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What’s old (and revered) is new again

Apart from top brass and various other engineering true believers at Mercedes-Benz, maybe nobody was more delighted than me when it was confirmed a couple of years ago that Mercedes was introducing a new architecture for inline 6-cylinder engines, a powerplant layout that long served as a cornerstone for the brand’s reputation for consummate powertrain performance and refinement.

The inline six became synonymous with Mercedes in its “modern” era that started roughly in the 1950s and appeared in some form or other for the next half-century (including the seminal 3.0-L Bosch direct-injected M198 for the 300 SL gullwing). The company cut ties with its last I-6 in 1998.

In October, Mercedes made known the basic details of the new inline 6-cylinder family, the foundation of which is a modular 500-cc cylinder—not to mention the incorporation of new-age electrification features; Automotive Engineering European correspondent Stuart Birch delivers the initial rundown at: http://articles.sae.org/15093/.

I’ve certainly missed the I-6. As many know, inline sixes gradually became a vehicle-development liability as front-wheel drive (FWD) vehicle architectures began to dominate and, more directly, as global frontal-crash regulations tightened. Inline sixes typically were too long to be effectively packaged in transverse-engine FWD platforms (although it was accomplished)—and the straight six’s physical length similarly made it difficult to fit one even in a platform designed for longitudinal engine placement, because the unyielding engine didn’t permit enough energy-absorbing crumple zone in frontal impacts.

Only BMW—which over the years became more famous for the straight six than even Mercedes—somehow kept the faith. When inline sixes started to bite the dust all over the globe, I repeatedly asked senior engineers, designers and executives how BMW could somehow get on the right side of crash physics when everyone else claimed it couldn’t be done. The usual answer, I’ll paraphrase, tended to be: “Perhaps it’s because we make the
inline six-cylinder a priority.”

It surely must have been difficult for those concerned with engine superiority to turn their backs on the I-6 layout’s inherent balance and outstanding torque characteristics. Then there are the considerable design and manufacturing advantages compared with a V-6, as Ron Kociba, former General Motors chief engineer of the “zig-when-everyone-else-is-zagging” early 2000s Vortec 4200 I-6, always explained. It’s ironic those benefits are being revisited as cost advantages compared with a V-6, given that one justification Mercedes and others cited for moving to vee-arranged 6-cylinder engines was modular compatibility with V-8s. My, how the world has changed: now the critical cost-sharing modularity metric is with inline 4-cylinder engines, not V-8s.

The German luxury-car makers didn’t have an exclusive on the I-6 secret—Toyota, for one, authored some magnificent inline sixes, including my personal craving, the ballistic twin-turbocharged 2JZ-GTE 3.0-L used in the last-generation Supra. But for Mercedes and BMW, there’s no doubt the format is indelibly tied to those brands.

What makes it all the better for straight-six disciples: as with the M198 from the 1950s, Mercedes is launching its new-generation I-6s with the era’s most bleeding-edge technology: integration with a 48-volt electrical system that facilitates several nifty efficiency and performance game-changes, included an electrically-accelerated turbocharger as the last word in eradication of turbo “lag.”

What’s old really is new again. In Mercedes’ revival of the inline-six, “old” may equate to vintage attributes, but these new engines promise to be anything but vintage. What a world.

Bill Visnic
Editorial Director
One might expect Japan’s largest automaker to be “all-in” on promoting autonomous-driving technology, but Toyota to now has rather conspicuously avoided self-driving hype. Instead, said Kiyotaka Ise, the company’s chief safety technology officer and President of its Advanced R&D and Engineering Company, Toyota is being “more cautious than others” because it sees the chief promise of autonomy to be enhanced safety rather than enhanced convenience.

Definitely a little tamer than cars driving themselves across the country.

“Our stress with autonomous is safety first, a safer traffic environment,” insisted Ise in a recent interview with Automotive Engineering.

Instead of focusing on the gee-whiz potential of SAE Level 4-5 fully-autonomous driving, Ise said Toyota is concentrating on the driver-assist possibilities of Levels 2-3: the potential to drastically reduce or even
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eliminate accidents altogether—while still providing the driver with the opportunity to enjoy piloting the vehicle under conditions of choice. The autonomous vehicle works with the driver in a “mobility teammate” collaboration, a strategic concept Toyota revealed in 2015.

Ise won’t commit to a timeframe, but he admitted Toyota’s goal is no less than “accident-free society.” But it’s clear he means sooner than later.

**SAE Level 3 Teammate**

Although many automakers and Tier 1 suppliers say it’s most logical to direct development resources to achieving high-level autonomy, skipping the system-to-driver “handoff” complications of Level 2-3 systems, Ise said Toyota’s mid-level autonomy focus makes the most sense to more quickly produce safer roads. That’s the endgame to which the company has been directing more than 20 years of autonomous-technology research from three primary corporate R&D channels: the Toyota Research Institute, the Collaborative Safety Research Center and Toyota Connected (formed in early 2016 to be Toyota’s “big data” hub).

Toyota’s efforts are focused on integration...
For car makers, squeak and rattle phenomena represent a significant problem as many customers will interpret the noise as a general lack of quality in the product. To combat these issues, PSA Peugeot Citroën Group partnered with Altair ProductDesign to explore the use of simulation technologies and numerical optimization methods at an early stage of development. This 60-minute Webinar discusses the project and its progress.

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Tuesday, December 13, 2016 at 10 a.m. U.S. EST

For car makers, squeak and rattle phenomena represent a significant problem as many customers will interpret the noise as a general lack of quality in the product. To combat these issues, PSA Peugeot Citroën Group partnered with Altair ProductDesign to explore the use of simulation technologies and numerical optimization methods at an early stage of development. This 60-minute Webinar discusses the project and its progress.

FROM THE EDITORS OF SAE – SENSOR FUSION FOR AUTONOMOUS VEHICLES
Wednesday, December 14, 2016 at Noon U.S. EST

Enhanced vehicle systems rely on vision and camera systems, sensor technology, and software to automate driving tasks. Future systems will leverage more advanced sensing, car data networks, vehicle-to-vehicle and vehicle-to-infrastructure systems, and wireless network connectivity to automate most of the driving experience. In this 60-minute webinar, three experts will offer insight on this important topic.
of sophisticated onboard active-safety features and systems, vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication and automated-driving technology. The company has pledged, for example, to have its “Safety Sense” active-safety technology suite (pre-collision alert/avoidance, pedestrian detection, lane-departure assist, automatic headlight high-beam control and adaptive cruise control) standard for nearly every vehicle in the Toyota and Lexus model lines by 2017. Combine the onboard technology, Ise said, with V2I communication and go after a big-time reduction in intersection accidents, for instance, which account for a quarter of all vehicle fatalities in the U.S.

Toyota sees the approach extending into two distinct paths for its Mobility Teammate philosophy, a “Highway Teammate” and an “Urban Teammate.” The highway teammate is targeted at taking over the mundane and riskier aspects of highway driving; flip a switch when preparing to enter an Interstate, say, and the system automatically merges the vehicle, accelerates and brakes and changes lanes. Leaving the highway, the driver resumes control for the presumably more-engaging (or more complex, depending on one’s perspective) aspects of the trip. Highway Teammate is targeted for introduction in Japan sometime around 2020.

The Urban Teammate tackles automated driving in more-congested
environments, where active-safety systems such as pedestrian detection and avoidance come into play.

According to Toyota’s description of the Teammate strategy, “This approach acknowledges the utility of automated-driving technologies while maintaining the fun experience of driving itself.”

**Automatic maps and AI**

As technology advances, Toyota sees artificial intelligence assuming a larger role, using LIDAR and camera vision to generate, on-the-fly, ultra-precise maps for the vehicle, but also for others in the vicinity or scheduled to use that road.

Meantime, Toyota safety executives are not unaware of the development hurdles surrounding the driver handoff required for engaging and disengaging with Level 2-3 autonomous systems. They’re studying the most effective methods to alert and inform the driver and hope to standardize that interface.

Ise also acknowledges that different world regions will adopt autonomy at a different pace. In Japan, he said, the Urban Teammate concept is more critical than in the U.S., where more suburbanized driving, lengthy highway travel and more crashes with big trucks might suggest quicker adoption of Level 4-5 autonomy.

Bill Visnic
**POWERTRAINS/PROPULSION**

**Straight-sixes are back (with electrification) at Mercedes-Benz**

The M256 is Mercedes’ new inline 6-cylinder engine. If that’s not a big-enough deal, it also incorporates 48V technology.

**Mercedes-Benz** is not generally given to hyperbole to detail its technology, so when company engineers describe a program as “the biggest strategic engine initiative” in the automaker’s long history, it is worth taking notice. And electrification is very much to the fore.

The company’s latest propulsion blitz opened with the new 4-cylinder 2.0-L diesel now used in the E-Class. It will continue in 2017 with the appearance of a new gasoline 4.0-L V8 biturbo for the S-Class, new 6-cylinder units in gasoline and diesel forms with 48V technology, and a 2.0-L 4-cylinder gasoline which also uses 48V to power auxilia-

ries. The sixes are inline, not “vee”-arranged, because Mercedes’ engineers reckon in combination with 48V electric systems, the return to the hallowed inline-six layout delivers meaningful packaging advantages.

The V8 has capacity reduced by about 0.7-L from the outgoing V8 and gets cylinder deactivation, becoming a “four-pot” unit under light loads while cruising. With a claimed output of over 350 kW (469 hp) with about 700 N·m (516 lb·ft) peak torque, the engine has received attention from Mercedes’ AMG tuning specialists.

Some premium car makers are fixated on reduction of cylinder count—for
example Volvo, with its aim of being accepted by the market as a premium producer, reckoning four cylinders is the maximum for all its models—to achieve required fuel-consumption and emissions targets. Mercedes, though, while on many models already demonstrating what can be achieved with four cylinders, is not being seduced by the prospect of drastic displacement reduction. Instead, it is using the latest complementary technology to meet the unremitting demands for cleaner, more-frugal engines while maintaining the level of performance and refinement expected of its powertrains in their higher-level models.

As well as 48V, those complementary technologies include an integrated starter generator (ISG) and electric auxiliary turbocharger compressor (eZV) to assist the exhaust-driven compressor.

To help continue maximum-efficiency systems cohesion, Mercedes opened a new powertrain integration center (AIZ) at its Sindelfingen, Germany assembly complex.

**All-new I6 replaces V6**

Prof. Dr. Thomas Weber, responsible for group research for Daimler AG and Mercedes cars’ development, says of the strategic power unit initiative: “Our high-tech engines need to be (and are) designed with a view to all current and future requirements. A key success factor is the extensive electrification of the powertrain.”

Of the new engines, it is the 3.0-L inline sixes that are the real attention-grabbers. The gasoline version (M256) produces a claimed 300 kW (402 hp) and delivers maximum
torque of “more than” 500 N·m (369 lb·ft)—the qualifying words, which the company uses extensively in its initial talk about the new engine architectures, shows either a caution about claims or a plan to surprise later. Mercedes has chosen 500 cc per cylinder as the optimum swept volume, the same as that for the new 4-cylinder diesel.

The gasoline inline 6-cylinder (the S-Class gets that too, next year) uses a 48V system and forced air via an eZV and has an ISG to look after hybrid aspects, including energy recovery.

Mercedes’ first V6, the M112, was introduced in 1998 as a response to new frontal-crash requirements, replacing the company’s classic gasoline I6 family. For the move back to inline cylinders for 2017, Mercedes engineers cite performance akin to an 8-cylinder, which should make next year’s S-Class something very special. It also brings design opportunities, such as eliminating the need for a front-end accessory belt drive, that help reduce overall length.

Near-engine exhaust aftertreatment for low heat loss helps reduce emissions. The 48V system delivers the high-power demands of the water pump and air-conditioning compressor and the ISG. With this setup, emissions are down some 15% against the outgoing V6, engineers claim.

48V with new I4

The diesel version (OM656) of the new I6 family incorporates the Camtronic variable valve timing, with steel stepped-bowl pistons and 2-stage turbocharging.

The stepped-bowl piston has a positive...
effect on the combustion process, engineers explain, in terms of thermal loading of critical areas of the pistons and the introduction of soot into the engine oil. Efficiency is increased by the higher burn rate in comparison with the previous “omega” combustion bowl. The characteristic feature of the specifically configured combination of bowl shape, air movement and injector is its very efficient utilization of air, which allows operation with high air surplus. This means that particulate emissions can be reduced to an especially low level, engineers said.

The engine’s block is aluminum and what is described as “improved” Nanoslide coating is used to line the cylinders. The engine also uses near-engine exhaust treatment. A Camtronic switchable exhaust camshaft is integrated.

Output is over 230 kW (308 hp) to make it the most powerful passenger-car diesel in Mercedes-Benz history, according to the company. Maximum torque is over 650 N·m (479 lb·ft).

Topping the muscle chart for the new engine group is the M176 gasoline V8 4.0-L, claimed to deliver a hefty 350 kW (469 hp) and 700 N·m (516 lb·ft) from 2000 rpm.

Cylinder shut-off via Camtronic at part-load effectively creates a V4. For added efficiency, the engine’s two turbochargers are placed between the cylinder banks.

Less glamorous than the sixes and V8 but very significant for Mercedes’ higher-volume models is the new gasoline 2.0-L 4-cylinder (M264). Also known as the Toptype, it follows downsizing/rightsizing philosophy by offering a specific output of 100 kW (134 hp) per liter. It is technology-dense with a twin-scroll turbocharger, belt-driven 48V starter-generator and 48V water pump. Energy recovery capability is claimed to be some 12.5 kW (17 hp).

The design enables engine-off coasting and Camtronic is used on the intake side. And Mercedes plans to expand its application of particulate filters across its gasoline engine range.
Weber always talks of “rightsizing” rather than downsizing. “Instead of trimming the number of cylinders from the outset, thereby foregoing refinement and output, there are much more intelligent solutions,” he noted. The M176 V8 uses cylinder shut-off; at part-load up to 3600 rpm it is an especially efficient 4-cylinder, he claims. Then, imperceptibly for the vehicle’s occupants, cylinders 2, 3, 5 and 8 cut in.

Meanwhile, Mercedes’ new Powertrain Integration Center houses 10 test rigs fitted with high-precision torque measurement directly at the wheels. Integration covers engine and transmission, comfort, dynamics and overall agility—essentially ride and handling. There’s also a climatic altitude chamber and fully automatic vehicle operation on a dynamometer.

Mercedes is just starting work on a vehicle safety, electronics, and computer technology center. Just revealed is Mercedes EQ pure electric SUV concept, with motors on front and rear axles to give all-wheel drive and front/rear variable torque distribution. A battery is positioned between the axles in the car’s floor.

Mercedes has talked of a maximum 300-kW (402-hp) output and up to 700-N·m for the concept, and a potential 500-km (310-mi) range.

Stuart Birch
Collaboration. Despite today’s highly competitive world, it’s still how problems are solved, challenges overcome, and advances are made.

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Essential automotive standards for connected transportation
Pressing the engine start button of a McLaren ignites a cacophony of sound that signals its place in the vanguard of ultra-high performance supercars.

But even such an authoritative burst of decibels is not quite sufficient to drown out another cacophony—of rumors that the company had been in discussions with Apple regarding acquisition of the British sports- and race-car icon.

When Automotive Engineering recently was invited to drive two of McLaren’s products in the U.K., it was a question that still

McLaren faces the electrified and autonomous future

McLaren Automotive CEO Mike Flewitt says the company will remain “fiercely independent.”

Can low-volume supercars survive amid stringent CO₂ regs and robot cars? McLaren is betting £1 billion on a speedy, powerful—and independent—sports-car future.

by Stuart Birch
hung in the air. And to which CEO Mike Flewitt replied: “McLaren will remain fiercely independent; the company is not in talks with Apple.”

Never has been? “Such is the nature of our business we have discussions with many parties,” Flewitt said. “These are confidential and must remain confidential.” So it’s neither yes or no.

But as many experts have observed, McLaren Automotive would bring to any potential suitor industry-leading expertise in advanced materials and lightweight construction, chassis and suspension technologies, aerodynamics and powertrain controls. It also is developing a pure electric car, albeit a very, very high-performance one.

Winning in electrification

Compared to the automotive giants, McLaren is a minnow. It has huge technology potential, with a remarkable turnover-to-R&D-ratio enabler. Flewitt confirmed
that McLaren Automotive’s Track 22 R&D business-plan spend through 2022 will be £1 billion—and entirely self-funded.

“For a small company like ourselves, that is perhaps a large sum, but last year we put 30% of our turnover (£120M) into future-product investment and that is how we intend to move forward over the next six years,” Flewitt explained. “In terms of our future-product strategy it is quite simple: sports cars. It will be a mix of series production cars and limited-production cars like the P1. But definitely no SUVs—we have no desire to make one.”

One new model per year is the projected product cadence, with the upcoming EV “conceivably” plugged into the Ultimate Series level in its range. But again there is tantalizing haze around the project. Says Flewitt: “We have begun work on an electric vehicle. Probably you will not see it in the timeframe of the six-year business plan...but you may!”

For EVs to be truly efficient in terms of range, ride and handling, they have to be lighter than their combustion-engine counterparts. Any non-automotive industrial organization considering edging into that sector knows that lightweighting is absolutely vital. And McLaren is very good indeed at shaving away the kilos.

Flewitt has a neat phrase to encapsulate this: “We are now in a weight race, not a power race.”

At present, the signs are that its electrification program will depend on batteries delivering a significantly improved energy...
density, for greater range. The difficult part of the “fiercely independent” McLaren, though, is its dependence on battery producers. “It is a technology beyond our control,” Flewitt admits.

What of a hydrogen-based fuel cell solution? “Not in McLaren’s thoughts at this moment,” he asserted.

The auto industry has embarked on what he terms a serious journey to develop and produce battery-electric vehicles. McLaren wants to be ahead of that curve, reflecting the McLaren Technology Group’s maxim: “We exist to win in everything we do.”

There are two McLaren companies: McLaren Automotive and the Technology Group that includes Applied Technologies and Racing. McLaren Automotive builds on F1 knowledge to create high-performance sports cars; McLaren Applied Technologies brings expertise in electronic systems, modeling, simulation and design engineering, its disciplines spanning health and wellness to transport and energy. And Racing, not surprisingly, is all about Formula 1.

All aspects of the McLaren companies demand an element of somewhat esoteric “emotions.” These include that fabulous combustion soundtrack—but an EV’s appliance-like whirr is unlikely to prove a soul-stirring attribute, as Flewitt and his teams are well aware.

A solution will doubtlessly be found. “Our engineers are getting their heads around that,” Flewitt says. Meanwhile, the aural delights are certainly delivered.
by McLaren’s present model range that has three strata: Sports, Super and Ultimate.

**Driving with ‘Inertia Push’**

To help understand this “emotion” and other aspects of what makes a McLaren, the author was provided with the no-frills 478-kW (641-hp) 650S (Super Series) and the new, more cosseting 419-kW (561-hp) 570GT (Sports Series). Model nomenclature refers to PS output.

Dihedral doors and a high sill make the 650S marginally more difficult to enter than some jet fighters in which the author has flown, but that’s all part of the image.

The car’s MonoCell carbon-fiber chassis is claimed to be 25% stiffer than a comparable aluminum chassis. The 650S comes as a coupe and spider; no change in the tub’s basic structure ensures requisite torsional stiffness.

Unlike some supercars, the 650S is driver-friendly in terms of visibility, ergonomics and driving position. Pedals and steering wheel are directly in front of the driver with no offset. Being all about performance, the 650S delivers impressive figures with accompanying “emotional” noise—but not to excess; it’s mature, with nothing to prove.

The 650S’s 3.8-L M838T twin-turbo V8 has a claimed peak torque of 678 N·m (500 lb·ft) to complement its power output. Acceleration from standing start to 100 km/h (62 mph) comes in 3.0 s and 200 km/h in a blistering 8.4 s.

McLaren explains that for maximum acceleration the car has “Inertia Push,” a control algorithm that harnesses the engine torque levels, raising the rpm at a faster rate for each gear.

Transmission is a twin-clutch 7-speed. Ceramic brakes are...
standard and on the latest version of the 650S, developed to be more progressive at high speed but with added predictability and modulation at low speed.

The Sports Series 570GT is the “luxury sports car” of the range, the luxury coming from a panoramic glass sunroof and a side-opening rear hatch that creates access to an additional 220 L (7.7 ft³) of leather-decked luggage space, offering a maximum 370 L (13 ft³).

The 570GT uses a carbon-fiber tub that weighs all of 75 kg (165 lb) and provides easier occupant access via lower sills. Visibility betters that of the 650S due to the A-pillsars moved further outwards and narrower B-pillsars. The use of superformed aluminum body panels marks a first for McLaren.

Despite a claimed 0-100 km/h time of 3.4 s, the GT is slightly less powerful than the 650S but retains the latter’s muscular exhaust tone.

Driving both McLaren models on regular roads leaves lasting impressions not only of towering performance and adroit handling but also of comfort and easy, confidence-generating controllability—aspects that are not always supercar plus points.

So, could all this technology—and more to come—find a place in a takeover or partnership involving any company new to the auto industry? And still manage to remain “fiercely independent?”

Only time will tell. At present, McLaren will not.
New Peugeot SUVs jump to modular platform, increase composites content

PSA Peugeot Citroën used the 2016 Paris Motor Show for the public launch of the Peugeot 3008 and 5008 models, now re-defined as SUVs. The 3008 accommodates five passengers while the larger 5008 offers seven seats in three rows. Both models use the PSA Efficient Modular Platform 2 (EMP2), already employed on a number of the automaker’s models including the recently revised Citroën C4 Picasso and C4 Grand Picasso, the Peugeot 308 C-segment model and the recently launched Peugeot Expert and Citroën Jumpy cargo vans.

The flexible EMP2 can be extended by adding 55-mm (2.1-in) extensions to the rear section of the platform. Bertrand Clergeot, 5008 SUV Project Director, explained: “From a structural point of view we have the front part and what we call the rear synthesis. The rear synthesis is the part that can accept extensions, so enables the wheelbase to be adjustable.”

Clergeot noted that the front section is common with the 308, 3008, 5008, 308 SW and Citroën C4 Picasso. The rear section is modular. The construction enabled the 5008 to have nearly the same wheelbase as the C4 Picasso.

The idea behind the 55-mm extensions is that they give the engineering and design teams flexibility to match the wheelbase as closely as possible to their needs, while keeping the vehicle’s overall length within European C-segment parameters. So the 5008 wheelbase represents three extensions more than the wheelbase of the 3008 and 4008, the latter built specifically for the Chinese market. It has one extension more than the 3008.

PHEV coming in 2019

PSA’s Grip Control driveline provides front-wheel-drive models with improved traction on different terrain and now includes a hill-descent control feature. “We’ve left the 4x4
systems because they are heavy and have high fuel consumption. I think that’s not the trend today,” Michel asserted.

As on the previous model, there will be a hybrid variant that will provide all-wheel-drive through an electrically-driven rear axle; 5008 models will not be offered with a hybrid powertrain because of the packaging difficulties of accommodating a third row of seats and a hybrid battery pack. PSA engineers are working on a plug-in hybrid version, which will be available in 2019, Michel said.

Weight reduction was one of the key program objectives of the new 3008 SUV according to Project Director Frank Michel. “We worked on new steels and new materials, to save thickness and save weight, including more aluminum and composite materials at the very beginning,” he told Automotive Engineering. “This means that when we started to design the parts, we decided how much each part was supposed to weigh.”

As a result, up to 100 kg (220 lb) was saved compared with the previous model. Mass-reduction measures include using aluminum for the hood and front fenders, which meant that the hood stamping tooling needed careful design to ensure the sharp creases in the hood outer were well defined. Peugeot engineers also saved mass using composite parts.

“We optimized the thickness of the floor,” said Michel. Part of the EMP2 platform involves composite material in the floor. He said the car’s composite liftgate is the company’s “third or fourth experience” with engineering composites in this application, in the ongoing quest to reduce vehicle mass by “100 g here and 100 g there.”

Peugeot worked with Michelin on a new low rolling-resistance tire design, which Michel described as “tall and narrow,” for the car.

New interior materials were chosen for the 3008, but Michel noted that it is difficult to find companies that can produce materials on the scale needed for car production. “We were involved in very specific activities to produce these new materials on an industrial scale,” he commented.

John Kendall
Mercedes EQ concept previews 2019 electric SUV

Mercedes-Benz officially revealed its comprehensive electrified-mobility strategy at the 2016 Paris Motor Show, while unveiling a new electric concept vehicle, the Generation EQ, that previews an electric SUV slated for production by 2019.

The new strategy, named CASE—which stands for Connected, Autonomous, Shared and Electric—incorporates all electric mobility-related activities under the EQ brand. These will include a diverse range of services including energy storage units, designed for both private and commercial customers and charging technologies, including inductive charging.

Sustainable recycling will also be included.

Mercedes-Benz says that by 2025, the company aims to have more than 10 all-electric vehicles in its model range. Heavy investment, over €1B ($1.12B U.S.) will be made in battery production around the world. €500 M ($560 M) will be invested in a second battery production site in Kamenz, Germany.

Describing the new electric models, Dr. Thomas Weber, Member of the Board of Management of Daimler AG responsible for Group Research and Mercedes-Benz Cars Development, said, “The new generation of electric vehicles will be based on an...
architecture developed specifically for battery-electric models, which is scalable in every respect and usable across all models. It is suitable for all model series as well as sub-models, such as SUVs, saloons and coupés. Wheelbase and track are variable.”

This dedicated architecture will incorporate two electric motors driving both front and rear axles, with a total power and torque output of up to 300 kW (402 hp) and 700 N·m (516 lb·ft). The Generation EQ concept car has a range of up to 500 km (310 mi), Dr. Weber claimed.

The design of the new EVs will include a specific “radiator” grille and new exterior lighting treatment. Inside, the only traditional switchgear to survive will be the electric seat adjustment switch. All other controls will use touch-sensing switchgear.

This includes the steering wheel spokes, where the touch controls are integrated into Organic Light Emitting Diode (OLED) displays. A 24-in (609-mm) TFT dashboard display carries all relevant driver information. The displays can be customized to suit individual needs.

The scalable architecture of the new EVs will provide for varying wheelbase lengths and track width. Battery architecture will also be scalable using a modular system, with the batteries contained in the floor section within the wheelbase. Mercedes-Benz has chosen to build the cars in a mixture of steel, aluminum and carbon fiber.

Features include tight panel gaps, concealed windscreen wipers, cameras replacing conventional door mirrors and no conventional door handles. The front features a black panel with a three-pointed star illuminated in white and surround illuminated in blue, with LED headlamps. At the rear LED optical fiber illuminates the rear panel surround and switches to red when the vehicle is moving, providing a tail light function.

The concept EQ will illuminate automatically when the driver approaches, with digital lighting embedded in the interior door panels. Mercedes-Benz mapping partner HERE (co-owned with BMW and VW Group) will provide mapping that can integrate with autonomous drive functions.

John Kendall
Nissan gives its Rogue compact crossover utility a hybrid-electric powertrain option for model year 2017, boosting the estimated fuel efficiency of the front-drive model to 33 mpg city/35 highway and that of the all-wheel-drive version to 31 mpg city/34 highway. That’s an increase of approximately 5 mpg combined city/highway for both the FWD and AWD hybrids versus the standard Rogue.

“The CUV segment is on fire in the U.S. and that’s why we’re putting a lot of emphasis on this segment,” said Ty Webb, Senior Manager of Rogue Marketing for Nissan North America. He said Rogue is poised to become Nissan’s top-selling model, overtaking the Altima midsize sedan.

Rogue Hybrid provides a full EV mode, unlike the milder hybrid systems on the 2014 MY Pathfinder, which ceased production in 2015, and the current midsize Murano CUV.

“The electric-only mode on the Rogue Hybrid automatically engages when the vehicle is coasting at highway speeds up to 75 mph, and for a short time during speeds up to 25 mph,” according to Motohisa Terada, Manager of Electric Powertrain Project Group for Nissan Motor Co., based in Kanagawa, Japan.

Terada and other Nissan technology product experts spoke with Automotive Engineering during a recent ride-and-drive program. While the conventionally-powered 2017 Rogue is powered by a 170 hp (127 kW) 2.5-L gasoline I4, the new Hybrid model features a 2.0-L 4-cylinder gasoline engine generating 141 hp (105 kW) at 6000 rpm and 144 lb·ft (195 N·m) at 3600 rpm combined with a 30-kW (40-hp) e-motor for a combined system rating of 176 hp (131 kW).

Packaging the battery
The Rogue Hybrid driveline uses Nissan’s one-motor/two-clutch Intelligent Dual Clutch Control system in which a wet clutch is located in the traditional torque-converter space between the engine and e-motor and a dry clutch is fitted between the motor and the JATCO-supplied Xtronic CVT. The dry clutch is used only to start-stop the engine. The overall system design
allows the engine and e-motor to operate flexibly and offer the electric-only mode depending on load and driving situations.

A Hitachi-supplied 56-cell lithium-ion battery pack is located under the cargo deck, resulting in a slightly higher floor height. That height difference means the standard Rogue’s 18-configuration Divide ‘N Hide cargo system isn’t part of the hybrid vehicle’s cargo bay.

In addition, the second-row seat in the hybrid vehicle doesn’t have 9 in (229 mm) of seat travel like the standard Rogue, according to Brian Wilson, Nissan North America’s Product Planning Department Manager for Nissan Vehicles.

“Battery packaging didn’t affect the cargo area,” Wilson said, noting that both the standard and the hybrid Rogue have more than 61 ft³ of stowage space behind the first seating row.

**Electric A/C system**

Rogue Hybrid’s electric A/C system is an application-first for a Nissan vehicle in North America. Said Terada, “If we used a mechanical A/C system, the A/C would stop during engine idle when the stop/start technology is activated. With the electric system, the flow of cool air isn’t interrupted when the Rogue Hybrid is in an idle stop/start mode.”

Paul Cullen, drivability engineer at Nissan’s Arizona Testing Center, said both the standard hybrid versions of Rogue have similar acceleration G-force curves. “The tuning of the powertrain is not a mirror image between the standard and hybrid Rogue, but the performance will feel similar to a driver,” Cullen said.

Rogue Hybrid’s high-output Li-ion battery pack charges and discharges quickly, contributing to high-speed, precise control of the electric motor and optimum clutch control as well as enabling quiet and quick acceleration, according to engineers.

“We have a great hybrid vehicle that has a nice balance of performance and fuel economy as well as a seamless transition between the electric-only mode and the ICE-only mode,” Cullen said.

Pricing will be announced closer to Rogue Hybrid’s production launch in late 2016. The warranty for the battery pack and inverter unit covers 8 years or 100,000 miles.

Kami Buchholz
Renault’s kids’ racer

The strategy of using junior racing to interest youngsters in automotive engineering careers gets a boost in Europe with Renault’s decision to launch a UK Clio Cup Junior Championship for 2017.

Drivers will be from 14 to 17 years of age and will be competing in race cars capable of running 160 km/h (100 mph).

The announcement closely follows Renault’s announcement of its 2017 model range, in which the road-going Clio gets two fresh powertrains, a 1.5-L dCi 110 turbodiesel 4-cyl. and 1.2-L TCe 120 gasoline 4-cyl., the latter driving through a 6-speed manual gearbox. The most powerful new Clio model is the turbocharged 1.6-L Trophy, making 217 hp that can accelerate the car from 0-100 km/h in 6.6 s and on to a top speed of 146 mph (235 km/h).

Racing hoped to stoke interest in engineering

Scheduled to start next year, the UK Junior Clio Cup already has gained outline approval from the championship control panel of the Motor Sports Association (MSA), the UK motorsport governing body. The new junior series’ spec race car is based on Renault’s Clio Sport 220 Trophy.

Teams will use identical racing versions of the Sport 220 trophy, which also is used by adult drivers in Renault Clio Cup series that races in conjunction with the Dunlop British Touring Car Championship.

The junior-league drivers are expected to become familiar with all aspects of the cars they race. Turbocharged 1.6-L direct-injection engines employ Cosworth SQ7 Di – XAL electronic controls. The gearbox is a
Sadev ST82-17 6-speed sequential automated manual—but with sixth gear blocked via an ECU modification. Steering wheel-mounted paddle shifters mirror the gear-shift interface used by the Clio Cup racers.

A Sadev 23/90 self-locking limited slip differential is fitted and tires are Michelin Pilot Sport 3. Maximum power output is limited by MSA Junior regulations and with only a 5-speed gearbox to limit top speed to 160 km/h.

Because the modifications for the juniors’ cars are described by Renault as being “simple” (i.e. mainly electronic) these can be adapted, so the same car may be used in both Clio Cup categories.

The junior racing cars also are fitted with a steel roll cage.

Will Fewkes, Renault Sport UK’s Motorsport Championship Manager, said: “We hope that a Junior entry-level championship, with backing from Renault UK and, centrally, Renault Sport Racing and all the associated expertise and professionalism, will appeal to smaller racing outfits and also to more female drivers. We feel this marks a real shift in the junior-racing marketplace.”

Renault UK Communications Manager Jeremy Townsend, added: “This marks the first time we have entered the junior racing marketplace. Extensive testing of the UK Clio Cup cars shows that it can easily complete a full season of both Clio Cup categories without need for engine rebuilds—the product really is that good in terms of engineering and reliability.”

Renault subtly links high performance with safety; shortly after it announced the Junior Clio Cup plan, it revealed that the 2017 Mégane-based Scénic has received a 5-star safety rating from Euro NCAP.

The award makes it the 20th Renault model to receive a top NCAP rating. The Scénic has active emergency braking with pedestrian protection as standard, claimed as a first in its segment. Euro NCAP gave it a 90% score for adult occupant protection, 82% for children and 67% for pedestrians. Parts of the car’s structure are described as “ultra-high elastic”—each square mm can resist up to 120 kg of pressure.

Stuart Birch
SPOTLIGHT: ENGINE COMPONENTS

Hybrid and electric powertrain microcontroller

Silicon Mobility’s (Sophia-Antipolis, France) OLEA T222 automotive microcontroller is a dedicated solution for hybrid and electric powertrain control. According to company claims, it is the first-ever automotive microcontroller with embedded, robust and secured programmable logic. Based on a standard ARM Cortex-R5F CPU running at 200 MHz, OLEA T222’s flexibility, hard real-time parallel processing and safe architecture makes it suitable to control all types of hybridization—micro, mild or full, including integrated belt starter-generator, crankshaft motor-driven generator, gearbox motor-driven generator, in-wheel motor or in-axle motor, dc/dc converter, and full electric powertrains. OLEA T222’s technologies and feature set address other applications and make it a suitable controller for a battery-management system, exhaust or selective catalytic reduction systems or even a conventional internal-combustion engine. OLEA T222 directly contributes to a vehicle’s CO₂ emissions reductions by enabling the democratization of electrification, says Silicon Mobility. For more information, visit www.silicon-mobility.com.
SPOTLIGHT: ENGINE COMPONENTS

Engine, transmission and alternative-drive seals

Freudenberg Sealing Technologies (Plymouth, MI) has expanded its LESS (Low Emission Sealing Solution) lineup to include new products designed to address challenges associated with powertrain friction, smaller spaces, lighter weight vehicles and growth in the electric mobility vehicle arena. Covering the engine, transmissions and electric mobility product groups, the LESS portfolio was developed to focus on four core areas: emissions, friction, weight reduction and downsizing. One of the products in the portfolio suitable for the reduction of emissions and friction is the gas-lubricated mechanical face seal Levitex (pictured), which lowers CO₂ emissions by up to 1 g of CO₂ per km during driving, says the company. The Levitex seal also promotes a longer operating life by reducing powertrain wear. The seal’s greater pressure stability is assisting with new developments in engine technology. According to Freudenberg, a German manufacturer has selected Levitex for its first series-production order. For more information, visit www.fst.com.
Fan selection application

The OPTIMISER 10 Fan Specification App, from supplier of high-performance axial-flow fans Multi-Wing America (Burton, OH), is a resource for original-equipment engineers to specify the most-efficient, tailor-made Multi-Wing fan for their application. The app is suitable for specifying fans in several applications, including engine cooling in off-highway equipment and power generators. It features an intuitive user interface, advanced natural-frequency sound calculations and visual display of total efficiency on the fan performance curves. OPTIMISER 10 also offers blade-profile previews with available diameter ranges, materials and rotations. For more information, visit www.multi-wing.net.

Biodiesel hoses

GH100 and GH101 hoses from Eaton (Eden Prairie, MN) are suited for high-percentage biodiesel blend and high-temperature oil applications. Engineered for maximum performance in systems with a variety of fuel types, the hoses feature a unique polymer that more effectively resists degradation. The GH100 and GH101 are designed to perform in high-temperature mobile applications, including trucks, buses, agriculture and construction equipment and eco-friendly power vehicles.

Compatible with high-percentage biodiesel fuels and new synthetic oils, the GH100 and GH101 support a longer hose life while also ensuring safety requirements and quality standards are met. They are qualified for -40 to +150°C (-40 to +302°F) with B2, B5 and B20, -40 to +125°C (-40 to +275°F) with B100. For more information, visit www.eaton.com.
Arc suppressors

NOsparc arc suppressors from Arc Suppression Technologies (Bloomington, MN) are designed for both AC and DC power applications. The AC products are currently produced to operate between 100-V AC and 480-V AC while DC products operate from 12-V DC through 250-V DC. The company claims the devices suppress 99.9% of the electrical arcing in relays, which increases their operational life and saves the cost of up to nine replacement relays, as well as protects the associated motors from failing. This off-the-shelf technology is easy to install, says the company, and may be used in any electromechanical switch application, including automotive and precision manufacturing. For more information, visit www.arcsuppressiontechnologies.com.

Noise and vibration-resistant rotary latch

Southco, Inc. (Concordville, PA) has launched the stainless steel R4-10 rotary latch with integrated bumper that can be combined with the company’s line of mechanical and electronic actuators and cables for a complete rotary latching system. Available in single- and two-stage options, the R4-10 features an integrated rubber bumper that eliminates noise and vibration caused by normal operation. The R4-10 with integrated bumper features a design that traps the striker between a rubber bumper and rotor. Without extra clearance or room to move, any noise potential that could be caused by metal-on-metal movement or vibration is eliminated. The stainless steel version offers corrosion resistance for consistent performance in harsh environments. For more information, visit www.southco.com.
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