Edited by **Kevin Jost**

Ford Super Duty: a towing machine

Ford has only offered the F-450 as a chassis cab, but the status quo changed with the debut of the 2008 Super Duty F-450 pickup truck at the 2006 Texas state fair. Texas, an increasingly popular industry launch site for pickup truck reveals, accounts for one of every six sales of F-Series products.

Therefore, the newest F-Series is a very important addition to the lineup. "We will sell the furniture to support our new products," said Mark Fields, President of the Americas for Ford, after emerging from an F-450 that had been dangling from a tall crane. The F-450 is a weight-moving powerhouse in its own right with a maximum towing capability of more than 24,000 lb (10,900 kg) and its payload capacity is over 6000 lb (2720 kg).

The F-450's unique chassis incorporates a new rear leaf-spring suspension with redesigned rear springs—gaining more than 8 in (200 mm) in length and a different attachment location—in addition to retuned shocks and bushings as well as a carryover F-450 chassis cab radius arm front suspension. The setup is said to provide the tightest turning radius in its class. "It actually feels like you're turning around on the rear axle when you go lock-to-lock," said Pete Reyes, Super Duty Chief Engineer.

F-450 has three engine choices: the 5.4-L Triton V8 producing 300 hp (224 kW) at 5000 rpm and 365 lb·ft (495 N·m) at 2000 rpm, the 6.8-L Triton V8 with 362 hp (270 kW) at 4750 rpm and 475 lb·ft (644 N·m) at 3250 rpm, and the 6.4-L Power Stroke Diesel having 350 hp (261 kW) at 3000 rpm and 650 lb·ft (881 N·m) at 2000 rpm. "It's new from the oil pan up," Reyes said about the diesel engine with a durability prove-out schedule matching more than 10 million equivalent miles of dynamometer, computer, and in-vehicle testing.

"The new 6.4-L Power Stroke Diesel erases all of the stereotypes about diesels in North America because it now is quiet and clean," according to Dan Davidson, Powertrain Supervisor for the 2008 Super Duty truck. "It will be the first pickup engine in North America to use a high-precision, high-pressure, common-rail, fuel-injection system featuring piezoelectric injectors." The engine's injectors as well as a new diesel particulate filter will help elicit emissions more akin to a gasoline engine.

The three engine offerings can be mated to two transmission choices: a six-speed manual with overdrive or a five-speed TorqShift automatic. A new mounting system better isolates the powertrain and reduces vibration. Like other F-Series pickups, the F-450 will be offered in two- and four-wheel-drive models. The F-450's drivetrain is the same as the chassis cab F-550.

The F-450, shown here during an icy media launch in January, "is absolutely the most capable non-commercial pickup truck we've ever built," said Pete Reyes, Super Duty Chief Engineer. The F-450 has maximum towing capacity of more than 24,000 lb (10,900 kg).

Reyes flanks the new F-450 Super Duty, whose large grille serves to improve engine cooling. Behind the grille, the truck's high-strength-steel front body structure (two side rails welded to the bulkhead and frame) rides atop a specially designed chassis.

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The new 6.4-L Power Stroke Diesel will be the first pickup engine in North America to use a high-precision, high-pressure, common-rail, fuel-injection system featuring piezoelectric injectors, according to Dan Davidson, Powertrain Supervisor for the 2008 Super Duty truck.

Super Duty F-450's optional tailgate step and a 21-in (530-mm) tall, blow-molded polypropylene two-piece bed extender are unique features. The tailgate step is made of high-strength MIG-welded steel. A 16.7 x 4.5 in (424 x 114 mm) flip-down step pad—tested to support up to 1000 lb (454 kg)—can be used when the tailgate is in the down position. (When not in use, the lower step serves as the center of the tailgate's top rail.) A grab handle, which fits into a molded channel within the tailgate inner liner, folds up and out of the tailgate to support up to 300 lb (136 kg).

The truck also features power-fold and power-telescoping side mirrors, which extend outward up to 2.75 in (70 mm). "That's an industry first," Reyes said of the viewing elements, which feature a power adjustable main mirror with a manually adjusted spotter mirror that is about double the size of the previous generation. The mirrors also incorporate heated glass, clearance lamps, and integrated turn signals.

Ford's Super Duty lineup—a designation for trucks over 8500 lb—consists of the F-250 pickup, the F-350 pickup, the F-350 chassis cab, the new F-450 pickup, the F-450 chassis cab, and the F-550 chassis cab. When the Super Duty debuted in 1998 as a 1999 model, the maximum towing capability was 13,500 lb (6120 kg). Even at the conception of the new F-450, the notion of towing in excess of 24,000 lb (10,900 kg) was "laughable," said Reyes, who has worked on Super Duty trucks since 1994. No one is laughing now, and as Reyes points out, "the F-450 is absolutely the most capable non-commercial pickup truck we've ever built."

Kami Buchholz

Fifth generation for Chrysler minivans

The latest interpretation of the minivan-segment originator from **Chrysler** continues a trend toward numerous upgrades with each iteration, the new range including even more versatile interiors.

"Others have been talking about exiting this segment, but we intend to stay and improve," Larry Lyons, Vice President of Chrysler Group's Front Wheel Drive Product Team, said in a subtle reference to the minivan's future at **General Motors** and **Ford**.

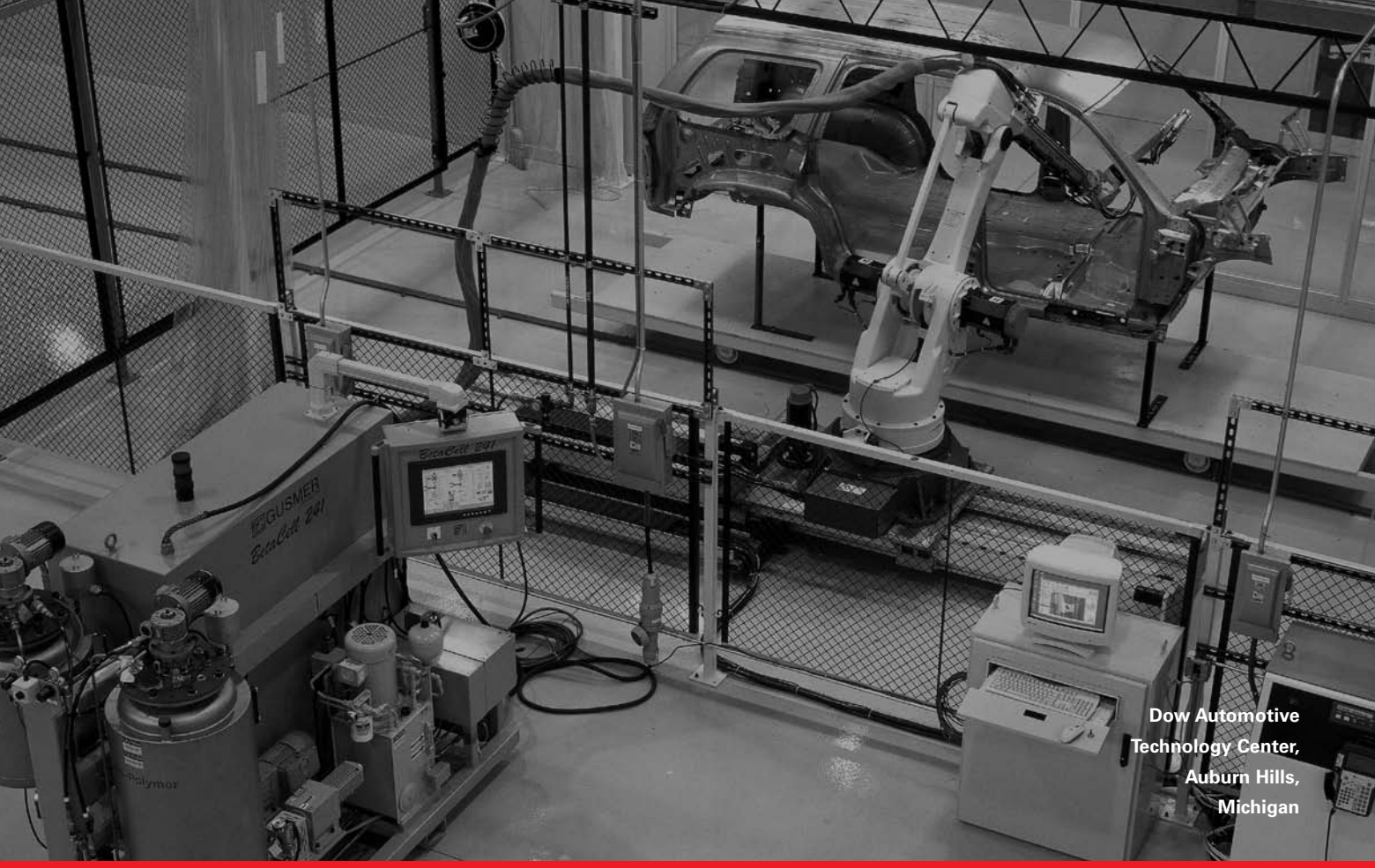
The 2008 Chrysler Town & Country and **Dodge** Grand Caravan have six areas of differentiation: hoods, headlamps, front fascias, instrument panels, taillamps, and grilles. An array of equipment, including 35 new or revised features, is available on either model.

The 2008 Chrysler Town & Country minivan is the latest generation of a vehicle that debuted in the 1984 model year.

Only the base platform remains fundamentally unchanged in the 2008 model year. "Even though it's a carryover underbody, we focused on suspension attachment points—adding rigidity—in order to optimize ride, handling, and NVH characteristics," said Steve Jakubiec, the minivans' Vehicle Development Synthesis Senior Manager.

The minivans offer three powertrain combinations. A 4.0-L V6 engine with 240 hp/253 lb·ft (179 kW/343 N·m) or a 3.8-L V6 engine producing 198 hp/230 lb·ft (148 kW/312 N·m) mates to the new six-speed transaxle, or a 3.3-L flex-fuel V6 engine with 170 hp/205 lb·ft (127 kW/278 N·m) matches with a four-speed transaxle. The new six-speed transaxle debuted on the 2007 Chrysler Pacifica and the Dodge Nitro.

Inside the new minivans, which ride



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The Town & Country minivan has three distinct seating and stow systems, including the new Swivel 'n Go (shown).

on a 2-in (50-mm) longer wheelbase, the seat options include Swivel 'n Go. This new option allows the second-row seats to turn 180° and face the third row.

"Each second-row seat swivels so that the seatback is always toward the center of the vehicle, which means the seat bottom is always toward you," said Christine Alaniz, Chief Engineer for Chrysler Group's minivans. Each Swivel 'n Go seat is manually operated, and the seats can be removed from the vehicle.

A 90° second-row seat swivel makes it easier to use the integrated child booster seat, while a 180° swivel puts the occupant in a position for using a two-piece table. The table, which has a lock-in-place twist mechanism for its top and another lock-in-place mechanism for the pole that supports it, fits inside a covered stowage area between the first- and second-row seats.

Third-row seats can automatically be transformed into stadium mode via pushing a button. When stadium mode is selected, the seatback becomes a seating surface and the seat bottom becomes an outdoor-facing seatback. **Intier** is the seating supplier.

The new minivans, unveiled at the Detroit auto show, also accent interior illumination. "We wanted to minimize the interior dark spots, so we put light just about everywhere we could think of," said Alaniz. There is LED lighting in all three seating rows, puddle lights on the front doors, front door map pocket lights, reading lights for all three rows, door-open lights on the overhead rail, and a removable flashlight on the rear quarter trim panel. "When doors are open, white lights come on. And when the doors are open and the headlights are on, ambient green lights come on," said Alaniz.

New available features include second-row power windows in the sliding doors, an umbrella holder, and a retractable sunshade for second- and third-row seat occupants. The minivans will be produced at plants in Windsor, Ontario, Canada and Fenton, Missouri.

Kami Buchholz

Lexus ups sports ante with IS-F

When designing the 2008 **Lexus** IS-F, the first Lexus with the "F" performance badge, engineers came up with a theme that stuck with them through every phase of the program.

"Muscles," said IS-F Chief Engineer Yukihiko Yaguchi through an interpreter. "Not artificially created muscles; naturally strong muscles."

To help change the perception of Lexus as simply a mainstream luxury vehicle producer, Yaguchi and a small group of Lexus engineers were tasked with developing their own vision of a Lexus performance car. The standard rear-wheel-drive IS provided a strong foundation; however, Yaguchi was not satisfied to make minor changes. A luxury car has to feel very smooth and comfortable, but a sports car has to allow the driver to really sense and feel the handling and feedback, he said.

The IS-F features a 5.0-L V8 engine topped with specially engineered heads and fed by a two-stage intake manifold that delivers more than 400 hp (298 kW) and 350 lb·ft (475 N·m). Engine-oil and transmission-fluid coolers are employed for high-speed performance and a scavenging oil pump assists with high-*g* driving.

The engine is mated to an eight-speed direct sport-shift transmission, which Lexus claims to be a world's first. Torque-converter lock-up control allows for direct, crisp gear changes through the constant lock-up of the torque converter in second through eighth gears. The addition of the torque converter made the IS-F capable of achieving a 0-60 mph (0-97 km/h) time of less than 4.9 s.

Heavy-duty **Brembo** brakes have been designed for the IS-F to the specifications of the Lexus engineering team. Large, 14.2-in (360-mm) perforated front discs are gripped by six-piston aluminum calipers, while 13.6-in (345-mm) rear perforated discs feature two-piston calipers. The IS-F's standard 19-in wheels are custom-designed and built by **BBS**.

A dual-exhaust system and quad tail pipes, wider front fenders, and a larger grille and rear spoiler help to differentiate the IS-F from the base IS. A larger hood and lower intake also had to be redesigned to fit and cool the bigger engine.

Matt Monaghan

The IS-F is the first in a line of a new Lexus sub-brand devoted to enthusiasts.

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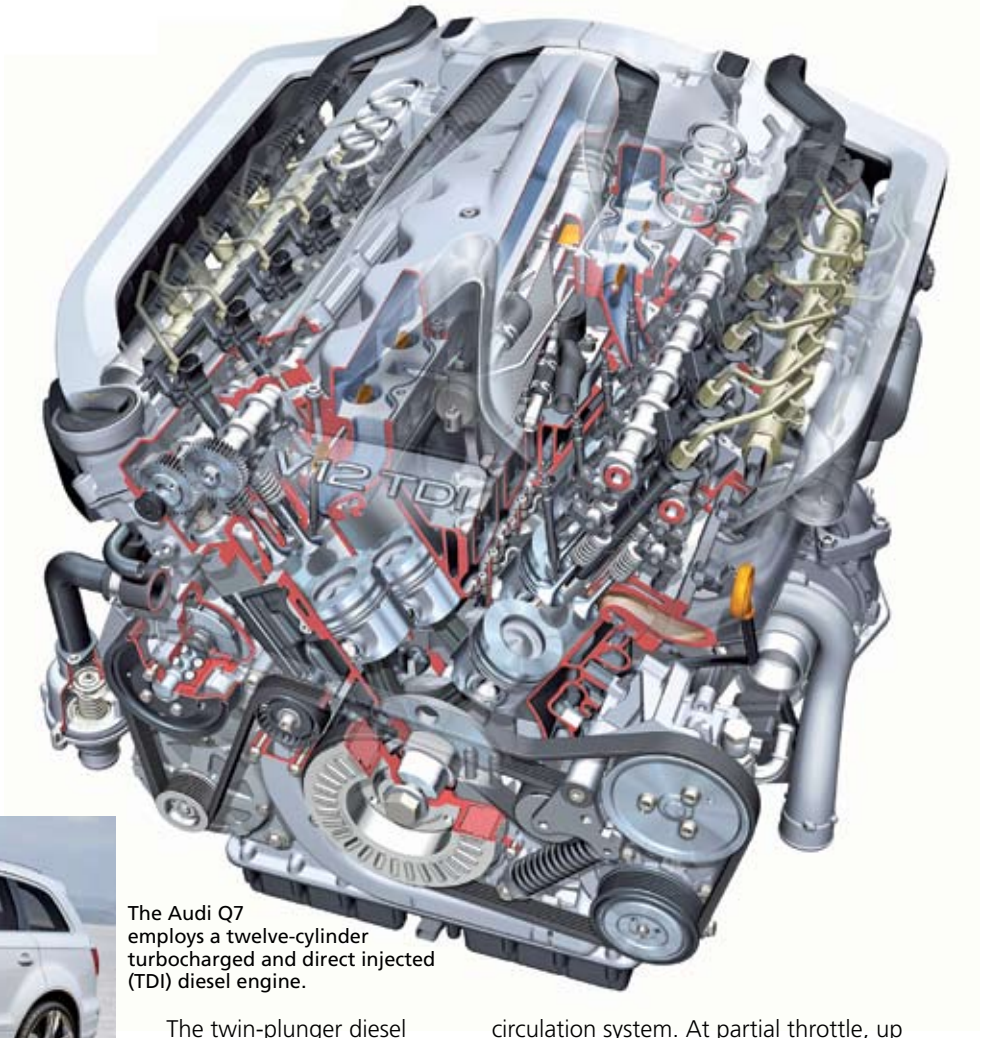
V12 diesel for Q7

The performance future of the diesel engine looks bright if the **Audi** Q7 V12 TDI concept is any indication. The high-performance SUV, which takes its cylinder count if not ultimate power numbers from the Le Mans-winning R10 TDI sports prototype, employs a twelve-cylinder turbocharged and direct injected (TDI) engine displacing 6.0 L and putting out 368 kW (493 hp) and a colossal 1000 N·m (738 lb·ft) from 1750 to 3000 rpm. Audi says the engine "injects the high-performance SUV with the dynamism of a powerful sports car." Straight line numbers bear that claim out, with a time of 5.5 s from 0 to 100 km/h (0 to 62 mph) and an electronically governed top speed of 250 km/h (155 mph). Average consumption is 11.9 L/100 km.

The concept's V12 TDI engine will become the diesel flagship for Audi's growing diesel production range in Europe that includes six-cylinder engines that power 2.7 TDI and 3.0 TDI models as well as the eight-cylinder in 4.2 TDI models. And its introduction at the Detroit auto show singles Audi's intentions to enter the U.S. market in 2008 with a 3.0 TDI model that complies with emissions legislation in all 50 states with the aid of **DaimlerChrysler**'s Bluetec technology.



The Audi Q7 employs a twelve-cylinder turbocharged and direct injected (TDI) diesel engine.

The V12 TDI production engine, which will be built in its Györ plant in Hungary, borrows its bore and stroke of 83.0 and 91.4 mm (3.27 and 3.60 in) from the six-cylinder 3.0 TDI for a total capacity of 5934 cm^3. Its layout includes an opposing cylinder offset of 17 mm (0.67 in) between banks, a compact overall engine length of 684 mm (26.9 in), the 90-mm (3.54-in) spacing between cylinders of other Audi V engines, and cylinder banks at 60° instead of the customary 90° for better operational smoothness.

The twin-plunger diesel injection pumps of the **Bosch** common-rail system are capable of pressures as high as 2000 bar (29.0 ksi) in the rails. The piezoelectric injectors have nozzles with eight holes measuring 0.12 mm (0.005 in) in diameter. Over 300 piezo discs packed into each of the V12 TDI injectors enable actuation of just a few milliseconds and a maximum of five injections. Pilot injection lessens the undesirable combustion sound most noticeable at low engine loads. A delayed post injection increases exhaust gas temperature to aid regeneration of two particulate filters.

The engine's two turbochargers (one per cylinder bank) have variable-vane geometry for fast response and generate up to 2.6 bar (18 kPa) absolute of boost. The temperature of the compressed air is reduced by two large intercoolers, and two control units operate proceedings inside the engine.

Compliance with Euro 5 emissions standards of 2010, specifically tough new rules for nitrogen oxide reduction, is enabled by a water-cooled exhaust gas recirculation system. At partial throttle, up to 50% of the exhaust gases are fed back into the intake to reduce NOx emissions.

The V12 concept gets its power to the road through a six-speed automatic transmission and quattro all-wheel drive that splits the torque 40:60 (vs. 50:50) between the front and rear wheels under normal driving conditions for sportier handling characteristics. An adaptive air suspension, in conjunction with electronically controlled dampers, can adjust ride height from a normal 180 to 240 mm (7.1 to 9.4 in).

The Audi Q7 V12 TDI is distinguished from its lower-powered siblings by contrasting underfloor panels front and rear, a single-frame radiator grille with a finish similar to those of Audi's high-performance S6 and S8 models, and headlight units with visible light tubes.

Optional driver-assistance systems include radar-based side assist for lane changing, visual and acoustic parking guidance, and cruise control capable of braking the vehicle to a standstill if required.

Kevin Jost

Chevy subcompact gets makeover

The **Chevrolet** Aveo sedan has been a popular seller in more than 120 countries since its introduction. In its second incarnation, the car maintains an emphasis on fuel economy in a vehicle segment that continues to gain consumer attention.

"We think there's a tremendous opportunity for growth," said Ed Peper, Chevrolet General Manager, adding, "This economy-subcompact segment is exploding, and we're ready to compete in a big way."

Taller, wider, and longer than its predecessor, the 2007 Aveo sedan—when fitted with the standard five-speed-manual transmission—goes from 35 to 37 mpg for estimated **EPA** highway fuel economy. The mpg improvement was the result of technology tweaks.

"What was done is all part of the whole process of continued improvement," Aveo's Vehicle Line Director Mike Allen said referring to various modifications, such as improving the coefficient of drag from 0.348 to 0.326 and refining the engine calibrations. "We reduced idle rpm by 50 to use less fuel at idle," said Rod Michaelson, Aveo's Program Engineering Manager. In addition, a new-for-2007 low-pressure power-steering system "takes less of an engine load to run the pump, and that reduces the engine's fuel consumption."

Ride and handling was revised by suspension adjustments as well as a changed rear track width. The 2007 Aveo sedan has a 57.1-in (1450-mm) front track (same as the 2006 model) and a 56.3-in (1430-mm) rear track; the 2006 model's rear was 55.5 in (1410 mm). "There's been a complete redo of the ride and handling characteristics of the vehicle so that it's more European-like," said Michaelson.

A new 17-mm (0.67-in) front stabilizer bar was substituted for the 2006 car's 18-mm (0.71-in) unit. "The reason we went with a 17-mm front stabilizer bar is because we increased spring rates and damping for the shocks. So since the springs and shocks are doing more, we could downsize the stabilizer bar," said Michaelson. Rear suspension is a semi-independent torsion beam axle with coil springs.

A carryover from the 2006 car, the North American-sold Aveo sedan sports a 1.6-L, 16-valve four-cylinder producing 103 hp (77 kW) at 5800 rpm and 107

The 2007 Aveo is Chevrolet's fuel-economy leader and has a base price in the United States of $12,395.

Interior features include a multi-adjust driver's seat. "You can raise or lower the seat by [nearly] two inches," said Chevrolet's Mike Allen.

lb·ft (145 N·m) at 3400 rpm. The optional transmission for North America is an **Aisin** four-speed automatic with Hold Control Mode, which permits manual gear selection. A **GM DAT** (General Motors Daewoo Automotive Technologies) manufactured manual transmission is standard.

The 2007 Aveo has further minimized wind, road, and engine noise into the cabin by adding a sound insulation block inside the B-pillar structure to close the acoustic cavity. To accomplish this, an insulator was used at the instrument panel's windshield interface to seal off an engine noise path, and sound absorption pads were attached to the windshield's defroster ducts.

Standard safety features include advanced dual-stage front airbags and seat-mounted side-impact airbags. A roof-mounted mast antenna was replaced with a rear glass window radio antenna for 2007. Optional fare includes four-channel ABS with electronic brake force distribution, 15-in aluminum wheels, and steering-wheel audio controls.

Primary development work on the new Aveo was done in South Korea by GM Daewoo, but engineers in Europe took the lead in ride-and-handling development while North America technical specialists spearheaded the vehicle's aerodynamic testing. "The benefit of being a global company is you can share engineering ideas and creative solutions," said Allen.

Kami Buchholz

Porsche adds glass roof to 911

Unlike the previous 996 version, **Porsche**'s new 911 (997) Targa is only available with all-wheel drive in 4 and 4S models. A viscous multiplate clutch provides (depending on conditions) between 5 and 40% of engine output to the front wheels. Engine power is by 239-kW (321-hp) 3.6-L or 261-kW (350-hp) 3.8-L flat six.

The new Targa has an improved version of the sliding glass roof system used for the 996. Although polycarbonate was considered as a glass substitute for the 997, the mass savings would have been relatively small—about 2 kg (4.4 lb)—and Porsche specialists found that it became brittle at temperatures of -25°C (-13°F). The glass roof measures about 1.5 m^2 (16 ft^2), stretching from the windshield header rail to the rear window.

Although the design is similar to that used previously, Porsche has worked to improve sealing and reduce aerodynamic noise at high speed. It has been successful, although the car is not as quiet as the coupe; nor is it as stiff. Torsionally, the 911 Cabriolet achieves about 9800 N·m (7230 lb·ft) per degree of twist, the Coupe around 33,000 N·m (24,300 lb·ft), and the Targa 15,000 N·m (11,100 lb·ft). So it is a reasonable compromise for the near-convertible effect it can create. Closing the roof brings no changes to torsional stiffness.

The roof is supplied by **CTS** and is a complete module, tested for operation, sealing, and quality ready for fitting by Porsche on the 911 production line at Zuffenhausen in a single operating cycle. The module has a mass of 52 kg (115 lb) and is fitted by a robot. The rear window, which opens as a tailgate, is also fitted at this time. The frame of the roof module is secured to the car via 16 bolts.

Porsche's new glass-topped 911 Targa is available only in all-wheel drive.

The Targa's roof comprises two layers of partially stressed laminated security glass, each of 2.6-mm (0.102-in) thickness, with two layers of plastic film 1.1-mm (0.043-in) thick between. This has saved 1 mm (0.039 in) in thickness and about 1.9 kg (4.2 lb) in mass compared to the 996 Targa. Also, the mechanical lifting system of the roof has been made to operate more quietly. An improved wind deflector with a 35-mm (1.38-in) depth minimizes air turbulence within the car. The rear window is of 3.8-mm (0.150-in) thick security glass.

Roof operating power comes from two electric motors and the maximum opening area is 0.45 m^2 (4.8 ft^2)—about twice the open area of the Coupe's sunroof.

Stiffening for the car includes the use of high-strength-steel tubes in the A-pillars. They are welded in on both sides and extend into the roof profile over the B- and C-pillars for rollover protection.

Compared to the Carrera 4 911's curb mass of 1450 kg (3197 lb), the Targa roof adds about 60 kg (132 lb)—52 kg (114 lb) for the roof itself and 8 kg (18 lb) for stiffening.

Spring rates of the Targa are slightly softer than those of the Coupe but anti-roll bars have increased diameters.

Stuart Birch

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