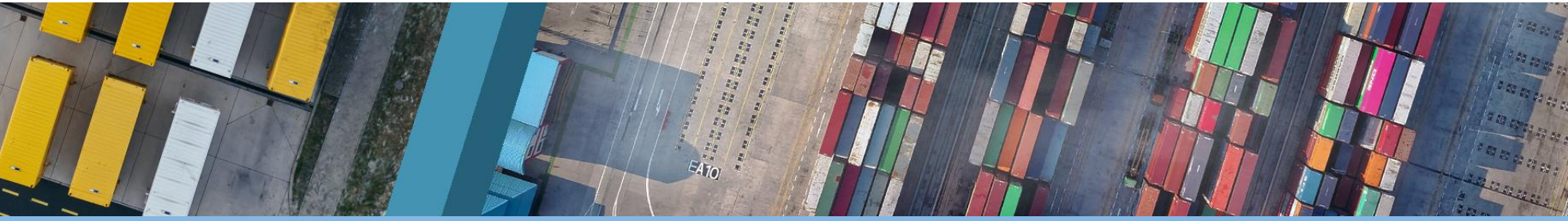
ITS WORLD CONGRESS 2022

AWARD

Scaling autonomous logistics



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A review of the Cerema PAVIN fog & rain platform: from past and back to the future

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LOS ANGELES
ITS WORLD CONGRESS 2022

A review of the Cerema PAVIN fog & rain platform: from past and back to the future

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Cerema
CLIMATE & REGIONS, THE FUTURE

AWARD
Scaling autonomous logistics

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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 evaluation
  - Test track evaluation
- 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

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Introduction and context

Review of research work in the Cerema PAVIN fog & rain platform

- What is Cerema?
  - French Public Agency

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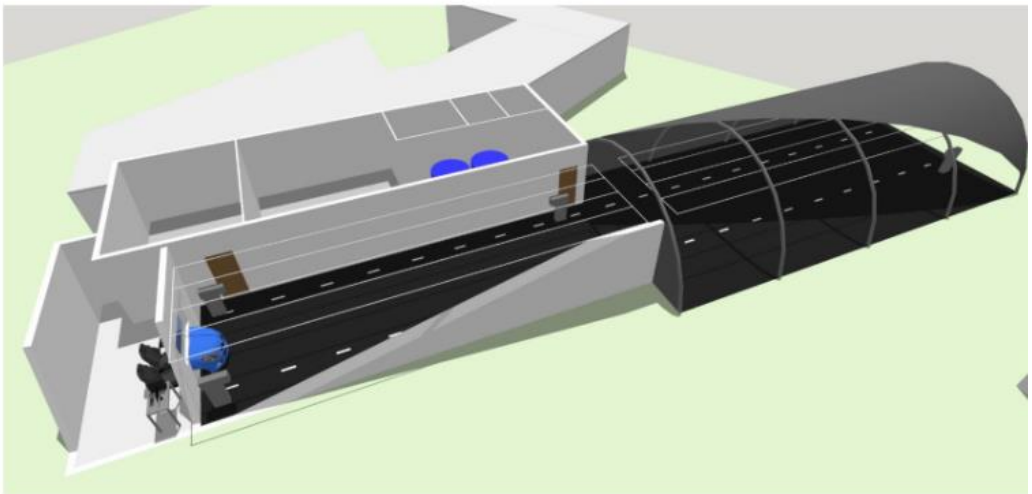
- What is the PAVIN fog & rain platform
  - Tech bench for ADAS or AV



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Summary

- Introduction & context
- Origin of the PAVIN platform, the fog production
- Addition of rain production
- Today’s use of the platform
- The future

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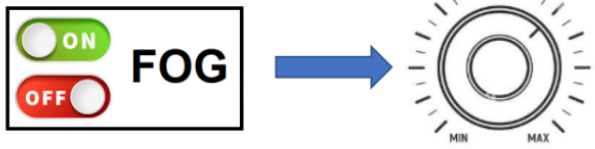
Origin of the PAVIN platform, the fog production

- 80's
  - Tragic accidents in France
  - Construction of the PAVIN platform in 1983
  - Initially only fog production



- 90's
  - Intensive development of the fog system
  - Droplet Size Distribution qualification

Particle Size Analyzer (PSA)

Transmissiometer

- 00's
  - Complete review of the system
  - Two kinds of fog reproducible (Droplet Size Distribution)
  - Active regulation to maintain a specific fog density (10 meters to 100 meters, +/- 10%)

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Add of rain production

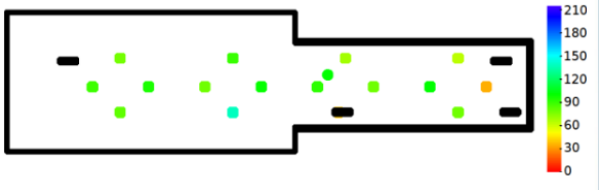
- 2007-2009
  - First system, 30 to 55 mm/h
  - Research oriented towards human perception
  - Examples: windshield aspersion, wiper system

- 2016-2019
  - H2020 DENSE project, new system, 16 to 165 mm/h
  - Better representativeness + homogeneity

Disdrometer

Bucket rain gauge

- From 2015
  - Impact of rain conditions on the camera



We will talk about that later…

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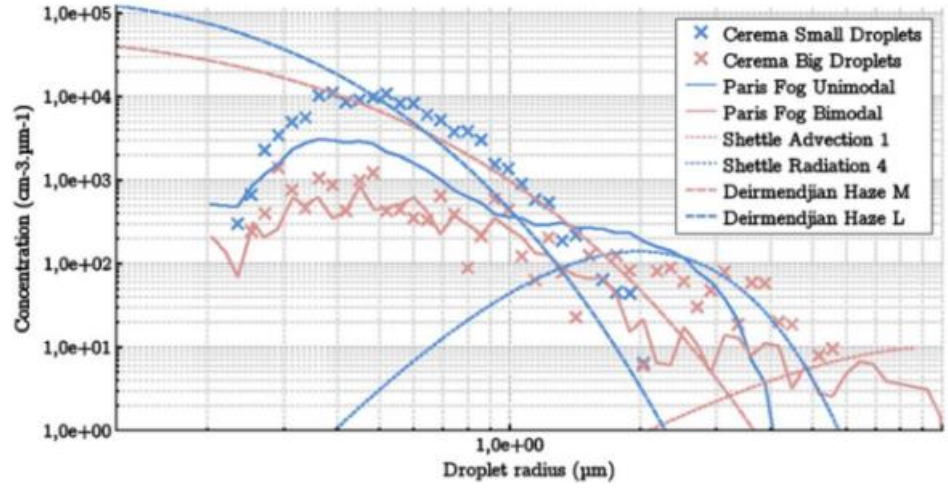
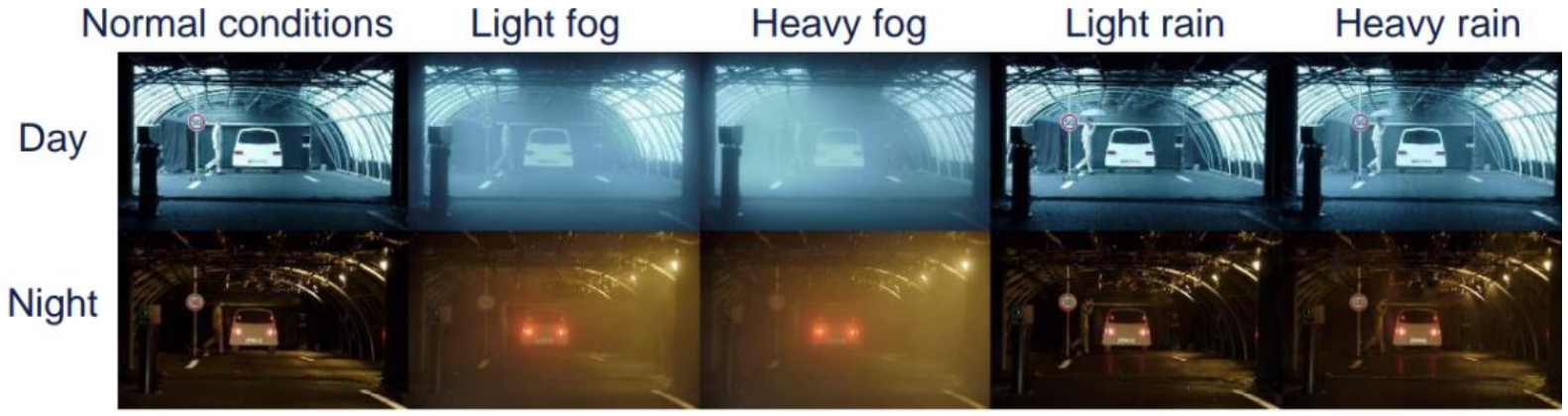
Fog and rain features

- 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)





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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

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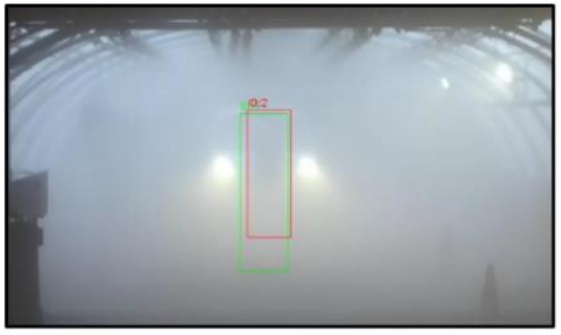
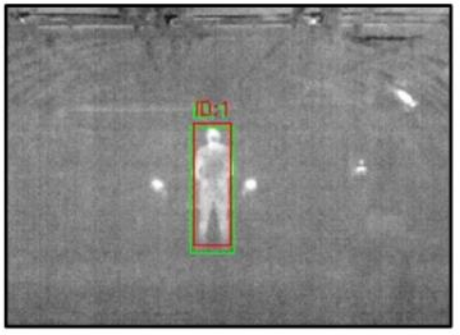
Impact of adverse weather on vehicle perception systems

- Examples in the european AWARD project (2021-2024)
  - All Weather Autonomous Real logistics operations and Demonstrations
  - Innovations to the transport industry, fleet operators and the entire logistics sector
  - Different scenarios: warehouse, hub to hub, airport, port

- 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)





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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

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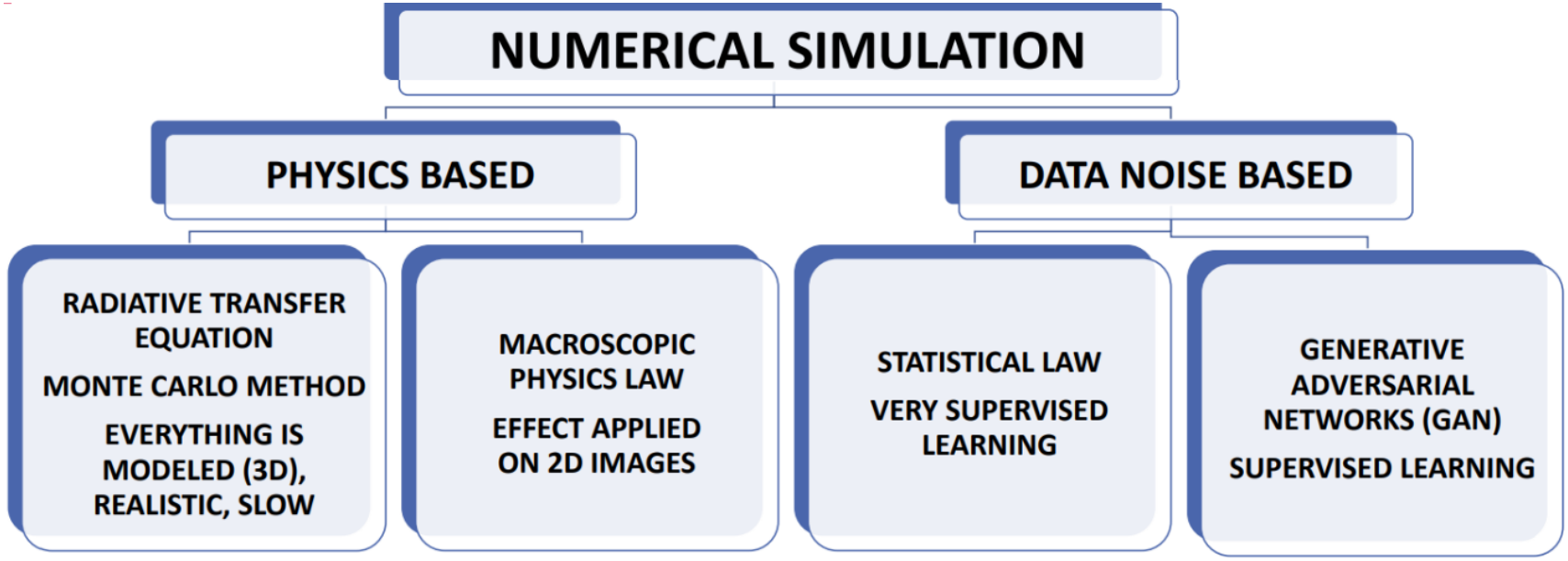
Numerical simulation of adverse weather



Cerema research team is working on these topics which are complementary

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

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And now the future...

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PAVIN Météo dégradée

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

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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

The platform can be rented for confidential private trials

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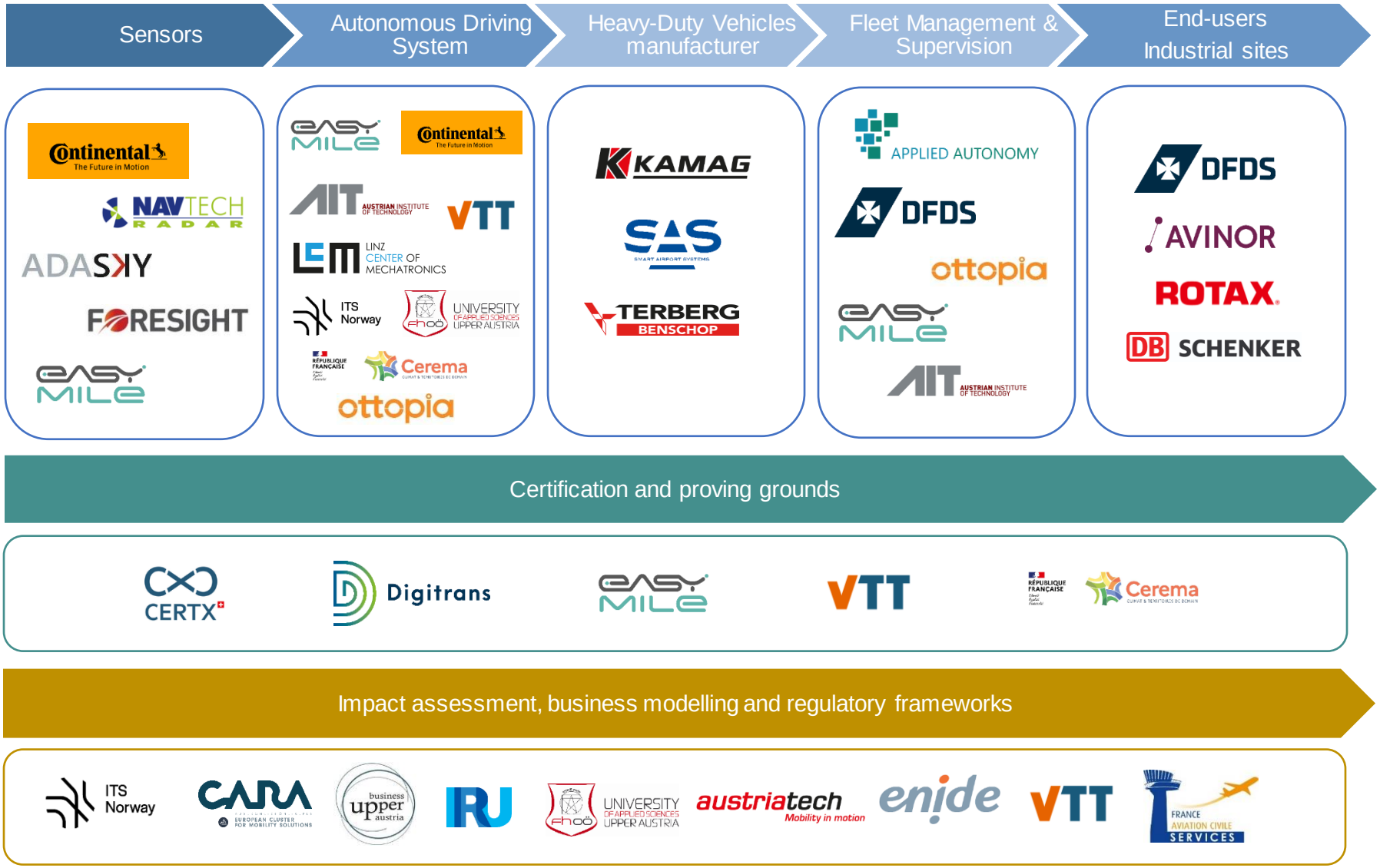
Complementary-skilled Consortium



From multiple horizons

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Support us !

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Let's keep in touch!

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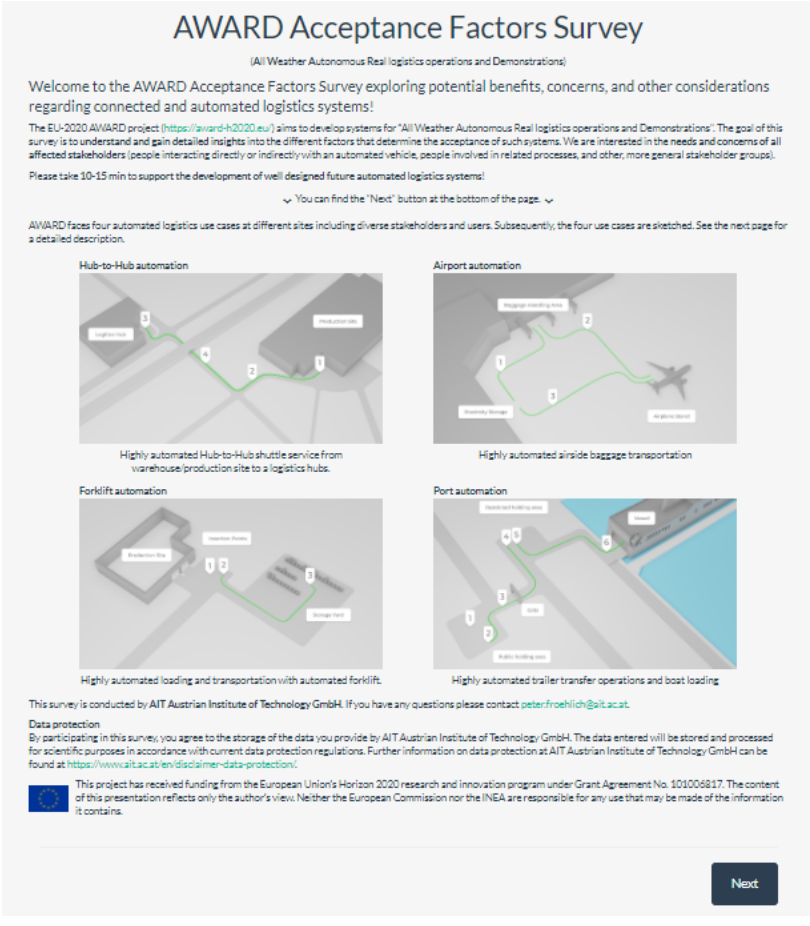
Participate to our Acceptance Factors survey!



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/.

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Next

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THANK YOU FOR YOUR ATTENTION

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Thank you!

DUTHON PIERRE

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