The future of the original. The research cars of Mercedes-Benz.
Research is the motor of progress.
The future of the original.
From idea to finished research car.
The research cars of Mercedes-Benz.
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Auto 2000.
The short-distance vehicle. NAFA.
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08 Gottlieb Daimler was issued a patent for his upright single-cylinder four-stroke engine on April 3, 1885. The engine was installed in the Daimler Riding Car for testing.
After 125 years, the demand for the automobile is higher than ever before – and this is precisely why we are reinventing it once again. For as the global need for mobility increases, so do the demands on vehicle engineering in all disciplines: from safety to comfort – and particularly with regard to achieving the highest efficiency and effective environmental protection. The key lies in new, efficient and clean technologies. Therefore, at Daimler we consistently focus not only on high-quality development, but also on our research, which has formed the basis of our success since the beginning. This has made Daimler the only car manufacturer today with a complete range of vehicles and technologies for sustainable and emission-free mobility – from optimized combustion engines to hybrid drives, to electric vehicles with battery and fuel cell drive systems.

Our company’s founding fathers passed their love of inventing down to us. In 1885, Gottlieb Daimler installed his high-speed combustion engine in a two-wheeler, the Riding Car. Independently of Daimler, Carl Benz presented his Patent Motor Car in 1886, the world’s first integral design for an automobile. Nobody talked about research cars in either case at the time, but both the Riding Car and the Patent Motor Car marked the starting point of our tradition of having the foresight to create groundbreaking vehicle concepts early on in order to obtain findings for the development of tomorrow’s motor vehicles and beyond.

This power of innovation has been one of the key motivating forces within our company for 125 years – and will continue to be so now and in the future. A tangible example of this is the constant development of Mercedes-Benz research vehicles, which we have been using for over four decades to bring innovations to life. The fully functional Mercedes-Benz research vehicles make it possible to experience and directly evaluate new technologies. With these vehicles, we are continuously further developing a combination of fascination and responsibility that is specifically geared toward possible use in future Mercedes-Benz series cars.

The 1991 Mercedes-Benz F 100, for instance, featured not only a novel seating concept with a correspondingly pioneering bodywork design, but also numerous electronic functions for enhanced safety and comfort. Almost 20 years later in the spring of 2010, the Mercedes-Benz F 800 Style made its debut in Geneva under the motto “Efficiency paired with elegance”. The five-seat upper-range sedan combines highly efficient drive technologies and intelligent seat, control and display concepts with unparalleled safety and convenience features and an emotive design idiom.

The latest research vehicle known as the Mercedes-Benz F 125 is offering insight into how completely emission-free, individual mobility might be achieved in the future in the luxury segment. The key innovations include emission-free electric mobility with a range of 1000 kilometers based on a logical further development of the fuel cell drive system, a revolutionary hydrogen composite storage unit, and a lighter and more powerful battery based on next generation lithium-sulfur technology in combination with plug-in technology. In keeping with the anniversary motto „125 years of innovation”, Daimler, the technology leader, is demonstrating the potential of fuel cells – a technology that could turn hydrogen into a key energy source in our economy of the future, similar to that of oil today.

This brochure introduces you to all of the company’s research vehicles – from the 1969 Mercedes-Benz C 111 to the Mercedes-Benz F 125, which, thanks to its technical and formal innovations, should pave the way to a society that does not rely on fossil fuels. We plan for groundbreaking concepts in our research vehicles and for decades have been setting trends for the future and thus also for individual mobility.

Prof. Dr. Thomas Weber
Member of the Board of Management of Daimler AG
Group Research & Development Mercedes-Benz Cars

Research has a long tradition at Daimler, where it occupies a key position. Findings from our own research have always set the pace in the development of new, forward-looking vehicles – and this is why we officially established research unit in the early 1970s.

Research is the engine of progress.
Devoted to originality.
The future of the original.

The desire to get to the bottom of things was already driving Carl Benz back in 1886 when he designed the famous Patent Motor Car. He researched, calculated, tinkered, and discarded ideas – until he had finally built a vehicle that, apart from the wheels, had little in common with its contemporaries. Everything else was original and different – a stroke of genius. This was the first automobile.

Daimler AG is proud of being the motor manufacturer with the longest tradition. But the company has never rested on its laurels – it has always recognised that success is driven by research and innovation.

Since the beginning, Daimler AG has devoted itself to this path of innovation and has presented exciting research vehicles to the public at almost regular intervals. These reflect a recent chapter in the company’s 125-year history.

Because a look at the past and current research vehicles is both retrospective and a preview of the future of the automobile – for instance of the current F 125.!

The company has always been committed to this path of innovation and has been presenting the public with fascinating research vehicles at virtually regular intervals. These reflect a young chapter in the almost 125-year history of the company. The view of those research vehicles created to-date reaches back in time, but also into the future of the automobile – and thus to the F 800 Style.

Mercedes-Benz has always tested new automotive concepts on fully operational vehicles, and has stepped up this practice since 1969. The Wankel, or rotary-piston engine, in the C111 was the first to be tested and was later followed by other drive systems. This car was thus the forerunner of the research cars. Their history began in 1978 with the “Auto 2000”, the Mercedes-Benz stepping stone to in-depth basic research for new automobiles. It was followed by the NAFA in 1981. The more recent line-up began with the F 100 in 1991 – the “F” standing for the German for “research car”. Since then, research cars fitted the description “holistic” have been produced with almost infallible regularity; they serve not just to test single components, but often to demonstrate an entirely new vehicle concept in the form of a ready-to-drive automobile that incorporates many forward-looking technologies. Apart from research cars, the company classifies several other types of vehicle that serve to develop new models.

Test vehicles are close relatives of the research cars. Their purpose is to put new technologies from the research labs out onto the test track to try them out in practical operation.

Concept cars at Daimler AG are near-production, ready-to-drive vehicle studies. They position a future vehicle model on the market. One example is the Study A of 1993, which reveals several characteristics attributed to the subsequent A-Class. Concept cars are equipped with new technology that is already in production cars or soon to reach production standard.

Vehicle studies are feasibility studies that show new ideas in the form of a complete automobile. These, however, are not usually roadworthy. This category includes NAFA, a short-distance vehicle that originated a good twenty years ago. It had a short, high body and, as such, was a forerunner of the Mercedes-Benz A-Class and the smart city coupé.
From idea to finished research car.

Once the engineering concept of a research car has been specified, the designers set out to create the car – first on the computer, then as a clay model, and eventually as a life-size, one-off unit.

Mercedes-Benz research cars are fully operational because their goal is to make new technology experiential, road-ready and, as far as performance is concerned, measurable. This approach fulfills the purpose of providing insights into the car of tomorrow. Each of these special automobiles follows a holistic concept. Single components are not being tested; rather, the entire vehicle springs from an original idea. Although this can cast doubt on certain conventions, and unusual solutions can give rise to astonishment or enthusiasm; it is all part of the visionary brainwork behind the automobile of the future.

As a result, the sometimes very unusual concepts stimulate a public debate about the future of mobility, which, in turn, gives market researchers important pointers as to what customers want and need. Since vehicles must meet customers’ demands, research must be oriented to the future. Designers, engineers and marketing experts jointly draw up the technical specifications for a new research car.

Each car is a reflection of a clear strategy – sometimes it stresses the technological competence of the company, sometimes ergonomics, sometimes driving safety. The designers and engineers then have their work cut out in order to comply with all the specifications that result from the visionary ideas.

Entirely new and unusual ideas need to be spawned. Original concepts are constantly reviewed for feasibility, which is where information technology and simulation tools come into their own. If the idea works on the screen, approval for made-to-measure manufacture is given. Practically every part of a research car is built to order, which is a costly procedure: electronic systems are drafted, the interior compartment is redesigned and set up, the bodywork is formed. It is not simply a question of setting up a technical product. Every vehicle feature reflects great attention to detail and the quest for the highest quality of workmanship. It takes some two years before a research car is ready to drive.
Carl Benz was fascinated by technical things. As early as 1877, he applied himself to designing stationary internal combustion engines as a substitute for the steam engine. He soon discovered that these drives were suited for more than just stationary use. The idea of the self-propelled vehicle – the automobile – took shape. Before long, Benz realised that it was not enough simply to install an engine in a horse-drawn carriage and declare it an automobile. Applying classic engineering methods, he recognised the limitations of the existing art and created innovative technology: a horizontal, petrol-powered, single-cylinder four-stroke engine, electric ignition, a clutch, carburettor, radiator, a means of gearing, and a differential for the two drive wheels.

Equipped with these items, the first motor car rolled out in 1885. It was not merely a modified carriage, but a wholly new design for which Carl Benz registered a patent on January 29, 1886. This motor car was the first automobile in the history of Daimler AG, and it was sold in small numbers. This pioneering effort was the start of the successful history of the automobile which Daimler has continued to dominate for more than 125 years. At the same time, it was the first research car in corporate history, since the motives that incited Carl Benz to build his car remain unchanged for every present-day research car from Mercedes-Benz. Each represents bold thinking far ahead into the future, combining several innovative technologies and making them something that can be experienced. At the same time the technologies are tested and introduced to the public. This was true for the Benz Patent Motor Car, and still holds true for the latest research car.

### The research cars of Mercedes-Benz.

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<thead>
<tr>
<th>Year</th>
<th>Model</th>
<th>Engineering tested</th>
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<tr>
<td>1969</td>
<td>C 111-I</td>
<td>Three-rotor Wankel engine, plastic bodywork</td>
</tr>
<tr>
<td>1970</td>
<td>C 111-II</td>
<td>Four-rotor Wankel engine</td>
</tr>
<tr>
<td>1978</td>
<td>Auto 2000</td>
<td>Reduction of fuel consumption</td>
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<tr>
<td>1981</td>
<td>NAPA</td>
<td>Compact short-distance vehicle</td>
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<tr>
<td>1991</td>
<td>F 100</td>
<td>Ergonomics, ambient sensors</td>
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<tr>
<td>1991</td>
<td>C 112</td>
<td>Dynamic handling, Active Body Control</td>
</tr>
<tr>
<td>1995</td>
<td>Vario Research Car</td>
<td>Car body variants, ergonomics, display systems</td>
</tr>
<tr>
<td>1996</td>
<td>F 200 Imagination</td>
<td>Drive-by-wire, cockpit design</td>
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<td>1997</td>
<td>F 300 Life Jet</td>
<td>Active lift control, dynamic handling</td>
</tr>
<tr>
<td>2002</td>
<td>F 450 Carving</td>
<td>Dynamic handling, active camber adjustment</td>
</tr>
<tr>
<td>2003</td>
<td>F 500 Mind</td>
<td>Interior compartment concept, variable door concept, hybrid diesel drive, x-by-wire systems</td>
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<tr>
<td>June 2006</td>
<td>Mercedes-Benz bionic car</td>
<td>Aerodynamics, lightweight design, diesel engine with novel SCR emission control</td>
</tr>
<tr>
<td>October 2005</td>
<td>F 600 HY²max</td>
<td>Fuel cell drive, variable operating concept, variable interior design, safety equipment</td>
</tr>
<tr>
<td>September 2007</td>
<td>F 700</td>
<td>DIESOtTO engine, PRE-SCAN suspension, variable deluxe interior compartment concept with REVERSE seat and innovative operating concept</td>
</tr>
<tr>
<td>March 2010</td>
<td>F 800 Style</td>
<td>Variable vehicle architecture with plug-in hybrid or electric drive with fuel cell, DISTRONIC PLUS Traffic Jam Vehicle Follow Assist and PRE-SAFE® 360°, intelligent seating, operating and display concept, bodyshell concept with rear pivoting sliding doors</td>
</tr>
<tr>
<td>September 2011</td>
<td>F 125/F</td>
<td>F-CELL Plug-in HYBRID with a lithium-air/hydrogen battery, pioneering hydrogen composite storage technology, 4MATIC all-wheel drive, bodyshell of lightweight hybrid construction, a visionary Cloud-based infotainment system, touch, gesture and voice control for the highest level of driver-fitness safety and ease of operation, Advanced Driving Assist</td>
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### Benz Patent Motor Car. The forerunner of all motor vehicles.

Carl Benz was fascinated by technical things. As early as 1877, he applied himself to designing stationary internal combustion engines as a substitute for the steam engine. He soon discovered that these drives were suited for more than just stationary use. The idea of the self-propelled vehicle – the automobile – took shape. Before long, Benz realised that it was not enough simply to install an engine in a horse-drawn carriage and declare it an automobile. Applying classic engineering methods, he recognised the limitations of the existing art and created innovative technology: a horizontal, petrol-powered, single-cylinder four-stroke engine, electric ignition, a clutch, carburettor, radiator, a means of gearing, and a differential for the two drive wheels.

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At the Frankfurt International Motor Show (IAA) in September 1969, Mercedes-Benz presented an exceptional car: the C 111. The world queued up to see this “test lab on wheels” with its wedge-shaped body and upward-opening gullwing doors. The colour, orange metallic, originally described as “rosé wine”, also helped attract attention. Less conspicuous, but no less unusual, were the technical innovations. The body consisted of fibre-glass reinforced plastic and was riveted and bonded to the steel frame-floor unit.

The C 111 was a test bed for the Wankel engine. The three-rotor unit, developing 206 kW (280 hp), provided the propulsion power and permitted a top speed of 260 km/h – quite remarkable for its time. Just a few months later, a thoroughly revised version of the C 111 was shown at the Geneva Motor Show. It featured a four-rotor Wankel engine with an output of 257 kW (350 hp). The car accelerated from standstill to 100 km/h in 4.8 seconds and attained a top speed of 300 km/h.

Little more was heard about the Wankel engine; diesel technology now became the focus of research. And record-breaking versions of the C 111 again captured public interest: in June 1976, April 1978 and May 1979, the C 111 completed runs on the high-speed test track in Nardo in southern Italy, and produced several absolute world records over various distances.

On the first record-breaking run, the C 111-IIID was almost unchanged on the outside compared with the 1970 model. It was powered, however, by a thoroughly revised five-cylinder diesel engine with a displacement of 3.0 litres. Instead of the 59 kW (80 hp) of the production car, it now achieved 140 kW (190 hp).

In 1978 the C 111-III, fitted with an additional intercooler, achieved an output of 169 kW (230 hp). By this time, the record-breaking car had little in common with the original C 111. The silver-painted body, mounted on a floor unit and now with revised dimensions, boasted an even more streamlined shape.

The record-breaking C 111-IV of 1979 came with further aerodynamic refinements, featuring distinctive spoilers, a changed front end and two tail fins. Its propulsion unit was a series-production 4.5-litre V8 engine, enlarged to displace 4.8 litres and to develop 367 kW (500 hp). This version of the C 111-IV was no longer purely a research vehicle, but one that achieved top-class sporting performance. As such, it provided many insights that benefited series production.
In the late 1970s the Federal German Ministry for Research and Technology launched the Auto 2000 project, in which several carmakers participated. Fuel consumption was not to exceed eleven litres per 100 km (21.3 mpg) for a vehicle with a curb weight of up to 2,150 kilograms – a very ambitious target in those days – and the maximum for vehicles weighing 1,250 to 1,700 kilograms was 9.5 litres/100 km (24.7 mpg). In addition, the car was supposed to accommodate four occupants and provide a payload capacity of more than 400 kilograms. Mercedes-Benz met the requirements.

The Auto 2000, first presented to the public at the 1981 Frankfurt International Motor Show, had an aerodynamically optimised body with a very low Cd (drag coefficient) of 0.28. As many as three different engine concepts were tested in this vehicle. An automatic cylinder cutoff system was premiered in a 3.8-litre V8 petrol engine. When only little power was required, four of the eight combustion chambers were temporarily shut down – today this is a feature of several large-displacement petrol engines built by Mercedes-Benz.

The 3.3-litre diesel engine tested in the Auto 2000 had exemplary accelerating power thanks to its six cylinders and two turbochargers; it offered an excellent range of 7.5 litres per 100 kilometres (about 31.3 mpg) at a speed of 120 km/h.

With the third drive unit of the Auto 2000, the engineers realised an ambitious project: the automotive gas turbine. It had several qualities, including low-pollutant combustion, low weight, compact dimensions, favourable torque characteristics, and the elimination of water cooling. All engines were harnessed to a four-speed automatic transmission. Integral seats for the driver and front passenger, with all the belt mounts on the seat itself, along with integral child restraint systems in the rear and pedestrian-friendly bumpers, were also tested in the Auto 2000.

Congested streets, a lack of parking space, and long tailbacks raised new questions in motor vehicle research. Mercedes-Benz answered them in 1981 with a concept study labelled “Nahverkehrsfahrzeug” or NAFA for short – the short-distance vehicle. With an overall length of 2.50 metres and an overall height and width of 1.50 metres, the innovative two-seater contradicted everything the company had been known to stand for to date.

Its four-wheel steering even allowed the car to be parked forwards into tight spaces. Its turning circle was all of 5.7 metres. Even if the distance from other parked vehicles on each side was small, two sliding doors permitted convenient entry and exit. They opened forwards, and the side mirror folded in automatically. The car had front-wheel drive and an automatic transmission. Its equipment included air conditioning, power steering and seat belt tensioners. The comparatively high seating position, low waistline and large glazed surfaces each contributed to superb all-round vision.

The NAFA study did not fall into oblivion. The insights it produced were incorporated into the design of the Mercedes-Benz A-Class, the prototype of which made its debut in 1996. In the smart city coupé, introduced in 1997, the concept of the compact urban car celebrated its coming of age. It has been manufactured in large numbers ever since.
Unbridled technology. Mercedes-Benz F 100.

Facts

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<tr>
<th>Vehicle</th>
<th>Mercedes-Benz F 100</th>
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<tr>
<td>Introduced</td>
<td>1991</td>
</tr>
<tr>
<td>Where</td>
<td>North American International Auto Show, Detroit/USA</td>
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Goals

- Novel seat and door concept, passive and active safety, ergonomics
- Four-stroke spark-ignition engine, six cylinders, 2.6 litres' displacement, 143 kW (194 hp), front-wheel drive, three-speed automatic transmission

Powertrain

- Central driver’s seat
- High level of crash safety
- Steering wheel with fixed impact absorber
- Telephone operation by means of steering wheel buttons
  - Production launch in the Mercedes-Benz S-Class (1998, W 220 series)
- Novel door concept
- Sophisticated ergonomics
- Autonomous intelligent cruise control
  - Production launch under the name DISTRONIC in the Mercedes-Benz S-Class (1998, W 220 series)
- Radar system for monitoring following traffic
  - Production launch under the name Active Blind Spot Assist and Active Lane Keeping Assist in the Mercedes-Benz S- and CL-Class (2010, W 221 and C 216 series)
- Solar cell roof
  - Production launch with the panoramic roof of the Maybach 62 (2002)
- Gas-discharge headlights
  - Production launch under the name xenon headlights in the Mercedes-Benz E-Class (1995, W 210 series)
- Prismatic rod-type taillights
- Linear windshield wipers
- Office equipment (voice-controlled telephone, fax, PC)
  - Production launch of voice recognition for the car phone under the name LINGUATRONIC in the Mercedes-Benz S-Class (1996, W 140 series)

Technical highlights
Mercedes-Benz F 100.

Technical highlights

- CTS tires (Continental Tyre System) with flat-running properties
- Electronic tyre pressure monitoring
- Production launch in the Mercedes-Benz CL (1999, C 215 series)
- Electric parking brake
- Production launch under the name ADAPTIVE BRAKE in the Mercedes-Benz S-Class (2005, W 221 series)
- Optical fibres for signal transmission
- Rain sensor
- Production launch in the Mercedes-Benz S-Class (2005, W 221 series)
- Electric parking brake
- Production launch in the Mercedes-Benz S-Class (1997, W 168 series)
- Chip card instead of car keys
- Production launch in the Mercedes-Benz S-Class (1999, W 220 series)
- Automatic adjustment of seat and steering wheel
- Production launch in the Mercedes-Benz A-Class (1997, W 168 series)
- Sandwich floor
- Production launch in the Mercedes-Benz A-Class (1999, W 220 series)
- Automatic door closing
- Production launch in the Mercedes-Benz CL and E-Class (2006, C 216 and W 212 series)
- Lane Keeping Assist
- Production launch in the Mercedes-Benz S- and E-Class (2009, W 221 and W 212 series)

Daimler-Benz deliberately chose the North American International Auto Show in Detroit in 1991 – the first major trade show of the year – to present a very special automobile: the Mercedes-Benz F 100. This research car gave tangible expression to the vision of engineers and market strategists for the automobile of the future. Never before had so many ideas and innovative technologies been realised in a fully operational car.

Driver seated in the middle of the F 100. This car put the results of accident and social research resolutely into practice. Statistically, a car is occupied by 1.2 to 1.7 persons – driver included. So the driver deserves the safest place, which is the centre position, with its large distances to car body parts. Furthermore, the driver can always get out of the car on the off-traffic side. Passengers also benefit from the concept. The two seats behind the driver are offset, rather than fixed in a row, so that the passengers are a considerable distance from the driver. Two more passengers are seated towards the middle of the vehicle between the sturdy rear wheel houses.

The body of the F 100, with its prominent tail end, anticipated the trend for a deeply raked rear. Daimler-Benz obviously calls for a novel body and door concept. A new door concept eases access to the F 100: the hinged and sliding doors; the B-pillar was dispensed with to allow easy access without impairing crashworthiness. Instead of having to close the doors, they can all be left slightly ajar – servomotors then pull them into their locks.

Central screen and autonomous intelligent cruise control. The gauges are arranged around the driver. A screen moves the crucial information into the centre of attention at all times. A distinction is made between three logical priorities – ranging from speedometer to warnings – for the forthcoming, safe journey. The F 100 used a conventional cathode ray tube, which has long since been replaced by silicon-based displays in present-day cars. A forward-looking feature was the use of optical fibres instead of copper wires for signal transmission. The steering wheel had a fixed impact absorber and integral controls for activating the car phone and voice control.

Numerous electronic units assist the driver and enhance safety, one of these being the distance warning radar. Another radar system monitors traffic behind the car and warns the driver if there is a vehicle in the blind spot when changing lanes. It can also be used for automatic lane holding. When the driver puts the car into reverse, a camera is extended from the rear spoiler, and images are displayed on the monitor.

The front headlights are very compact thanks to the first-time use of gas discharge lamps, today known as xenon lamps and a common feature on cars. The rear lights consist of transparent prismatic rods, which serve as light-wave conductors and take their energy from a central light source in the colour required for the immediate function. Together with the back window, they are cleaned by a rear wiper, discreetly concealed underneath the roof spoiler when not in use. The windscreen is cleaned by a linear wiper, which is guided across the entire width of the windscreen at top and bottom and thus sweeps almost the entire glazed area. A sensor in the windscreen ensures that the wiper is automatically switched on when it rains.

Debut of the voice-controlled car phone. Solar cells are integrated in the roof to support the batteries. Almost two square metres in area, they generate an output of 100 watts, which, among other things, provides power for the ventilation when the car is stationary,
Mercedes-Benz F 100.

Thus keeping temperatures at a pleasant level. By way of its car phone, including voice control, mobile fax and a personal computer, the F 100 anticipated the communication and work options of later production vehicles.

Different engine concepts were examined in the F 100, including a modified internal combustion engine operating on hydrogen. The vehicle has front-wheel drive – a novelty for Mercedes-Benz at the time. It rolls on CTS (Continental Tyre System) tyres with flat-running properties, and the tyre pressure is electronically monitored. The suspension features hydropneumatic auxiliary spring elements, enhancing comfort and handling safety. The first sandwich floor was realised in the F 100. This feature subsequently made it to large-scale production in the Mercedes-Benz A-Class. In the event of a crash, the engine – guided by the sloped firewall – slides downwards underneath the passengers, so that they are protected.

With all its qualities, the Mercedes-Benz F 100 was not simply a test mule for the engineers – it represented a new type of automobile. It anticipated the future of mobility, which has partly become reality since the car made its debut in 1991. At the same time, it emphasised the fact that the customer is the focus of technical progress when a research vehicle is designed.
Performance at its best. Mercedes-Benz C 112.

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<tr>
<td>Introduced in</td>
<td>1991</td>
</tr>
<tr>
<td>Where</td>
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Goals

High-performance sports car for testing active dynamic handling systems

Powertrain

Four-stroke spark-ignition engine, 12 cylinders, 6.0 litres' displacement, 300 kW (408 hp), rear-wheel drive, six-speed manual transmission

Technical highlights

- Active Body Control (ABC)
  - Production launch in the Mercedes-Benz CL (1999, C 215 series)
- Active rear-wheel steering
- Active aerodynamics
  - Actively controlled rear airfoil for increasing downforce at the rear axle and for acting as an air brake
  - Production launch in the Mercedes-Benz CL (1999, C 215 series)
- Electronic tyre pressure control system
  - Production launch in the Mercedes-Benz CL (1999, C 215 series)
- Autonomous intelligent cruise control
  - Production launch under the name DISTRONIC in the Mercedes-Benz S-Class (1998, W 220 series)
- Electrohydraulic gullwing doors
- Novel sensors for steering, clutch, brakes, doors, seat and mirror adjustment
The return of the gullwing door. The C 112 was the first vehicle since the C 111 to feature gullwing doors. Ever since the 1950s, they have been a symbol of Mercedes-Benz sports cars. The 300 SL coupé (W 194/198 series from 1952 and 1954 respectively) was the first to have them – a car whose excellent technical qualities made it stand out in its day. The C 112, with its streamlined body, followed suit.

Active aerodynamics. And the C 112 has even more to offer. One of its highlights is active aerodynamics. The fully adjustable front spoiler and rear airfoil are adapted to the particular driving situation to ensure the optimum compromise between low air resistance on the one hand, and high downforce on the other.

During normal operation, the rear airfoil is inactive and forms an integral part of the rear body structure; in this inactive state, the car has the optimum 
C 112 experimental car – a technology vehicle developed on the basis of the Sauber C 11 sports prototype.

C 112 experimental car – a technology vehicle developed on the basis of the Sauber C 11 sports prototype.

For the 1990 racing season in Group C, Mercedes-Benz, in cooperation with the Swiss Sauber team, fielded the C 11. It proved a great success, and the team was crowned world champion at the end of the season. The triumph was an inspiration for the Mercedes-Benz engineers. Looking for a way to test active dynamic handling systems for series-production cars, they came up with the C 112, a high-performance sports car. It was powered by a six-litre V12 engine that generated 300 kW (408 hp) and put 580 Newton metres of torque on the crankshaft. The challenge was to stretch the physical limits while transferring this performance to the road and meeting the highest levels of active safety.

Active Body Control. The C 112 was the first car to afford active suspension labelled Active Body Control (ABC). Each wheel is equipped with a combination of a spring and hydraulic servo cylinder. Sensors detect all the vehicle’s motions – vertical displacement, roll and pitch. To eliminate the unwanted motion, computers evaluate the data and control the active suspension elements accordingly. The result: an unprecedented level of stable roadholding.

The sports car features active rear-wheel steering. It corrects directional deviation which can be caused, for instance, by ruts and side wind or by road surfaces with changing tyre-to-road adhesion. Even in critical situations, for example, a change in load distribution while cornering, the vehicle maintains the handling and traction behaviour to which the driver is accustomed. An anti-lock braking system (ABS) and latest-generation acceleration skid control (ASR) complement the technology.

Equipped with all these features, the C 112 offered neutral handling, irrespective of load and roadway condition, even during high-speed cornering. Its safety reserves were thus higher than those of previous sports cars – a result which also benefited the series production.

Active aerodynamics. And the C 112 has even more to offer. One of its highlights is active aerodynamics. The fully adjustable front spoiler and rear airfoil are adapted to the particular driving situation to ensure the optimum compromise between low air resistance on the one hand, and high downforce on the other.

During normal operation, the rear airfoil is inactive and forms an integral part of the rear body structure; in this inactive state, the car has the optimum Cd, and lift forces tend toward zero. But the story is quite different when taking a corner at high-speed at the critical limit: here, appreciably larger wheel contact forces permit decidedly greater lateral acceleration and more stable handling.

In such a situation, the rear airfoil extends to the rear and upward within a tenth of a second and, in extreme instances, also changes the angle of incidence. The lip of the front spoiler, on changing height, works together with the rear airfoil. The system allows higher cornering forces and immediately extends the critical limits for the driver.

The rear spoiler is also used to improve the emergency stopping properties: with lightning speed, it is raised into the wind when required and helps slow the vehicle down. In addition, the brake system intelligently distributes the brake pressure between front and rear wheels to achieve optimum deceleration. Other components tested in the C 112 are tyre pressure monitoring, which warns the driver of sudden pressure loss, a distance warning radar for vehicles in front, and some new sensor systems for the steering, clutch, brakes, doors, seat and mirror adjustment.

The return of the gullwing door. The C 112 was the first vehicle since the C 111 to feature gullwing doors. Ever since the 1950s, they have been a symbol of Mercedes-Benz sports cars. The 300 SL coupé (W 194/198 series from 1952 and 1954 respectively) was the first to have them – a car whose excellent technical qualities made it stand out in its day. The C 112, with its streamlined body, followed suit.
Four cars in one. Mercedes-Benz Vario Research Car.

Facts

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<td>Goals</td>
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<td>Powertrain</td>
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Technical highlights

- Interchangeable bodies: saloon, estate, convertible and pickup on one and the same chassis, conversion achieved within 15 minutes
- Light and sturdy bodies of carbon-fibre reinforced plastic (CFRP)
- Active Body Control (ABC)
- Production launch in the Mercedes-Benz CL (1999, C 215 series)
- Colour display
- Production launch in the Mercedes-Benz S-Class (1998, W 220 series)
- Central rotary control to operate electronic functions
- Production launch in the Mercedes-Benz S-Class (2005, W 221 series)
- Navigation system
- Production launch in the Mercedes-Benz S-Class (1995, W 140 series)
- Safety display coupled to traffic sign evaluation function and distance warning radar
- Production launch under the name Speed Limit Assist and DISTRONIC PLUS in the Mercedes-Benz S- and E-Class (2009, W 211 and W 212 series)
Mercedes-Benz Vario Research Car.

One car, four vehicles – variability was the design focus of the Vario Research Car (VRC) by Mercedes-Benz, a car that attracted great attention at its premiere at the 1995 Geneva Motor Show. Within just a few minutes, the VRC can be transformed into a different car.

Whatever trip you’re planning, you need only one car thanks to the Vario Research Car, the feedback was particularly extensive and unusually diverse. The responses have given Mercedes-Benz many valuable suggestions for future production models.

For the electric connections in the rear, which differ for each body, there is a central terminal that automatically recognises the type of body. If, for example, an estate body is mounted, the rear-screen wiper/washer is supplied with current. With the saloon, the heated rear windscreen and lights for the boot have to be connected to the electric system, whereas for the convertible, the electric drive for the soft-top requires energy.

Diversity with the Vario Research Car: it can be an appealing estate car with plenty of load space, or a two-door coupé.

But to own such a fleet of vehicles would be uneconomical. The Vario Research Car from Mercedes-Benz presented the solution. Moreover, the VRC clearly illustrates that research vehicles require a dialogue with the public. Mercedes-Benz asks drivers to state their opinions about each new concept. In the case of the Vario Research Car, the feedback was particularly extensive and unusually diverse. The responses have given Mercedes-Benz many valuable suggestions for future production models.

This research car also features a number of futuristic technical solutions. The body change had to be easy to accomplish. This was only possible through the interaction of several components. The service technicians place the roof structure on the chassis; electric motors pull it into its final position, where special locking mechanisms hold it at eight anchorage points. To release it, all that is required is to activate levers on the door pillars and the upper windshield frame. The rest is again left to the servomotors, which release the locks and raise the body slightly so that it can easily be lifted off.

For the electric connections in the rear, which differ for each body, there is a central terminal that automatically recognises the type of body. If, for example, an estate body is mounted, the rear-screen wiper/washer is supplied with current. With the saloon, the heated rear windscreen and lights for the boot have to be connected to the electric system, whereas for the convertible, the electric drive for the soft-top requires energy.

Bodywork made of new materials. The bodies are light and sturdy – a result of the new materials tested by the engineers. They are made of the high-tech material CFRP – carbon-fibre reinforced plastic. Compared with aluminium, CFRP is 25 percent lighter; what’s more, it’s exceptionally strong. Weighing only 30 to 50 kilograms each and, despite their lightweight design, the bodies afford a high level of stability and crashworthiness.

The Vario Research Car served the purpose of further testing the front-wheel drive concept in a Mercedes-Benz – in this case in combination with a stepless automatic transmission as well as active suspension (Active Body Control, ABC) in the interests of enhanced handling safety and comfort.

The cockpit contains a colour display, showing the driver all the required information. The rotary actuator installed on the centre console enables the driver to control the entire menu selectively. It includes not only the rev counter, trip computer and trip odometer, but also route recommendations from the onboard navigation system. A special feature is the safety display in conjunction with the traffic sign evaluation system. If the driver keeps to the official speed limit, it shows a green circle. If he drives faster or does not maintain the correct distance from the vehicle in front, the colour and shape of the symbol change – the circle turns into a yellow ellipse or a red triangle, depending on whether the driver exceeds the speed limit or falls below the safe distance. This function requires the onboard electronics to be coupled with distance radar and traction control.

The upper part of the centre console accommodates a second display which, among other things, shows information on the air conditioning settings and navigation system. Also, when the driver stops to refuel, the system indicates whether the tyre pressure, engine oil, coolant and windscreen wash levels, and the lights are in order. While driving, additional functions cannot be selected, so that the driver is not distracted from the traffic. Front passengers have unimpeded access, however, to all secondary information. The rotary control “senses” whether the display is being touched by the left hand (front passenger) or right hand (driver).

First-time use of drive-by-wire for steering and brakes. The Vario Research Car was the first research car from Mercedes-Benz featuring drive-by-wire technology, in which the steering and the brakes, for example, are activated electrically with no mechanical steering or braking. However, testing this technology was not the main purpose of the VRC – body variability was the principal concern. By way of the Vario Research Car, Mercedes-Benz has underpinned its strengths, namely the holistic design of new vehicles – and the ability to put them on wheels, ready to run.
A new driving sensation.
Mercedes-Benz F 200 Imagination.

Facts

Vehicle
Mercedes-Benz F 200 Imagination

Introduced in
1996

Where
Paris Motor Show

Goals
Testing of new ergonomic concepts based on drive-by-wire technology, cockpit design

Powertrain
Four-stroke spark-ignition engine, 12 cylinders, six litres’ displacement, 290 kW (394 hp), rear-wheel drive, five-speed electronically controlled automatic transmission

Technical highlights
• Sidesticks instead of a steering wheel: drive-by-wire
• Forward-looking dynamic handling control system
• Active Body Control (ABC)
  ➤ Production launch in the Mercedes-Benz CL (1999, C 215 series)
• Headlight system featuring variable light distribution
  ➤ Production launch of bi-xenon headlights with Active Light Function in the Mercedes-Benz E-Class (2003, W 211 series)
  ➤ Production launch under the name Adaptive Highbeam Assist in the Mercedes-Benz E-Class (2009, W 212 series)
• Window-Airbag
  ➤ Production launch in the Mercedes-Benz E-Class (1998, W 210 series)
• Video cameras in place of rear-view mirrors
• Electro-transparent panoramic glass roof
  ➤ Production launch with the panoramic roof of the Maybach 62 (2002)
• Swivelling gullwing doors
  ➤ Production launch in the Mercedes-Benz SLR McLaren (2003, C 199 series)
• Voice recognition for mobile phone
  ➤ Production launch under the name LINGUATRONIC in the Mercedes-Benz S-Class (1996, W 140 series)
Does the car of the future still have a steering wheel and foot-operated controls? The Mercedes-Benz F 200 Imagination, presented at the 1996 Paris Motor Show, systematically tested a new ergonomic concept and was the product of the joint efforts of engineers and designers. Sidesticks – small joysticks in the doors and the centre console for steering and braking – replace the steering wheel. The signals are exclusively transmitted electronically to the relevant components (drive-by-wire). The conventional mechanical control elements used by the driver are now linked to electric and hydraulic actuators, and electronic pulses carry out the desired actions.

**Sidestick instead of steering wheel.** When the driver pushes the sidestick forward, the F 200 Imagination accelerates. If he then moves the lever to the right or left, the vehicle steers to the right or left. If he pulls the lever back, the vehicle brakes and, if desired, reverses after coming to a standstill. Should the driver need a break, he can switch the system to the front seat passenger’s sidestick.

Drive-by-wire is a technical solution that also allows the interior to be improved, for example. If the steering wheel and the pedals are removed, the passengers have more space and thus more comfort. It also enhances safety because the cockpit and footwell can be designed completely differently.

The F 200 Imagination embodies the systematic networking of electronic systems. One result is futuristic dynamic handling. The electronics recognise the driver’s commands as requests for a certain driving mode – accelerate, brake, steer, reverse – and decide in a flash how to comply with the commands in the best and safest manner. In response to the actual situation, the computer utilises the information from various sensors concerning travel, wheel and engine speed, road conditions and body movement.

**Electronics as an active driving aid.** Based on the data, the computer decides, for example, how sharply the wheels should be turned when cornering, or what engine speed is appropriate for driving on a wet road. The system is interlinked with the active suspension Active Body Control (ABC). Even in critical traffic situations, the electronics keep the car safely on course by intervening at lightning speed to regulate steering, braking, engine or transmission management and chassis control.

The driver can fully utilise the technical capabilities of the car without transgressing physical limits – a genuine advantage for safety. The electronically controlled rear spoiler system of the F 200 Imagination also enhances safety, setting itself upright in a flash and creating drag for better deceleration when an emergency braking situation is detected.

The F 200 Imagination research car presents further innovative technology. The headlights, for instance, feature variable light distribution. Six individual reflectors in each module, each with a separate bulb, are switched on and off depending on the situation and speed. This ensures optimum light without dazzling oncoming traffic. In bends, the light follows the wheel angle set by the driver, thus enhancing safety when driving at night. At high speeds on motorways, an additional spot reflector is switched on to improve the illumination of the roadway far ahead. The rear end sports a very compact light unit, incorporating nine separate functions: turn signal, rear light, rear fog lamp, brake light, reversing light, rear reflector, side reflector, side-marker light and ambient light. The unobtrusive indicator panel – a slender, arched neon tube – is distinguished by high luminous power and a long life.

Debut of the window airbag. Safety has always been a priority for Mercedes-Benz. This commitment is demonstrated in the F 200 Imagination by the first-ever window airbag. It inflates across the side walls and considerably reduces the risk of head injuries in side crashes and rollovers. Since the coupé study does not have a steering wheel, the front airbags are incorporated in a kneepad underneath the dashboard.

Instead of the conventional rear-view mirrors, the experts installed a video system with five permanent mini-cameras. Four of them are discreetly concealed in the roof frame struts on each side of the car and, out on the road, they constantly monitor the areas alongside and behind the vehicle. The fifth camera is in the rear bumper and automatically switches on when the vehicle reverses. The images appear on various monitors in the vehicle interior, where normally the mirrors would be located.
Mercedes-Benz F 200 Imagination.

**Groundbreaking design.** A large, advanced coupé, the F 200 Imagination anticipated the major design features of the Mercedes-Benz CL (C 215 series) that made its debut in 1999. The F 200 Imagination has a transparent roof to flood the interior with light. At the push of a button, the electro-transparent glass can be darkened to avoid excessive heating of the interior due to strong solar radiation. The glass has an intermediate layer in the form of a liquid crystal film of electrically conductive plastic. Electric current causes the crystals to arrange themselves so that the glass is transparent. This roof is a standard feature of the Maybach 62.

**Findings for large-scale production.** Especially when considering its overall characteristics, the F 200 Imagination is revealed as a truly pioneering research vehicle. Its electronics prepared the ground for new concepts and will play an even greater role in future cars. The F 200 Imagination was the forerunner of a special Mercedes-Benz SL in the R 129 series. It was equipped with electronic steering and sidesticks for test purposes in 1998 and was used for intensive trials.

Although steering, braking and accelerating with sidesticks requires the driver to think differently, it opens up new dimensions in driving dynamics, ride comfort and handling safety. The steering ratio and steering forces can be customised and adapted to specific situations – parking is different from negotiating a fast curve. To brake, the foot no longer has to move from the accelerator to the brake pedal, which enables the driver to respond more quickly.
The curve master. F 300 Life Jet.

Facts

Vehicle
F 300 Life Jet

Introduced in
1997

Where
Frankfurt International Motor Show (IAA)

Goals
Feel and cornering dynamics of a motorcycle, combined with the safety and comfort of a car

Powertrain
Four-stroke spark-ignition engine, four cylinders, 1.6 litres’ displacement, 75 kW (102 hp), rear-wheel drive, electrohydraulic five-speed manual transmission featuring sequential gear change

Technical highlights
• Active Tilt Control (ATC)
• Actively controlled rotational headlights
• Light sensor
• Production launch in the Mercedes-Benz S-Class (1998, W 220 series)
• Electrohydraulic manual transmission (shift-by-wire)
• Newly developed tyres
F 300 Life Jet.

Motoring pleasure at its best: the F 300 Life Jet leans into bends thanks to Active Tilt Control.

The development of the F 300 Life Jet was initiated by a specific question: how can the feel and cornering dynamics of a motorcycle be combined with the safety and comfort of a car?

Motorcyclists enjoy the freedom offered by their vehicles: they lean into bends, sense the power of the engine, are agile, feel at one with the elements, and experience the unbridled pleasure of the road – all of which are also part and parcel of the F 300 Life Jet. Over and above this, it offers the advantages of a car: even three wheels are more stable than two. The top can be closed, and seat belts are provided. The motoring experience can be shared with a second person inside the vehicle, both unimpeded by protective clothing, helmet and wind noise. And air conditioning makes for pleasant temperatures.

Body leans into bends. Never before had the world seen a three-wheeler that leans into bends. To make this possible, Active Tilt Control (ATC) was developed. A complex electronic system computes the tilt angle, calculating the speed, acceleration, steering angle and yaw of the vehicle so that the tilt always complies with the actual driving situation. The electronic control commands are transmitted to a hydraulic cylinder on the front axle. Depending on the steering angle, it press one of the two spring struts outwards so that wheel and body adopt the tilt angle calculated by the computer. The maximum angle of inclina - tion is 30 degrees. Special tyres that allow large camber and slip angles were specially developed in cooperation with a tyre manufacturer. The rims of the F 300 Life Jet are made of magnesium and tip the scales at only about 75 percent of what a conventional aluminium motorcycle rim weighs.

Lightweight aluminium chassis. The chassis of the two-seater is an aluminium construction weighing just 89 kilograms. The bodywork styling resembles that of a jet. The vehicle is as long as a regular car, but not as wide – so that it can lean into bends. The F 300 Life Jet has room for two persons seated one behind the other. The special features of the body include an upward-opening, space-saving, hinged door for the driver, a hinged door which swings to the rear for the passenger, and a fixed two-part roof made of aluminium and transparent plastic. In good weather, the two halves of the roof can be removed in a jiffy and stowed in a compartment aft of the rear wheel, thus converting the F 300 Life Jet into an open roadster.

The lighting technology is in keeping with the unusual vehicle concept. The headlight has three reflector sections and two bulbs. The headlight electronics ensure the best possible roadway illumination including in bends. They are linked to the Active Tilt Control computer and turn the headlight to conform to the body tilt; when required, they also cut in a special cornering light. This increases the range of the low-beam headlight by more than 80 percent. A light sensor controls the beam: the light comes on automatically at dusk and when the vehicle enters a tunnel. Neon lamps are used for the indicators, brake lights and marker lights. The slender tubes are accommodated in the wings.

Transmission with sequential gearshift. The engine – a 1.6-litre unit from the Mercedes-Benz A-Class – and the electrohydraulic transmission (shift-by-wire) are installed in a space-saving position between the interior and the rear wheel. Power is transmitted via a toothed belt to the rear wheel. The 75 kW (102 hp) output allows acceleration from standstill to 100 km/h in 7.7 seconds and a top speed of 211 km/h. Consumption is around 5.3 litres per 100 kilometres (44.3 mpg). To change gear, after stepping on the clutch, the gear lever situated on the right of the cockpit is moved lightly forward and backward. This technique is known as “sequential gearshift.” It enables particularly rapid gear change and underscores the dynamic character of the F 300 Life Jet.

The cockpit of the F 300 Life Jet is reminiscent of that of an aeroplane. The steering wheel, gauges, gear lever and seats have the feel of a jet plane and give the driver the impression that he has just taken a seat in an aeroplane cockpit. The segmented steering wheel is also an active element of the “control centre”. Buttons for operating the car radio and phone are integrated in the side sections of its impact surface, so that the driver does not have to take his hands off the steering wheel.
F 300 Life Jet.

From the computer to the world of research.
The F 300 Life Jet was the first research vehicle to be designed entirely on the computer and then brought to life. It thus served not only as a proving model for new vehicle equipment, but also to test a design tool called CASCaDE (Computer Aided Simulation of Car, Driver and Environment), developed by Daimler-Benz. From a very early stage, the computer was able to deliver data on the F 300 Life Jet's handling by means of simulation.

The company consistently adopts an unconventional approach in the interests of developing both the automobile and mobility – as demonstrated by the F 300 Life Jet. The F 300 may be capable of establishing a new type of vehicle, combining everything required to fulfil the modern desire for perfect enjoyment on wheels: the fresh-air feel of a convertible, the individuality of a roadster, the performance of a sports car, the comfort of a compact car, and the safety of a Mercedes-Benz.
Safe driving pleasure. Mercedes-Benz F 400 Carving.

Facts

Vehicle
Mercedes-Benz F 400 Carving

Introduced in
2001

Where
Tokyo Motor Show

Goals
Testing of novel dynamic handling systems

Powertrain
Four-stroke spark-ignition engine, six cylinders, 3.2 litres' displacement, 160 kW (218 hp), rear-wheel drive, electrohydraulic five-speed manual transmission

Technical highlights

- Active camber control
- Electronic steering system (steer-by-wire)
- Electronic brake system (brake-by-wire)
  - Production launch under the name Sensotronic Brake Control (SBC™) in the Mercedes-Benz SL (2001, R 230 series)
  - Brake discs made of carbon-fibre reinforced ceramic
    - Production launch in the Mercedes-Benz CL 55 AMG F1 (2000, C 215 series)
- Active hydropneumatics with a new type of Active Body Control (ABC)
- Aluminium space frame with CFRP body (carbon-fibre reinforced plastic)
- Xenon headlights incorporating fibre-glass technology
- Additional headlights for cornering, also operating as fog lamps
  - Production launch in the Mercedes-Benz E-Class (2002, W 211 series)
- Turn signals with high-performance LEDs
- 42-volt onboard power supply
Mercedes-Benz F 400 Carving.

The F 300 Life Jet research vehicle provided extensive insights into the active wheel chamber control for cars. The engineers then systematically extended their research work to a four-wheeled vehicle and, in 2001, presented the F 400 Carving. In particular, its systems enhance handling safety, driving dynamics and motoring pleasure.

The most conspicuous feature of the F 400 Carving, which gets its name from the sporty carvers on ski slopes, is the tilting of its wheels. When cornering, the wheels on the outside of the bend tilt by as much as 20 degrees, which distinctly improves directional stability and roadholding, and reduces the danger of skidding. Electronics have been combined with mechanics to achieve this. Sensors measure the road speed, acceleration, steering lock and yaw of the car, and send control signals to the outer wheels' hydraulic servo cylinders, causing them to tilt at a precisely defined angle. The kerb-side wheels, like the body, remain in their normal position.

Active camber adjustment for enhanced safety. Thanks to the F 400 Carving’s active camber control, the cornering forces, compared with a contemporary car chassis, are up to 30 percent higher. Longitudinal forces are improved by up to 15 percent. Due to high lateral forces acting on the outer wheels, lateral acceleration is up to 28 percent higher than with sports cars built on conventional chassis technology. This solution not only affords more dynamic cornering and sporting agility, but also improves handling safety. This applies in critical situations in particular, such as taking bends too quickly or swerving suddenly.

The risk of skidding caused by under or over-steering is eliminated by means of efficient hydraulics. The system tilts one or more wheels briefly and to a precisely computed angle, which increases the cornering forces and stabilises the vehicle. For emergency braking, all four wheels can be cambered in a flash so that only the insides of the tyres, with their friction-optimized tread compound, have contact with the road. This shortens the stopping distance from 100 km/h by a good five metres. The chassis technology also has the ability to change the tyre contact patch if aquaplaning threatens.

Special tyres for the research car. The success of the F 400 Carving is attributable, in major part, to its tyres. These were developed specifically for this car and combine the advantages of car tyres with those of the motorcycle. The inner tyre has a rounded tread to allow best cornering behaviour; this tread also has an especially high coefficient of friction. When the wheels are tilted, the transmitted forces are particularly high. The outer shoulder of the tyre features a proven car tread and good straight-line stability. The tyre is mounted on a special rim with a diameter of 17 inches on the inside - the active cornering side, and an outer diameter of 19 inches. This ensures that, on a straight stretch, the research car drives on only the part of the tread that is not arched. On bends, thanks to the smaller inside diameter, the largest possible tyre contact patch is ensured.

Advanced electronics. Drive-by-wire technology was a further development goal of the F 400 Carving. The F 400 Carving does not have a mechanical linkage like a steering column, with its spindles and joints, or links between the brake pedal and brake booster. Instead, cables transmit the driver’s steering and braking commands solely by electronic means. This allows for additional safety. In hazardous situations, automatic steering correction reduces the risk of skidding. The electronics compute and, as required, apportion brake pressure to each wheel according to the situation, thus ensuring highly reliable braking on bends, for example.

Carbon-fibre reinforced ceramic brake discs. The brake discs are made of carbon-fibre reinforced ceramic, a high-tech material which resists extreme temperatures in the range of 1,400 to 1,600°C and permits optimal deceleration. In addition to the standard onboard power supply, the F 400 Carving is equipped with two 42-volt systems, mainly for the electronic steering.
Suspension and lighting. The F 400 Carving features a new kind of Active Body Control (ABC) coupled with an active hydropneumatic system. This influences both the springing and damping of the car. The result, once again, is enhanced handling safety and better ride comfort.

The headlight system is another new development. The light source and headlight proper are separate – glass fibres transmit the combined light of the xenon bulbs to the apertures without loss, where it is distributed across the roadway by special lenses. This has special benefits for the design of the sports car’s front, because the headlights occupy very little space. On bends, depending on the angle of the wheels, additional side headlights switch on; they also function as fog lamps. The indicators are high-performance light-emitting diodes, whose light is distributed by prismatic rods.

Research into materials was also undertaken for the F 400 Carving. The body is made of carbon-fibre reinforced plastic (CFRP) and weighs just over 100 kilograms. The space frame chassis is made of steel, aluminium and CFRP. The F 400 Carving roadster brings back the gullwing doors – a distinctive characteristic of special Mercedes-Benz sports cars.
Research lab on wheels. Mercedes-Benz F 500 Mind.

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<td>Where</td>
<td>Tokyo Motor Show</td>
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<td>Goals</td>
<td>Testing of hybrid drive, novel door and interior compartment concept, electronic driver information system</td>
</tr>
<tr>
<td>Powertrain</td>
<td>V8 four-litre diesel engine (184 kW/250 hp) in combination with an electric motor (50 kW/68 hp)</td>
</tr>
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</table>

Technical highlights

- Hybrid drive (combination of diesel engine and electric motor)
- Variable door concept with two different opening options
- Electronic accelerator and brake pedal
- Electronically controlled steering
  - Production launch under the name STEER CONTROL in the Mercedes-Benz B-Class (2005, T 245 series)
- Night view system with infrared laser headlights
  - Production launch under the name NightView Assist in the Mercedes-Benz S-Class (2005, W 221 series)
- Novel operating and display concept
- Multi-vision display
- Driver information system based on ultrasonic technology
- Folding lab table with computer for monitoring the vehicle systems
The future will never cease to be exciting. This is borne out by the Mercedes-Benz F 500 Mind, presented at the 2003 Tokyo Motor Show. The four-door car, designed as a modern hatchback saloon, served as a research lab on wheels and demonstrated over a dozen technical ideas for enhancing the safety, propulsion and comfort of future Mercedes-Benz passenger cars.

The innovation begins with the hybrid drive, the first in the luxury car segment. It has the ability to utilise different propulsion energies. If a great deal of power is required, a V8 diesel engine with 184 kW (250 hp) drives the F 500 Mind - and simultaneously charges the batteries, as the car also features a 50 kW electric motor that works either by itself or in conjunction with the internal combustion engine. An electronic control unit that adapts to the traffic situation and driving style perfectly coordinates the engine and motor. The electric motor, for instance, powers the car when it starts up, in stop-and-go traffic and in other situations where the internal combustion engine, by virtue of its design principles, does not develop optimum efficiency.

Moreover, the idea of a central pillar offers new air conditioning options. The engineers integrated air ducts in the pillar cladding. These run upward to the central roof structure. Together with the additional cross-bracing in the floor and the massive side-skirt profiles, the central pillar offers high bending and torsional strength. The innovative structural element owes its special design to a study, conducted specifically for this purpose, of visibility conditions for the driver. As a result, the slightly curved shape of the central pillar ensures that the driver’s view of the sides and the rear is not impeded in any way.

Night view system for enhanced driving safety in the dark. In the dark or poor visibility conditions, the innovative NightView function appears on the right-hand display of the instrument cluster. NightView consists of two infrared laser headlamps whose invisible light illuminates the road up to 150 metres ahead. A camera in the windscreen of the F 500 Mind captures the headlamps’ light as it is reflected by other vehicles, cyclists or pedestrians, and converts the signals into an unambiguous black-and-white picture which is shown in the multi-view display. The driver thus becomes aware of potential danger spots much earlier than he would if relying on standard low-beam headlights that illuminate about 40 metres of the road ahead.

Workplace on the passenger side. Being a research lab on wheels, the F 500 Mind is equipped with a special folding lab table complete with a computer. This enables a researcher, travelling in the back, to monitor and control the vehicle’s systems during a test drive, and to carry out measurements. The research car was actually used for intensive acceptance testing of the new operating and display concept, road tests with the diesel hybrid drive, and testing the night view assistance function.
## Taking its clues from nature.
### Mercedes-Benz bionic car.

### Facts

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<tr>
<th>Vehicle</th>
<th>Mercedes-Benz bionic car</th>
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<tr>
<td>Introduced</td>
<td>June 2005</td>
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<tr>
<td>Where</td>
<td>Washington, DaimlerChrysler Innovation Symposium</td>
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### Goals

- Investigation of the potential of bionics for automotive development
- Testing of forward-looking diesel engine technology with novel emission control (SCR technology)
- Turbodiesel engine with common rail direct injection, 2.0 litres’ displacement, 103 kW (140 hp), emission control using SCR technology, maintenance-free diesel particulate trap

### Technical highlights

- Outstanding aerodynamic efficiency (drag coefficient \( CD = 0.19 \)) with body modelled on the boxfish
- Body-in-white designed by the SKO (Soft Kill Option) method
- Advanced diesel engine with direct injection
- Emission control system using SCR technology with AdBlue, reducing nitrogen emissions by up to 80 percent
- Production launch in the Mercedes-Benz Actros (2005), the Mercedes-Benz E 320 BLUETEC (2006, W 211 series) in the USA and E 300 BLUETEC in Europe in 2007
- Maintenance-free diesel particulate trap
- Consumption of just 4.3 litres of fuel per 100 kilometres (54.7 mpg) in the EU driving cycle
- Infinitely variable AUTOTRONIC automatic transmission
- Production launch in the Mercedes-Benz B-Class (2005, T 245 series)
- Door handles flush with the outer skin and folded out by electric motors upon being touched
- Front indicators using prismatic optics
- High-performance light-emitting diodes as position lights
- Rear light units with high-performance LEDs and prismatic rods
- Cameras instead of rear-view mirrors
With the Mercedes-Benz bionic car – a concept car – the company is investigating the great potential of bionics (the combination of biology and technology) for automotive development. The combination of forward-looking diesel engine technology and innovative emission control has achieved outstanding results in fuel economy and in reducing pollutant emissions. For the first time, the engineers specifically looked for a role model in nature, one that lends itself to an aerodynamically efficient, safe, comfortable and environmentally compatible automobile - not just in detail features, but also in its overall shape and structure. Their search led them to the boxfish. This fish, which lives in tropical waters, has excellent hydrodynamic properties, despite its angular, cube-like body. Its shape is aerodynamically ideal. On a model representing a true copy of the boxfish body, the engineers measured a drag coefficient (Cd) as low as 0.06.

To be able to use this great potential for automotive development, a 1:4-scale car model was developed as a first step, its shape being largely identical to that of the boxfish. Using this clay model, a drag coefficient of Cd = 0.095 – an extremely low value in automotive engineering - was measured in tests in the wind tunnel. This corresponds to the figures achieved by streamlined bodies (Cd = 0.09) and other aerodynamically efficient shapes. The scientists and engineers drew on the findings from these investigations to develop the bionic car, a fully operational and ready-to-drive compact car with a length of 4.24 metres. It accommodates four people and their luggage and, in terms of safety, comfort and everyday practicality, incorporates qualities that are typical for Mercedes-Benz. With a Cd value of 0.19, the concept car ranks among the aerodynamically most efficient automobiles in its size category.

20 percent reduction in fuel consumption, nitrogen-oxide emissions lowered by up to 80 percent. Alongside maximum aerodynamic efficiency and a lightweight concept gleaned from nature, the advanced turbodiesel engine with common rail direct injection (103 kW/140 hp) and novel SCR (Selective Catalytic Reduction) technology contributes significantly to reductions in fuel consumption and pollutant emissions. In the EU driving cycle, the concept car consumes 4.3 litres of fuel per 100 kilometres (54.7 mpg) – 20 percent less than a comparable production model. In line with US measuring methodology (FTP 75), the car does some 70 miles per gallon (combined) – 30 percent more than a production car. At a constant speed of 90 km/h (55 mph), the direct injection engine consumes 2.8 litres of diesel per 100 kilometres, corresponding to 84 miles per gallon in the US test cycle.

With SCR technology and the AdBlue additive, the nitrogen oxide emissions of the advanced direct injection diesel engine can be reduced by up to 80 percent. AdBlue is an aqueous urea solution which, precisely apportioned to match engine operating conditions, is sprayed into the exhaust system. This solution triggers the transformation of nitrogen oxides into harmless nitrogen and water. The reservoir for this additive is accommodated in the spare wheel recess of the concept car; one filling is sufficient for the entire period between the maintenance intervals of a modern Mercedes-Benz diesel model. In addition, the Mercedes-Benz bionic car study is equipped with a maintenance-free diesel particulate trap.

Body structure: nature’s construction principle for high rigidity and low weight. In cooperation with bionics experts, the company’s researchers have developed a computer-based process for transferring the growth principles in nature to automotive engineering. This process is based on the SKO (Soft Kill Option) method. The body and chassis components are dimensioned by means of computer simulation; the material is made ever thinner and finally cut away completely in low-load areas, while highly stressed areas are reinforced. By applying the SKO method to the entire body-in-white structure, weight is reduced by some 30 per cent, while the high levels of stability, crashworthiness and driving dynamics remain unchanged. This reduction in weight makes an important contribution to further improving fuel economy.
Powerful, comfortable, clean.
Mercedes-Benz F 600 HY\textsuperscript{GENIUS}.

Facts

Vehicle
Mercedes-Benz F 600 HY\textsuperscript{GENIUS}

Introduced in
October 2005

Where
Tokyo Motor Show

Goals
Testing of the further developed fuel cell drive, interior compartment matched to the needs of families, innovative operating concept, expanded PRE-SAFE\textsuperscript{R} system

Powertrain
Fuel cell with electric motor, peak output 85 kW (115 hp), continuous output 60 kW (82 hp)

Technical highlights

- Further developed fuel cell hybrid drive
- Start-of-production at the end of 2009 in the Mercedes-Benz B-Class F-CELL
- Interior appointments and seats matched to the needs of families
- Driver’s seat with automatic adjustment to body contours and sophisticated support of spinal discs
- Two-part boot-lid for maximum variability
- Space-saving front doors which swivel upwards
- High-performance light-emitting diodes for all light functions
- Flashing brake lights in emergency braking manoeuvres
- Production launch in the Mercedes-Benz S-Class (2005, W 221 series)
- Expanded PRE-SAFE\textsuperscript{R} system with active knee protection and head restraints with automatically extending side bolsters for supporting the head
- Production launch under the name kneebag in the Mercedes-Benz E-Class (2009, W 212 series)
- Video cameras for risk-free alighting and safe lane changes
- Innovative operating concept with virtual display
- Revised COMAND system for even easier operation
Mercedes-Benz F 600 HYGENIUS.

The continuous output of the fuel cell drive is 60 kW (82 hp). Energy not required for driving the car is stored in a high-performance lithium-ion battery. The system therefore operates rather like a hybrid drive and selects the source of energy best-suited to the driving situation. The generous amount of energy made available by the fuel cell can also be used for the well-being of the passengers in the F 600 HYGENIUS research car. The cup holders, for instance, cool or heat beverages with electricity generated by the environment-friendly fuel cell.

The F 600 HYGENIUS is exceptional for its good cold-start ability. The cup holders, for instance, cool or heat beverages with electricity generated by the environment-friendly fuel cell. The engineer’s eyes do not have to be fixed on the environment to prevent accidents. The LEDs are allocated to three projection modules which ensure wide and even distribution.

The two-part boot lid of the F 600 HYGENIUS is a perfect family car. The seats, for instance, are designed to match the needs of children and families. Thanks to a new design, both sides of the back of the front passenger and single rear seats can be used. Moving the seat forward allows a rear-facing ISOFIX child’s seat to be engaged. This face-to-face seating arrangement enhances children’s safety and makes it easier to keep an eye on them.

The driver’s seat features two-part backrest padding, whose height, width and angle can be precisely adjusted to the driver’s body shape by means of electric motors. It therefore offers firm support, especially at waist height. The backrest is mounted to follow the movements of the upper body, thereby reducing the strain on the spinal discs in every seating position.

The F 600 HYGENIUS continues the series of fascinating and groundbreaking research cars. Powered by an 85 kW (115 hp) zero-emission fuel cell drive, the compact family car consumes the equivalent of just 2.9 litres per 100 kilometres (81 mpg) and has a range of over 400 kilometres.

Compact car with the comfortable space of a luxury model. Despite its compact 4.35-metre-long body, the space inside the four-door F 600 HYGENIUS surpasses the dimensions conventionally found in the luxury class. The distance between the front and rear seats is a generous 95 centimetres and can be increased by up to 40 centimetres by moving the individual rear seats further back.

With its host of well-thought-out details, the F 600 HYGENIUS is a perfect family car. The seats, for instance, are designed to match the needs of children and families. Thanks to a new design, both sides of the back of the front passenger and single rear seats can be used. Moving the seat forward allows a rear-facing ISOFIX child’s seat to be engaged. This face-to-face seating arrangement enhances children’s safety and makes it easier to keep an eye on them.

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Two-part boot lid, and picnic site in the luggage compartment. The two-part boot lid of the F 600 HYGENIUS is extremely practical. It opens automatically at the push of a button and, in cramped conditions, the lower element folds inside, so that the swivel range is substantially reduced. At the same time, the rear bumper moves downwards and pulls out the luggage compartment floor, making it easier to load and providing a seat for picnics. The front doors of the F 600 HYGENIUS swivel forwards, thereby taking up less space than conventional car doors – an advantage in narrow parking bays.

Video cameras for risk-free alighting and safe lane changes. Cameras in the wing-mirror housings monitor the area alongside and behind the car, including when the F 600 HYGENIUS research car is being parked. When another car or a cyclist approaches from behind, the system automatically locks the relevant door for a short while to prevent a collision. An audible alarm sounds and a red danger symbol appears in the mirror glass. While the vehicle is moving, cameras monitor the two wing-mirrors’ blind spots and, on changing lanes, the driver is warned if another vehicle is too close behind. Images appearing on the two high-resolution colour displays in the dashboard are deflected by two mirrors and projected in such a way that they appear to be 1.40 metres in front of the driver. With this novel virtual display technology, Mercedes-Benz renders an important contribution to physiological safety because the driver needs less time to refocus from the more distant traffic situation to the cockpit display. Scientific studies confirm that, with this technology, the driver’s eyes do not have to adapt from short-range to long-range vision and therefore do not tire as quickly.

High-performance light-emitting diodes for all light functions. The engineers also concerned themselves with light technology. Headlights with high-performance light-emitting diodes improve the driver’s vision in the dark and help prevent accidents. The LEDs are allocated to three projection modules which ensure wide and even distribution. The middle light module is activated in specific driving situations and also functions as the full beam, cornering light and daytime running lights. The individual light-emitting diodes are activated to perform different light functions, the conventional moving parts required for cornering lights are no longer necessary. Mercedes-Benz also uses LEDs for the rear and brake lights. In case of emergency braking manoeuvres, flashing brake lights warn drivers behind and reduce the risk of rear-end collisions.
Preventive PRE-SAFE® protection with knee bolster and new head restraints. The preventive PRE-SAFE® occupant protection system, which made its worldwide debut in the Mercedes-Benz S-Class in 2002, is to be the subject of further engineering refinement. The F 600 HYGENIUS offers two additional protection systems, namely active knee protection for supporting the front passenger, and automatically extending side bolsters to restrain the head. These and other PRE-SAFE® features are activated before an imminent accident to prepare the occupants and the car itself for the impact. When the accident actually occurs, seat belts and airbags provide maximum protection. If the accident is prevented at the last minute, the reversible PRE-SAFE® systems return to their original settings.
For luxurious travel. Mercedes-Benz F 700.

### Facts

<table>
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<th>Vehicle</th>
<th>Mercedes-Benz F 700</th>
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<td>Introduced in Where</td>
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**Goals**
- Combining outstanding ride comfort with a high standard of environmental compatibility, good performance and exceptionally low fuel consumption

**Powertrain**
- Four-cylinder DIESOTTO engine (1.8-litre displacement, 175 kW/238 hp) combined with a hybrid module (15 kW/20 hp)

### Technical highlights

- DIESOTTO engine, combining the strengths of the low-emission gasoline engine with the diesel engine's fuel economy
- PRE-SCAN suspension: advance identification of road conditions and corresponding adjustment of the electrohydraulic active suspension
- PRE-SCAN door: laser scanner in the base of the exterior mirror on the driver’s side to identify obstacles in the door opening range
- SERVO-HMI: novel operating concept
- Innovative, generously large and flexible interior including a REVERSE seat in the rear
- LEDs for driving and daytime driving lights
- Contour illumination all round
The Mercedes-Benz F 700 presents the future of the superior touring sedan. It demonstrates innovative approaches and technologies for using resources sparingly, protecting the environment and permitting the driver and passengers to travel in a completely relaxed style.

At the heart of the F 700 is a novel powertrain. DIESOTTO combines the advantages of the low-emission petrol engine with the diesel’s fuel economy. For the first time, the diesel’s principle of (controlled homogeneous) charge compression ignition is incorporated in a petrol engine. Also, thanks to homogeneous combustion at reduced reaction temperatures, nitrogen oxide emissions are minimized. Moreover, the reduction in displacement and the number of cylinders improves the degree of efficiency. The F 700 is powered by a compact four-cylinder engine with a displacement of 1.8 litres, which nonetheless delivers the superior performance typical of a luxury-class saloon. A two-stage turbocharger is responsible for the engine’s excellent response and high-torque accelerating power. In addition, on ignition, the hybrid module electric motor assists the internal combustion engine. The maximum engine output is 175 kW (238 hp), the electric motor develops another 15 kW (20 hp), and the system’s maximum torque is as high as 400 Newton metres. Acceleration from standstill to 100 km/h in 7.5 seconds is testament to the dynamism of the F 700, whose top speed is limited to 200 km/h. Despite this outstanding performance, the F 700 has a fuel consumption in the EU driving cycle of just 5.3 litres (44.3 mpg), which corresponds to carbon dioxide emissions of 127 grams – an extremely low level for a car of this size.

Suspension with anticipatory intelligence. The research car is also taking a major step into the future as regards suspension engineering. With its active PRE-SCAN suspension, the car not only reacts highly sensitively to uneven patches of road surface, but also acts in an anticipatory manner. PRE-SCAN uses two laser sensors in the headlamps as “eyes” that produce a precise picture of the road’s condition. From this data, the control unit computes the parameters for the active suspension settings in order to provide the highest level of comfort.

The eyes of the F 700. The headlamps of the F 700 are a futuristic version of the brand’s characteristic four-eye face. Two vertical rows of LED line arrays with a lens system in front serve as driving lights. A third vertical row of individual high-performance LEDs functions as daytime driving lights. Together with the all-round contour illumination, the lights give the F 700 an unmistakable appearance, including at night. Even the driver’s door “watches” its environment closely. A highly compact laser scanner is accommodated in the base of the wing mirror on the PRE-SCAN door. It checks for obstacles in the door opening range. If there is a
Mercedes-Benz F 700.

The design of the F 700 stands out through its soft, flowing lines. The designers refer to “Aqua Dynamic” when using this formal language to translate the flow dynamics of fish into automotive design.

“An innovative design language. The design of the F 700 is characterised by soft, flowing lines. The designers refer to “Aqua Dynamic” when using this formal language to translate the flow dynamics of fish into the design of a special automobile. In addition, the design makes it immediately evident that the occupants have particularly generous space at their disposal. With its exterior length of 5.18 metres, the F 700 is slightly shorter than the long-wheelbase version of the S-Class from the W 221 series. Its wheelbase of 3.45 metres, however, makes the research car longer than the production model by 28.5 centimetres. The side view of the F 700 is dominated by the dynamically arching roof contour and shoulder line.

Light and elegant interior. The generously large and flexible interior is visible from the outside, and not just because of the long wheelbase. The impression of ample space is also visually enhanced by two large glazed roof sections. The use of natural materials, such as leather and cork, and a harmonious colour scheme with shades of brown and beige give the interior a light and elegant appeal, and expresses high-grade quality. The rear door on the right-hand side (near side) can be adjusted to a relax position on the near side. If the front passenger’s seat is unoccupied, the rear seat on the right-hand side (near side) can be adjusted to a relax position at the push of a button. In addition, the REVERSE seat can be swivelled so that the occupant faces away from the direction of travel – if he wishes to talk face-to-face with the person opposite, or to work, rest, or indulge in some audiovisual entertainment. A 51-centimetre monitor, 3D technology and surround sound system create a genuine cinema atmosphere.

More convenient and easier operation. In the F 700, a completely new display concept was incorporated, and the proven COMAND system was further developed with several groundbreaking innovations. These include:

- Reduced number of control functions through automation
- Rotary/pushbutton controller with extended sliding function
- Entertainment system with Road View and 3D cinema
- Speech recognition with a virtual operating assistant
- SERVO-HMI, a technology that reduces eye fatigue by enlarging the distance between the display and eyes
- Rotary/pushbutton on the centre console.
- SERVO-HMI: a technology that reduces eye fatigue by enlarging the distance between the display and eyes
- Speech recognition with a virtual operating assistant (AVATAR) to facilitate the control of complex functions by means of spoken dialogue
- ENTERTAINMENT: a technology that reduces eye fatigue by enlarging the distance between the display and eyes
- Speech recognition with a virtual operating assistant

The navigation, communication, phone and audio entertainment systems are operated by means of a rotary/pushbutton control on the centre console. A pleasant climate is created by means of a separate climate control system is operated by means of a separate rotary/pushbutton on the centre console.

The control panel automatically recognises whether it is being operated by the driver or passenger, and correspondingly activates the desired functions on the left or right-hand side. For more complex input functions, innovative support is provided by an individual assistant, known as AVATAR in computer language. In the F 700, the AVATAR has the identity of a young woman. While in the F 100, AVATAR was a virtual operating assistant, in the F 700, AVATAR is a virtual assistant function can be expanded almost infinitely. The AVATAR can, for instance, serve as a virtual assistant and access online databases via an on-board internet link, make new entries in the driver’s appointment calendar, or read out important e-mails. Through dialogue-controlled operation, distractions are reduced to a minimum – safety is, after all, always writ large at Mercedes-Benz.

This form of dialogue simplifies voice control and improves the system’s speech recognition. Furthermore, the scope of a dialogue assistant function can be expanded almost infinitely. The AVATAR can, for instance, serve as a virtual assistant and access online databases via an on-board internet link, make new entries in the driver’s appointment calendar, or read out important e-mails. Through dialogue-controlled operation, distractions are reduced to a minimum – safety is, after all, always writ large at Mercedes-Benz.
Efficiency meets elegance. Mercedes-Benz F 800 Style.

Facts

Vehicle  
Mercedes-Benz F 800 Style

Presentation  
March 2010

Location  
Geneva Motor Show

Objectives  
Generous interior with intelligent seating, operating and display concept in combination with highly efficient and environmentally compatible drive technologies and innovative comfort and safety functions, as well as an emotional design language

Drive  
Variable vehicle architecture laid out for two alternative drive concepts – plug-in hybrid with direct-injection V6 gasoline engine, approx. 220 kW/300 hp in combination with a hybrid module (approx. 80 kW/109 hp) or electric drive based on fuel cell technology (approx. 100 kW/136 hp)

Technical highlights

• Locally emission-free driving and refined performance with plug-in hybrid or alternatively with fuel-cell electric drive
• Variable vehicle architecture with optimized crash characteristics
• New display concept with focus on electric drive
• HMI with Cam-Touch-Pad for intuitive and safe operation
• DISTRONIC PLUS Traffic Jam Vehicle Follow Assist for even greater active safety and comfort plus expanded passive safety with PRE-SAFE® 360°
• Easy entry via rear pivot-and-slide doors
• Headlamps in LED technology
• Innovative lightweight-construction seats consisting of a magnesium shell and a carbon fiber laminate seatback with resistant netting
The F 800 Style with plug-in hybrid can be recharged safely and easily at charging stations or household outlets.

With its F 800 Style research vehicle presented in early 2010, Mercedes-Benz offers a comprehensive preview of the future of the premium automobile. The five-seat luxury-class sedan, which provides generous interior space with intelligent seating, operating and display concepts, combines highly efficient drive technology with innovative comfort and safety functions, as well as an emotional design language that re-interprets modern Mercedes-Benz design within the context of the brand’s hallmark refined sporting character. One feature that is unique worldwide for large sedans is the completely new variable vehicle architecture. It is suited both for electric drive with a fuel cell, enabling a range of around 600 kilometers, and for the application of a plug-in hybrid with an overall range of around 700 kilometers, up to 30 of which can be driven on electric drive alone. Both variants of the F 800 Style thus enable locally emission-free mobility on a premium level, combined with complete everyday usability.

With the F 800 Style, Mercedes-Benz is demonstrating its assertion in innovative drive concepts with classic Mercedes strengths in the fields of design, safety, comfort and refined performance. With an overall length of 4.75 meters (wheelbase 2,924 mm, width 1,938 mm), all component parts of the highly efficient and environmentally-friendly drives in the F 800 Style are located to save space in the engine compartment and in the free space within the vehicle chassis. Thanks to their extremely compact designs, both the plug-in hybrid and the fuel cell system require very little packaging space, thus leaving the vehicle interior completely unaffected.

**F 800 Style with plug-in hybrid.** In the hybrid version, Mercedes engineers placed particular emphasis on the further development of electric-only driving in urban traffic. The drive unit consists of a V6 gasoline engine with an output of approximately 220 kW (300 hp), next-generation direct injection and a hybrid module with an output of about 80 kW (109 hp). The lithium-ion battery with a storage capacity of >10 kWh is mounted in the interests of space and best-possible protection beneath the rear seat bench. It can be charged at charging stations or household power outlets and enables an electric range of up to 30 kilometers. The powerful and high-torque hybrid module is fully integrated into the casing of the 7G-TRONIC seven-speed automatic.

Its high power reserves enable a top speed of 120 km/h in electric mode – more than enough even for highway driving. The overall power output of the hybrid drive is around 300 kW (409 hp), guaranteeing sporting performance (0-100 km/h in 4.8 s, top speed 250 km/h). Yet, due to the efficient drive and a CO₂ bonus for battery-electric operation, the F 800 Style achieves a certified fuel consumption of only 2.9 liters of gasoline per 100 kilometers. The result is an extremely low CO₂ emissions figure of only 68 grams per kilometer. With its highly efficient drive, the F 800 Style marks a further important step toward market-readiness for the plug-in hybrids that Mercedes-Benz will put into series production with the next generation S-Class.

**F 800 Style with fuel cell electric drive.** The F 800 Style also offers clean driving fun with an electric drive system based on fuel cell technology. The approx. 100 kW (136 hp) electric motor generates refined torque of around 290 Nm. The F 800 Style is characterized by innovations that are already in a close-to-production stage of development. The fuel cell components, which can be used flexibly, come from the modular Mercedes-Benz platform for electric vehicles and are already being built in low-volume series production for the B-Class F-CELL. They are suited to different drive configurations, meaning that they also work in the F 800 Style, which, contrary to the B-Class F-CELL, is rear-wheel drive. In the research vehicle, the fuel cell is mounted in the front of the vehicle while the compact electric drive is located close to the rear axle. The lithium-ion battery behind the rear seats is also afforded the best possible protection in the event of an accident, as are the four hydrogen tanks. Two tanks are mounted in the center tunnel, with the other two beneath the rear seat bench.

**HMI with Cam-Touch-Pad for intuitive and safe operation.** The many innovations in the F 800 Style include a new operating and display concept that, for the first time, is conceived primarily for electric drive functions. The new Cam-Touch-Pad HMI is a highly user-friendly expansion of the COMAND system. The operating unit consists of one touchpad in the center console and a camera that records video images of the user’s hand on the touchpad. In the live image, the hand is displayed transparently in the monitor above the center console. The user sees the contours of his or her fingers moving over the image without concealing anything. The menu functions – including air conditioning, phone, audio and navigation system, as well as internet service – can be controlled via light pressure on the touchpad. Thanks to...
Mercedes-Benz F 800 Style.

its extremely simple, intuitive and comfortable operation, the driver is less distracted from the traffic situation, meaning that the system has a role to play in the further improvement of active safety.

**Range on Map for graphic range display in electric mode.** The "Range on Map" function presents the available traveling distance in electric drive as a 360° view on the map. In the event that city authorities should, in future, permit only electric-drive vehicles, the driver will be able to use this system to determine whether the electric range is sufficient for the drive into and out of the city zone.

The system also combines information about the battery charge status with data from the navigation system. In an expanded version, the system can also be set up to display electricity charging stations.

**DISTRONIC PLUS Traffic Jam Vehicle Follow Assist.** In 2005, Mercedes-Benz launched with DISTRONIC PLUS the world’s first proximity and cruise control system that operates right down to a complete standstill. The new function DISTRONIC PLUS Traffic Jam Vehicle Follow Assist presented in the F 800 Style is the world’s first system that is also able to follow the vehicle in front through bends. The necessary data is generated by the radar proximity sensors and an additional stereo camera. Up to a speed of ca. 40 km/h, the system takes over both longitudinal and transverse movements, meaning that the driver no longer has to steer. Instead, he or she can – with hands on the steering wheel – sit back and relax. At speeds of more than 40 km/h, the Traffic Jam Vehicle Follow Assist is gradually deactivated by successively reducing the steering force. Naturally, the driver can override the system at any time. DISTRONIC PLUS Traffic Jam Vehicle Follow Assist is the next logical step in the Mercedes-Benz safety philosophy and forms a further milestone on the road of innovative technologies that will continue to increase the high level of driving comfort in future vehicles that is so characteristic of Mercedes.

**PRE-SAFE® 360° for protection in rear-end accidents.** PRE-SAFE® 360° is based on the PRE SAFE® pro-active occupant protection system developed by Mercedes-Benz. The expanded system also monitors the area immediately behind the vehicle and activates the brakes around 600 milliseconds prior to an impending rear-end collision. Benefit – if an already stationary vehicle is fixed in position during a rear-end collision, secondary accidents can be avoided – such as an uncontrolled jettison of the affected vehicle into an intersection. PRE-SAFE® 360°, too, can be overridden – should the driver accelerate forward in order to escape the approaching vehicle, the brakes are released immediately.

**Modern Mercedes-Benz design – re-interpreted.** The F 800 Style is both technology package and a showcar. Its external appearance is characterized by its long wheelbase, short bodyshell overhangs and the sensuous flow of the roofline. The taut, distinctly coupe-like roofline and the balanced proportions deliver a stylish, sporty look that takes the Mercedes-Benz design language to the next level and emphasizes the sculptural character of the vehicle. The result is a clear harmony of innovation in form and function that conveys a sense of style and refinement.

**Distinct front end with state-of-the-art LED headlamps.** The front view of the F 800 Style features a variation of the radiator grille with the centrally-positioned star typical of sporty Mercedes models. The curving louvers of the broad grille and the sweeping air intakes combine with the powerful LED front headlamps to emphasize the dynamic look of the research vehicle. The rear lights of the F 800 Style are also equipped with state-of-the-art LED technology. They facilitate an interplay of indirect lighting and direct illumination. The result is an attractive, unmistakable and distinctive look.

**Cosseting interior.** In the interior of the F 800 Style, fine wood veneer and plenty of light make for superb comfort. The bright and modern feel is immediately apparent – functional elements like the cockpit and door pulls seem to float in space like sculptures. The innovative lightweight seats in the F 800 Style consist of a magnesium shell and a backrest made from carbon-fiber laminate across which a fine yet resistant netting is stretched.
Redefinition of automotive luxury **Mercedes-Benz F 125!**

**Details**

**Vehicle Introduced**

September 2011

**Location**

Frankfurt International Motor Show (IAA)

**Objective**

Objective visionary look at the luxury sedan of the future. Four-seater luxury sedan with gull-wing doors and lightweight bodyshell construction. Generously sized interior with a pioneering control and display concept combined with highly efficient, emission-free drive technology, innovative comfort and safety features as well as an expressive design

**Drive system**

F-CELL Plug-in HYBRID, pioneering hydrogen composite storage technology, lithium-sulfur high-voltage battery with high energy density, modular e4MATIC system with a continuous output of 170 kW (231 hp) and a peak output of 230 kW (313 hp)

**Technical highlights:**

- Completely emission-free F-CELL Plug-in HYBRID with a range of up to 1000 kilometers
- Revolutionary structure-integrated hydrogen composite storage unit
- Lithium-sulfur high-voltage battery with high energy density, charged by induction
- e4MATIC all-wheel drive with four wheel electric motors and individual torque control at each wheel
- Effective lightweight hybrid construction with an intelligent mix of carbon-fiber, aluminum and high-strength steels
- Driver-fitness safety and ease of operation thanks to natural touch, gesture and voice control
- Convenience opening of the gull-wing doors through hand gestures
- @yourCOMAND: visionary, comprehensive Cloud-based infotainment system
- Advanced Driving Assist is able to carry out frequently occurring driving manoeuvres autonomously
- Significant reduction in driver workload due to Car-to-X communication
Visionary engineers and utopians like Carl Benz, Gottlieb Daimler and Wilhelm Maybach paved the way for „automobility“ at the end of the 19th century. The idea of fitting vehicles with compact, fast-running internal combustion engines to make individual, easy and comfortable mobility possible was seen as „utopian“ at the time – i.e. synonymous with „science fiction“. With the F 125! Mercedes-Benz is affirming its pioneering spot. As a highlight marking the 125th anniversary of the automobile at the 2011 International Motor Show (IAA) in Frankfurt, the research vehicle demonstrated how completely emission-free, individual mobility might be realized in the luxury segment in the future. While previous Mercedes-Benz research vehicles have “looked ahead” by roughly one vehicle generation, the latest technological visionary goes a whole step further, by more than two generations to the year 2025 and beyond. With the F 125/ Mercedes-Benz is demonstrating that large, comfortable and safe sedans have an excellent future, in part because they are able to operate with no emissions.

The researchers and developers have incorporated already well-proven concepts and technologies which are not yet available today, but for which basic research has shown great potential, and therefore a realistic chance of implementation in future Mercedes-Benz models. On this basis, the F 125! was created as an innovative four-seater luxury sedan with a powerful, emission-free electric drive system based on the fuel cell technology developed to series production maturity by Mercedes-Benz. The “S-Class of tomorrow” combines pioneering, highly efficient storage, drive and bodyshell technologies with unparalleled control and display concepts. The research vehicle also features an expressive design which transforms the classic Mercedes design idiom in the future.

Effortless driving pleasure without harmful emissions. The F 125! is powered by a F-CELL Plug-in HYBRID consisting of a further developed fuel cell and a powerful lithium-sulfur high-voltage battery. This combination allows for completely emission-free mobility with full day-to-day suitability, superior performance and a total range of up to 1000 kilometers. With respect to performance, consumption and practical suitability, the further improved fuel cell provides the power for four powerful electric motors installed near the wheels, which ensure sporty, superior performance figures. All in all, the modular 4MATIC system generates a continuous output of 170 kW (231 hp) and a peak output of 230 kW (313 hp). This allows the F 125! to accelerate in 4.9 seconds, with a top speed of 220 km/h. Nevertheless, NEDC fuel consumption is only 0.79 kilograms of hydrogen per 100 kilometers, which is the equivalent of 2.7 liters of diesel fuel.

Metal Organic Frameworks: the hydrogen reservoir of the future. The structure-integrated hydrogen composite storage unit of the F 125! provides a total range of up to 1000 kilometers. The pioneering hydrogen composite storage unit is powered by a F-CELL Plug-in HYBRID consisting of a further developed fuel cell and a powerful lithium-sulfur high-voltage battery. This combination allows for completely emission-free mobility with full day-to-day suitability, superior performance and a total range of up to 1000 kilometers. With respect to performance, consumption and practical suitability, the further improved fuel cell provides the power for four powerful electric motors installed near the wheels, which ensure sporty, superior performance figures. All in all, the modular 4MATIC system generates a continuous output of 170 kW (231 hp) and a peak output of 230 kW (313 hp). This allows the F 125! to accelerate in 4.9 seconds, with a top speed of 220 km/h. Nevertheless, NEDC fuel consumption is only 0.79 kilograms of hydrogen per 100 kilometers, which is the equivalent of 2.7 liters of diesel fuel.

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Lithium-sulfur battery with high energy density. A highly advanced, very powerful and extremely compact lithium-sulfur battery is envisaged for the F 125! It has a storage capacity of 10 kWh and is installed behind the rear seats. It can be inductively charged at “intelligent” charging stations, and the convenient charging process can be monitored by smart phone. When designing the F 125!, the developers worked on the assumption that by the time of its introduction into series production, this battery type will be capable of energy densities up to 350 Wh per kg. This would represent roughly a doubling of the current performance.
Apart from ensuring optimal traction at all times, the electronic all-wheel drive with its wheel-specific yaw-damping intervention. The F 125 Touring sedan with sports car genes offers a number of advantages in terms of driving dynamics. Mercedes-Benz has already delivered an impressive demonstration of the performance potential residing in this eAMATIC design with the battery-electric SLS AMG E-CELL super sports car, whose rear-end module was developed further for the F 125. The new front axle design provides a visionary outlook on the integration of electric drive systems into the front axle. The chosen positioning of the drive components allows optimal weight distribution, and also - thanks to active torque vectoring - the on-demand assignment of power to each individual wheel. Apart from ensuring optimal traction at all times, the electronic all-wheel drive with its wheel-specific yaw-damping improves handling stability at high speeds. During brisk cornering, however, wheel-specific intervention allows for a metered increase in the yaw rate with an improved steering response and less steering effort. This drive configuration also allows for highly efficient energy recuperation at each wheel, cross-wind stabilization, avoidance of load-change responses and therefore improved handling when cornering, without the need for ASR (acceleration skid control) intervention. The F 125 is the first electric car to feature an air suspension and continuous damper adjustment. The result is an ideal balance between ride comfort, driving dynamics and handling stability at fast highway speeds, for instance. Thanks to the single-stage gears at the front and rear axles, the F 125 accelerates comfortably and without interruptions in tractive power, right up to the top-speed. Another technical highlight of the suspension system is special compensation for drive torque in the front axle, which almost entirely eliminates drive and recuperation influences on the steering, and noticeably reduces pitching.

Effective lightweight construction with an intelligent material mix. Specific lightweight construction methods will make a considerable contribution to fuel economy in the automobiles of the future. With a combination of fiber-reinforced plastics (FRP) and a high content of carbon-fiber reinforced plastics (CFRP), lightweight metals and high-strength steel alloys, as well as hybrid materials, precisely designed to meet the relevant requirements, the F 125 impressively demonstrates the wide variety of possible applications. The bodyshell weight of the research vehicle was thus reduced to around 250 kilograms - roughly 40 percent less than that of a comparable model in current series production. At the same time, the level of safety has once again been significantly improved.

Visionary infotainment system. With its visionary, comprehensive Cloud-based infotainment system, „IfyourCOMAND“, the F 125 provides a visionary outlook on future Mercedes-Benz telematic systems. Its trailblazing features include:

Seamless Experience: The multimedia systems of the F 125 are seamlessly and cross-functionally networked, socially interactive and non-distracting. The exchange of information is no longer impeded or interrupted on journeys, but is an integral part of the concept. Because of constant connectivity with the Cloud, the driver has seamless access to all the media he normally uses. The tedious synchronization of different communication and entertainment devices is also completely eliminated. Customers can therefore continue their „digital lifestyle“ seamlessly and safely in the vehicle.

Natural Handling: Operation is primarily through natural speech, supplemented by touch and intuitive hand gestures. In the interests of maximum driver-fitness and operating safety, the F 125 becomes the perfect, ever alert companion for its driver and passengers. The possibilities go well beyond those of current systems. The driver can, for instance, request news items that are tailored to his personal needs, and make specific, contextual inquiries, without removing his hands from the wheel. The COMAND of tomorrow will also be proactive. In the future, the driver will be able to start with the traffic report or retrieve personal messages before starting the individual music program. The weather report will then automatically come on before the journey ends. Thanks to the mood-based configuration function „Moods“, such individual adjustments will be completed in a matter of seconds in future. The F 125 also opens up completely new dimensions when it comes to external communication and the use of social networks. With the help of the Social Community Assistant, the driver alone can decide who is allowed to „disturb“ him, or who receives information.

Sensory Perfection: The F 125 features high-end sound and high-resolution screens with brilliant, individual displays. If required, the autostereoscopic 3D display for spatial representation of the instrument cluster is able to show relevant information in clustered form. The 3D image adapts natural visual habits, allows for a better overview and thus considerably reducing driver workload. The head unit in the upper section of the center console uses projector-beam technology, and is controlled via a touchpad with 3D finger-tracking located within easy reach of the driver. In addition to the head unit, the integrated selection bar enables the
instrument cluster and rear-view display to be selected. Activated in this way, these displays can also be centrally operated. A retractable 17-inch display is installed on the front passenger side, and this is fully controlled by hand gestures. In this way, a rear passenger can select his personal film program with no physical contact.

Remote Convenience: The F 125! multimedia system, as well as all applications and contents, can be completely preconfigured remotely. This means that authorized individuals have access at all times to information such as the fuel level, next scheduled service or fuel consumption via the vehicle’s specific homepage. Just as easily, a home PC or of course a smart phone can be used for remote configuration of the on-board navigation or entertainment system, and to select individual interior temperature settings for each seat.

Advanced Driving Assist for semi-autonomous driving: With the help of innovative driver assistance systems, the touring sedan of the future defuses even "invisible" hazards and considerably reduces driver workload in many standard situations. If the driver requires, the F 125! is able to carry out frequently occurring driving maneuvers autonomously. Advanced Driving Assist allows lane-changes on multi-lane, one-way roads, and in a further development stage even automatic overtaking maneuvers.

Driver workload considerably reduced due to new assistance systems. Thanks to radio-based networking with the environment, so-called Car-to-X communication, the F 125! is also able to exchange information with other vehicles, with a specially equipped infrastructure including traffic lights or warning signs and with traffic control centers. The F 125! might include a warning of obstacles on the road or of approaching emergency service vehicles well before the driver can see or hear them, a reminder that other vehicles have the right-of-way at obscure intersections.

Full visibility to the rear. Instead of conventional rear-view mirrors, the F 125! is equipped with a high-resolution wide-image display. This shows the images from a rear-facing stereo camera integrated into the third brake light and allows the entire traffic situation behind the vehicle to be monitored, making exterior mirrors unnecessary. In their place, the F 125! has two aerodynamically shaped fins accommodating the sensors used by Blind Spot Assist. The rear-facing stereo camera also allows for extended image display options, such as a view directly behind the rear end – with a distance measuring function – when reversing into a parking space, or a longer-distance image for fast highway driving. The image is adapted to human perceptive abilities at all times, and once again provides a much clearer overview with more rapid and intuitive registration of the relevant traffic situation.

Hand gestures for convenient door opening and closing. Opening and closing the gull-wing doors is also contact-free, from the outside. Simple wiping gestures control all the functions. The relevant control element is integrated into the rear side window. Door operation from outside is also possible by smart phone. Opening and closing from the interior is at the touch of a button, with control switches in both the front and rear.

Exemplary entry and seating comfort in a coupe atmosphere. In combination with an extremely long wheelbase of 3333 mm, the gull-wing doors opening along the entire flank of the car provide extraordinarily convenient access and egress. By way of comparison, the figure for the current long-wheelbase S-Class is 3165 mm. Since the side windows are also fully retractable as a unit, the F 125! not only offers extremely generous interior space, but also the driving pleasure of a classic coupe.

Expressive and unique: the sporty touring sedan of the future. The F 125! represents a radical reinterpretation of a sports sedan. Its sensuous sportiness and dramatic, organic use of body surfaces are a pioneering further development of the current Mercedes-Benz design strategy. Since the side windows are also fully retractable as a unit, the F 125! not only offers extremely generous interior space, but also the driving pleasure of a classic coupe. Dispensing with exterior mirrors and door handles, plus the uninterrupted, single-piece hood with integral front fenders, reduces the contours to the essential and lowers the drag coefficient. An electrically extending rear luggage module improves access to the trunk.

Interior with a lounge-like atmosphere. The interior concept of the F 125! makes central brand values such as driving pleasure and ride comfort directly tangible. The intentionally chosen, pronounced asymmetry – the interior is not divided between front and rear in the usual way, but between the left and right halves – reflects the different form of use. Using switches in the center console and rear door area, the rear seat backrest can be moved from upright to a chaise-lounge position: the seat cushion extends forwards and a footrest folds out to provide a very comfortable reclining position. At the same time, the front passenger seat is pushed forwards, providing even more generous space in the rear and allowing for a clear view of the integrated front passenger 17-inch display, which is fully controlled by hand gestures.