



Safety becomes active

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Mercedes-Benz has been setting standards for active safety of the car since the 1970s. Each of the solutions support the driver and therefore lower the risk of an accident. Highlights include the ABS anti-lock braking system (1978), the ESP® Electronic Stability Programme (1995) and the DISTRONIC adaptive cruise control (1998). The ABC Active Body Control active chassis system presented 20 years ago in the CL of the C 215 model series is also a Mercedes-Benz development for active safety. Countless intuitive and intelligent technologies work together today in the Mercedes-Benz Intelligent Drive concept.

Stuttgart. The car as a partner for people which reduces the risk of accidents for them: this is a guiding principle in the development of active safety. The term was coined in the early 1960s in Italy (“sicurezza attiva”). There were also early considerations at Mercedes-Benz back in the late 1940s. In the mid-1960s, the brand set out the definition that still applies today thanks to protagonist development managers Hans Scherenberg, Karl Wilfert and Béla Barényi. According to the definition, active safety includes the areas of driving safety, driver fitness, and operating safety.

Digital technology for active safety

Active safety makes a decisive step from the concept phase and research into series technology in 1978. Back then, Mercedes-Benz presented the anti-lock braking system (ABS) developed together with Bosch. Even with a full brake application, the driver can now maintain total steering control of the car. The Mercedes-Benz Press Release from 21 August 1978 states: “Thanks to the instantaneous cooperation of various control operations in the A-B-S, which the driver clearly feels and hears when braking, the wheels are slightly released before locking when braking. When doing so, they move in the ideal delay

condition to enable the best braking distances.” ABS became a success story far beyond the vehicles of the brand from Stuttgart. Today, the assistance system is in the cars of practically every manufacturer worldwide as a matter of course.

The origins of the anti-lock system at Mercedes-Benz go back to the early 1950s. What follows is an intensive development, also in cooperation with partners. In 1970, the “Mercedes-Benz/Teldix Anti-Bloc-System” was presented. The analogue-electronic system worked but was not yet reliable enough for series use. Therefore, by 1978, ABS with digital control was created. In a time that was still characterised by electrics and analogue electronics, it was a completely trendsetting solution.

Variety of assistance systems

The digital ABS sensor system was a key for the further development of active safety at Mercedes-Benz as the data that ABS provides is also used by other assistance systems. This included ASR acceleration skid control, ASD automatic locking differential, BAS brake assist, ESP® Electronic Stability Programme, the electronically controlled automatic transmission, DISTRONIC adaptive cruise control and much more. Depending on the function and task, further sensors and controls are also used.

ASR and ASD were presented in 1985 – they were the first systems with software stemming from the company’s own electrics/electronics development department. When a wheel is spinning, ASR not only applies the brakes, it also cuts the engine torque by reducing the throttle by a specific amount. Both traction systems really came into their own in rear-wheel drive vehicles on slippery roads. The ASD limits the compensation movement of the other wheel in the differential respectively with a disc lock as soon as the on-board electronics register that a driven wheel is spinning.

The newly developed 4MATIC traction system –a fast engaging and disengaging four-wheel drive system –also premiered in 1985. If there is a loss of traction, in three stages 4MATIC activates the all-wheel drive, then the additional interaxle differential lock and finally the rear interwheel differential lock. Two-wheel drive with ABS function is re-engaged automatically on braking.

To ensure the vehicle can always offer its driver comprehensive and intelligent support, Mercedes-Benz continued to develop the sensor systems of the assistance systems. In the 1990s, two pioneering solutions were premiered, which became the standard for the entire industry: the ESP® Electronic Stability Programme (1995) and the DISTRONIC adaptive cruise control (1998). The BAS Brake Assist was also debuted in this period. The system, presented in 1996, recognises emergency braking and immediately builds up the maximum braking power assist. In 1999, the ABC Active Body Control active chassis system celebrated its world premiere.

ESP® was presented in 1995 in the S-Class Coupé model series 140. It supported the driver in dynamically critical driving situations by applying a specific braking force on one or more wheels and – if necessary – by adjusting the engine torque. The driving status is also determined by the steering angle, lateral acceleration and yaw rate sensors, amongst other things. The digital CAN bus facilitates quick data exchange between the countless sensors and control units. ESP® became a further technological standard for the industry, not least because from 1999, Mercedes-Benz consistently equipped all car types with the new driving safety system as a standard feature.

The car learns to see

DISTRONIC adaptive cruise control had its world premiere in 1998 in the S-Class of the 220 model series. The system uses radar to continuously monitor traffic and thereby calculates the distance to the vehicle in front as well as its speed. Using this data, with cruise control activated, the system derives driving commands in order to continuously keep a safe distance to the vehicle in front: if the distance decreases, DISTRONIC slows the vehicle down by accessing the engine, brakes and automatic transmission. As soon as the lane becomes free again, DISTRONIC accelerates the car back up to the previously set speed. This system works fully automatically, initially in a speed range from 160 to 40 km/h. In 2005, Mercedes-Benz further developed the system to DISTRONIC PLUS, which now operates at a speed range from 200 km/h to standstill. This was made possible by the newly developed short-range radar in a 24-gigahertz range with a very wide perspective.

A driving feeling as if you are floating: the ABC Active Body Control is a source of inspiration. The active chassis system developed by Mercedes-Benz minimises pitching and rolling of the body, increases safety reserves and bolsters the freedom from fatigue of the driver. ABC was introduced in 1999 in the luxury class coupé of the C 215 model series as a standard feature.

Active safety is also supported by many assistance systems that make the operation of the vehicle more comfortable. Mercedes-Benz was early to lead the way with the PARKTRONIC parking assistant and the digital navigation system APS Auto Pilot System (both in 1995) as well as SBS voice control (1996, the system has been called Linguatronic since 1997). As an interface between man and machine that was as high-performing as it was intuitive, the Mercedes-Benz COMAND (Cockpit Management and Data System) premiered in 1998. In 2018, the MBUX Mercedes-Benz User Experience followed. The completely new multimedia system is teachable thanks to artificial intelligence and creates an emotional connection between the vehicle, driver and passengers.

Holistic concept for safety

The active safety systems by Mercedes-Benz have become more and more effective and versatile over the years. In order to properly describe the entire spectrum of this technology development and diversification, in 1999, Mercedes-Benz grouped the solutions under the term “integral safety”. This concept was implemented extensively in series production in 2005. Yet as early as 2002, central ideas of the philosophy flowed into the PRE-SAFE® system for anticipatory occupant protection. Here, the intelligent vehicle recognises typical signs of an impending accident via its sensors and prepares itself for this as well as possible in order to keep the effects of the potential crash to a minimum.

The new millennium brought enormous dynamism in the development of new and improved assistance systems, which also implement important goals in active safety. This included Adaptive Brake Lights and BAS PLUS Brake Assist (2005), PRE-SAFE® Brake and Intelligent Light System (both in 2006), Blind Spot Assist (2007), Active Parking Assist (2009), ATTENTION ASSIST, Adaptive Highbeam Assist, Lane Keeping Assist (all in 2009), Active Blind Spot Assist, and Active Lane Keeping Assist (both in 2010). Mercedes-Benz introduced these solutions into series production as parts of a harmonious whole.

In the 2010s, the future of vehicle safety received a new name: Intelligent Drive. The Mercedes-Benz S 500 INTELLIGENT DRIVE research vehicle showed in 2013 what the future of automated driving could look like in very complex traffic zones, particularly in cities and on country roads. In 2017 and 2018, the Mercedes-Benz Intelligent World Drive tied into this. A test vehicle based on the latest S-Class learned across all five continents in real traffic during automated test drives. Since 2013, Intelligent Drive has also been the name given to the new Mercedes-Benz philosophy for networking all in-car driver assistance and safety systems. In 2017, the brand presented the next level of the integrated network with the headline “Intelligent Drive Next Level” and took the comprehensive support of the driver – and therefore also active safety – further into the future.

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Demonstration of the ABS anti-lock braking system during maximum full-stop braking on an irrigated surface with two different S-Class saloons from the 116 model series. With the Mercedes-Benz 280 SE without ABS, the wheels lock up during maximum full-stop braking on a slippery surface. The Mercedes-Benz 450 SEL 6.9 with ABS retains steering functionality in the same conditions even during maximum full-stop braking. Mercedes-Benz Classic Insight “40 Years of Assistance Systems” in Immendingen, 25 to 27 September 2018.

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The automatic locking differential (ASD), acceleration skid control (ASR) driving dynamics systems and the 4MATIC automatically switching four-wheel drive system premiered in 1985 in the Mercedes-Benz W 124 model series (1985 to 1995). Sectional drawing from 1986.

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Mercedes-Benz 300 E 4MATIC from the W 124 model series with automatically switching four-wheel drive. Photograph from 1986.

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The ESP® Electronic Stability Programme premiered in 1995 in the luxury class coupé of the C 140 model series. Photo from the press trial drive of ESP®, developed together with Bosch, on a frozen lake in the Arctic Circle in Sweden on 15 March 1994.

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Functionality of the DISTRONIC adaptive cruise control in the Mercedes-Benz S-Class of the W 220 model series. Graphic from 1998.

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Mercedes-Benz DISTRONIC adaptive cruise control, radar sensor, photo from a Mercedes-Benz CL of the C 215 model series from 1999.

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Mercedes-Benz CL of the C 215 model series, front suspension with ABC Active Body Control active chassis system. Graphic from 1999.

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Functions of the PRE-SAFE[®] anticipatory occupant protection system in the Mercedes-Benz E-Class of the W 211 model series. If there is a risk of an accident, PRE-SAFE[®] can tension the front seat belts, move the electrically adjustable front-passenger seat with memory function into a more favourable position, and close the side windows and sliding sunroof as a precaution. Graphic from 2006.

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Mercedes-Benz Intelligent Drive in the facelifted S-Class of the 222 model series (combined fuel consumption: 14.2-2.5 l/100 km; combined CO₂ emissions: 325-57 g/km). When the DISTRONIC active distance assistant is switched on, the route-based speed adaption adjusts the vehicle speed to incidents on the route ahead. This includes corners, T-junctions, roundabouts and toll stations as well as exits. The section of route ahead is driven along economically, comfortably or dynamically, depending on the selected driving programme. After this, the vehicle again accelerates up to the selected speed. Photo from 2017.

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MBUX (Mercedes-Benz User Experience) multimedia system in the Mercedes-Benz EQC (combined electrical consumption: 22.2 kWh/100 km; combined CO₂ emissions: 0 g/km). The intuitive and teachable multimedia system premiered in 2018 in the A-Class of the 177 model series (combined fuel consumption: 7.4-4.0 l/100 km; combined CO₂ emissions: 169-107 g/km). Photograph from 2018.