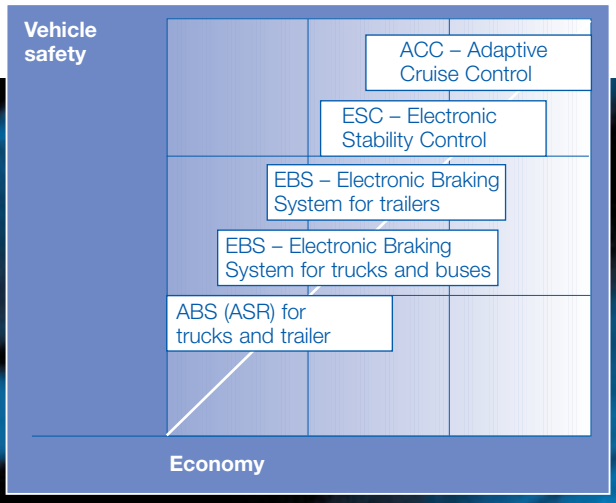
ESC

Electronic Stability Control
for Commercial Vehicles

WABCO

WABCO sets industry milestones

Highway rush-hour



More safety step by step

Drivers of commercial vehicles have been increasingly supported by active and passive safety measures. Vehicles have also become much more economical. WABCO has been instrumental in writing this chapter of technical evolution. The initial break-through was achieved decades ago with the introduction of ABS/ASR (anti-lock and traction control system) as standard equipment. In 1996, another milestone followed: Electronically Controlled Braking System (EBS).

With Electronic Stability Control (ESC), WABCO extended EBS to allow the system to automatically intervene in situations where vehicle stability enters a critical area, both in normal driving operation and while a vehicle is being braked. This is an important contribution to commercial vehicle safety in growing traffic density and given road hazards.

Within physical limits, ESC operates automatically and intervenes in both the drive train and the brake to support the truck or bus driver, who might not otherwise be able to safely steer or brake his vehicle.

ESC forged new paths

Losing control, semitrailer roll-over without ESC

The first steps along the road to Electronic Stability Control (ESC) were taken more than 10 years ago. Initially, research was done on a complex vehicle model, and by computer simulations. The vehicle model was then extended to a driver model, and the phase of field driving manoeuvres began, followed by further development of the system and pilot-run driving tests on WABCO's test tracks.

The complexity of the testing procedure can be illustrated by comparing it to similar systems known from the passenger car sector. While ESC in passenger cars factors in 1 to 5 people and luggage contained in a fairly small vehicle with two axles and only four wheels as well as a fairly low centre of gravity, the task is for more comlpicated for truck ESC: On a heavy duty semitrailer truck an almost infinite range of loads and differences in the vehicle design, plus high centres of gravity vary frequently. In addition, the braking system of a semitrailer must be controlled via a trailer interface.

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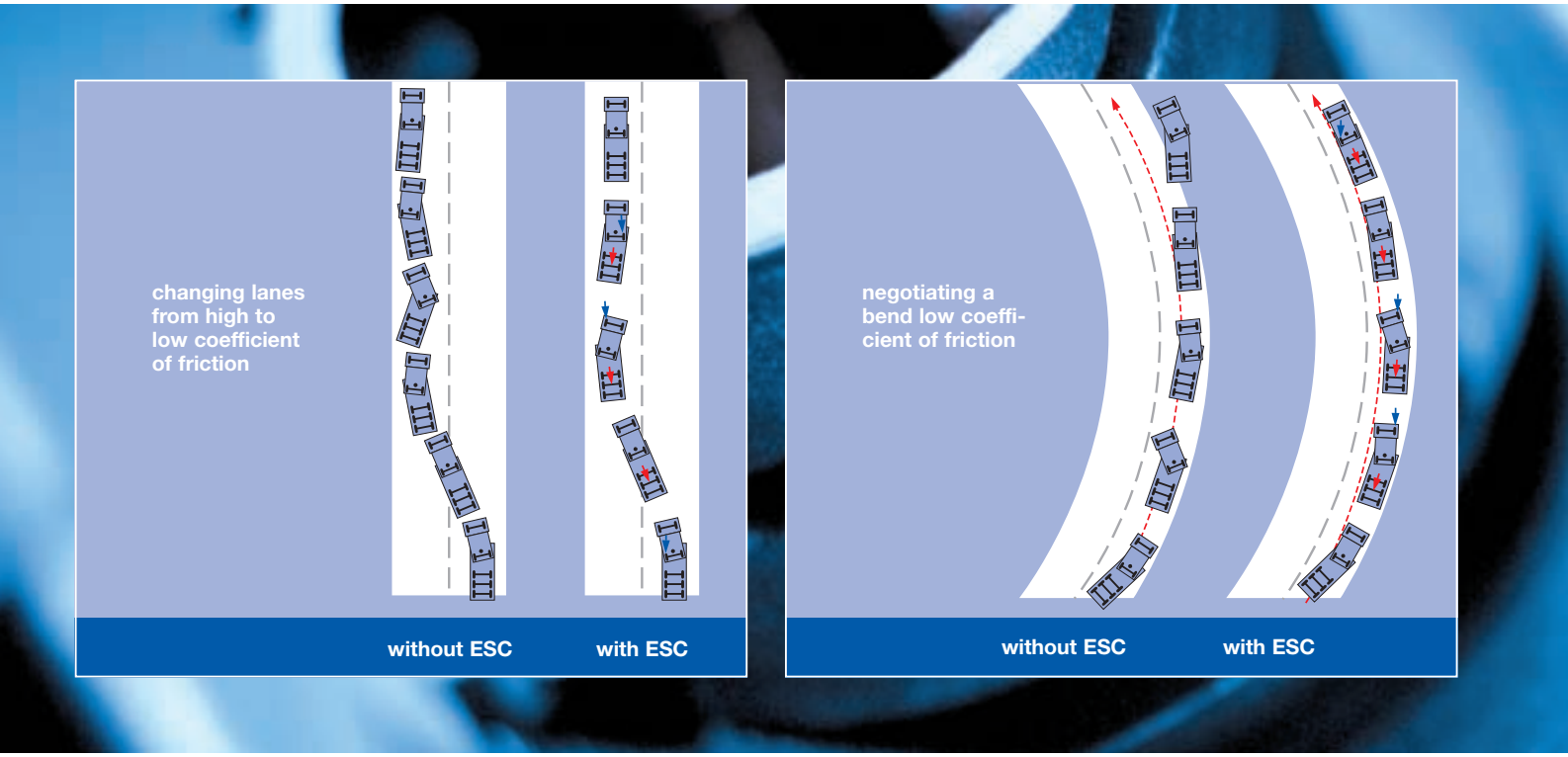
Fulfilling a complex task



Implementing ESC requires complex control engineering, plus high-performance electronics and sensors.

The central module of the Electronic Braking System (EBS) is connected to the control units of other systems such as the engine, the transmission or retarder via a CAN databus. This allows, for instance, the brake management integrated in the central module to coordinate air brakes with endurance brakes.

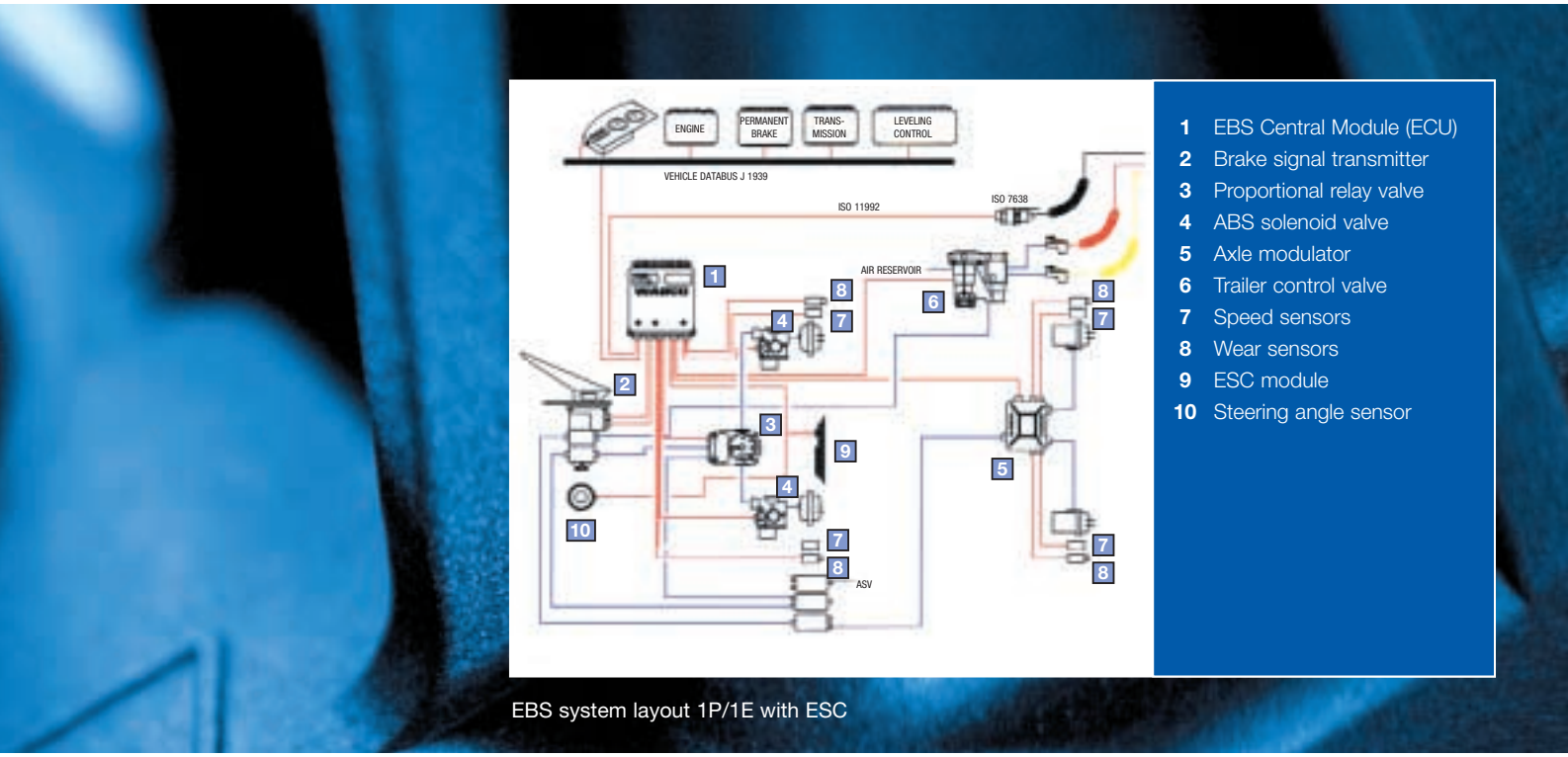
The EBS of a semitrailer also exchanges its data with the vehicle via the CAN databus to optimise the braking behavior for the whole tractor-trailer combination. Semitrailers with conventional braking systems are controlled from the towing vehicle via electro-pneumatic trailer controls.

The ESC central module communicates with the EBS central module via the high-performance databus of the braking system. The ESC central module works with high-performance microprocessors, a yaw rate sensor and an acceleration sensor. For this purpose, all inputs from the vehicle's sensors are transmitted to a computer module. This computer module then compares the actual condition of the vehicle with those permissible in theory. ESC intervenes if an approximation of the two values is detected, or if the reading exceeds the maximum reference value.

The sensors for the ESC system consist of:

- ABS sensors for measuring wheel speed
- Steering angle sensor to reflect the driver's motions
- Lateral acceleration sensor which measures the actual vehicle behavior and indicates the cornering situation
- Yaw rate sensor

Easy installation



EBS system layout 1P/1E with ESC

The ESC control module has been designed to be easily installed, yet withstand the harsh operating conditions of the vehicle frame: vibration, dirt, water, salt, ice and snow, changing temperatures and electro-magnetic stress.

The steering angle sensor can be integrated either in the steering wheel or in the steering gear. At 0.2°, its resolution has been designed to anticipate even future requirements. Control systems such as a “doze warner” which would require such accuracy can thus simply be docked onto the CAN databus, and no investment in an additional sensor will be necessary.

ESC Module

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Increased road safety

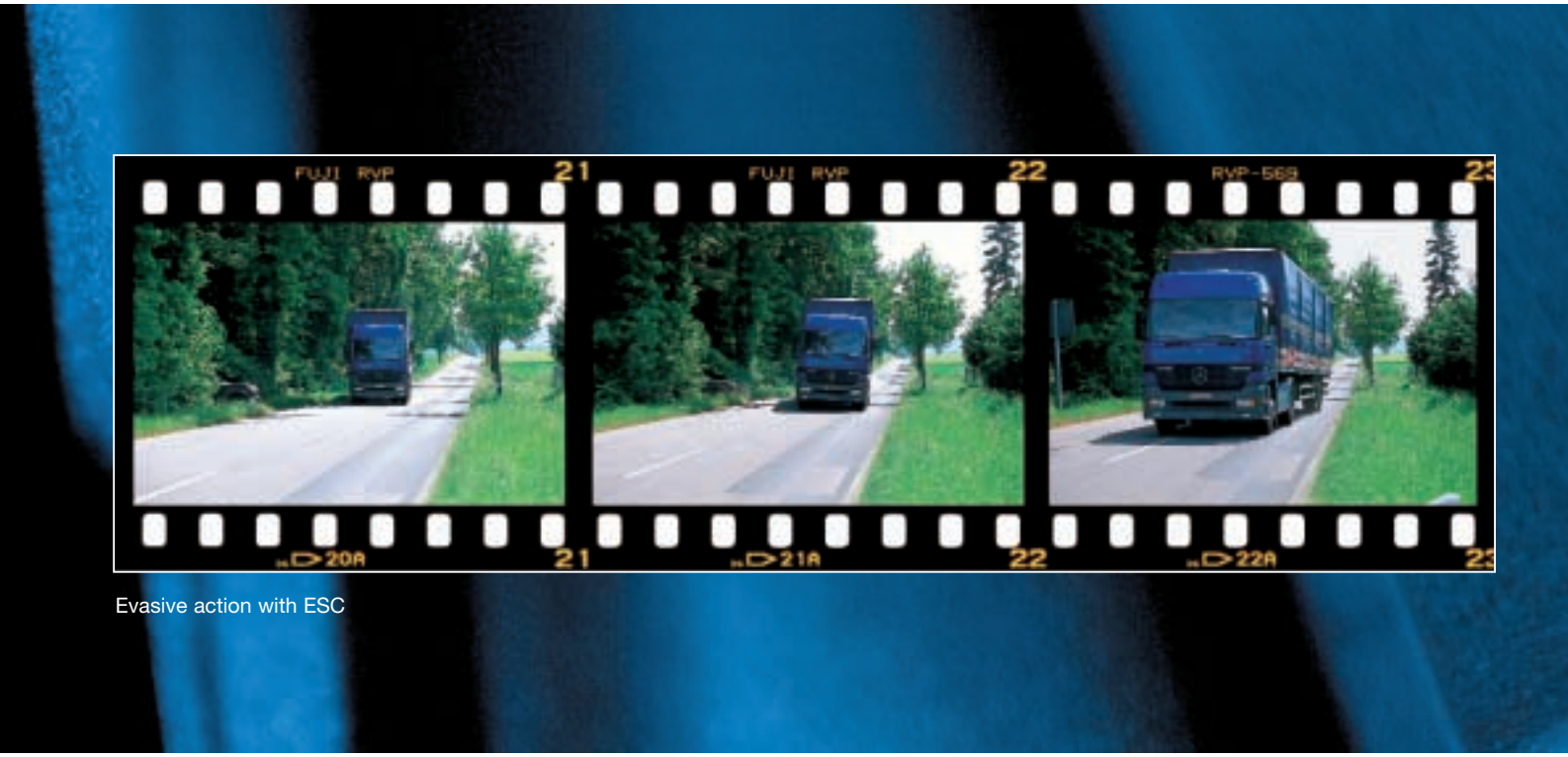
Driver's reaction

The system components of WABCO's ESC automatically and actively reduce the hazards of swerving when negotiating curves and when taking evasive action. This applies even when the vehicle is moving on changing road surfaces, and when road features are combined with steering mistakes. In such situations, where driving dynamics are critical, ESC uses EBS to control the braking forces on each wheel, at the same time throttling the vehicle's engine output.

ESC prevents semitrailer jack-knifing by simultaneous measured braking of the semitrailer, even if it is equipped with a conventional braking system.

The third issue addressed by ESC is the semitrailer's tendency to tilt. This increases at higher speeds in long curves (e.g. motorway exits) and can also be caused by changing lanes rapidly. When this happens, ESC automatically reduces the speed of the tractor-trailer combination when the tilting limit is reached. This occurs independently of the driver's behavior in response to the vehicle's imminent instability.

Safety for people and vehicles



Evasive action with ESC

Today WABCO's ESC is becoming state-of-the-art, as EBS did years ago, or ABS/ASR in the early 1980s. WABCO continues to innovate systems which – linked to dynamic navigation, driving dynamics and cruise control systems – will further revolutionize long-distance road transportation.

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WABCO, the vehicle control systems business of American Standard Companies, is the world's leading producer of electronic braking, stability, suspension and transmission control systems for heavy duty commercial vehicles. WABCO products are also increasingly used in luxury cars and sport utility vehicles (SUVs). Customers include the world's leading commercial truck, trailer, bus and passenger car manufacturers. Founded in the US 135 years ago as Westinghouse Air Brake Company, WABCO was acquired by American Standard in 1968. Headquartered in Brussels, Belgium, the business today employs nearly 6500 people in 29 office and production facilities worldwide. In 2003, WABCO contributed US$ 1.358 billion to American Standard's total sales of US$ 8.568 billion.

Website: www.wabco-auto.com

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