HIGH CAPACITY ROAD TRANSPORT

FOCUSSING INNOVATION ON
SMARTER MOBILITY SOLUTIONS FOR SMARTER POLICIES

Efficiency Improvement up to 33% by 2030
The meeting will start 15 minutes earlier (13.45h) so that attendees can get over any technical obstacles before the meeting starts. Please use this time and be ready for the meeting at 13.45h (already with your cup of coffee/thee).

Please stay on mute and keep the camera off when not speaking.

If you are speaking please switch off mute and switch on the camera.

This webinar will be recorded for the ones not able to attend.
Welcome and rules of the webinar

ALICE introduction
Project overview
Highlights innovations
  - Aerodynamics and hybrid distributed powertrain
  - Analysis of European crash data and scenario specification, front-end design and vehicle architecture
Q&A

Modular architectures for efficient logistics operations
  - Smart Loading Units
  - AEROFLEX smart power dolly: Towards efficient and mission-oriented long-haul vehicles
Q&A

Impact and requirements
  - How to make road freight transport efficient in my supply chain
    - Demonstration and assessment
    - Transport assessment tool, a cost benefit analysis tool
  - How to drive efficiency and new technology adoption
    - European logistics market
    - State of the art of the regulatory framework and analysis of the technologies
    - Smart and intelligent access regulations to transport infrastructure.
Q&A

Next steps, outlook
### ALICE membership per type of organization

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<th>EU/International Associations</th>
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<td>Shippers &amp; Retail</td>
<td>P&amp;G, L'OREAL, profrumus, Atlas Copco, HÖFNER, GLS, CEFC, GS1</td>
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<td>Logistics Service Providers, Courier and Postal operators &amp; Freight Forwards</td>
<td>LINEAS, BLOGIST, FH LOGISTIS, CHEP, Posttelane, TRÍ-VÍZOR</td>
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<td>Ports, Hubs, Intermodal terminals &amp; Transport Infrastructure</td>
<td>INTERPORTO ECT ROTTERDAM, Port of Barcelona, Doldersum, Algeciras</td>
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<td>Vehicle Manufacturers &amp; Logistics operations, handling (modular units)</td>
<td>VOLVO, SCANIA, TEVVA, PONERA, LOGIFRUIT, eucar</td>
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<td>Information and Communication Technologies &amp; Consultancy</td>
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<td>Regional &amp; National Logistics Clusters &amp; Associations</td>
<td>CNR, CASA, FRAUNHOFER, INDUSTRIA, SUMITOMO, KLAASMACHER</td>
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<td>Research and technology Centers</td>
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<td>WATERBERG, ERRAC, EFFRA, MANUFACTUREEU</td>
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<td>VINNOVA, TRUKEDLOGIST, KLAASMACHER, SUMITOMO, KLAASMACHER</td>
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* Involved in ALICE Mirror Group

Activities performed partially in the frame of WINN, SETRIS & SENSE Projects. WINN, SETRIS & SENSE projects have received funding from the European Union’s FP7 and Horizon 2020 research and innovation Programme under grant agreements No. 314743, No. 653739 and No. 769967
Towards zero emissions logistics 2050

Activities performed partially in the frame of WINN, SETRIS & SENSE Projects. WINN, SETRIS & SENSE projects have received funding from the European Union’s FP7 and Horizon 2020 research and innovation Programme under grant agreements No. 314743, No. 653739 and No. 769967
Towards a Truly Integrated Transport System for sustainable and efficient freight transport & logistics → 2030

The Physical Internet
Interconnected logistics networks, sharing assets and capabilities

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ALICE liaison with projects & industry initiatives

New in 2020:
- PortForward
- DataPorts
- LEAD
- ULaaDS
- Sprout

Running:
- AEROFLEX
- BE OPEN
- COREALIS
- DOCKSTheFuture
- FENIX
- ICONET
- levitate
- LOGISTAR

Finished:
- AEOLIX
- ATROPINE
- CAPITAL
- Clusters 2.0
- CO-GISTICS
- CORE
- DynaHubs
- LEARN
- LogiCon
- logiMatic
- Mobility 4 EU
- nextnet
- novelog
- SAFE
- SELiS
- SMART RAIL
- synchro-NET
- U turn
- VITAL NODES

Activities performed partially in the frame of WINN, SETRIS & SENSE Projects. WINN, SETRIS & SENSE projects have received funding from the European Union’s FP7 and Horizon 2020 research and innovation Programme under grant agreements No. 314743, No. 653739 and No. 769967.
Project Overview
AEROFLEX SUPPORTS VEHICLE MANUFACTURERS TO MEET THE COMING CHALLENGES AND INCREASE EFFICIENCY FOR ROAD FREIGHT TRANSPORT.

- Contribution in achieving implementation of “The Physical Internet”. *
- Optimization of multimodal transport chains by drawing on the advantages of the different modes.

In this context, it is essential to develop **flexible and adaptable vehicles and loading units**

- Distributed powertrains,
- Optimized aerodynamics,
- Smart load carriers,
- Interconnectedness

for low emission and highly efficient long-distance and inter-urban transport and distribution in urban areas.

*http://www.etp-logistics.eu/
The optimal matching of novel vehicle concepts and infrastructures require the definition of smart (performance-based) standards for future trucks, load carriers and road infrastructures (Intelligent Access Policies).

*new standards for hybrid-distributed powertrain, aerodynamic devices for complete vehicle, utilisation of loading units, performance based standards (PBS), access to infrastructure in a multi-mode context
HIGH CAPACITY TRANSPORT, focus on the right cargo

Infrastructure

Address logistics concepts for cargo consolidation in logistics hubs and intermodal transport chains

Relevant cargo units

Address most relevant cargo units – palletized and other cargo collis / customized boxes on long distance transports
High lights of innovations
AEMPT / Aerodynamics / Front End Design
Concept
- Global Energy Management coordinates powertrain components in truck and trailers.
- Local System Management in trailers control the specific e-Drives.
- Communication via new AEROFLEX protocol on Automotive Ethernet.
- Higher data load on conventional plugs.

Benefits
- Reduced energy consumption, first results 8 - 12%.
- Improved traction and road safety.
- Easiness in creating HCV configuration reducing number of pulling trucks.
- Opportunity to split a vehicle in self driving units.

Architecture allows configuration up to 5 units
AEMPT, Advanced Energy Management Powertrain

- Automotive Ethernet routers to combine conventional CAN-Communication with new AEROFLEX Protocol

- Vehicle in the Loop Testing: Real truck tested with virtual dolly and trailer

- Virtual Dynamic Simulations to test the global energy

- HMI for giving Driver Feedback on the powertrain state

- Multi Body Simulations to assess vehicle stability
AEMPT demonstrator

Communication: Automotive Ethernet, new Protocol for Energy/Torque Management; no new connectors

eTrailer: Schmitz-Cargobull from EU-Project “Transformers”

MAN 6x2 TGX580: Energy and Torque Management; 8,2m Swap Body

eDolly: Hydraulically Steered Dolly front axle Axle

eDolly: Axle: ZF AVE130, 250kW; Battery: AKASOL 75kWh

eTrailer: Drive axle: Bosch 80kW Battery:
Aerodynamics for the complete vehicle

**Concept**
- Active and passive aerodynamic features for complete vehicle
- CFD simulations have been used in the development of the aerodynamic features
- CFD methods have been verified by wind tunnel tests using a 1:3 scale model
- Final verification with a demonstrator

**First results**
- Tractor semitrailer $\Delta C_{dx}A = >40\%$
- EMS1 $\Delta C_{dx}A = 40\%$

**Benefits**
- Active features for complete vehicle allow optimal drag at all circumstances reducing energy consumption and no restrictions in handling of cargo during loading a/o unloading
Aerodynamics demonstrator

- Active air deflector
- Gap reducer
- Active boat-tail
- Underbody panel
- Sideskirt extensions
- Dolly sideskirt
- Rear diffuser
- Active ride height

Adaptable box and trailer shape
Front End Design and vehicle architecture, protection of car and truck occupants.

**Concept**
- Rear-end crashes are the most relevant scenario. Add protective structures in the elongated front end of the AEROFLEX truck.
- Investigate the use of ADAS (AEB, SGW, LSS)

**First results**
- Passenger car protection: specific crash absorber designed to absorb energy during the collision are added to the front of the truck.
- Truck occupant's protection: simulations highlight the huge amount of crash energy that cannot be effectively absorbed by any protective structures, despite frontend elongation.
- Use of active safety systems obligatory to avoid truck – truck collisions and better preserve all the other road users.

**Benefits**
- Use of ADAS do reduce collisions with other vehicles and VRU and in combination with earlier mentioned features avoid serious injuries and fatalities
**Concept**

- Impact with pedestrians are one of the most relevant scenarios involving VRUs
- Human Body Modelling (HBM) for impact simulations
- Adult Head (AH) and Pelvis (upper leg UL) impactors equivalence to HBM

**First results**

- Front End modifications for VRUs
- Add some gap between external skin and windscreen glue area (AH)
- Add reinforcement in glue area to increase the energy absorption (AH)
- Reduce the headlamp box to reduce the local stiffness in this area (UL)
- Add a reinforcement to improve the energy absorption (UL)

**Benefits**

- Extended front end can be equipped with above summarized features avoiding serious injuries a/o fatalities for VRUs
**Concept**

- Following ADAS were virtually installed, configured and tested on the Aeroflex truck in order to bring more safety:
  - Automated Emergency braking (AEB)
  - Side guard warning (SGW)
  - Line support system (LSS)

**Benefits**

- ADAS reduce serious and fatal injuries in combination with the earlier structural features mentioned before

Please check the TRA paper “An analysis of European crash data and scenario specification for heavy truck safety system development” for more details.
Front End Design and vehicle architecture, Active safety systems

- AEB, camera on the top and radar on the bottom the truck can avoid collision in most of the defined test cases but in some testcases involving VRUs collision cannot be avoided.

- SGW, radar on the side of the cabin. Data fusion with frontal radar (AEB) with consequent extension of the detection range

- LSS, camera on top showed bests results (could be the same camera used for AEB) assist by a radar on the side of the truck (same used for SGW).
**AEMPT**

5-12% energy efficiency improvement from the flexible, advanced powertrains.

**Aerodynamics**

5-10% reduction in energy consumption through improved vehicle aerodynamics.

**Front End Design**

Standardized interfaces and sharing of components for higher economies of scale.

Front end designs to ensure survivability in crashes up to 50 km/h for occupants and vulnerable road users.
High lights on
Smart Loading Units and Smart Power Dolly
Smart and Flexible Loading Units

**Concept**
- Collaboration with Cluster 2.0, ALICE-ETP, End-Users and AEROFLEX-SB
- Focus on efficiency in handling of cargo (palletized goods)

**Development and optimization of**
- PUZZLE© software
- CargoCam
- Double stack and adaptable trailer

**Three use cases to demonstrate under real-life and conditions**
- Optimization loading of trailers at P&G
- Trailer to Train by CFL lorry rail Bettembourg - le Boulou
- EMS2 configuration

**First results and benefit**
- Utilisation of loading unit improved up to 40%
- Reduction of transport cost (€ t/km) up to 35%
- Opportunity to bring cargo to rail destressing road on long distance transport
Trailer to Train and EMS2

**Concept 1: Multimodal - Market segment: long distance transports**

- Aerodynamic optimized trailer must fit for 6 most relevant multimodal techniques in EU: Crane (>97% rail market share), NiKraSa, Modalohr, CargoBeamer, RoLa & ferry
- Proof aerodynamic devices (boat tail and side skirts) do not cause problems for multi-modality

**Highlights:**
- EMS2, opportunity to bring high amount of cargo to rail and potentially reduce emissions by >20% and cost by >30%
- Craneability of trailer realised by VanEck
- Demonstration in Q1/2021 in real life at CFL, Bettembourg Luxembourg, lifting via crane and NiKraSa and train transport via Modalohr to le Boulou France – Spanish border
**Concept 2:** Loading space efficiency – Market segment: Palletized goods

- Flexible floor trailer allows higher load factor
  only feasible with smart elements
- Puzzle® software and camera CargoCam developed to support effective and efficient loading

**Highlights:**
- PUZZLE® software, by Fraunhofer IML, realized for trailer optimization
  (incl. respecting flex floor option, packing problem and weight balancing (!))
- Test result with low and not stackable pallet loads at P&G test case -> 38% higher filling rate

http://demo.mypuzzle.de/aeroflex
Concept 3: Modularization and Horizontal collaboration - market segment: milk run

- Intermodal transport Holland - Italy
- Horizontal collaboration
- 43% reduction in labour cost
- Fast
- Safe
- Secured
- Covid friendly

Flexible modules successfully tested within cooperation project Clusters 2.0
Advantages

- Reduction of fuel consumption and emissions
- Improved traction and driving stability
- Still a weight reduction of ca. 4ton ref EMS1 and EMS2 configurations

Driven axle ZF AVE130 (250kW)
Akasol Li-Ion battery (75kWh)
Automotive Ethernet Router Repeater

Smart Power Dolly
Opportunities

- Hybrid distributed powertrains \(\rightarrow\) split the vehicle in self driving units
- Autonomous yard operation with electric powertrain

Focus on yards – instead of public roads
- Controlled environment
- Lower requirements regarding functional safety
- Quick cost / benefit regarding handling, safety and planning

- AEROFLEX Smart Power Dolly equipped with remote control to demonstrate manual operation
Fraunhofer Solutions for Yard Automation: 

helyOS Control Tower Software

- Controls and monitors autonomous vehicles
- Provides a GUI for creating, executing and supervising missions assigned to autonomous vehicles
- Shows where the autonomous vehicles are and what they are doing → live view
- Coordinates up to 30 vehicles to optimize efficiency
- Uses internet-technologies to access vehicles all over the world
AEROFLEX smart power dolly: Towards efficient and mission-oriented long-haul vehicles
**Smart Loading Units**

- 4-5% energy saving by separate platforms
- 4-6% energy saving by effective use of loading space

**Smart power dolly**

- Standardized interfaces and sharing of components for higher economies of scale
Demonstration & Assessment
How can I make road freight transport efficient in my supply chain?
Demonstration & Assessment

Concept
- Representative use cases in common supply chains
- Test and assessment framework
- Evaluation and assessment of test results

Results
- Test matrix, test protocols and test cases
- Reference and advanced reference tests
- Assessment framework as in picture

Benefit
- Confirmation of test program validity by SAE
- Assessment build up on test results AND representative end user cases

Highlights of assessment framework
- Inclusion of end user specific cost / benefit module
- Efficiency benefits for end user in multimodal context
Demonstration vehicles

Baseline:
- MAN 4x2 + Curtain semitrailer (Zero-case)
- SCA 4x2 + Box semitrailer (Aero baseline)

Advanced reference (TRANSFORMERS project):
- MAN 4x2 + TF - SCB
- SCA 4x2 + TF – VET

EMS 1 (25m) reference
- MAN 6x2 – Curtain semitrailer
- SCA 6x2 – Box semitrailer

Beyond State of the Art:
- MAN 6x2 + e-Dolly + e-Trailer SCB
- Scania 6x2 + Aero-Dolly + Aero-Trailer VET
- MAN 4x2 + Aero-Trailer VET + e-Trailer SCB

Q4/2020
Q4/2020
Q1/2021
Evaluation and impact assessment

AEROFLEX - ALICE - Webinar

AEROFLEX

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15.09.2020

Testing

Evaluation

Real world impact assessment

4–5% energy saving by separate platforms

4–6% energy saving by effective use of loading space

5–12% energy efficiency improvement from the flexible, advanced powertrains

5–10% reduction in energy consumption through improved vehicle aerodynamics
Structure of cost-benefit model

- Added to the transport efficiency assessment framework
- Cost-benefit analysis for actual end user cases
- Structure of model and typical outcomes checked and agreed by LSP’s

Use case inputs:
- Km/working day
- Avg payload
- Avg. m³
- Stops
- Fuel consumption
- Total km

Cost/Benefit categories:
- Driver
- Shunting
- Fuel
- Road tax
- Incentives
- Financing
- M&R
- Insurance
- Tires

Vehicle modules:
- Truck/tractor
  - Trailer 1
  - (E-)Dolly
  - Trailer 2

Open question: is there a need for a webtool application as activity beyond AEROFLEX?
Impact & requirements
How to drive efficiency and new technology adoption?
Impact & requirements
How to drive efficiency and new technology adoption?

Concept
- Survey on the needs of the European transport logistics market and requirements of EU road freight transport
- Analyses of the European transport market, trends and market drivers in logistics
- Derive first recommendations regarding use cases coming from the market analysis
- Define the state-of-the-art regulatory framework regarding the freight transport market:
  - Current state of the EU legislation
  - Definition of the boundary conditions

Results
- New technologies and vehicle concepts are needed to further reduce emissions and to use the infrastructure safe and efficient
- The optimal matching of novel vehicle concepts and logistics require the definition of smart standards for trucks, load carriers and infrastructures, Intelligent Access Policies.

Benefits
- The use of new vehicle concepts and smart loading units maximise the freight transport efficiency, reduction on the environmental impact and stimulate multi-modal transport.
- Our contribution to re-thinking the transport logistics as a short-term contribution for the European Green Deal goals
Transport of freight and goods needs use of all modes

Take the advantage of each mode

Corridors, ports, hubs and terminals, the right mode, the right vehicle and loading unit ensure the optimal delivery at destination
Overview of freight

Characterisation of transported cargo in EU-28 in 2016 (source EUROSTAT 2018)

- Palletised goods which recorded 42.9% of the EU-28 road freight
- Palletised through flexible loading units
- Modes need to focus on right cargo segments

![Bar chart showing different types of cargo and their transportation distances in billion tonne-kilometres](chart.png)

- Less than 50 km
- From 50 to 149 km
- From 150 to 299 km
- From 300 to 499 km
- 500 km or over
AEROFLEX innovations most relevant Physical Internet (PI) advancement

Steerable e-dolly supports:
- (Autonomous) maneuvering of loading units in logistics yards (PI nodes)
- Drivers focus is driving, relieves driver shortage and improves specialization

- Modular, adaptable loading unit
  - Perfectly in line with PI concept
  - Optimization with puzzle software
  - Robust on all transport modes

- Less energy demand per tkm
Macroscopic modelling –
modal and mean split differences (EU28 – incl. UK)
- Baseline (without EMS)
- EMS1 operating without any restrictions
- EMS1 and EMS2 operating without any restrictions
- Consideration of external costs of transport (e.g. study of infrastructures)
- Limit the average load factor (payloads) to avoid that heavy cargo (commodity groups: e.g. coal, ores, fertilizer, soils) will be shifted from rail to road in the simulation

Result
- Estimate expected benefits of new vehicle concepts in EU freight transport market

Projection of Modal split in 2010, 2030 (bright colours) and 2040 (dark colours) predictable - sample Germany
Cost reduction for pre- an post haulage on road in intermodal transport will support mode shift road/rail, road/IWW and road/short sea shipping.

Figure: Intermodal transport chain – use of EMS2 and the opportunity to extend the trip planning and reduce of daily circle runs (example)
Impact and requirements, state of the art of the regulatory framework and analysis of the technologies

Establishment of a **Sounding Board** to advise and help guide the process of defining the recommendations for implementation of the solutions and measures developed within the AEROFLEX project.

Drafting of coherent **recommendations for revising standards and legislative frameworks** in order to allow the new aerodynamic and flexible vehicle concepts on the road.

**Recommendations** to policy-makers, authorities and industry on **standardization issues and a legislative framework** for multi-modal use of the vehicle concepts developed.
Intelligent Performance Based Standards for safe and efficient use of vehicles

**UN level**
- Modular Vehicle Combination Group
- Requirements for Road Train Combinations (mainly in R13, for Braking Systems).
- Interconnections (EBS systems).
- 2nd step would include introduction of steered dollies (Regulation 79).

**EU level**
- Masses and dimensions
- New requirements for Aerodynamic devices (tests and dimensions).
- New requirements for Elongated Cabs (maximum dimensions, direct vision improvement and safety for VRU).
Intelligent Access Standards for
safe and efficient use of infrastructure

- More and more local regulations are introduced restricting access creating barriers for logistics

- Transport of freight and goods are confronted with diversity in regulations

- Access policies are an opportunity to take away the burdens through
  - management of access and
  - regaining the control on the logistics and transport operation.

- Need to develop “the Pathway to Intelligent Access Policies through Europe to safeguard freight transport in a healthy, safe and environmentally friendly context”.
Intelligent Access Policies for Safe and Efficient Use of Infrastructure (example)

“Pathway to Intelligent Access Policies through Europe to safeguard freight transport in a healthy, safe and environmentally friendly context”.

Urban Vehicle Access Regulations (UVAR) & Management for Electronic Traffic Regulations (METR)
e.g. NORDICWAY project, DG MOVE UVAR pilot

Task force to promote European Vehicle Access Regulations (EVAR) & Management for Electronic Traffic Regulations (METR) for transport of freight in Europe
Intelligent Access Policy
Identified Stakeholder Clusters

- **USERS** – represented by the transport companies, fleet owners, logistic service providers, shippers, other road users, and users of other modes

- **PROVIDERS** – represented by the companies/institutes, offering systems and tools to execute EVAR and METR

- **POLICYMAKERS** – policymakers and (safety) certification authorities on European, national, and regional level

- **PLANNERS & OWNERS** – responsible for building and maintenance of infrastructure (road/rail/water/air/tube)
Task force to involve the stakeholders and achieve commitment to IAP-agenda

The project AEROFLEX has decided to initiate a start of IAP Task Force, find budget to continue the activities driving the IAP-agenda beyond AEROFLEX.

Join our initiative! ->
marta.tobar@idiada.com
www.aeroflex-project.eu
Demonstration & assessment

Impact & requirements

Standardized interfaces and sharing of components for higher economies of scale
Summary of activities to be addressed in future R&I projects

Scaling (logistics) projects to further demonstration and implementation new technologies / systems to realize the needed impact and efficiencies. (autonomous handling and transportation of freight and cargo).

Link EMS to zero tail pipe vehicles, connections to urban logistics including last mile operations. Potential solution to speed up decarbonization at cost able to bear by the society and contributing to the Green Deal targets (50 - 55% CO2 reduction by 2030).

Project OEM / trailer-manufactures / transshipment / intermodal operators to demonstrate the holistic system.

Access policies on a European base, linked to Balkan and Turkey, managing growth of transportation by a constant reduction of emissions.

Ensure formation and continuation of TF-IAP beyond June 2021.

Involvement of and supervision by ALICE, ERTRAC, POLIS and DG MOVE.
Next steps and outlook

IDIADA, Santa Oliva

Next meetings

- GA web-meeting – 3 / 4 November 2020
- SB web-meeting – 4 / 5 November 2020
- ALICE web-meeting – March 2021
- Final meeting preliminary 22-24 June 2021

https://aeroflex-project.eu/tra2020-aeroflex-papers/
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