ALICE Webinar – 24 March 2021

***** PART 2 *****

HIGH-CAPACITY ROAD TRANSPORT

FOCUSSING INNOVATION ON
SMARTER MOBILITY SOLUTIONS FOR SMARTER POLICIES

Efficiency improvement up to 33% by 2030

The AEROFLEX project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 769658

Agenda

Use Slido:

- To make your questions and remarks known
- To collect opinions
- To challenges audience
- To find support for IAP and eDolly
- To join project ideas beyond AEROFLEX

14:00h **Opening Session:**

- Welcome and rules of the webinar
- ALICE introduction (by Fernando)
- Project overview and highlights (by Ben/Per/Giuseppe)

~14:30h **Session I - Short presentations followed by Q&A and interactive Sessions on the following topics:**

- **P&G use case and next steps: Smart Loading Units and Tools into Practice (by Ton/Hilal)**
- Modelling of freight 2040: Implications of High-Capacity Transport (by Andreas/Christoph)
- e-Dolly and the next steps (by Julius/Henning)
- Intelligent Access Policies initiative and next steps (by Marta/Elisah)

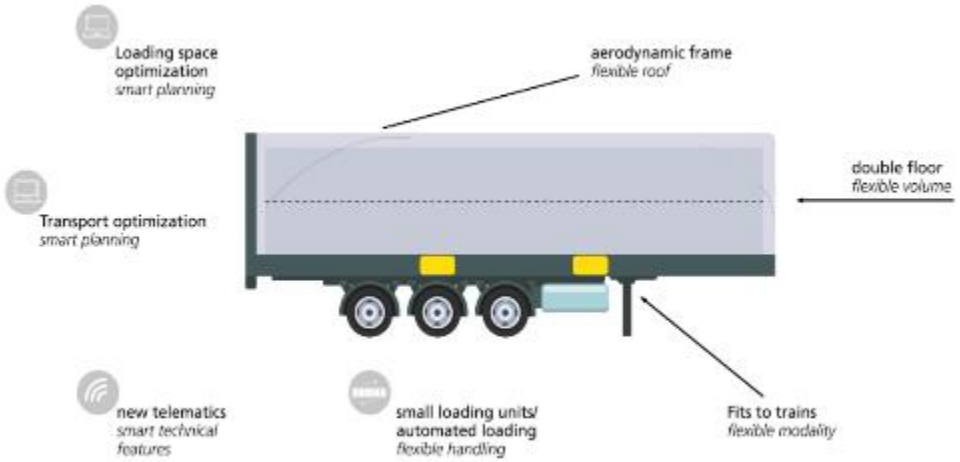
~15:45h **Session II - Outlook and closure:**

- R&I opportunities beyond AEROFLEX (by Ben)
- Horizon Europe opportunities (by Ben)
- Outlook and closure (by Ben/Fernando)

Smart Loading Units and Tools

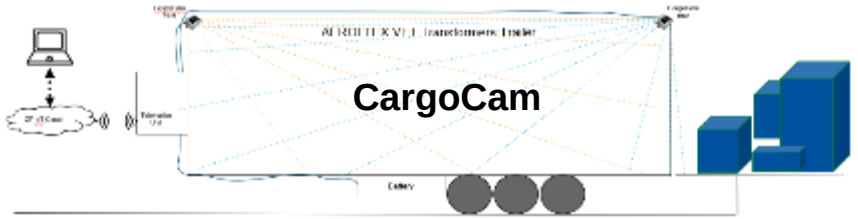
Concepts

- Craneable VET trailer, demonstrated last webinar
- Puzzle SW, demonstrated last webinar
- ZF-CVCS CargoCam,
- three concept customer use cases, announced last webinar



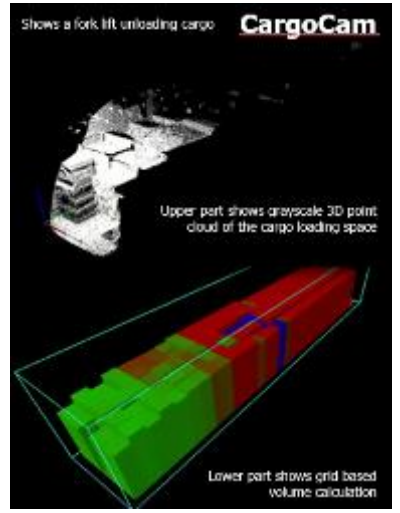
Progress since Sept 2020

- D4.3, preparation of a demonstrator design for smart loading
- Planning three customer use cases, EMS2, T2T-CFL and P&G



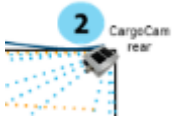
Expected results

- Aerodynamic trailer fit for rail/road transport
- Proof of concept CargoCam, possibility to monitor, measure and optimize loaded goods, an enabler of future automatic (un)/loading goods



P&G use case

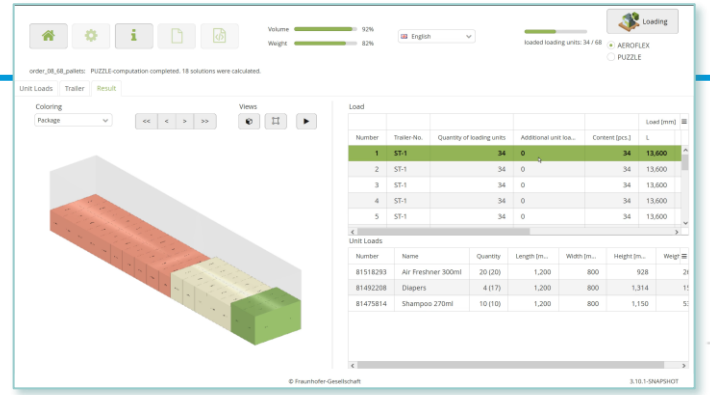
- Volume Optimized Trailer with Flex Floors allows higher load factor by double stacking
- Aeroflex Innovations: Puzzle software and CargoCam developed to enable effective and more efficiënt planning and control tested in this use case
- Test Lane between two warehouses not possible yet due to covid
- If no tests done in Aeroflex follow up project - testing 3-4 months at P&G

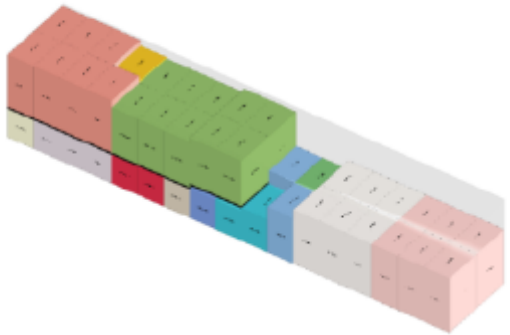


PUZZLE®

P&G use case

Filling 58%





Filling 77% = plus40%

Load

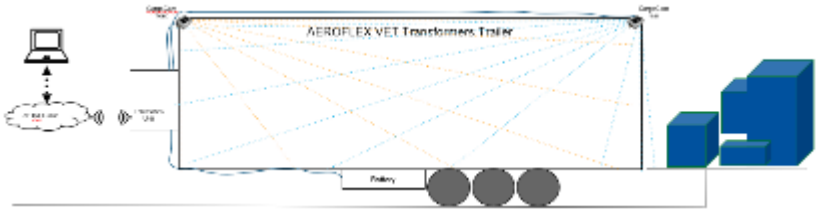
Numb...	Trai...	Qua...	A...	Co...	Load [mm] l	Load [mm] w	Load [mm] h	Volume [m³]	Net Weight [kg]	Filling...	Axle loads Kingpin	Axle loads Rear axle
1	AN...	52	18	52	1...	2...	2,664	68.28	16,313.734	77	7,332.9...	8,980.807
2	AN-1	52	18	52	1...	2...	2,664	68.28	16,313.734	77	-11.68	16,325.414
3	AN-1	52	20	52	1...	2...	2,692	68.28	16,313.734	77	7,029.26	9,284.473
4	AN-1	52	20	52	1...	2...	2,692	68.28	16,313.734	77	7,046.425	9,267.308
5	AN-1	48	14	48	1...	2...	2,692	61.57	15,603.182	70	5,492.921	10,110.26
6	AN-1	48	14	48	1...	2...	2,577	61.57	15,603.182	70	9,088.533	6,514.648

Unit Loads

Number	Name	Quantity	Length [mm]	Width [mm]	Height [mm]	Weight [kg]
81714328	FEBRE AIR BLOSSOM&BREE 6X300ML PATA DACH	2 (2)	1,200	800	1,053	307
81689094	PA PP P7 PATS 55 1X136 MSB WE TRUST	6 (6)	1,200	800	1,747	177.038
FF01	Flex-Floor	1 (1)	800	2,400	60	0
81729326	FAIRY 15CT MIX CASE 450 NOV19	10 (10)	1,200	800	1,464	520
81714317	FEBREZE AIR APRFRLEN 6X300ML PATA DACH	4 (4)	1,200	800	925	270.792
81726200	HS KF SHM SENSITIVE 300ML DACH	1 (1)	1,200	800	953	476.341
81719918	PNT VS 3IN1 CLASSIC CLEAN 250 ML DACH	1 (1)	1,200	800	915	440.426
81726200	HS KF SHM SENSITIVE 300ML DACH	1 (1)	1,200	800	953	476.341

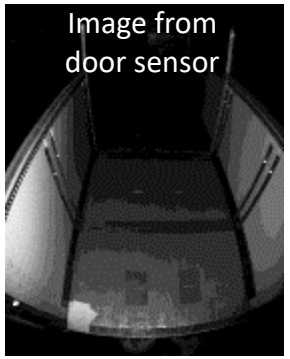
- Flexible floor but difficult for planning
- Puzzle software makes most optimal pallet pattern
- Calculates axle king pin loads
- Creates Different loading patterns
- Loading procedure
- Profile of roof for Aerodyn drag reduction

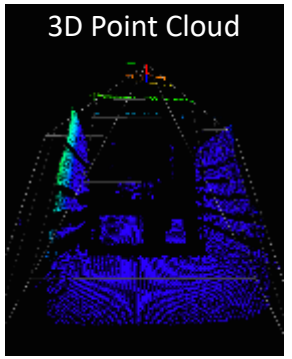
CargoCam - Overview



Objective

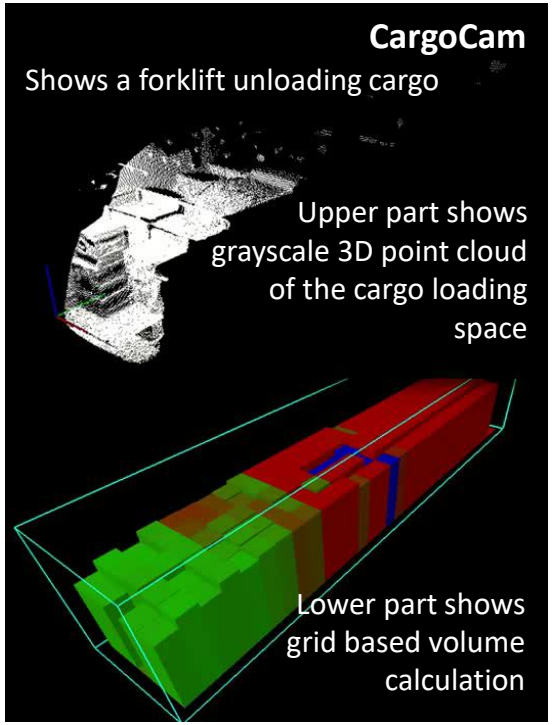
- Improve load optimization, efficiency and indirectly vehicle aerodynamics
- Sensor solution for loading space volume detection inside the trailer
- 3D sensor technology, computer vision-based algorithms and software
- PoC and prototype implementation
- Installation in AEROFLEX trailer and in-field test





Achievements

- Grid based free/occupied volume detection
- Grayscale image & 3D point cloud data provisioning
- Sensor setup + telematics + cloud backend remote access (installed in AEROFLEX VanEck roof transformable trailer)



Outlook

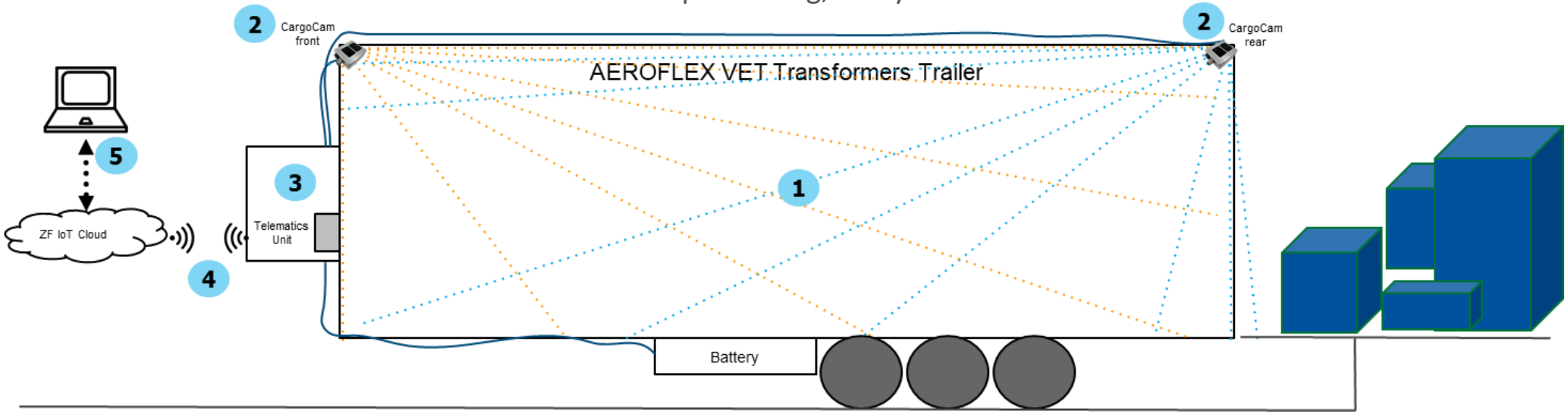
- In-field test with Procter & Gamble (planned Q3/2021)
- Final event demonstration and preparations

CargoCam - Setup & Scope

- Trailer ~14m, e.g., VanEck trailer with transformable roof
- Hardware: 3D sensor(s), box with telematics unit and other equipment
- CargoCam steps to determine volume of the loading space in the trailer
  1) Measure the cargo loading space and generate 3D point cloud date
  2) Apply algorithms on 3D point cloud data to calculate and detect free / occupied volume
  3) The telematics unit retrieves the detection results and stores it
  4) Detection results can be accessed remotely through the ZF IoT Cloud
  5) Detection results can be accessed for further offline processing, analysis and visualization

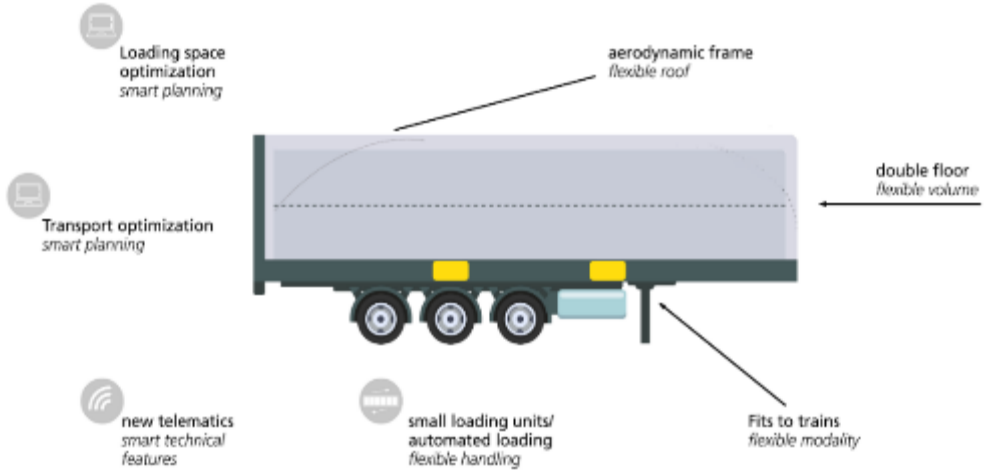
View of trailer front

View of trailer end



Discussion and exchange of views
P&G Use case and CargoCam

- CargoCam as enabler to develop automated (un)loading of freight in trailers and loading units. What is your opinion and where do you see further needs to investigate?
- What benefit brings the combination of Puzzle Software and CargoCam?
- How do you see the market for a double stack trailers and is there currently (in 2021) a request by logistic operators?
- To implement the smart (e-)trailer,
  what would be the proper cost benefit price model and
  which features would be of most value / desirable?



discussion

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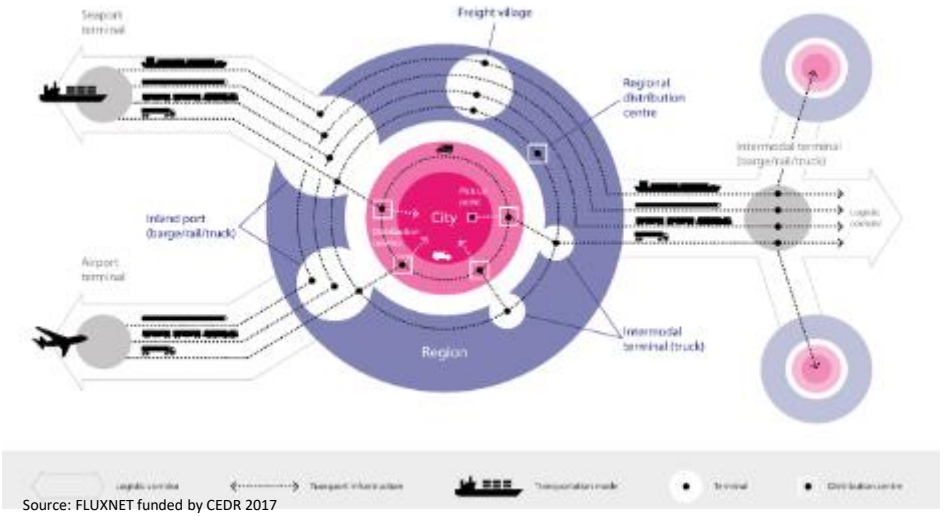
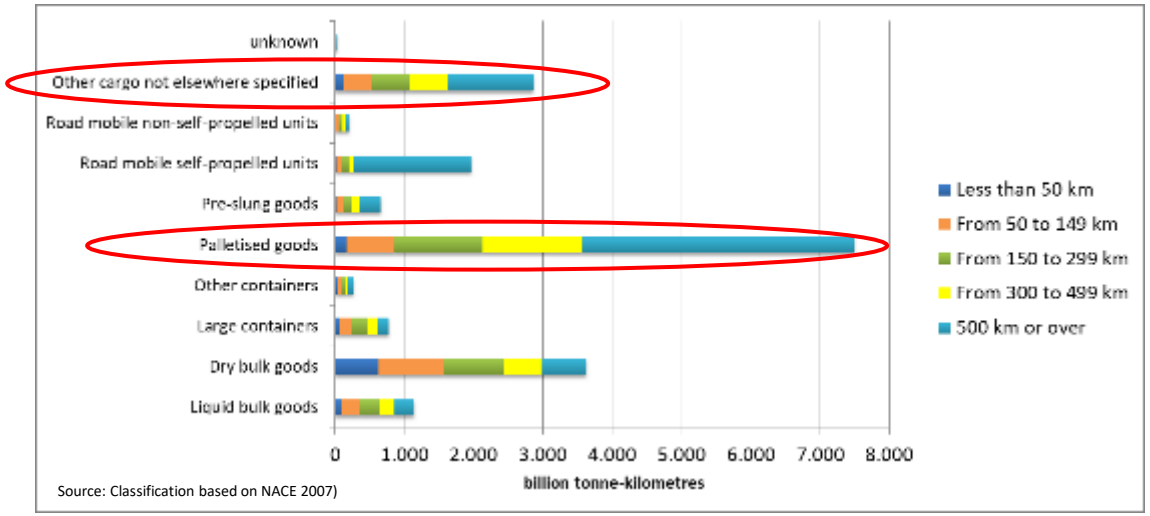
High-capacity transport, focus on the right cargo

- Infrastructure



Source: FLUXNET funded by CEDR 2017

- Relevant cargo units



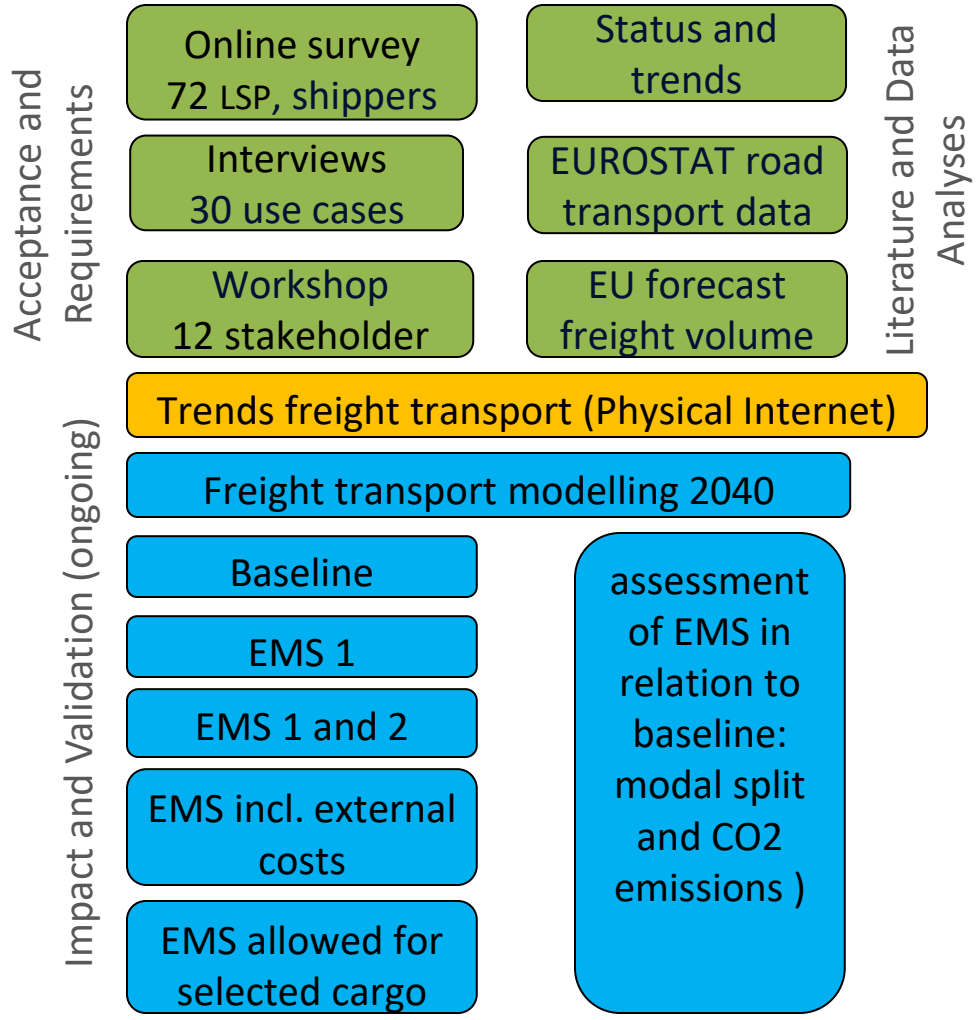
Source: Classification based on NACE 2007)

- Address logistics concepts for cargo consolidation in logistics hubs and intermodal transport chains
- Address most relevant cargo units – palletized and other cargo collis / customized boxes on long distance transports

Methodology market requirements

Concept and Progress since Sept 2020

- Macroscopic freight transport modelling – simulation of modal and mean split
- Development of 5 scenarios
  - Baseline scenario (without High-Capacity Transport (HCT))
  - Scenario 1 - HCT including EMS 1 operating without any restrictions
  - Scenario 2 - HCT including EMS 1 and EMS 2 operating without any restrictions –
  - Two scenario, 3 and 4, to limit a reverse modal shift from rail/IWW to road
    - consideration of external costs of transport
    - selection of cargo groups

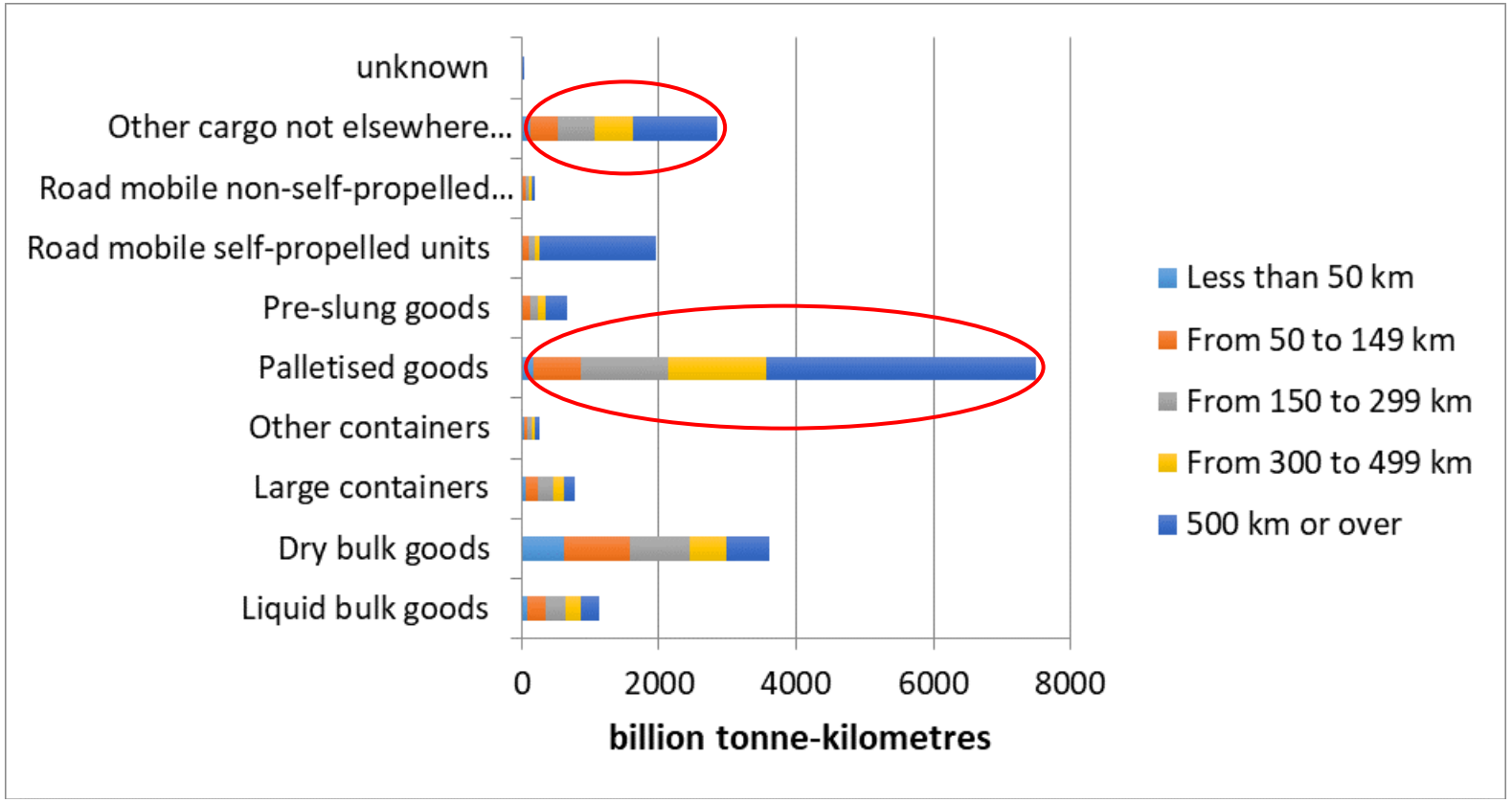


Scenario approach 2040

Identify market for HCT

- To address cargo transport with the expected highest tonne-kilometres on long road haulage
- To address growing cargo groups
- To limit a reverse modal shift from rail/IWW to road transport
- To contribute to a reduction of CO_2 emissions generated by EU freight transport

Characterization of transported cargo in EU-28 in 2016 (EUROSTAT)

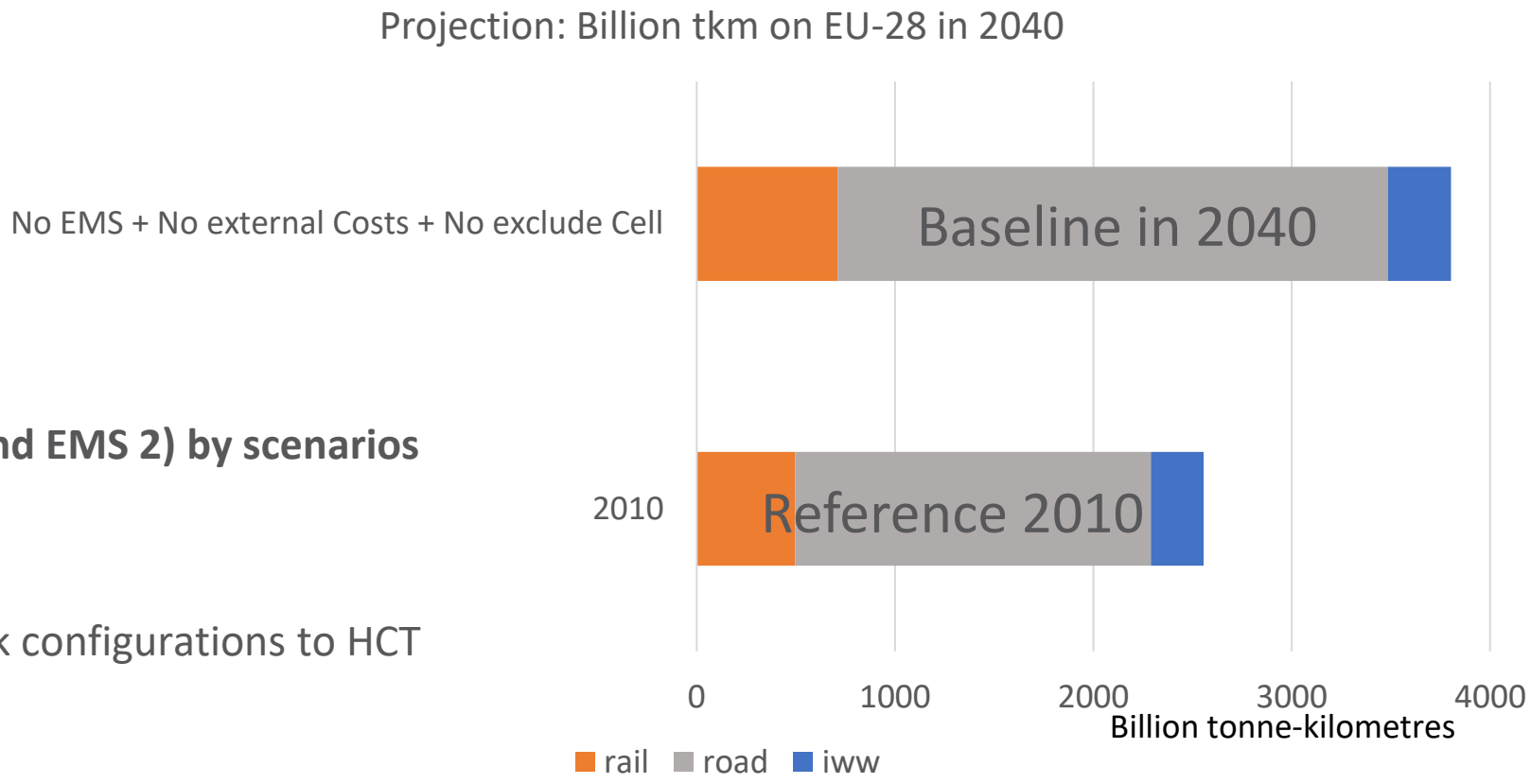


Scenario approach 2040

Baseline scenario in 2040;

tonne-kilometres **increase** in

- rail by about 43 %,
- road by about 55 % and
- IWW by about 19 %



Target is a <u>comparison</u> HCT (EMS 1 and EMS 2) by scenarios

- show the impact on
  - modal shift,
  - mean-split from standard truck configurations to HCT
- scenario approach
  - external costs and
  - selection of cargo groups

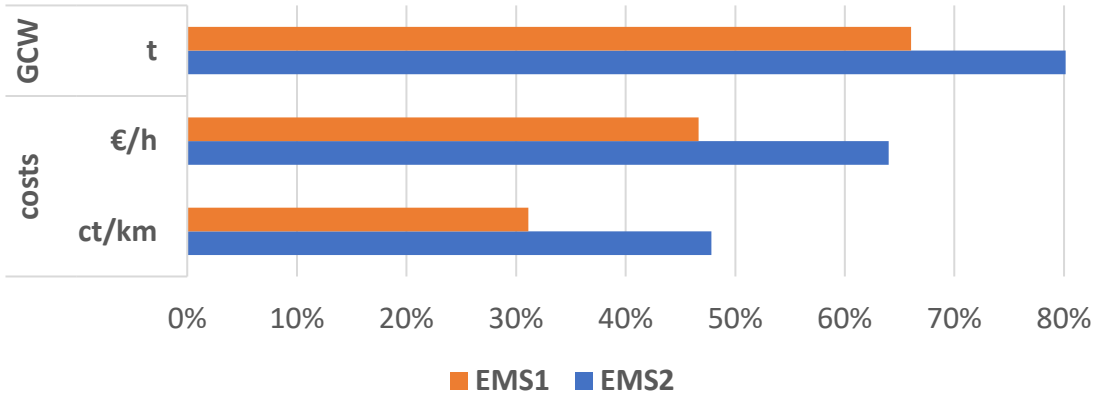
Scenario approach 2040

Important parameters adjusted in all scenarios

Increase of:

- load factor
- gross combination weight
- equipment / vehicle costs
- average fuel consumption

average increase of costs and GCW standard HDV vs EMS1/2



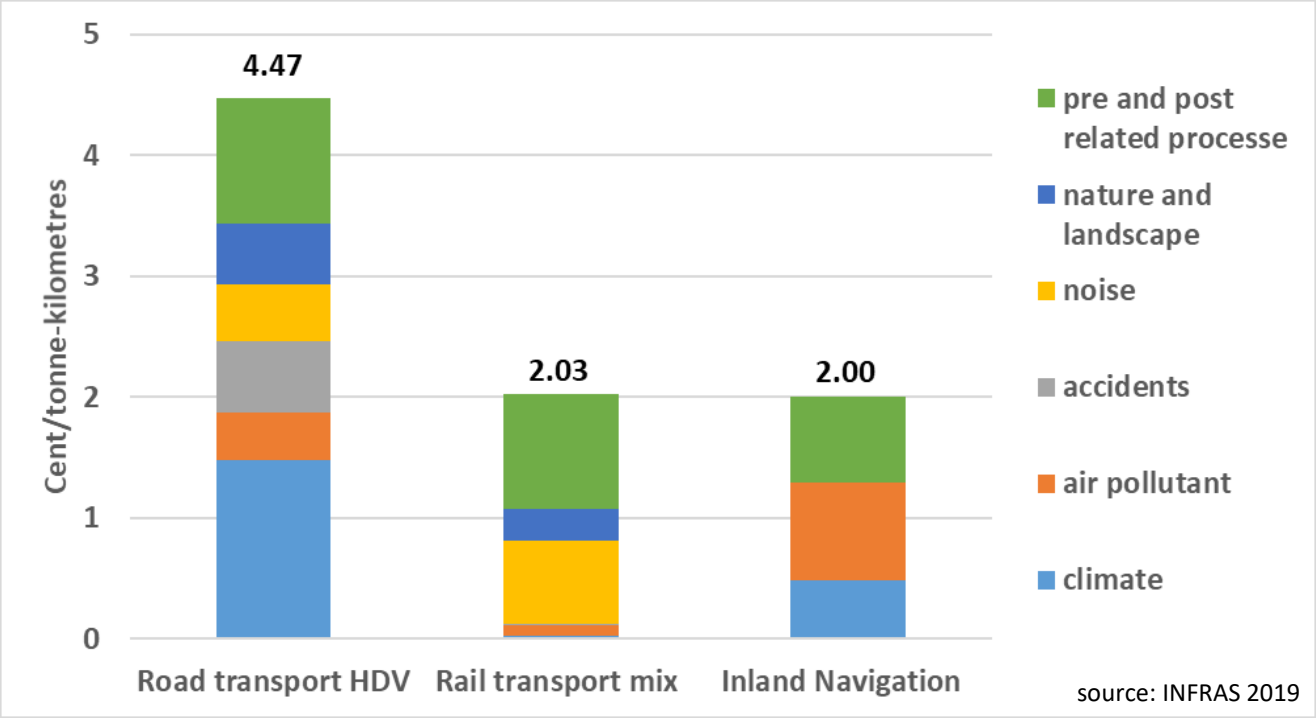
Assumption average load factor due to use of puzzle software and cargo cam

No commodity group	Description	Assumption average load factor increase in %
4	Food products, beverages and tobacco	30
5	Textiles and textile products; leather and leather products	20
9	Other non-metallic mineral products	10
10	Basic metals; fabricated metal products, except machinery and equipment	15
15	Mail, parcels	50
16	Equipment and material utilized in the transport of goods	25
18	Grouped goods: a mixture of types of goods which are transported together	35
19	Unidentifiable goods: goods which for any reason cannot be identified and therefore cannot be assigned to groups 01-16.	25

Scenario 3 including external costs

Objective: to limit modal shift from rail/IWW to road

- Figure: external costs and the different cost categories most are self explaining
- Road freight transport about 2.4 cent/tonne-kilometres higher than rail/IWW
- Pre and post related processes mean:
  - GHG and air pollutant (up and downstream) generated by maintenance and recycling related to:
    - energy sources (fuels, current)
    - “vehicles”
    - transport infrastructure
  - consequential climate costs



source: INFRAS 2019

Scenario 4 excluded cargo groups

Objective: prioritization of cargo groups for EMS vehicles

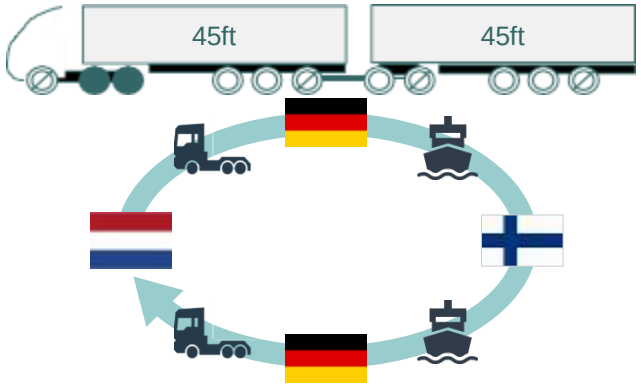
- Table: in red excluded cargo groups to minimize
  - mass commodities (group 1/2/3/7/10) will be shifted from rail/IWW to road
  - commodities not relevant for long road haulage (group 14 / 17)

Cargo group	Description	EMS1/2
1	Products of agriculture, hunting, and forestry; fish and other fishing products	
2	Coal and lignite; crude petroleum and natural gas	
3	Metal ores and other mining and quarrying products; peat; uranium and thorium	
7	Coke and refined petroleum products	
10	Basic metals; fabricated metal products, except machinery and equipment	
14	Secondary raw materials; municipal wastes and other wastes	
17	Goods moved in the course of household / office removals; baggage / articles accompanying travelers; motor vehicles being moved for repair; other nonmarket goods n.e.c.	

Results of two use cases with EMS

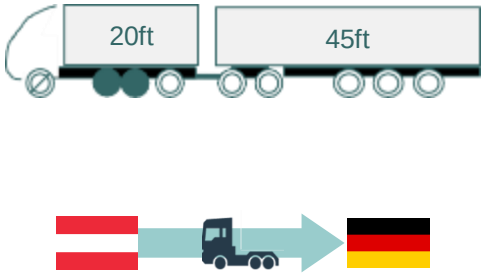
Use case 1:

- **CO_2 emission reduction potential of -25,81% (-129.6 kg CO_2e)** due to efficiency gains of EMS2
  (prime candidate 6.1; 92 t vs. 40 t GCW permissible)
- On fleet level, saving factor 2 -> 1
- Intermodal logistic chain (road & water)
- Multiple countries involved (Netherlands, Germany, Finland)



Use case 2:

- **CO_2 emission reduction potential of -32,44% (-72.0 kg CO_2e)** due to efficiency gains of EMS1
  (prime candidate 3.2; 76 t vs. 40 t GCW permissible)
- On fleet level, saving factor 4->3
- Single mode logistic chain (road)
- Multiple countries involved (Austria, Germany)



Benefits and recommendations for industry and society

Benefits

- impact on **CO2 emissions of EU road freight transport** due to decrease of road mileage in road freight transport only in scenario if external costs are considered
- **lower average transport costs** for long road-haulage determine impact on modal split
- impact on **company (logistics) level** depends on trip and route planning – that could not be derived on macroscopic freight modelling (use case level)
- impact of using EMS1 and 2 in combined transport (reduced costs for pre- and post haulage) are not significant enough

Recommendations

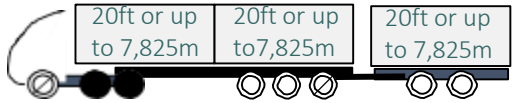
- Focus on **good classes with high tonne-kilometres and expected growing of transport volume**
- emphasize logistics optimization to **increase load factors** focus on use of EMS1 and 2 in **hub and spoke concepts** of LSP
- ramp-up of EMS1 and 2 should **be aligned with intermodal transport concepts** (e.g., flexibility of loading units)

Feedback request

SLIDO: Question 1

Which EMS1 und EMS2 vehicle configuration have the potential to become relevant for transport and logistics?

- A



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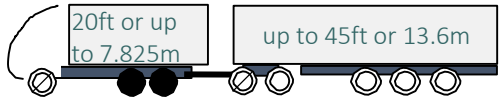

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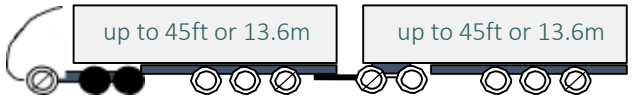

Feedback request

SLIDO: Question 2

- Select cargo groups to prioritize for EMS
- Other (use chat)

Cargo group	Description	Excluded EMS1/2
1	Products of agriculture, hunting, and forestry; fish and other fishing products	
2	Coal and lignite; crude petroleum and natural gas	
3	Metal ores and other mining and quarrying products; peat; uranium and thorium	
7	Coke and refined petroleum products	
10	Basic metals; fabricated metal products, except machinery and equipment	
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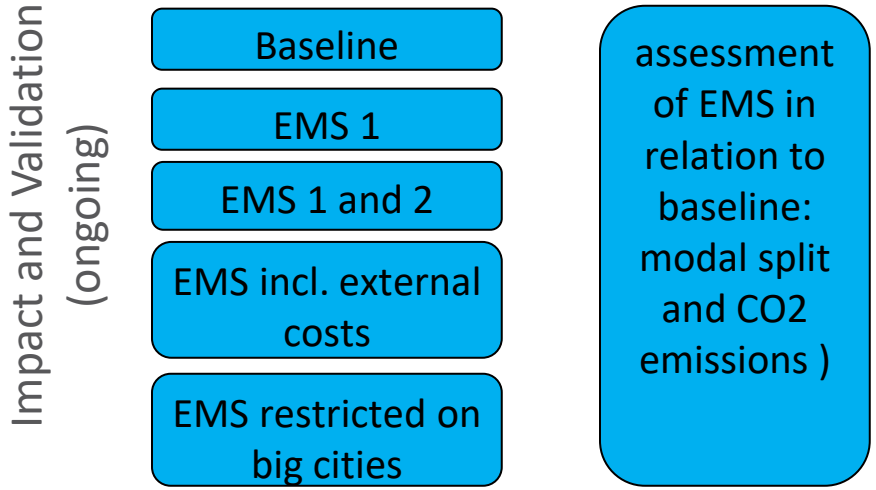
Feedback request,

SLIDO: Discussion

Are the presented scenarios and use cases addressing those with higher impact of EMS1 and EMS2 on European freight transport?

- Yes, agree
- No, I recommend …(use chat box or contact speaker)



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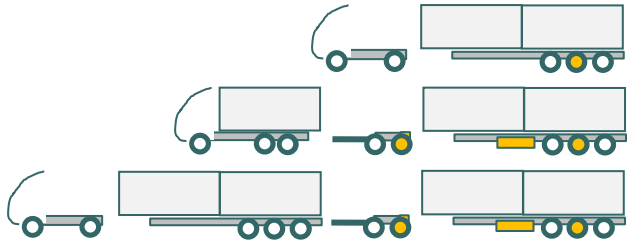
Advanced Energy Management Powertrain (AEMPT)

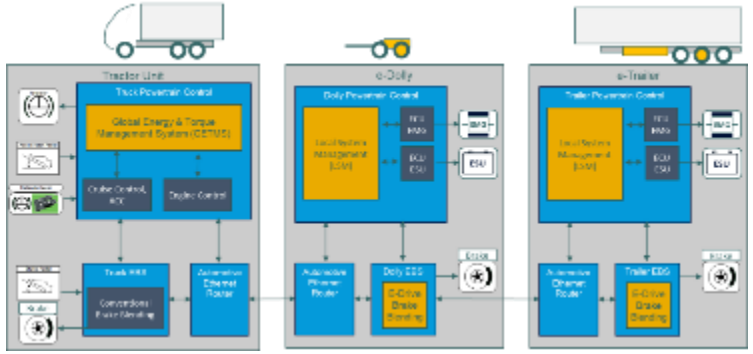
Distributed Hybrid Powertrain

- … consisting of conventional diesel engine in truck and additional electric powertrains in trailer units



Global Energy Management System

- … coordinates powertrains in truck and trailers
- … communicates via (standardized) communication protocol with local system management of trailers



Smart Power Dolly

- … equipped with steerable front and driven rear axle
- … supports manual operation via remote control

AEMPT - Benefits

Distributed Hybrid Powertrain

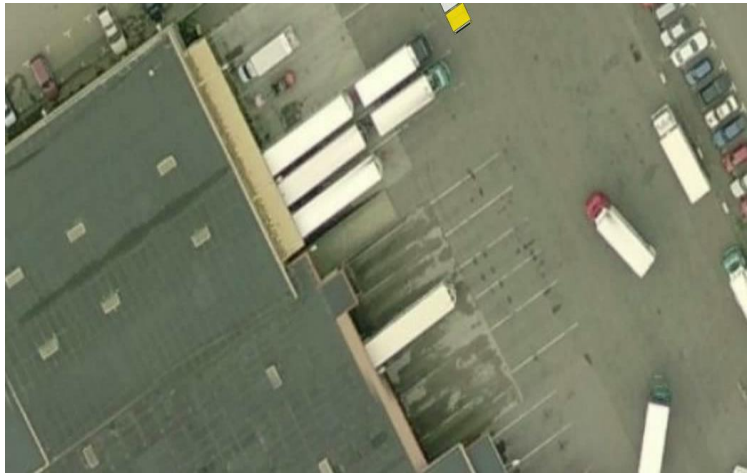
- … reduces fuel consumption and emissions
- … improves traction and driving stability (gradeability)
- … allows for flexible combination of intrinsically efficient vehicle units

Global Energy Management System

- … allows for efficient drive train control and maximum recuperation
- … supports control of up to five driven trailer units

Smart Power Dolly

- … allows for splitting of vehicle in self-driving units for manual shunting of trailers on terminals/yards



AEMPT – Progress since Sept. 2020

Development of vehicle units

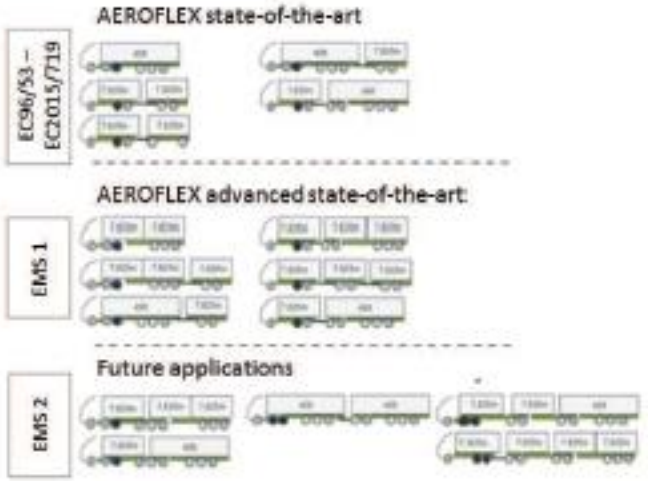
- Adaptation of TRANSFORMERS trailer drivetrain control to AEROFLEX communication protocol
- Commissioning of AEMPT demonstrator (EMS1 vehicle) at the ZF-Test Track
- Comprehensive testing of
  - Functions of Global Energy Management System
  - Behavior of electric drivetrains
  - Automotive Ethernet Communication
  - Safety measures

All functions are working. After last tests in Munich, Truck, eDolly and eTrailer are ready for consumption test at IDIADA/Spain

Smart Power Dolly, next steps

- Smart Power Dolly allows splitting of vehicle in self-driving units for manual shunting of trailers in terminals/yards

- The dolly enables long vehicle combinations, as EMS1 and EMS2
- The dolly is equipped with an electric drivetrain, enabling the use of standard truck/tractor even at a GCW up to 74 tonnes
- The dolly can operate remote controlled and at a later stage it will be driving autonomous
- In future the dolly can be used also in combination with battery electric or fuel cell driven trucks



- Safe handling of vehicle and single units,
  Reduce energy consumption,
  Reduce number of driver,
  Reduce vehicle kilometers per ton freight,
  Reduce cost of operation.

Smart Power Dolly, next steps

- Founding of a new consortium, the “knowledge and drivers”, to further develop the e-Dolly and bring it to market
- Analysis of the state of the art & cost/benefit of the prototype e-Dolly as is build and demonstrated
- Collection of typical use cases to further develop the market requirements and needs for a final e-Dolly portfolio
  - Define a minimum set of variants, dealing with the majority of market needs
- Finalization of:
  - the development portfolio and technology areas (e.g., functional testing, automated & autonomous driving, production, fast charging, road safety on public roads, multi-brand, …..)
  - Finalization and agreement on the deployment & exploitation roadmap & first draft business case for bringing the e-Dolly to the market
  - Roll out of scaling projects to demonstrate the benefits of the e-Dolly, and to convince and agree on the acceptance of the standards for type approval, homologation, and road access
- GoTo market strategy and production facilities

- Discussion & invitation to join working group
- Priorities the most important topic /decision point using slido

Feedback request AEMPT and Smart Power Dolly

- AEMPT: An e-Trailer or e-Dolly can save fuel costs.
  Which obstacles do you see for Integrating an e-Trailer or e-Dolly into logistic processes?

- A plug-in option in the trailer or dolly could further decrease fuel consumption.
  What do you see as a minimum amount of fuel saving in %,
  to consider integrating an additional charging process into your logistic processes?

- To operate a double trailer combination (tractor+ dolly+2semi trailers), a 6x4 tractor is necessary to ensure enough traction.
  An e-Trailer or e-Dolly would allow to operate such a combination with a 4x2 tractor.
  How high could the extra-costs for such a feature be so that you would consider buying it?

- An e-Dolly will allow to maneuver trailers in terminals.
  In a first step with a remote control, in future automated.
  How high could the extra-costs for such a feature be so that you would consider buying it?

- Do see any other advantages of using an e-Trailer or eDolly?

Agenda

Use Slido:

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- To find support for IAP and eDolly
- To join project ideas beyond AEROFLEX

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- **Intelligent Access Policies initiative and next steps (by Marta/Elisah)**

~15:45h **Session II - Outlook and closure:**

- R&I opportunities beyond AEROFLEX (by Ben)
- Horizon Europe opportunities (by Ben)
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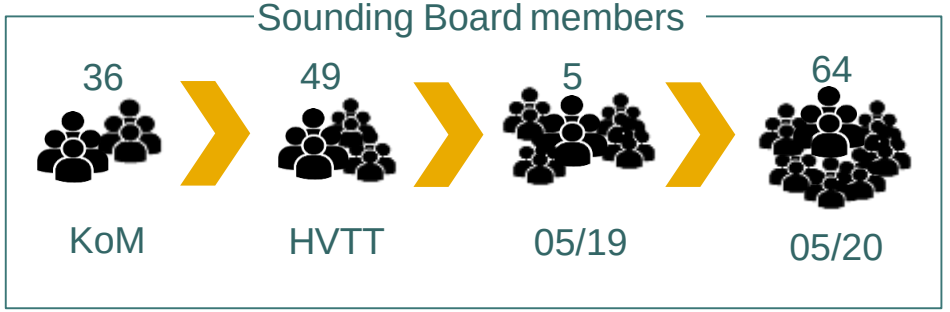
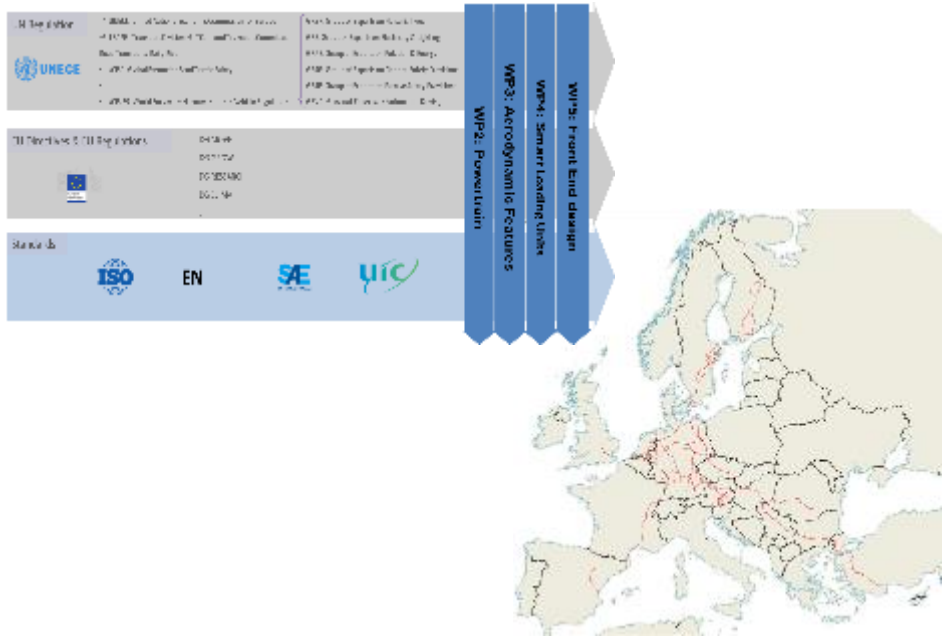
Impact and requirements, state of the art of the regulatory framework and analysis of the technologies

- 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

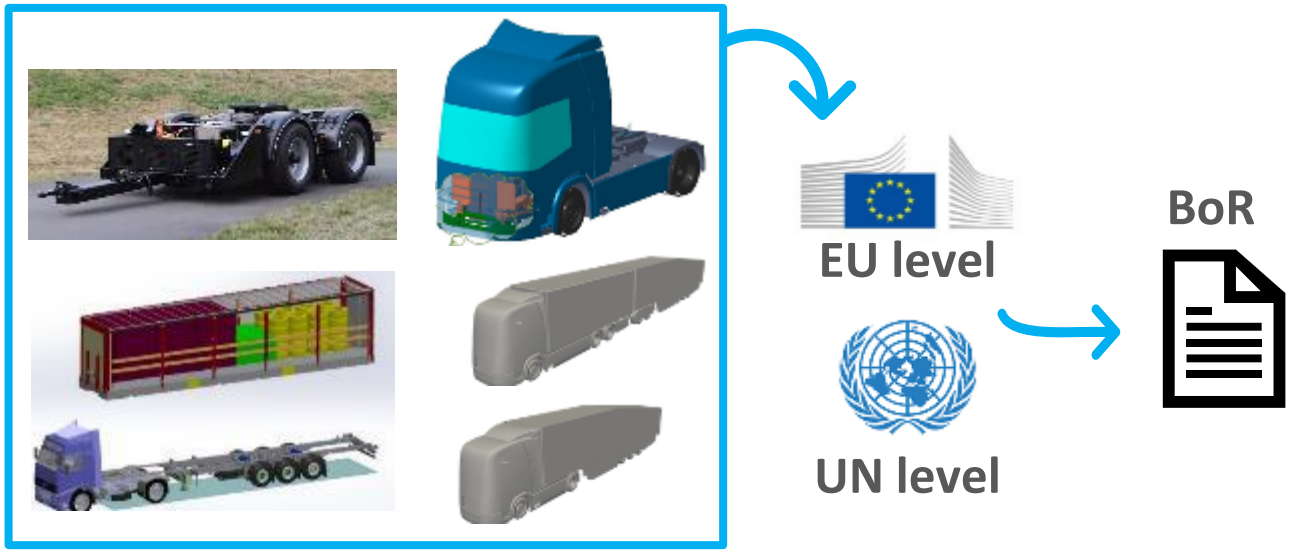
- **Recommendations** to policy-makers, authorities and industry on **standardization issues and a legislative framework** for multi-modal use of the vehicle concepts developed





Book of Recommendations

- Handbook of requirements and **recommendations** to policy-makers, authorities and industry for the **standardization, legislation and implementation** of the vehicle concepts developed within the project.



- Towards **Intelligent Access Policies Task Force**
  - Interviews → 34 interviews
  - Quizzes → 4 quizzes with 19 participants
  - Workshop → 15 participants

Participants from the five different stakeholders' clusters
(users, providers, policymakers, planner & owners, facilitators)

Intelligent Performance Based Standards for safe and efficient use of vehicles

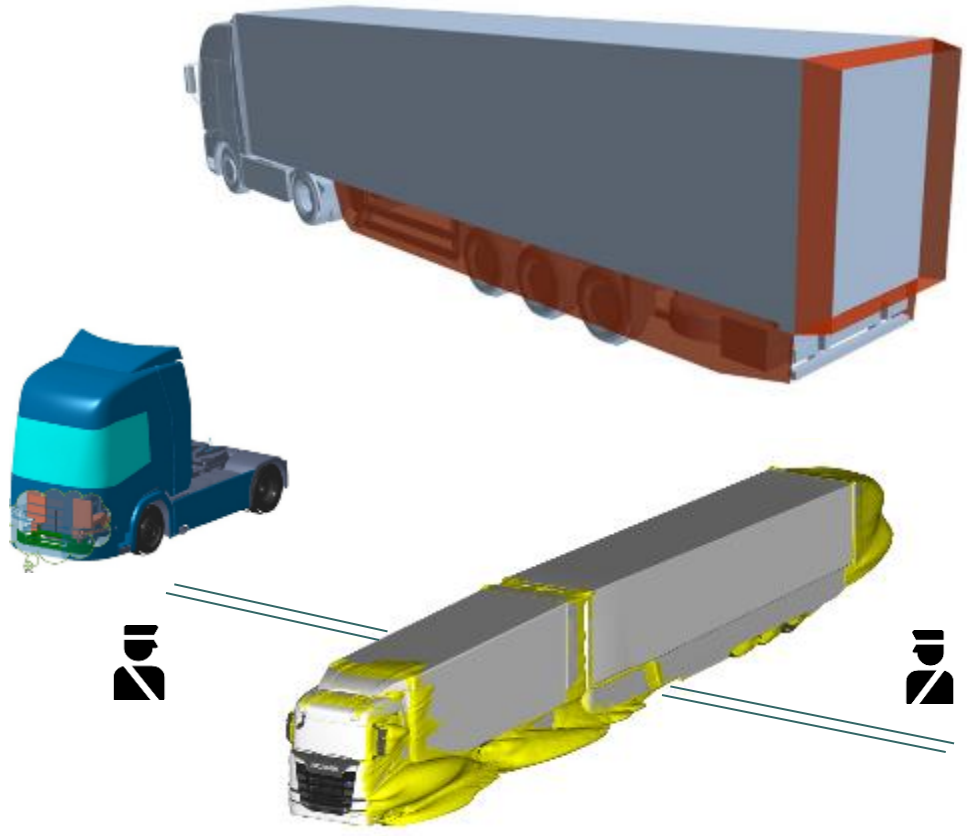
EU level

EC tenders

- Bodies and trailers –development of CO2 emissions determination procedure
- Further development of VECTO and update with new technologies

EU Regulation

- Amendment on Directive (EU) 2015/719 and Directive 96/53/EC of Weights and Dimensions

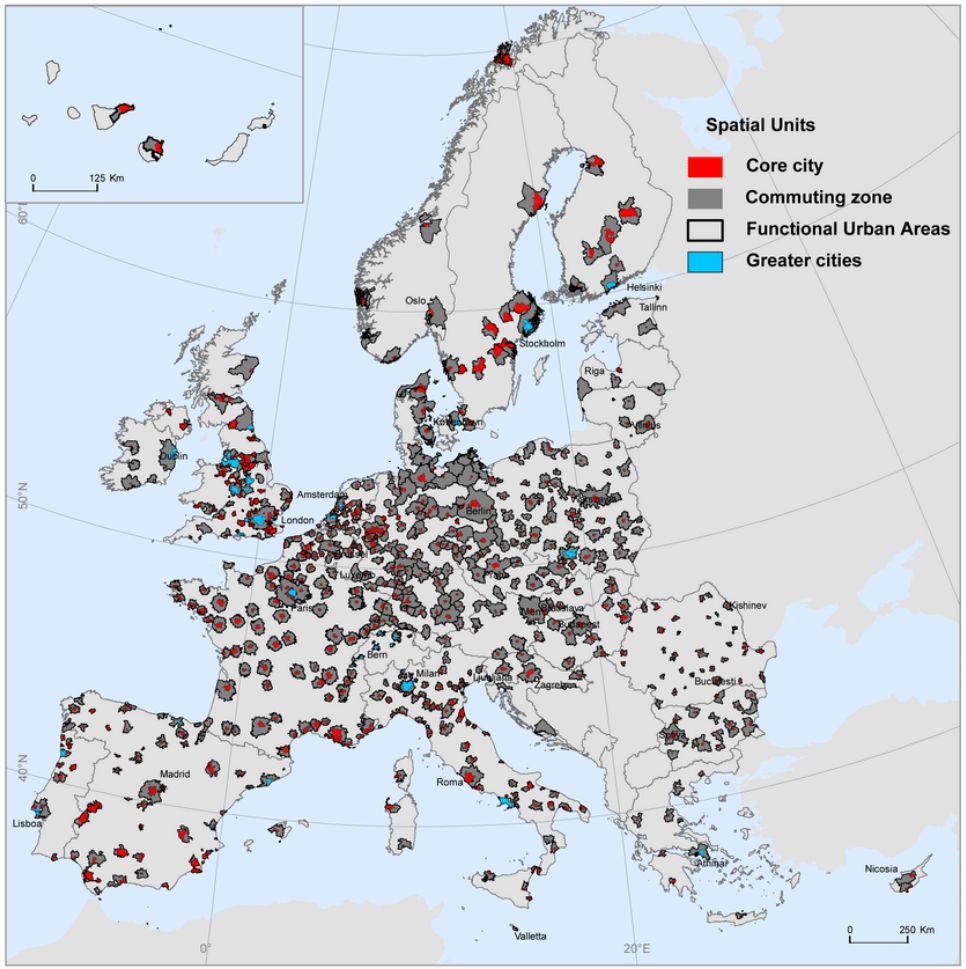


Intelligent Access policies are an opportunity to take away the burdens

- Group of experts to identify and agree on technical requirements to be linked with the AEROFLEX initiative,
  the Intelligent Access Policies (IAP) Task Force

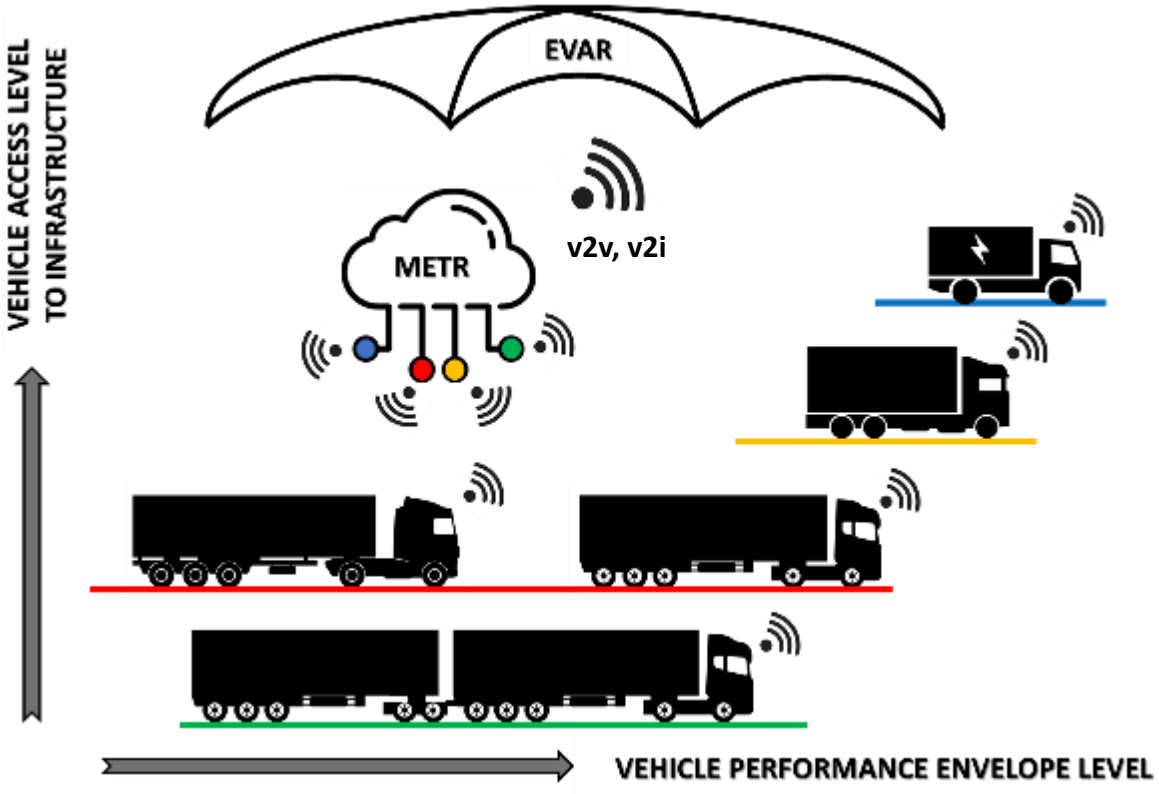
- **Access policies,**
  an opportunity to take away the burdens through
  - **management of access,**
    the right truck - the right cargo - the right time – the right cost
  - **regaining the control on the logistics and transport operation**

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



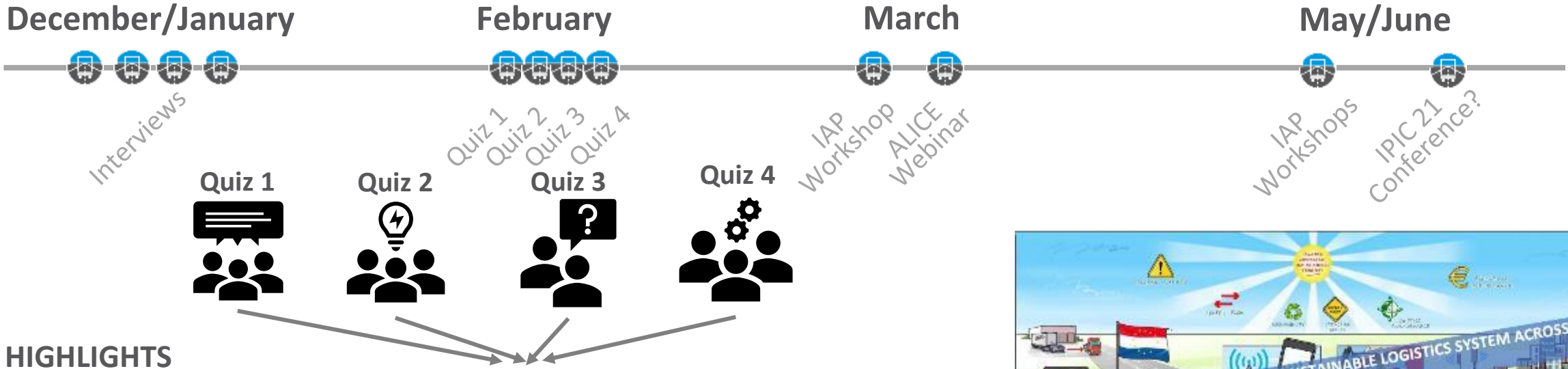
Intelligent Access Policies for Safe and Efficient Use of Infrastructure

- "Pathway to Intelligent Access Policies through Europe to safeguard freight transport in a healthy, safe and environmentally friendly context"



- Task force to promote European Vehicle Access Regulations (EVAR) & Management for Electronic Traffic Regulations (METR) in Europe
- High level harmonized rules, adoption of parameters to manage local circumstances
- Current directive on weight & dimensions already allow EMS vehicles at regional and national level
- Group of experts to identify and agree on technical requirements using standard and EMS vehicles for EU cross border freight transport

IAP Task Force, interviews, quizzes, workshops



HIGHLIGHTS

- Positive view of EMS vehicles because of their benefits regarding CO2 emissions and cost reduction
- Harmonization and shared-view. IAP to start working at local level and in parallel communicate at EU level on the benefits of IAP
- Pick-up the interest of DG MOVE and use it as a momentum (CO2 emissions, road safety, growth in demand)

Results Quiz meetings

How do we get sustainable & efficient (EMS) vehicles on the road in Europe?

- Harmonized policies and shared vision needed

What are the challenges to implement IAP in the EU?

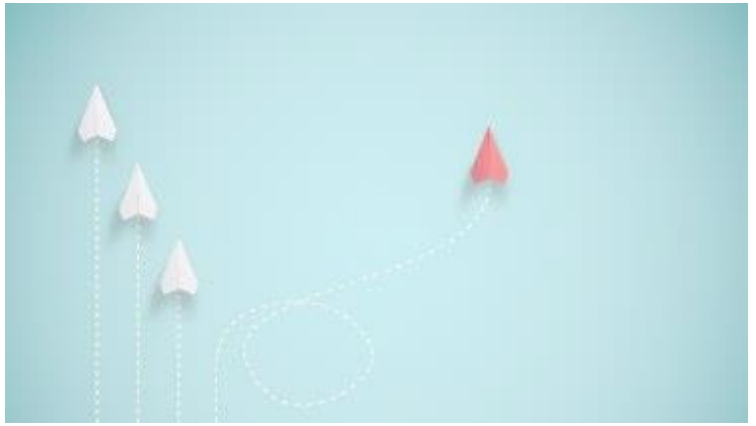
- Resistance to change
- Resistance to share data

What are the success factors for IAP in the EU?

- Green deal
- Trust, and scalability important for success

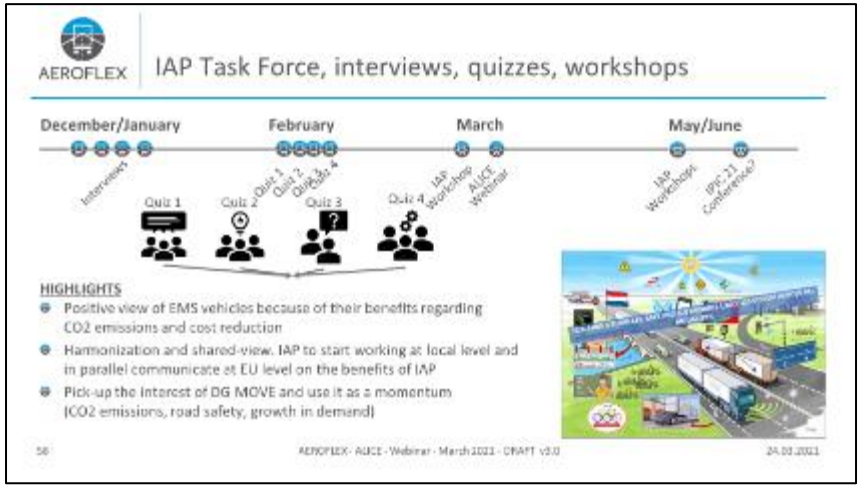
What are the opportunities to use IAP as enabler for more sustainable transport in the EU?

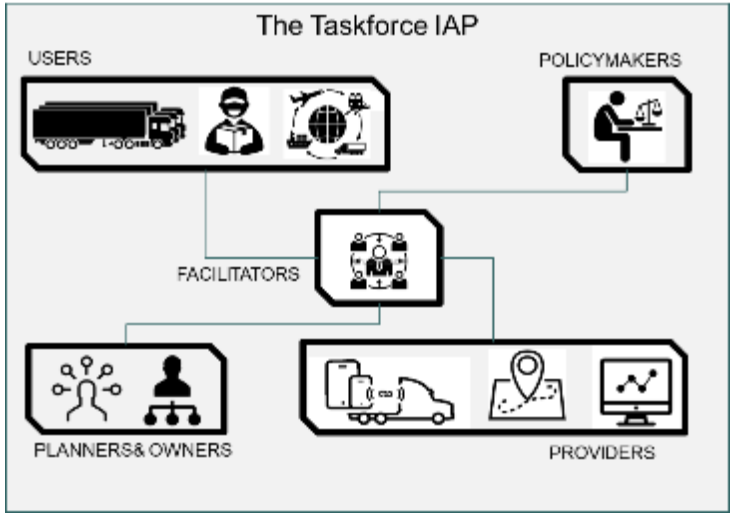
- Reduction of road freight emission biggest opportunity



Aggregated results based on 4 quizzes: n=19; n=19)

Workshop creating a common story





- Pilot NL EMS2 introduction supported by Intelligent Access Policies

Output workshop, first draft and in need of follow up

Special edition, December 2030

TIME

First the iPod, then the iPhone, now the "iAP": getting your goods to you, green and groovy!

Intelligent Access puts the right truck on the right road (at the right time)

- Community, reclaiming streets
- Trust and transparency
- Better planning for logistics & transport

- Less stressed roads (congestion & accidents)
- Advantages overachieved a safe and well-maintained infrastructure

- IAP contribute to a more robust system by allowing instead of restricting

- System using standards as plug in being in place

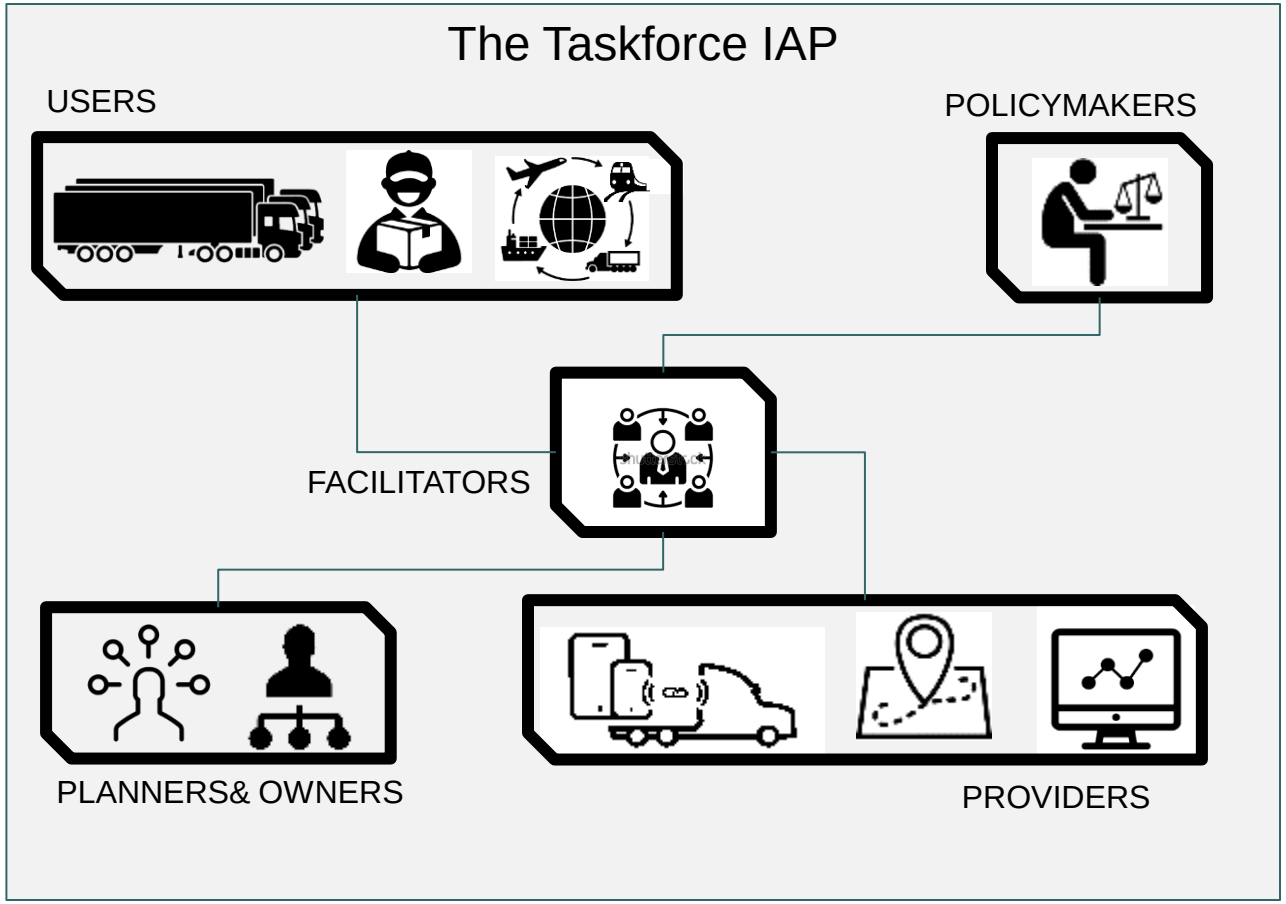
- Neutral institution in which all stakeholders are present

core achievements and steps

- Create awareness
- Get all stakeholders involved
- A governmental mandate to start IAP process
- An organization drives the change
- Small scale show cases on regional, national level,
- …….
- …….

IAP Task Force, next steps

- Return your opinion by slido or mail



- How can we support the group of experts, identifying technical requirements for EMS cross border?
- How can stakeholders support the IAP Task Force?
  - Develop the concrete steps / activities
  - How to secure the budget
  - How to bring the IAP on the EU agenda

- Do you want to join the IAP Task Force as active person?
- Do you want to contribute the IAP Task Force as advising expert?

End of part 2

Agenda Part 3

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Keep healthy

The AEROFLEX project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 769658