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

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Deliverable Type	REPORT	
Dissemination level	CO - Confidential, only for members of the consortium (including the Commission Services)	Public Summary

Publishable Executive Summary

Work package 4 – Smart and flexible loading units - analysed and worked out three new concepts for smart and flexible loading units within the Aeroflex project.

At first, Deliverable D4.1 defined several use cases, requirements and KPI's for smart loading units in a multi-modal context. D4.2 described the definition of three concepts with different point of view and assessment of their potential efficiency improvements. These concepts were detailed and delivered as a set of design specifications of smart and flexible loading units for demonstrators. These concepts aim for different market segments, so there is no perfect solution for all, but individual perspectives for each market.

This Deliverable D4.3 describes the detailed design of the smart loading unit solution to be incorporated in the demonstrator for the whole Aeroflex project and the first results.

Concept 1 handles the multimodal flexibility, which is relevant for future transport chains for more than 300 km distance. The CO_2 saving for railway transportation is high. The flexible Loading Unit must fit to the most relevant handling techniques to switch from road to rail in this concept. The VanEck trailer is equipped with many innovations for load effieciency improvements and aerodynamic features. The goal is to prove that these innovations also allow the transport of the trailer by train.
Therefore, this trailer was technically changed by VanEck like adding grapperpockets, active side skirts, fixing the aerodynamic devices for moving backwards and a many more, and is ready now for testing. The test is planned for spring 2021 at CFL Luxembourg, where the test for the handling techniques crane, NiKraSa, Modalohr and pocket waggon and the train transport to Spain on Modalohr waggon starts.

Concept 2 refers to the loading space efficiency. There is much potential in load space optimisation left for palletized goods. For this concept, the technical innovation of Transfomers – the flexible double floor- has been combined with two digital / electronical innovations to come to a further effect.

The trailer allows lifting parts of the floor, to have an additional floor inside the trailer and one can load more pallets in the same trailer. However, in detail there are several problems for the planner like e.g. weight balance in the trailer or the mathematical knapsack problem. This is a common but difficult mathematical problem. For Aeroflex, Fraunhofer IML further developed their software PUZZLE® and used the proven algorithms for the double stock trailer. It helps now in calculating a good solution and loading plan. The test of the real use case, spring 2020, showed that within that case the filling rate went up significantly with a final growth of 40 % volume efficiency. An additional test, spring 2021, of the real use case will verify the calculated plan and at the end the loaded plan is the same which is highly expected to be so.

Additionally, a camera inclucing several sensors is developed by ZF (CargoCam). The demonstrator shall allow to determine the height profiles of cargo space in the trailer. The proof-of-concept includes the integration and installation of the CargoCam prototype in the VET semi-trailer with a transformable roof to be used in field tests in the first half of 2021. First tests have also shown trailer-specific challenges like reflections.

Concept 3 – Modularisaton and horizontal collaborations – has a visionary focus. It deals with preparation of automatized handling in future and the devlepment of smaller units (NMLU) than a standard trailer. The customer Use case for milk run, spring 2020, in co-operation with EU-project Cluster 2.0 was a great succes. It showed for example that the total time saving for the Logistic Service Provider was 43 % and the shift form road to rail of the small units was shown.

The technical features developed in this WP show current developments; further gains will arise due to the vision of physical internet (self-routing loading unit) and all the necessary innovation within the process to reach it. All three concepts show different parts of being prepared for the future physical internet.

The evaluations have shown that future loading units need to be flexible in the use of transport mode (Road, Rail and Waterway), need several “intelligent” devices, to have necessary data available and at the end, the technique should allow automation of the processes.

The ambition is now to prove both concept 1 and concept 2 early 2021 regarding Multimodal Trailer to Train EMS2 application and loading space optimization.

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1	MAN	MAN TRUCK & BUS AG
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5	VOLVO	VOLVO TECHNOLOGY AB
6	CRF	CENTRO RICERCHE FIAT SCPA
7	UNR	UNIRESEARCH BV
8	SCB	SCHMITZ CARGOBULL AG
10	TIRSAN	TIRSAN TREYLER SANAYI VE TICARET A.S.
11	CREO	CREO DYNAMICS AB
12	MICH	MANUFACTURE FRANCAISE DES PNEUMATIQUES MICHELIN
14	CHALM	CHALMERS TEKNISKA HOEGSKOLA AB
15	DLR	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV
16	FHG	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
17	HAN	STICHTING HOGESCHOOL VAN ARNHEM ENNIJMEGEN HAN
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26	VET	Van Eck Trailers

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