



Overview: ZF Technology Expertise for Cleaner, Safer and Connected Commercial Vehicles

1. Automated Coupling Assist

World premiere: Proof-of-Concept for an innovative fully-automated coupling assist system that enables the truck to detect and hook a specific semi-trailer.



1-1_ZF_ADAS_Automated-Coupling-Assist.jpg



1-2_ZF_ADAS_Automated-Coupling-Assist.jpg

The industry's first fully automated coupling assist system for heavy-duty tractor-semitrailer combinations. It controls the tractor in longitudinal, lateral and vertical direction for an optimized coupling maneuver. This system also leverages commercial vehicle industry-first image processing algorithms which enable 3D modelling with a mono digital camera.

Advantages:

- Safety, efficiency and comfort for the driver and depot operatives
- Over 50% reduction in coupling time
- Helps to minimize vehicle damages, repair cost and downtime
- A key assistance for less experienced drivers

2. Highly efficient truck-trailer combination

World premiere: Lightweight chassis tractor truck, with optimized installation space in combination with advanced trailer aerodynamics.



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3-1_ZF-Truck-Trailer-Comb.jpg



3-2_ZF-Truck-Trailer-Comb_aerodynamics.jpg



3-3_ZF-Truck-Trailer-Comb_lightweight.jpg

The low air resistance of the semi-trailer truck can help reduce fuel consumption by up to seven percent. The truck chassis saves up to 150 kg of weight, which allows for increased payload and improves truck handling. The new components also provide additional installation space – an important approach for electric vehicle platforms with battery or fuel cell.

3. Advanced Reversing Assist

World premiere: Innovative ADAS solution to support the driver when reversing truck-trailer combinations.



4-1_ZF_ADAS_Advanced-Reversing-Assist.jpg



4-2_ZF_ADAS_Advanced-Reversing-Assist .jpg

Offering smart solutions for various operational challenges, this system features a trailer mounted rear camera and a first-of-its-kind articulation sensor which cover the blind spot behind the trailer. The system's smart HD image processing algorithms enable periphery monitoring without the need for additional sensors – another industry breakthrough. Utilizing information from a digital rear camera as well as a first-of-its-kind articulation angle sensor to offer the driver guided reversing paths. The system also features a unique sensor cleaning concept to ensure clear camera view.



Advantages:

- Increases safety, efficiency and comfort by helping to avoid collisions with obstacles, pedestrians or other vehicles
- Helps to minimize vehicle damage, repair cost and downtime
- Increases driver effectiveness at all experience levels
- Scalable concept that offers a whole range of new ADAS functionalities

4. Advanced Chassis Control for Automated Commercial Vehicles

Instant stability control of automated vehicles in "real world" operating conditions, leverages the ADOPT (Autonomous Driving Open Technology) software platform.



5_ZF_ADOPT-Chassis-Control-System_SW-Platform.jpg

ADOPT provides the automated vehicle's virtual driver (Autonomous Driving Artificial Intelligence) with an "Intelligent Control Interface" to the vehicle's motion control systems (driveline, braking, stability and steering systems). It not only delivers enhanced safety but also improves operational efficiency through the optimized calibration of the vehicle's performance conditions, such as poor road adhesion, where ADOPT is able to keep the vehicle stable on its path when cornering or changing lanes.

The ADOPT approach applies ZF's expertise in autonomous driving and artificial intelligence to the commercial vehicle world to simplify and accelerate the development of automated driving applications for virtual drivers.



5. Electric drives for commercial vehicles

Clean, future-proof axle and central drives as well as other electrification solutions.



2-4_ZF_E-Mobility_CeTrax_Truck.jpg



2-1_ZF_E-Mobility_CeTrax_Truck_Charging.jpg



2-3_ZF_E-Mobility_eTrailer.jpg



2-5_ZF_E-Mobility_CeTrax_lite_Truck.jpg



2-6_ZF_E-Mobility_CeTrax_Bus.jpg



2-2_ZF_E-Mobility_AxTrax-AVE.jpg

ZF's electric drive portfolio simplifies the path to locally emission-free commercial vehicles. And this portfolio is growing: By 2023, the Group will offer a modular electric drive kit with axle and central drives for buses and trucks of up to 44 tons. This expands current e-Mobility product families such as the **CeTrax** central drive. These electric drives target specific urban applications, from small delivery trucks to large city buses. For this purpose, the most powerful version delivers 300 kilowatts of power and 4,500 newton meters of torque. CeTrax can be installed in vehicle platforms according to the plug-and-drive principle making it easier to change from combustion engine to electric motors. Volume production will start in 2020. For years now, the **ZF AxTrax AVE** electric portal axle has been promoting clean public transport in cities around the globe for low-floor buses and is ideally equipped for "Zero Emission Zones". Another advantage of AxTrax AVE includes the particularly quiet operation.

ZF's electric drive solutions are generally open to technology: They can be combined with a battery or fuel cell or - in the case of buses - with



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an overhead contact line. They are available as a system which includes a tailor-made inverter and control unit (ECU) for maximum efficiency in operation.

Electrification at ZF, however, goes beyond the actual vehicle drive. An example of this is the **eTrailer**. This semitrailer with integrated electric motor can make every conventional truck a hybrid, that can consume up to 16 percent less fuel. In addition, traction and acceleration improve while noise levels and brake wear decrease. Moreover, ZF electrifies other commercial vehicle actuation systems like the steering.