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Automotive News

Europe

2005 Guide

Advanced Technology

and

New-Model Development

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S
eeing in the dark, parking without touching the steering wheel and never having to worry about a flat tire again are some of the luxuries that today’s drivers enjoy. This guide looks at those high-tech solutions as well as the technologies that will make next-generation models even safer, more fuel efficient and more fun to drive.

In addition, the guide provides you with the names of the product development executives who will decide which new technologies will enter tomorrow’s cars. By reading this guide, you’ll also learn who the creative geniuses are behind the exterior and interior looks of those future-generation models.

This special section concludes by revealing things you probably didn’t know about some key new models.

We hope you enjoy this look at future technologies and the people who are integrating them into the car.

### Chassis & Materials
By-wire systems are making their way into European models by way of the brakes, transmissions and safety systems. Electronics also are being used to improve steering, prevent skidding and make the ride in today’s cars more comfortable.

### Powertrain
Rising fuel prices and the prevailing belief that fuel cell vehicles are more than a decade away have forced the auto industry to take new steps to reduce consumption. The solutions range from better performing engines and transmissions to fuels grown by the sun.

### Safety
Headlights that see around corners, hoods that pop up and cruise control systems that can prevent a crash are making cars safer for occupants – and pedestrians.

### Convenience
Carmakers and suppliers are racing to find ways to allow their customers to enjoy hand-held gadgets such as the iPod in the car. They also are getting closer to providing car air conditioning systems that are better for the environment.

### Senior product development executives and technical centers
DaimlerChrysler’s Thomas Weber, Ford Europe’s Joe Bakaj and Renault’s Patrick Pelata join an elite group of European executives who must decide what technologies will be on the cars of tomorrow. See who else is on the list and how to reach these important executives.

### Design studios
Meet the people who are crafting the auto industry’s next design legends.

### New-model development programs
Find out when the hottest new cars will reach European markets.

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**ON THE COVER:** The night vision system available on the eighth-generation Mercedes S class helps drivers see better in the dark. Using infrared technology, the device extends a driver’s visibility about 150 meters. See story, Page 15
By-wire replacing mechanical systems

**By-wire** systems can eliminate some of the jumble of hydraulic and mechanical links in the car, replacing them with an electric architecture controlled by microprocessors. A big benefit is that by-wire requires fewer mechanical parts. That gives automakers greater flexibility in a vehicle’s design. For example, the driver could be positioned anywhere inside the car. Even in the back seat.

Here’s why: Drive-by-wire technology uses sensors to translate steering or braking movements by the driver into electronic signals. Onboard computers interpret the movements and relay them to electric motors and actuators connected to the moving parts of the car. The systems respond more quickly than today’s controls and can give feedback to the computer as they operate, allowing the car to deliver precise performance.

By-wire systems already have replaced direct links in one area. “Most cars nowadays don’t have a mechanical linkage between the accelerator pedal and the fuel injection system. It’s done electronically, and most people don’t even realize there’s no mechanical linkage,” says Steven Brown, director of North American Programs for SKP Automotive’s drive-by-wire business unit.

**Little fanfare**

While General Motors demonstrated drive-by-wire on its Autonomy and By-wire fuel cell concept cars in 2002 and 2003, more progress has happened with less fanfare in recent years – especially in European-built vehicles. Brakes, transmissions and safety systems are bringing by-wire technology into the vehicle in small steps.

Electric parking brakes such as those on the BMW 7 series, Audi A8 and Renault Vel Satis are examples.

**ELECTRIC POWER STEERING**

Electric power steering removes the need for hoses and pumps, and offers fuel savings over hydraulic steering.

**HOW IT WORKS**

A battery-driven electric motor provides the drive on the steering system rather than a hydraulic device operated by the engine. The solution also disconnects the steering system’s power needs from the engine resulting in better fuel economy than hydraulic steering in a typical small car.

**WHERE TO FIND IT**

Electric power steering is most common in Europe and Japan but can also be found in the US. Globally, about half of all new cars are expected to have electric power steering by 2010. The majority of the new small cars in Europe and Japan now have the technology. The 2005 Volkswagen Passat is the first volume car above the lower-medium segment in Europe to get the technology. In North America, electric power steering is standard on Chevrolet Malibu. The technology also is available on the new Lexus GS and typically is found in hybrid cars.

**OBSTACLES**

For suppliers, the cost of electric power steering is still relatively high, said Peter Rieth, head of advanced engineering at Continental Automotive Systems. As a result, he said, “OEMs [are] very keen to have extra functions when they have integrated electric power steering.” Continental has addressed this need by using an electronic control unit to link its second-generation electronic stability control to its electric power steering. Another issue is that electric power steering is only starting to have enough power to be used in the upper-medium segment and above. The axle weight and the associated torque loads required to turn the wheels in bigger cars would quickly drain the battery.

**PRIMARY SUPPLIERS**

Delphi, Koyo, NSK, Showa, TRW Automotive, Visteon, ZF Lenksysteme.

**Delphi supplies its column-drive electric power steering to the Opel Meriva. The electric motor is mounted on the steering column (circled).**

**Losing the link**

Primary suppliers of by-wire solutions:

- Bosch
- Continental
- Delphi
- Denso
- Johnson Controls
- Hitachi
- Magneti Marelli
- Magna Steyr
- Mitsubishi Electric
- Motorola
- Siemens VDO
- SKF
- Toyota
- TRW
- Valeo
- Visteon

By-wire adaptation stumbled when promised 42-volt electrical systems failed to become an industry standard, but new dual-voltage systems offer promise of enough power for high-force uses such as braking and steering.

A European consortium called SPARC – short for Secure Propulsion using Advanced Redundant Control – and organized by DaimlerChrysler and Fiat is working on by-wire accident-avoiding truck and car demonstration vehicles. 

Deliveries of electric power steering to General Motors' 2007-10 vehicles, mostly by Delphi Automotive, may exceed one million units a year once the vehicles are launched.

**Hybrid vehicles** including the Toyota Prius and Honda Civic Hybrid have introduced drivers to the advantages of regenerative braking, a kind of brake-by-wire system that converts forward motion into stored battery energy. Shift-by-wire technology is available on high-end autos such as the Aston Martin DB9 and Rolls-Royce Phantom, as well as some BMW, Mercedes-Benz and Lexus models.

Also, comfort and safety systems such as adaptive cruise control, automated parallel parking and steering intervention for lane-keeping, such as those shown by Continental Tews at last month’s IAA in Frankfurt, rely on by-wire control of some steering and braking functions.

Any supplier doing work in the by-wire arena will tell you there are obstacles to mass adoption of the technology. The auto industry is used to the highly refined technology currently in place. Also, car buyers are not clamoring for a change and some early by-wire technology features haven’t sold well. Until by-wire systems combine more advantages into a single system, adoption of the technology will be gradual.

**October 31, 2005**
**Chassis & Materials**

**ELECTRONIC STABILITY CONTROL**

Electronic stability control helps prevent skids and swerves that can happen in an emergency. This makes ESC especially effective in combating rollover accidents.

**HOW IT WORKS**

The electronic control unit at the heart of the ESC system brakes each wheel individually and decreases engine torque to maintain a stable direction of travel. ESC continuously monitors key inputs such as yaw rate and wheel speed.

**WHERE TO FIND IT**

The overall installation rate in 2004 was about 40 percent in western Europe. It took antilock brakes twice as long to achieve a similar level, according to data from German supplier Robert Bosch.

A law adopted in August 2005 requires US regulators to develop standards aimed at preventing rollover crashes. Even without the new law, the US National Highway Traffic Safety Administration appeared headed toward adoption of an antirollover rule. Automakers also have been increasing installation rates for electronic stability control systems in the US. As a result, installation rates should grow to about 80 percent of all passenger cars in North America by 2009.

TRW Automotive has cooperated with Goodyear to develop ESC that can be linked to the characteristics of the tires. New tires are often fitted with identity tags. Using those tags “we can tailor the ESC software to suit different tires and wheels,” says Phil Cunningham, product business director for chassis systems at TRW Automotive. “For components align differently, rendering it thicker or thinner as needed. A computer controls the coil to provide very fast reaction to road inputs based on input from sensors that monitor body and wheel motions. Others, including ZF Sachs of Germany, use a valve control mechanism for damping. Continuous valve control uses a combination of acceleration, displacement and steering sensors to help an electronic control unit choose a damping level for the suspension. An electronic valve on each shock or strut reacts to the computer commands by restricting or enlarging the channel that oil flows through.

**OBSSTACLES**

Consumer and dealer awareness of ESC remains relatively low, especially in North America. As a result, Bosch in particular has put considerable effort into holding events to raise awareness among consumers. ESC systems are increasingly required to interact with a number of other systems in the vehicle – such as steering, adaptive cruise control and tires – increasing the risk of electronics problems.

**PRIMARY SUPPLIERS**

Advics, Bosch, Continental Teves, Delphi, TRW Automotive.

– Alex Graham

**PLASTIC PARTS**

Suppliers are substituting super-strength plastic for steel in some components such as front-end modules and instrument panels. It’s a trend that began in Europe and is finding its way into North American vehicle programs.

**HOW IT WORKS**

Injection molded plastic is mixed with glass fibers to create high-strength structural frames and carriers for components. These structural parts are stronger than standard plastic parts.

**WHERE TO FIND IT**

Faurecia of France announced in July 2005 that it won a contract with the Chrysler group, which includes Chrysler, Dodge and Jeep, to make what it calls High Integrated Module door systems in the US using a carrier made with an injection-molded long-fiber thermoplastic. The module consists of a single structural plastic part that includes mechanical functions such as the window lift unit, internal and external handles, speakers and electrical harness. In addition, ArvinMeritor recently introduced what it terms as its Highly Integrated Plastic door module, which also uses a thermoplastic composite to replace a steel inner structure.

**OBSSTACLES**

Although the price of steel is high, the resins used to make high-strength plastics may cost more per pound than steel.

**PRIMARY SUPPLIERS**

Faurecia, ArvinMeritor, HBPO (a joint venture with Hella, Behr and Plastic Omnium), RheTech Inc., Owens Corning.

– Rhoda Miel, Chaz Osburn

**CONTINUOUS DAMPING CONTROL**

Continuous damping control is an electronic system that can adjust the tension in a shock absorber to create a more dynamic ride quality for the vehicle. The technology includes the use of magneto-rheological fluid that can be made syrupy or water-like depending on a mild electrical charge. Other suppliers use electronics to continuously vary the valves that control fluid flow within the shock. Both systems let the shocks adjust to road input for maximum stability, handling and comfort.

**HOW IT WORKS**

In US supplier Delphi’s system the oil normally used in shocks and struts is replaced by a magneto-rheological fluid, which surges through special orifices to dampen axle motion. When an electromagnetic coil inside the damper’s piston is activated, the fluid’s pressure monitoring systems or electronic stability control because it offers fewer clear-cut benefits to the consumer. The main issues are cost and maintenance. Shocks are a high-wear item, which means replacement could be expensive. Also, integrating electrical, mechanical and hydraulic components in an exposed underbody location increases the complexity of diagnostics.

**PRIMARY SUPPLIERS**

The main suppliers are Delphi, Tenneco Automotive, ZF Sachs, Continental Teves and most other shock absorber makers.

– Alex Graham
Powertrain

Hybrid choices will multiply until fuel cell technology arrives

RICHARD TRUETT
AUTOMOTIVE NEWS EUROPE

The early optimism for hydrogen-powered fuel cell vehicles got a reality check in 2005. With the exception of General Motors, virtually no automaker, supplier, energy company or government official expects fuel cell vehicles to be ready for mass production until at least 2020.

Even GM has softened its once bullish position on fuel cells. Instead of having a complete vehicle ready for production in 2010, GM says it now plans to have a fuel cell powertrain tested and validated by the end of the decade.

Because fuel cell vehicles are so far off and because automakers need a mid-term strategy to reduce consumption and lower emissions, gasoline-electric hybrids moved into the lead this year as the quickest and least expensive way to achieve those goals.

The new generation of clean-running diesels will be another fuel-saving powertrain available in North America, but more on that later.

Gasoline-electric hybrids will account for slightly less than 200,000 of the roughly 17 million vehicles expected to be sold in the US this year.

In western Europe, hybrid sales will account for less than 40,000 units of the region's forecast 14.6 million car sales this year.

Despite the small numbers, most major automakers have or will be investing in the technology and launching new hybrid models starting next year.

Hybrids are not expected to be widely available in Europe until around 2008 or 2009. They likely won't get as warm a reception as in the US. Hybrids will be competing against thrifty diesel engines, which already account for about half the new-cars sales in western Europe.

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Coming from Ford
Ford, fresh off the success of its hybrid Escape SUV in the US, launched a Mercury version called the Mariner and has announced that it will boost hybrid production to 250,000 units in five years.

The next hybrids from Ford will be the Ford Fusion and Mercury Milan compact sedans.

Ford aims to start selling models equipped with a hybrid powertrain in Europe by 2007.

Toyota, the leader in hybrid sales, plans to raise global production to 1 million units a year by 2012. Toyota sold about 135,000 hybrids worldwide in 2004.

Diesels, which are hugely popular in Europe, will be returning to the North American market in significant numbers starting in 2008.

Cleaner fuel that dramatically reduces sulfur emissions will be introduced in the US in late 2006. By using urea to clean the exhaust, D/C, BMW GM and Ford will be able to meet strict new emission regulations that require diesel engines to run as cleanly as gasoline engines.

D/C already has confirmed that diesels are scheduled for several US-bound Mercedes-Benz models starting in 2008. The Chrysler group, which includes Chrysler, Dodge and Jeep, has had success selling the diesel version of the Jeep Liberty SUV (badged the Cherokee in Europe) in the US and could add diesel versions of the Chrysler 300 sedan and Jeep Grand Cherokee SUV.

Meanwhile, engineers are continuing work on both the gasoline and diesel internal combustion engine. Several potential breakthroughs could see dramatic improvements in emissions and efficiency.

Fuel cell hybrid
Ford last year launched production of a small fleet of Ford Focus FCV sedans for testing in the US and Canada. FCVs also will be tested in Germany.

The FCV is a hybrid car that uses a fuel cell powertrain supplied by Ballard Power Systems as well as a nickel-metal hydride battery pack and a brake-by-wire electro-hydraulic regenerative braking system. The fuel cell engine converts chemical energy into electric energy using hydrogen fuel and oxygen from the air.

The electric energy then powers the vehicle's electric drive motor; producing only water vapor and heat as byproducts.

Finally, fuel cell researchers are making progress but are still struggling with some very tough problems.

The cost per kilowatt hour is still about 10 times too high, cold-weather performance is not up to the same standards as internal combustion engines and no one has figured out how to produce and distribute enough hydrogen to replace gasoline.
ALTERNATIVE FUELS

The threat of running out of crude oil and concerns about the environment are driving the industry to adopt alternative fuels for internal combustion engines. The industry’s focus is on two groups: those based on natural gas and those made from biomass. Hydrogen – an alternative for the distant future – is not a fuel but an energy carrier. Legislation is driving the research. European Union laws focus on reducing carbon dioxide, a greenhouse gas that some scientists blame for global warming, but are not as tough on particulate matter (soot) and nitrogen oxides (NOx), which are blamed for damaging respiratory systems, aggravating asthma and even death. US and Japanese regulations focus more on reducing soot and NOx.

HOW THEY WORK

Natural gas in compressed condition is a practical and efficient alternative fuel. Compressed natural gas (CNG) has an advantage over other fossil fuels: It contains less carbon and in turn produces less CO₂ when burned. Gas-to-liquid (GTL) is a more sophisticated fuel. It is made from natural gas with naphtha as an additive. GTL reduces diesel emissions, plus, both CNG and GTL are sulfur free. Biomass-to-liquid (BTL) fuels are another option. Because biofuels are made from plants, trees or other organic matter that absorb CO₂ to grow, they are almost CO₂ neutral. Biofuels also can be mixed with existing fuels to improve their properties and reduce emissions such as NOx. BTL can be made from different materials. In Brazil, sugar cane is used to produce ethanol. Rapeseed oil is used to create biodiesel in Europe.

WHERE TO FIND THEM

Available in much of Europe, biodiesel is a blend of 5.75 percent of a BTL fuel such as rapeseed oil with diesel fuel. Italy and Holland are Europe’s top markets for cars that can operate using gasoline with either CNG or liquefied petroleum gas, but combined 2005 new-car sales in each country won’t exceed 10,000 this year. In Sweden, E65 (a mixture of 85 percent gasoline and 15 percent ethanol) is used as part of a nationwide government project. Today, 4 million Brazilian cars, or 40 percent, are running on a local mixture of 25 percent ethanol and 75 percent gasoline.

DUAL-CLUTCH TRANSMISSIONS

Dual-clutch transmissions promise the smooth operation of automatic transmissions with fuel economy equal to or better than manual transmissions. Like continuously variable transmissions and automated manual transmissions, the dual-clutch solution offers better fuel economy than automatic transmissions, which lose power and fuel economy in the torque converter. Transmission specialists expect dual-clutch transmission technology to gain share in Europe and the US during the next five years.

HOW IT WORKS

The dual-clutch transmission works like two automatic transmissions side by side. In a six-speed version, one clutch would operate first, third and fifth gears, while the other would operate second, fourth and sixth. Because the transmission uses two OBSTACLES

Distribution and cost are the main obstacles. It is difficult to find a place to fill up a car that runs on an alternative fuel, and expensive modifications need to be made to the car so that it can burn the alternative fuel. There is one other problem:

WHERE TO FIND IT

Europe's largest automaker, Volkswagen, offers the solution, which it calls DSG, as an option on 10 models. DSG is short for direct shift gearbox. About 11 percent of the VW Golfs sold in western Europe are equipped with DSG. In the US, the VW group offers DSG as an option on the VW Jetta and Audi A3 and TT. Analysts expect Ford will offer the solution in Europe on the Mondeo and Galaxy. They also believe Volvos ranging from the C30 to the V70 or even the XC90 could get dual-clutch technology.

Obstacles of dual-clutch transmissions is that, because of low volume, it costs more to make than most manual transmissions.

PRIMARY SUPPLIERS

BorgWarner is the only supplier with its dual-clutch technology in a mass-market model. Its competitors include Germany’s ZF Friedrichshafen, Getrag, LuK, France’s Valeo and Graziano Trasmissioni of Italy.
GASOLINE DIRECT INJECTION

Gasoline direct injection got off to a false start in the 1990s. Mitsubishi invested heavily in the technology, but in Europe its cars failed to live up to their fuel-saving promise so most buyers stayed with their diesels. Pressure to compete with diesels in Europe and the global requirement to improve fuel economy—without sacrificing performance—has sparked a renewed interest in GDI.

HOW IT WORKS

GDI improves the efficiency of gasoline engines by providing greater control of the fuel-air mixture and the combustion processes. Fuel can be injected in precisely the desired location—generally right next to the spark plug—to maximize power and keep pollutant emissions to a minimum.

Two main types of GDI are used—homogeneous and stratified charge. Homogeneous GDI is the simpler of the two. The fuel-air mixture remains constant throughout. That means a conventional three-way catalyst is all that’s needed for exhaust-gas after treatment. Stratified charge is more oriented toward fuel saving and relies on burning a small pocket of rich mixture surrounded by an excess of air. These so-called lean-burn systems are economical on partial loads—savings of up to 20 percent are claimed—but need a much richer fuel-air mixture for high-load operation, such as carrying heavy objects. The high amount of nitrogen oxides produced in lean-burn mode means costly after-treatment systems are needed.

WHERE TO FIND IT

The Volkswagen group offers direct-injection gasoline versions of many VW and Audi cars. VW calls the technology FSI, which means fuel stratified injection. BMW is set to roll out direct injection across its entire gasoline range in late 2006. “Our focus is not one or two niche models,” BMW spokesman Wieland Bruch said, “but to provide the best available technology over all our model ranges.” BMW has a 6.0-liter direct-injection V-12 engine in the face-lifted 7 series it debuted in the spring. Plus, it revealed late last year that the second-generation Mini will get direct-injection engines co-developed with France’s PSA/Peugeot-Citroen.

OBSTACLES

The principal drawback is cost, especially for stratified charge systems with their complex exhaust after-treatment set-up. The future looks better for homogeneous-charge GDI engines. According to Lotus Engineering of the UK, the overall cost of such engines is still less than a modern Euro 4-compliant diesel.

TURBOCHARGERS

Almost all direct-injection diesel engines use variable geometry turbochargers. As of 2005, no production gasoline engine had been fitted with a variable geometry turbocharger. Gasoline engines typically have fixed-vane turbochargers.

HOW IT WORKS

Exhaust gases are recycled and forced through the turbine, causing it to rotate. This draws in air from outside, which is cooled and forced into the engine cylinders. The extra air creates more powerful and efficient combustion. This in turn boosts economy and performance, and cuts emissions.

WHERE TO FIND IT

They are on most diesel models sold in Europe and the US. By 2008, sources expect global turbocharger demand to exceed 16 million units. At last month’s IAA in Frankfurt, Volkswagen presented its new Twincharger system for direct-injection gasoline engines. VW’s technology uses an electrically powered supercharger from Eaton and a turbo to provide a boost through the entire engine speed range.

In Europe, the Twincharger is on the new VW Golf GT and will be an option on the VW Touran starting next year.

OBSTACLES

The high exhaust temperature and range of operating speeds in a gasoline engine are more demanding than in diesel engines. The maximum temperature of a diesel’s exhaust is about 800 Celsius; gas engines can run up to 1000 C. As a result, it costs too much to make the movable turbine blades durable enough to withstand the heat in direct-injection gasoline engines.

Camcon, Eaton, Lotus Engineering, Starman Industries, TRW Automotive, Valeo.

– Tim Moran

CAMLESS ENGINES

The fewer friction-causing, energy-robbing parts to an engine, the better its efficiency. Until recently, few production engineers could envision a way to eliminate camshafts and their timing hardware. Driven using power from the engine crankshaft, rolling camshafts and their lobes have been used to actuate valves since the dawn of the internal combustion engine itself. Variable valve timing has brought efficiency advances, but only by altering the way the camshaft contacts the valves. So-called camless technology may allow for engines that get up to 35 percent greater fuel economy than a conventional gasoline engine while lowering engine emissions.

HOW IT WORKS

In a camless engine, the valves are opened and closed electronically. Unlike mechanical systems, which give fixed amounts of valve travel and timing, an electro-hydraulic device can move valves independently to any lift position for any duration desired. This gives an opportunity for engine systems to tailor the performance of each piston on every cycle, increasing fuel economy and engine torque while reducing emissions. Beyond valve adjustment alone, camless technology could allow for ultra-lightweight valves because the need to absorb the force and action of rolling camshafts is eliminated. Some engineers have suggested that camless technology could ultimately use waste exhaust gases to power valve motion. But, that concept is far in the future.

WHERE TO FIND IT

Valeo, which calls its camless technology Smart Valve Actuation, announced at last month’s IAA in Frankfurt that it expects several leading carmakers to introduce the technology in 2009.

Valeo says the technology could reduce vehicle emissions 20 percent versus a conventional engine. Earlier this year Valeo acquired Johnson Controls Inc.’s engine-electronics unit to gain expertise in camless engines.

OBSTACLES

Durability and cost.

PRIMARY SUPPLIERS

Camcon, Eaton, Lotus Engineering, Starman Industries, TRW Automotive, Valeo.

– Tony Lewin

Volkswagen combined a supercharger (dark blue) with the turbocharger (red) for efficiency over a wider range of engine speed.
TIRE-PRESSURE MONITORING SYSTEMS

Underinflation can cause wear on tires, which can lead to poor fuel economy and, in worst cases, accidents. A tire-pressure monitoring system offers a way to increase tire safety and add value to the vehicle at a relatively small cost. Following the tire tread separation on Ford Explorers equipped with Firestone tires, American lawmakers mandated automakers include tire-pressure monitoring systems on vehicles sold in the US. Beginning September 1, 2007, all new four-wheel passenger vehicles must be equipped with a system that warns the driver when any one tire falls below 25 percent of its recommended inflation rate. There is no similar rule in Europe, but automakers in the region have adopted the technology for premium vehicles as well as for cars they sell in the US market. “We don’t expect TPMS to become mandatory any time soon in Europe. Nevertheless, the product is getting more and more important as a voluntary additional feature,” Beru spokeswoman Monika Schmierer said.

HOW IT WORKS

An electronic sensor is attached to the inner end of the valve stem or mounted to the wheel. The sensor transmits a low-power radio signal to a central control unit that sets off the warning light when the pressure reading drops below a designated trigger point. Third-generation systems also can measure tire temperature and register that information for the driver as well as provide a more accurate pressure reading.

RUN-FLAT TIRES

The main safety feature of run-flat tires is that they are designed to prevent a driver from losing control when a tire loses pressure, especially at high speeds. Equally important is that a driver can continue traveling on a punctured run-flat tire for up to 200km at a maximum speed of 80kph before repairing the tire. Another advantage of run-flat tires is that they also eliminate the need for a spare tire creating more trunk space in the vehicle and reducing weight.

HOW IT WORKS

There are two types of run-flat tires: auxiliary support or self-support. Auxiliary support tires have a structure inside the tire that can support the weight of the car when the tire deflates. Self-supporting tires have highly reinforced sidewalls that can support the weight of the vehicle. Both systems make sure a vehicle maintains stability and the wheel does not touch the road even if there is a total loss of tire pressure.

WHERE TO FIND IT

Millions of vehicles in both Europe and North America already feature tire-pressure monitoring systems. They are still mainly found in premium models, but in two years will be in all new cars sold in the US.

OBSTACLES

The environment inside the tire is harsh on electronics. A lasting power source is needed and batteries are not the best solution because they need to be maintained and replaced often. Some sensor suppliers are developing battery-less technology that will make tire-pressure monitoring systems smaller and lighter. Sensors also can be damaged during tire repair or tire installation.

PRIMARY SUPPLIERS

Beru, Michelin, Continental Teves, Johnson Controls, Schrader-Bridgeport, Pacific Industrial, TRW Automotive, IQ Mobil, SmarTire, Rayovac and Fleet Specialties Co.

WHERE TO FIND IT

The tire-pressure monitor (lower left), and the support ring, which is made of polyurethane and rubber, add about 1kg to the weight of the tire.

WHERE TO FIND IT

The solution is still limited to premium brands with notable exceptions being the Honda Odyssey and the Toyota Sienna in the US. Nearly all BMW models, including the Mini Cooper, are equipped with run-flats. The tires are available in the Audi A4, A6 and A8 ranges. Mercedes-Benz offers it on the S class and the SLK class. The Cadillac and Lexus also offer the solution.

OBSTACLES

Costs, weight and ride quality are the main issues. Run-flat tires are more expensive than regular tires, especially when combined with tire-pressure monitoring systems, because of the added maintenance costs. The added weight inside each tire, about a kilogram, creates a higher rolling resistance which lowers fuel economy. Run-flats also have a reduced ability to absorb bumps, making the ride more harsh. Also, some

Punctures don’t stop run-flat tires like this one because the support ring is strong enough to support the car’s weight.

European countries require cars to carry a spare tire regardless of run-flat technology which eliminates any potential space advantage.

PRIMARY SUPPLIERS

Most tire makers including Michelin, Continental, BF Goodrich, Bridgestone, Dunlop, Pirelli and Yokohama.

– Alex Ricciuti
Adaptive lighting provides precise patterns

TIM MORAN

**AUTOMOTIVE NEWS EUROPE**

Ever since lights were added to vehicles, it seems people have tried to find ways to make them swivel and focus to help drivers see their way. The problem with early attempts to “steer” headlights was the relatively low power of the beams, limitations of the sealed-beam headlamp designs that dominated the automotive sector from 1941 through 1983 and the difficulty of truly matching mechanical linkages to what the driver needed to see. Today, adaptive lighting offers a new start with a clean slate and effective technology.

**Choices, choices**

Adaptive lighting systems divide into two broad categories. One uses additional bulbs housed in specially engineered reflectors within the headlight lens assembly to switch on extra lights. The other uses motors and projector lenses to mechanically pivot one or both headlamps. Think of an eyeball in a socket.

The systems can work with either halogen bulbs or xenon high-intensity discharge bulbs. In either case, adaptive lighting relies on a complex reflector — the silver sculpted shape behind the bulbs — to provide precise lighting patterns. The need to change the beam pattern is analyzed by a computer program that takes inputs from sensors including speed, light level and steering angle. When the adaptive lighting system determines the driver is rounding a curve, it changes the headlight beam angle to light the road surface farther along the curve.

European cars are more likely than US cars to have motorized lighting, as European standards already demand automatic-leveling headlamps.

Mercedes-Benz offers adaptive lights with a cornering function. The system uses a computer-controlled motor to move xenon headlamps, in which a projector lens is used to give both low and high beams.

BMW, meanwhile, adds inputs from a lateral acceleration sensor (to measure the severity of a turn’s G-force) and map information from the onboard navigation system to tailor its similar active system.

The system is called Adaptive Light my way

Primary suppliers of adaptive lighting
- Automotive Lighting
- Denso
- Hella
- Osram
- Philips
- II Stanley
- Valeo-Sylvania
- Visteon

Light Control and is standard on the 2006 330i.

**Sensing a turn**

The Audi A8 uses a fixed-bulb cornering system that is called Adaptive Light. The additional bulb comes on when it senses the driver making or signaling a turn at speeds up to 70kph. In addition, the adaptive lights come on to illuminate a light parking spot or driveway when the driver is backing the car.

Adaptive lighting has mostly been limited to top-end luxury cars with xenon projector bulb systems; the cost of motorized lighting could limit adoption in lower cost mass markets. Drivers need to experience adaptive lighting in order to value it as a feature, but most car sales do not include a nighttime test drive. North American manufacturers, not required to have self-leveling headlamps, are unlikely to spend extra for motorized systems. Some automakers may be waiting for light-emitting diode front lighting before making significant lens changes.

**Bright future for dim mirrors**

The 2006 Citroen C6, PSA/Peugeot-Citroen’s new upper-medium car, carries external and internal rear-view mirrors from US supplier Gentex Corp. that automatically dim when bright headlights hit them. Internal auto-dimming mirrors are standard on the car, while external dimming mirrors will be an option on all but top-of-the-line trim packages for the Citroen.

It’s the first three-mirror system to be supplied in France by the Zeeland, Michigan, company. The outside dimming mirrors are also available on the 2006 Volkswagen Touareg and the Mercedes-Benz CLS class. Gentex mirrors use proprietary electrochromic gel technology to dim proportionally to the amount of light detected.

**Trade secret**

While Gentex does not discuss its trade secrets in detail, electrochromics typically use layers of polarizing material placed within a sandwich of glass plates. Under normal circumstances, the material remains clear, but when a mild electric current is passed through it, the polarity is expressed by making translucent what was transparent. By making one or more thin sandwiched layers react with the gel, a darker and darker filter can be placed over the silvery reflective layer of the mirror.

The mirrors use a complementary metal oxide semiconductor chip to sense both ambient light levels forward of the car and bright light sources coming from behind the car, and sensor circuitry to communicate with a digital microprocessor that does not need signal amplifiers or other conversion circuitry to do its job. Gentex calls the solid-state device an Active Light Sensor.

Gentex was the first company in the world to supply automatic-dimming rear-view mirrors when its products came onto the market some 15 years ago. Gentex dominates about 80 percent of the market for automatic dimming mirrors; competitor Magna Donnelly holds about 16 percent. Magna Donnelly refers to its electrochromic mirror as solid polymer matrix technology.

According to press materials, Gentex’s customers include Audi, Bentley, BMW, Daimler-Chrysler, Fiat, Ford, General Motors, Honda, Hyundai, Isuzu, Kia, Lexus, Mazda, Mitsubishi, Nissan, Opel, Renault, Samsung, Rolls-Royce, SaangYong, Toyota, Volkswagen and Volvo.

~ Tim Moran

| October 31, 2005 |

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PEDESTRIAN SAFETY

Automakers face increasing legislative demands to make cars less dangerous in the event of a collision with a person. Pedestrian fatalities make up nearly a third of the 40,000 annual car-related deaths in Europe. About 5,000 pedestrians are killed on US roads each year. That represents about 12 percent of the total annual highway death toll of 42,000 in the US. Most of these deaths, estimated at 80 percent, are caused by head injuries resulting from a collision with the car hood, A-pillar or windshield. Starting this month new types of cars sold in the European Union must meet more demanding pedestrian safety rules. By 2012, this requirement will be expanded to all new cars.

HOW IT WORKS

Car designers are taking three major paths to meet the EU regulations.

1. Creating more space between the front grill and the so-called hard points such as the engine and radiator to passively absorb kinetic energy from a collision.
2. Redesigning the car’s hood to make it a better energy absorber and fitting it with active safety systems such as a pop-up mechanism and airbags to deflect the pedestrian’s head away from the windshield and A-pillars.
3. Equipping the car with active safety systems such as night vision and active braking systems to prevent any impact from ever taking place.

WHERE TO FIND IT

The Jaguar XK, scheduled for launch in Europe in March 2006, will have the Autoliv pop-up hood. The Honda Legend also will have a pop-up hood in European markets. Raising the hood away from the engine results in a 30 percent reduction in head injuries. “You have a maximum of 60 milliseconds to cover all sizes of people,” Honda Europe spokesman Thomas Brachmann said. The engine in the new Mercedes-Benz S class has been lowered 13 mm to provide more crash-absorbing crush space.

OBSTACLES

Active systems put additional electronic complexity into cars, which adds cost and increases the risk of software-related problems.

Changing the front ends of cars forces designers to overcome engineering challenges while making sure their cars still look good.

PRIMARY SUPPLIERS

The main suppliers are Autoliv, TRW Automotive, Denso, Robert Bosch, Siemens VDO Automotive, Valeo and HBPO, the venture between supplier Hella, Behr and Plastic Omnium.

NIGHT VISION

BMW and Mercedes-Benz each will offer night vision on upcoming vehicle programs for the US and Europe. The technology debuted in the US five years ago. Demand for a Raytheon-built system was brisk when General Motors introduced it on the 2000 Cadillac DeVille. But sales slowed, and GM dropped the factory-installed option after the 2005 model year. With the feature gone from the DeVille, Toyota became the only carmaker offering a night vision system in the US.

HOW IT WORKS

Mercedes says the night vision system on its new S class can extend a driver’s visibility about 150 meters. The system bathes the road with infrared light from two projectors mounted in the headlight assemblies. An infrared camera in the windshield receives the reflected infrared light and shows it as a black-and-white image on a screen on the instrument panel.

Siemens VDO’s Night Vision, which is integrated in the head-up display, could make driving in the dark more comfortable by helping drivers identify potential hazards earlier.

BMW says the night vision system on its 2006 7 series is effective up to 300 meters. It, too, uses an infrared camera. The image is displayed on the iDrive monitor on the top center of the instrument panel.

Honda offers what it calls Intelligent Night Vision on the Honda Legend in Japan. A camera detects heat-emitting objects as far as 460 meters ahead of the car and projects the image onto the lower left portion of the windshield.

Toyota’s Night View system, available on the Lexus LX470 in the US and other models in Japan, uses so-called near-infrared technology to illuminate everything in front of the vehicle up to about 150 meters. Two lamps in the grille project light beams that reflect off objects in the vehicle’s path, bouncing back to a camera mounted inside the top of the windshield. A computer processes the reflected images and projects a black-and-white image onto a section of the windshield.

OBSTACLES

Like many other new technologies, cost is a big factor. And there are limitations. For example, Honda’s system will not function if the temperature rises above 30 Celsius.

PRIMARY SUPPLIERS

Autoliv, L-3 Communications, Raytheon, Siemens VDO Automotive.

– Lyle Fink

– Chaz Osburn
Safety

ADAPTIVE CRUISE CONTROL

Adaptive cruise control lets the car maintain a driver-selected speed while automatically adjusting to changing traffic. Second-generation systems work in stop-and-go situations, an improvement over the first generation, which would not function at speeds below 30kph.

HOW IT WORKS
Adaptive cruise control systems use sensors, such as cameras or near-range radar, to monitor the lane. The systems determine the direction and position of the vehicle in relation to lane markers. When the technology recognizes that a lane departure is imminent it sends a signal to the driver. Some systems make a noise, others cause a vibration of the steering wheel or the driver’s seat. Advanced systems can automatically steer the vehicle back into the lane. In the future, the system could be extended to help a driver change lanes and avoid collisions with vehicles in a driver’s blind spot.

WHERE TO FIND IT
In Europe on the Citroen C4, C5 and C6. US models with the solution include the FX45 and M45 from Infiniti, Nissan’s luxury division. Toyota is equipping some of its models in Japan. General Motors featured the technology on the Cadillac STS SAE 100 concept it showed in April at the SAE World Congress in Detroit. Ford Motor Co. and DaimlerChrysler also have been testing lane departure warning systems.

OBSTACLES
Challenges include stopping false alarms and getting the system to work properly during some types of bad weather and on roads that are not well marked. Another drawback is price – more than €1,000 in many cases.

PRIMARY SUPPLIERS
Bosch, Continental, Delphi, Motorola, Siemens VDO Automotive and Visteon all aim to have their systems in production models before the end of the decade.

– Ian Morton

Cars equipped with adaptive cruise control automatically slow when another car gets too close. When the object gets out of the way, the car returns to a driver-set speed.

LANE DEPARTURE WARNING

Lane-departure warning systems are being developed to help distracted or drowsy motorists avoid an accident. Almost 2 million accidents a year are attributed to drivers inadvertently changing lanes.

HOW IT WORKS
Lane-departure warning systems use sensors, such as cameras or near-range radar, to monitor the lane. The systems determine the direction and position of the vehicle in relation to lane markers. When the technology recognizes that a lane departure is imminent it sends a signal to the driver. Some systems make a noise, others cause a vibration of the steering wheel or the driver’s seat. Advanced systems can automatically steer the vehicle back into the lane. In the future, the system could be extended to help a driver change lanes and avoid collisions with vehicles in a driver’s blind spot.

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Bosch, Continental, Delphi, Motorola, Siemens VDO Automotive and Visteon all aim to have their systems in production models before the end of the decade.

– Chris Wright

Valeo has been fastest to market: its systems are on Citroens and it supplies a separate system to Nissan that was developed by Iteris. Aisin Seiki’s lane departure warning system can be found on Toyota models. Continental, Delphi, Denso, Hella, Robert Bosch, Siemens VDO Automotive and Visteon all aim to have their systems in production models before the end of the decade.

– Chris Wright
Hand-held devices move into the car

RHODA MIEL
AUTOMOTIVE NEWS EUROPE

People want to listen to their own music in their cars. This desire has been the catalyst behind the installation of everything from eight-track tape players to compact disc players to digital music systems to satellite radio receivers.

In each case the auto industry has been slow to satisfy the new desire.

Along with trying to catch up with the surge in popularity of Apple’s iPod and other MP3 players, automakers are looking for ways to allow people to use hand-held devices such as mobile phones and personal digital assistants in the car in a better and safer way.

Getting connected

Last year, BMW started to offer the option of having an iPod connection retrofitted into the glove boxes of its models. BMW’s system lets the driver control the iPod by using the standard buttons on the steering wheel.

BMW spokesman Frank Schöder said the carmaker’s target is to have a standard USB interface so that all MP3 players can be used in the brand’s cars. He said future generations of BMW’s cars will offer the feature, but he couldn’t reveal when.

Starting this year, Mercedes-Benz models such as the B class allow users to play music stored on an iPod through the vehicle’s in-car system and control the iPod through standard stereo buttons on the instrument panel and steering wheel.

Users even can display their iPod song information on the instrument cluster.

The integration works through the 30-pin connector on the bottom of every iPod and iPod Mini.

That connection will continue to exist, so the auto industry has a specific standard around which to design its systems.

Coordinated effort

In-car solutions will require renewed emphasis on coordinating vehicle interior design, electronic connections, wire housings and LED displays to make it all work seamlessly for the vehicle owner.

“That is a major issue,” said Hans-Gerd Krekel, vice president of product and innovation management for Siemens VDO Automotive’s infotainment solutions. “The simpler the design on the outside, the more complicated it is [on the inside],” he said.

There is more than aesthetics at stake. Coordinating digital music systems smoothly into cars will make it less likely that drivers will be distracted. They can use standard switches and controls in the car to control their music, rather than taking their eyes off the road to fiddle with a small player on an instrument panel or tossed onto a seat. In a fully integrated system, the controls on the iPod are locked out in favor of the main controls, said Bob Borchers, senior director of iPod auto integration for Apple.

According to Apple’s research, 67 percent of iPod owners listen to them in their cars.

Apple launched an iPod adapter for some BMW models in 2004. It says it has deals with Honda, Acura, Volkswagen and Audi to integrate iPod products into their car stereos for 2006 model lines.

Apple expects more than 5 million vehicles will ship with iPod support in the US in 2006, according to Reuters.

The next step

Siemens VDO Automotive, of Regensburg, Germany, is concentrating on using Bluetooth, a wireless connection being built into many consumer electronics and mobile phones, to widen potential entertainment links in the car.

In Europe, mobile telephones increasingly are able to store digital music, Krekel said. Siemens VDO can link a variety of telephones to the auto entertainment system through Bluetooth, and even upgrade the software within the stereo players so they can adapt more quickly, he said.

In the long term, Siemens VDO is developing a system called “content-based multimedia” that lets drivers organize their stereos to look for songs by a certain artist or style of music and play them back through the speakers. The computerized search engine then will draw from digital music storage systems on telephones and MP3 players, through CDs and even satellite radio stations.

More than 20 automakers worldwide offer optional or standard Bluetooth-enabled communications systems in their new models. Models from premium carmakers such as Lexus and BMW as well as mass market brands Toyota, Opel/Vauxhall and Chrysler have the solution.

Bluetooth is a short-range wireless connection system that allows various digital devices such as in-car audio, PDAs and mobile phones to communicate. The most common use of Bluetooth technology currently is for hands-free use of mobile phones. It allows drivers to talk without having to hold their phones and saves them from searching for their mobile phones while driving.

As with other hand-held devices, automakers have difficulty keeping up with the much quicker product life cycles in the electronics industry. Successfully integrating personal electronic devices such as the iPod into their models can take years and while some consumers want the extra functionality, they don’t want to pay a lot for it.
feature.
gale-force air conditioning is the North American market, European cars where, unlike expected to be important for equipment. Cooled seats are the load off the HVAC comfort while taking some of the car – the seat – can increase humans make contact with the directly to the place where system. Bringing cooling power ventilation and air conditioning a heavy load on a car’s heating K according to scientists.

layer than CO2-based refrigerant, times more damaging to the earth’s ozone replacement candidate. R134a is 1,300 though a greenhouse gas, is the leading used in new cars sold after 2011. CO2, R134a as the air conditioner refrigerant conventional systems. CO2 technology – as little as one-fifth – compared with system requiring a smaller amount of gas CO2-based air conditioners use a closed exchanger, which would add more cost. There are also infrastructure issues such as providing service and maintenance equipment, plus clarifying and standardizing procedures on how to handle CO2 air conditioning systems during service. CO2 systems also must include a way to warn passengers if the gas enters the car because too much CO2 can be poisonous.

WHERE TO FIND IT Saab introduced power-ventilated seats in 1998 in the Saab 9-5; other manufacturers followed quickly with systems in luxury models. Mercedes used 16 minifans to push air through seats in the S class; Audi, BMW, Cadillac, Ford, Infiniti, Lexus, Lincoln, Toyota and Volkswagen all offer some form of cooled seat in their premium vehicles. Cooled seats are expected to penetrate mid-market automobiles.

OBSTACLES Cost and acceptance among consumers, particularly European countries where cool temperatures prevail. And many consumers are not aware the technology exists.


CO2 AIR CONDITIONING The European Union is expected to outlaw the use of the hydrofluorocarbon R134a as the air conditioner refrigerant used in new cars sold after 2011. CO2, though a greenhouse gas, is the leading replacement candidate. R134a is 1,300 times more damaging to the earth’s ozone layer than CO2-based refrigerant, according to scientists.

HOW IT WORKS An inexpensive natural by-product, CO2-based air conditioners use a closed system requiring a smaller amount of gas – as little as one-fifth – compared with conventional systems. CO2 technology also involves a heat pump operation, providing auxiliary warmth for the passenger cabin and better control of glass fogging.

OBSTACLES The complexity of the system and the cost of materials are the main drawbacks to CO2 air conditioning. Above 40 degrees Celsius, the system needs an additional interior heat exchanger, which would add more cost. There are also infrastructure issues such as providing service and maintenance equipment, plus clarifying and standardizing procedures on how to handle CO2 air conditioning systems during service. CO2 systems also must include a way to warn passengers if the gas enters the car because too much CO2 can be poisonous.

WHERE TO FIND IT The Toyota Kluger V FCHV-4 fuel cell hydrogen vehicle incorporates a Denso CO2 prototype system with electric heat pump. Last year Delphi demonstrated CO2 air conditioning in an Alfa Romeo 147. Visteon, which exhibited its CO2 system on an Audi A8 earlier this year, and Behr say their CO2 systems will be ready by 2009.

PRIMARY SUPPLIERS Behr, Delphi, Denso, Modine, Valeo, Visteon. – Ian Morton

PARKING ASSIST Proximity sensors in the front and rear bumpers and camera-aided devices are two systems that currently help drivers park. The most advanced systems completely take over the chore.

HOW IT WORKS Front and rear sensors, either ultrasonic or radar-based, trigger an audible warning when the driver gets too close to an object. In cars with a rear-vision camera a picture of what is behind the vehicle is sent to the screen on the navigation system to make backing easier. Cars equipped with self-park solutions have a computer that uses inputs from Global Positioning System satellites, the car’s navigation system, steering-wheel sensors and a rear-vision camera to provide the necessary information to guide the car into a parking space.

WHERE TO FIND IT Most luxury brand models as well as many station wagons and SUVs have back-up sensors in their bumpers. Cars in the US and Europe

Convenience

COOLED SEATS Keeping drivers comfortable when it’s warm outside puts a heavy load on a car’s heating ventilation and air conditioning system. Bringing cooling power directly to the place where humans make contact with the car – the seat – can increase comfort while taking some of the load off the HVAC equipment. Cooled seats are expected to be important for European cars where, unlike the North American market, gale-force air conditioning is seen as a flaw rather than a feature.

HOW IT WORKS Cooling seats work in several different ways. Some use special absorbent materials under breathable seat coverings to wick away moisture and heat. Johnson Controls Inc. demonstrated such a system at the recent IAA in Frankfurt called EcoClimate that uses coconut fiber and activated charcoal. The supplier claims the seat can absorb 300 percent more moisture than conventional seats.

Other suppliers use active ventilation from a fan, or multiple fans, that pick up air-conditioned air from the car’s ducts and channel the cool air through the seatback. Some systems briefly use a solid-state thermoelectric device to create cool air quickly, close to the seat, to supplement air conditioning at start-up.

WHERE TO FIND IT Park Mate automatically scans a row of parked cars until it identifies a space large enough. The system takes over control of the steering and maneuvers the car into the chosen space.

OBSTACLES Bumper sensors are in a vulnerable location and if they are damaged they are expensive to repair. Rear-vision cameras are expensive as are self-parking systems, which require a high-powered computer to process the data.

PRIMARY SUPPLIERS Alisin Seiki, Denso, Siemens VDO Automotive, Valeo. – Ian Morton

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29360 Mlada Boleslav, Czech Republic
Tel: (420) 326-815-401
Fax: (420) 326-815-010

SMART
Executive:
Ulrich Walker
President of Smart

Technical center:
Lehnzstrasse 2
71032 Böblingen, Germany
Tel: (49) 7031-90 76 200
Fax: (49) 7031-90 74 999

TOYOTA
Executives:
Shinichi Sasaki
President and CEO, Toyota Motor Engineering and Manufacturing Europe
Kazuhiko Miyadera
Executive vice president TMEM; in charge of R&D

Technical center:
TMEM
Hoge Wei, 33A,
1900 Zaventem, Belgium
Tel: (32) 2-712-3211
Fax: (32) 2-712-3279

SUBARU
Executive:
Kazuo Saito, general manager

Subaru Test and Development Center in Europe
Konrad-Adenauer-Strasse 34
53218 Ingelheim am Rhein, Germany
Tel: (49) 6132-763-70
Fax: (49) 6132-76331

VOLKSWAGEN
Executive:
Wolfgang Bernhard
board member responsible for technical development (also VW brand chairman)

Technical center:
Forschung und Entwicklung (Research and Development)
Volkswagen
38436 Wolfsburg, Germany
Tel: (49) 5361-90

VOLVO
Executive:
Hans Folkesson
Senior vice president, research and development

Technical center:
Department 90000, Building PV3A
405 31 Gothenburg, Sweden
Tel: (46) 31 59-7125
Fax: (46) 31 59-17 02

October 31, 2005
Design studios

ASTON MARTIN

Senior design executive: Marek Reichman, design director

Studio: Banbury Road, Gaydon, Gaydon, Warwickshire, CV35 0DB, UK

AUDI

Senior design executives: Walter de’ Silva, head of design, Audi brand group
                      Gerhard Pfefferle, head of design, Audi

Studios: Audi Design I/ED 85045 Ingolstadt, Germany
                   Design Center Europe 08870 Sitges, Barcelona, Spain
                   Design Center California 82 W. Cochran Street Simi Valley, California 93065, USA

BENTLEY

Senior design executive: Dirk van Braeckel, director of design

Other senior styling managers: Raul Pires, head of exterior design
                              Robin Page, head of interior design
                              Luis Santos, design project manager

Studio: Bentley Motor Cars
            Pym's Lane
            Crewe, Cheshire CW1 3PL, UK

BERTONE

Senior design executives: Roberto Piatti, engineering
                         Eugenio Manassero, managing director

Studio: Stile Bertone
            Via Roma 1
            10040 Caprie, Turin, Italy

BMW

Senior design executive: Chris Bangle, director of design

Other senior styling managers: Adrian van Hooydonk, head of BMW brand design
                               Michael Ninic, head of interior design
                               Thomas Plath, head of advanced design
                               Gert Hildebrand, head of Mini design
                               Verena Kloos, head of DesignworksUSA
                               Ulf Weidhase, head of M-design

Studios: Forschungs- und Innovationszentrum (Research and Innovation Center)
            Knorrstrasse 147
            80788 Munich, Germany

DesignworksUSA
            2201 Corporate Center Drive
            Newbury Park, California 91320-1421, USA

CITROEN

Senior design executive: Jean-Pierre Ploue, director of Centre de Creation Citroen

Other senior styling managers: Oleg Son, head of Platform 2
                               Gilles Vidal, concept cars

Studio: Centre Technique de Velizy
            Centre de Creation Citroen, Route de Gizy
            78973 Velizy-Villacoublay Cedex, France

DAIMLERCHRYSLER

Senior design executives: Peter Pfeiffer, senior vice president design; head of design, Mercedes Car Group
                        Gunther Ellenrieder, director advanced vehicle engineering

Studios: DaimlerChrysler Design Department
                   HPC X900
                   71059 Sindelfingen, Germany

DaimlerChrysler Advanced Design Italia
            Largo Spluga, 1, 22100 Como, Italy

Studio director: Norbert Weber

Mercedes-Benz Advanced Design of North America
            17742 Cowan Street
            Irvine, California 92614, USA

Studio director: Franz Lecher

Mercedes-Benz Advanced Design Center of Japan
            1-17 Chigasaki-minami 2-Chome
            Tsuzuki-ku, Yokohama, Kanagawa 224-0037 Japan

Studio director: Olivier Boulay

FIAT AUTO

Senior design executives: Frank Stephenson, vice president design, Fiat, Lancia and light commercial vehicles
                        Flavio Manzoni, design director, Fiat, Lancia and light commercial vehicles

Studios: Centro Stile Fiat
                   Via La Manta 22
                   10137 Turin, Italy

Studio director: Christopher Reitz

Fiat Auto Advanced Design
            Corso Settembrini 40
            10137 Turin, Italy

Studio director: Wolfgang Egger

Centro Stile Lancia
            Viale Fausto Coppi 2
            10043 Orbassano, Torino, Italy

Studio director: Marco Tencone

FIORAVANTI

Senior design executives: Leonardo and Matteo Fioravanti

Studio: Fioravanti SrL Styling Studio
            P Vittorio Emanuele 4
            Moncalieri, Italy

FORD

Senior design executives: Martin Smith, executive design director Ford Europe
                        Chris Bird, director integrations and operations

Other senior styling managers:
                              Stefan Lamm, chief designer exteriors
Design studios

**ITALDESIGN GIUGIARO**
Senior design executive: Fabrizio Giugiaro, styling area director

**JAGUAR**
Senior design manager: Ian Callum, director of design

**KARMANN**
Senior design executive: Jorg Steuernagel, studio head

**LAMBORGHINI**
Senior design executive: Walter de’ Silva (also head of design, Audi brand group)

**LAND ROVER**
Senior design executive: Geoff Upex, director of design

**LOTUS**
Senior design executives: Russell Carr, chief designer

**MAZDA**
Senior design executives: Morray S. Callum, executive officer

**MEL DESIGN**
Menard Engineering

**HYUNDAI/KIA**
Senior design manager: Suk Geun Oh

**HONDA**
Senior design executive: Erwin Leo Himmel, CEO

**HEULIEZ**
Senior design executives: Alain Masquelet, research and development director

**FUORE DESIGN**
Senior design executive: Justyn Norek, design director

**I.DE.A. INSTITUTE**
Senior design executive: Suk Geun Oh

**JACQUES DE SEDAT**
Senior design executive: Jacques de Sedat, creative director

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Claudio Messale, chief designer production and execution
Chris Clements, chief designer FCSD RS
Nikolaus Vidakovic, chief designer interior design
Ruth Paul, chief designer color and materials

Studio: Merkenich Design Center
John Andrews Entwicklungszentrum
Spessartstrasse 30
50725 Cologne-Merkenich, Germany

HEULIEZ
Senior design executives: Alain Masquelet, research and development director
Jean-Marc Guillez, advanced engineering director

Studio: Heuliez
79140 Cerizay, France

HONDA

Studios: Honda R&D Europe
Carmen Legien-Strasse 30
83073 Offenbach, Germany

Senior design executive: Makoto Yamashita

Honda R&D Co., Ltd.
Wako R&D Center
Tokyo Studio
33 F Jumi Garden Tower
1-6-1 Roppoungi Minato-ku Tokyo
106-6033 Japan

Senior design executive: Kiyoshi Nishigata

Honda R&D North America
1900 Harpers Way
Torrance, California 90501, USA

Senior design executive: Masahito Okubo

HYUNDAI/KIA
Senior design manager: Suk Geun Oh

Studio: Hyundai Motor Europe Technical Center
Am Hyundai-Platz
Marie-Curie-Strasse 2
65428 Russelsheim, Germany

I.DE.A. INSTITUTE
Senior design executive: Justyn Norek, design director

Studio: I.DE.A. Institute

ITALDESIGN GIUGIARO
Senior design executive: Fabrizio Giugiaro, styling area director

Studios: Italdesign
Via Achille Grandi, 25
10124 Moncalieri, Turin, Italy

Diseno Industrial
C/Rocas Peral 13
08960 Sant Just Desvern, Barcelona, Spain

Italdesign France
Bure de Porny 254
7830 Buc, France

Berci
655 Av. Roland Garros, BP 328 Cedex
78533 Buc, France

JAGUAR
Senior design manager: Ian Callum, director of design

Other senior styling managers:
Julian Thomson, chief designer, advanced design
Giles Taylor, senior designer manager, sports cars
Kim Challiner, manager, color and trim

Studio: Jaguar Cars Engineering Centre
Design Studio W1/3/20, Abbey Road
Whitley, Coventry CV3 4LF, UK

KARMANN
Senior design executive: Jörg Steuernagel, studio head

Other senior styling managers:
Marian Dziubiel, deputy studio head
Jutta Sommer, head of color and trim

Studio: designStudio Wilhelm Karmann
Karmannstrasse 1
49894 Osnabruck, Germany

LAMBORGHINI
Senior design executive: Walter de’ Silva (also head of design, Audi brand group)

Studio: Via Modena 12
40019 Sant’Agata Bolognese, Bologna, Italy

LAND ROVER
Senior design executive: Geoff Upex, director of design

Other senior styling managers:
David Saddington, chief platform director
Discovery and Defender
Richard Woolley, chief platform director, Range Rover and Freelander

Studio: Design, G-DEC Land Rover
Banbury Road, Lighthorne
Warwick CV35 0RG, UK

LOTUS
Senior design executives: Russell Carr, chief designer

Other senior styling managers:
Steve Crjins, design manager
John Statham, design manager
Barney Hatt, principal designer
Richard Kilgren, designer
Anthony Bushell, designer
Neil Lloyd, studio manager

Studio: Group Lotus plc
Potash Lane, Hethel, Norfolk, NR14 8EZ, UK

MAZDA
Senior design executives: Morray S. Callum, executive officer, general manager, design division
Koichi Hayasuni, deputy general manager, design division
Atsushi Yamada, chief designer, Mazda R&D center Yokohama
Peter Birthwistle, chief designer, Germany
Franz von Holzhausen, chief designer

Studio:
Mazda Motor Corporation
3-1 Shinchi Fuchu Aki
Hiroshima 730-8670 Japan

Mazda R&D Center Yokohama
2-5 Moriya Kanagawaku Yokohamashi
Kanagawa-ken Japan

Mazda Europe GmbH
European R&D and Production
Hiroshimastrasse 1
61440 Oberursel, Germany

Mazda North American Operations
1422 Reynolds Avenue
Irvine, California 92614, USA

MEL DESIGN
Menard Engineering

Leafield Technical Centre
Langley, Witley, Oxfordshire
OX29 9EF, England
Tel: +44 1993 871000

Senior design executives: Andrew Mill, head of design, Andrew Miles, modeling manager
Design studios

MITSUBISHI
Senior design executives: Kitaori Kitukuro, president Efi Maas, general manager, design
Studio: Mitsubishi Motor R&D of Europe Head Office & Design Studio Diamantstrasse 1 65466 Trebur, Germany

NISSAN
Senior design executives: Satoru Tai, vice president design Stephane Schwarz, design director
Studio: Nissan Design Europe 181 Harrow Road London W2 4NB, England

OPEL
Senior design executive: Bryan Nesbitt, executive director design, GM Europe
Studio: General Motors Europe ITDC IPC 86-01 65423 Rüsselsheim, Germany

PSA/PEUGEOT-CITROEN
Senior design executives: Gerard Welter, chief designer Robert Peugeot, executive vice president, innovation and quality
Studio: Automotive Design Network (ADN) Route de Gisy 78943 Velizy Villacoublay Cedex, France

PININFARINA
Senior design executive: Ken Okuyama, creative director
Studio: Pininfarina Ricerca e Sviluppo Strada Nazionale 30, Cambiano, Turin, Italy

PORSCHE
Senior design executive: Michael Mauer, chief designer
Studio: Dr. Ing. h.c.F. Porsche Forschungs- und Entwicklungszentrum (Research and Development Center) Porschestraße 71227 Weissach, Germany

RENAULT
Senior design executives: Patrick Le Quément, senior vice president, corporate design Anthony Grade, vice president, car exterior design programs

Jean-Francois Venet, vice president, light commercial vehicle/commercial vehicle design and special programs
Michel Jardin, director, concept car design
Studio: Technocenter, Direction du Design Industriel, 1 Avenue du Golf 78288 Guyancourt, France

SAAB
Senior design executive: Simon Padian, design manager
Studio: Saab Automobile 461 80 Trollhattan, Sweden

SEAT
Senior design executive: Luc Donckerwolke, design director
Other senior styling managers: Juan Perez, exterior design Juan Manuel Lopez, interior design Simona Falcinella, color and trim
Studio: Design Center Europe Avda. Navarra s/n 08700 Sitges, Spain

SKODA
Senior design executive: Thomas Ingenlath, head of design center Other senior styling managers: Andres Meyer, head of interior Peter Wounda, head of concepts Radek Simon, head of computer animated design Vaclav Capouch, head of visibility
Studio: Skoda Auto Design Vaclava Klementa 869 293 60 Mlada Boleslav, Czech Republic

SMART
Senior design executive: Hartmut Sinkwitz, chief designer
Studio: Leibnizstrasse 2 71032 Böblingen, Germany

TOYOTA
Senior design executives: Kazuo Okamoto, executive vice president in charge of research and development, design group Hidai Wabes, managing officer in charge of global design management division, Toyota and Lexus design divisions Tokuo Fukuchi, president Toyota Europe Design Development
Studios: Toyota Europe Design Development (ED2) 2650 Route des Colles, BP 253 06905 Sophia-Antipolis Cedex, France

Toyota Technical Center (Head Office) Toyota City, Aichi prefecture, Japan
Tokyo Design Research and Laboratory (Technical Center) Ishikawa, Hachioji City Tokyo, Japan
Calty Design Research Newport Beach, California 92660, USA

VALMET
Senior design executive: Aimo Ahlman, vice president product development
Other senior styling managers: Jouni Koskinen, head of exterior design Esa Kiiski, head of interior design
Studio: Valmet Automotive Technical Center PO Box 4, FIN 23501, Autohteitaankatu 14 23500 Uusikaupunki, Finland

VOLKSWAGEN
Senior design executive: Murat Gürün, vice president of design
Studies: Volkswagen Design Center Briefbach 1683 28436 Wolfsburg, Germany
Design Center California 82 W. Cochran Street Simi Valley, California 93065, USA

VOLVO
Senior design executive: Steve Mattin, vice president & design director (design director of Volvo’s 3 studios)
Other senior styling managers: Lars Erik Lundin, operations manager David Ancona, operational manager & chief designer
Studies: Volvo Car Corp., Product Design, 51000 PVS, 405 31 Gothenburg, Sweden
Volvo Monitoring and Concept Center 700 Via Alondra Camarillo, California 93012, USA
Volvo Barcelona Studio, Calle Diputacio 246 3-1 08067 Barcelona, Spain

ZAGATO
Senior design executive: Andrea Zagato, chairman and CEO
Studio: Via Arese, 30 20017 Terrazzano di Rho, Milan, Italy
Profiles of new-model development

**ALFA ROMEO SPIDER**

**Code-name:** 946  
**Market launch:** March-April 2006  
**Project leader:** Carlo Andrea Arcelloni  
**Platform:** Alfa Romeo premium platform, already used by 159 sedan and Brera coupe  
**Development notes:** Originally planned for 2003, the car was delayed 3 years because of 2 complete changes to its platform and a complete change to the design.  
**Design:** Baldesign Giugiaro and Pininfarina  
**Key suppliers:** Canvas roof system from Webasto subsidiary Oasys  
**Where built:** Pininfarina’s plant in San Giorgio Canavese, near Turin  
**Technology:** All gasoline engines have direct injection. It is the first Alfa Spider with 4wd and diesel engines.  
**Production target:** 20,000 to 25,000 (includes the Brera coupe from which the Spider is derived)

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**AUDI Q7**

**Code-name:** AU716  
**Market launch:** March 2006  
**Project leader:** Gerhard Hametner  
**Platform:** SUV platform shared with Volkswagen Touareg and Porsche Cayenne  
**Development notes:** The Q7 has a longer wheelbase than the Touareg and Cayenne, which gives it room for a seven-seat interior.  
**Design:** Dany Garand under Walter de’Silva  
**Where built:** Bratislava, Slovakia, alongside the Touareg and Cayenne  
**Technology:** Lane departure warning  
**Production target:** 40,000

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**AUDI TT**

**Code-name:** AU554  
**Market launch:** Mid-2006  
**Project leader:** Matthias Muller  
**Platform:** PQ35/PQ36 platform derivative shared with VW Golf, Audi A3 and others  
**Design:** Under Walter de’Silva  
**Where built:** Bodies are manufactured and painted in Ingolstadt, Germany; then shipped to Gyur, Hungary; for assembly.  
**Production target:** 40,000

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**BMW X5**

**Code-name:** E70  
**Market launch:** Autumn 2006  
**Development notes:** The X5 will become a bigger car than its predecessor and share modules with the entire BMW lineup, even the entry-premium 1 series.  
**Design:** Under Chris Bangle  
**Where built:** South Carolina, USA  

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**BMW X6**

**Code-name:** E71  
**Market launch:** 2008 or later  
**Development notes:** The X6 will be a 4-door SUV with a coupe-like roofline. It is heavily based on the X5.  
**Design:** Under Chris Bangle  
**Where built:** South Carolina, USA

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**BMW SPACE-FUNCTIONAL CONCEPT**

**Code-name:** E62  
**Market launch:** 2008 or later  
**Platform:** Modular platform, loosely based on 5, 6 and 7 series  
**Design:** Under Chris Bangle  
**Development notes:** The space-functional concept will have a new interior concept similar to a minivan, but the car will ride lower to the ground than a minivan.  
**Where built:** Dingolfing, Germany

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**CITROEN C7**

**Market launch:** Mid-2007  
**Platform:** Shared with Mitsubishi’s lower-medium Lancer and its Outlander SUV  
**Development notes:** Bought from Mitsubishi, this vehicle will have SUV looks but won’t be built for serious off-road driving. The total development time of the car, which also will be built for Peugeot, will be 30 months. The length suggests PSA/Peugeot-Citroen is working to differentiate the bodies of the Citroen and Peugeot from Mitsubishi’s Outlander. PSA also wants to fit its own engines in the SUVs.  
**Where built:** Mizushima, Japan  
**Production target:** 15,000 each for Citroen and Peugeot

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**CITROEN C6**

**Code-name:** X6  
**Market launch:** December 2005  
**Project leader:** (marketing): Jean-Denis Bigot  
**Platform:** Platform 3 for large sedans; shared with the Citroen C5, Peugeot 407  
**Development notes:** Citroen Managing Director Claude Satinet spearheaded the carmaker’s effort to produce an up-market car in the tradition of the Citroen DS.  
**Design:** Marc Pinson  
**Where built:** Rennes, France  
**Technology:** Head-up display; lane departure warning  
**Production target:** 25,000

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**CITROEN XSARA PICASSO**

**Code-name:** F139  
**Market launch:** Mid-2006  
**Platform:** Short-wheelbase version of the 612 Scaglietti’s aluminum spaceframe  
**Development notes:** The car, which will be called either the Imola or Monza, will replace the 575M Maranello, the last Ferrari to have a steel frame. The new model’s arrival completes Ferrari’s switch to aluminum for its cars’ frames and body panels. The switch began in March 1999 with the 360 Modena.  
**Design:** Pininfarina  
**Key suppliers:** Aluminum frame and body panels from Alcoa’s plant in Modena, Italy; Brembo supplies optional composite ceramic brake discs  
**Where built:** Maranello, Modena, Italy  
**Production target:** 800 to 1,000

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**FERRARI 600 (IMOLA OR MONZA)**

**Code-name:** F139  
**Market launch:** Mid-2006  
**Platform:** Short-wheelbase version of the 612 Scaglietti’s aluminum spaceframe  
**Development notes:** The car, which will be called either the Imola or Monza, will replace the 575M Maranello, the last Ferrari to have a steel frame. The new model’s arrival completes Ferrari’s switch to aluminum for its cars’ frames and body panels. The switch began in March 1999 with the 360 Modena.  
**Design:** Pininfarina  
**Key suppliers:** Aluminum frame and body panels from Alcoa’s plant in Modena, Italy; Brembo supplies optional composite ceramic brake discs  
**Where built:** Maranello, Modena, Italy  
**Production target:** 800 to 1,000
Profiles of new-model development

FIAT PUNTO

Code-name: 199  
Market launch: 2005  
Project leader: Cristina Siletto  
Platform: Small Common Components & Systems (SCCS) co-developed with Opel/Vauxhall, which will use it for the Corsa replacement due in Q1 2006.  
Development notes: To avoid confusion with the second-generation Punto, which will be produced until at least the end of 2006, Fiat often refers to the third-generation Punto as the Grande Punto, which means big Punto in Italian. At 430mm, the new Punto is the biggest small-segment car ever. It took 22 months to develop the car.  
Design: Exterior, Italdesign Giugiaro; interior, Fiat styling center  
Key suppliers: Magneti Marelli supplies the common-rail system for the 1.3-liter diesel engine; Bosch for the 1.9-liter. Fiat the pop-up hood system.  
Where built: Melfi, Italy; starting in early 2006, Mirafiori, Italy, near Turin  
Production target: 360,000-450,000

FIAT SEDICI

Code-name: 196  
Market launch: March 2006  
Project leader: Enrico Gench  
Platform: Lengthened version of Suzuki’s A platform that was first used on the new Suzuki Swift  
Development notes: Lancia will be the third brand after Fiat and Suzuki to have a version of the medium SUV. The Lancia debuts in early 2008.  
Design: Italdesign Giugiaro  
Where built: Esztergom, Hungary  
Technology: The 4wd variant uses Suzuki’s Electric Control Coupling Device. The driver can select one of the ECCD’s three modes: fwd only; fwd with rear drive automatically activated when driving on slippery surfaces; and permanent 4wd.  
Production target: 90,000 (60,000 for Suzuki, 20,000 for Fiat and 10,000 for Lancia)

FIAT STILO REPLACEMENT

Code-name: 198  
Market launch: Q1 2007  
Project leader: Gianfranco Romeo  
Development notes: Fiat’s new lower-medium model – which will abandon the Stilo name – will be offered as a 5-door hatchback only. Currently, the Stilo also has 3-door and wagon variants. Fiat is working with Magna Steyr of Austria to get the car to market in just 18 months.  
Design: Fiat brand styling center  
Where built: Cassino, Italy  
Production target: 120,000 to 150,000

FORD GALAXY

Code-name: CD340  
Market launch: Mid-2006  
Project leader: Jens Ludmann  
Platform: Ford’s global C/D (upper-medium) architecture  
Development notes: Second-generation of Ford Europe’s large minivan  
Design: Ford Europe design, Cologne, Germany, and Dunton, UK, under Martin Smith  
Where built: Genk, Belgium  
Production target: 25,000

FORD CROSSOVER

Code-name: CD 140  
Market launch: Mid-2006  
Project leader: Jens Ludmann  
Platform: Ford’s global C/D (upper-medium) architecture  
Design: Ford Europe design, Cologne, Germany, and Dunton, UK, under Martin Smith  
Where built: Genk, Belgium

HONDA CIVIC

Code-name: DM  
Market launch: January 2006  
Project leader: Yosihyu Matsumoto  
Development notes: The car’s 2.2-liter diesel is assembled in Swindon, England, using components shipped from Japan. The Civic’s fuel tank is under the rear seat, which creates more cargo space in the car despite it being 35mm shorter than its predecessor.  
Design: Toshiyuki Okumoto  
Where built: Swindon, England  
Production target: 80,000 in 2006

HONDA LEGEND

Market launch: July 2006  
Development notes: The new Legend is expected to include a pedestrian-friendly pop-up hood system.  
Where built: Hamamatsu, Japan  
Production target: 50,000

MASERATI ENTRY-LEVEL SPYDER

Market launch: Late 2007.  
Platform: The car will use Alfa Romeo’s Premium platform, which underpins the Alfa 159.  
Development notes: Early this year, Maserati killed a new Spyder derived from its Quattroporte sedan because its sticker price would have been close to €100,000. At €70,000, Maserati hopes the entry-level Spyder will help the brand increase its volume to about 10,000 units by the end of the decade.  
Design: Pininfarina  
Production target: 5,000

MAZDA2

Market launch: 2007  
Platform: Ford global small-car architecture  
Development notes: The new model, which was hinted at by the Sassou concept show at the 2005 IAA in Frankfurt, will come in various body styles.  
Design: Mazda design in Oberursel, Germany, under Peter Birtwistle  
Production target: 100,000

MERCEDES CL CLASS

Code-name: W221  
Market launch: October 2006  
Project leader: Hans Multhaupt  
Platform: Coupe derived from S-class sedan  
Design: Under Peter Pfeiffer  
Where built: Sindelfingen, Germany

MERCEDES S CLASS

Code-name: W221  
Market launch: October 2005  
Project leader: Hans Multhaupt  
Platform: Large rwd platform  
Design: Under Peter Pfeiffer  
Where built: Sindelfingen, Germany  
Technology: The S class features the latest in electronic equipment, including pre-crash sensors and radar-based driver assistance systems.

MERCEDES GL CLASS

Code-name: X164  
Market launch: Early 2006  
Project leader: Uwe Ernstberger  
Platform: Modular SUV platform  
Development notes: The GL class is the final derivative of the new SUV platform that already serves as the basis for the M class SUV and the R class crossover  
Design: Under Peter Pfeiffer  
Where built: Vance, Alabama, USA

October 31, 2005
### MINI
- **Market launch:** Early 2007
- **Platform:** Compact fwd
- **Development notes:** BMW’s second-generation Mini will come in at least three body styles – 3-door hatchback, convertible, and station wagon. It will feature new engines jointly developed with PSA.
- **Design:** Gert Hildebrand
- **Where built:** Oxford, England

### OPEL/VAUXHALL CORSA
- **Code-name:** 4400
- **Market launch:** Q1 2006
- **Project leader:** Klaus Nuchter
- **Platform:** Small Common Components & Systems (SCCS) co-developed with Fiat, which uses it for the third-generation Punto
- **Design:** GM Europe in Rüsselsheim, under Bryan Neshbitt
- **Where built:** Zaragoza, Spain; Eisenach, Germany
- **Production target:** More than 450,000

### OPEL/VAUXHALL CORSA
- **Code-name:** E11A
- **Market launch:** September 2005
- **Project leader:** Colin Dodge
- **Platform:** B, shared with Renault
- **Development time:** 31 months
- **Designer:** Nissan’s design center in London, led by Satoru Tai
- **Key supplier:** Folding hardtop system from Karmann of Germany
- **Where built:** Sunderland, England
- **Production target:** 20,000

### NISSAN MICRA C+C
- **Code-name:** P32L
- **Market launch:** Early 2007
- **Project leader:** Colin Dodge
- **Design:** Nissan’s design center in London
- **Where built:** Sunderland, England
- **Production target:** More than 100,000

### NISSAN NOTE
- **Code-name:** X11E
- **Market launch:** March 2006 (sales in Japan started in autumn 2004)
- **Project leader:** Colin Dodge
- **Platform:** B, shared with Renault
- **Development notes:** Replaces the Almera Tino
- **Design:** Taiji Toyota
- **Where built:** Sunderland, England
- **Production target:** 100,000

### NISSAN QASHQAI
- **Code-name:** E2
- **Market launch:** September 2005
- **Platform:** Large fwd platform
- **Development notes:** The Panamera, Porsche’s first 4-door sedan, will share many of its components with the 911 and Cayenne.
- **Design:** Michael Mauer
- **Production target:** 20,000

### PEUGEOT 407 COUPE
- **Code-name:** D25
- **Market launch:** November 2005
- **Platform:** Platform 3 for large sedans; shared with the Citroen C5 and C6
- **Development notes:** The 407 coupe was designed in-house. Italy’s Pininfarina designed the car’s successful predecessor, the 406 coupe, which achieved sales of 107,000 units between 1997 and 2004.
- **Where built:** Rennes, France
- **Production target:** 25,000

### PEUGEOT 207
- **Market launch:** Spring 2007
- **Platform:** Platform 1 for small cars; shared with Peugeot 107, 1007 and Citroen C2, C3
- **Development notes:** In Europe, the small-segment car will replace the 206, Peugeot’s all-time best seller. The 206 will continue to be sold in developing markets. Peugeot is expected to build station wagon, coupe-cabriolet and minivan versions of the 207. The minivan, which likely will be called the 207, will have power sliding doors.
- **Where built:** Pau, France; Trnava, Slovakia; Villaverde, Spain

### RENAULT LAGUNA
- **Code-name:** X91
- **Market launch:** 2007
- **Development notes:** The second-generation Laguna has failed to make its mark in the upper-medium segment. The third generation is expected to be larger and more powerful. There is speculation that the car could have coupe and cabriolet derivatives.
- **Where built:** Sandouville, France

### SMART FORTWO
- **Market launch:** Early 2007
- **Platform:** Mid-engine small-car platform
- **Development notes:** The second-generation ForTwo is designed to meet US crash-test and emissions standards so that it is possible to export it to the world’s largest market.
- **Design:** Hartmut Sinkwitz
- **Where built:** Hambach, France

### VOLKSWAGEN GOLF SSV
- **Market launch:** Late 2006
- **Platform:** Large fwd platform
- **Development notes:** New entry for Volvo in lower-premium segment.
- **Design:** Started by Peter Horbury; finalized under Steve Mattin
- **Where built:** Gent, Belgium
- **Production target:** 50,000

### VOLVO C30
- **Market launch:** Late 2006
- **Platform:** Ford’s global C1 (lower-medium) architecture
- **Development notes:** New entry for Volvo in lower-premium segment.
- **Design:** Started by Peter Horbury; finalized under Steve Mattin
- **Where built:** Ghent, Belgium
- **Production target:** 65,000

### VOLVO S80
- **Market launch:** Summer 2006
- **Platform:** Ford global C/D (upper-medium) architecture
- **Development notes:** First application of Ford’s upper-medium architecture for a large Volvo
- **Design:** Started by Peter Horbury; finalized under Steve Mattin
- **Where built:** Ghent, Belgium
- **Production target:** 65,000