CONTINENTAL: GETTING TO GRIPS WITH TYRE DESIGN

HYDROGEN POWERTRAIN BREAKTHROUGH

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Eliminating driver distraction

Autonomous driving has been at the core of three technology events that I have recently attended: Bosch, Continental and Harman all demonstrated technologies that are being developed to aid drivers, and bring down road deaths and injuries.

The road map towards fully automated driving goes something like this, according to senior engineers at Continental: semi-automated driving by 2016, highly automated driving four years later and full automated driving by 2025.

To many, the concept of sitting in a car, or any vehicle for that matter, which will then be responsible for its own actions heralds a dystopian future where machines will rule, leading to a ‘Terminator’-like doom.

That’s hardly likely to happen, as mankind invariably over-predicts the future; if we didn’t, we would all now be commuting in the atomic-powered hover cars seen as concepts in the 1950s.

And while systems that prevent accidents are welcome, there needs to be a fundamental improvement in driver training and a reining in of mobile ‘phone use while driving. The Alliance insurance group revealed that 10% of accidents in Germany are caused by driver distraction, while Harman said there are 400,000 mobile ‘phone violations a year in Germany.

I was also told it takes 15.6 seconds to tune the radio and 6.9 seconds to perform other functions. And a car travels a long way at high speed during that time. Is it little wonder, then, that NHTSA – National Highway Traffic Safety Administration – is proposing that a single glance away from the road should take no longer than two seconds?

Eliminating these types of distraction would have an immediate and obvious effect on accidents, and should be a priority.

Ian Adcock, Editor in Chief
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Bosch solution to slash emissions penalties – and cost

Bosch is developing a modular plug-in hybrid platform for low-volume sports car producers that can't afford to develop a unique solution for their own products.

“High-powered cars will have problems reaching emission levels in 2016 and even more so in 2020. They will require hybridisation to avoid additional penalties. There’s a need to reduce cost as well, since these low-volume OEMs can’t afford to develop hybrids themselves,” explained Bernhard Bihl, president of Bosch Engineering GmbH.

Bosch recently displayed an Aston Martin DB9 fitted with the system, which comprises twin electric motors, mounted ahead of the V12 engine, that drive the front wheels via a bevel gear and a short driveshaft through the suspension, making it easier for customers to convert their cars. The 180 kW/h lithium ion battery pack in this prototype is located where the rear seats would normally be, with its own dedicated two-stage 6kW cooling fans on top of the cell stack to create turbulence and keep them cool.

Combining the electric motors with the V12 engine results in a total output to over 550kW, reducing 0 to 100Km/h in a predicted 3.4 seconds – a 20% reduction over the standard car.

INCREASED PERFORMANCE

However, the Bosch hybrid is about more than just increasing the car’s performance and delivering a 260kms electric-only mode, says engineer Gabriele Pieraccini. “Not only does it show the potential of hybridisation, in terms of CO₂ or fuel consumption, but we wanted to increase performance and driving pleasure. For that, we developed a new concept for human-machine interface (HMI) and how the driver interacts with the car by creating this fully digital display. For example, when you switch the car on, you see a normal graphic display, with the needle coming up when the engine fires up.

“In this car, there are a lot of things that can be tuned from the driver’s side. These customers spend a lot of money personalising the interior of the car with materials and we want to put the same concept into the car’s dynamic behaviour. Standard traction control, for example, never suits how you want to drive. It’s too much of a compromise. Here, you select the page for traction control, and then you can tune it, give it a name and file it away. Other drivers could do the same or you could download from the manufacturer’s website the handling app and choose from a list of options: for instance, the ‘Fernando Alonso’ or ‘Jenson Button’ setting at a particular race track.

“The pedal response can be tuned as well as the regenerative braking capabilities. You could also limit the car’s performance; if you gave it to your son and he is not very experienced, you can de-tune it to 150PS with a safe traction control setting.”

The car’s dynamic capabilities would also be improved, claims Pieraccini, as the electric motors would allow torque vectoring across the front wheels, as well as integrating the electronic rear differential into the network.

EXTRA POWER BOOST

“And, if you need that additional turn of speed, there’s an actuator on the throttle that, when the driver reaches the final 10% of throttle travel, delivers an extra power boost from the electric motors, which can also be used to fill in any torque gaps at low engine speeds,” he adds.

“Packaging the components into the restricted confines of a high-performance GT like the DB9 presented its challenges, but moving the radiator forwards allowed Bosch to incorporate the electric motors without causing any detrimental affects to engine cooling air. However, Bosch is confident that its modular approach would mean the hybrid technologies could equally be installed in a mid- or rear-engined car.

“In this trim, the hybrid Aston Martin is some 300kgs heavier than a standard DB9, which is about the same as the convertible version. Weight balance is practically unchanged, with around 1% more going to the rear, due to the battery.

“If we manage to get this to a decent cost level, and OEMs put that against the penalty they would have to pay, if they don’t achieve the CO₂ levels demanded, then I am sure we can get a hybrid that would be available for everyone,” concluded Bihl, who added that Bosch is already talking to customers.
New-gen wipers: all clear ahead

A new generation of windscreen wipers that can reduce water consumption by 30% or more has been developed by Bosch and is due to go into series production at the end of 2014.

The ‘Jetwiper’ has two nozzles integrated directly into the wiper arm; each nozzle has two to four jets spraying water directly in front of the blade during the ‘up’ part of the wiper’s motion. This results in improved cleaning performance and, at higher speeds, eliminates any obscuration for the driver. Both the connecting hose and the nozzle bodies have a heating wire to prevent freezing down to -40°C to keep the wipers functioning in extreme conditions. The system also greatly reduces smearing caused by road dirt thrown up from vehicles ahead.

Pressure off when it comes to checking tyres

Under-pressure tyres are becoming a thing of the past, due to systems like Continental’s electronic-Tire Information System (eTIS).

A sensor fitted to the underside of the tyre tread can detect both the correct pressure and the vehicle’s weight to inform the driver if the tyre is underinflated via a radio signal running at 433 or 350 Megahertz, depending on the country. By putting the information through the car’s CAN bus system, the warning is then displayed either in the instrument cluster or by Wi-Fi to the driver’s smart phone.

With forthcoming legislation requiring that tyre pressure monitoring is done within 10 minutes of the car setting off, Continental’s Loksync can determine which tyres are incorrectly inflated within that timeframe. It does so by using information from the accelerometer to detect when the sensor is at the top of the tyre by looking at the gravitational pull of the earth. Whenever it’s at the top, the sensor looks at the ABS tick information and compares the two, so they know when a full revolution has been completed. By looking at where each tyre is, only one will match, and Loksync can then warn the driver which tyre is incorrectly inflated. It then repeats that process for the three remaining tyres.

The unit sleeps below 30km/h and, after 10 minutes’ driving, reverts to lower power mode.
Ford tests high-tech early warning ‘brake light’

Ford has participated in a special test of a high-tech early warning “brake light” that can alert drivers following behind, even if they are around a bend or behind other traffic.

The technology is one of 20 potential future systems that Ford tested as part of Safe Intelligent Mobility – Testfield Germany (simTD), a four-year joint industry research project.

In emergency braking situations, the experimental ‘Electronic Brake Light’ transmits a wireless signal to illuminate a dashboard light in cars following behind. The study found the technology could enable drivers to brake earlier and potentially mitigate or avoid a collision.

The simTD field tests involved 500 test drivers in 120 vehicles – including 20 Ford S-MAX models. Testers logged more than 41,000 hours and almost 1.6 million kilometres on public roads and an enclosed test track in Germany.

“Car-to-car and car-to-infrastructure communications represent one of the next major advancements in vehicle safety,” said Paul Mascarinas, Ford’s chief technical officer and vice president, Ford Research and Innovation. “Ford is committed to further real-world testing, here and around the world, with the goal of implementation in the foreseeable future.”

Ford used specially equipped S-MAX models to help test the potential of car-to-car and car-to-infrastructure communication; also testing Obstacle Warning system, which alerts to the presence, position and type of potentially hazardous objects in the road; and Traffic Sign Assistant, that keeps in contact with traffic management centres for up-to-date information. See also page 29.

Bi-coloured fascias debut

Benecke-Kaliko has developed a moulding process that allows OEMs to have bi-coloured fascias for the first time. It will debut this summer on the face-lifted Alfa Romeo Mito.

The foil is produced in one colour and then gradient overprinted for the second. This allows the OEM to retain the black non-reflective upper surface, but use a contrasting colour elsewhere.

The company is also developing door panels with embedded lighting effects, using a translucent foil. Although the process still needs further development, Dr Alexander Jockisch, director of business development and marketing, Benecke-Kaliko, is confident about its future. “[This] will be the next big thing in a couple of years and, in the longer term, displays and things like that will be embedded into the surface material,” he predicts.
ON POLE POSITION

Fast on braking, hot on energy

Shorter and more rapid braking distances are claimed for the new Bosch iBooster system, which recovers almost all the energy lost in typical braking operations by ensuring deceleration rates of up to 0.9g are achieved using the electric motor alone.

A motor integrated into the iBooster controls the degree of brake boosting via a two-stage gear unit for situation-dependent support on demand. This dispenses with the continuous process of generating a vacuum, using either the engine or a vacuum pump. Not only does this save fuel, it also allows more comprehensive use of fuel-saving functions that stop the engine for periods of time, such as start-stop or coasting.

Also, if the predictive emergency braking system detects a dangerous situation, the iBooster can build up full braking pressure autonomously in a mere 120 milliseconds or so – three times faster than previous systems.

High-wire act is fuel saver

Clutch-by-wire is now a reality and could deliver as much as a 10% improvement in fuel economy, claims Bosch.

The mechanical link between the clutch pedal and the hydraulic actuator has been replaced with a sensor that gives the same feedback as a conventional clutch, and an electric wire linked to an AC motor on the hydraulic actuator.

For the first time, this allows manual gearboxes, as opposed to automatics or dual clutch systems, to be disconnected from the engine to allow stop-start coasting while driving. Typically, over a 100km route of mixed roads, this could mean the engine is switched off for a quarter of the journey.

Other benefits for the system, which is currently being assessed by a number of OEMs, includes an anti-stall function, and stop-and-go in traffic jams. All the driver needs to do is use the brake and throttle while leaving the car in first or second gear, with the clutch automatically opening or closing immediately the driver touches the brake or throttle. As the control is linked to the engine management system, shifts can be optimised for ultimate control to prevent clutch abuse when starting on steep inclines and, because of the link between the ECU and clutch control, shift quality will be enhanced, with the prospect of extending clutch life.

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Under-bonnet parts’ tensile strength boosted by Arnite A

As a result of continuous engine downsizing, particularly in the compact car segment, under-bonnet temperatures are going up, putting extra demands on plastics components used in this area. On top of this, identical electronic components used in vehicles sold and used worldwide mean they operate under a wide range of temperature and humidity conditions. Therefore, there is an increasing need for materials that retain key properties such as strength, stiffness and impact strength under demanding hot-humid conditions.

“Injection-moulded parts from conventional PET lose as much as half of their tensile strength after 1,000 hours at 85°C and 85% relative humidity,” says Wouter Gabrielse, automotive segment manager for DSM. “Parts made from DSM’s new hydrolysis-resistant Arnite A PET keep around 90% of their initial strength under the same conditions, according to simulated laboratory conditions in our laboratory.”

Arnite A-X07455 enables substitution of metals or higher cost engineering plastics, such as polyphthalamides (PPA) and polyphenylene sulphide (PPS), in automotive parts that require high dimensional accuracy, strong chemical resistance and very good mechanical properties. It will enable car makers to save on costs and improve fuel efficiency through light weighting, an increasingly important trend.

This hydrolysis-resistant Arnite A is being targeted at a variety of automotive under-bonnet applications, including throttle valve bodies, sensors, air control valve housings, electronic throttle control (ETC) and exhaust gas recirculation (EGR) covers, and ignition systems. It also exhibits high stiffness, strength and dimensional stability.

Arnite A-X07455, which contains 50% glass reinforcement, has a tensile stress at break of 200MPa, according to ISO 527.

Lifecycle focus will determine true carbon profiles

A new study commissioned by the Low Carbon Vehicle Partnership (LowCVP) says that, with increasing efficiencies of powertrains and fuels that contribute to lower emissions during the driving phase of the car, the use of tailpipe CO₂ emissions will become “almost irrelevant, in terms of focusing on true carbon profiles” of future vehicles. As vehicle production phase emission impacts become more significant, “this new research reinforces the need for a lifecycle approach to emissions regulations,” says Coes ten Broek, director, WorldAutoSteel.

“Automakers and others are significantly reducing emissions associated with the vehicle’s use phase through advanced powertrain technologies and fuels. With these efficiencies, the emissions generated during materials production and vehicle manufacturing become increasingly more important and should be accounted for.”

All significant legislation currently focuses on tailpipe or use phase emissions. A more thorough way of measuring automotive CO₂ emissions is by using lifecycle assessment (LCA), which takes into account all of the emissions created during the life of a product — from raw material production through to end-of-life recycling or disposal. The value of a lifecycle approach is illustrated in the chart from the LowCVP PE report, which shows how production phase emissions become dominant with increasingly efficient powertrain technologies, while comparing total vehicle lifecycle emissions for various powertrain and fuel technologies.

Ten Broek also notes that an LCA approach in regulations will provide greater design flexibility in meeting the regulatory requirements for vehicle fleets. “As this chart shows, a lifecycle-based regulation will provide automakers with the ability to develop an optimal mix of technologies to achieve the intended emissions reduction target” he says. “One thing is certain – without LCA, we are not solving the vehicle emissions problem; we are merely shifting it to another vehicle lifecycle phase.”
System detects when drivers are falling asleep

The latest advances in capturing data on brain activity and eye movement are being combined for the potential development of a system that can detect when drivers are in danger of falling asleep at the wheel.

Research undertaken at the University of Leicester, UK, with funding from the Engineering and Physical Sciences Research Council (EPSRC), and in collaboration with the University of Buenos Aires, Argentina, has resulted in a breakthrough.

This combines high-speed eye tracking that records eye movements in unprecedented detail, using cutting-edge infra-red cameras and high-density electroencephalograph (EEG) technology that measures electrical brain activity with millisecond precision through electrodes placed on the scalp.

By developing novel signal processing techniques, the EEG looks for brain signals that only occur in the early stages of sleepiness. The eye tracker would reinforce this by looking for erratic gaze patterns, symptomatic of someone starting to feel drowsy and different from those characteristic of someone driving who is constantly looking out for hazards. Fatigue has been estimated to account for around 20% of traffic accidents on the UK’s motorways.

The challenge will be to devise a system that will not impinge heavily on the driver. No one will want to wear EEG technology while they are actually driving.

MOST® enters the mass market for automotive infotainment and ADAS

First MOST150 Intelligent Network Interface Controller supports USB 2.0 and coaxial physical layer

MOST technology is the de-facto standard in the automotive industry for infotainment and Advanced Driver Assistance System (ADAS) networks. Now, Microchip’s new OS81118 simplifies in-car mobile and WiFi® connectivity over MOST150.

Already used as the backbone for in-car infotainment in more than 140 car models worldwide, MOST’s synchronous network technology delivers cost- and bandwidth-efficiency for transmitting audio, video, data and control information between any attached devices. Its ultra-low latency, high quality of service and minimum hardware is available across three speed grades of 25, 50 and 150 Mbits/s, with support for optical and electrical physical layer.

With 150 Mbits/s bandwidth and an automotive-grade physical layer for Ethernet protocols the highest speed grade, MOST150, now introduces support for in-car internet, email, social networking and connection to the cloud.

To simplify the development of this new level of in-car infotainment, Microchip has released the latest member of its MOST150 INIC family: The OS81118 features on-chip USB 2.0 high-speed device port for easy USB connection to standard Wi-Fi/3G/ LTE modules and to multi-core consumer Systems-on-a-Chip. Additionally the integrated coax transceiver offers a low cost electrical physical layer.

For more information visit: www.microchip.com/get/euOS81118
News in brief

**Compact radar offered**
Denso has developed a smaller and more cost-effective laser radar. To minimise space, the newly developed laser radar features a simpler laser beam generation mechanism than previous versions. Also, the electronic control unit was integrated into the signal processing boards, which were typically separate. Additionally, Denso was able to reduce the overall size of the radar by using a smaller lens.

**JLR proof of concept**
Xchanging, the business process, procurement and technology services provider and integrator, has announced that Jaguar Land Rover has been collaborating with Xchanging and Arynga to create a proof of concept that allows remote software and firmware updates to be sent to vehicles over standard network protocols. The proof of concept has been created on openly available hardware with an Intel CPU, using the Tizen open source Linux distribution as a software platform, with latest HTML5 graphical user interface.

**South Africa venture**
International Automotive Components (IAC) has formed a joint venture with Feltex Automotive, a South Africa-based supplier of automotive flooring, acoustics and trim components. The joint venture, IAC-Feltex Pty Limited (IAC-Feltex), marks IAC’s initial entry into the growing South Africa automotive region. IAC will provide design, engineering and manufacturing expertise for vehicle interior components. It will be located in the East London IDZ automotive supplier park.

**In-cell touch system**
Review Display Systems Ltd (RDS) has introduced Solomon Goldentek Displays’ (SGD) in-cell touch system as an option on custom-passive LCD designs. By using existing X and Y planes needed for the LCD segments as the touch sensor, it is possible to create up to 20 individual switch areas. No extra touch panel or touch controller is required. The projective capacitive touch will project through up to 3mm of polycarbonate, allowing the display to be sealed behind a protective window and still be backlit in the normal way. The system is designed to provide a single-touch function and the touch encoding is handled by a controller integrated into the LCD driver chip.

Getting the habit

Visteon has developed a unique cockpit concept that incorporates artificial intelligence (AI) to deliver an enhanced driving experience. Its Human Bayesian Intelligence Technology (HABIT) system employs machine-learning algorithms that are cognisant to a specific driver and surrounding environment.

The HABIT system continually learns, as it processes a driver’s selections of climate temperatures, radio stations, phone call tendencies and other unique behaviours, depending on the outside temperature and time of day. It factors in the individual’s historical inputs to present a human-machine interaction (HMI) that is customised for the driver. The system also learns the driver’s tastes – even when they are not in the vehicle. For example, HABIT registers activity such as music that the driver has listened to, using his or her on-line music library or internet radio.

“HABIT’s goal is to become an experience that improves each time the driver uses the system,” said Shadi More, innovation manager at Visteon. “With vehicle manufacturers striving to deliver a more personalised driving experience, the HABIT cockpit concept demonstrates how your car can learn and grow with you over its lifetime.”

Pushing the limits for stop-start testing

UK-based low carbon vehicle specialist Controlled Power Technologies (CPT) has completed more than two years of continuous testing to validate its SpeedStart belt-integrated starter-generator for 1.2 million stop-starts, considered to be the industry standard required for a new generation of micro-mild hybrid vehicles. No issues were identified with the technology in any of the data throughout this period of testing, which was followed by a successful teardown and forensic examination of CPT’s motor-generator system.

“We have tested the unit as painstakingly as possible to confirm its capability of stopping and starting an engine beyond the 150,000 to 300,000 stop-starts currently mandated by OEMs,” says Nick Pascoe, chief executive of CPT, “but consistent with the continuing trend towards increasing levels of hybridisation and more opportunities for stop events.”

Stop-start is seen as vital for OEMs when meeting future CO2 levels, especially 2019.

Carbon coating for wear protection

Sulzer Metaplas has developed a new diamond-like carbon (DLC) coating for the automotive industry. The new surface solution A.CARBON combines friction reduction and wear protection to a high-performance coating for many components. An amorphous coating A.CARBON provides wear protection for dry and starved lubrication applications, as well as abrasive and adhesive wear protection in tribological systems. The application of low friction and wear protection coatings, it’s claimed, ensures reliability for the component’s lifetime. This is due to its amorphous structure and the a-C:H:W layer within the multi-layer coating architecture, as well as the resulting high hardness of 22 to 30 GPa.

Although the individual friction reductions might be minimal, by the time they are all added up it represents a useful contribution to better overall fuel usage.
Are you sitting comfortably?

By using the sliding functions of a smart phone, it’s possible to tailor the seat’s position precisely to an individual’s own physique, without any compromises, while a series of bladders in the back rest and the squab itself can fine-tune its profile. It would even be possible for an individual’s physiotherapist to profile the seat for them. It could also help relieve back ache by using the bladders to move to a set pattern and pre-determined intervals to alter pressure points and improve blood circulation.

If the system is combined with Google maps, it would sense what type of road is being driven on and adjust the seating accordingly for motorway cruising or town driving. Continental does admit that there could be legal issues with the seat being adjusted while the car is in motion and that such adjustments would only be carried out, if the car was stationary at traffic lights or tollbooths, for instance.

The seat’s heating and cooling systems could also be tailored to the individual’s requirements far more subtly than the limited preset conditions found in most cars today.

“Basically, this is free, as all the functions already exist in high-end seats with electric adjustments,” a Continental spokesman told Automotive Design, adding: “Technically, we could implement the function today; no extra hardware is needed and it’s all done through the app or widget, and could be downloaded off the OEMs websites. We need to determine if it’s legal to move the seat whilst driving and have that discussion with the authorities.

“We have started demonstrating it to German OEMs and they all say it’s nice, but are cautious about using it.”
Thomas Korn was previously senior project manager for BMW’s hydrogen programme in Oxnard, California, USA. Having spent more than 12 years at BMW, he has extensive experience in working with hydrogen internal combustion and hydrogen refuelling technologies, as well as the certification and homologation processes for hydrogen technologies in the US and Germany.

Korn holds an Applied Physics degree from the University of Applied Science in Munich, Germany. As VP of product management and technology at Ailet Global, he is responsible for engagement with OEMs worldwide. He is married, with two children.
Thomas Korn, Alset Global’s VP of product management and technology, talks to Ian Adecock on the company’s pioneering hydrogen dual fuel system

As the most abundant chemical known to man, hydrogen has the potential to provide a limitless source of energy, but it has never really made the breakthrough into powering vehicles that, perhaps, it should have done - until now, that is.

To date, hydrogen has usually been associated with fuel cell vehicles, although Ford did unveil a supercharged 2.3-litre i-4 in 2003, while Mazda has had a series of hydrogen-powered rotary Wankel engines.

The difference with the Alset Global system is that it is dual fuel, capable of running on petrol, hydrogen or a combination of both: “At Alset, we saw that fuel cells, electric vehicles (EV) etc weren’t really going to challenge diesel and gasoline.

“There is a lot of interest in hydrogen, the right price, and they have a fuel infrastructure that is accepted on the market and in society,” Thomas Korn explains. Alset concluded that, if it were to bring a new, clean technology to the market, it had to be immediately competitive to existing technology, with low add-on costs and meet customer requirements, in terms of durability and freedom of movement, with no range restrictions.

**HYDROGEN ECONOMY**

“The technology needs to be cost efficient and deliver CO2 reductions. Only hybrid systems can meet these needs,” adds Korn. “Electric hybrids are sort of a success, with two million sold in 10 years. EVs don’t work for all the reasons we know, whilst hydrogen is coming and being integrated into the energy chain, with many companies investing in electrolyser technology to store energy to compensate for power peaks and troughs.”

Korn and his Alset colleagues sense that we’re on the verge of the hydrogen economy, but to make its interpretation of a hybrid acceptable to the market, it had to be based around a core competence of the automotive industry – the internal combustion engine.

**THE SET-UP**

The base engine in this application is Aston Martin’s 6.0-litre V12, developing 410kW and 629Nm, suitably modified with a pair of small turbochargers to improve the mixture heating values of the charge by forcing more air/fuel mixture into the combustion chamber when the car is running on hydrogen. A second set of injectors upstream of the regular ones to inject the hydrogen are similar to those used on compressed natural gas (CNG) engines, but modified with high durability seals and materials; the inlet manifold is modified to accommodate the second set of injectors and the additional hydrogen rail that delivers the fuel at 4.5 bar.

The race car was equipped with four Magna Steyr-developed Type 3 350bar fuel tanks, featuring fully wrapped carbon fibre with a 15mm aluminium liner. “700 bar tanks are more costly, but have a higher energy density with more fuel, although it’s more tricky to handle the higher pressure; 350 is a bit older technology, with less density, but much more affordable.”

“We’re working on 700 bar for premium segment cars,” explains Korn, adding: “For commercial applications, the tank systems would be integrated into the flooring, so as not to compromise passenger or boot space – similar to CNG installations.”

The other structural challenge for the team, Korn says, was preventing seepage. “Achieving a very tight sealed system without any leakages, with the proper materials and connectors, was certainly a challenge, but with hydrogen technology being available for some time now and 769/2009 type approval, it didn’t prove to be an issue.”

Hydrogen’s innate combustibility, though, did cause a few headaches, as Korn explains. “Because hydrogen is a very good combustible fuel, with a wide ignition range from 4 to 75% hydrogen in air, you don’t require much energy to ignite it, as it burns six times faster than gasoline. It’s tricky to control the combustion, because of these specific properties, but, if you know how and are able to do it, then, due to its characteristics, you can increase efficiencies much higher than in an Otto engine; comparable, I would say, to an immediate 20-30% gain because of hydrogen’s characteristics.”

**VITAL BREAKTHROUGH**

This, claims Korn, is where Alset has made the vital breakthrough with its patented Alset Engine Operating Software (AEOS) that allows the engine to run on pure hydrogen or petrol, or a blend of both.

“We’re developing technology that uses the best characteristics of both fuels – blending the fuels, depending on each specific driving circumstance, and creating optimum performance and CO2 reduction. We have either pure hydrogen or a micro injection of petrol/air mixture then controlling the combustion of this new compound, adjusted to each driving situation.
The fuelling blend depends on the load requirements. If you’re cruising through the city, it would be a pure hydrogen, lean mixture around Lambda 2, with quite good performance, but not specific power. The moment you need more torque and power, there is a micro injection of liquid fuel, in addition to the mixture of hydrogen/air in the combustion chamber. Then, for maximum power, you have liquid fuel, which, depending on the vehicle and engine, goes up to 30% of the energy. The result is a powerful engine with the carbon footprint of a small car and no range anxiety.” Due to hydrogen’s fast burn rate, the pressure peak can be higher, compared to petrol, creating more mechanical stress on the cylinder head gaskets, piston rings, the valves and, sometimes, the valve seats.

**DRAMATIC CO₂ REDUCTIONS**

Whether the compression ratio is changed or not depends on the engine. “Right now, we have a project where we add it to a non-turbo engine and there we reduced the compression ratio; usually we don’t have to,” comments Korn. “You have to find a way to control the combustion process, so the peak doesn’t happen. Then you can decrease the modifications.”

Engine efficiency can be immediately improved by 20-30%, claims Korn, depending on the engine itself, while range depends on the size of the tank.

Although a little reticent about specific range and performance figures, Korn says that 90% of the driving time would be on hydrogen, resulting in “dramatic” CO₂ reductions for the average driver.

A pure hydrogen solution affects engine performance, because of its lower volumetric energy density, normally losing 17% of power, if there’s stoichiometric combustion of pure hydrogen and compared to pure stoichiometric combustion of gasoline. However, if you could perfectly control the hydrogen combustion, which is very difficult, says Korn, you would still lose 17%.

“Others like Ford and BMW, when they experimented, lost up to 40%. Now, with Alset’s technology, we can compensate for that entirely, because there’s always the possibility, depending on the torque requirements, to inject a micro injection or a bigger portion of liquid fuel.

“Then you can control perfectly the combustion at Lambda 1 and increase energy by fuel in the combustion chamber to compensate for that disadvantage. That’s why we apply this technology to a performance car and the premium segment, because the customer doesn’t suffer any loss in performance.”

Alset, says Korn, is talking to OEMs about putting fleets together in the UK and China, but he wouldn’t be drawn on series production targets beyond saying that system would add a further 10-15% to the car’s price.
Let’s face it; driveline design can be a real brainteaser. Reduced emissions. Improved fuel economy. Enhanced vehicle performance. Getting all the pieces to fit is challenging—especially when you can’t see the whole picture. That’s why you need one more piece to solve the driveline puzzle.

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SAE International’s change is about more than just a new logo. The updated brand unites the organisation around our common purpose of being the ultimate knowledge source for mobility engineers. We already play a critical role in connecting mobility engineers to one another or to information that they need and, with more than 138,000 members worldwide, our branding initiative opens even further possibilities of expansion and unification.

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Finally, and perhaps most importantly, SAE International’s rebranding effort will help us serve our members in more meaningful ways than ever before. A complete redesign of sae.org will accompany the rebranding later this summer.

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Modelling tyre behaviour and how that influences vehicle dynamics is a key factor in developing ride and handling. But, as Ian Adecock discovers, advances at Continental are bringing this goal all the closer

Tyre development is one of the few areas in vehicle advancement that still relies heavily on the expertise and sensitivity of human beings.

The final few per cent that gives a tyre its combination of grip, comfort and low noise can still be determined by how a tyre development engineer feels about the response he or she is getting while driving a car fitted with a particular tyre. In all other areas of vehicle design, number-crunching computer programmes and software can, invariably, get engineers to within a few percentage points of how the finished component will perform. To the extent that, in theory, there’s no need to see cars physically crashed, although legislators will probably always demand that they are.

QUEST FOR THE MISSING LINK
“Once the tyre starts to roll, the deformation and energy or temperature and heat distribution alter and this is a really crucial point in understanding what happens inside the tyre”

The challenge facing tyre developers is the vast spectrum of influences that a tyre undergoes when in use. In most aspects of automotive development, engineers can festoon the car or components with arrays of sensors to get instant feedback. “But you can’t look into the tyre whilst it’s operating; it’s very hard to put any sensor in the tyre that would survive the curing process or very high levels of deformation in real-world driving,” says Dr Achilles Tsotras, product line development tyre mechanics and NVH engineering at Continental Tyres.

MANY CHALLENGES
And while simulation is the only tool that allows him and his colleagues to look inside the tyre and gain an understanding of how it is performing, that solution, too, is fraught with many challenges.

“For many years, simulation was only possible on static tyre performance. One has to know the underlining problems – tyres built mostly from elastomeric materials, polymers, cords and rubber compounds,” he states. “And, in the building process, these materials are exposed to many changes in temperature and strain, so they’re conditioned from raw materials to one which, in the cured tyre, is a long way from the original, with a lot of changes to its composition and chemistry. It was a challenge for many years to predict a new tyre’s geometry and stiffness very precisely, as this is essential to predict later handling performance and rolling resistance. Any inaccuracy in this stage would lead to false results.

“Once the tyre starts to roll, the deformation and energy or temperature and heat distribution alter and this is really a crucial point in understanding what happens inside the tyre when in use.”

HANDLING CHANGE
Different temperatures and changes in materials also happen in tyre life later on, he explains. “The cords, rubber compounds, change their stiffness, depending on temperature levels and conditions; plus, depending on how much strain the rubber has seen, the lower its stiffness [becomes]. Therefore, we have to be in a position to reliably predict how the material is changing in all these conditions. That’s why temperature computation was really an enabler for us to talk about the dissipation of energy, which affects rolling resistance minimisation. So, if we want to have fuel-saving tyres, we need to control and minimise the energy dissipation within the tyre to make it as small as possible.”

“Furthermore,” adds Dr Rafał Nojek, development engineer tyre contour and mechanics, “the tyre’s components change significantly when it warms up, is misused, or subjected to high friction conditions or different road surfaces etc. There are mathematical models and ways to simulate all these things. But, during the operating cycle, they change every one or two seconds, so you can’t calculate everything with one model; it’s very common.
to carry out standardised simulation, but they don’t correspond to driving a car on the open road. That’s why you can’t close the loop.”

As the tyre is constantly changing during use, this poses a series of non-linear challenges that need to be solved and incorporated into a consistent FEM model and then combined with the OEM’s own models, using a simplified interface.

**FLUID DYNAMIC CODES**

For the past decade, Continental has been developing its own software in-house and, says Dr Tsotras, computer capabilities have developed sufficiently for them to compute, robustly, characteristics such as high heat build-up caused by severe slip angles and deformation. It’s now finally possible to have fluid dynamic codes incorporated into their programmes that, when combined with simulations, can predict how the contact patch changes as the water wedge develops in front of the tyre under wet braking or hydroplaning.

What still remains a big challenge for both academia and the automotive industry is how the tyre vibrates, which is to do with the material’s elasticity and the tyre’s structure. The easy part of this is the tyre’s steel components, but how the rubber parts vibrate is still an issue.

“There’s a lot of effort in internal research and working with academia on how we can actually model the interaction between the elastic rubber materials, the road’s roughness and the pattern design – and doing all that without compromising the rest of the performance. We know how to design a silent tyre, but it’s doing that without compromising all the other attributes,” says Dr Nojek.

This is an area of particular concern to Dr-Ing. Christoph Bederna, Continental’s director, NVH engineering. “For each tyre that’s produced, we carry out optimised simulation of the noise pattern, using special tools that calculate the tyre’s excitation as a function of the pattern geometry and the way in which the patterns are shifted against each other,” he points out.

“For the interior noise, which is the vibration over the sidewall and the rim transferred into the vehicle, we have models based on the finite element model of the tyre itself.”
Tread patterns have a big influence over exterior noise, as does the tyre’s width. The broader they are, the more noise they normally generate, whereas noise transmitted to the vehicle’s interior can be influenced by the sidewall height. “If you excite the tyre, so you have a resonance in the tyre itself. The pressure differences in the air in the tyre directly act on the surface of the rim and transfer this frequency into the vehicle.”

TYRE GEOMETRY
The cavity’s frequency is dependent on the tyre’s geometry, rather than its construction, as well as temperature: for every 10°C, the frequency increases by roughly 4Hz, while, by using an internal foam damper, the cavity can be eliminated – and inflating with a gas, instead of air, can shift the frequency. “The trick is to have the damping in the correct position where it helps for NVH, but does not affect the rolling resistance performance too much, because the frequencies are the same,” he adds.

MAJOR BREAKTHROUGH
However, Continental’s big breakthrough is the world’s first indoor automated tyre testing facility, specifically engineered to facilitate year-round brake testing.

Costing an estimated €10 million to design and build, the 300m long Automated Indoor Braking Analyser (AIBA) at its Contidrome test track near Hannover, Germany, can conduct 100,000 braking manoeuvres a year when fully operational and irrespective of ambient weather conditions.

A 1,200hp linear electric drive, as used in high-tech fairground rides, has the capacity to accelerate vehicles weighing up to 3.5 tonnes to 96km/h in under four seconds, though speeds of 110-120km/h are possible. An industry-standard Anthony Best Dynamics braking robot ensures consistent braking throughout the tests.

DIFFERENT SURFACES
The ambient temperature and humidity can be set between 10°C and 25°C to within ±1°C. Engineers have a choice of five different road surfaces with varying degrees of grip and, although it takes only 12 minutes to change from one surface to another, it takes between two to three hours to stabilise ambient temperature, so the changeovers tend to be conducted on a weekly basis. Moreover, adjacent to the main hall, there’s a shorter ice track where temperatures ranging from -1°C to -10°C, with an air temperature range of 5°C to 12°C, mean that ‘winter’ testing can be conducted even on the warmest summer day.

The AIBA is subject to numerous patents, which, says David O’Donnell, head of R&D for Passenger and Light Truck Tires at Continental, “enables us to improve reproducibility by 70%. That means we can measure development progress with an optimum degree of precision and also conduct tests all year round under fully air-conditioned test conditions on interchangeable road surfaces with constant friction coefficients”.

Combine the AIBA with Continental’s advances in modelling tyre behaviour and it could be that the black art in tyre development is about to become that little bit more transparent.
After fuelling and ignition, the valves are the third major system influencing the behaviour and efficiency of petrol and diesel engines. In contrast to fuelling and ignition, however, valve operation has taken much longer to escape the compromises forced by fixed settings: it was only in 1980 that variable valve timing first appeared on a production car engine – the twincam four cylinder from a then still independent and inventive Alfa Romeo.

That two-litre engine featured a mechanical variator on the inlet camshaft only, giving better flexibility and lower emissions, but making little further difference to the driving experience. It was left to Honda to come up with VTEC, which switched the engine over to a more aggressive cam profile as the revs rose. This was the first solution that clearly showed the performance-enhancing benefits of variable valve control: the eager, high-revving engines quickly became a byword amongst sports enthusiasts and, by the end of the ‘90s, most automakers had some form of valve adjustment as a required part of their repertoire.

The steadily increasing sophistication of systems such as VTEC, BMW’s Vanos and Valvetronic, and Toyota’s Valvematic saw control of the valves extend beyond just timing and overlap to encompass adjustment of lift, too. This provided engine designers with the biggest prize of all: controlling airflow into the cylinder using the valve, rather than a throttle butterfly, allowed the near elimination of pumping losses, a major source of inefficiency. BMW was first on the market with such a system, claiming substantial CO₂ savings; others have followed suit, generally with simpler arrangements, but still providing many more degrees of freedom than designers had previously been granted.

WHAT LIES BEYOND

“Variable valve timing for petrol engines is almost ubiquitous,” says Richard Osborne, chief engineer for gasoline engines at engineering specialist Ricardo. “And variable lift has been in the market for over 10 years – so now the question is whether we want to go beyond that.”

The answer, says Osborne, is probably not yet. While there could be opportunities with entirely different cycles, such as HCCI and controlled auto ignition (see later), that would require greater freedoms in valve control. The optimisation of conventional operating modes is probably the more important task right now.

The variable valve timing and lift systems that are already in the market...
Valve control systems

cylinder switch-off is one of the cleverest tricks performed by intelligent valve control systems. Initially seen on larger V6 and V8 engines where the dynamics are easier to manage, cylinder deactivation made its first appearance on a four-cylinder engine, from Volkswagen, in 2012.

The neat solution, labelled Active Cylinder Management, in effect works like a cam-profile switching mechanism, with the cam followers moving from a conventional cam lobe to a zero-lift cam. This keeps the valve shut and the air trapped inside the cylinder. As soon as the driver requires full power, the stationary valves are re-engaged within one half a revolution of the camshaft. Fitted to the 1.4 litre gasoline TSi engine, ACT operates between 1,250 and 4,000 rpm when torque demand lies between 25 and 100 Nm. Some 70% of the NEDC is conducted under these conditions, leading to claimed fuel savings of between 0.4 and 1.0 litres per 100 km.

VW’s system shares its principles with that on V8-engined Audis and Bentleys, where the fuel savings are even more significant. However, many North American V-configuration engines still feature pushrod valve operation, where the single camshaft is located in the block. This architecture presents inherent problems for valve control and it was only in 2007 that Chrysler was able to pioneer variable valve timing (on the V10 Viper) using a concentric cam-in-cam arrangement developed by Mechadyne and Mahle. Others have simple cam phasers where both inlet and exhaust valves are shifted at the same time. Cylinder deactivation presents a parallel challenge. The preferred solution, as shown by Delphi with its Deactivation Roller Hydraulic Lifters, is to shut off selected cylinders by absorbing the cam lobe’s motion within the lifter, thus keeping the pushrod, rocker and valve stationary. The new Corvette Stingray has just such an arrangement, dubbed Active Fuel Management.

Honda’s V6 Accord, by contrast, has full ohc valve control and can run in six-, four- or three-cylinder modes. In the latter mode, only the front bank of cylinders is active.

ENGINEERING SOLUTIONS

While cam phasers are now a near-universal fit on modern engines, their design and layout depends on engine architecture – most notably whether the engine is sohc or dohc. Most phasers work using hydraulic pressure, but recently, says Ricardo’s Richard Osborne, niche applications have been turning to electric versions from suppliers such as Denso and Hitachi. Though more expensive, these have the advantage of faster response, a wider range of operation and the fact that they can move when the engine is stationary – to the advantage of cold-start emissions.

A broader variety of solutions is evident where the VVT application also includes variable valve lift. Here, package height is an important consideration, particularly with today’s emphasis on pedestrian safety and under-bonnet clearance. The systems fall into two broad categories: cam profile switching systems, such as Audi’s Valvelift, where individual cylinder control is possible, but there are two
discrete settings, rather than a stepless band of adjustment. Most automakers, notably BMW, with Valvetronic, Toyota, Nissan and now GM, have chosen to vary lift, using an extra shaft, on an eccentric and driven by a stepper motor to alter the geometry of the rockers and thus the stroke of the valve. This arrangement does, however, make individual cylinder control more difficult.

KSPG’s UniValve system takes the Valvetronic thinking a step further, offering the potential of individual valve control. It can be applied to both inlet and exhaust sides of the engine, and claims a 12% reduction in fuel consumption. KSPG also has the benefit of the advanced work of the UK’s Mechatyndne, which it took over in 2012.

Finally, Fiat’s MultiAir uses electrohydraulics to modulate the transfer of movement between the inlet cam and valves, and is widely admired within the engineering community. “It’s the most flexible system that’s actually in production,” says Osborne. “It goes a long way towards the optimisation of conventional operating modes.”

Conventional wisdom has it that valve control is most important for petrol engines where pumping losses are a major problem. Yet Osborne’s diesel colleagues at Ricardo say cam profile switching systems can be useful in several ways: early exhaust valve opening can be exploited to heat the catalyst system and the geometric compression ratio can be effectively reduced (for greater efficiency), yet also be high enough to deal with cold starts.

MEETING NOx STANDARDS

In addition, says Osborne, asymmetric independent control of inlet valve opening can be used to vary swirl and perform internal EGR. This is to be introduced by VW, while the Mazda SkyActiv D engine already has a second exhaust valve event (through an extra lobe on the camshaft) to achieve internal EGR. This enables it to meet NOx standards, without needing a costly after-treatment system.

It has long been the engineer’s dream to decouple valve operation from crankshaft position and achieve totally independent control of each individual valve. Many F1 racing engines employed such systems and suppliers such as Valeo have spent many years on concepts for camless engines. More recently, as featured in this magazine’s last issue, Camcon Automotive has extolled the advantages of its prototype Intelligent Valve Actuation systems in enabling a whole spectrum of new combustion strategies to be introduced.

Yet, argues Ricardo’s Osborne, though complete freedom in valve actuation is great for research, it is still no closer to production and the trend towards downspeeding has made its high-speed advantages irrelevant outside motorsport. Nevertheless, for advanced engine concepts such as HCCI and CAI (controlled auto ignition), independent valve actuation would be important.

“You have modes like exhaust rebreathing, where you use a second valve event to draw gases back in,” he points out, “and for catalyst heating you might see some advantage in a secondary opening event.” Independent valve control would also be an enabler for smooth transition between Otto, Atkinson and Miller combustion cycles, and even two- and four-stroke operation, according to Osborne.

Overall, however, it appears clear that mechanically-based variable valve lift systems, along with Fiat’s electro-hydraulic enhancement of the principle, provide more than enough flexibility to meet today’s and tomorrow’s emissions requirements – and it is equally clear that alternative non-camshaft based systems will have to show some very convincing advantages, in terms of performance, packaging and cost, before mainstream automakers will consider making the switch.
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On the right track
Mapping data can help systems understand where other vehicles are in relation to the road, writes Terry Costlow

Active safety systems rely on input from a number of onboard sensors to monitor driving conditions and watch for situations that may cause accidents. A number of design teams are beginning to consider external inputs as a way to augment or even replace these sensors.

Instead of relying solely on vehicle sensors like cameras and radars, some engineers are considering ways to expand the level of knowledge by combining data sent from GPS satellites with data from the vehicle’s navigation system.

More companies are studying vehicle-to-vehicle and vehicle-to-infrastructure communications, jointly abbreviated V2X. This communication technology uses dedicated short range communications to provide data that usually can’t be collected by onboard sensors.

**HIGHWAY TESTS**

Though V2X isn’t yet near production, major on-highway tests are now finishing up in the US. Regulators will use data from these road tests when they determine whether to set some sort of mandate for putting V2X equipment on vehicles. Many companies feel that the promise for improved safety and better traffic flow is great enough that they are considering adopting this technology.

“Along with cameras, LiDAR and radar, there’s a piece that’s not there yet – V2X communications,” says Doug Patton, senior vice president of engineering for Denso International America Inc. “V2X gives you non-line-of-site information. No other sensor does that for you.”

Getting braking information or other data from unseen vehicles far ahead will let cars slow down well before drivers or onboard sensors can see that a potential problem is arising. This can not only enhance safety, but also help improve fuel economy and reduce traffic slowdowns.

“V2X can extend the range of radar and camera sensors on vehicles today, allowing vehicles to share traffic and road information in real time with each other and the network, further expanding the ‘cocoon of safety’ around the vehicle,” states Jeff Owens, Delphi’s chief technology officer. “Looking even further, these systems will enable highway platooning and fully autonomous driving.”

**ROADBLOCK**

One roadblock for V2X is that there must be a fair number of nodes on roadways, so there is a critical mass of vehicles that can communicate with each other. A mandate would ensure that numbers will rise, but some feel the benefits are great enough that commercial vehicle and other fleets may employ the technology, even without a mandate.

Strategists are now working on the technology, so they’re ready if either of these reasons spark growth. Some are even looking into the long term, when V2X may let system designers replace some sensors now used for advanced driver assistance systems (ADAS).

“V2X can provide a lower cost system than traditional ADAS,” comments Brian Daugherty, associate director of advanced development at Visteon. “V2X will complement ADAS on many vehicles, but could be offered as an alternative to ADAS on lower cost vehicles. ADAS provides an excellent, but relatively short-range, solution, whereas V2X increases the detection range. It also provides additional functionality, such as intersection cross-traffic warnings, slippery road ahead warnings and emergency electronic brake light, which allows vehicles to ‘see’ braking cars that are blocked from view by the car immediately ahead.”

**SAFE GROUND**

While some engineers consider the trade-offs for adding sensors or V2X communications, others are determining how GPS and mapping data can be used to augment sensors. Knowing whether the vehicle’s going around a curve or up a hill can be helpful information for a safety system.

“You can use navigation and GPS input in a matrix with radar and cameras to help confirm that you’re on the right track,” says Alois Seewald, global director, research and development and cognitive safety integration, at TRW Automotive. “Maps and GPS data can tell you you’re going around a curve, so the vehicle that’s turning in front of you is not switching into your lane; it’s just going around a curve.”

However, today’s map data are not usually thought to be precise enough for safety. Still, it can provide useful input. Over time, map data will continue to improve, with better coverage and more accurate information regarding road curvature, but it will always be subject to change.

“Maps will be used as an additional sensor, but data will be regarded as inaccurate. Systems won’t rely on it alone,” adds Martin Schleicher, vice president of strategic development at Elektrobit Automotive. “Map data will be reviewed in conjunction with other sensors when there is a conflict. Map data can never be perfect; things can change for construction or other factors.”
The automotive sector is seeking out increasingly lightweight solutions to help OEMs meet tight emissions and fuel consumption targets. BASF is one company heeding that call, as Ian Adcock finds out.

That lighter touch

The automotive sector at present accounts for 15% of BASF sales, according to Dr Martin Budermüller, vice chairman of the board of executive directors, and, although he wouldn’t predict how much it would grow by in the future, he reports an increasing demand for lightweight solutions in the automotive sector to help OEMs meet strict emissions and fuel consumption targets in the future.

Currently, the average plastic content per vehicle globally is about 160kgs or 12-15% of vehicle weight. Over a 150,000kms lifecycle, that results in a saving of approximately 750 litres of fuel per car and, while there are numerous existing automotive applications, ranging from interior trim to oil pans, there is significant potential for continuous fibre reinforced plastics, or composites, in body and chassis that, claims BASF, could save upwards of 60% in weight, compared to a steel version.

SIGNIFICANT INVESTMENT

BASF predicts the market for composite body and chassis components will reach €2 billion by 2025-30 and is investing “a high double digit million Euro sum” into research and development into the fields of thermoplastic and thermoset composite materials for vehicle light weighting over the next three years.

The first evidence of this investment was the installation of a high capacity composite production pilot plant, using in mould forming/over moulding process to produce multi-functional composite test specimens, at its Ludwigshafen facility, which became operational last March.

And, at the K2013 in October, BASF will offer the automotive industry for the first time a package of prefabricated, plastic impregnated fibre fabrics and plastic pellets for over moulding as a complete development platform.

Called Ultracom, it comprises three components: continuous fibre reinforced semi-finished laminates, based on woven fabrics impregnated with Ultrimid or Ultradur; adapted over moulding compounds, developed for use with these laminates; and the complementary engineering support.

Shocking treatment

BASF has developed an antistatic, thermoplastic polyurethane (TPU) granule under the brand name of Elastostat, which can be used as a masterbatch – ie, as a ready-to-use granular mix.

Elastostat, claims BASF, has the advantage over existing solutions, in that its antistatic effect is permanent and doesn’t require any specific ambient conditions, such as a certain atmospheric humidity.

Plastic surfaces in vehicles are particularly prone to electrostatic charging, especially in very dry or cold conditions when an elevated surface tension can cause materials used on the fascia, seat covers etc to attract dust and dirt particles. The antistatic masterbatch can be used in both film extrusion and injection moulding to significantly reduce this phenomenon.
The manufacturing process that forms the laminate uses both draping or in-mould forming, followed by over moulding and represents, claims Dr Reinhard Jakobi, BASF’s head of processing technology, “the most promising approach for production of structural components from laminates and injection moulding compounds”.

The key to achieving sub-60 seconds production times is a six-axis robot, a trio of clamping frames and an infrared (IR) heating station, all supplied by FPT Robotik GmbH & Co.KG. While one clamping frame is in the injection moulding machine, the second frame is holding the laminate in the 250°C IR oven, as the robot inserts the new laminate in the third frame.

In order to explore all aspects of composite design with its new cell, BASF developed a test part. Known as CIFO (combination of in-mould forming and over moulding), the 1,600 sq cms part has 1.5mm formed laminates and 20 3mm moulded-on functional elements, such as ribs and edges designed to create over moulded edges, long flow paths, punched or formed holes. Additional elements include an array of ribs for crash investigations, a variety of wall/rib thicknesses, transitions between laminates and over moulded materials.

This new facility is now available for customer-specific projects with the mould, gripper, clamping frames and robot kinematics designed to a client’s particular components.

Presently, the majority of work involves laminates, but by K2013 uni-directionally oriented fibres and tapes consolidated into sheets will be available.

Steron, BASF’s polyurethane-based coating for plastics and leather applications, is now coming to market. When applied to the substrate, it gives a smooth, velvety-like feel to the material, complementing the trend towards creating a sense of well-being in the car.

It has already been used on seat covers for the smart forvision side panels for the Hyundai HED-7, as well as Ioniq concept car’s seats and interior components.

Compared to leather, which can account for up to 25 kgs per vehicle, Steron can offer weight savings of up to 50%.

The first licensee for Steron is the Pune, India, based AIM Filtertec, which is due to start production in September. It is thought that VW is the first OEM customer.
IN GREAT TRIM

Dr Alexander Jockisch explains why Benecke-Kaliko, just three years short of its tri-centenary, is the world’s leading supplier of automotive interior trim.

“Sustainability is an important topic for us as well, because our materials are the direct interface between the human being and the car’s interior. So environmental friendliness was always extremely important to us and there’s continuous upgrading of our products to reduce odour and emissions.”
One important part of our success is that we manufacture superior products from a haptic and quality point of view; and, to achieve that, we need a lot of knowledge about the materials and processes, and how our materials are used in the car. Because we can achieve that, we are the number one supplier in the world for decorative surfaces.

“Sustainability is an important topic for us as well, because our materials are the direct interface between the human being and the car’s interior. So environmental friendliness was always extremely important to us and there’s continuous upgrading of our products to reduce odour and emissions.”

Low interior emissions

Given that its cities are some of the most polluted on the planet, it is surprising to learn that it is the Chinese authorities that are making the most strident calls for low interior emissions from interior materials, as Jockisch explains: “The Chinese government really focuses on green aspects. They’re trying to set the same standard as here in Europe. The second thing is that Asian people, and especially the Chinese, have a different sense of smell than we do. An odour that someone from the United States or Europe doesn’t have a problem with, or smells good, can be a totally different story in China.

“We know that the smell of a car from Europe is a problem for Chinese customers. The Chinese government is, in fact, pushing for interior smell levels that will be significantly better than either the USA or Europe. This is a big challenge, but for us it’s good, because we have a clear advantage over our rivals in China, as for more than 30 years we’ve been working on how to develop these materials and test them.

“The odours are significantly lower, but I think there’s almost no material in the world that is odour free. Because we add very high quality plasticisers, we don’t use any of those currently under discussion [for potential elimination]. The next challenge for Acella Eco green is to deliver it with the same properties, but with up to 50% natural materials.”

Allergenic-free

“Western OEMs, too, are under heavy pressure to reduce the smell and fogging values in car interiors. By using Acella Eco green material in seating applications, we have been able to remove all the harmful constituents. This results in very low smell and emissions, free of allergenic materials and tested against the EcoTest 100 standard. In Germany, you can’t sell any material that doesn’t comply with that – that guarantees the material can be in direct contact with human skin for an indefinite time, without causing any harm.”

Passenger safety, even for a downstream supplier like Benecke-Kaliko, is a prime concern, says Jockisch. “Today, technical foils play a very important part in decoration and even safety. Nowadays, cars have invisible airbags and they have to open in a well-defined time; nor can they be damaged by, for example, the surface material or very low temperatures. Furthermore, there can be no particle shredding that could cause any harm to the passengers and this means, overall, [the airbag] must be perfectly matched with a specific part and airbag module. That’s possible with a lot of technology inside the foil to ensure you have the perfect airbag opening. From Alfa Romeo to Volvo, there’s almost no OEM that doesn’t use our foils in the interiors of their cars.”

As manufacturers such as Audi, BMW and Mercedes-Benz stretch their product sectors to include models that would have been unheard of even 15 years ago, there’s a “strong trend”, asserts Jockisch, to have stitch lines in interiors, carried out by the Tier One interior suppliers. “Stitch lines not just in the S-class or Rolls-Royce, but in smaller cars as well. For instance, you can get a stitch line instrument panel for a Mercedes-Benz A-class.

Know-how

“It’s very important to have a lot of know-how about processing the materials, because the surface of the material changes significantly during the processing – from the material that leaves our plants to the finished product. When it’s stretched, you can get colour changes or it can affect the gloss and grain.”

Shedding weight has become almost an obsession with OEMs, as they strive to meet stringent fuel consumption legislation, and Benecke-Kaliko is playing its part, says Jockisch, having developed a lightweight decorative material. “Yorn Light is a hybrid foam laminate material with a pvc surface and a lightweight polyolefin foam backing that’s half the weight of standard decorative materials, with 46% better CO2 balance, compared to standard PVC foils. This soft-touch material is available in a variety of grains and bi-tone colours, and, although it might increase the cost of interiors by €100-150, depending on the car, it can save up to 4kgs per interior.”
Towards an accident-free future

“We are going to base our driver assistance functions on certain components. For instance, we have a couple of different radar systems and we use them for different applications, such as ACC and rear radar, where it can detect cross traffic. This is based on the same technology. I would call it a modular approach, rather than off the shelf.

“EuroNCAP is the main driver for the next generation of driver assistance coming to market in 2014-16, and here we will see emergency brake systems and pedestrian protection technology, with added value functions, like cruise assist, where you can autonomously follow another car up to a certain speed, as well as lane assist. There are two main drivers at the moment: safety, and that’s reflected in EuroNCAP; and the other is comfort, while construction zone assist is added value.

“Driver assistance is already established in the mass market with cars like the latest generation VW Golf. The democratisation of this technology has already started. But it’s a good point regarding the BRIC and other emerging nations where it’s a big challenge to reduce road deaths. The UN has instigated this ‘Decade of Action’ where, if we don’t do anything by 2020, the number of people killed on the road will be about 1.9 million and we need to cut that by half at least. That means sufficient take-up of ESP and ABS in emerging countries. In India, there are hardly any cars with ABS. We’re in discussion with customers to see if they’re willing to equip their cars 100% with ABS. That’s the first step to avoid those classic braking accidents.

“Right or wrong, we have these different NCAP organisations in Europe, the USA and Japan, and they’re focusing on their own needs. In the USA, using the smartphone in the car causes the majority of accidents. We see all the NCAP organisations working together to try to align themselves.

“In an ideal world, they would all be commonised, but we’re not going to change the political system. Where the responsibility lies with autonomous driving is a critical issue, especially when it comes to insurance liability. In the end, the driver has to retain command and control of the vehicle, in line with the Vienna convention.

“With all this technology and cloud-based information, it’s a good question to ask about the potential misuse of data and how you protect an individual’s privacy. Whether we like it or not, the data is out there, and can be tracked and used by the wrong people.”
Many say the automotive industry could well be standing before a paradigm shift with respect to propulsion. If so, a future that uses environmentally friendly motors partially or entirely powered by electricity represents one of the most challenging and profound technological transformations of our time.

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