

Edited by **Kevin Jost**

## NY show headlined by Hyundai, GM concepts

Think Big was the message from **Hyundai** at the New York International Auto Show (NYIAS), as the fast-growing Korean automaker unveiled the concept of its 2009 E-class luxury sedan. Think Small could have been **General Motors'** theme as it took the wraps off a trio of cheery minicar concepts designed for world markets including, potentially, the U.S.

### Hyundai Concept Genesis

The joke among media at the NY show was that, if you were looking for executives and designers from any automaker, just go to the **Hyundai** stand. Its Concept Genesis debut was the show's most anticipated introduction. The rear-drive V8-powered concept was displayed in close-to-production sheet metal, without an interior.



Hyundai Concept Genesis

Hyundai North America Vice President of Vehicle Development John Krafcik said the Genesis sedan (the first vehicle based on Hyundai's new BH architecture) will be positioned above the current Azera that starts at \$25,000. But the base Genesis sedan, with a 3.8-L DOHC V6, will be priced "well under \$30,000," Krafcik said. (The Genesis name has not been confirmed for the production car, and Krafcik noted that Hyundai is considering a second sales channel for its BH vehicles, which are expected to include short- and long-wheelbase luxury sedans, sports coupes, and crossover utilities. See the

Krafcik interview in May AEI's Insiders & Insights department.)

Body-in-white development focused on exceeding the torsional rigidity of **BMW's** current 5 Series and the **Mercedes-Benz** E-Class—Hyundai's primary bogies for the Genesis program, said Krafcik. Extensive use of high-tensile-strength steel alloys resulted in a unibody structure that is 10-12% more rigid in torsion, and lighter in overall mass, than those of the BMW and Mercedes.

The rear-drive architecture provides a 53/47 front/rear weight distribution. Genesis is powered by an all-new 4.6-L, DOHC, four-valve V8 with aluminum cylinder block and heads that will be mated to a **ZF** six-speed automatic with manual shift control and a limited-slip differential.

Codenamed Tao, the V8 is expected to produce more than 300 hp (224 kW) and will propel the Genesis from 0 to 60 mph (0 to 97 km/h) in under six seconds, said Krafcik. Future Tao variants will include larger displacement and forced induction as well as variants tuned for light-truck applications.

The car's five-link front-suspension arrangement, with upper and lower control arms, creates a "virtual kingpin axis" to reduce bump steer and improve steering feel and responsiveness, Krafcik said. A five-link independent suspension also underpins the rear of the car. Electronically adjustable suspension dampers are in development.

Hyundai engineers opted for large brake rotors—12.6 in (320 mm) diameter front and 12.4 in (315 mm) rear—augmented by ABS with brake assist and electronic brake distribution. The single-piston calipers (floating-type on the front wheels) may be upgraded to dual-piston units in production. The Genesis safety suite will include electronic stability control, at least eight airbags, and active headrests.

*Lindsay Brooke*



Chevrolet Beat, Trax, and Groove (L to R)

LINDSAY BROOKE



Ford Flex

## Chevrolet Beat, Trax, and Groove

While **Hyundai** was showing the path to larger vehicles, **General Motors** was going in the opposite direction. It used the NY show to introduce and begin market tests of a new family of global mini vehicles sized between the A- and B-class. The trio—the Beat, Trax, and Groove—carry the **Chevrolet** nameplate. GM will select one of the three concepts for production by 2009, said Vice Chairman Bob Lutz, based in part on public response to the cars through Internet polling.

The car selected will be sold around the world, including potentially the U.S. GM officials said the cars are not yet part of the company's North American forward-product plans but are under consideration as it prepares future fleet mixes for higher fuel prices, a possible change in U.S. fuel-economy regulations, and a change in Americans' tastes for very small vehicles.

The Beat, Trax, and Groove were designed by **GM-Daewoo's** Incheon, South Korea, studio using GM's common "global mini" front-drive architecture. GM's India studio rendered the Beat concept, while the Trax and Groove were styled at the automaker's Warren, MI, tech center.

"The design team was so enthused

about being given the assignment to develop the perfect small car for urban commuters around the world that they created three interpretations of how this car may be developed," said Ed Welburn, Vice President of Global Design.

The hatchback Beat, wearing an eye-grabbing lime-green paint scheme, is powered by a turbocharged, direct-injected, 1.2-L, three-cylinder gasoline engine with dual exhaust. GM is targeting the car toward import-tuner enthusiasts who enjoy personalizing their rides. Beat includes a high-wattage, multiple speaker audio system and navigation.

The all-wheel-drive Trax, described as an "urban crossover vehicle," is powered by a 1.0-L, three-cylinder gasoline engine. Its body features a one-piece bumper-and-fender system front and rear.

And the Groove, with its short hood, near-vertical windshield, long cabin, and oversized fender flares, is a blend of contemporary cool and retro. Power comes from a 1.0-L three-cylinder diesel. Lutz said production models would likely be built in India, China, or another low-cost location, and that some of the trio's design cues may influence the next-generation Aveo.

Lindsay Brooke

## Ford Flex

In terms of functionality, **Ford's** 2009 Flex walks the line between crossover SUVs and minivans. But many NY show-goers described the two-box design as a modern interpretation of the classic American station wagon. The seven-passenger Flex

will serve as Ford's people-mover, filling the role once held by the Freestar and fitting into Ford's North American lineup above the current Taurus X (formerly Freestyle) and below the Edge.

The production Flex is based very faithfully on the Fairlane concept that drew rave reviews in 2005. Its standard powertrain will be the 3.5-L Duratec35 V6 and 6F55 six-speed automatic (codeveloped with **General Motors**) with optional all-wheel drive.

According to Global Design Vice President J Mays, Ford decided to engineer Flex with conventional front-hinged rear doors, rather than sliding side doors or rear-hinged "suicide" rear doors. "The cost we saved by not engineering 'sliders' into this vehicle freed up investment resources for other areas of the car, such as higher-quality interior materials."

Mays said the savings also allowed Ford to add an optional built-in refrigerator, 8-in drop-down DVD screen in the back, and a multipanel sunroof. The compressor-driven refrigerator is located between the second-row captain's chairs. Ford claims it can cool a variety of soft-drink bottle sizes, including two 20-oz (0.6-L) vessels, from room temperature to 41°F (6°C) in about 2.5 h—40% faster than a typical home refrigerator.

Flex's all-steel body-in-white features a high quantity of high-strength boron alloys. Energy-absorbing interior door panels are designed to optimize occupant safety and 6-mm (0.24-in) thick windshield glass helps reduce wind and powertrain noise. The independent rear suspension system has a unique geometry for improved ride and handling characteristics, and Flex will feature Ford's roll-stability control system.

Higher-spec versions will feature LED taillamps, a backup camera, seven-color programmable ambient interior lighting, and a capless fuel-filler. Flex will be assembled at Ford's Oakville, Ontario, plant beginning third-quarter 2008.

Lindsay Brooke

## Jeep Liberty

The **Chrysler** Group updated its popular and off-road-capable **Jeep** Liberty compact SUV with improvements aimed at addressing some of the vehicle's weak points—on-road ride quality, interior space, and convenience. The 2008 model is 2 in (50 mm) longer and rides on a



Jeep Liberty

wheelbase that is also 2 in (50 mm) longer than that of the original 2002-2007 model. This stretched frame is essentially unchanged otherwise from its predecessor, very much like the **Dodge Nitro's**, which is stretched 4.5 in (114 mm), reported Chief Engineer Rick Reuter.

Like the Nitro, the Liberty enjoys an improved suspension bolted to that little-changed frame. The front track is 0.5 in (13 mm) wider on each side, with revised ball-joint attachment. The wider track and longer wheelbase combine to help calm the old Liberty's busy ride motions on-road, while the new ball-joint attachments improve suspension motion off-road.

A five-link rear suspension, also seen on the Nitro, debuts on the Liberty. Electronic stability control, a standard feature, appears for the first time on the small Jeep. In addition to hill descent control and hill start assist features provided by **Bosch**, remote start and express-up windows are also added.

The **New Venture Gear**-supplied transfer cases for the two available four-wheel-drive systems (Command-Trac and Selec-Trac II) feature reduced internal friction, contributing to a 1 mpg improvement in fuel economy even though the available engines are unchanged. This improvement will not be apparent to customers because of the tougher EPA test for 2008 model year vehicles, but it will still leave the Liberty in a better position



Jeep Grand Cherokee and 4.7-L V8



compared to its competitors, Reuter pointed out.

Of significance for Jeep's effort to attract more female Liberty customers is a change to an electrically engaged transfer case rather than the previous model's manual shift lever.

The longer wheelbase contributes to a roomier back seat, while relocation of the spare tire to underneath the vehicle frees up additional space in the cargo area. "There is quite a bit more room, without appreciably making the car bigger," said Reuter.

In an effort to make the cabin more user-friendly, Jeep added a recline capability to the rear seats for improved comfort. The company also redesigned the rear seat so that it now folds completely flat for hauling cargo. The old model's seat rested at a 5-7° angle, which interfered with sliding in large objects, Reuter said. To help accommodate even longer loads, such as lumber, now the front passenger seat also folds flat, he added.

The front seat console, glove compartment, and other bins throughout the interior are upgraded to provide more secure storage places for small items too, Reuter explained.

The Liberty's most visible feature, literally, is a large 33.3 x 41.1 in (845 x 1040 mm) optional folding canvas sunroof. The Sky Slide roof gives Liberty drivers a taste of the open-air experience available to

Wrangler owners, without requiring a re-engineering of the vehicle. The **ASC**-supplied canvas top adds little weight to the Liberty because the canvas replaces steel in the roof, which nearly offsets the steel bracing added for structural reinforcement, said Reuter.

*Dan Carney*

## Jeep Grand Cherokee

The 2008 **Jeep** Grand Cherokee features a variety of updates including a lightly refreshed exterior design. The significant changes are under the skin, where the Grand Cherokee offers the previously announced 3.0-L V6 Bluetec diesel engine as an option and a revised version of the corporate 4.7-L OHC V8 powerplant. An array of new luxury amenities round out the changes.

The biggest powertrain change is the new version of the 4.7-L V8 engine. The Chrysler team sought to address some of the engine's flaws to keep it relevant in the face of competitors with V6 engines that were smoother and more powerful.

In upgrading the engine, the company attacked four areas that it identified as needing improvement, said Joe Guertin, Director of Chrysler's rear-wheel-drive

Infiniti G37 coupe



3.7-L V6 compared with the previous 3.5-L engine.

A rocker arm and linkage close the intake valves by transferring a shaft's rotational movement (using an eccentric cam) to the output cam. The output cam's movement can be varied by rotating the control shaft within the dc electric motor and changing the fulcrums of the links.

The overall benefits include improved volumetric efficiency, stronger mid-range performance, and reduced engine-out emissions. The system allows optimized intake valve timing during cold starts, helping to light off the catalyst faster. According to Nissan, by keeping valve lift low at low-to-mid rpm, hydrocarbon emissions are reduced.

The valvetrain was designed to help Nissan bridge its gasoline engines into direct injection and lean-combustion strategies. The VQ37VHR is expected to generate 330 hp (246 kW) and 270 lb-ft (366 N·m), compared with the current VQ35HR's 293 hp (218 kW) and 268 lb-ft (363 N·m). Redline is 7500 rpm. Nissan aims to deploy the new valvetrain architecture across multiple engine platforms.

Four-wheel active steering in the G37 automatically varies front steering ratios and rear suspension settings using servomotor-driven controls to adjust the dampers according to steering angle and vehicle speed.

Dan Carney

Lindsay Brooke



Mercedes-Benz CL65 AMG

of eliminating that trashy-sounding noise," said Guertin.

Improved idle quality was another goal, for which Chrysler targeted the **Lexus** LX 470's 4.7-L engine as a benchmark, he said. "In the end, we are quite comparable." Idle quality benefited from the dual spark plugs, which helped reduce the coefficient of variance of the idle by half, Guertin reported.

The Grand Cherokee's fuel economy is improved by 5%, he said. Of that, 2% is attributable to the boosted compression ratio and dual spark plugs, and the rest is the result of an improved torque converter lockup and shift schedule, said Guertin.

The Grand Cherokee adds comfort and convenience features too, such as **Sirius** satellite video service for the rear-seat entertainment system, hill descent control, hill start assist, trailer sway control, and high-intensity-discharge headlights.



Mercedes-Benz CLK63 AMG Black Series

engine engineering group. They were horsepower, fuel economy, torque, and refinement, he explained. The result is replacement of about 30% of the engine's total parts, and half of the parts could be described as "major" ones, Guertin added.

Much of the old engine's efficiency was lost in the poor flow of the heads, so new head castings improve the flow and accommodate dual spark plugs that permit a higher compression ratio—9.8:1 vs. the old engine's 9.0:1. The result is 305 hp (228 kW), a 30% increase, and 334 lb-ft (453 N·m), a 10% increase.

New camshafts, valve lash adjusters, and reduced accessory drive speed contribute to improved NVH, while new connecting rods feature floating wrist pins for better durability. A new intake manifold design also aids the reduction of unwanted noise. "We've done a good job

## Infiniti G37 coupe

**Nissan** unveiled its slickly styled 2008 **Infiniti** G37 at New York. The new sports coupe is slightly larger overall than the G35 it replaces and has a more refined interior. Both cars share the FM architecture with 112-in (2840-mm) wheelbase, but Nissan claims the G37 is 36% stiffer in torsion.

But the big news on G37 is under the hood—the first application of Nissan's all-new VQ37VHR V6 with VVEL/C-VTC. That tonque-twisting acronym stands for variable valve event and lift and continuous valve and timing control.

The new VVEL/C-VTC system was inspired by **BMW's** Valvetronic system; both valvetrains allow infinitely variable valve timing and lift, and both use the intake valves as a throttle to control air intake. Nissan claims the arrangement provides a 10% increase in fuel efficiency on the

## Mercedes-Benz coupes

**Mercedes-Benz** used the New York show to unveil a pair of ultra-high-performance coupes, the CL65 AMG and the CLK63 AMG Black Series.

The CL65 matches the company's flagship coupe with its 604-hp (450-kW), 738-lb-ft (1000-N·m) twin-turbocharged V12 to produce 0-60 mph (0-97 km/h) acceleration of 4.2 s. The **AMG**-tuned version of the Mercedes-Benz V12 includes a longer-stroke crankshaft, bigger-bore pistons, improved bearings, and upgraded oil-spray system.

The car also features new brake technology, with two single sliding-piston calipers per front wheel. Mercedes claims the system provides the low heat transfer and comfort of floating calipers with the performance of fixed calipers. The rear brakes also use single sliding-piston calipers, but with a more conventional one



Subaru Tribeca and 3.6-L flat six

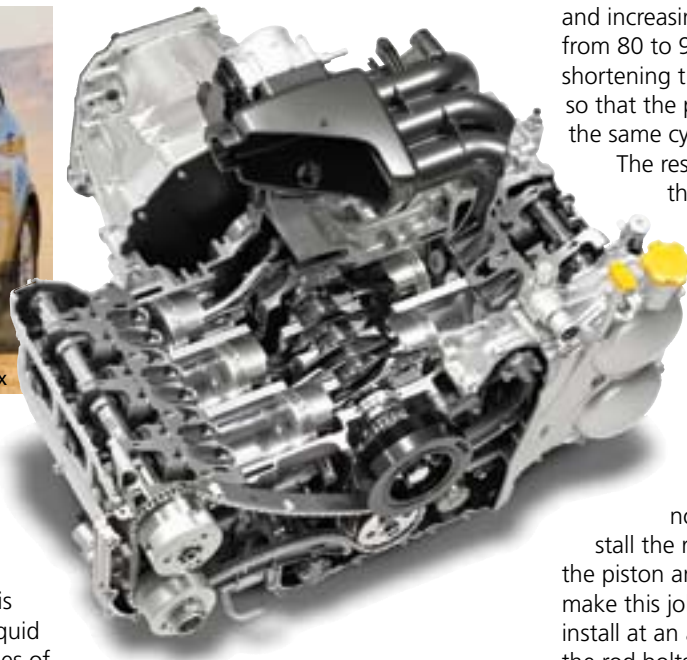
caliper per wheel. Their stopping performance results in an astounding 60-0 mph (97-0 km/h) stop of 116 ft (35.4 m) for the 4599-lb (2086-kg) car.

The CLK63 wears Mercedes' new Alubeam metallic silver paint, which is meant to convey the impression of liquid metal through its use of metal particles of only 30-50 nm (1.2-2.0  $\mu\text{m}$ ), compared to the 100-300 nm (3.9-11.8  $\mu\text{m}$ ) typical of metallic paint.

The CLK63 AMG Black Series is built to the same specifications as the pace cars AMG provides the Formula One racing series. "This is for AMG customers who are looking for something a little more special," remarked Mark Ramsey, MB USA Department Manager for exclusive vehicles. The compact coupes are built as virtual production racecars, with flared carbon-fiber fenders, fully adjustable suspension, and a 500-hp (373-kW) version of the AMG-designed and built 6.3-L V8 engine.

The car rolls on AMG 19-in forged-aluminum wheels mounting **Pirelli P-Zero** Corsa tires. A front air dam and rear spoiler and diffuser contribute to high-speed aerodynamic stability, while enlarged air intakes increase flow to the bigger radiator, second transmission cooler, and brakes.

The limited-slip differential has its own oil cooler with a thermostatically controlled electric fan. The CLK's chassis is stiffened by bracing in the engine bay and trunk for more racecar-like rigidity to support the more sophisticated suspension. The Black Series model features new spring links, wheel carriers, thrust arms, and camber and torque struts to allow greater adjustability as needed to suit specific tracks. The **Koni** dampers are adjustable for compression and rebound.



The CLK63 Black Series has only two seats, unlike regular CLK63s, with a pair of racing-style bucket seats and abundant carbon-fiber trim to underscore the car's track orientation.

Dan Carney

## Subaru Tribeca

Acting with surprising agility, **Subaru** rolled out an updated version of its only two-year-old Tribeca crossover SUV for 2008. Products in this segment are driving sales for other manufacturers, but Subaru has been left behind due to two primary consumer objections with the current model. One is exterior styling that Subaru diplomatically describes as "polarizing," and the other is disappointing fuel economy because of an engine over-matched by the vehicle's mass.

To address the power shortfall, Subaru followed the proven technique of increasing displacement, in this case from 3.0 to 3.6 L. The challenge for the company's engineers was to boost the capacity of the existing flat-six engine within the confines of its already-tight bore spacing and without raising the deck height because that would make the engine unacceptably wide, reported Masaaki Owa, Project General Manager for Tribeca.

Subaru engineers met that challenge by increasing the cylinder bore slightly, from 89.2 to 92 mm (3.51 to 3.62 in),

and increasing the crankshaft's stroke from 80 to 91 mm (3.15 to 3.58 in), but shortening the connecting rods' length so that the pistons now top out within the same cylinder deck height as before.

The resulting packaging is so tight that engineers had to get creative. On the downstroke, the pistons' bottoms would have fouled the rising counterbalance weights on the crankshaft, so the pistons' skirts are cut away on the sides to provide clearance for the crankshaft.

Even more perplexing was the fact that there was no room for assemblers to install the rod bearing caps after sliding the piston and rod into the cylinder. To make this job possible, the bearing caps install at an angle that permits access to the rod bolts from below the engine, rather than mounting in the usual perpendicular plane.

Subaru sought to improve efficiency through the use of new coolant passages that cool each cylinder individually for better thermal consistency. The new system narrows the range of variation among the cylinders by 10°F (6°C), according to Owa.

Meanwhile, the valve operation has been revised with the elimination of variable lift on the intake cams, but with the addition of variable timing for the exhaust cams. This arrangement is more cost-efficient and brings similar power benefits.

The result is an engine that is 2 lb (0.9 kg) lighter than its smaller-displacement predecessor, with better predicted fuel economy and a significant increase in power from 245 to 256 hp (183 to 191 kW) and torque from 215 to 247 lb-ft (292 to 335 N-m). Along with a recalibrated five-speed automatic transmission, the changes yield a 0-60 mph (0-97 km/h) acceleration time of 8.2 s, which is more than 1 s faster than with the old powertrain. The transmission is also 7 lb (3.2 kg) lighter than before, thanks to a lighter torque converter.

The Tribeca—Subaru dropped the "B9" portion of its name for 2008—also received a sheet metal refresh that exchanges the original version's *avante-garde* wardrobe for a more conservative style.

Dan Carney