



## DELIVERABLE REPORT

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## Executive summary

The objective of the EU-funded project TRANSFORMERS is to demonstrate highly efficient truck-trailer concepts for long-haulage applications. Therefore, TRANSFORMERS combines a modular approach for mission rightsizing by means of hybridization, truck engine downsizing and a trailer design that addresses simultaneously aerodynamics and load efficiency improvements. The overall goal is to achieve a 25% higher load efficiency (in energy/km.tn) in a real world application, while taking the needs to maintain road infrastructure and traffic safety into account.

A key innovation of TRANSFORMERS is the so-called Hybrid-on-Demand-Driveline (HoD-Driveline). For the first time, this system enables an augmentation of conventionally driven trucks and tractors to fully functional mission-adaptable hybrid vehicles, simply by coupling them to an innovative trailer equipped with an electric driveline. Hence, the HoD-Driveline concept is applicable to many kinds of truck-trailer and tractor-semitrailer vehicle combinations.

In addition to the HoD-Driveline concept TRANSFORMERS develops a pre-standard HoD-Framework. The objective of this framework is

- to ensure the interoperability of the HoD-Driveline concept with today's trucks *and* with future trucks featuring advanced energy management capabilities,
- to provide a slim common interface between trucks and trailers, that requires only minimal changes in trucks.

Deliverable D3.1 describes the capabilities and features of the framework. The main outcome is the definition of

- the content and scope of the standardization process included in the framework,
- the main functional tasks of the HoD-Driveline, and
- logical and physical HoD-Driveline architecture.

Therefore, the framework defines considered vehicle combinations that are clustered into two reasonable cases:

- Case A. Standard truck without complete Vehicle Energy Management System (VEMS) is coupled to HoD-Trailer,
- Case B. Future truck with HoDF-compliant Vehicle Energy Management System is coupled to a HoD-Trailer.

This distinction is necessary, because standard trucks are not designed for driven trailers. Hence, for Case A the trailer driveline is allowed to operate only in carefully predefined scenarios, to avoid interferences with advanced fuel-saving technologies like e.g. gear shifting strategy, weight approximation, cruise control strategy, ECO-Roll or even vehicle dynamics. The scenarios defined for Case A will be part of the framework.

In contrast to that, the truck's VEMS is fully responsible for operating the trailer driveline in Case B applications. The framework will not define any operating scenarios for Case B. Thus, technological competition is ensured and supported.

Based on these findings, the HoD-Framework defines use cases, logic structure, main functionality, and interfaces for each case separately. Despite the significant differences, the consortium succeeded in defining a common E/E-Architecture taking into account not only the two cases but also key features like interoperability, mission-based rightsizing, and modularity.

The final outcome is a multi-domain driveline architecture for the HoD-Driveline concept, which ensures a broad interoperability with different trucks today and in future, while taking key parameters like costs and complexity into account. Furthermore, the driveline architecture including the associated capabilities and features are translated into a requirements specification that will support the development of HoD-Framework applications.

## Contents

Contents .....	3
List of Acronyms .....	4
1 Introduction .....	5
2 Considered Vehicle Combinations .....	5
3 Operating Conditions and Vehicle States .....	8
3.1 General vehicle states for truck with HoD-Trailers .....	8
3.2 Vehicle States to be considered for the HoD-Framework.....	10
4 Capabilities and Features of the Hybrid-on-Demand Framework.....	13
4.1 Case A Framework Capabilities and Features .....	13
4.1.1 Scenario 1 – Truck Driveline Torque Request > 0 .....	13
4.1.2 Scenario 2 – Truck Brake Request > 0.....	14
4.2 Case B HoD-Framework Capabilities and Features .....	16
4.3 HoD-Framework System Architecture .....	16
4.3.1 Logical System Architecture .....	17
4.3.2 Physical System Architecture .....	18
4.3.3 Required Signals and Signal Routing Solution .....	20
5 Resulting Requirements .....	23
5.1 Non-functional Requirements .....	23
5.2 Functional Requirements .....	24
5.2.1 TDMS Requirements .....	24
5.2.2 VCU-Interface Requirements .....	26
5.2.3 EMG-Interface Requirements .....	28
5.2.4 ESU-Interface Requirements .....	30
6 Discussion and Conclusions .....	31
7 Recommendations .....	31
8 Risk Register .....	32
9 Acknowledgment .....	33
10 Appendix List .....	33

## List of Acronyms

**Table 0-1: List of Acronyms**

Acronym	Description
<b>ABS</b>	Anti-lock Braking System
<b>ASR</b>	see TCS
<b>CC</b>	Cruise Control
<b>EBS</b>	Electronic Braking System
<b>EBSI</b>	Electronic Braking System Interface
<b>EMG</b>	Electric Motor Generator of the trailer
<b>EMGI</b>	Electric Motor Generator Interface
<b>ESU</b>	Energy Storage Unit of the trailer
<b>ESUI</b>	Energy Storage Unit Interface
<b>HoD</b>	Hybrid-on-Demand
<b>HoDD</b>	Hybrid-on-Demand-Driveline
<b>HoDF</b>	Hybrid-on-Demand-Framework
<b>ICE</b>	Internal Combustion Engine
<b>PTO</b>	Power Take-Off
<b>TCS</b>	Traction Control System
<b>TDMS</b>	Trailer Driveline Management System
<b>TEMS</b>	Trailer Energy Management System
<b>VCU</b>	Vehicle Control Unit
<b>VCUI</b>	Vehicle Control Unit Interface
<b>VDC</b>	Vehicle Dynamics Control
<b>VEMS</b>	Complete Vehicle Energy Management System

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	<p><a href="http://cordis.europa.eu/fp7/cooperation/home_en.html">http://cordis.europa.eu/fp7/cooperation/home_en.html</a></p>
	<p><a href="http://ec.europa.eu">http://ec.europa.eu</a></p>

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## 10 Appendix List

N/A