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A Driving Force to the Future - 10 Years of Fuel Cell Vehicles at DaimlerChrysler

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- Worldwide Fleet Tests Initiated with the F-Cell
- The Fuel Cell Demonstrates its Potential for the Future: Highly Efficient, Environment-Friendly and Quiet
- DaimlerChrysler has Been Playing a Decisive, Pioneering Role in Fuel Cell Technology Since 1994

Fuel cell technology at DaimlerChrysler has reached a new milestone along the road to market maturity: The delivery of the first F-Cell cars to German, Japan, Singapore and now U.S. customers is an important step in the largest practical fleet testing program for fuel cell vehicles worldwide.

DaimlerChrysler has been involved in this technology for 10 years. Fuel cells release energy from the reaction of hydrogen with oxygen. They operate to a high level of efficiency and, depending on the fuel used, can be true zero emission vehicles. The hydrogen-powered fuel cells emit only pure water vapor.

The principle of the fuel cell was discovered in 1839 by the English physicist Sir William Grove. In the fuel cell, a chemical reaction takes place between hydrogen and oxygen, in which electrical energy and heat are released and chemically pure water is produced. The fuel cell has a sandwich-like structure; between two gas-permeable electrodes of graphite paper is an electrolytic plastic foil, the proton exchange membrane (PEM). Since a single cell produces only a very small electrical potential, several cells are connected in series to form a fuel cell stack. The electrical energy generated is used to power the vehicle's electric motor, as well as supplying the peripheral elements of the fuel cell system.

In order to focus expertise and resources, and to press ahead with the development of the fuel cell, DaimlerChrysler has entered on a strategic alliance with the Ford Motor Company and the fuel cell specialist Ballard Power Systems. Over the past 10 years, DaimlerChrysler has developed numerous concept vehicles in order to sound out the opportunities presented by this technology.

1994: NECAR 1
With NECAR 1 (New Electric Car), the first fuel cell vehicle, was presented to the public on April 13, 1994. DaimlerChrysler demonstrated the technical feasibility of this new drive principle. The apparatus, weighing 800 kilograms, took up the entire load space of this Mercedes-Benz van; there was only sufficient room left for the driver and front-seat passenger. This experimental vehicle thus resembled a laboratory on wheels.

1996: NECAR 2
NECAR 2, a six-seater Mercedes-Benz V-Class, was presented on May 14, 1996. This vehicle had a range of 250 kilometers and a top speed of 110 km/h. The fuel cell apparatus, with a rated output of 50 kilowatts, was located under the rear seat bench. The hydrogen tanks were located on the roof, so that the passenger compartment was utilizable in its entirety.

1997: NEBUS
With the fuel cell bus NEBUS (New Electric Bus) presented in May 1997, Daimler-Benz demonstrated a further application of fuel cell drive technology: city buses. With a single tank filling of hydrogen, the NEBUS had a range of 250 kilometers, well in excess of the distances typically covered by a regular-service bus in the course of a day's operation. With a power rating of 250 kilowatts, the fuel cell drive unit made for a maximum speed of 80 km/h. The NEBUS demonstrated its suitability for regular-service operation in Oslo, Hamburg, Perth, Melbourne, Mexico City and Sacramento.

1997: NECAR 3
With NECAR 3, DaimlerChrysler demonstrated for the first time that the hydrogen required for the fuel cell could be generated directly on board from a liquid fuel. NECAR 3 ran on methanol and reached speeds of up to 120 km/h. Along with the fuel cell system and its bulky reformer, there was sufficient space for two passengers in this test car based on the Mercedes-Benz A-Class.

1999: NECAR 4
In 1999, the DaimlerChrysler engineers first succeeded in stowing the entire compact fuel cell drive system with an output of 70 kilowatts in the sandwich floor unit of NECAR 4, an A-Class vehicle. This car, which ran on liquid hydrogen, attained a top speed of 145 km/h and had a range of 450 kilometers. It offered sufficient space for five occupants and their luggage. This state-of-the-art technology was presented to the public on March 16, 1999 in Washington D.C.

NECAR 4a was introduced in the fleet test of the California Fuel Cell Partnership. Its further developed drive technology was based on that of NECAR 4, although it now used pressurized hydrogen and was considerably more compact. The core element was a fuel cell stack with a combined power output of 75 kilowatts. This car's operating range was 200 kilometers, with a top speed of 145 km/h. In the course of extensive test drives carried out both in wintry conditions and in the desert in summer, NECAR 4a demonstrated its suitability for use in extreme temperature conditions.

2000: NECAR 5
In November 2000, DaimlerChrysler presented NECAR 5, a fully operable fuel cell car that ran on methanol as a hydrogen storage medium. This technological successor to NECAR 3 reached speeds of over 150 km/h. In this Mercedes-Benz A-Class vehicle too, the entire drive system including the methanol reformer was located in the underfloor unit. It had a power rating 50 percent higher than that of NECAR 3, even though it was only half the size and 300 kg lighter.

In 2002, NECAR 5 set a long-distance record of 5,250 kilometers for a fuel cell vehicle when it crossed the American continent from San Francisco to Washington, taking in its stride first the Californian heat, then the Sierra Nevada and the Rocky Mountains in cold, snowy conditions; it also crossed several mountain passes at heights of up to 2,640 meters and endured the bumper-to-bumper traffic of large cities. The objective of this undertaking was to sound out this vehicle's technological limits in everyday operating conditions.

2000: Jeep® Commander 2

The Jeep Commander 2 is a luxury-class fuel cell sport utility vehicle (SUV) which demonstrates that this environment-friendly drive system is also well suited to larger vehicles. Its tank is filled with methanol, from which hydrogen is reformed directly on board.

2001: Hermes Sprinter
In 2001, DaimlerChrysler established a joint venture with the Hamburg forwarding company Hermes Versand Service, in order to test the fuel cell-powered Mercedes-Benz Sprinter in everyday service for a customer. This vehicle runs on gaseous hydrogen and has a range of 150 kilometers. Its 55 kW electric motor makes for a top speed of 120 km/h. The fuel cell apparatus in no way compromises the van's load capacity. In its first year of practical application, the fuel cell Sprinter covered over 16,000 kilometers in all four seasons, delivering goods to 4,200 customers in the process.

2001: Natrium
Natrium is based on the Chrysler Town & Country Minivan. (Natrium is the German and Latin word for sodium.) It runs on sodium borohydride (NaBH4), a white salt with a relatively high hydrogen content. With the help of a catalyst, elementary hydrogen is generated which supplies the energy for the fuel cell. Natrium has a range of 500 kilometers, accelerates from 0 to 100 km/h in 16 seconds and reaches a top speed of 130 km/h.

2002: The Citaro city bus
Ten European public transport operators each purchased three revolutionary Citaro city buses in 2002 for the purpose of testing them over a two-year period on a daily basis in highly demanding regular city service. These buses must show their mettle in both the Arctic winter and in the Spanish summer, on level ground and in hilly terrain such as in Stuttgart. The 12-meter Mercedes-Benz Citaro with fuel cell drive has a range of about 200 kilometers and can

transport up to 70 passengers. Its fuel cell unit with an output of 200 kW is located on the roof, as are the pressurized hydrogen cylinders.

2002: The Mercedes-Benz A-Class F-Cell

F-Cell vehicles are currently in operation in the world's first small fuel cell car series for joint venture partners in Europe, the USA, Japan and Singapore. The entire Ballard fuel cell system of the F-Cell is located in the sandwich underfloor unit of this long-wheelbase Mercedes-Benz A-Class. The development of fuel cell technology is now being carried forward in practical application and extensive field tests.

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