


IPIC 2023

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AWARD
Scaling autonomous logistics

Measuring Efficiency of Automated Road Freight Transport: The AWARD Approach

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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.

All Weather Autonomous Real logistics operations and Demonstrations

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General Information:			
Project Coordinator: EasyMile	**Partners:** 29	**Project Timeline:** 01/2021 – 06/2024	**Budget:** € 26,4m

Project Ambitions:
Develop **a unique set of sensors** that enables **24/7 availability** (night and day, good or bad weather conditions)
Deploy **fully automated heavy-duty vehicles** in **scalable** and **replicable** pilots
Integrate a **new fleet management** system for **optimized logistics flows**

Use Cases:
UC1: Autonomous loading & unloading forklift operations
UC2: Hub-to-hub shuttle service from warehouse/production site to logistics hubs
UC3: Automated baggage tractor on airside in Avinor OSL Gardermoen airport
UC4: Trailer transfer operations and automated ship loading in Rotterdam Port

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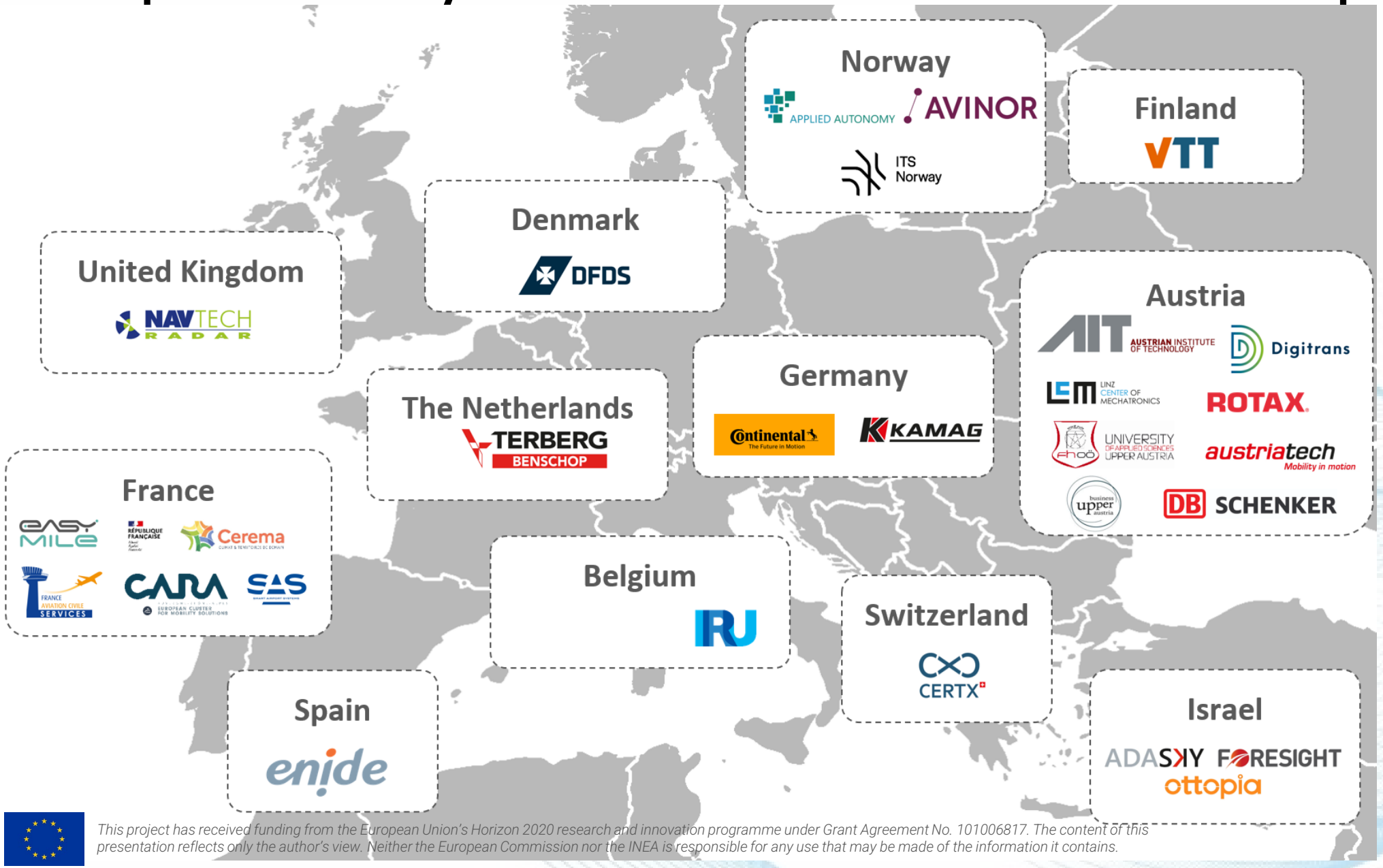
Complementary-skilled Consortium from multiple horizons



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AWARD Global Approach

Development of the ADS

Able to **handle adverse environmental conditions** such as heavy rain, snowfall, fog

Targeting compliance with **ISO 26262** and taking into consideration **SOTIF recommendations**

Integrating **multiple sensor modalities and an embedded teleoperation system to address 24/7 availability**

Optimized fleet management & supervision system for logistics use cases

Integration into HDV

AIT

Manufactured by PALFINGER

KAMAG

TLD

TERBERG

Demonstrations

Industrial autonomous loading & unloading operations

Hub to hub autonomous logistics on public roads

Airport autonomous ground support equipment

Port Trailer autonomous transfer operations

How can the efficiency of these use cases be evaluated?

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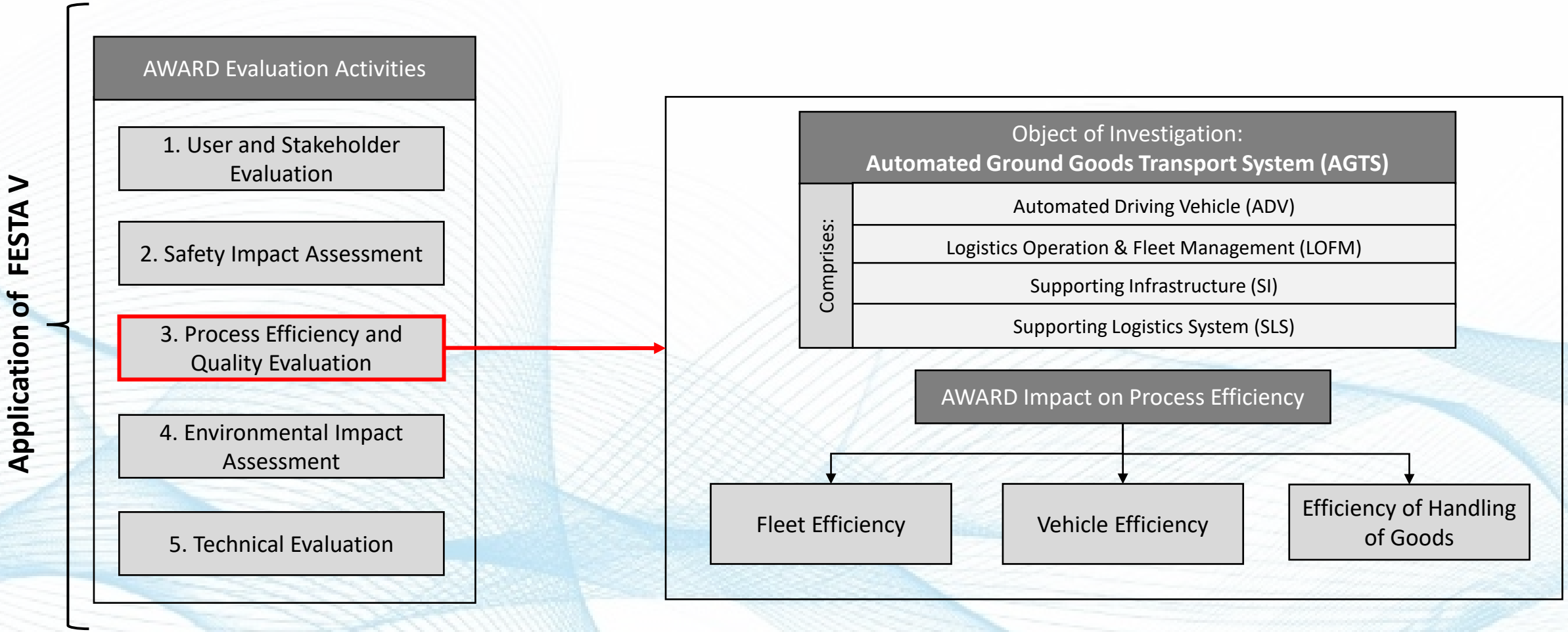
AWARD Efficiency Evaluation Design (1)



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AWARD Efficiency Evaluation Design (2)

	Fleet Efficiency	Vehicle Efficiency	Efficiency of Handling of Goods
Focus	Fleet Management System	Automated Driving Vehicle (ADV)	Automated Ground Goods Transport System (AGTS)
Impact Categories	Financial Indicators		
	Operational Indicators		
	Quality Indicators		

KPIs					
	Fuel Costs	Total Costs/KM	Personnel Costs	Vehicle Operation Costs	Personnel Costs	Purchasing Costs for SLS
	Vehicle Utilization	Distance Driven	Net Transfer Time	Vehicle Uptime	Operation Costs of SLS	Waiting Times
	No. of Vehicle Breakdowns	Average Maintenance Downtime	Support Time	Fuel Consumption	Personnel time	Inventory Size
			Vehicle Speed	Operational Availability	Timeliness of Handling of Goods	(Un)Loading Time
			Timeliness of Transport Orders	Transport Reliability		

General Research Questions:
How does the AWARD *[Focus]* influence *[Impact Category*]?

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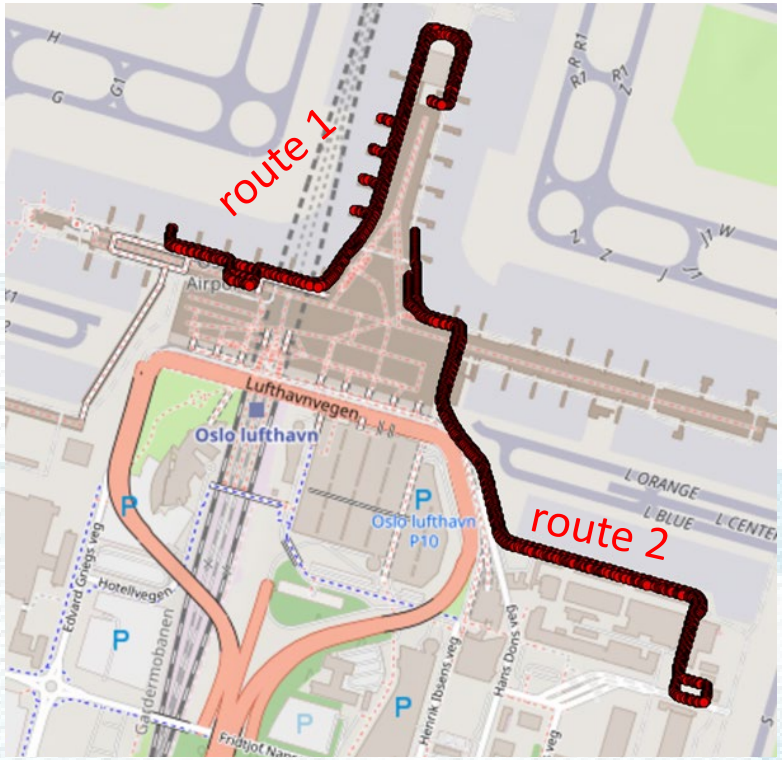
Initial Results (UC3 at OSLO Airport) (1)

- Setup:
  - Use of TLD baggage tractor with level 4 automated driving function (incl. integration in FMS)
  - Vehicle accompanied by trained operators who report issues (in logbook) and additional information (i.e. type of stop)
  - 50h of driving on two routes
- Targeted advantages:
  - reduction in number of drivers / solve driver shortage
  - safety improvements
  - better utilization of luggage tractor capacity (supported by the FMS)
  - less driving, if automated vehicle trips are better planned and managed (supported by the FMS)
  - less manual planning with improved fleet management.



First test routes at Oslo airport

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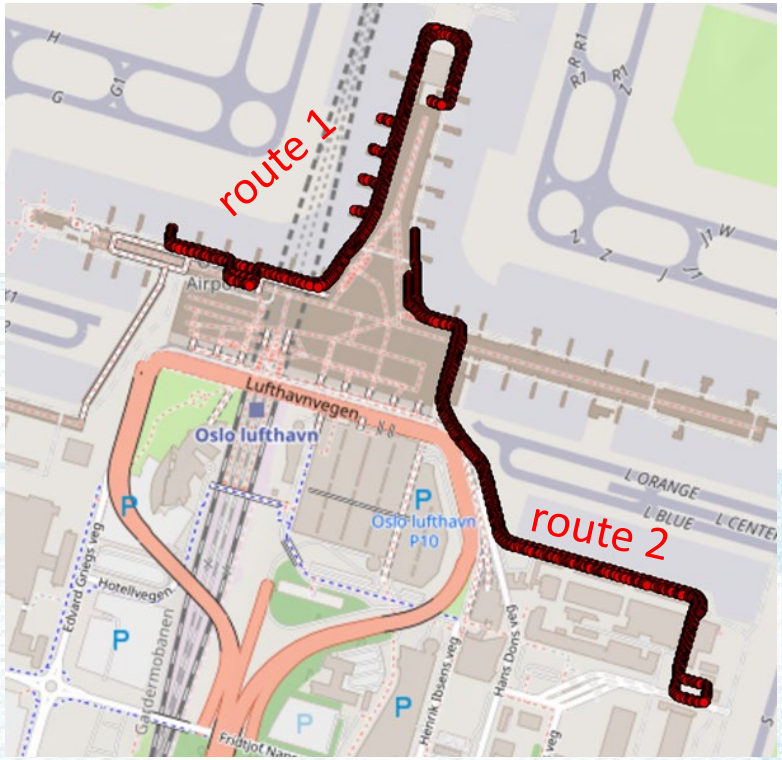
Initial Results (UC3 at OSLO Airport) (2)

- Vehicle speed < speed of human driven tractor
  - 50% more time needed to complete route 1 → route 1 is more complex, with more crossings and traffic participants
  - Only minor time differences for route 2
  - Vehicle still fast enough to complete tasks during plane turnaround time
- Rain and crossing pedestrians did not significantly impact the tests
- Most common reasons for safety stops were "no obstacle" or "route blocked," often due to baggage carts left by human drivers
- Safety stops required a safety operator or teleoperator to actively support or drive the vehicle for around 5 minutes per operational hour
- No real-life tests have been conducted under harsh weather conditions yet.



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Next Steps

- Comprehensive data analysis across different test phases and technological improvements is still necessary (no final results yet)
- The evaluation in Oslo (UC 3) is currently in progress
- In Austria, preparations are being made for Evaluating UC 2 (currently on test track)
- Next month, testing of UC 2 will also take place on public roads
- UC 4 to be tested in Rotterdam by the end of the year
- Use Case 1 will be tested in Seibersdorf in Vienna at the beginning of next year
- Ongoing work will provide further insights into the efficiency of the automated transport vehicles developed for the AWARD use cases.

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Thank you!

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