



# AEROFLEX

Deliverable No.	AEROFLEX D1.1	
Deliverable Title	Transport market and its drivers with respect to new vehicle concepts	
Deliverable Date	30-04-2018	
Deliverable Type	REPORT	
Dissemination level	Public	
Written By	Anika Lobig, Saskia Seidel, Andreas Lischke (DLR) Tim Breemersch (TML)	2018-04-09-
Checked by	Magnus Olbäck (Volvo) Gertjan Koornneef (TNO)	2018-04-15 2018-04-12
Approved by	Cor van der Zweep (Uniresearch) Ben Kraaijenhagen (MAN) - Coordinator	2018-04-26
Status	FINAL	2018-04-30



The mission of the AEROFLEX project is to support vehicle manufacturers and the logistics industry to become prepared for future challenges in road transport. The main objective of the AEROFLEX project is to develop and demonstrate new technologies, concepts and architectures for complete vehicles that are energy-efficient, safe, comfortable, configurable and cost-effective. Work package 1 contributes to the overall project objective by describing the needs of the European logistics market in order to enable a vehicle development in line with the market requirements. The present report represents deliverable 1.1. The objectives of this deliverable are:

- to describe the European transport market
- to describe trends and market drivers in logistics
- to describe variables which influences actor's modal choice in freight transport
- to derive first recommendations regarding use cases coming from the market analysis.

The results of the deliverable 1.1 are used in other work packages to support the selection of use cases. A first stakeholder workshop has shown that it is difficult to translate the requirements of the logistics service providers directly into technical details of new vehicle concepts. Therefore it wasn't possible to define primary candidates immediately and solely based on the input that was given by the FALCON project.

Instead, the results are based on the one hand on the analysis of literature and reports of European projects like TRANSFORMERS, FALCON or ALICE. On the other hand a first workshop with stakeholders (e.g. logistics service providers, shippers) have been conducted and analysed regarding user needs and requirements. The results and requirements are compiled as follows.

First of all, the improvement of efficiency is one important driver of European freight transport market. Comodality and synchromodality are key elements to improve the efficiency. Freight transport should be organized by the consideration of the strength and weaknesses of the transport modes that are relevant to fulfil the requirements of the shipper that are defined by lead and transport time, weight and volume of the order /the shipment and further specific costumer and good related characteristics. The transport by only one transport mode could be the most efficient way in case the strength of this mode fulfil the given constraints, e.g. to carry goods due to time constraints, direct link between origin and destination without detours, availability of infrastructure and specialised equipment, sum of working time. Furthermore, it is necessary to fulfil the costumer related expectations regarding transport costs.

The available European data shows that in terms of tonne-kilometres, about 80 % of all freight transport is realised on long haul. Freight transport services up to 150 km are also relevant for new vehicle concepts in combination with smart loading units in order to support more efficient transport services at the interface between long and short distance transports e.g. in terminals and hubs. From the perspective of tonne-kilometres, new vehicle concepts could address all goods classes and not only selected ones due to the objective to develop a configurable and cost-efficient vehicle concept that is not dedicated for only some commodities.

New vehicle concepts should address good classes with high transport performance measured in tonne-kilometres (e.g. food products, beverages and tobacco, agricultural products) in combination with long transport distances. Furthermore, the potential revenues in logistics segments (e.g. Contract Logistics, full and less than truck load with palletized goods and Courier/Express/Parcel) should be considered. These segments should be addressed, because the balance between market size, expected revenues and small order sizes expect a high demand for advanced vehicle concepts using modular loading units. Finally, it is recommended to realize an optimum trade-off between payloads and transport volumes in order to maximize the use of the loading capacities.

Due to the increasing amount of courier/parcel/express cargo and general cargo, hub and spoke concepts are increasingly used to consolidate the shipments and thus, to increase transport efficiency. Therefore, a promising and growing segment for new truck concepts can be identified in transports between hubs (e.g. terminals, ports,



huge warehouses) as well as between industrial sites and hubs. Here, it is essential that loading units can be optimally manoeuvred and placed at the gateways in cross-docking stations or in warehouses, even if there is a limited infrastructure conditions. Further, the organisation of a fast exchange of loading units between different vehicles or between transport modes is important.

Infrastructure conditions and constraints of the existing road infrastructure – road, bridges, yards, driveways, roundabouts, parking areas and docks – are key issues for new vehicle concepts. Currently, most parking areas and docks are not suitable for long commercial vehicles. The new vehicle concepts should be compatible with the existing road infrastructure to avoid an extensive enhancement of the European road infrastructure or sophisticated technical solutions supporting manoeuvring in confined spaces on motorways and inter-urban roads.

The digitalization of logistics processes supporting the driver, simplifying vehicle routing and route planning, and enabling the monitoring (e.g. smart loading units) of the whole transport chain is ongoing. Based on these digital opportunities, new transport services and processes are expected to emerge. Further approaches (in particular platooning and automated driving) reduce the stress for the driver and may contribute to a reduction of transport costs. However, they require sensors, communication technology and energy supply within the vehicle.

Further trends with an effect on the transport and the vehicle are seen in:

- Dematerialisation, i.e. the amount of materials used in products might be reduced.
- 3D-printing technology will be developed, i.e. personalised, small scale local production in regional production sizes or for spare parts retailing.
- Postponement of final product assembly, i.e. local assembly close to the consumer, leading to the transport of intermediate products (parts and components) rather than final products, with the potential to reduce the amount of space required for transport.
- Transport of Intermediary goods instead of final products is increasing and may enable a higher packaging efficiency and higher density of goods in the loading unit. This may help to meet volume restrictions.

The AEROFLEX project develops an innovative vehicle concept for a major percentage of the European transport market, which shall simultaneously contribute to an efficient overall freight transport system. The use cases considered in the AEROFLEX should meet the requirements of significant sub-markets in the current transport market in Europe. Based on the analyses we conducted, the uses cases should:

- include own account transports as well as transports conducted by own company and conducted by third parties (e.g. by logistics service providers)
- offer the possibility to use intermodal transport chains in cases of long transport distances
- address preferably logistics segments with high expected demand for advanced vehicle concepts like Contract Logistics, full and less than truck load with palletized goods and Courier/Express/Parcel, food products, beverages and tobacco
- address transports that are mainly conducted on motorway and inter-urban roads today.

It is not sufficient to identify and validate primary candidates only based on literature analyses and aggregated European transport and logistics data. Instead, is additionally necessary to get more information in direct contact with stakeholders and potential users of new vehicle concepts. Thus, further stakeholder workshops will be conducted within the Work Package 1. The results will be described in the deliverable 1.2.



Publishable Executive Summary .....	2
Abbreviation .....	
1    Introduction .....	
1.1    Overall objective of project AEROFLEX and of WP1 .....	
1.2    Requirements of other AEROFLEX work packages towards work package 1	
1.3    Terms and definitions .....	
2    Methods .....	
2.1    Literature analysis .....	
2.2    Data mining .....	
2.3    Stakeholder discussions .....	
3    Results of market analyses .....	
3.1    Road transport market .....	
3.1.1    Market volume concerning transport volume and distances .....	
3.1.2    Market volume concerning revenues .....	
3.1.3    User Needs and Requirements for logistics concepts and new vehicle concepts	
3.1.4    Driving patterns of vehicle used in long road haulage .....	
3.1.5    Vehicle cost structure of a tractor semitrailer combination in long road haulage	
3.1.6    Hub and Spoke concepts .....	
3.1.7    Mileage of HCV related to road classes .....	
3.1.8    Use of loading units in road freight transport .....	
3.1.9    Infrastructure conditions .....	
3.2    Intermodal Transport – Role of road transport .....	
3.2.1    Mode Choice Criteria .....	
3.2.2    Loading units in Combined Transport .....	
3.3    Load factors .....	
3.4    Trends and drivers .....	
3.4.1    Trends and drivers in long road haulage .....	
3.4.2    Trends and drivers in long logistics .....	
3.4.3    Trends and drivers in intermodal road/rail transport .....	
3.5    Conclusions .....	
4    Recommendations .....	
4.1    Recommendations regarding the selection of use cases .....	



---

4.2	Recommendations regarding the vehicle concepts (HDV and LHDV) and configurations .....
4.3	Recommendations by SB members and other stakeholder .....
4.4	Conclusion.....
5	Prospects for the further progress in WP 1.....
6	Risk and quality assurance .....
6.1	Risk Register.....
6.2	Quality Assurance .....
7	References.....
8	Acknowledgement .....
	Appendix A – Risk table .....
	Appendix B – Standard goods classification for transport statistics, 2007 (NST2007)

Figure 1-1 AEROFLEX Project plan, project phases and milestones ..... 7

Figure 3-1 EU28 Performance by mode for freight transport (European Union 2017)

Figure 3-2 Freight transport development until 2050 (European Environment Agency 2007)

Figure 3-3 Transport demand related to transport distances (EUROSTAT 2018c)..

Figure 3-4 Distribution in tonne-kilometre of European transport market related to the transport distance of the freight (EUROSTAT 2018c) .....

Figure 3-5 Transport volumes and tkm of all good classes (classification based on NACE 2007,see .....

Figure 3-6 Characterisation of transported cargo in EU-28 in 2016 (EUROSTAT 2018a)

Figure 3-7 European logistics expenditure by costs type (assumption for 2016 based on German data evaluation); (Schwemmer, 2017 p. 26) .....

Figure 3-8 Structure of costs of a standard tractor and semitrailer operating national and international freight transport with an annual milage of 135.000 km based on German data in year 2010 (source: own figure based on(BVU Beratergruppe Verkehr und Umwelt, TNS Emnid 2015). .....

Figure 3-9 Hub and spoke concepts (MAN) .....

Figure 3-10 Used roads by HCV in Austria with more than 3.5 tons laden weight (ASFINAG and bmvit 2005)

Figure 3-11 Used roads by HCV in Germany with more than 3.5 tons laden weight (Bäumer et al. 2017)

Figure 3-12 Vehicle categories (axle configurations) linked with weight (Kuiper and Ligterink 2013) .....

Figure 3-13 Expected innovation in urban and non-urban transportation (MAN)

Figure 3-14 LHV configurations.....



---

Figure 3-15 Drivers of logistics (source: own figure based on Schwemmer 2017)

figure 3-16 overview over different transhipment technologies used in combined transport

Table 1-1 Requirements of results and findings coming from WP1 .....

Table 1-2 Terms and Definitions.....

Table 3-1 Explanation of biggest good classes of figure in 2016 (NST 2007, see Appendix B)

Table 3-2 Density of selected commodities (in tonnes per cubic metre).....

Table 3-3 Expenditure on logistics services by according to segments and logistical functions

Table 3-4 Overview of KPI for road freight transport (Barbarino and Hariram 2014)

Table 3-5 Characterization of good determining vehicle use and transport equipment in long road haulage

Table 3-6 Characteristics of logistics hubs and transport services (Thaller et al. 2014)

Table 3-7 Criteria influence the fuel consumption of HCV .....

Table 3-8 Dimensions of Loading Units used in the EU (source: Kraaijenhagen et al. 2014)

Table 3-9 Share of tractor-semitrailer combinations as a function of trip distance and cargo weight.....

Table 3-10 Maximum share of LHV in road freight transport by good type (De Ceuster et al. 2008, NST 2007 see Annex B)

Table 3-11 LHCV type applications by market segment (Kindt, Burgess, and Groen 2011)

Table 3-12 Field test in Germany – included vehicle concepts and share of usage

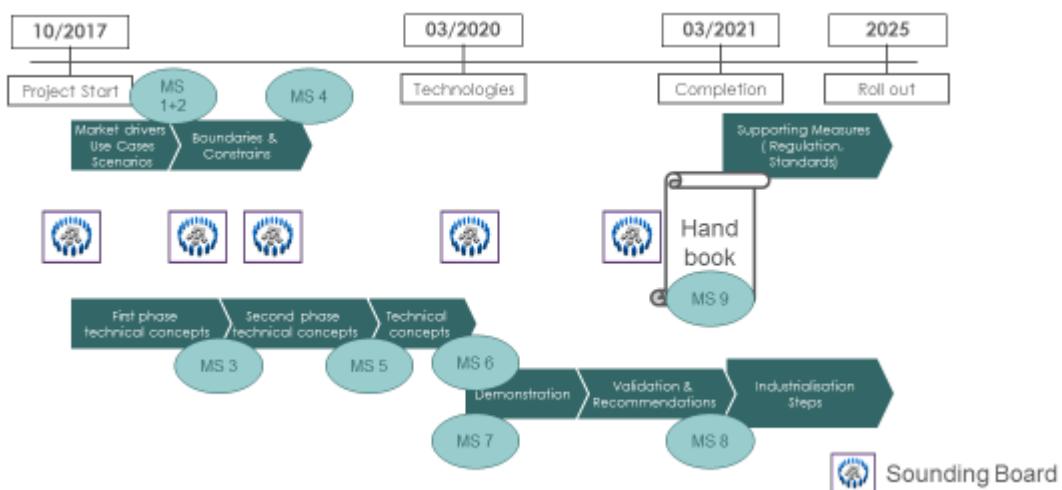


This present document is the AEROFLEX deliverable D1.1 summarizes the first results of WP 1 in the AEROFLEX project and covers the following topics:

- Characterization of the European road transport market in general
- Description of the role of road transport in intermodal transport
- Analysis of load factors measured in France and the Netherlands
- Description of trends and drivers in the transport market.

The achieved results base on a literature analysis of European studies and project reports, an analysis of available data, and discussions with logistics service providers. The document describes the relevant information that has to be considered in the AEROFLEX project to determine the relevant and suitable use cases for new vehicle concepts. It gives necessary input to WP2-WP6 of AEROFLEX based on the requirements towards WP 1.

The figure below shows the schematic project plan with main phases and milestones within the project as a guide to better understand the Initial Dissemination Plan. The present deliverable contributes to Milestone 1 (MS 1) in the first quarter of the project.



Error! No text of specified style in document.

Several members of the sounding board were represented in the stakeholder workshop, which was contributed by WP 1. The sounding board consists of representatives from authorities, policymakers, and employees of logistics and manufacturing firms. The purpose of the sounding board is to advise the process of defining the recommendations for implementation of the solutions and measures developed within the AEROFLEX project.

In order to facilitate an efficient decision-making, three types of sounding group during the course of the whole project are foreseen:

- Technical Assessment Assembly (TAA) –Initiatives leaders, research & industry partners & relevant associations
- Policy Regulatory Consolidation Group (PRCG) – Regulatory groups & Public administration
- Complete Sounding Group (CSG) – All type of stakeholders will be involved in such meetings.

Keywords of this deliverable are: vehicle engineering, logistics, road freight transport, vehicle concepts for heavy commercial vehicles (HCV), green logistics and trends

Supported by sub themes within the different keywords:

Multimodality, combined transport, intermodal transport, logistics hubs, smart loading units