Truck platooning

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Part of the Tranzinfo Hot Topics series, this issue offers a brief overview of an emerging area of heavy vehicle automation called platooning. A truck platoon is a convoy of automated trucks travelling in close proximity. They are wirelessly connected using radar and vehicle-to-vehicle communication technology, with acceleration, braking and steering controlled by the lead vehicle. Benefits of the technology include fuel savings and lower emissions, improved road safety, less congestion, and greater efficiency and productivity for fleets.

Contents:

Glossary

The UK Government's truck platooning feasibility study makes the following distinction between convoys and platoons:

Convoy – a group of vehicles following a lead vehicle. Drivers remain in control of the vehicles but are required to monitor automatic systems.
Platooning - vehicles following the lead vehicle control themselves with V2V communication between vehicles.

V2V – inter-vehicle communications technology

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Trials and Projects

SARTRE: Safe Road Trains for the Environment
Period: 2009-2012
Project Partners: Ricardo (coordinator), Volvo Cars, Volvo Technology, IDIADA, Tecnalia Robotiker, SP and IKA

This EU research project developed a prototype vehicle platoon system using two heavy goods vehicles and three passenger cars. The manually-driven lead truck was followed by one truck and three Volvo cars. The following vehicles were driven autonomously using real-time information to follow the movements of the lead vehicle while simultaneously coordinating their actions with each other. The project estimated a potential 10-20% energy saving compared with conventional road transportation.

SARTRE automated platooning vehicles
Chan, E, Transport Research Arena 5th Conference, 2014
An overview of the SARTRE project. A demonstration system with two trucks and three cars was operated on test tracks and on the public motorway at speeds of up to 90 km/h and gap sizes from 4-25m. They were used to measure the fuel consumption gains at a range of inter-vehicle gaps, demonstrating the potential for significant fuel savings for both trucks and cars. The business case for the introduction of automated platooning systems in trucks and cars was investigated, and estimates for the costs as well as the benefits were evaluated.

HAVEit: Highly Automated Vehicles for Intelligent Transport
Period: 2008-2011
Project Partners: 17 project partners, including Continental (project coordinator), Volkswagen and Volvo Technology

The EU HAVEit project developed, validated and demonstrated key steps towards highly automated driving, including technologies for situation awareness and safe vehicle architecture. The new capability was demonstrated in seven vehicles ranging from passenger cars to trucks and buses.

Final report
Detailed final project report published in 2011. The results promise potential exploitation within 3-7 years, according to the project partners.

Partial Automation for Truck Platooning
Period: 2013-2017
Project partners: FHWA, California Department of Transportation (Caltrans), University of California PATH Program, Volvo Technology Americas, Cambridge Systematics, Inc., Los Angeles Metropolitan Transportation Agency (LA Metro), Gateway Cities Council of Governments (COG), and Peloton Technology

This project is the most recent autonomous technology project funded by the California PATH program and the FHWA. The project team will be applying cooperative adaptive cruise control (CACC) with DSRC technology to three tractor-trailer trucks. The project combines U.S. and European truck platoon experience, and will work closely with local stakeholders on deployment strategies for operating the vehicle platoon on the 23-mile-long I-710 in Los Angeles.

Project update
The project is now in its third and final phase.

Heavy Truck Cooperative Adaptive Cruise Control: Evaluation, Testing, and Stakeholder Engagement for Near Term Deployment
Period: 2013-2016
Project Partners: Auburn University, Peloton, Peterbilt Trucks, Meritor WABCO, American Transportation Research Institute, and Bishop Consulting

This project is investigating the practical issues associated with implementing CACC technology in a truck fleet. The goal is to increase traffic flow and save fuel. The project is using the Peloton solution – partial automation with integrated vehicle-to-vehicle communication and adaptive cruise control. A two-truck platoon will be tested on Auburn's 1.7 mile test track.

Phase 1 final report 2015
A summary of Phase I results for evaluating the commercial feasibility of Driver Assistive Truck Platooning

Phase 2 final report 2017
A summary of Phase 2 results of the project.

Automated Truck Platoon within Energy ITS Project
Period: 2008-2013
Project Partners: Japan Automobile Research Institute (JARI), Japanese universities

The Japanese Automated Truck Platoon demonstrated a fully automated truck platoon consisting of three heavy duty trucks and one light duty truck, travelling at speeds up to 80 km/h with a 4 metre gap between vehicles, on the AIST test track. This demonstration project utilised lane marker detection technologies, radar, laser scanning and inter-vehicle communications.

Project overview
Tsugawa, S. 2013

A review of truck platooning projects for energy savings
Tsugawa, S, Jeschke, S & Shladovers, SE 2016
The objectives of truck automation are energy saving and enhanced transportation capacity by platooning, and eventually possible reduction of personnel cost by unmanned operation of following vehicles. The sensing technologies for automated vehicle control are computer vision, radar, lidar, laser scanners, localization by GNSS, and vehicle to vehicle communications. Experiments of platooning of three or four heavy trucks have shown the effectiveness of platooning in achieving energy saving due to short gaps between vehicles.

Daimler Trucks tests truck platooning on public highways in the US
Daimler press release, 25 September 2017
Daimler Trucks North America (DTNA) will drive digitally connected trucks on selected highways in Oregon and Nevada.

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In the news

Semi-automated truck convoys get green light for UK trials
The Guardian, 25 August 2017
The UK Government is providing £8.1m for trials of truck platooning on UK motorways to be held by the end of 2018.
Feasibility study

Singapore to start truck platooning trials
Ministry of Transport, 9 January 2017
The Ministry of Transport (MOT) and PSA Corporation signed agreements with two automotive companies, Scania and Toyota Tsusho, to design, develop and test-bed an autonomous truck platooning system for use on Singapore's public roads.

Truck platooning trials take to the highways
ITS International, May/June 2017
Details of the growing interest in America and beyond for the concept of truck platooning, with trials being planned in several US states.

MIT study: Driverless truck platoons will save fuel and money, especially if they tailgate
ExtremeTech, 21 December 2016
Truck platoons that are closely bunched for aerodynamic efficiency can save up to 20% on fuel costs, according to new research from Massachusetts Institute of Technology.

Truck platooning to be trialled in WA
Prime Mover, 13 October 2016
A trial of truck platooning will be conducted in Western Australia by the Australian Driverless Vehicle Initiative (ADVI) and US automated and connected vehicle technology company Peloton Technology.

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Further reading

Driver behaviour and driver experience of partial and fully automated truck platooning: a simulator study
Hjälmdahl, M et al. 2017, European Transport Research Review, vol. 9, no.1, 11 pp.
This paper builds knowledge of truck driver behaviour in and experience of automated truck platooning, focusing on the effect of partially and fully automated truck platoons on driver workload, trust, acceptance, performance, and sleepiness.

Managing the transition to driverless road freight transport
International Transport Forum 2017, Case-Specific Policy Analysis, 32, 74 pp.
This report considers how a transition to driverless road freight transport could happen. Today's technology already makes it possible to operate automated trucks. Reduced reliance on humans to move road freight in the future could offer large cost savings for business and consumers. It could also disrupt the careers and lives of millions of professional truck drivers. Based on different scenarios for the large-scale introduction of automated road freight transport, this study makes recommendations to help governments manage potential disruption and ensure a just transition for affected drivers.

Identifying autonomous vehicle technology impacts on the trucking industry
Short, J & Murray, D 2016, American Transportation Research Institute (ATRI), Arlington, Virginia, USA
Autonomous vehicle technologies have the potential to dramatically impact nearly all aspects of the trucking industry. Autonomous truck technology is advancing rapidly, and as these advancements enter the marketplace, the responsibilities of truck drivers could dramatically shift. How individual carriers respond to the advent of the autonomous truck may determine their successes or setbacks in this new environment.

European Truck Platooning Challenge 2016: creating next generation mobility: lessons learned
An initiative of the Dutch Ministry of Infrastructure and the Environment, 2016. Six brands - DAF Trucks, Daimler Trucks, Iveco, MAN Truck & Bus, Scania and Volvo Group - drove semi-automated trucks in platoons on public roads from several European cities to the Netherlands. The aim was to bring platooning one step closer to implementation.

Self-driving vehicles in logistics: a DHL perspective on implications and use cases for the logistics industry
DHL Trend Research, 2014
This report sheds light on best-practice applications of self-driving vehicles in various industries today, and also reveals a detailed look into the use cases of self-driving vehicles across the entire logistics value chain. Applications for self-driving vehicles that are discussed in the report include warehousing operations, outdoor logistics operations, line haul transportation, and last-mile delivery.

Commercial truck platooning demonstration in Texas: Level 2 Automation.
Kuhn, B et al. 2017, Texas A&M Transportation Institute, 222 pp.
The Texas Department of Transportation (TxDOT) funded the creation of a comprehensive truck platooning demonstration in Texas, serving as a proactive effort in assessing innovative operational strategies to position TxDOT as a leader in this research area and the overall transportation systems management and operation using connected vehicle and automated vehicle initiatives.

Potentials for platooning in U.S. highway freight transport.
Muratori, M et al. 2017, SAE International Journal of Commercial Vehicles, Volume 10, Issue 1, 5 pp.
Truck platooning has been identified as an early feature for connected and automated vehicles (CAVs) that could provide significant fuel savings and improved traffic safety and efficiency without radical design or technology changes compared to existing vehicles. A statistical analysis was performed based on a large collection of real-world U.S. truck usage data to estimate the fraction of total miles that are technically suitable for platooning.

Truck platooning: driving the future of transportation.
Janssen, R, TNO, 2015, 35 pp.
This TNO whitepaper explains what platooning is, what kind of benefits it brings for which parties in the supply chain, and the roadmap towards deployment of platooning on Dutch and European roads.

Automated Truck Platoon Control.
Lu, XY & Shladover, S 2011, PATH Research Report, University of California, Berkeley, California Department of Transportation, 63 pp.
This report demonstrates a successful application of 5.9 GHz DSRC with 100 ms update intervals to coordinate the automatic longitudinal control of a platoon of three Class 8 tractor-trailer trucks.

Development of Automated Platooning System Based on Heavy Duty Trucks.
Suzuki, Y et al. 2010, 17th ITS World Congress, ITS Japan,11 pp.
The Japan Automobile Research Institute (JARI) and 14 organizations including universities, private sectors and national institutes in collaborative relationship have been developing advanced sensing technologies and vehicle control technologies in order to build a feasible automated platoon system based on heavy duty trucks. In this paper, the authors report on the concept, system configuration, and experimental result on the new expressway under construction.

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