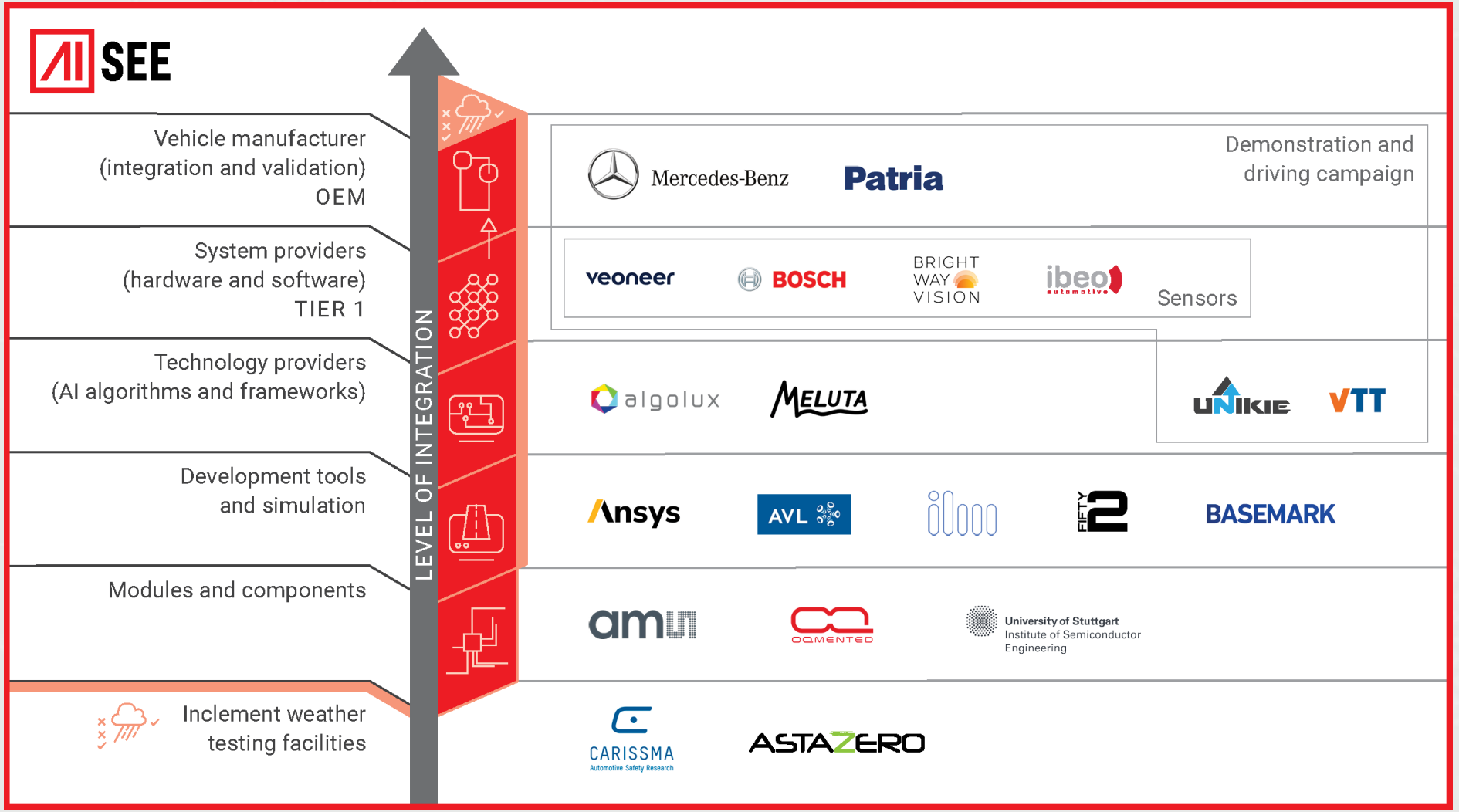
€20,70M

Total costs

€10,21M

Funding budget

CONSORTIUM OVERVIEW



CONSORTIUM OVERVIEW

OEMs

Mercedes-Benz

Patria

SYSTEM PROVIDERS (HARDWARE & SOFTWARE)

BOSCH

BRIGHT WAY VISION

ibeo automotive

veoneer

TECHNOLOGY PROVIDERS

algolux

MELUTA

UNIKIE

VTT

DEVELOPMENT TOOLS & SIMULATION

Ansys

AVL

iMAGE

FIFTY2

BASEMARK

MODULES & COMPONENTS

ams OSRAM

OQMENTED

University of Stuttgart
Institute of Semiconductor Engineering

INCLEMENT WEATHER TESTING FACILITIES

CARISSMA

ASTAZERO

CONTACT US

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FUNDING:

THANK YOU VERY MUCH

FOR YOUR ATTENTION!