TRANSFORMERS

PUBLISHABLE SUMMARY

WORKPACKAGE:	**WP4**
DISSEMINATION LEVEL:	**PUBLIC**
TITLE:	**MISSION ADAPTABLE TRUCK TRAILER ARCHITECTURE**
DATE:	**20/12/2014**
VERSION:	**FINAL**
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1 WP4 Mission Adaptable Truck Trailer Architecture

1.1 Task 4.1 – Configurable Aerodynamics

One important event for Task 4.1 in the first year was the Aerodynamics Workshop that was held in Gothenburg on June 3rd and 4th. Participators were Thorsten Koch from Fraunhofer LBF, who is in charge of this activity, and participants from trailer makers and OEMs. Especially important were the aerodynamics experts from Volvo and Daimler, Anders Tenstam and Theo Volkers, who are not participating in the TransFormers project otherwise, but made a really important contribution with their expertise. Delivery D4.1, the "aerodynamics toolbox", has been successfully delivered. See Figure 4-1 for one of the highlights from this report.

		c_D	A/m^2	$c_D \cdot A/m^2$	$\Delta F_{D, rel.}$
	a)	0.651	10	6.51	+25.0%
	b)	0.542	10	5.42	+4.0%
	c)	0.521	10	5.21	Ref.
	d)	0.554	8.93	4.94	-5.2%
	e)	0.472	10	4.72	-9.4%
	f)	0.457	8.93	4.08	-21.7%

Figure 1. Values and drag force reductions for a few use cases with different settings of trailer height and roof deflector.

So with deflector and trailer roof in their lowest positions, which could be the case when driving with high density goods, the drag force is reduced by 22% compared to the reference with deflector and trailer roof at 4.0 m. The impact on the fuel consumption depends on several other variables, but a reduction by 5 to 7 percent may be an indication.

1.2 Task 4.2 – Load Optimization

For Task 4.2 it has been an exciting year with a workshop in Brussels on July 29th and stakeholder workshop with Nestlé on September 9th to mention a couple of highlights.

One of the challenges is to find some extra millimeters to be able to always squeeze in 34 pallets. Van Eck has presented some alternatives, such as a flexing front bulkhead and some different alternatives for the door, that will give at 60 mm extra or more. Also some options for double floor and some options for moveable roof have been presented.

It has been decided that for moveable roof on the prototype trailers, there will be four sections on the Van Eck trailer and only one section on the SchmitzCargobull trailer. Also it has been decided that on the SCB trailer lowest front edge height will be 3.50 m and lowest rear height will be 3.10 m.
A tour analysis at EDEKA has been performed, with the objective to identify trailer requirements. The transport tour, facilities with ramp etc. and the loading process were observed and analyzed. A few observations were that an uneven or deep step creates problems during loading, additional reinforcements inside of sidewall is needed to cope with fork lift impacts, and a box with securing straps was in the way, so a possibility to store straps would be good to develop.

Fraunhofer LBF is working with load volume indicator. There are a few concepts to choose from, each with their pros and cons depending of concept, each sensor will "see" a smaller or larger area within the trailer, and depending on that a different number of sensors will be needed to calculate the height profile. When the height profile is known, the roof height can be automatically adjusted accordingly, see Figure 4-2.
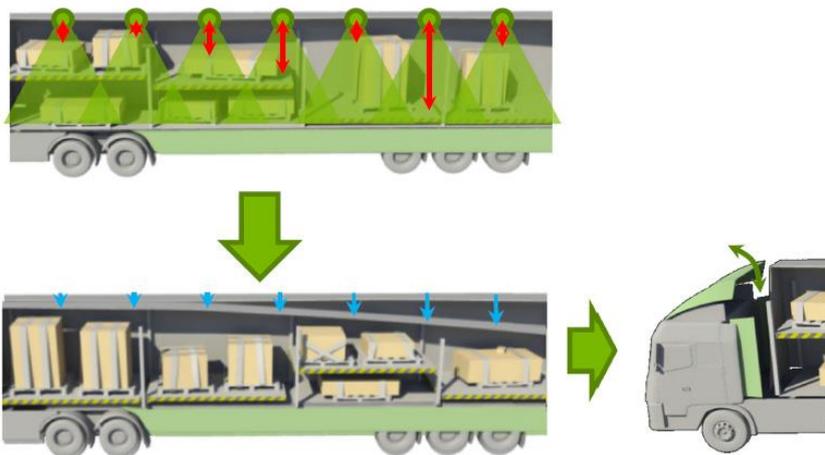

Figure 2. Values and drag force reductions for a few use cases with different settings of trailer height and roof deflector.

Van Eck has started to look at future concepts beyond present regulations, but the discussions and collaboration in this area has not started yet.

1.3 Task 4.3 – Simulations on Stability

TNO has investigated the dynamic properties of both a proposed combination of driven tractor and a HoD semi-trailer, as will be tested in WP6, and a conventional combination of a driven tractor and a passive semi-trailer as reference. Frequency analysis and simulations have been performed.

The frequency analysis gave that stability issues mainly occur at higher vehicle velocities and that there were no significant differences between the conventional vehicle and that with the hybrid-on-demand system.

Simulations showed that the proposed combination with HoD will not endanger stability compared to the conventional combination. It does show slightly larger lateral displacements, but velocity, angular rate and acceleration is similar. During maneuvers, slip could sometimes happen to wheels on the driven trailer axle, and therefore it is recommended to have traction control installed in order to save energy and tire wear.

1.4 Task 4.4 – Prototype Development, Integration and Test

Task 4.4 is a real challenge where WP3 and WP4 come together. The load optimization systems for the Van Eck trailer, the two solutions for moveable roof and hybrid-on-demand system for the SchmitzCargobull trailer are to be specified in detail and integrated and tested.

A plan for purchasing and planning is in the process of taking form, and detailed design has come long way already. One important milestone was that the drive axle from Meritor was delivered to SchmitzCargobull, to be included in the trailer.

Figure 3 The drive axle from Meritor to be used together with the electric motor and generator and batteries in the SchmitzCargobull semi-trailer prototype.