



# Aerodynamic and Flexible Trucks for Next Generation of Long Distance Road Transport

HIGH CAPACITY ROAD TRANSPORT

FOCUSSING INNOVATION ON SMARTER MOBILITY SOLUTIONS FOR SMARTER POLICIES

IPIC London, 11 July 2019



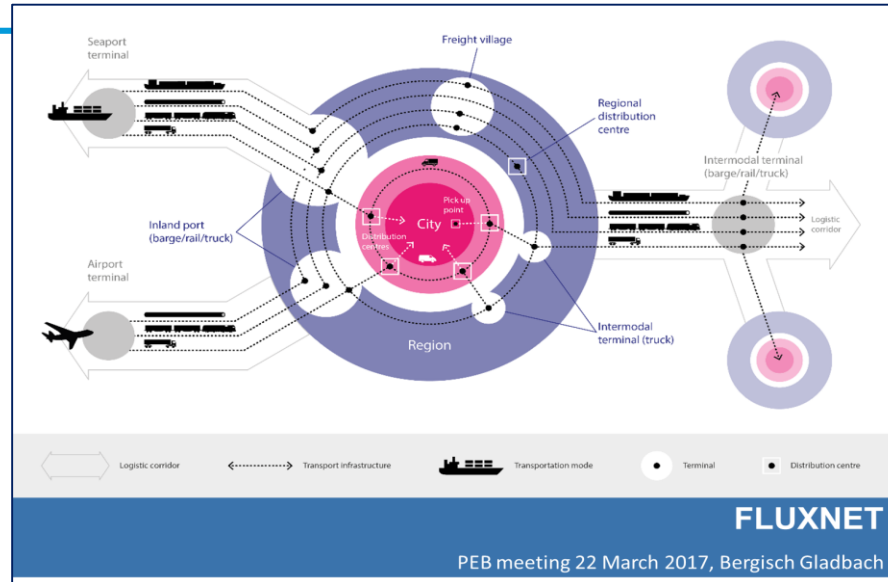
*The research leading to these results has received funding from the European Union*

# Back ground project

TRUCK MAKERS CALL FOR EU-WIDE INTRODUCTION OF HIGH-CAPACITY VEHICLES TO BRING DOWN CO2 EMISSIONS, BRUSSELS 7 MAY 2019



European Automobile Manufacturers Association

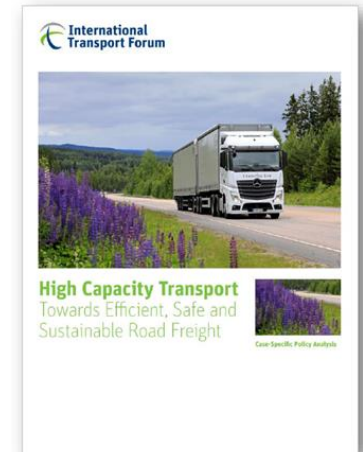


## We investigate:

- Economic and political developments
- Impacts of High Capacity Transport (HCT)
- Regulations and enabling technologies for HCT

## We develop:

- Package for policy makers



High Capacity Transport: Towards Efficient, Safe and Sustainable Road Freight  
Jerker Sjögren, Chairman of the ITF Working Group on HCT, 7 May 2019



## CEDR-FALCON | project Goals

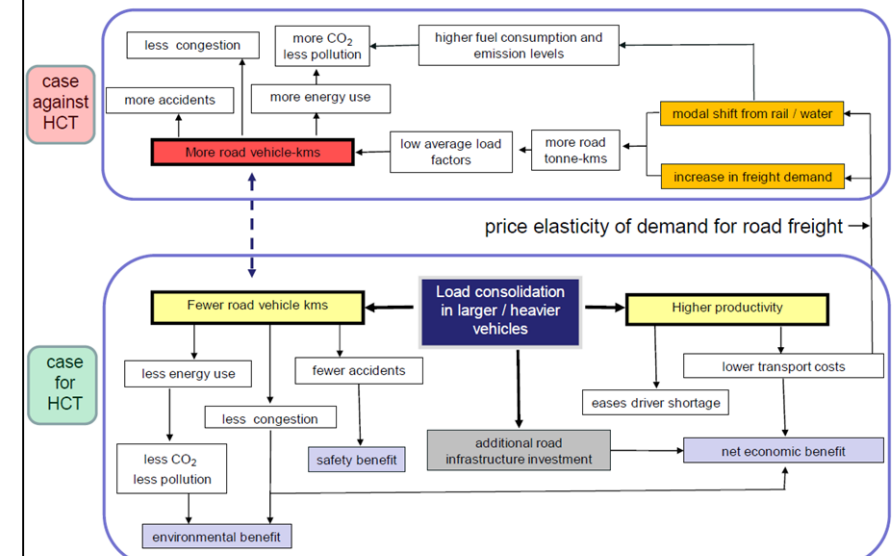


- Define a concept of Smart Infrastructure Access Policy (SIAP) using principles of Performance based Standards, Intelligent Access Programs and Digitalization
- Ensure better fit between the road and the vehicles through vehicle performance and knowledge of vehicle impact on the infrastructure



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## High capacity transport: *polarisation of the cases for and against*



# Goal and objectives

## Goal

Develop and demonstrate

- new technologies
- new vehicle concepts
- new architectures
- new standards\* for complete vehicles

meeting

- future logistics and
- co-modality needs.



Boundaries & Constraints

Technologies and Innovations

Up to 33% Efficiency Improvement  
in Long Haul road transport

Demonstration and  
impact assessment

Recommendations for  
new standards and  
adapted legislative  
framework

\*new standards for hybrid-distributed powertrain, aerodynamic devices for complete vehicle, utilization of loading units, performance based standards (PBS), access to infrastructure in a multi mode context

# Significant contribution to CO2 reduction objectives and to increase efficiency

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## ● **Vehicle concepts**

- A wider use of Higher Capacity Vehicles (HCV)
- An enhancement of EMS concept

## ● **Logistics operations**

- For both low and high density goods as well as for long and short haulage
- Consolidation of freight as a precondition

## ● **Transformation**

of the assets (semi-trailers, boxes, wagons) into **smart devices**

## ● **Smart Infrastructure Access Policies (SIAP)**

for optimal matching of novel vehicle concepts and infrastructure

# Overview Targets and Innovations

- 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
- 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

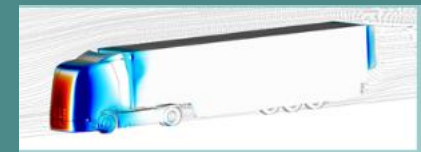
## Smart Loading Units

**PUZZLE**   
Maximize utilization

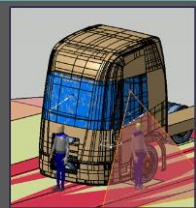
## Hybrid Distributed Powertrain



## Aerodynamics for Complete Vehicle



## Front End Design



# European road freight transport market

## Literature and Data Analyses

Status and Trends, Eurostat data, Forecasts

- 38% of analyzed transports in long road haulage is fully loaded\*
- Palletized cargo is most interesting for efficient handling and carrying of cargo
- Low and high density goods
- Long (>150km) and short haulage (>50km)
- Rail/road in need of optimization

## Acceptance and Requirements of LSP and Shippers

Online Survey, Interviews, Workshops

- Variety of requirements concerning length and laden weight
- Any vehicle concept:  
Standard units,  
one fits for all or most transport
- Willingness to adapt new solution depends on feasibility and framework

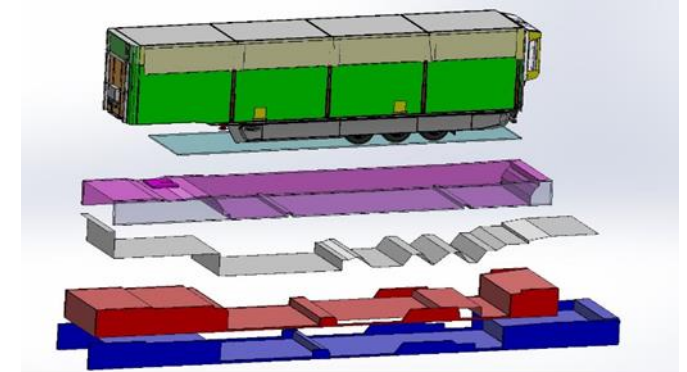
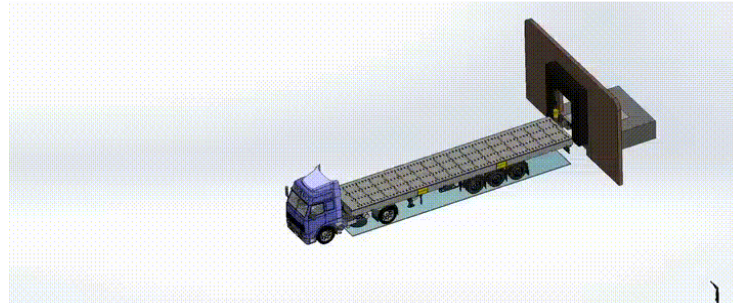
\*Analysis EUROSTAT-EU-NST2017

# Smart Loading Units, collaboration with Cluster 2.0

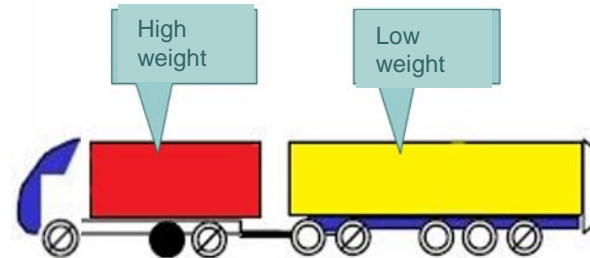
PUZZLE® 

Maximize utilization

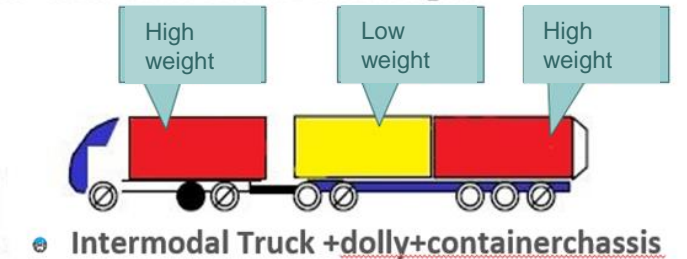
Cargo Cam



Combine heavy weight with light weight to fill both volume and weight !

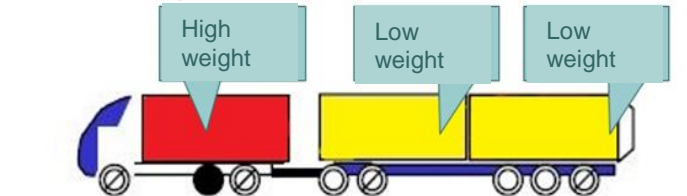


Demonstrator Truck +Dolly+ VEG trailer



Intermodal Truck +dolly+containerchassis

1 x C 7,82 2x 20 ft container

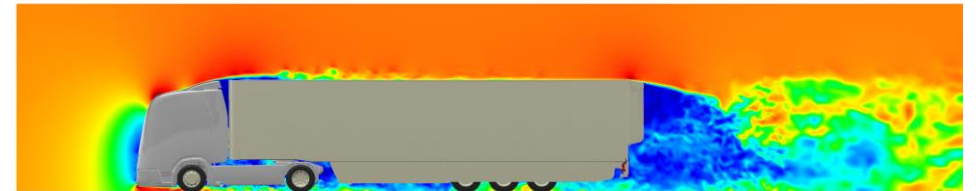
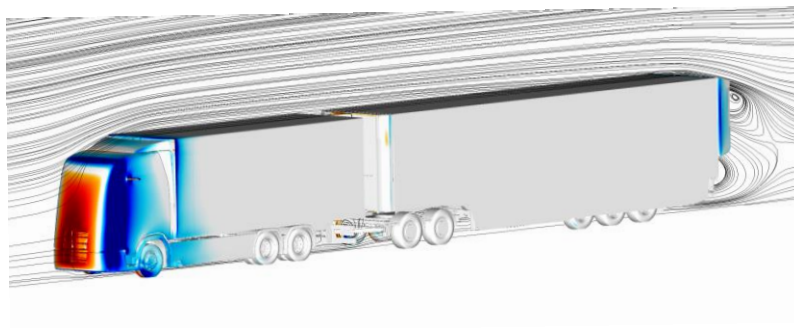


# Hybrid Distributed Powertrain Aerodynamic Features for the Complete Vehicle



- Flexible, advanced powertrains
- Enabler to split vehicles in self driving units
- Develop an electrically driven dolly
- Build of a EMS demo vehicle  
incl. e-dolly and an electrified trailer  
(trailer provided by Transformers project)

- Active and passive aerodynamic features;  
simulations by CFD and wind tunnel and vehicle for demonstration





# Customer Use Cases

- 31 use cases collected (individual transports; route, sources, sinks and its load)
- 41 legs (use cases can consist several different legs, i.e. type of route, type of vehicle or type of transport)
- 18 countries involved (origin, destination or transit)
- 21 of 27 available Prime Candidates (from FALCON project) selected for use cases
- 65 analyzed combinations of tour, vehicle and load variants

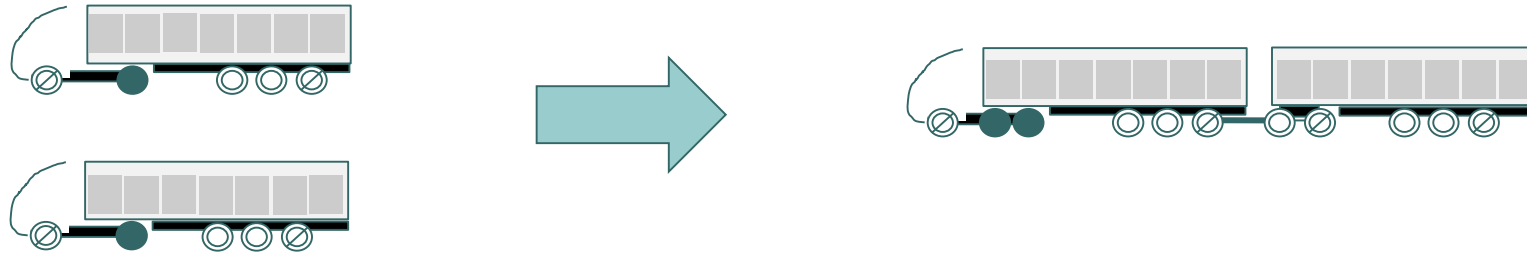


Examples of popular vehicle combinations

Logistics Sector	Route Type
Bulk	FTL - Main run
CEP	FTL - Main run
Consolidated Cargo / LTL	FTL - Main run
Consolidated Cargo / LTL	FTL - Pre/Onward
Consolidated Cargo / LTL	Milk Run
Consolidated Cargo / LTL	Source
Consolidated Cargo / LTL	Consolidation
FTL	FTL
FTL	FTL - Main run
FTL	FTL - Pre/Onward
Special transport	FTL - Main run
Special transport	LTL
Special transport	Milk Run

# Results – Average Savings Potential

Average savings potential for all analyzed use cases / legs for optimized and maximized load.  
Technical innovations coming from the AEROFLEX project are not yet included!

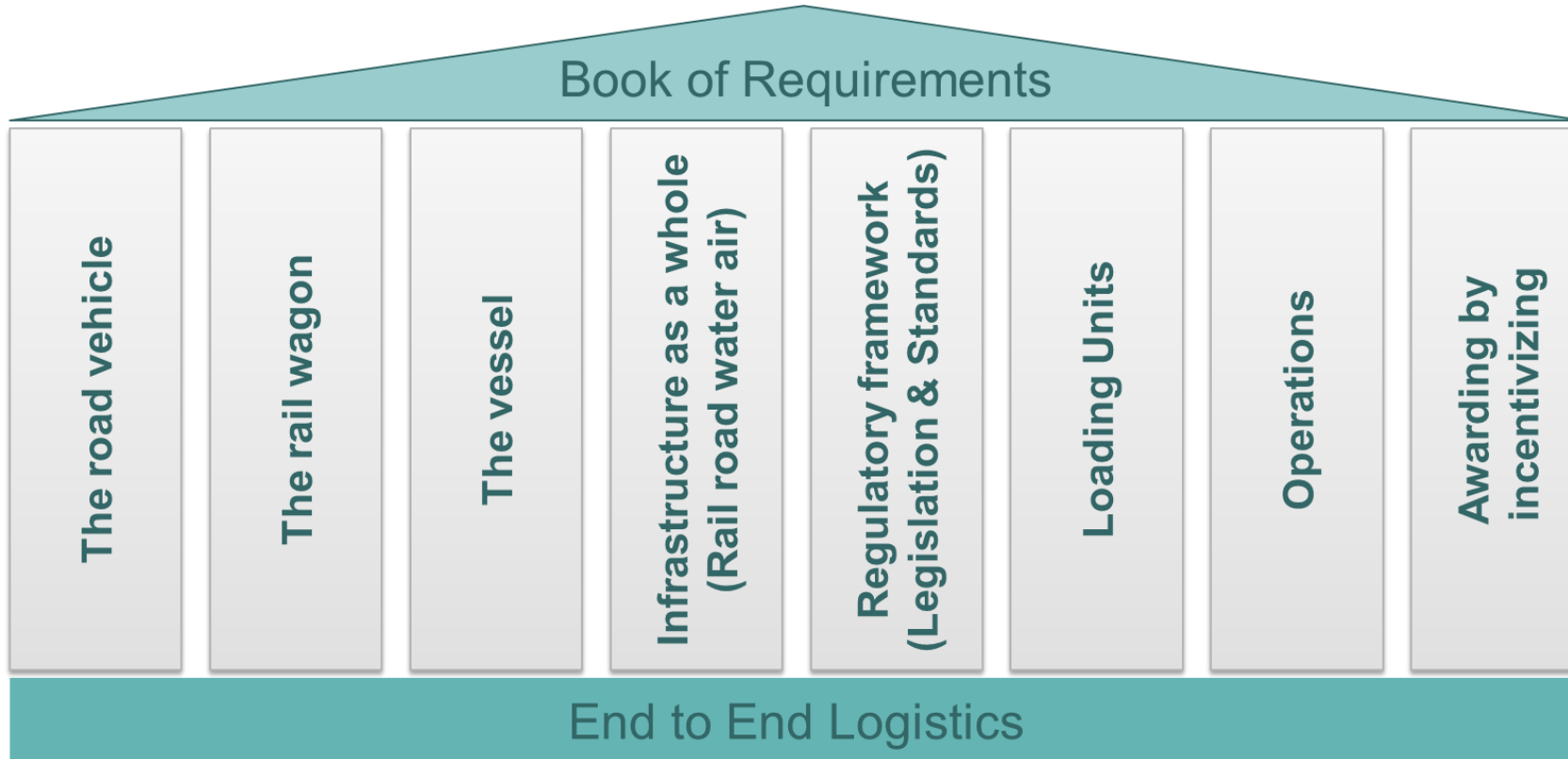


Exemplary for a standard semi trailer vs. a double semi trailer

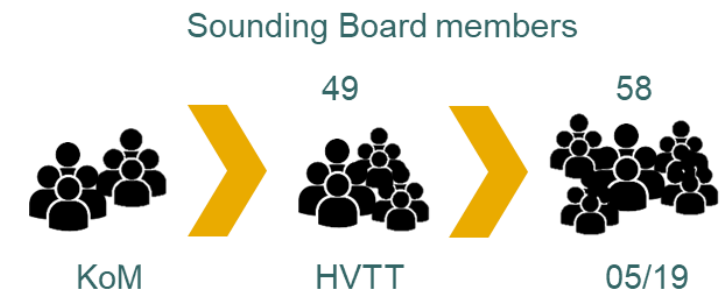
	€/m <sup>3</sup> km	€/tkm	Cost/tour	CO <sub>2</sub> e TTW	Co <sub>2</sub> e WTW
<b>Average savings potential (%)</b>	<b>-32,4</b>	<b>-32,4</b>	<b>-31,7</b>	<b>-18,4</b>	<b>-23,0</b>

- Use cases show a wide spread, results differ depending on conditions, routing, topography, etc.
- The overall efficiency on European level depends on the market penetration.
- The market penetration depends on the allowance to use new vehicle concepts in a regional and cross boarder context.

# Requirements for implementation



- Sounding Board, consisting out of representatives from authorities, policymakers, logistics of freight and industry.



# Pathway dependency on Performance Based Legislation

## AEROFLEX delivers

Recommendations for new standards\*

Proven logistics capabilities of future vehicle combinations

Proven efficiency of future vehicle combinations

Proven concepts and new standards for future vehicle combinations

## Opportunity

2030  
Up to 33% Efficiency achieved and proven

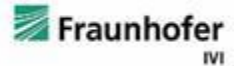
2025  
Large scale roll-out of concepts and new standards

2020  
Introduction of AEROFLEX concepts and new standards

\*new standards for hybrid-distributed powertrain, aerodynamic devices for complete vehicle, utilization of loading units, performance based standards (PBS), access to infrastructure in a multi mode context



# AEROFLEX



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