



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

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STATUS: 13.12.2021





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

# THE GOAL

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# THE GOAL

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- 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



# THE CHALLENGE

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- 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.

# THE INNOVATION

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SAFETY FIRST

# THE INNOVATION

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- 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.**



# PROJECT OBJECTIVE

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Night

Fog

Day

Rain

Snow

# PROJECT OBJECTIVE

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Night

Fog

Day

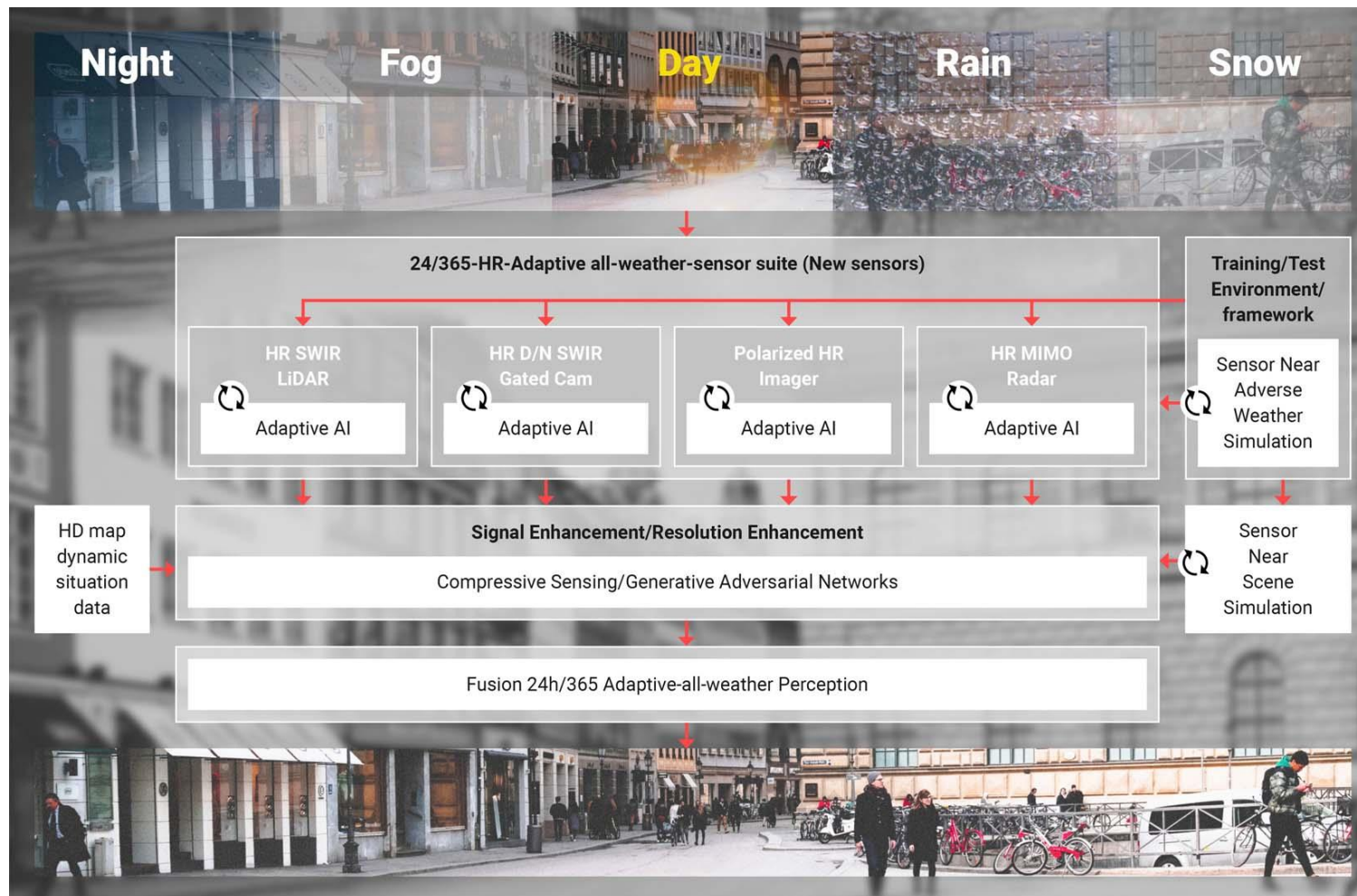
Rain

Snow



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

# THE CONCEPT



# THE CONCEPT

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- 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

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# 24/365 HIGH RESOLUTION ADAPTIVE ALL WEATHER SENSOR SUITE

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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





# ALL WEATHER MULTI-SENSOR PERCEPTION SYSTEM SUPPORTED BY AI

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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.

# 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

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**SUSTAIN JOBS &  
FOSTER ECONOMIC  
GROWTH**



**REDUCE HIGH  
COSTS FOR AI &  
LIDAR DATA**



**STRENGTHEN  
EUROPE'S LEAD IN  
AUTOMOTIVE**



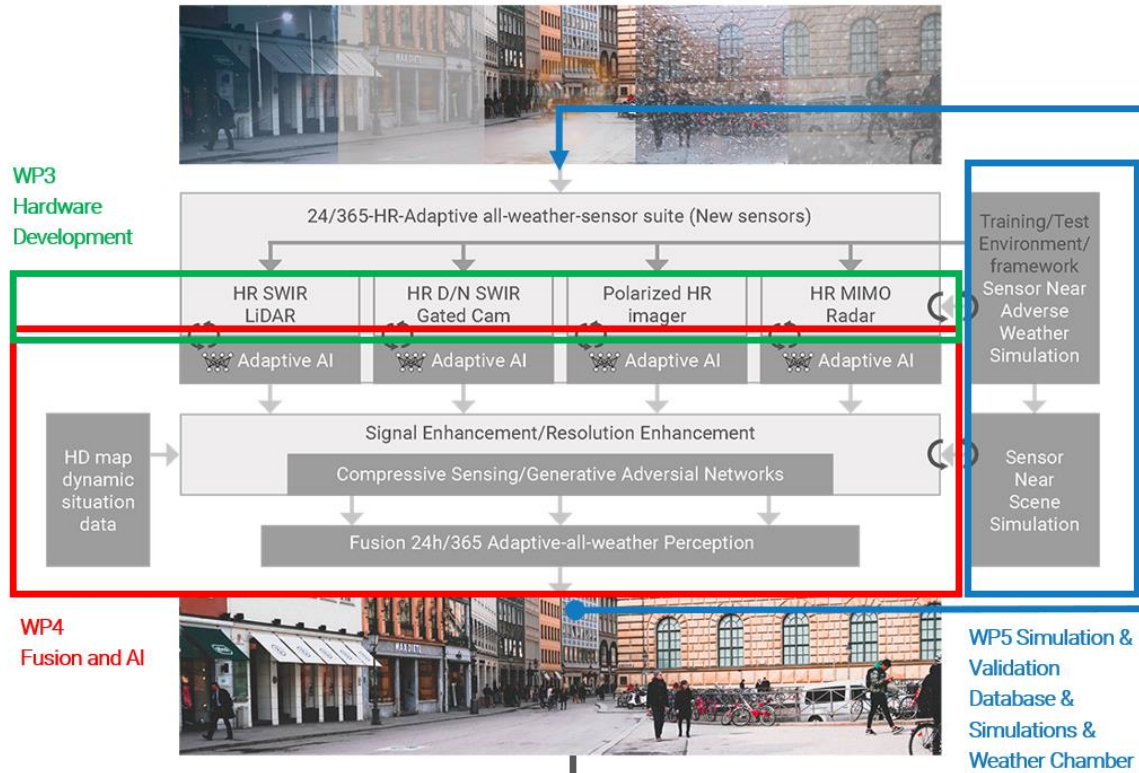
**SHORTEN THE  
TIME TO MARKET**



# THE STRUCTURE



## WP2 Requirements & Architecture





## WP1 - Project Management

WP2  
Requirements &  
Architecture

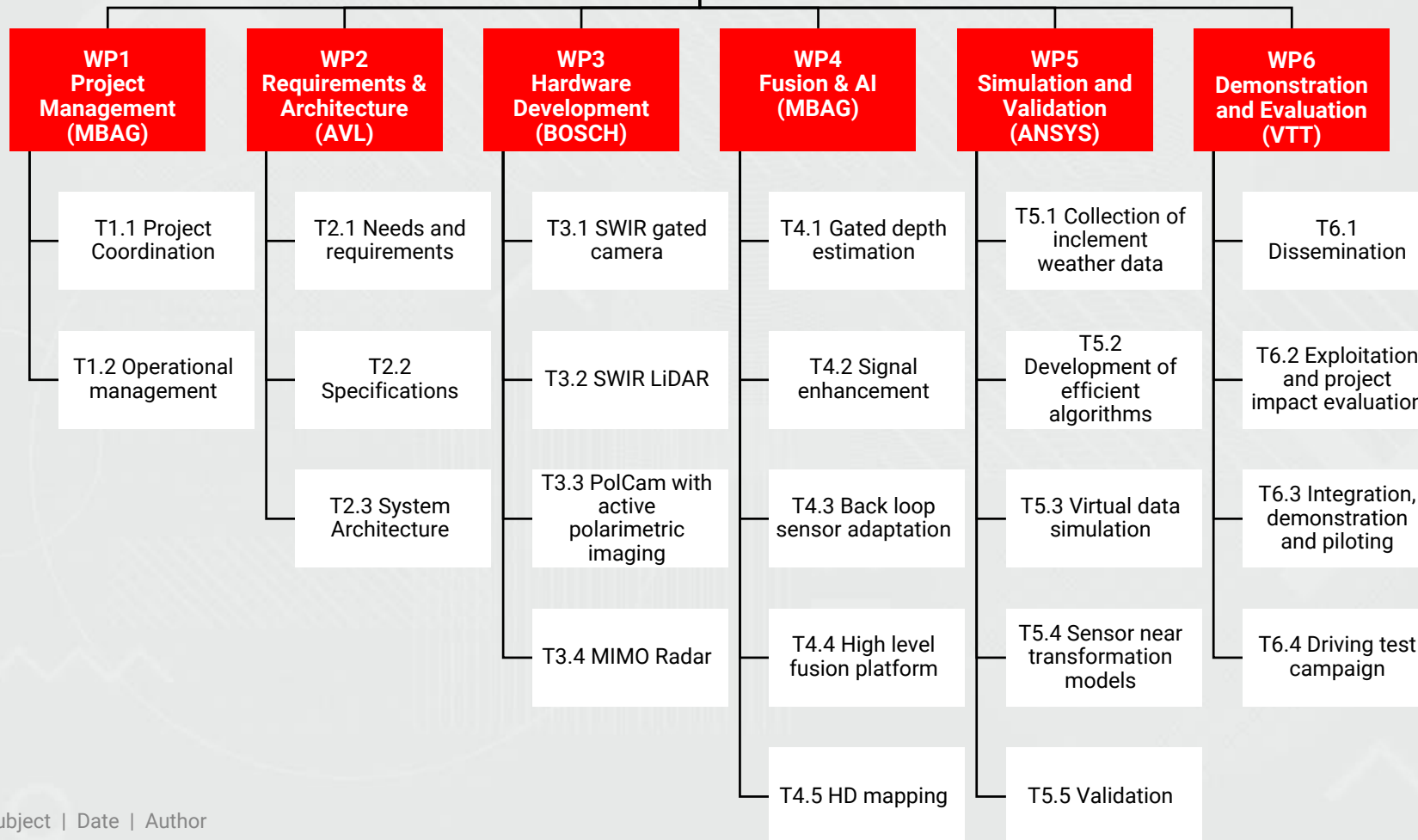
WP3  
Hardware  
Development

WP4  
Fusion  
& AI

WP5  
Simulation &  
Validation

WP6 - Demonstration, Exploitation and Evaluation

# THE STRUCTURE





# FACTS & NUMBERS

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## 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



**€21,81M**

Total costs



**€9,75M**

Funding budget

# CONSORTIUM OVERVIEW



# CONSORTIUM OVERVIEW



## OEMs



## SYSTEM PROVIDERS (HARDWARE & SOFTWARE)



## TECHNOLOGY PROVIDERS



## DEVELOPMENT TOOLS & SIMULATION



## MODULES & COMPONENTS



## INCLEMENT WEATHER TESTING FACILITIES





## MORE INFORMATION ABOUT THE PROJECT:

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## FUNDING:





**THANK YOU VERY MUCH**  
FOR YOUR ATTENTION!