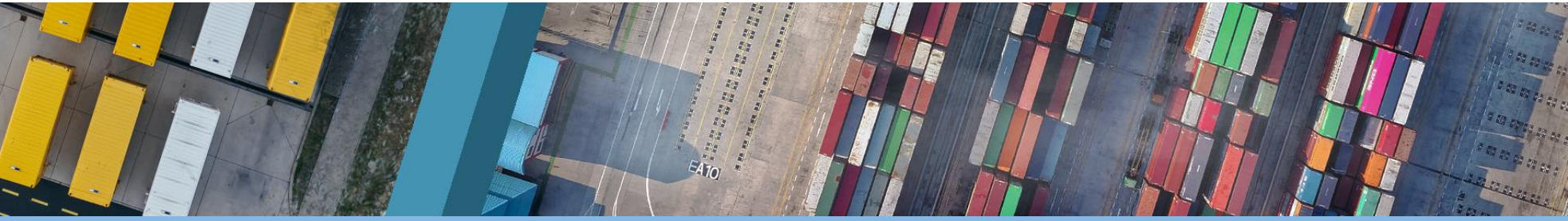
SIA VISION 2022 Congress

AWARD

Scaling autonomous logistics



AWARD has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No 10 1006817

USE AND DEVELOPMENT OF THE PAVIN FOG AND RAIN PLATFORM IN THE FRAMEWORK OF THE H2020 AWARD PROJECT

DUTHON PIERRE
Cerema
pierre.duthon@cerema.fr

AWARD has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No 101006817

With the support of

USE AND DEVELOPMENT OF THE PAVIN FOG AND RAIN PLATFORM IN THE FRAMEWORK OF THE H2020 AWARD PROJECT

DUTHON PIERRE, CEREMA
adweather@cerema.fr

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Introduction and context

- A world with autonomous vehicles?
  - Science-fiction to near future
- Regulation was proposed for level 3 automated driving systems
- Advanced scenarios but rarely in adverse weather
- Importance of tests in controlled environment
- Different levels of integration and realism
  - Numerical modeling
  - Virtual reality simulation
- Test bench are essential because numerical simulators:
  - must be validated under real controlled conditions
  - In order to operate, require data that is difficult to collect

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Summary

- The PAVIN Fog and Rain platform : capabilities and applications
- AWARD European project: an example of application
- The future of the platform

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

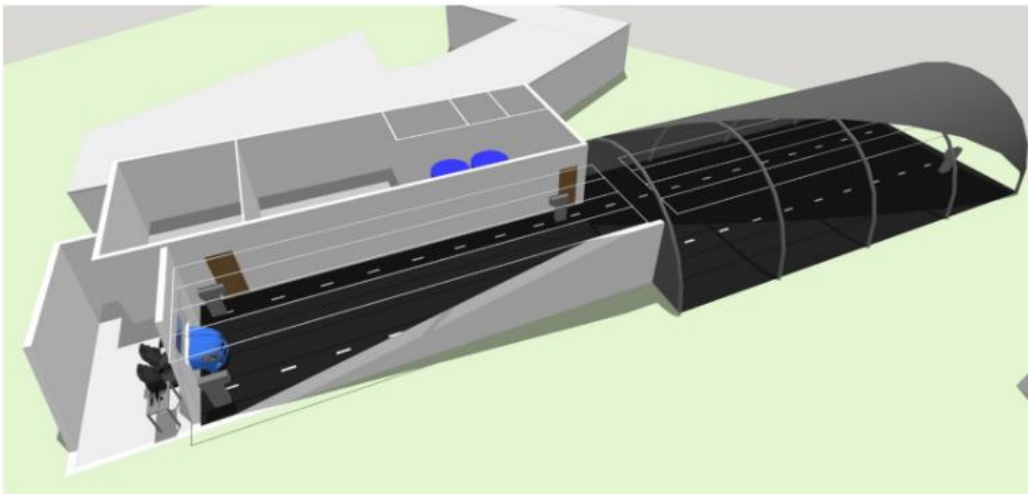
Introduction and context

- What is Cerema?
  - French Public Agency

RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité

Cerema
CLIMATE & REGIONS, THE FUTURE

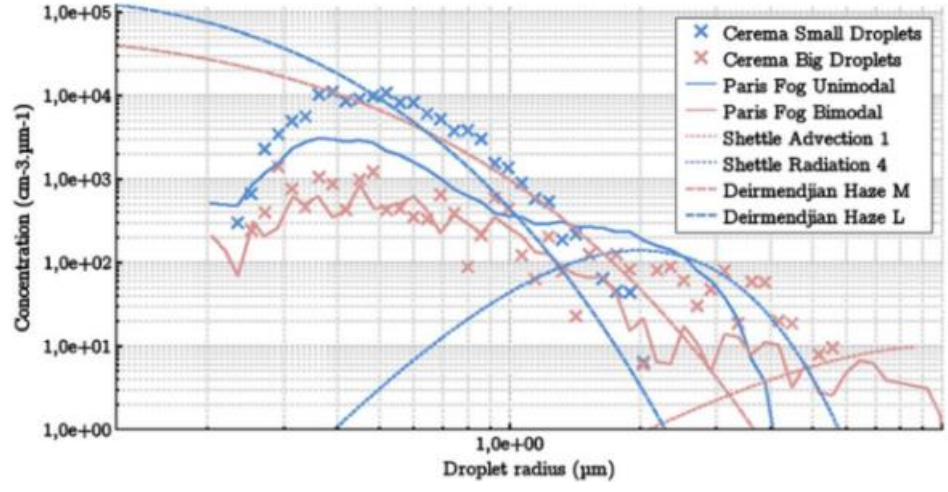
- What is the PAVIN fog & rain platform
  - Tech bench for ADAS or AV



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Fog and rain features

- Fog generation with controlled density
  - Regulation between 10m to 100m (+/- 10%)
- Rain generation with controlled intensity
  - 16 mm/h to 165 mm/h
- Realistic Droplet Size Distribution
  - Rain
  - Two kinds of fog (continental or maritime)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Main applications of the PAVIN platform

- From 2010: Research on computer vision became predominant
  - Rise of ITS and the AV development)

3 main areas of use of the PAVIN platform

Measurement of weather conditions by camera (AI)	Numerical simulation of meteorological phenomena	Measurement of the impact of adverse weather conditions on vehicle perception systems

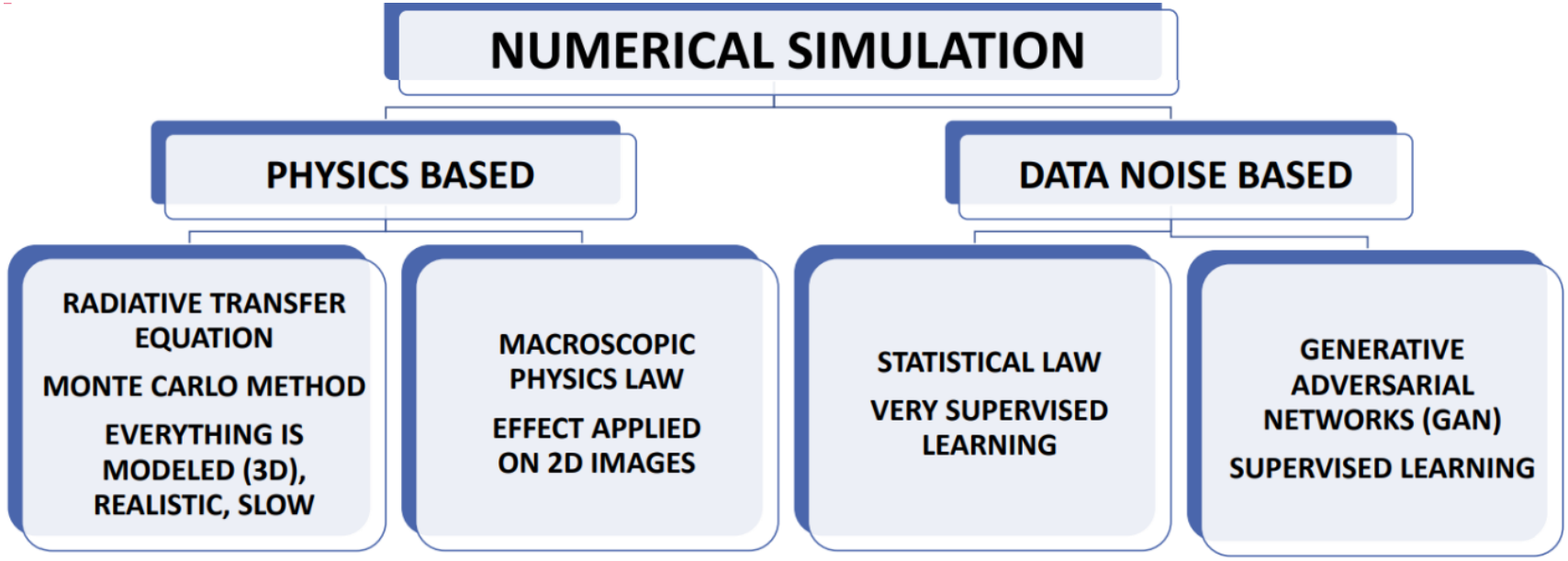
This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Measurement of weather conditions by camera (AI)

- First: Impact on image features
  - Rainfall intensity has proportional effect on common image features
- Then: use of Deep Convolutional Neural Networks (DCNN)
  - Single view, 90% success with WeatherEye solution
- No possible generalization if the point of view is changed
- Now: generalization possible with multi sites
  - First learning in artificial physical conditions within the PAVIN platform
  - Transfer and fine-tuning on images that are acquired on a different real site

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Numerical simulation of adverse weather



Cerema research team is working on these topics which are complementary

All the model has to be validated with physical data, natural or simulated

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Impact of adverse weather on vehicle perception systems

- Examples in the european project AWARD (2021-2024)
  - Easymile: Comparison of different Lidar technologies
    - Spinning, Risley prisms, micro-motion and MEMS
- Foresight Automotive: Test of its Quadsight vision system
  - 3D object detection (pedestrians and vehicles)
- Adasky: Test of thermal cameras
  - Performance of thermal cameras

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

AWARD project

- This work is part of the AWARD* project:
  - 3-year innovation action.
  - Consortium of 29 partners.
  - Scaling the autonomous logistics operation.
  - Safety consideration.
  - 24/7 availability, including harsh weather conditions.
  - 4 use cases.


Warehouse


Port


Airport


Hub to hub

AWARD
Scaling autonomous logistics

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Zoom on Foresight Automotive work

- Objective : To test the Foresight's QuadSight vision system in foggy and rainy conditions, using the PAVIN platform.

- The novelty of this work is to present results of 3D object detection:

  - on a commercialized system,
  - using visible light and thermal wavelengths,
  - in controlled fog and rain conditions.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

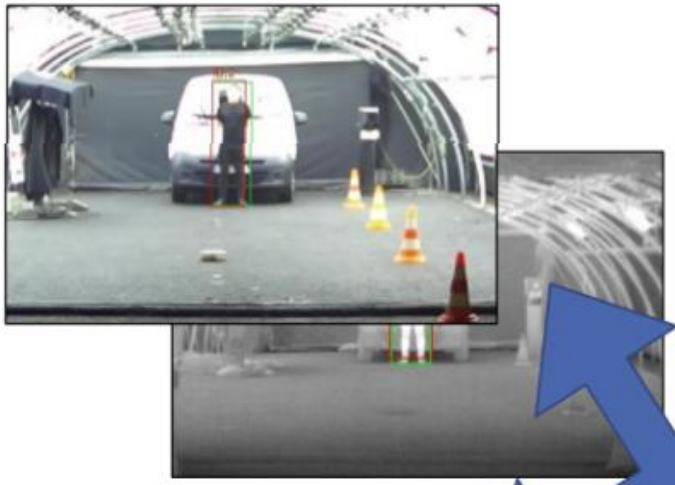
Quadsight® Vision System

FORESIGHT

- Automotive-grade, cost-effective solution.
- 2 pairs of stereoscopic vision channels: a visible light stereo channel in conjunction with a thermal stereo channel.
- 3D video analysis and advanced image processing algorithms.

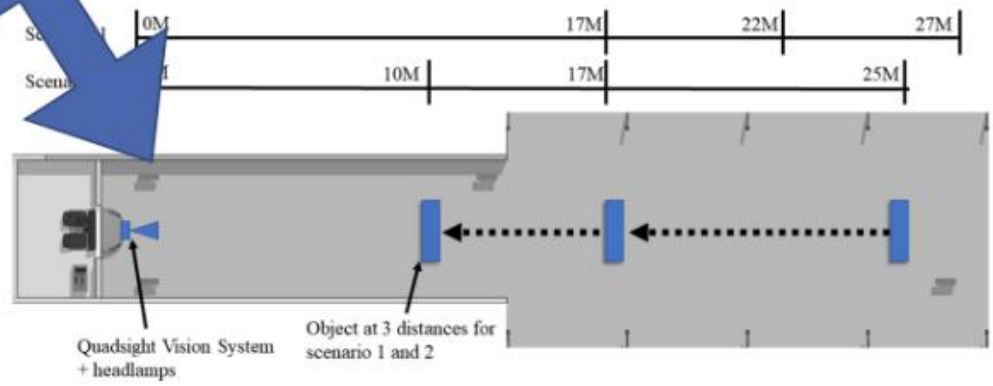
This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Protocol



Precision and Recall measurement

$$P = \frac{TP}{TP + FP} \qquad R = \frac{TP}{TP + FN}$$



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Object detection results summary: Car

		Visible	Infrared
Day	Clear	+++	+++
	Fog	++	++
	Rain	+++	+++
Night	Clear	+++	+++
	Fog	+	++
	Rain	+++	+++

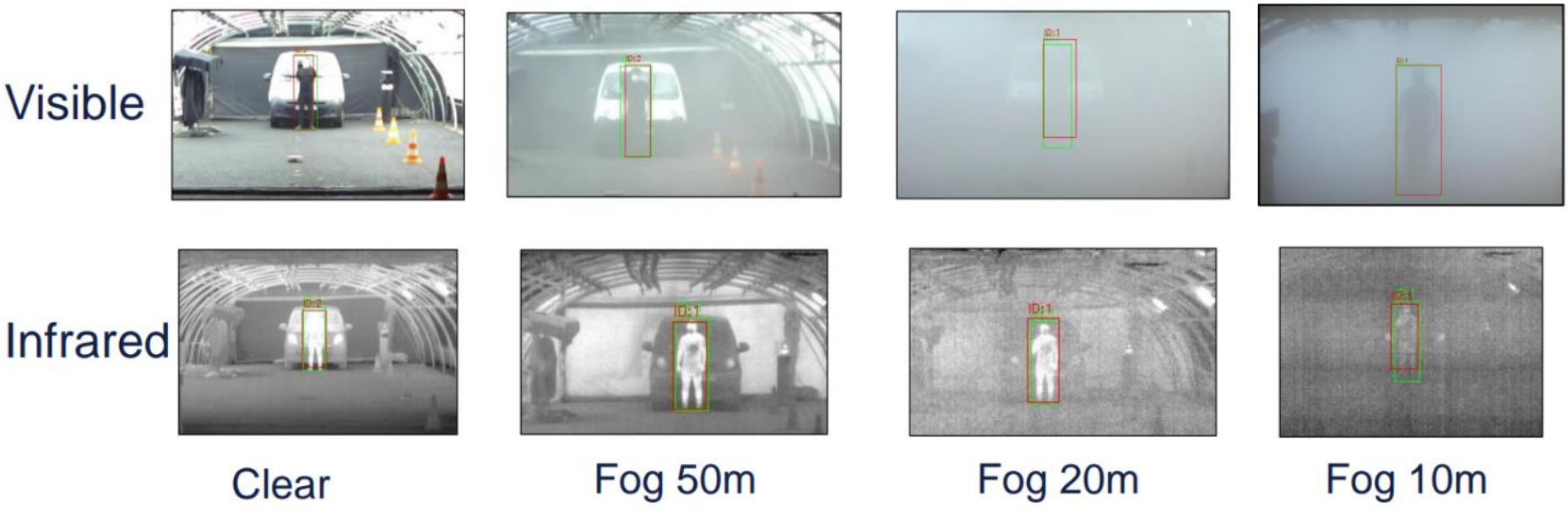
This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Object detection results summary : Pedestrian

		Visible	Infrared
Day	Clear	+++	+++
	Fog	++	+++
	Rain	+++	+++
Night	Clear	+++	+++
	Fog	+	+++
	Rain	+++	+++

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Some example of images



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

A brand-new platform…

4 main evolutions

- Dimensions
  - 50 meters length
  - 7 meters width
  - 6 meters high

- Temperature stability
  - In space and time
  - Isolation and ventilation

- Illumination conditions
  - Great homogeneity
  - Artificial and natural

- Environmental exemplarity
  - Water reuse
  - Biobased materials
  - Few energy consumption

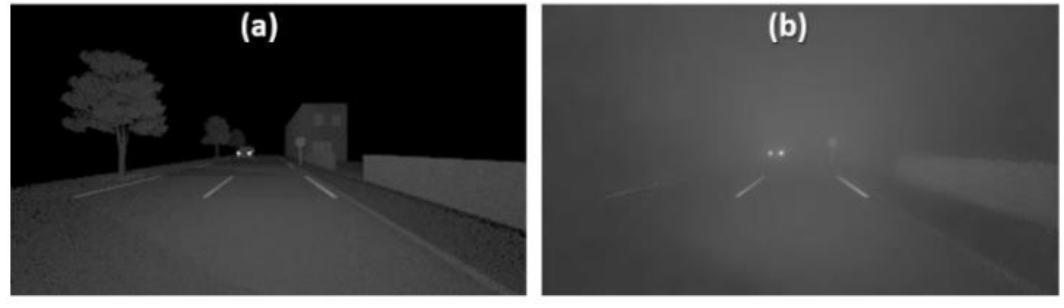
…coming up in 2024

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

New capabilities

- Dynamic tests
  - Slow speed, up to 50km/h

- Numerical twin
  - In the continuity of adverse weather simulation work
  - Calibrated numerical model of the platform



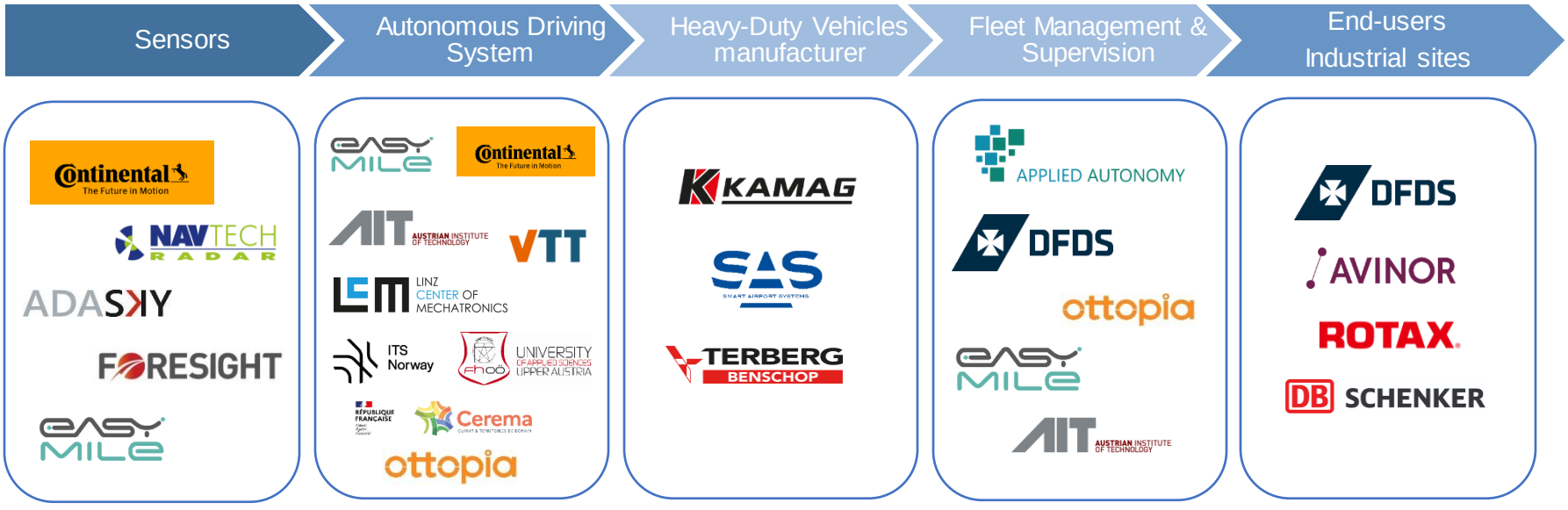
This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Conclusions

- The Cerema PAVIN fog & rain platform
  - 40 years of evolution
  - Controlled conditions of adverse weather
- Involved in many major research and development projects
  - Impact on vehicle perception systems
  - Weather measurement by camera
  - Numerical simulations
- Worldwide presence
  - About 50 different sensors
  - About 15 countries in the world
- New upcoming possibilities
  - New platform
  - Digital twin

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Complementary-skilled Consortium



From multiple horizons

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

Support us !

AWARD has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No 101006817

Let's keep in touch!

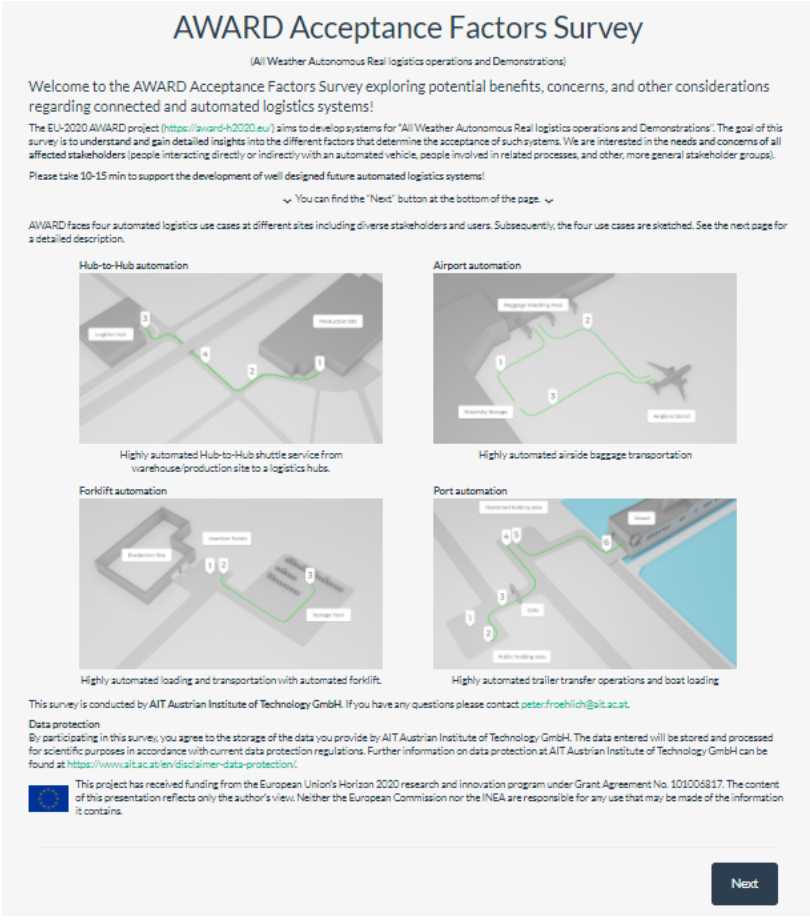
SCAN ME

LinkedIn

SCAN ME

Twitter

Participate to our Acceptance Factors survey!



AWARD Acceptance Factors Survey

(All Weather Autonomous Real logistics operations and Demonstrations)

Welcome to the AWARD Acceptance Factors Survey exploring potential benefits, concerns, and other considerations regarding connected and automated logistics systems!

The EU-2020 AWARD project (https://award-h2020.eu/) aims to develop systems for "All Weather Autonomous Real logistics operations and Demonstrations". The goal of this survey is to understand and gain detailed insights into the different factors that determine the acceptance of such systems. We are interested in the needs and concerns of all affected stakeholders (people interacting directly or indirectly with an automated vehicle, people involved in related processes, and other, more general stakeholder groups).

Please take 10-15 min to support the development of well designed future automated logistics systems!

You can find the "Next" button at the bottom of the page.

AWARD faces four automated logistics use cases at different sites including diverse stakeholders and users. Subsequently, the four use cases are sketched. See the next page for a detailed description.

Hub-to-Hub automation

Highly automated Hub-to-Hub shuttle service from warehouse/production site to a logistics hubs.

Airport automation

Highly automated airside baggage transportation

Forklift automation

Highly automated loading and transportation with automated forklift.

Port automation

Highly automated trailer transfer operations and boat loading

This survey is conducted by AIT Austrian Institute of Technology GmbH. If you have any questions please contact peter.froehlich@ait.ac.at.

Data protection

By participating in this survey, you agree to the storage of the data you provide by AIT Austrian Institute of Technology GmbH. The data entered will be stored and processed for scientific purposes in accordance with current data protection regulations. Further information on data protection at AIT Austrian Institute of Technology GmbH can be found at https://www.ait.ac.at/en/disclaimer-data-protection/.

This project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA are responsible for any use that may be made of the information it contains.

Next

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.

19-20/11/2022

Thank you!

DUTHON PIERRE

AWARD has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No 101006817

AWARD

Scaling autonomous logistics

@award_h2020

AWARD-H2020

www.award-h2020.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 101006817. The content of this presentation reflects only the author's view. Neither the European Commission nor the INEA is responsible for any use that may be made of the information it contains.