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CAMARO NASCAR

How ZL1 was developed to carry legendary brand to the top

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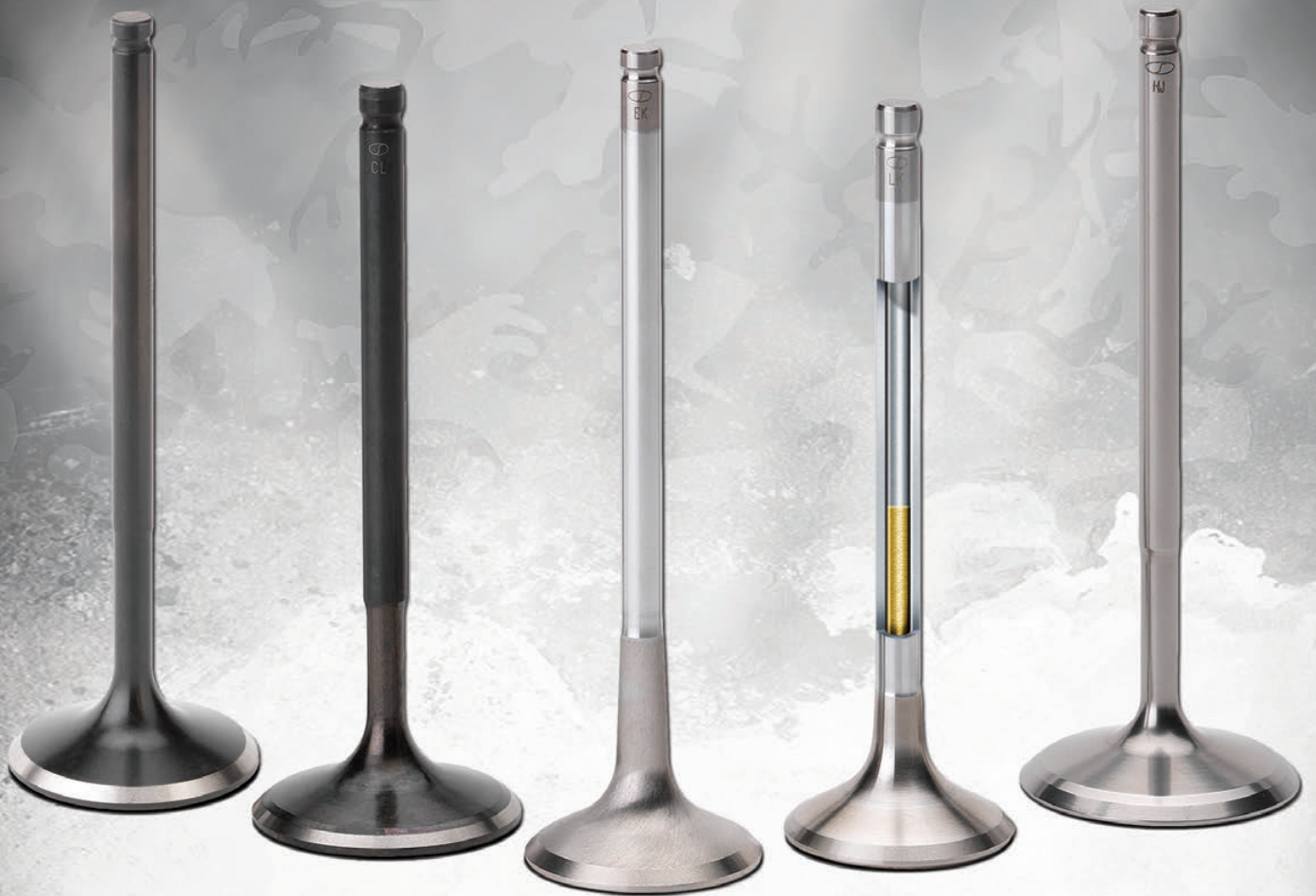
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Dan Gurney, the evil of plastic and educating the educators

I consider myself lucky and that is because I managed to meet Dan Gurney, a hero from virtually my boyhood, just two or three years ago when visiting California. It wasn't a formal visit, and I didn't interview him, but I did have a very memorable chat with him. That he is no longer with us is deeply saddening.

As has been pointed out by Sergio Rinland and Ben Bowlby in this issue, he was more than just a racing driver and team owner, he was an inspiration, one who never accepted the status quo and who was always open to ideas. He was the one who enabled Ben to work on and complete DeltaWing and bring it to Le Mans in 2012 when pretty well everyone else had washed their hands of the project.

Quite what he would have thought of the homework my four and a half year granddaughter had to do recently, I'm not sure, but she was set the question "What harm does plastic do the environment? Talk about plastic pollution and why it might be bad." Apart from being a pretty loaded question, it also puts in the mind of the really young that plastic is universally bad. It's a black and white question that in my view should not be set for someone even twice her age. A friend of hers of the same age also told me that all petrol and diesel cars are bad. Only electric cars are good. He knew because his teacher said so, so it was true.

So our children, well at least in the UK, are already being got at by the state education system that such things are "bad". It means that by the time they come into society in whatever capacity, their minds will have long been set. It's also not good news for motorsport as we know it.

I don't really want to carry on about this

theme any more as I have already written too much about it, but what I would like to see is some commonsense engineering enter the equation and the education system. We have the superb Formula 1 in Schools, but we need more, much more. We need to educate the educators not to be sucked in by the half truths they subscribe to.

I think it needs to be driven from the top, and that means Formula 1 and NASCAR, both bodies have an absolute responsibility in my view to engage with the educationalists whenever and wherever they can. I know there is STEM, but we need more. There needs to be some original thinking going on.

What I would like to see, although to be honest I cannot see anyone doing it, is for a motorsport and education conference whereby the sports leading bodies put forward programmes and engage with universities and probably more importantly schools and the relevant government departments to get a dialogue going. As I said, we need to engage with and enthuse the educators because if we don't, we will have a whole generation who simply do not comprehend the big picture. Plastics bad! Engines bad! What will be next?

Quite what Dan Gurney would think of this I don't know, but I would hope that such an idea would have his backing. **RT**

William Kimberley
EDITOR



IndyCar still seeking a 3rd manufacturer

William Kimberley

DETROIT, MI: IndyCar is actively seeking a third manufacturer to join the series. At the recent Detroit Motor Show, Mark Miles, the president and CEO of Hulman & Company, the parent company of IndyCar, restated why growth is a continual priority after unveiling the Verizon IndyCar Series' newly redesigned car with a universal aero kit.

"We're standing here at the North American International Auto Show and you just see the marketing power of these companies," he said, referring to the many eye-catching displays in the halls. "Our two engine manufacturers, Chevrolet and Honda, are great, but add another one and, sure, there would be an alternative engine supplier and that's important, but there would also be a third major global company that's invested in and marketing the series."

Miles went on to say that Jay Frye, IndyCar's president of competition and operations, visited six prospective engine manufacturers after Sonoma at the end of last year. "He talked to those companies for their input just as though they were Honda and Chevy, and already engaged."

Frye reiterated that interest from prospective engine manufacturers and how IndyCar's current plan — to use this car from 2018 to 2020 with an option year in 2021 — is conducive to bringing in a third builder.

"We talked to other engine manufacturer friends, partners," he said. "Many engine manufacturers who aren't in IndyCar are nonetheless IndyCar fans or have been in IndyCar. They're paying attention. We wanted their opinion."

Both Frye and Miles said Chevrolet and Honda would also welcome the competition. "Chevrolet and Honda have been hugely supportive," said Frye. "It helps feed the whole ecosystem. If another manufacturer comes in, it's good for the racetrack, it's good for the broadcast partners, it's good for the teams, and it's good for everybody. Chevrolet and Honda do a spectacular job. If we could have one more, that would be a good thing.

"We're showing them that we're paying attention and listening, here's our approach and our plan. If they came in, it would be very simple. We have a two-month window here that we could possibly get one to come in for '20. If we miss this window, it would be '21."

Miles said there's no such thing as IndyCar being satisfied with where it is now. Thoughts are always on the future, how the sanctioning organisation and its premier series can continue to thrive and grow.

"I quickly get tired of saying we're positioned for growth," he said. "We're here to talk about how we have grown, we are growing and the future trajectory continues to be up. There's a lot to celebrate.

At the same time, engine development has been slowed down. Both Chevrolet and Honda have agreed in a gentleman's



ABOVE Actively seeking another car manufacturer to join IndyCar

agreement to reduce the work on their respective powerplants, despite it being an even year when under the IndyCar engine regulations drawn up in 2012, development was allowed unlike in odd years when it is severely restricted.

This agreement was drawn up to stop both companies spending minor fortunes eking out any performance gains on what is now quite an old engine. It is now going into its seventh year in a formula that was expected to last just four years. Both manufacturers are also aware of the pending engine regulations changes due in the next couple of years. **IT**



ABOVE Jay Frye has been in dialogue with a number of engine manufacturers

BELOW The sleek new body kit was designed from the ground up to be attractive, as well as promoting exciting racing



New IndyCar officially breaks cover

Alan Stoddart

DETROIT, MI: IndyCar officially launched its new-for-2018 car package at the Detroit Motor Show in January. The unveiling of the Dallara IR-12 chassis and its Universal Aero Kit was watched by key executives from manufacturing rivals Chevrolet and Honda, as well as open-wheel racing greats Mario Andretti, Bobby Rahal and Roger Penske.

Early testing of the 2018 car has shown a livelier racer with less downforce, less drag and faster straightline speed, all wrapped in a sleeker package.

"We're having trouble finding a critic," said Mark Miles CEO of Hulman & Company, IndyCar's parent. We believe that the changes that have been made will provide for great racing, more passing, more

exciting racing. So we expect that to be great news for the ongoing growth of the series and we're looking forward to seeing this beautiful car in action."

The Universal Aero Kit puts an end to the aero kit competition between Chevrolet and Honda. Those kits sought to continually add downforce for higher cornering speeds – much of it generated by winglets and aero attachments. The new universal kit produces less downforce overall than the previous bodies, and most of that comes from the underwing on the bottom of the car.

The aesthetics of the kit were also considered from the start of the development process - it was always intended to be sleek, bold and reminiscent of fan favourites from the 1980s and '90s. From there the aerodynamic and safety

objectives were achieved without sacrificing the attractive appearance.

Josef Newgarden, who won the 2017 IndyCar Series, was enthusiastic about the changes. "We believe it's going to be faster, we believe it's going to be safer, it's going to provide better racing like we've talked about," he said.

"We want it to be an incredible-looking Indy car. We want people to come back to the IndyCar Series and love what we're producing from an aesthetic standpoint, but the message that we really want to push is that our racing product is going to be the best on the planet. Speaking as a driver, I don't think you're going to get a better race car out there to drive as far as an open-wheel car goes. You're really going to have a great racing product." **RT**

TCR UK announces partnerships with Öhlins and Yokohama

Alan Stoddart

BIRMINGHAM, UK: TCR UK has announced that it has confirmed its suspension and tyre partners for its inaugural 2018 season. Öhlins and Yokohama both confirmed their support for the rapidly growing category at the Autosport International show in January.

Öhlins will be represented on site in the TCR UK's seven rounds in the form of its distributor, Mick Gardner Racing, and will be able to serve and advise teams as the exclusive on-event suspension service.

"We have a new venture with TCR UK and we are excited to be part of the new race series based on the TCR concept which is growing rapidly," Chris Witter, the general manager of



ABOVE The confirmation of Yokohama as TCR UK's tyre supplier means teams are able to start testing race set ups

Öhlins distribution and test centre, told *Race Tech*. "We use our standard TTX-based shock absorbers, which is the kind of product you'd see fitted to a GT car for example, and we've taken this and applied it to TCR in a more budget oriented form."

Witter emphasises that the partnership is as much about supporting race teams at the track as it is about being present on the cars themselves. This support even stretches as far as embracing the series' cost-conscious ethos.

"It's important that the teams have the backup and knowledge to work with the product," he said. "For example, it can help them get the longest life out of the tyres by making sure the cars are correctly balanced and set up. It makes the racing more cost effective for them because the tyre life will be improved."

Öhlins believes that the tie-up will be good for both itself and for TCR UK. The Swedish firm will be able to demonstrate the abilities of its shock absorbers in cars very similar to those that can be tracked by enthusiasts, while teams in the championship will benefit from high-end technology and expert support.

"We made contact with TCR UK and they saw the value in having a high-end brand like Öhlins on board, and the rest is now

history," concluded Witter.

Yokohama meanwhile, which was chosen in part because of its long association with Touring Car racing, is set to offer two tyres for TCR UK. For dry tracks the Japanese firm will offer its A005 racing slicks while the A006 rain tyre will be used in wet conditions. Both options will be provided in 250/660 R18 size.

The confirmation of the series' tyre supplier means that teams will now be able to begin testing with the rubber they'll be using during the actual racing, which gets underway at Silverstone over the Easter weekend.

"The new TCR UK championship is set to be one of the most exciting series

in British motorsport and we're incredibly proud that Yokohama is playing a pivotal role from the outset," said Yokohama HPT's head of motorsport Mark Evans. "The cars will be fitted with our proven motorsport products, which have delivered fantastic successes for many drivers around the world. Given their impressive levels of performance and reliability, we are confident that the tyres will help produce a first class racing spectacle." 

ABOVE The Öhlins TTX 36 shock absorber which will be used by teams in the TCR UK series

Duo Motorsport with HMS reveals Alfa Romeo for BTCC

Alan Stoddart

BIRMINGHAM, UK: Dunlop MSA British Touring Car Championship team Team Duo Motorsport with HMS has revealed its newly constructed Alfa Romeo Giulietta, which is set to take on this season's championship.

After little more than four months since it officially confirmed that it would bring the iconic Italian brand back to the BTCC through a tie-up with the Alfa Romeo Dealer Council, Duo Motorsport revealed the new-for-2018 entrant at the Autosport show in Birmingham with HMS driver Rob Austin and team principal Simon Belcher.

As well as revealing the new car, the pair also announced an enhanced commercial partnership with long-standing sponsor Duo, resulting in the team being entered in this year's championship as Duo Motorsport with HMS.

"We are so proud to be unveiling the new Alfa finally," Austin enthused. "Everyone in our team has put in an incredible amount of work to keep the project on schedule while maintaining an impressive attention to detail.

"To see the Alfa here today is the result of the hard work and passion of so many people, and also the passion of our fantastic



ABOVE The brand new Team Duo Motorsport with HMS Alfa Romeo Giulietta attracted a lot of interest when it was unveiled at the Autosport International show in January

sponsors. We consistently work hard to provide them all with unquestionable value from their support year-on-year and, as such, our partnerships strengthen and grow."

Duo Motorsport with HMS is now focused on a comprehensive winter testing programme ahead of the opening weekend of the new season at Brands Hatch on the 7-8 of April. Austin and Belcher are confident that the squad will be able to make significant progress with the development and the set-up of the Giulietta over the coming weeks.

"All in all, we are in a very good place", Austin added. "We have a great team of guys here who have built a beautiful BTCC car which, on paper, looks to be a notable step forward from our previous car. This is the biggest and most important season of my 27-year career, and I cannot describe how excited, motivated and determined I am." 

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ABOVE The 308TCR was designed by Peugeot Sport with the help of designers from the Centre de Style Peugeot, where aerodynamics were a key concern

Peugeot launches upgraded 308TCR

Alan Stoddart

PARIS, France: Peugeot has revealed its new 308TCR, which is ready to compete in the inaugural season of the World Touring Car Cup.

The model is distinct from the 308 Racing Cup, which the French manufacturer had previously made to TCR rules and entered in various regional series last year. Peugeot describes the new 308TCR as a 'significant evolution' of the 308 Racing Cup, but with a different philosophy targeting 'absolute performance'.

The car's engine has been proven to withstand significant amounts of power per litre. It has undergone extensive work to the induction, the exhaust and turbocharging, meaning the 4-cylinder block puts out 350 horsepower and 310

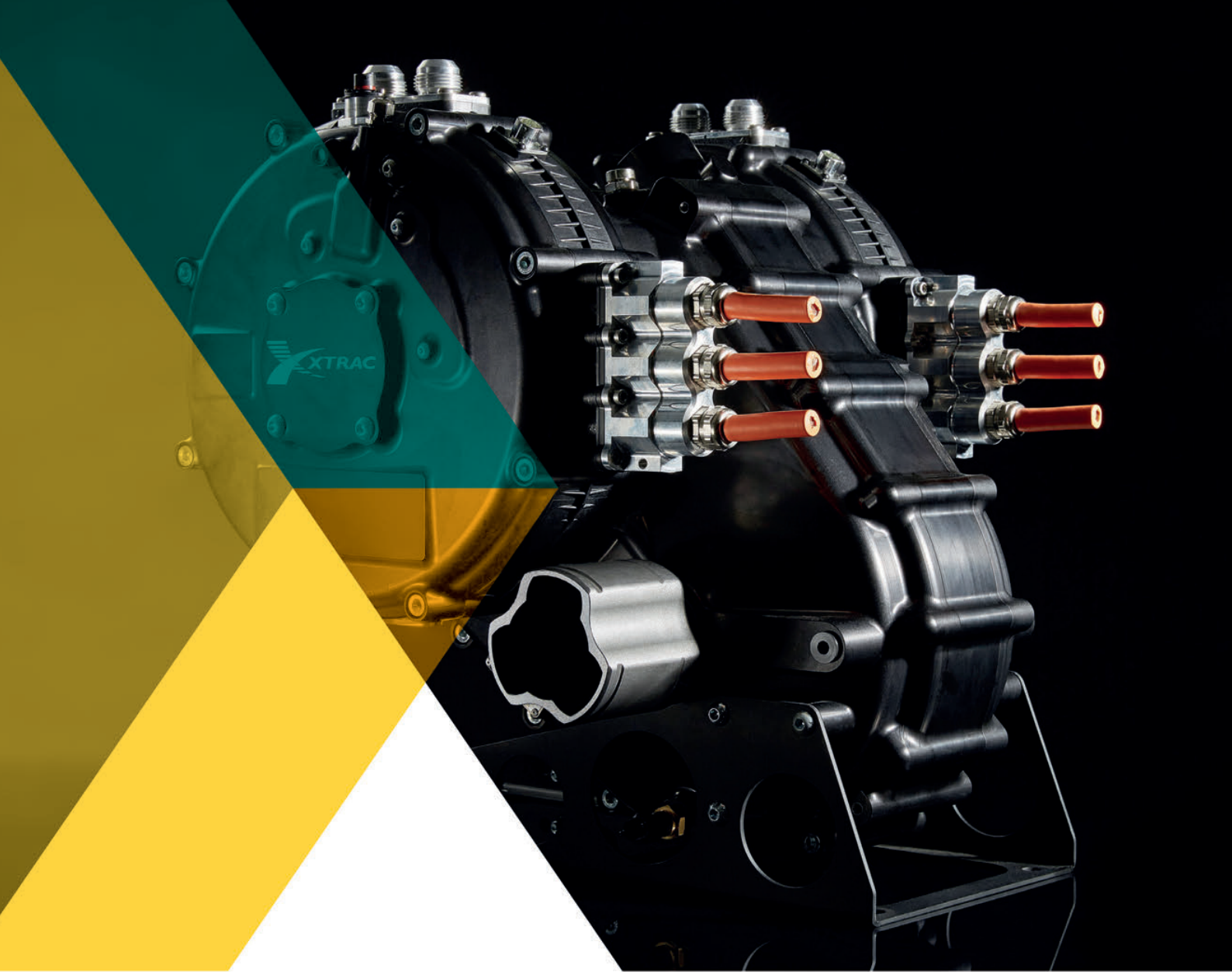
lb/ft of torque from 3000 rpm, while maintaining the potential to cover 5000 kilometres, or nearly double the amount needed for the entire WTCR season.

Delivering the power to the wheels is a bespoke 6-speed sequential gearbox, which is strengthened compared to the one found in the Peugeot 308 Racing Cup, and controlled by steering wheel-mounted paddles. To improve handling, the track has been significantly widened, while a specific suspension layout, ball joint suspension all-round and adjustable anti-roll bars give the car strong turn-in and a compliant rear end.

Peugeot Sport's director Bruno Famin explained that the car had been designed to allow customers to compete all the way up to the top level of the TCR, which from 2018 is the World Touring Car Cup.

"The arrival of the new Peugeot 308TCR comes at just the right time. We've used our experience and expertise to come up with a car that is competitive, reliable and always increasingly enjoyable to drive."

Peugeot says cost-effectiveness was one of its key considerations while developing the car. "Our ambition is to step up to the next level when it comes to competitiveness; not just from a sporting point of view, but also from an economic one," explained Peugeot Citroën racing shop director Mayeul Tyl. "Running costs were a key factor as we developed the car, without compromising performance or reliability. Some safe technical choices and a reasonable purchase price of €109,000 (before taxes) have allowed us to provide a very competitive cost per kilometre of €4.5, not including consumables." **RTI**



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BELOW The race-prepared Tesla P100D has successfully passed the FIA crash test

Electric GT Tesla passes FIA crash test

William Kimberley

LONDON, UK: The Electric GT Tesla Model S P100D has passed its crash test. It was carried out by IDIADA (Institute for Applied Automotive Research) at its facility in Barcelona. The crash test is mandated by the FIA as part of the homologation of the race car ahead of the inaugural Electric Production Car Series. This is a new all-electric, zero-emissions motorsport category created by Electric GT Holdings to promote sustainable mobility. It will commence this year featuring up to 20 drivers racing the fully race-prepared cars.

During the official test, the

race car, equipped with the latest OMP safety equipment, experienced a frontal collision against a rigid barrier - a block of concrete that weighs 130 tonnes covered with a 19 mm wooden plate - at a speed of 14 m/s (50.4 km/h). The absolute value of average deceleration measured at floor level, under the centre of the driver's seat, was 17.83g, well below the FIA 25g limit.

The car's high-voltage battery was active and charged according to manufacturer and FIA instructions and had an 88 kg dummy in the driver's seat. The weight of the vehicle was 1,720 kg, representing the maximum race weight of

the race car plus the weight of the dummy and a 25 kg data acquisition system.

IDIADA officials measured the acceleration of the dummy and vehicle during the crash. After the collision, officials also measured the protection against electrolyte spill and electric shock, plus static deformation in different points of the vehicle.

The cars will run on bespoke Pirelli tyres and be equipped with the latest OMP safety equipment and Alcon brakes. Rounds will consist of a 20 minute practice session, a 60 minute qualifying heat, a day race (60 km) and a dusk race (60 km).

Race weekends will also include the eKarting Series and the eSports Championship, a groundbreaking innovative new virtual racing platform. Each round

of the championship will be a weekend-long festival of technology and innovation for sustainability, in and around the circuits. Fans will be able to stream races via Periscope, Twitch and YouTube, as well as interact directly with the teams using social media platforms.

"We are very pleased to have successfully passed our crash test," said Mark Gemmell, Electric GT Holdings' CEO. "While there was no doubt as to the safety of the race car we have built, thorough safety testing is always a priority.

"The car performed very well during the collision. In many ways it was worse for us than for the car, having to watch the destruction of a machine we have lovingly built throughout our development of the championship. We are very excited to go racing in 2018." **IT**



Ford to offer support to M-Sport world rally team



ABOVE M-Sport is hoping that Ford's increased backing will enable it, and the Fiesta WRC which it runs to keep on winning in 2018

Alan Stoddart

COLOGNE, Germany: Ford Motor Company has announced a new agreement which will see it supply extended technical and financial support to its long-term motorsport partner, M-Sport. The team, which is based in Cockermouth, UK, last year won both the FIA World Rally Championship Drivers' and Manufacturers' titles with the EcoBoost-powered Ford Fiesta WRC.

The new deal will see the M-Sport team benefit from additional technical support from the global Ford Performance organisation at Ford's headquarters led by the company's global director of Motorsport, Mark Rushbrook.

Ford is extending its investment in the M-Sport team to ensure that it remains competitive through the 2018 WRC season and beyond. The backing is also a key factor in M-Sport's retention of 2017 WRC driver's champion Sébastien Ogier for the 2018 season.

"Ford's 20-year relationship with M-Sport has delivered unparalleled success at all levels of rallying, something we're very proud of, and has also established Fiesta as the standard for rally competitors around the globe," said Rushbrook. "Last year we supported M-Sport with the development of the all-new Fiesta that went on to campaign to an FIA championship win. For 2018, we're excited to be able to provide even greater support." **IT**



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ANDROS Trophy debuts electric four-wheel drive car

Hal Ridge

SERRE CHEVALIER, France: The Andros Trophy series has revealed the first of the four-wheel drive electric cars that will headline the Alps-based winter series from 2020.

The new four-wheel drive tubular spaceframe car has been built to have equivalent performance to the conventional mid-engined V6 ICE [internal combustion engine] racers in the pinnacle Elite Pro category. Weighing 1000 kg (without driver) the ANDROS Sport 01 prototype uses two 250 kW motors and produces the equivalent of 340 horsepower which is the same as its ICE rivals, and 1600 Nm torque. Energy is stored in 14 50v air-cooled battery modules, which produce a maximum voltage of 750v. Sadev differentials are used front and rear, while the car has four-wheel steering to match the current racers.

ENGINEERED EQUIVALENCE

French firm Exagon Engineering, responsible for building the two-wheel drive single-make electric ANDROS Trophy support category cars, has built the new machine. "Developed with the Exagon engineers and former Formula 1 driver Franck Lagorce, particularly fine tuning has gone on to get the right power-to-power ratio compared to the combustion ones, making us a real laboratory for manufacturers of electric cars," said ANDROS Trophy founder Max Mamers.

"With the Trophée ANDROS Electrique and Formula E now in full swing, we see a new generation of drivers very involved in this technological innovation, concerned for the future of the planet. With the birth of the ANDROS Sport 01, we want to offer manufacturers the opportunity to see their brand associated with the energy of the future and to return through this new era of automotive."

The car was tested on ice for the first



ABOVE The ANDROS Sport 01 is designed to compete on an equal footing with ICE cars in the Andros Trophy

time at the Serre Chevalier round of the series, where one driver from each of the existing teams sampled the car. "This prototype offers incredible sensations, I am really impressed by the strength of the torque of the electric motor," said Formula E racer and two-time ANDROS Trophy electric champion, Nicolas Prost, who was due to debut the car against the current ICE machines in the series' penultimate

round at Lansen Vercors as *Race Tech* went to print.

"The potential of this car is enormous. The power of the acceleration when it starts is comparable to the internal combustion cars in third or fourth gear. I was able to go into the corners with a lot of speed and I can already say that the ANDROS Sport 01 will, without doubt, compete [with the ICE cars] and will exceed them very quickly." **LT**



ABOVE The car was tested on ice for the first time at the Serre Chevalier round of the series by one driver from each team

IN BRIEF

THE TCR technical department has drafted the Balance of Performance for Honda's new Civic Type R TCR. The new racer has been allocated 40 kg of ballast in addition to the minimum weight of 1285 kg. The new Civic TCR will also have its power reduced to 95 per cent thanks to a boost pressure restriction of 2480 mbar.

MILLERS Oils has acquired 100 per cent of the share capital in Fuel Additive Science Technologies (FAST). By acquiring the company, Millers will take ownership of the established Exocet range of additives, which will broaden the company's customer base. "This modest acquisition

of FAST is strategic and fits very well with Millers Oils due to the high profile of the Exocet brand within a broad range of sectors, some of which will be new to the company," said Jamie Ryan, Millers Oils managing director. "With FAST being a former supplier of Millers Oils, we know the company well. FAST has a great team of dedicated skilled employees who operate along similar high quality and technologically innovative lines," he added. **RT**

PERSONNEL

Citroën boss Matton takes FIA role, Budar promoted to Citroën helm

CITROËN World Rally boss Yves Matton has been appointed as FIA rally director, replacing Jarmo Mahonen who retired at the end of 2017. Matton will be succeeded by Pierre Budar as Citroën racing director. In his new role with the FIA, Matton will be "responsible for the strategic vision of rallying and cross-country rallying at all levels, from grassroots with amateurs through to the regions and the pinnacle of the disciplines".

He will be in charge of administration and regulatory management of the FIA championships and sporting commissions, and will liaise with the sport's stakeholders in order to optimise the attractiveness, efficiency and future sustainability of the discipline.

"Yves has a wealth of experience across many facets of rallying, which is

important for its continued growth," said FIA president, Jean Todt. "He has great passion for the sport and his understanding of competition and management at independent and manufacturer levels will be a great asset to further securing the future development of our sport."

Matton joined Citroën Sport as logistics manager in 2002 before becoming WRC co-ordinator and team manager. He left Citroën in 2008 but returned as team principal in 2012, heading up its WRC and WTCC programmes. The Citroën team scored two WRC victories with British driver Kris Meeke in 2017, but struggled for consistent performance with the C3 WRC. As a leading engineer, Budar was instrumental in the creation of Peugeot's

308 TCR and Citroën's C3R5 and heads up Citroën Racing's 2018 challenge.

"I never imagined one-day running one of the most prestigious competition teams in the world," he said. "I measure the challenge that is proposed to me at the head of an extraordinary team and I will strive to obtain the best of its talents." **RT**

PERFORMANCE Friction Corporation announced that Mary Ann Burgoon took over as the company's president on 5 January 2018. In addition to her new role, Burgoon will also continue in her position as chief executive officer. In her expanded role she will focus on production, quality, continual improvement and fulfilment. By improving in these areas, PFC hopes it will be able to offer better value to its customers and meet the demands of an ever changing market. In addition, Burgoon will also continue to set the company's strategic direction. **RT**

First customers confirmed for the new Polo GTI R5

HANOVER, Germany: Volkswagen has provided the first 15 customers with information on the delivery of their new Polo GTI R5. Development of the four-wheel drive rally car for the customer sports scene, which is based on the new sixth generation Polo, began at the start of last year, and the new car was presented to the public for the first time in December. Demand for the new rally Polo is great – not least because the Polo GTI R5 incorporates all the know-how of its predecessor, which won four world titles in the pinnacle of rallying, the WRC.

"We are overwhelmed by the positive feedback on the Polo GTI R5," said Volkswagen Motorsport director Sven Smeets. "The customer demand is enormous. We are obviously pleased about this, and it is an additional motivation to provide the teams with the best possible rally car." **RT**



Read **THE CAR EVERYONE'S BEEN WAITING FOR**, page 60

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CHILDREN OF THE REVOLUTION

What will define motorsport for Generation Z?

As Klaus Schwab, Founder and Executive Chairman, World Economic Forum Geneva, has written:

“We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society.

The possibilities of billions of people connected by mobile devices, with unprecedented processing power, storage capacity, and access to knowledge, are unlimited. And these possibilities will be multiplied by emerging technology breakthroughs in fields such as artificial intelligence,

robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing

The inexorable shift from simple digitisation (the Third Industrial Revolution) to innovation based on combinations of technologies (the Fourth Industrial Revolution) is forcing companies to re-examine the way they do business.”

So where will motorsport be in all this. Does it even have a future or will it be consigned to history in the way that chariot races were?

Unlike previous World Motorsport Symposiums, we will be engaging the young as never before. It is their future. What do they want? What do they expect? Are they ready for the challenge? Are they excited or intimidated by the future?

These and many more questions will be discussed.



“*Once again the RACE TECH World Motorsport Symposium has been spot on with the current hot topics when future motorsport regulations are taken into consideration. I am sure that all the next Technical Working Groups will be influenced by the deep and relevant discussions which have happened there under the direction of John and Ulrich.*”

PASCAL VASSELON, Technical Director,
Toyota Motorsport GmbH

“*The RACE TECH World Motorsport Symposium this year covered some fundamental questions over the future directions of motorsport with a great deal of interesting and enlightening debate. It was good to see so much interest from an international audience and also the presence of young future engineers interested in motorsport. What better setting than the IMechE for this event. I took away a new insight into how the future of motorsport may be formed and enjoyed playing a small part in the discussions held.*”

JAMES KEY, Technical Director, Scuderia Toro Rosso

A MAN WHO KNEW NO TECHNICAL BOUNDARIES

Dan Gurney will be remembered not only for his feats as a driver and engineer but, says **Sergio Rinland**, as a source of inspiration to many

THE old adage says: 'You should never meet your heroes'. If ever I had a hero in life, that was the great Daniel Sexton Gurney, a man larger than life. I not only met him, I worked for him for a couple of years and got to know him well. I never had a moment of regret: he was everything I thought he would be and much more.

It was a privilege that I treasure. He was an inspiration for many generations of drivers and engineers in motor racing, in the US and the world over. He was certainly an inspiration to me when I was starting out in this business.

Dan Gurney was a great man, an ambassador of motorsport like no other. As a driver he was as good as it gets, to the point that the great Jim Clark said Gurney was the rival he feared the most – a compliment

for a driver if ever there was. Like Clark, his versatility was legendary. He won at Le Mans with Ford, in Formula 1 – where he raced for Ferrari, Porsche, Brabham and in his own Eagles – and was victorious in Indy Cars, NASCAR, GT, Trans-Am and Can-Am. You name it, he won it.

But he was a lot more than a first class driver. He was a thinker, a natural engineer, an innovator. He was always thinking of how to make his cars to take him faster.

There are many innovations attributed to Dan, the most famous being the Gurney Flap. We all take it for granted when designing a wing for a race car – it is even in the rules of many disciplines – but it came about in typical Dan fashion, as a head-scratching idea to improve the poor performance of his 1971

Indy Car. It transformed the car's behaviour to the point that Bobby Unser qualified on pole in seven of 11 races and won two.

According to famous aerodynamicist Bob Liebeck, who worked for McDonnell Douglas at the time and collaborated with Gurney's All American Racers organisation, the Gurney Flap was the first aerodynamic innovation transfer from racing cars to aircraft.

The other famous innovation, this time non-technical, is the champagne spraying which has become a tradition in motorsport the world over to this day. That one came about after winning the 1967 Le Mans 24 Hours. The victorious crew were given a bottle of champagne to toast their achievement but with his typical sense of humour and exuberance, another of Dan's traits, he saw no better use for it than bathing Henry Ford II, CEO of the Ford Motor Company, and all who were celebrating such an iconic success on the Le Mans podium.

Gurney was also instrumental in the adoption of full-face helmets and the formation of CART, the governing body for Indy Cars from 1979 to 2003. The list can go on and that is why Dan Gurney was such an icon of motorsport.

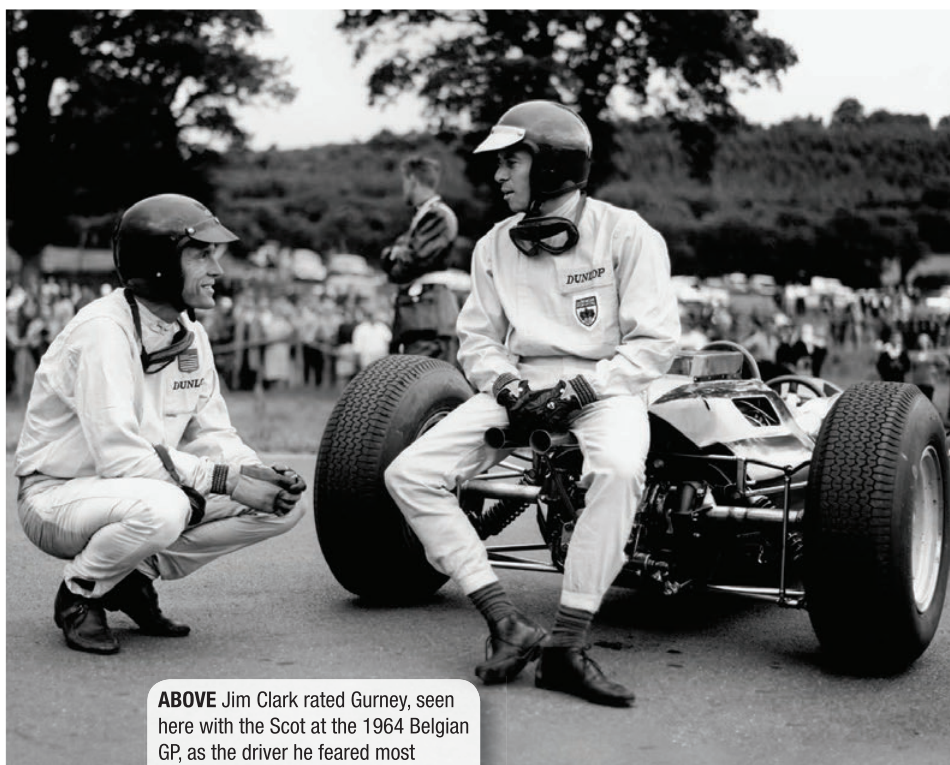
He was also a true motorsport entrepreneur, creating All American Racers in the '60s to build his own cars at that factory in Santa Ana, California, where I worked. It is still there, innovating in motorsport and aerospace.

Not many people know, but the DeltaWing car that competed at Le Mans in 2012 in the Garage 56 category came from the AAR stables. I had the honour to be part of that project and to collaborate

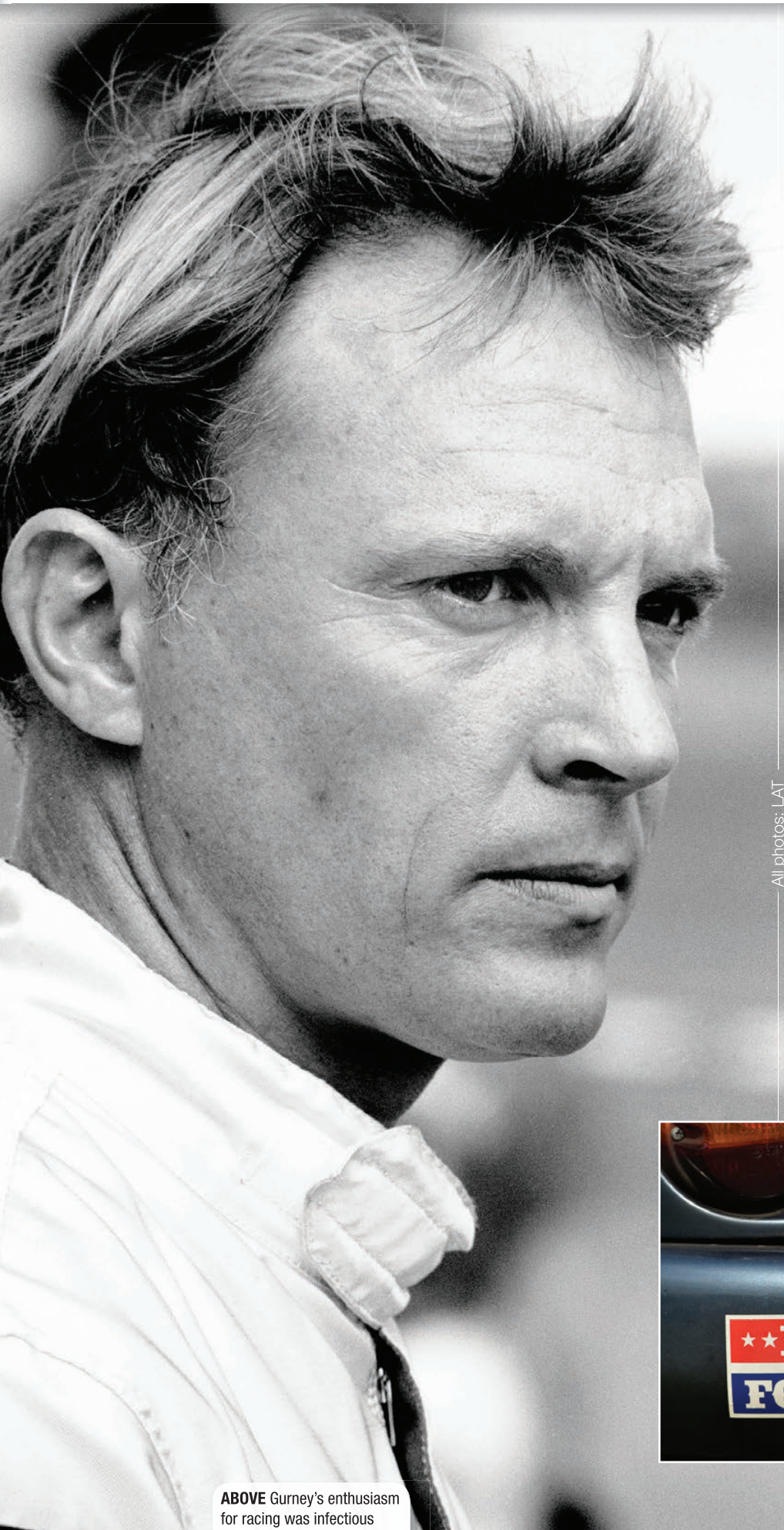
“The great Jim Clark said Gurney was the rival he feared the most”

again with AAR. When he saw Ben Bowlby's concept, Gurney, ever the enthusiast, did not doubt for a second that he should be involved. The car was duly designed and built at AAR. All American Racers is also part of the team building the SpaceX ship from Elon Musk of Tesla.

In the early '90s, AAR dominated IMSA to the point that it prompted the rule change to stop the development of cars like the Eagle MK III. I was there in 1993 when the team won the IMSA championship for the last



ABOVE Jim Clark rated Gurney, seen here with the Scot at the 1964 Belgian GP, as the driver he feared most



ABOVE Gurney's enthusiasm for racing was infectious

time, an amazing experience. The front end aerodynamics of the MK III were an innovation that we see to these days in Le Mans-type cars. That car was a monster – in the good sense of the word! Its 4-cylinder turbo engine had power to spare, allowing us to run very aggressive aerodynamics, with a 'barn door' rear wing needed to balance the super-efficient front splitter. It was the class of the field.

Dan's 'hidden' passion was for motorbikes, his first and last love. For many years he developed his motorbike concept, the Alligator, a bike where the riding position is more like a single-seater than a bike. I was there when that bike started to take shape and today it is a low production special.

RIDING AN ALLIGATOR

Many bike champions tested the Alligator and said it was incredible to ride. When I worked for Dan, on Sundays at 7am a group of friends (including some of the greats like four-time world champion Eddie Lawson) would meet at his house and go for a day's ride through the California highways to test the Alligator prototypes. I went with them a few times. Dan used to lend me one of his many bikes: unforgettable memories that I treasure to these days.

Gurney was a unique man, generous, loyal to his friends, family and employees like no other. The great Phil Remington, the man who built the famous roof bubble at Le Mans for him – the 'Gurney Bubble' as some dubbed it – worked every day at the Santa Ana shop as a fabricator until his last days. Skip Hudson, Dan's friend and fellow sports car and Can-Am driver, likewise worked for Gurney after hanging up his helmet. And the list can go on much longer than that... ►

All photos: LAT



ABOVE His popularity inspired this tongue-in-cheek campaign



BELOW The tradition of spraying champagne on the podium stemmed from the celebrations of Gurney and AJ Foyt for their 1967 Le Mans win. They are seen here enjoying the moment with Porsche's Jo Siffert

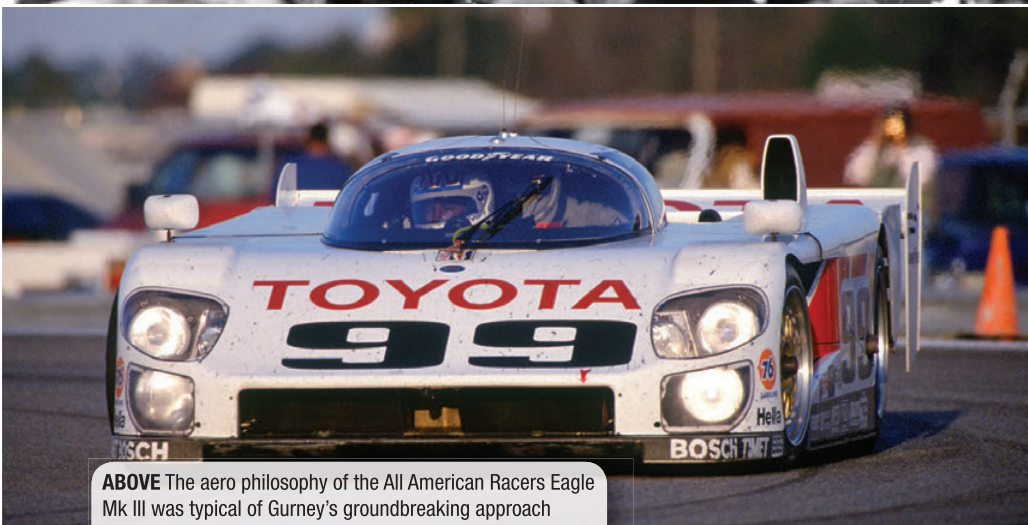


When Bruce McLaren got killed testing at Goodwood, it was Gurney who offered himself and helped the Can-Am team to carry on by driving Bruce's car for few races, even though at that time he was already building and racing his own Eagles. Dan was grateful, generous and loyal like no other person I ever saw in motorsport. In the offices of AAR there are hundreds of pictures covering the walls of all the friends he collected in his life, from Hollywood legends like James Dean or James Garner, to his many friends, rivals and triumphs in motorsport.

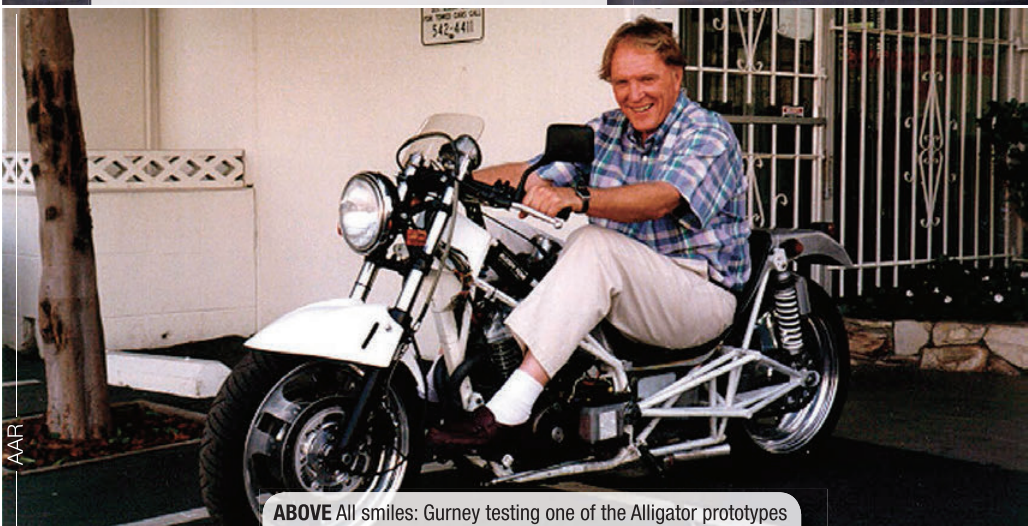
Gurney would say he was a racing fan, and he was. He loved cars, bikes, planes, machinery and the challenge of making them better. He even built his own 5-Axis machine in the early '90s to make the patterns of his racing cars. He knew no boundaries.

We have lost a great man, a true gentleman. He will be missed by all of us who, one way or another, were touched with his magic wand and tremendous passion for motor racing and the automobile.

I saw Dan for the last time in 2012 when he was honoured at the Goodwood Revival. His contagious enthusiasm was there, even if his health was not. John Surtees drove Dan's Lotus Indy car; now they will be having fun together somewhere. To Evi, his wonderful wife, to his six children and his long-time assistant, Kathy, my deepest sympathies. **RT**



ABOVE The aero philosophy of the All American Racers Eagle Mk III was typical of Gurney's groundbreaking approach



ABOVE All smiles: Gurney testing one of the Alligator prototypes

VBOX VIDEO



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LIFT-OFF FOR LMP1'S NEW GENERATION

Watching Ginetta's new G60-LT-P1 power down the runway at its roll-out test was a proud moment for technical director Ewan Baldry. **William Kimberley** catches him in the midst of a whirlwind schedule

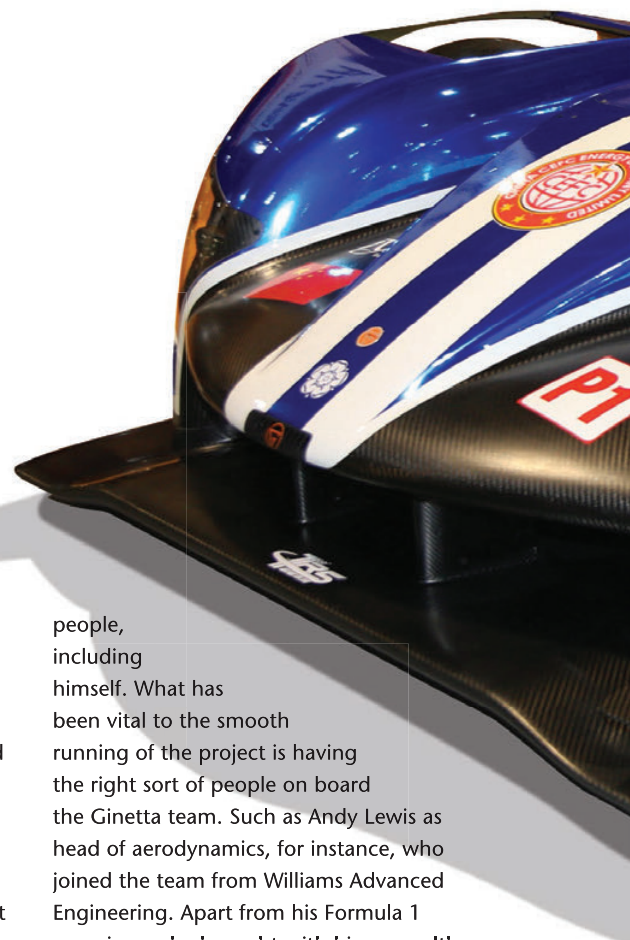
FRANTIC! That was the word used by Ewan Baldry, Ginetta's technical director and the person overseeing the development of the new LMP1 car we first reported on in RT199 (June 2017), to describe the last nine months.

He did continue, though, to say that it was nowhere near as pressurised as the LMP3 project, as it was the first time they had done a car of that type. The team at the time was also relatively newly formed, so the LMP1 project actually felt easier and it was relatively straightforward.

"Obviously the LMP1 car is far more sophisticated and technical with a full aero programme, but it's been helped by having the partners we have chosen to work with, such as Williams Advanced Engineering, Adrian Reynard's ARC and LMP1 expert Paolo Catone, which have made things that much easier and relatively smooth," says Baldry.

What is quite amazing about the project is that a running car has been delivered from scratch in just about nine months and at Ginetta, Baldry has a team of just five

people, including himself. What has been vital to the smooth running of the project is having the right sort of people on board the Ginetta team. Such as Andy Lewis as head of aerodynamics, for instance, who joined the team from Williams Advanced Engineering. Apart from his Formula 1 experience, he brought with him a wealth of knowledge from having worked as part of the aero team for three years on the



ABOVE The new Ginetta G60-LT-P1 had its first roll-out test at Leeds East Airport, where it performed several high-speed straight line runs



“We had a clear vision early on of what we wanted to achieve”

easily be under 770 kg, which means that we have 65 kg of ballast to play with and is obviously a massive advantage. You have to define the ballast positions and all of ours are pretty far forward on the car because the real focus is to get the front tyres switched on and get enough energy fed into them.

“I think the non-hybrid LMP1 is looking

reasonably strong with various other competitors so the tyre manufacturers are not just going to palm teams off with a hybrid tyre, so it all bodes pretty well.”

Baldry points out that it's not his decision about which tyre supplier the Ginetta teams should select, saying that his job has to be to liaise with both Dunlop and Michelin.

The relationship with Williams Advanced Engineering where the wind tunnel testing has been taking place worked well, Andy ▶

Porsche LMP1 919 Hybrid programme.

“It meant we were able to set targets and directions very quickly, so we haven't spent much time going down the wrong path and then having to back pedal,” says Baldry. “We had a clear vision early on of what we wanted to achieve.

“One of the things we've been good on is keeping a focus throughout the design process on the mass of the vehicle overall. It's impossible to make super-accurate predictions, particularly when you've only got nine months to do the project and don't have the time to do all the analysis and go into every bit of detail, but there was definitely a focus on making the car nice and light.

BALLAST TO PLAY WITH

“When we first put it on the scales, it was 732 kg with a few bits and pieces missing, which we did a table of and when added together, we ended up with 756 kg. It means we're pretty confident that even with things we may have missed, and we'll find out in the next few days, we should



ABOVE Ewan Baldry: unfazed by tight timescale



ABOVE Like the Porsche WEC project before it, Ginetta's LMP1 car has been honed in the Williams Advanced Engineering wind tunnel

Lewis having worked there being an asset. "He'd spent a lot of time in tunnel 1 when working there so the transition was pretty seamless," says Baldry. "Although it was an interesting dynamic, as Andy was switching from employee to customer, which was an interesting experience for everyone involved because he knew them warts and all, but it led to a good and successful outcome. He knew from his experience as an employee that delivery times had to be met in terms of the developments for the CAD surfacing that they then turn into a model.

WEIGHTED AERO DEVELOPMENT

"The tunnel programme ran without any hiccups and we are very happy with the numbers with which we've ended up. We clearly gained from Andy's experience as he had a bit of a feel about where we needed to be and we've exceeded that. However, that's clearly a simulation which track

“The real focus is to get the front tyres switched on”

testing will prove one way or the other.”

Baldry pays tribute to Paolo Catone (see sidebar), the proven Le Mans winner with Peugeot and more recently the designer of the BR01 LMP2 car for SMP Racing, who was among the first to be contacted at the outset of the project. "He's been around the block a few times and has a Modus Operandi for a project like this," he says, "but he was dealing with the design team at Ginetta that apart from myself, who is 44, the average of the rest is around 28-30, which means that there are some new ideas. I think that was something that Paolo really enjoyed, so it's been a good blend of youth and experience.

"His previous experience was using the FondTech wind tunnel for aerodynamic

development and it was very wind tunnel biased with just a little bit of CFD to back it up. When we first kicked off and Andy explained how we were going to go about it, I think that Paolo was a little bit unsure, but he was really impressed with the approach that has been taken. The key thing was that Andy hasn't been all about the headline number, but more about driveability and pitch sensitivity and making sure that the car is well rounded from an aerodynamic point of view.

"The way that he's operated is basically what he terms as a weighted average, so the car in the tunnel runs at a range of attitudes from which the lift/drag is taken from each one. He then applies a weighting as to which one is more important than ▶



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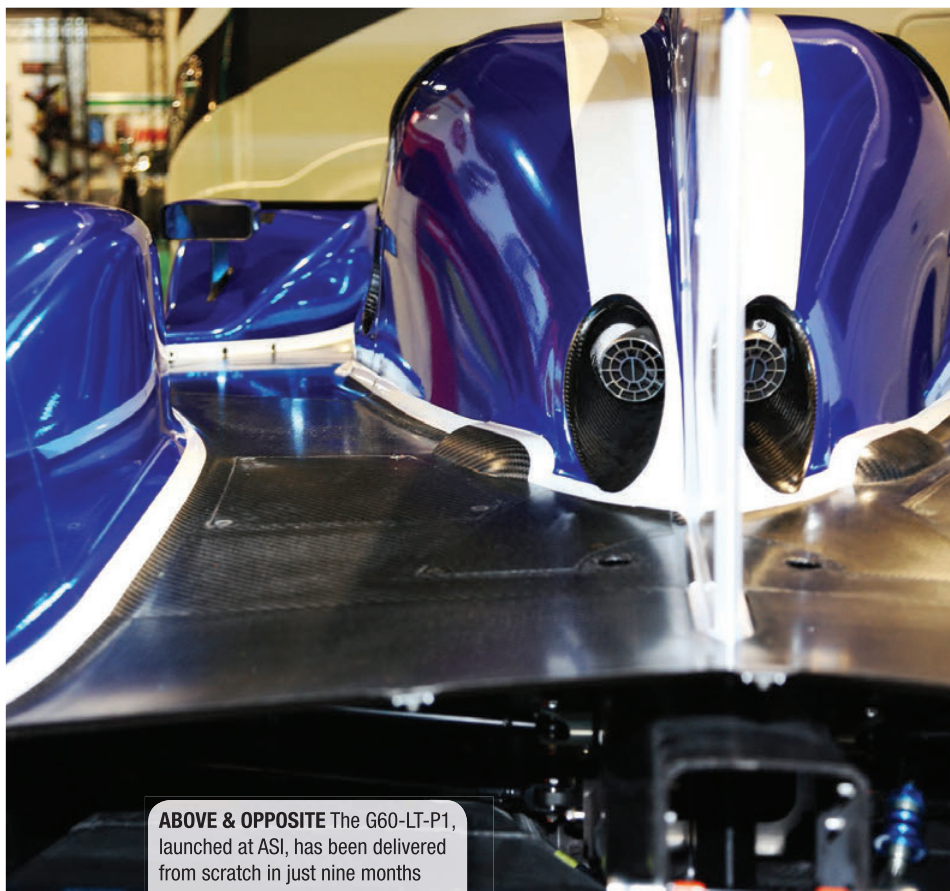
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ABOVE & OPPOSITE The G60-LT-P1, launched at ASI, has been delivered from scratch in just nine months

others. This then gives an overall lift/drag number for this kind of weighted average that has been more important than the headline number."

COMPOSITES ENGINEERING

Advanced Reinforced Structures Technology – ARS, the Italian composites company – did all the composite engineering that Ginetta has used in the past on other projects. "When I was chatting with Piero Consorti, the commercial guy there, and told him that we were thinking about LMP1, he introduced us to Paolo," explains Baldry. "ARS is an amazing company that gets it, so we had the real luxury of sending them the aero surfaces and some commentary on how we would like things to be split together and they then carried out the composites engineering of the panel fits, the interfaces between the panels, which has been a real godsend."

The Mecachrome relationship as featured in RT207 (February) has also worked very well, according to Baldry. "From the start of the project we knew we wanted to base

Guidance from a Le Mans winner

PAOLO Catone, who comes with a wealth of LMP1 and LMP2 experience, including winning Le Mans with Peugeot, has acted as an advisor on the Ginetta LMP1 programme from the start.

"It's the first project where I've been a consultant rather than being the technical director or chief designer managing the entire process," he says.

"It's a bit different because Ginetta has its own structure that works very well, so I've just helped with some basic points coming from my LMP1 experience and helping them develop along the right lines as they hadn't done an LMP1 project before.

"Aerodynamically they have a very good aerodynamicist in Andy Lewis so the discussion was more in terms

of targets and some specific points about LMP1 aero. I was involved in this part of the programme until August/September and then I followed more the composites path as I know the supplier very well having worked with them a great deal. Working closely with them we were able to add our expertise when it came to the overall design and manufacturing process."

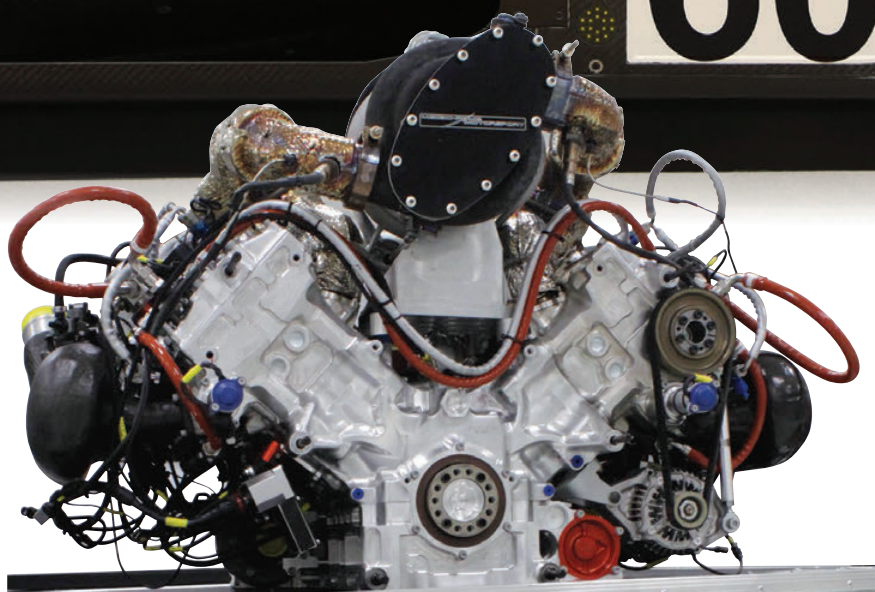
Catone admits that the biggest target for him was in aerodynamics and chassis performance. "That means to use the tyre correctly we need to have the correct mass distribution. When this is done with a non-hybrid with four tyres the same size, you need to find a way to have some weight on the front that naturally is not there. That means trying to have as much ballast as possible.

"I pushed quite a lot from the beginning on this point and the design followed, not necessarily doing very sophisticated things, but doing it in a clever way. I'm pleased to say that we achieved the targets we wanted." **RT**



Jeff Bloxham/LAT

ABOVE Paolo Catone brings invaluable experience to the project as a Le Mans-winning designer with Peugeot



ABOVE & BELOW Mecachrome's V6 turbo features a new direct injection system. Extensive simulation was employed as the GP3 and GP2 powerplant was developed for LMP1

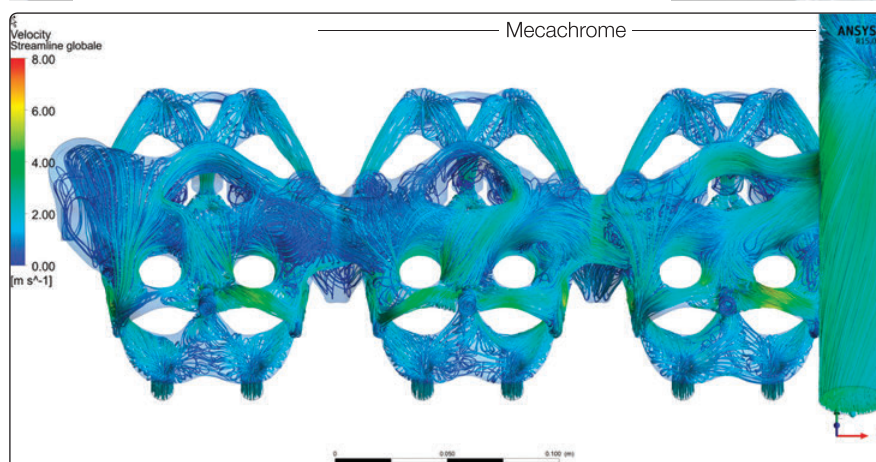
Mecachrome

the car around an engine and spoke to a number of engine suppliers, but it was at the PMW Show in Cologne in November 2016 that I came across it on the Van Laere stand that was exhibiting turbos. A week later I got a call from Bruno Engelric from Mecachrome, who had worked with Paolo in the past and had been looking at such a project. I was super impressed when I visited the facility in France and didn't know until then that they made all the Renault F1 engines, which filled me with confidence.

DIRECT INJECTION

"It was originally developed for GP3 and then GP2 but from the start there was an option of making it suitable for LMP1, particularly with the addition of direct injection and a bigger turbo in accordance with the fuel flow regulations. It features a revised cam cover with a double fixing point to increase the stiffness with very little increase in weight, so it's worked well so far."

"We have only just started running the car for systems checks and so on, but so far, so good," says Baldry. **RT**





ABOVE For all the bows towards Camaro's history, the ZL1's principal objective is current-day relevance, in the showroom and on the speedways

Chevrolet motorsports enters a new era this month when its Camaro muscle car brand joins the Monster Energy NASCAR Cup Series. **William Kimberley** quizzes the man who put the programme together

RIGHT from the beginning in the late 1960s, Chevrolet's Camaro has upheld its honour as one of the great muscle cars of its era. It has carried that mantle with varying degrees of success over the decades. Now, though, the sixth generation is set to push the bar even higher.

As someone who watched Australians Brian Muir and Frank Gardner manhandle their 5,740 cc Z28s around the British circuits in the late 1960s, the Camaro has always had a special place in the motor racing firmament. That Bill McGovern in his 998 cc Sunbeam Imp kept winning the series year after year was always a travesty because he was never at the front of the field, but stealthily winning his class. Meanwhile, Muir and Gardner, like Dennis Leech in the Ford Boss Mustang, slugged it out with the likes of John Fitzpatrick and Graham Birrell in their Ford Escort RS1600s.

It was at this time in 1969 that the ZL1 moniker became associated with the Camaro, an option package that consisted of replacing the iron-block and head L72 427 with a version of the 427-cid V8 used by the all-conquering Can-Am Chaparrals. So there is a lot riding on the new sixth generation Camaro and the ZL1 combination.

As Chevrolet's vice president, Performance Vehicles and Motorsports, Jim Campbell has been instrumental in bringing the package together and devising a programme that has already gathered plenty of favourable comments. The proof, though, will be in the pudding, but such is the work going on behind the scenes, that there is quite an air of optimism about it.

"The Camaro has a very special heritage and history at Chevrolet and in the market and the ZL1 has a very special place as it dates back to 1969 when that moniker ►

MUSCLE MEETS THE MONSTER



“We really consider the Camaro ZL1 to be the authentic connection from the track to the showroom”

ABOVE Chevrolet has gone out of its way to ensure the race car has the same design cues as its showroom counterpart

first appeared on the first generation Camaro,” he says. “We brought it back in 2012 with the fifth generation Camaro to denote the most powerful version, which at the time was 580 hp, and then it returned again in the sixth generation, announced in July last year, again on the most powerful version with 650 hp.

“That strong history and heritage, the power and the capability, were important considerations for us selecting Camaro to be the featured vehicle to race in the NASCAR Cup Series.”

PRODUCTION VALUES

That heritage is being reinforced as Chevrolet has gone out of its way to ensure the racing car looks as similar as possible to the production car. “We have to align with NASCAR’s rule set, but if you look at the front end of the race car and the production car, they share the design cues,” says Campbell. “They’re also both rear-wheel drive, fuel injected V8s and both have manual transmissions. We really consider the Camaro ZL1 to be the authentic connection from the track to the showroom and the showroom to the track in the NASCAR Cup Series.”

While the car coming to compete in the Monster Energy NASCAR Cup Series is new for this year, Chevrolet’s engineers have had a mass of information they could call on. Last year the Camaro SS was campaigned in the NASCAR Xfinity series while Camaro GT4.Rs competed in both the Pirelli World Challenge and the IMSA Continental Tire SportsCar Challenge Series.

“No matter what the series is, the

preparation we did for the GT4.R car was learning about aero balance between downforce and drag and side force,” says Campbell. “We do that very specifically through a lot of simulation work, CFD, scale models and full vehicle testing and eventually on-track testing. We also run the Camaro in some of the drag racing series, particularly the Sportsman classes (see sidebar). We also run a Camaro SS in the Xfinity NASCAR series, so ▶



ABOVE The outgoing Chevy SS has been a formidable racer, with 71 wins in NASCAR’s premier series

Getty Images for NASCAR

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now going to the Cup series with the ZL1 is really an extension of our strategy.

"We have a very close relationship between our design team, our engineering team, our powertrain/propulsion team and the race teams. We have found that when we work closely together, everyone really flexes to get the best result on track performance while maximising our pedigree character as well, and that's really quite important.

"We did the development with our design and engineering team at Chevrolet combined with our three key partner teams: Hendrick Motorsports, Richard Childress Racing and Chip Ganassi Racing, along with Pratt & Miller which was heavily involved in the CFD programme. We have long lasting relationships with them all and they collaborated with us in the development of the race car to make it the very best it can be.

"The teams have been with us every step of the way from the original rendering of the ZL1 race car for the Cup Series and what it would look like through to the very intensive CFD stage where we did a tremendous amount of simulation analysis. We narrowed down our choices for what would eventually be the race car and then created scale

“We’ve done more CFD work on this particular programme than all the previous Cup car programmes combined”

models and did a lot of scale model testing. We then built a full car that we submitted to NASCAR to homologate or approve, which they did last July.

"This team partnership has been critically important to the process in addition to the work we do with our design and engineering teams. A collaborative effort is really the key here so we get the best car for the track when we go racing.

KEY PARTNERS APPROACH

"However, our work with the race teams hasn't stopped and we continue to work intensively with them and have a collaborative approach to wind tunnel testing to continue to learn all of the details about how the car operates from an aero perspective. At a certain point the teams will then start working on their own points of difference, the way that they specifically want to approach the race, so

they have some degrees of freedom, which is fairly limited based on the rules, but they do have some choices. I would say, though, that we are still very much in a collaborative phase at this time.

"We call it the key partners approach to the way we race, no matter the series. We have found and have proven that this has been most effective for Chevrolet as we prepare for race seasons, races, and giving our drivers the best opportunities to compete for a drivers' championship and then for Chevrolet to compete for a constructors' or a manufacturers' championship. We find that if we work together we solve problems more quickly because it doesn't matter where the best idea comes from, we get it on the table quickly, evaluate it, then prove it through analysis or testing and then we take those results and roll it back out to the key partners."

While Chevrolet has been using the driver-in-the-loop tool for quite some time, it has ▶

BELOW Seven-time series champ Jimmie Johnson introduced the new car by ripping down Detroit's East Jefferson Avenue, the snarling of the engine echoing off the towers of General Motors' Renaissance Center headquarters





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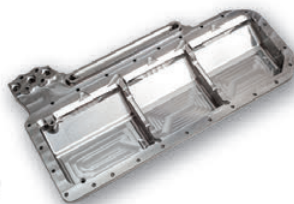
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recently taken it to a new level, says Campbell. "It's an important tool that has allowed us to take our simulation up to a whole other level. Everyone may have a simulator but it's how you use it and how mature you can develop the model and really use that to work on very practical solutions for the race track. It has helped us as a manufacturer with our key partners. It helps establish aero targets for the race car and we've done more CFD work on this particular programme than all the previous Cup car programmes combined.

"We use the simulator for both production cars and racing. It's been very helpful. There are some limitations, but far more enablers for us to get the answers we want, especially with the limitations on the track testing we can do, and so is a great surrogate. We also use a combination of wind tunnels, primarily using some that are a little bit closer to the race teams, Windshear being one of them." ▶



ABOVE & BELOW The launch car was adorned with the number 8, the favoured number of pioneering racer and company founder Louis Chevrolet



Feel the Force

WHEN John Force, the 16-time NHRA Funny Car world champion, raced the all-new '16 Camaro SS Funny Car at the NHRA Kansas Nationals in Topeka in May last year, he was continuing a tradition that has seen the model that dates back to 1967 with names like Dave Strickler and Bill "Grumpy" Jenkins successfully campaigning the cars. They were followed by Texan Lee Shepherd in the 1980s with

four consecutive Pro Stock titles.

More recently, Camaro has become a fixture of the Pro and Sportsman ranks. Behind the Pro Tree, John Force Racing has returned Camaro to the Funny Car class, while Camaro drivers have dominated the Pro Stock field, including consecutive championships in 2014 and 2015.

However, it is more than a marketing

exercise as the Chevrolet engineering team conducts computational analysis and scale-model wind tunnel testing to help give the new body the airflow management qualities necessary to deliver the downforce required by the 10,000 hp supercharged race car as it accelerates from 0 to 330 mph in less than four seconds — and in a mere 1,000 feet. **RT**



ABOVE The Gen-six Camaro SS seen in Pro Stock trim

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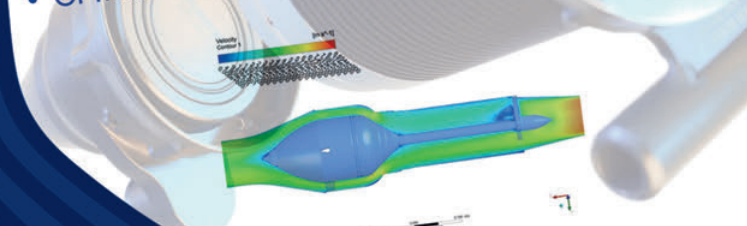


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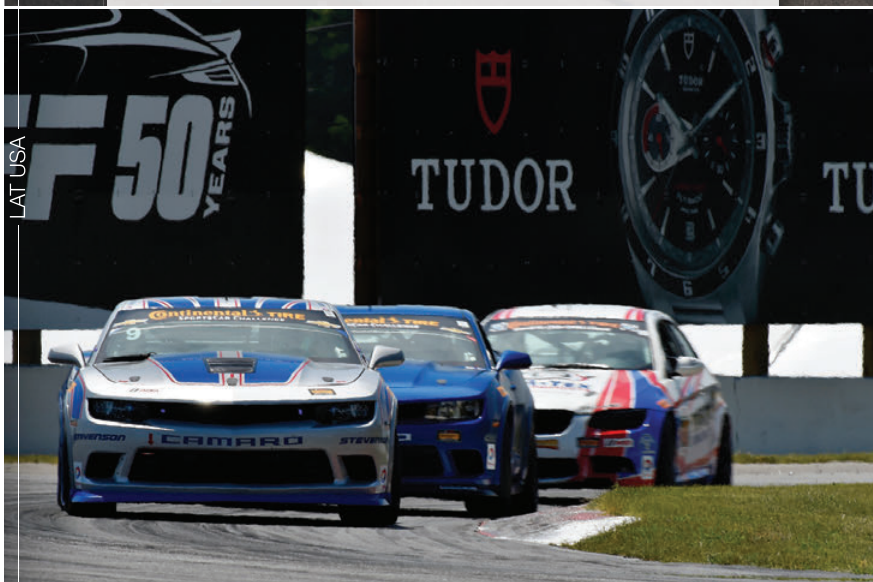
Use the Wireless Control System to communicate with the CARTEK Power Distribution Panel or ECU/Dashboard

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BELOW The ZL1 comes not only with a fantastic heritage but with high expectations



ABOVE & BELOW The Camaro SS won last year's NASCAR Xfinity series (above), while the Camaro GT4.Rs competed in the Pirelli World Challenge (below)



One of the challenges when designing the new ZL1 Cup car was taking into account the new inspection system that was being imposed by NASCAR. Rather than the more labour intensive method of templates, it has decreed that a Hawk-Eye camera-based inspection system will be used from the start of this season. While the six-minute process will be reduced to just 90 seconds, the 17 high definition black and white cameras and eight projectors do not lie and will detect any part of the body that does not conform to the regulations.

"We really took Hawk-Eye into consideration as we were doing the development work," says Campbell. "We designed the car to make sure that we could meet its requirements. It was something that was new for us as it is for all the teams and manufacturers."

There are no fundamental changes to the engine, as will be read in Chris Pickering's article elsewhere in this magazine. Instead it is a case of continual refinement because as Campbell says, in racing everything is on the edge, so it's a question of maximising reliability and performance.

The season has yet to begin but already the juices are flowing. It's too soon to say whether the Camaros will be regular visitors to the winner's circle as the campaign unfolds, but with all the work that has been done by the design, engineering and powertrain teams along with the key team partners and companies like Pratt & Miller, it would be hard to bet against them. **RT**

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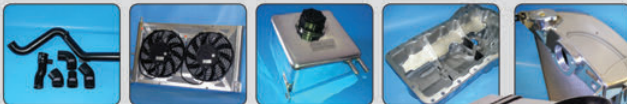


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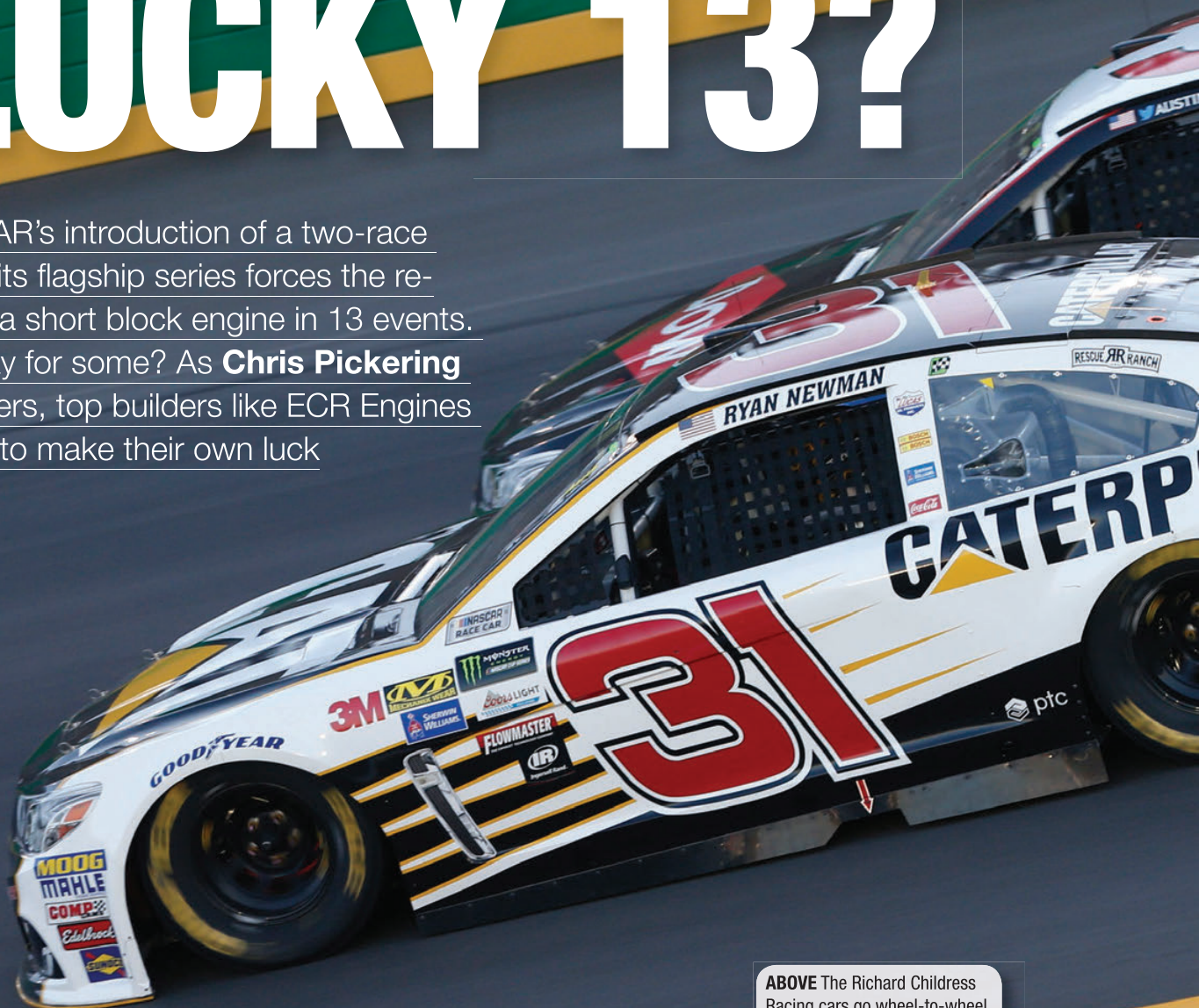
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LUCKY 13?

NASCAR's introduction of a two-race rule in its flagship series forces the re-use of a short block engine in 13 events. Unlucky for some? As **Chris Pickering** discovers, top builders like ECR Engines intend to make their own luck



ABOVE The Richard Childress Racing cars go wheel-to-wheel. The two-race requirement adds an extra dimension to the battle

NASCAR is not an organisation you'd associate with radical change. On paper, the Cup Series' template of a 90-degree pushrod V8 hooked up to a four-speed manual gearbox could easily date back to the 1950s. But this stability has nurtured a highly specialised breed of engines. Much like an apex predator that's evolved to the unique demands of its environment; you underestimate them at your peril.

Underneath the skin, the detail design of these engines is deceptively sophisticated. And the flipside to an environment where everything is so heavily optimised is that small changes can make a big impact. Cast against this backdrop, the relatively subtle changes to the Cup Series engine regulations

for 2018 are perhaps the most significant in half a decade.

In brief, they state that the teams must contest at least 13 of the 36 races with a short block engine that has been used in a previous event. This means the short block package (i.e. the cylinder block, crankshaft, camshaft, connecting rods, pistons and sump) now has to be engineered to survive a minimum of two races, where it could conceivably have been replaced for each round in the past.

In reality, it was already common practice for some parts to be examined and then re-used for future events (in fact some, such as cylinder head and block castings, are actually believed to perform better

once the stresses have been normalised). Nonetheless, the fact this is now a mandatory practice – taking place within a sealed engine – puts a rather different spin on things for the engine builders.

"It places the ultimate premium on what you might call powerful durability," explains Matt Wiles, director of engineering at ECR Engines. "Combined, two Cup Series races typically account for around 1,200 to 1,300 miles. The teams are free to decide when they bring the engine back for its second race. That means any given event will tend to see cars with fresh engines going head-to-head with those that are already partway through their service life, so it's crucial that the performance is maintained through to



“Cars with fresh engines will be going head-to-head with those that are already partway through their service life”

that second race, as well as durability.”

A certain amount of diagnostic work is allowed between the races. The engines can be taken out and put on the dyno, leakdown tests are carried out and borescopes used to visually inspect the components.

NASCAR teams are also increasingly reliant on the use of wear metal analysis. Traditionally, Cup Series engines have used conventional paper element oil filters, but ECR now employs sports car-style scavenge filters, plus magnetic debris catchers. These are mounted outside of the sealed short block, allowing the engineers to dismantle and inspect them between races. Analysis of the wear metals collected on the filter elements allows the engineers to monitor the extent and the source of any degradation.

Elsewhere, similar tests are often carried out with oil samples. This approach potentially allows problems to be diagnosed earlier (when the various alloys are present in lower concentrations) but it also has its drawbacks.

The main reason that ECR focuses on debris traps for ▶

ABOVE The new rules leave ECR Engines, like its rivals, balancing the need for both power and durability from the latest Cup engines



ABOVE & BELOW Used rod bearings illustrating overlay fatigue and, below, cavitation



its NASCAR engines, Wiles explains, is that the oil formulation changes significantly from race to race. "In order to use the oil sampling technique, you really need to build a comprehensive library of oil types and engine wear states before you can establish a correlation," he notes.

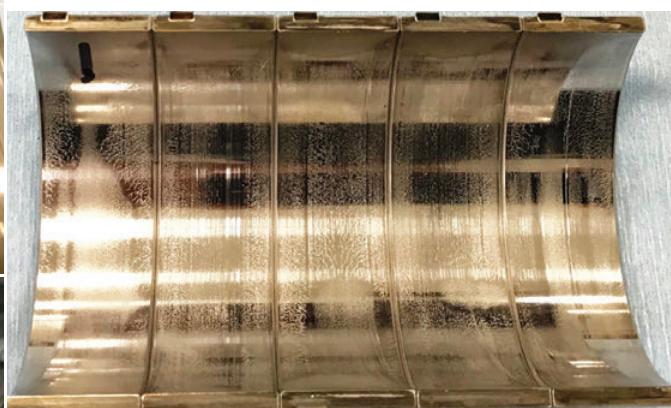
TAILORED TO EACH EVENT

Under the old rules, the benefits of running a new engine for each event extended beyond just durability. It meant the engineers could effectively develop a unique powerplant for every race, optimising things like cam profiles to tailor the power curve to the individual circuit.

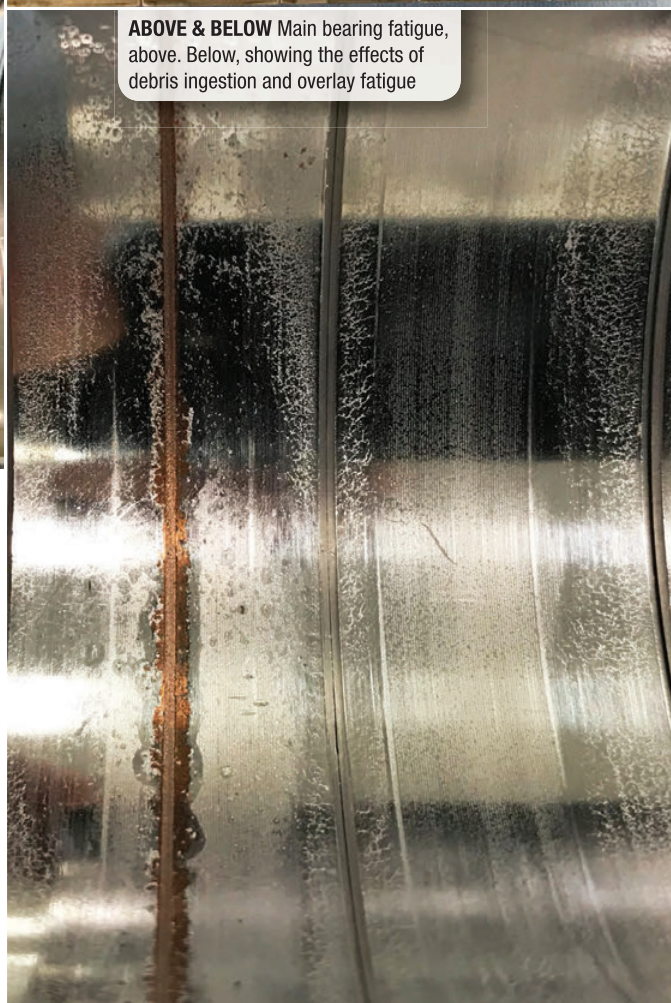
"The engine speed range varies significantly from track to track," points out ECR's technical director, Andy Randolph. "In terms of ovals, Martinsville covers a range of about 5,000 rpm

to 9,300 rpm at wide open throttle, while the restrictor plate tracks like Daytona could be 8,600 rpm to 8,700 rpm – just a 100 rpm variation over a complete flying lap. And then you have the road courses. At Sonoma, the cars are pulling about 3,800 rpm when they exit the final corner. That leads onto the main straight where most of the passing occurs and they will be pulling over 9,000 rpm by the end."

Of course, a degree of similarity already exists between specific events. The same engine configuration has traditionally been shared for the restrictor plate races at Daytona and Talladega, for instance, but the durability aspect remains. Restrictor plate races tend to be the most punishing from a rod bearing perspective, Randolph explains, with wide-open throttle potentially sustained for 30 minutes at a time. ▶



ABOVE & BELOW Main bearing fatigue, above. Below, showing the effects of debris ingestion and overlay fatigue





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"It wouldn't surprise me if we see more engine failures during the second race of the speedway events, but I feel like we've done our homework and we're in our best position in years to accommodate the new rules," he says.

With the camshaft being included in the short block assembly, access to one of the key tools for optimising the power curve has now been limited. However, cylinder head design remains free (at least for 2018) along with the intake manifold and exhaust headers.

"For the past couple of seasons, our primary focus – and I'm pretty sure everyone else's too – has been on how we use these bolt-on parts to tune the engine for individual tracks," notes Randolph. "That's going to remain a major area of development for 2018."

In terms of the base engine, the key battlegrounds have tended to be the valvetrain, the main bearings and the reciprocating assembly, Wiles explains.

"The valvetrain on a Cup engine is particularly highly stressed," he says. "Every component, be it the pushrods, the springs or the valves, is a potential failure point if you get it wrong. Also, it's one of the areas where any physical degradation can have a significant effect on the engine's performance."

Elsewhere, deterioration of short block components can also have a knock-on effect on other areas of the engine. Wear to the main bearings, for instance, leads to increased clearances and greater oil flow, which can result in lower oil pressure. The teams can adjust the oil pump between

races to counteract this effect, but it's down to the engineers to prevent any other issues in the sealed portion of the engine.

RUNNING HOT

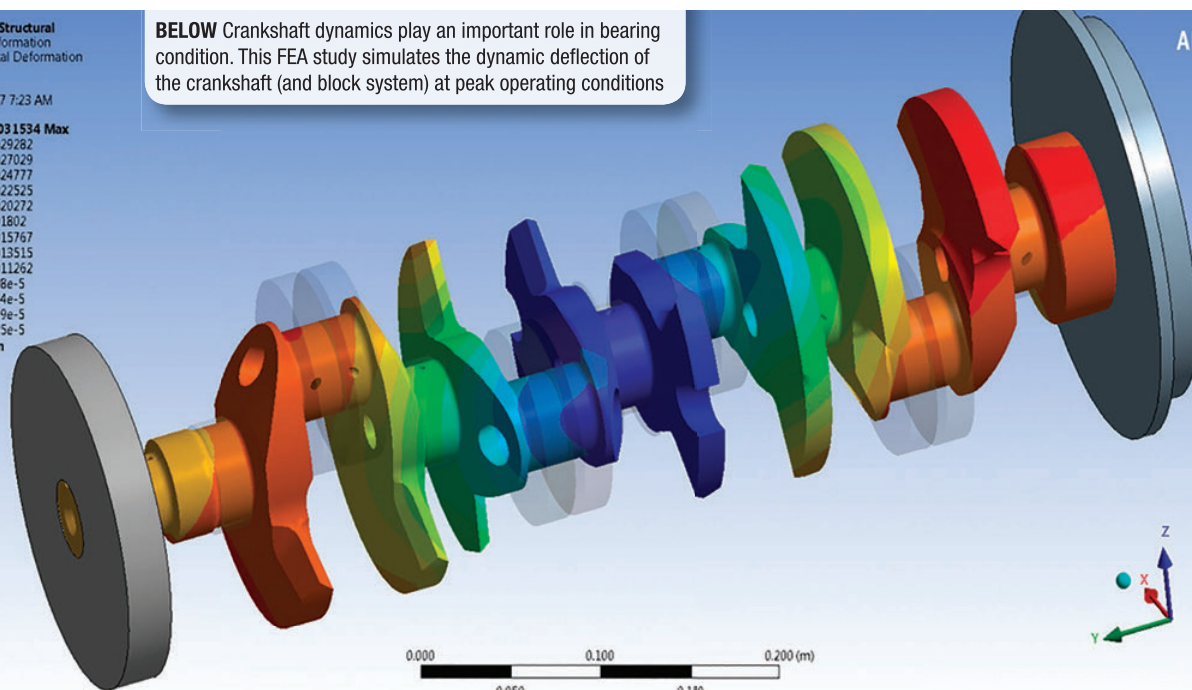
As with any race engine, the ultimate aim is to extract the best possible performance when it's running in the car. In the Cup Series, these conditions can include taping up the front valance to reduce drag, which results in the engine running hot.

"There are no rules on how hot you can run these engines. Generally, it's useful for the teams to restrict airflow through the car and instead direct it over the body for downforce and drag benefits," notes Randolph. "One of the biggest effects of these rules changes is that the teams are probably going to have to ▶

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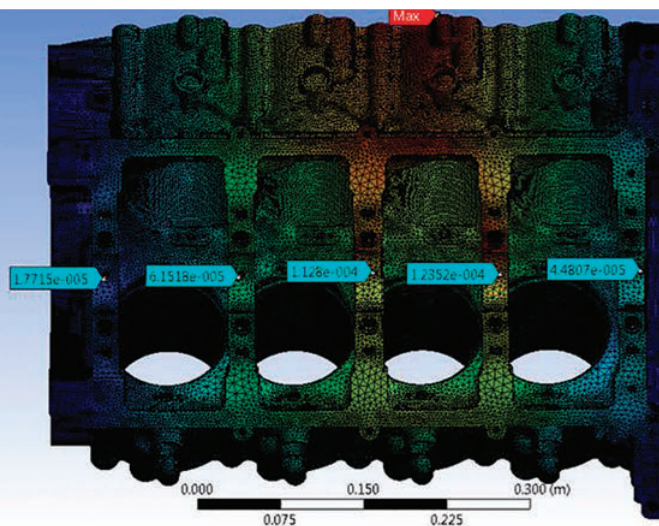
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BELOW Crankshaft dynamics play an important role in bearing condition. This FEA study simulates the dynamic deflection of the crankshaft (and block system) at peak operating conditions



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LEFT FEA is used extensively in the design of the engine. The main casting is one of the components that will now have to survive two races

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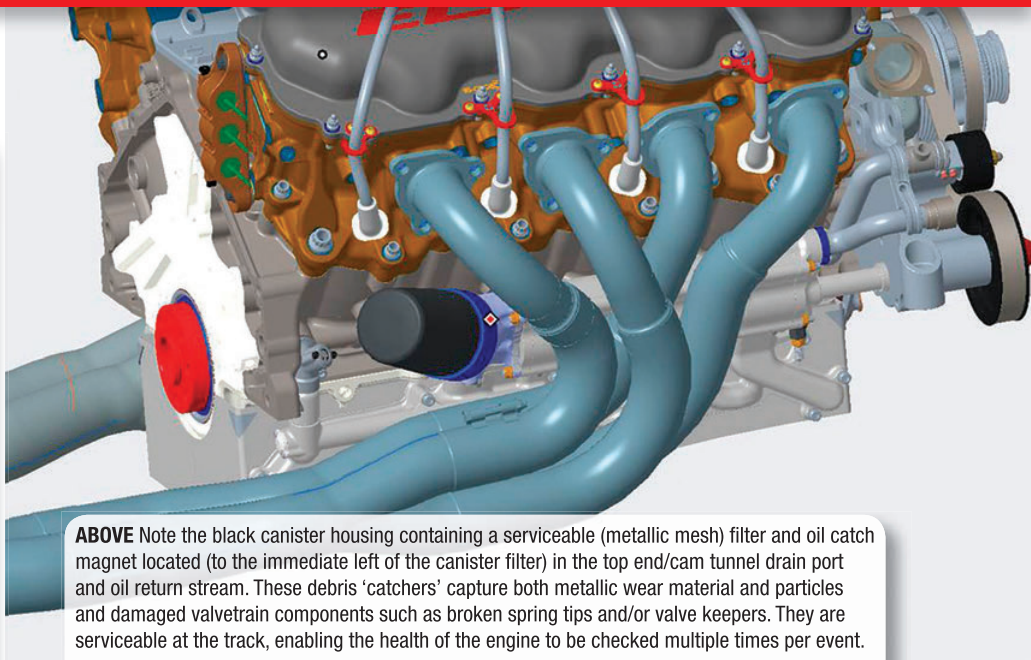
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Short blocks for long-term gain?

THE rationale behind the two-race rule is to help the teams save money, but will it actually work? As always, the reduced hardware cost needs to be offset against the inevitable development costs as engine builders seek to extend the durability of their components.

A lot of the parts that are covered by the two-race rule are things like crankshafts and connecting rods, which are already run for multiple events. After a race, the teams would traditionally take those parts, inspect them and put them back in another build, so there isn't likely to be a huge saving on components.

Instead, it mostly comes down to the labour costs of assembling a short block once rather than twice, but that too has to be offset against the additional inspection time as teams seek to ensure their engines are fit for a second race. The end result may add up to an incremental cost saving, but it's unlikely to be as dramatic as the 'two for one' rule would imply. **RT**



ABOVE Note the black canister housing containing a serviceable (metallic mesh) filter and oil catch magnet located (to the immediate left of the canister filter) in the top end/cam tunnel drain port and oil return stream. These debris 'catchers' capture both metallic wear material and particles and damaged valvetrain components such as broken spring tips and/or valve keepers. They are serviceable at the track, enabling the health of the engine to be checked multiple times per event.

“Underneath the skin, the detail design is deceptively sophisticated”

be more attentive to the temperatures that they run. Wear is very definitely accelerated at higher temperatures. Certainly when the water temperature exceeds 150 deg C you're entering a very problematic area; the temperature probably needs to be kept below about 140 deg C.”

This year also sees the introduction of a spec oil cooler. That's likely to impact the temperature gradient between the water and the oil, but the outright cooling effect can still be tailored to each team's

requirements by taping up the valance.

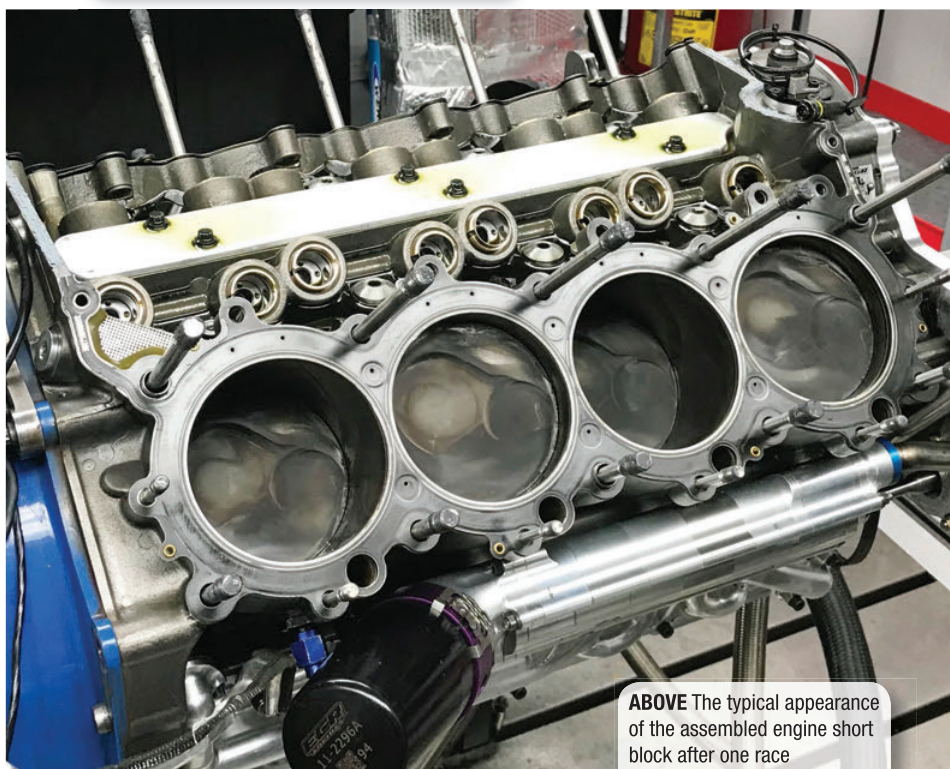
“Some components are more sensitive to water temperature and some more sensitive to oil temperature. So components like bearings, which are more oil-dependent, could start to suffer if you had a large delta between the two, but from what we've seen that gap is coming down with the introduction of the new oil cooler,” says Randolph.

The aerodynamic benefits of running the car taped up, combined with the increased durability challenge posed by the new rules, means that teams and engine builders are constantly looking for ways to increase the engines' high temperature capability.

Perhaps the biggest technological battleground in this respect is lubricant development, Randolph explains: “Oil film thicknesses decrease at high temperatures, so if you know you're going to run the engine hot that generally drives you towards a higher viscosity. The lighter you can go in oil, the less you're going to lose in shear losses. Virtually all the top teams have sponsorship from a lubricant company – in our case it's Lucas – and we work on oils that are not just NASCAR-specific, but unique to our engines. We believe we derive a competitive advantage from that relationship.”

THE LONG VIEW

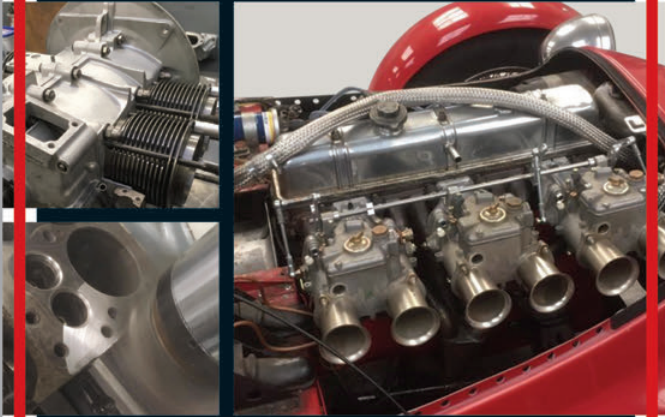
Most of the teams are expected to front-load the schedule with as many second-race engines as possible early on in the season. In theory, it would be possible to fulfil the ▶



ABOVE The typical appearance of the assembled engine short block after one race

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two-race requirement over the course of the first 26 events (13 with fresh engines and 13 with second-race engines). This would then allow the team to use a fresh engine for each of the final 10 races (dubbed the playoffs) where the final championship results are decided.

In reality, it's doubtful that anyone will be able to be that aggressive, Randolph explains: "You have to consider the conditions under which each engine has been run: the engine from Daytona, for instance, will have accrued over 800 miles

by the end of the event and will probably not be a reasonable choice for the second restrictor plate race, which is another 500-mile event in Talladega.

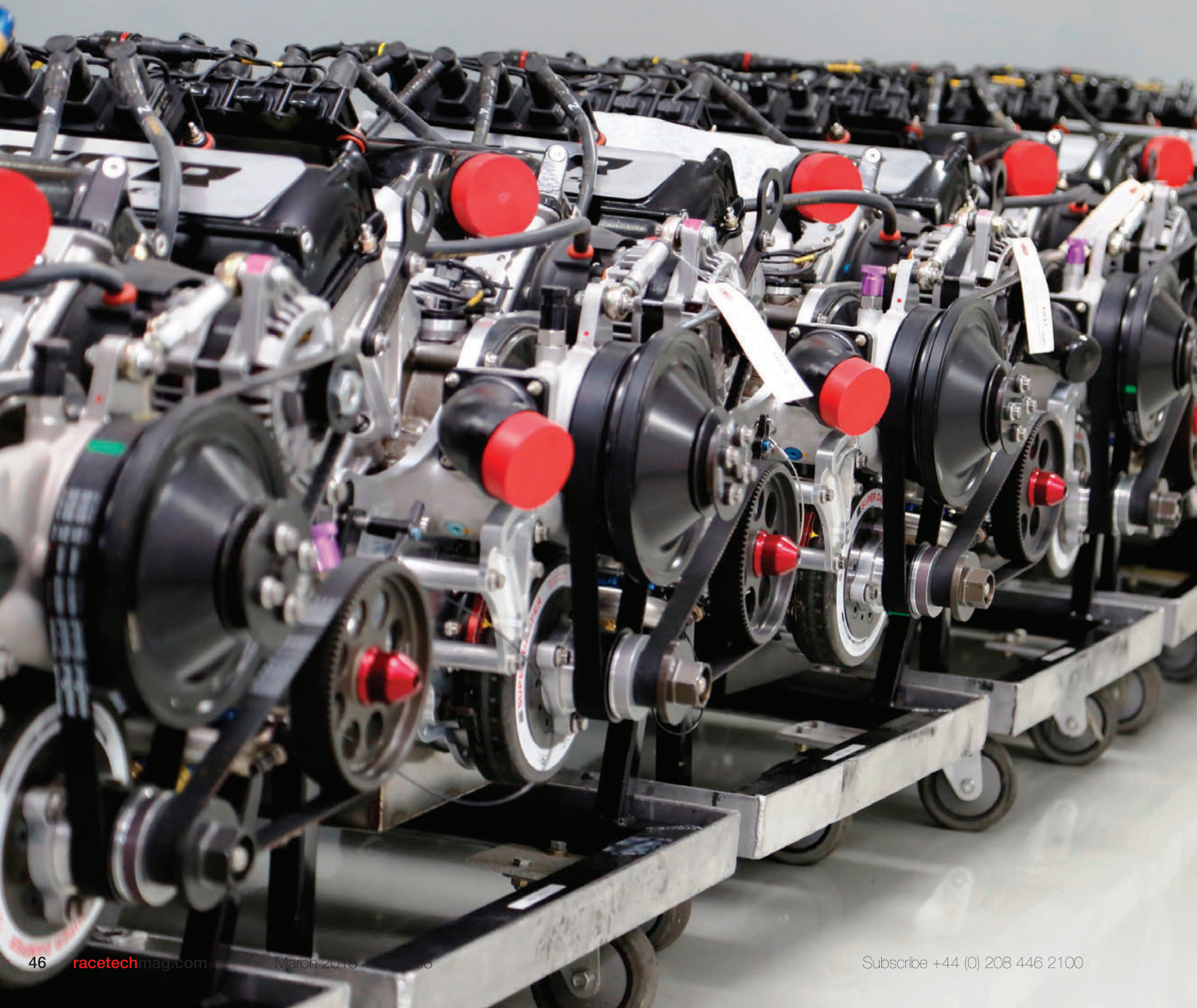
"There are other long races on the schedule which also would be difficult to use as part of the two-race requirement, such as the 600-mile race in Charlotte. Finally, engines that experience harsh conditions (inadvertent high temperatures, accidents) during their first use would probably not be used a second time, nor would engines that experience a catastrophic failure on their first

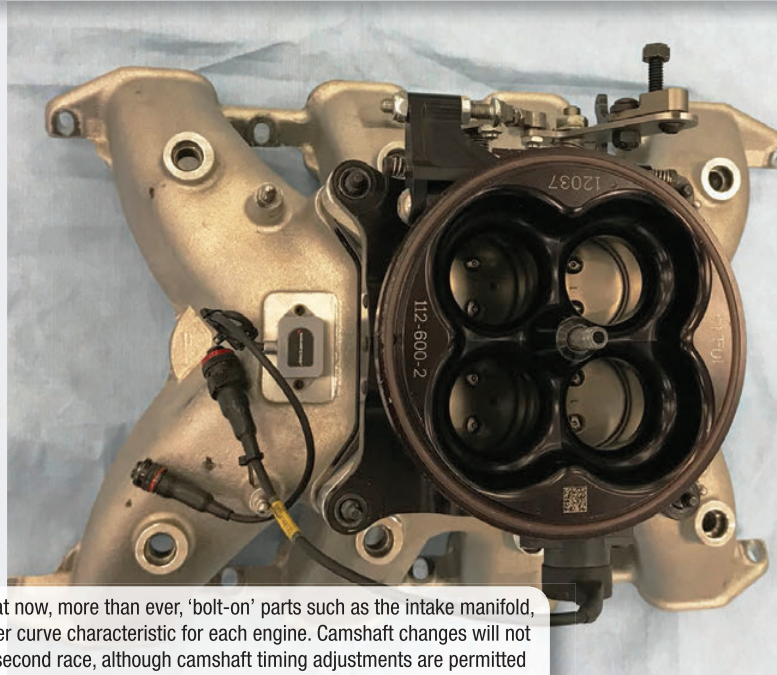
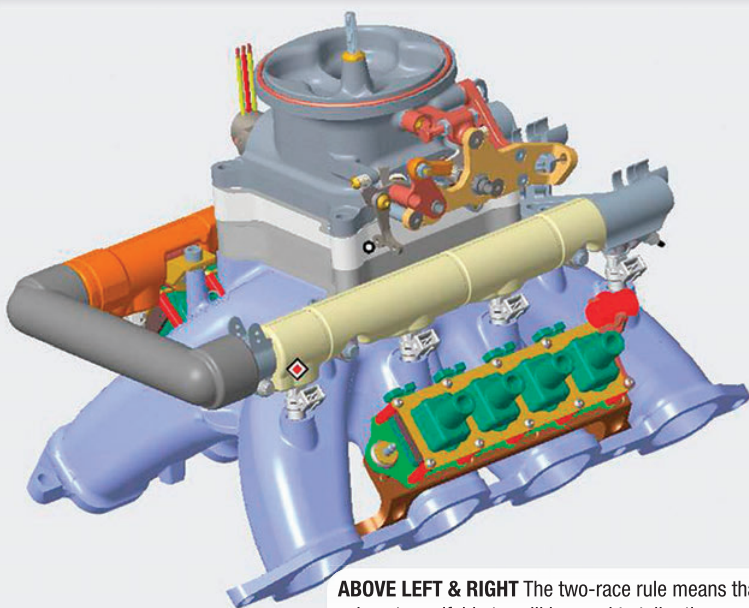
use. Thus, front-loading the schedule may mean that fresh engines are available for only the last five races or so."

There are also two non-points events to consider – the season-opening Clash at Daytona and the All-Star Race at Charlotte. This year these will have to be contested with a fully sealed 'long block' engine, including the cylinder head and valves. It's likely that this philosophy will be extended to the regular championship events next year, so the teams are already gearing up for that switch.

“Every component is a potential failure point if you get it wrong”

BELOW The two-race rule is a game-changer. Until now engineers could effectively develop a unique powerplant for every race





ABOVE LEFT & RIGHT The two-race rule means that now, more than ever, 'bolt-on' parts such as the intake manifold, exhaust manifold etc, will be used to tailor the power curve characteristic for each engine. Camshaft changes will not be allowed during the engines' preparation for the second race, although camshaft timing adjustments are permitted



"All the engine builders will be monitoring their valvetrain and cylinder head hardware. Providing the durability is there and the performance is maintained through the second race, I suspect we will see people sealing long blocks voluntarily for multiple races this year," comments Wiles. "We did a similar thing last year in preparation for the sealed short blocks and it worked well."

And so it seems the next chapter

in NASCAR's engine evolution may already be written as well. Sealing the valvetrain could be an even bigger step – particularly where long-term performance is concerned – but for now all attention will be on the performance of the sealed short blocks. In a formula where tiny changes make a big difference, the success of the engine builders' response to the 2018 rule changes could well determine whether their teams win or lose. **TI**

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THE RETURN OF THE RS

Motorbase Team Shredded Wheat Racing with Gallagher's new ride marks an important return to the BTCC for a very special badge, reports **Alan Stoddart**

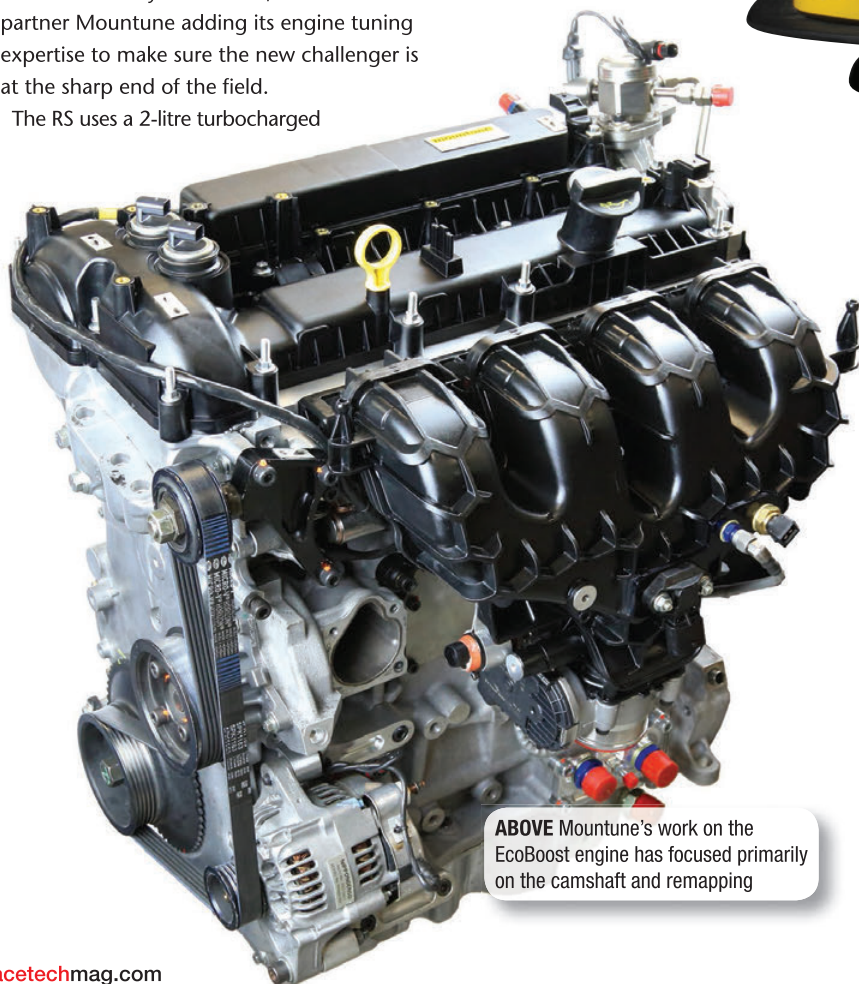
SOME 27 years ago, one car, carrying a very special badge, was proving particularly dominant on the British circuits that formed 1990's BTCC series, taking three of the top four spots at the end of the season. The winning Sierra, which proved to be so successful, and was also powered by Mountune, may now be relegated to historic races, but that very important RS designation is now back in the form of the Motorbase Team Shredded Wheat Racing with Gallagher Ford Focus RS.

The new car, which was launched at the Autosport International Show in January, was built in-house by Motorbase, with technical partner Mountune adding its engine tuning expertise to make sure the new challenger is at the sharp end of the field.

The RS uses a 2-litre turbocharged

engine in line with BTCC regulations, but Mountune has worked extensively to maximise its performance across the rev range, ensuring that the engine's power is able to be deployed at exactly the right moment.

"What we found with this Ford engine was that we had a pretty strong engine at high RPM, but we lacked a fair bit of torque so the drivers kept complaining that the other cars were pulling away," explains Mountune founder and technical director, David Mountain.



ABOVE Mountune's work on the EcoBoost engine has focused primarily on the camshaft and remapping



MISSING MIDDLE

The main reason for this lack of mid-range grunt stems from the fact that the Ford is the only engine on the grid with a direct tappet operation, which sees the camshaft run directly over the top of the valve and over a flat tappet. This traditional method of valve operation is inherited from the road car's power plant and therefore cannot be changed, but it puts the RS at a disadvantage compared to its rivals, which use a rocker system to operate the valves. Compared to the RS's direct tappet operation, the use of a rocker means that a cam with a higher acceleration rate can be used, giving full



ABOVE Motorbase Performance will bring the RS name back to the British Touring Car Championship grid for the first time since 1991 after reshaping its Ford Focus for this season

valve lift but within a shorter period. In order to offset this disadvantage Mountune has made some very innovative changes to the inlet camshaft, as well as making other revisions throughout the engine.

"We've done quite a lot of work changing the camshaft, we've done some remapping, we've also had to repackage the intercooler and the throttle body pipework to fit the new body, and we've really concentrated on filling the mid-range torque," Mountain says, adding that these changes have made significant improvements in both the dyno and track testing that has been conducted on the car.

Despite Ford continuing to use direct

tappet operation, a decision Mountain suspects is likely down to cost, he thinks the engine otherwise provides a good base for the Motorbase RS. "The engine works well," he says. "We always had good top end power, but it was just a matter of getting a good torque curve. It's a heavy car with quite a lot of drag, and if you look at the data, there is obviously a lot of time spent in the mid-range, and it's acceleration out of the corner onto the straight that really pays dividends, whereas a really strong engine just before you are going to hit the rev limiter doesn't help that much."

Another of the obstacles faced by Mountune and Motorbase is the

requirement that the cars use a wet sump. Although most other series use a dry sump to better deal with the G-forces that a car's oil is subjected to, TOCA still mandates the use of a wet sump. Ensuring that these systems are able to reliably feed oil into the engine adds considerable complexity. In the Focus RS, this includes the use of moving pick up pipes that pivot, responding to G-forces in the same way as the oil, windage trays to help oil get back to the sump and one-way valves and breather systems. However, in other cars such as the Subaru that Mountune has also worked on, separate Accusump devices are required to make sure that oil is fed into the engine. ▶



ABOVE Aggressive styling has rejuvenated the Focus

WORKING WITH WHAT YOU'VE GOT

As with many parts of the car, the actual ECU and its software is one-make as stipulated by the regulations. However, the teams are free to change anything within certain parameters. This gives each engine builder the ability to tune and optimise each engine as they see fit. With all the engines now being of the direct injection variety, this gives Mountune a significant level of control over things like multiple pulses and the individual spray patterns.

"We do the dyno calibration, then we very much work with the drivers with tweaking the maps because they all want a different pedal map," comments Mountain. "It is amazing that people want very different things, some want a long linear throttle which gives good progression, while some drivers just want instant response, which is difficult with a front-wheel drive car, because you've got to get traction."

What does make matters easier for Mountune is using suppliers that it trusts, with which it has a long history of proven results. "We do use people like Supertech for instance... they do a lot of valves for us, and we use a lot of traditional suppliers, such as Capricorn, and Omega which do our pistons, Arrow our conrods, Piper the camshafts for us, you know, suppliers that have worked with us for an awfully long time," says Mountain, emphasising the collaborative nature of these relationships.

"It's about having the right suppliers that can deliver the quality but in the short time period we have."

A RELIABLE TEAM

A similar story is told by Motorbase team principal David Bartrum of its own relationship with Mountune. Bartrum has worked with Mountain since 1988, when he built race engines for Bartrum's Sapphire Cosworths, while the current relationship between the two companies has been active since 2010. At the time Motorbase had been running BMW for a few years, and, with the incoming transition to Next Generation Touring Car regulations, was looking into turbocharging the BMW engines. For Bartrum this meant only one thing: "In my eyes, if you want a turbo engine, you go to Mountune."

After going through all the options with the BMW, Mountune and Motorbase concluded

that it wasn't going to work, and so Mountain, Bartrum and Motorbase's team manager and chief engineer went to the Arena team, which was moving to a newer model, and made a deal for their old Focuses there and then. "At that point I didn't know what I was going to do, whether we were going to outsource the build of the shells or whether I was going to do it in-house, but I knew I could use the engines," says Bartrum.

"So from my point of view, yes, I'm going to pay out on three cars, but I'm actually going to get the engines for our next programme."

That car proved to be very successful and raced until 2012, when Motorbase decided to build an NGTC car in-house, once again using Moutune on the engine. Subsequently this tie-up moved onto the EcoBoost engine in 2014, which was brought in for the 2015 season.

The longevity and closeness of this relationship helps to ensure that both Motorbase and Moutune work efficiently together. While Bartrum admits there are disagreements, sometimes stemming from things race teams want that engineers can't deliver, fortunately, the presence of Moutune's engineers, such as David Engwell, at the track during testing and racing means that most difficulties are able to be swiftly dealt with.

"With Dave Engwell, because he is at the ▶



ABOVE Moutune engineer David Engwell has been kept busy

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circuit so much of the time, when he leaves the circuit he knows what we want to do or need to do, and he'll go and push to get what we need for our team. He'll work for both of us," explains Bartrum.

"And David [Mountain] and the team at Mountune, if it's possible they'll do it... A lot of what happens with the car, apart from pre-season, is actually done on race day. Having Dave Engwell there, he can adjust the cars to the temperature, to the weather, he can work with the drivers' needs on the gears and how they want the thing to cut in," adds the Motorbase team boss.

This tireless work has led to some impressive gains. In addition to the engine development that Mountune has done, Motorbase itself has also made many changes that add up to more than the sum of their parts. The team has fabricated the shell on site, which, as well as bringing the RS aesthetic to the racer has meant the ability to fully control the new car's aero. Meanwhile, under the bonnet, the team has repackaged the radiators and changed the intercooler to make sure the engine gets as much cool air as possible. This is critical for the efficiency of the engine on hot days. At Oulton Park on a summer's day for example. It is a tight circuit and with the cars running around "up each other's exhaust pipes, swallowing each other's fumes" it can prove a real test of the car's



BELOW The two-litre turbo installed in the upgraded Focus RS

cooling system. Elsewhere, the team has also done lots of work to improve the car's braking performance.

HUNGRY FOR SUCCESS

Time will tell if the improvements made to the new car will pay dividends on race days, but both Bartrum and Mountain are eager to put the car through its paces. The next step is to shake the car down at the team's local circuit, Brands Hatch, in the second or third week of February, before shipping the cars over to Fast Parcmotor near Barcelona to see what they are really capable of. After that it

is back to the UK to do yet more testing on the run up to media day. This is, as Bartrum says, "probably more testing than we've ever done before. A lot of work."

Mountain is similarly excited about the coming season. "We'd love to win the championship with the Ford. We've worked with Motorbase for a long time, we get on really well, they are a very good outfit and we have more of a family feel; it's just a great team," he concludes.

"We've all put a lot of effort in and we really want to do well. We think the drivers we've got are capable of winning. Watch this space." **LT**



ABOVE The RS name used to represent an unstoppable force when the RS500 Sierra Cosworths ruled the BTCC. This is Brands Hatch, 1989, with Gravett, Rouse and Smith tussling at the start of the race



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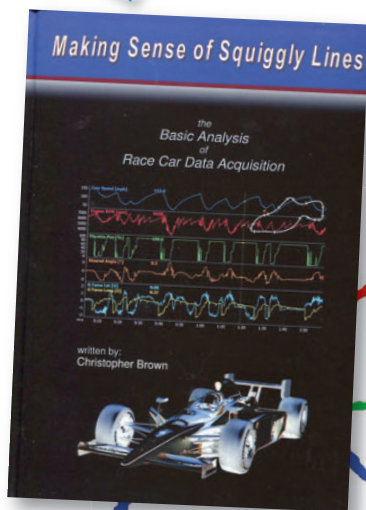


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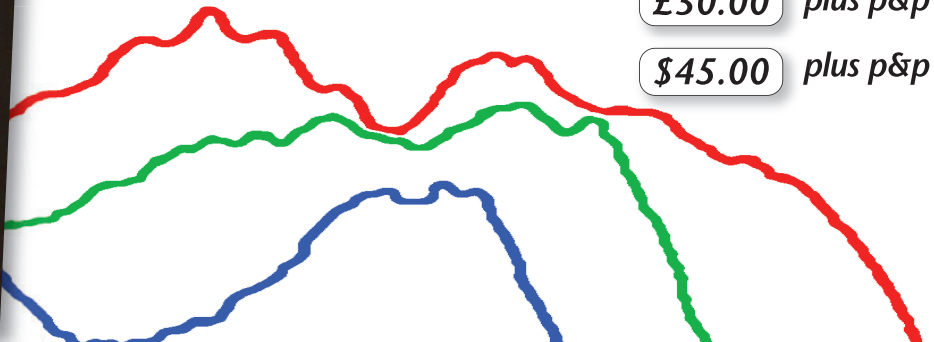


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READY FOR THE R4 REVOLUTION

ORECA might be best known for its success on the racetrack, but **Hal Ridge** investigates how its forthcoming R4 kit could shake up the rallying world

AS motor racing across the board continues to fall under increasingly strict governance with regards to categories' technical regulations, the opportunity for smaller firms to build their own cars diminishes, and with that variety lessens.

Rallycross aside, gone are the days of home-brewed machines being able to compete in top-flight competition.

The FIA and many of the world's ASNs are not about to make a severe about-turn on that stance. Nevertheless, the R4 rally

category, intended in part to take the place of the previously popular Group N division, filled with showroom-spec Japanese saloons from Subaru (Impreza) and Mitsubishi (Evolution), has provided a middle ground.

While R5 machines, built by manufacturers (see Skoda/Hyundai) or manufacturer-supported outfits (see M-Sport) are cost-capped, the investment required is still high. €200,000 won't get you far in acquiring a decent new car and initial spares package. Then there are the running costs. Regardless

of how often the strictly-homologated components need to be changed, whenever that happens it has to be via the manufacturer of the car.

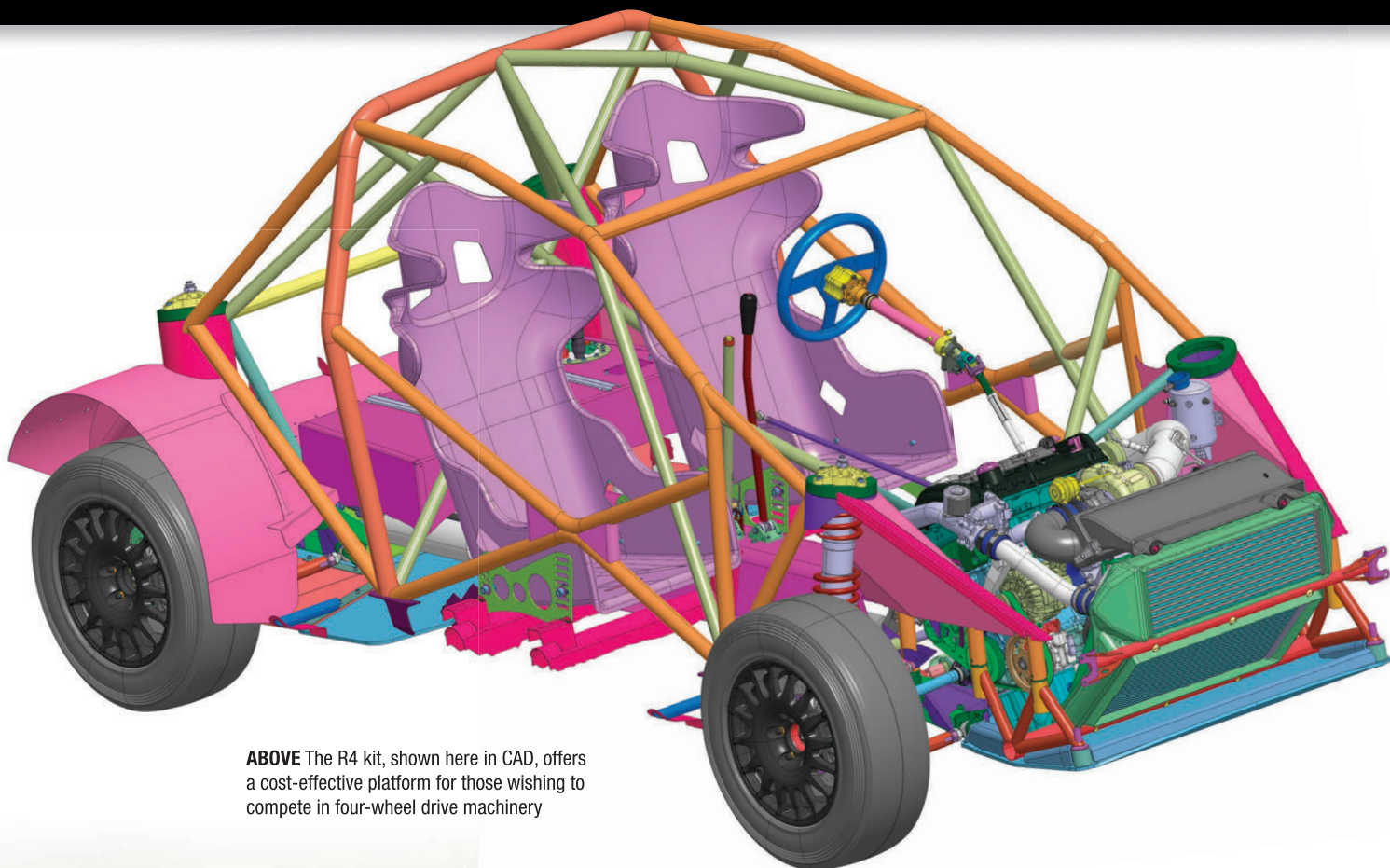
Rs one to three are front-wheel drive in various guises, but the new R4 class was conceived by the FIA to offer a more cost-effective platform for those wishing to compete in four-wheel drive machinery. The intention was to fill the 'void' between the front-drive R categories and four-wheel drive R5.

Designed to fit into almost any car, the new R4 kit comprises a turbocharged petrol engine, transmission, uprights, steering rack, subframes and fuel tank. It is intended to be able to compete around the world in regional and national championships, with an average performance of 0.5 to one second per kilometre slower than its bigger R5 brothers.

French firm ORECA, best known recently for its notable successes in LMP2, is the company chosen by the FIA to produce the new R4 kit, which will be available to customers this year. Aimed at preparation companies, those customers will then build

BELOW ORECA's tender won the FIA's approval. Its universal R4 kit, seen here in testing, built on the company's recent experience in the WRC2 and WRC3 ranks





ABOVE The R4 kit, shown here in CAD, offers a cost-effective platform for those wishing to compete in four-wheel drive machinery

a bodyshell (to the same technical and safety regulations as an R5 car) including roll cage and fabrication, dampers, bodywork and interior, to accept the kit. ORECA will even supply guides for the best roll cage design, chassis changes and wiring harness layout.

The range of models that can be used is substantial, as long as at least 2,500 units have been produced in 12 consecutive months. That chosen car is validated by the local ASN where the car is being built, and later homologated by the same body, which

machine for similar money. Efforts have been made to standardise parts so they can be sourced locally, from local suppliers.

“The main goal in the design office was to select some parts which are available worldwide,” explains ORECA’s chief R4 engineer, Matthieu Bassou. “The wheel bearings and ball joints are standard parts so it’s easy to find them everywhere, in every country. That allows the tuners to work with their own technical suppliers, and it gives the opportunity for the tuners and builders

“An opportunity for manufacturers to return to rallying without serious R&D expenditure”

also notifies the FIA and thus the car can be approved for use across the globe.

The process sounds more complicated than picking up the phone to Cockermouth and ordering a Fiesta R5, but in R4, the kit costs €108,000 and the homologation won’t change for at least seven years.

While the cost of the finished article will be rather more than the kit price, it will still be cheaper than an R5 car. Smaller outfits will also benefit in work creation from having produced the bodyshell and building up the car.

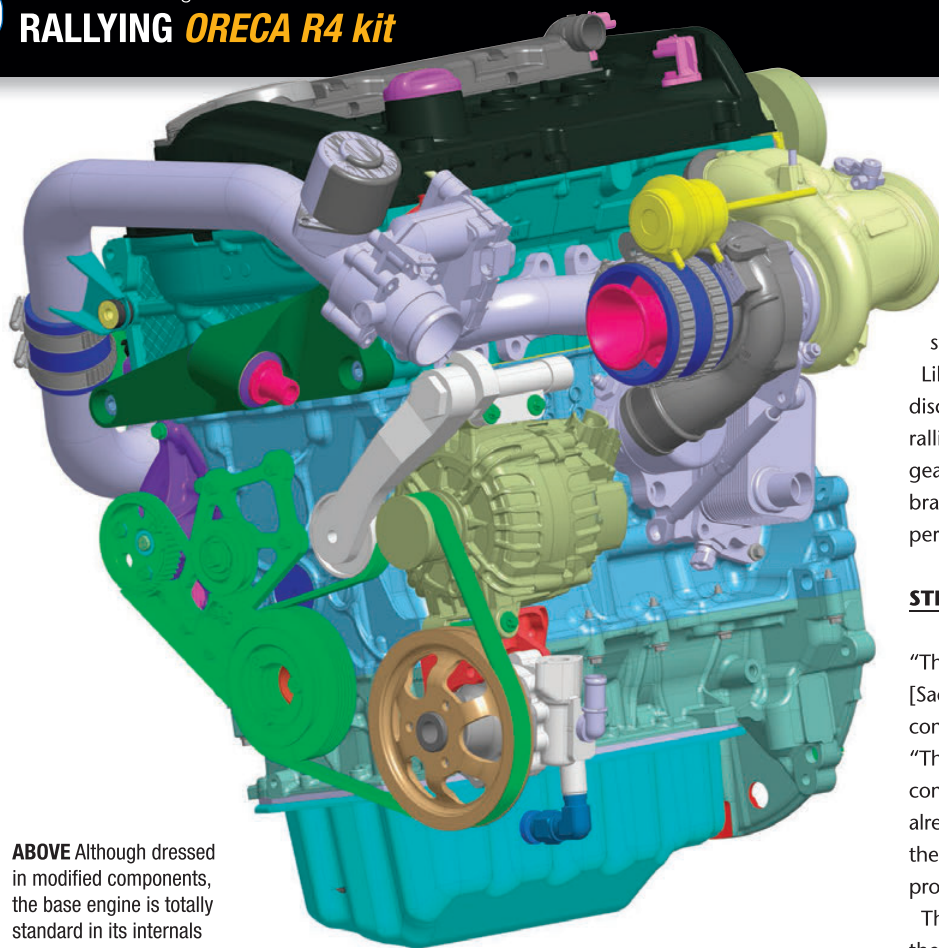
But really it’s the running costs where competitors will save their finances more than if they bought a second-hand R5

to make their own business.”

In a bid to further limit costs, many of the parts are universal, including uprights, suspension arms, bottom arm brackets, steering brackets and brake callipers, an FIA stipulation.

The base engine meanwhile, although dressed in modified components, is totally standard in its internals. “It’s very, very close to the standard engine. There is no internal modification, only oil sump and oil pump, and the water pump system is now with a belt,” says Bassou. The four-cylinder 1600 cc turbocharged powerplant has been taken straight from Peugeot’s 308 GTi, which, ▶

Photos: ORECA



ABOVE Although dressed in modified components, the base engine is totally standard in its internals

ORECA says, means there is no reason to return to France for an engine rebuild or refresh, or a new unit altogether.

"It's already a reliable engine. We just changed the exhaust manifold, water pump belt, flywheel, things like this," he explains. "Internally the engine is 100% standard, so the customer has the possibility to rebuild it or

get a new one. A complete engine assembly is €8,500 at a normal Peugeot dealer, so it's a big advantage on the running cost of the R4 cars." An R5 engine is understood to cost around four times that figure.

The electronic throttle body, turbo, alternator, steering pump and inlet manifold are also part of the R4 kit, as is the Magneti Marelli ECU and engine wiring loom. "The only thing that the tuner has to do is make the internal chassis loom, and they have the possibility to make the full car Magneti Marelli, or they can also plug Cosworth,

MoTeC or AEM dashboards and power units to the Magneti Marelli ECU," says Bassou. "The engine maps have been done for unleaded 98-octane fuel; it's a standard map for all the regions."

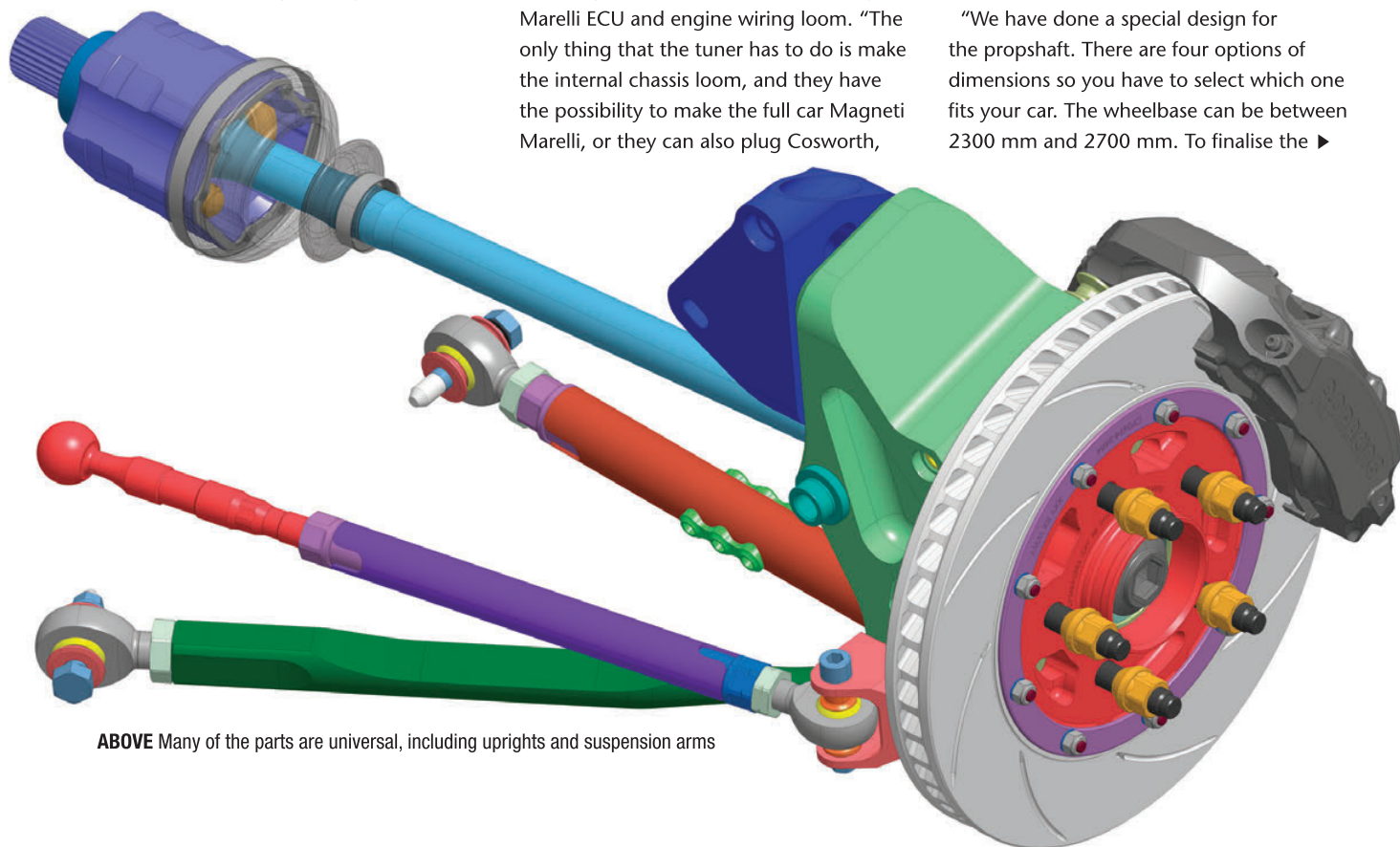
Like the brakes (which just require bell and disc changes between gravel and tarmac rallies), the clutch is from AP Racing. The gearbox that ORECA has chosen, like the brakes, was designed for R5 use, to ensure performance and reliability.

STRONG COMPONENTS

"The gearbox is the same as the Fiesta R5 [Sadev five-speed sequential], so that these components are very strong," notes Bassou. "There was no question of developing new components when you have these from Sadev already." French firm Sadev also provides the R5-based rear differential, while GKN has produced the propshaft and driveshafts.

The driveshafts are a standardised length, the R4 cars being set at the FIA's width of 1800 mm, but with the R4 cars being four-wheel drive, thought had to be given to the range of cars that could be used. ORECA's test mule, a Toyota Etios (chosen because the car already existed in Paraguay), available to the consumer market in South America, India and South Africa, is obviously shorter than a Ford Focus or Subaru saloon.

"We have done a special design for the propshaft. There are four options of dimensions so you have to select which one fits your car. The wheelbase can be between 2300 mm and 2700 mm. To finalise the ▶



ABOVE Many of the parts are universal, including uprights and suspension arms



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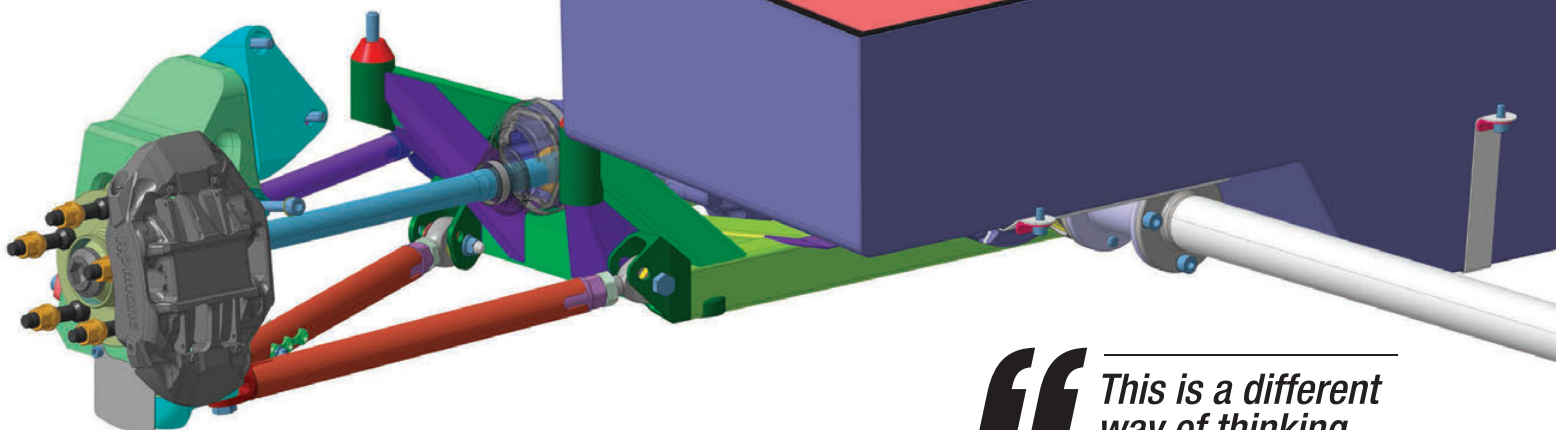
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adaptation, we designed a special spacer to fit the R4 kit more precisely," says Bassou. "The width is the same for every car; the tuner just has to make new wings to cover the wheels."

The R4 category will need to be sanctioned by each individual ASN, and for the meantime cars cannot compete in World Championship events within Europe. In Argentina, Mexico and Australia, where the WRC entries are smaller, R4 cars will be permitted, in the same way that the

Argentine Maxi category cars have been run in recent years.

"The very first idea with the FIA was to create a new category worldwide, to increase the quantities of cars in regional and nations championships outside of Europe, and now in Europe too. The second step was to also replace all the Group N cars which were out of homologation," says Bassou. "The R4 kit design started in December 2016, and the car started to drive in testing in September last year.

“ This is a different way of thinking. There has to be some evolution in the mentality of the tuners ”

"It took three months to do 5,000 km of testing, to make validation on all the kit parts. All these parts had to be validated for homologation in December and now it should be validated by the FIA in the coming weeks." ORECA is also working on a right-hand drive steering rack for the kit to be even more suitable for use in the UK, Asia Pacific and South America.

After-sales service and parts is arguably where the real return for the likes of Skoda, Citroen and M-Sport comes from with R5 machines. But because that doesn't work with the R4 initiative, ORECA knows it needs to sell a significant number of kits for the project to have been a profitable exercise.

HITTING THE RESET BUTTON

"We have to sell around 75 kits to have a quite good success," he says. "This is a different way of thinking instead of making business on selling spare parts. There are some good contacts and we are working now with some tuners, designers and builders to make bodysells, to start the life of R4. There is quite a bit of interest, but now there has to be some evolution in the mentality of the tuners because in the last 10 years, they were just changing parts on R5, R2 or R3 cars. Now they have to restart like in the '90s with Group A, to build rally cars. It will take one or two years to make this idea natural, but there are already some good tuners who want to invest in this new project."

While there can be hope that the tuners



ABOVE The standard parts in the kit will enable tuners to work with their own national suppliers

Bassou mentions come up with some weird and wacky models of car for the stages, rather than simply more Fiestas, Fabias or Subarus, ORECA believes that the R4 concept offers a chance for manufacturers to return to rallying, without serious research and development expenditure. "This is a good opportunity for tuners to develop their own business locally but also for manufacturers to enter the rally world; like Opel, Honda or Mazda [for instance]," he suggests.

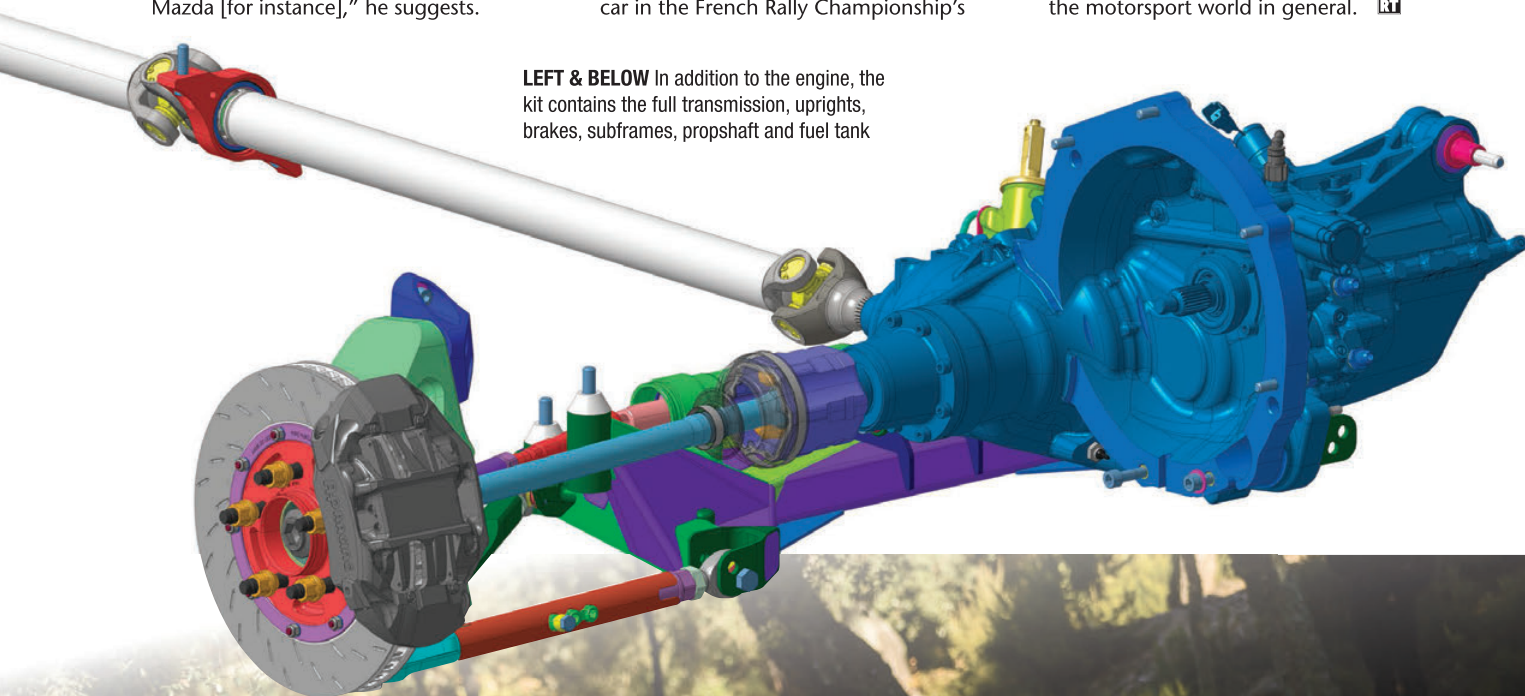
"For them there is no reason to come to R5 because the budget is really huge. R4 gives them the possibility to enter some national events and to develop a good image locally in a country, and it's a good opportunity for the FIA to bring new manufacturers into rallying too."

ORECA's new creation made its first public outing in late November, where test driver Stephane Sarrazin drove the Etios as course car in the French Rally Championship's

finale, Rallye du Var. This year, the cars will enter competition for real.

R4 is not about taking sales away from R5, it's about creating more affordable machinery for those who want to compete at domestic and regional level. Rallying's set of R classes is now complete, and if the introduction of the R4 kit can increase by the numbers of new cars in rallying that ORECA is projecting, that is very much a positive for the motorsport world in general. **RT**

LEFT & BELOW In addition to the engine, the kit contains the full transmission, uprights, brakes, subframes, propshaft and fuel tank



ABOVE ORECA's R4 creation first appeared as a course car in the French championship's finale. This year it enters competition for real

THE CAR EVERYONE'S BEEN WAITING FOR...

After many hours on the computer, in the design process and in the workshop, VW's eagerly awaited Polo GTI R5 has hit the stages. **Hal Ridge** reports

When Volkswagen made the shock announcement that it would withdraw from the World Rally Championship at the end of 2016, few expected the German marque to be lifting another FIA World Champions trophy the following year.

But, it did, albeit now working as technical partner to Petter Solberg's team in the World Rallycross Championship with an adapted version of its WRC Polo. That success was a significant step in the German outfit's new 'customer' era, which also includes the TCR circuit racing Golf.

As part of the new initiative that has switched focus from works efforts to customer programmes, almost exactly a year (to the week) after the Hannover squad started its final event with the Polo WRC in Australia, it rolled out the new R5 Polo for a first test at Fontjoncouse in France.

Based on the latest Mk6 version of the popular hatchback, the four-wheel drive R5 machine is the car that will return the WRC's most successful team of recent years back to the rally stages in 2018. But this time, it will do so with customers driving its cars, rather than headline works drivers.

Under the Volkswagen Group umbrella, VW Motorsport has close links with counterparts at Skoda Motorsport, which has been running an R5 Fabia since spring 2015 with much success in the WRC's second tier, WRC2, for the cost-capped specification cars. But, despite being able to glean knowledge from its more experienced colleagues, Volkswagen is adamant that its new Polo isn't just a rebadged Fabia.

"Ever since we decided to go down the direction of world championship rallying we've been talking to Skoda because as a brand traditionally Skoda has always been active in rallying somewhere. Many people have forgotten that our first steps in



Photos: VW

ABOVE RIGHT & BELOW Test driver Dieter Depping's feedback from the first test, at Fontjoncouse in France, was positive



“In a classic wind tunnel test you’re always bound by time. Now with CFD you can come up with the wildest things and try them”



WRC rallying were actually in Skoda Fabias [Super2000 cars while developing the Polo WRC],” says Project Manager, Gerard-Jan de Jongh, who has led the project together with Technical Director Francois-Xavier Demaison, known as “FX”. “We meet a couple of times a year and discuss things quite openly, to give our opinions and share experiences. Obviously in this project we have more to learn from them than they from us; they’ve been very helpful but it would be wrong to say that the Polo is just a development of the Fabia.”

Despite the close relationship, Sebastien Ogier’s former race engineer (de Jongh) doesn’t foresee conflict between Volkswagen

and Skoda once the Polo hits the stages. For a start, aside from the potential of running the car itself in initial rallies, Volkswagen won’t enter a works WRC2 team, unlike Skoda.

“Our sales targets for the R5 are quite modest so it’s not like we are going to out-sell Skoda because we have so much to learn about customer service, parts logistics, web shops, all the really important things for a customer experience,” he says. “It’s not like Skoda will lose 50% of their customers to us, it’s not going to happen. The main thing is that we are choosing not to enter the car as a team; we don’t want to go into competition with our customers.”

The Polo’s chassis is a new generation platform compared to that of the Fabia, based on Volkswagen’s MQB A0 platform. The new four-door Polo is larger in dimension from the Mk5 version and the Fabia R5, the Polo 72 mm longer and 122 mm wider than the Czech machine.

The Polo’s MacPherson strut dampers are courtesy of ZF, a continuing relationship from Volkswagen’s WRC programme, with suspension travel around 275 mm for gravel and 180 mm for tarmac. On gravel, 7x15” OZ Racing wheels will be employed housing 300 mm Alcon brake discs and aluminium callipers all round, while on tarmac 350 mm discs ▶

will be shrouded by 8x18" wheels, clad with Michelin tyres.

The transversally-mounted base engine, attached to a five-speed sequential gearbox via a twin-plate clutch, has been carried over from the Fabia. Initially derived from a 1.8-litre engine produced in China for the Volkswagen Lamando and Skoda Superb, the four-cylinder unit has been de-stroked with a bespoke crankshaft and connecting rods to achieve a capacity of 1620 cc (with a bore of 82.5 mm and stroke of 75.5 mm).

SKODA RIVALRY

Additional work was also carried out to the cylinder head and internals, injection system and turbocharger. The Fabia's turbo, fitted with the regulation 32 mm air restrictor, was donated by Audi's A3, but Volkswagen is as-yet coy about such details, although engine management is provided by Bosch. The Polo's performance figures are currently advertised as 272 horsepower at 5,500 rpm with 400 Nm torque at 4,000 rpm.

"It's not completely a Skoda engine in the Polo, we still do some development ourselves. On transmission, suspension and electronics for example, we keep each other in the loop but both companies have their own opinions," de Jongh says, wary of giving away specific details on Volkswagen's new challenger.

With the car still in the early stages of testing, de Jongh says the cost-capped nature of the regulations mean that some new suppliers are being sought: "The cost capping adds another dimension in the development. With the WRC car you do everything to reduce the weight, within the limit of price, but with R5 this price factor is bigger and more important. Some suppliers we can't work with because the products they produce are very high quality and very light, but very expensive and it doesn't work with R5. The companies that do machining, carbon fibre and glass fibre manufacturers [for instance]."

Design work on the Polo began in May 2017, once research had been undertaken. The first car turned its wheels in November ahead of the first test, incidentally run at the same venue where test driver Dieter Depping

had also given the ultra-successful Polo WRC its first run out.

"The bodyshell is produced elsewhere by a supplier and we used about four weeks to assemble the first car in our workshop," explains de Jongh. A further test, on gravel, took place in Mid-Wales before the Christmas break, ahead of an "intensive period of testing" for the start of 2018.

"We're still in the early stages and we've been testing in relatively cold conditions. If you look at the operating window of a rally car, we've only ticked a small corner of it at the moment," says de Jongh after around 1500 to 2000 kilometres of running. "We're very encouraged by what we've seen and the drivers' reactions. We've used some drivers who have experience of WRC2 [including 2017 WRC2 champion Pontus Tidemand] ▶



ABOVE & BELOW The R5 category has proved incredibly competitive but few would be surprised if the Polo GTI took it to a new level





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ABOVE Any doubts over the ability of VW's customer racing department to replicate the success of its WRC programme were quickly dispelled. The Polo took the rallycross world by storm

and Dieter, and so far the reactions have been positive. The reliability has been not bad; so far it's gone quite smoothly."

Using multiple drivers for testing is a new outlook for Volkswagen, but a necessity. Previously in its works programmes it has honed its machines for specific drivers, using both the drivers themselves, Depping and for its stillborn 2017 WRC machine, Marcus Gronholm. The R5 Polo however needs to work for drivers of all experiences and abilities.

Asked how far from the finished article the Polo currently is, de Jongh says: "I would say less than 80%. It's not like I say 50% and mean that we will redevelop 50% of the car, that's not the case, but there are still major decisions and major changes going to happen." The new car is expected

to be homologated in late summer and debut in autumn this year.

Constrained by both regulations and the external architecture of the standard bodyshell, the major aesthetics of the Polo R5 are set, but some adaptations will still be made before final homologation. The front bumper, front wings and rear quarters are the main areas that could feature future development. "The front bumper openings for instance we are still experimenting with and we will use the CFD (computational fluid dynamics) results to optimise this as much as possible. You can basically change the front bumper openings, and outwards from the inside of the front wheels, roughly 30 cm, on each side. Those areas that are free for R5 will definitely still change," says

de Jongh, who says that developing a new car from scratch with the constant increase in technological development, doesn't necessarily make life less complex.

"Increasing computing power and simulation never makes things easier. It increases the understanding of the car, but a rally car is a very complex, very dynamic thing. The models in any simulation, whether it's vehicle dynamics or CFD or whatever, are getting better, the software is getting better, you have more computing power so you can put more and more and more detail in. At some point you have to cut the level of detail because the rallying world is so complex.

CFD vs WIND TUNNEL

"CFD is helpful because wind tunnels are so very expensive, but getting good CFD software and good engineers that can operate it is also very expensive. In a classic wind tunnel test you can have a few installations but you're always bound by time and how to install them. Now you can come up with the wildest things and try them. It still costs money but it's not so visible."

Since the R5 category was introduced in 2012, over 400 cars have been produced by major players M-Sport (Ford), Citroen, Peugeot, Skoda and Hyundai. Volkswagen's new creation, however, based on the success of previous programmes and the undoubted ability of those involved, means that the new Polo is arguably the most eagerly anticipated of them all. **RT**



ABOVE Alcon and Michelin are among the suppliers. However, not all companies can adapt to the cost-capped nature of the regulations

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SEIZE THE DAY

Xtrac's new chairman tells **William Kimberley** that the current period of technical upheaval represents a huge opportunity for the industry

WHEN it was announced in early January that Joe Greenwell had been appointed as the chairman of Xtrac, it raised a few eyebrows.

He had carved out an impressive career in the automotive world, work that continues to this day in his role for the UK government-backed High Value Manufacturing Catapult, but what was it that caught his eye about Xtrac? The answer, it seems, was that he had come across the company a few years ago when he was on a judging panel for the Advanced Manufacturing category in the UK Manufacturer of the Year Awards.

"I have had my eye on Joe for some time," says Peter Digby in his new role as Xtrac president. "He brings unrivalled experience as a highly respected and influential figure within the automotive sector, having developed vital relationships with the global automotive industry, trade bodies, government and academia. His insight on key issues as the automotive industry undergoes a significant shift towards an autonomous, connected and electrified future will be invaluable in the continued development of Xtrac, helping to further position the company as an exemplar of UK research, innovation, advanced design and manufacturing prowess."

"I thought then, as I thought last summer when entering discussions with Peter, that it's a really successful mid-cap company



BELOW Xtrac's new chairman, Joe Greenwell CBE, is an influential figure within the automotive sector

with a very strong market position in its core motorsport activities," says Greenwell. "With its focus on innovative, advanced engineering, there was clearly the potential to do all sorts of other things in areas in which they are involved. I also liked the idea that 77% of its products are exported. I think it's what the UK government likes to imagine is an exemplar for an SME, which is a strong focus on innovation, engineering and on international business."

Another thing that impressed Greenwell was its expansion plans. It has recently added a new 26,000 square foot extension to its factory that will come on stream during the summer, while its employee head count will increase from 330 people to 400.

The company already has new machinery on site that is currently waiting to be installed.

As company president Digby explains: "While this expansion could have been done slowly and gradually over a five to seven year time period, with the business being here today, and with Inflexion taking a stake in the company, it has enabled this rapid expansion."

What could have been a road block during the delicate discussions that were taking place with Inflexion last year, in fact proved to be a blessing, as Digby explains: "At the time of our discussions, the British government announced its air quality targets for 2040 and its proposed ban on the sale of new conventional diesel and petrol cars

and vans. Rather than be put off in fright, though, the guys from Inflexion said it was a massive opportunity and saw that we have 20 years of a massive amount of work where companies have to bring out product very quickly, which is our speciality, plus prototypes and product demonstrators. It was these factors that Inflexion saw as even more of a reason to invest."

"It was this major focus on investment in plant equipment and skills development that impressed me as did its activities on the softer side of the business, such as its relationship with Newbury College and its apprenticeship schemes," says Greenwell.

OPPORTUNITIES ABOUND

It is not his intention to become an interfering chairman, but act in a more advisory capacity, using his knowledge and contacts where relevant. "You don't get in the way of a successful execution of a high performing business as we see from Xtrac, so my job is to use my experience and look at the global network and try to assist in that regard, whether it concerns engineering or high level contacts around major automotive marketplaces and governments around the world," he says.

"However, my main aim is to sit with the team, look at what we are trying to do and see how I can help. My background is at Ford and JLR, working in Germany and in the US and working with the Automotive Investment Organisation promoting the automotive business around the world in markets like China and North America, I hope to be able to use that experience for the management team.

"There is no doubt that these are very challenging times for the automotive



BELOW Fresh investment will see a 26,000 sq ft expansion of Xtrac's existing 88,000 sq ft purpose-built factory in Berkshire

“We are on the cusp of some significant developments in high-performance automotive engineering”

industry, but it's also when motorsport companies can come to the fore if they know how to go about it. There's always been technological change in the automotive business and companies are pretty adroit in adapting, developing and innovating new technologies to meet the demands of governments and regulatory authorities around the world. Right now, though, I think we are on the cusp of

some significant developments in high-performance automotive engineering and automotive engineering in general.

"Big companies look to businesses with innovative capacity and agility, rapid prototyping and a testing programme which can respond rapidly, and who get the technological challenge and are up to it. They've not only got the physical capacity but have the technological competence and Xtrac is well positioned. Just recently it introduced the P1227 Integrated Lightweight Electric Vehicle (ILEV) gearbox family. It was designed, developed and made in just four months to address the growing market requirement for single speed, lightweight and power dense EV transmissions, which illustrates the company's agility.

"As we move more towards electric vehicles there will be more offerings and companies like Xtrac with their track record in motorsport and high-performance engineering are well positioned to be able to scan the marketplace and develop products that meet its customers' needs." **RTI**

Proven track record

Joe Greenwell's 45-year career in the motor industry has included many senior roles, including chairman and CEO of Jaguar Cars before being appointed chairman of Ford of Britain.

He has most recently served as chief executive of the UK government's Automotive Investment Organisation, established in 2013 and now part of the Department for International Trade. He is also chair of the RAC Foundation and has served as a board member of the UK government-backed High Value Manufacturing Catapult since 2012. The Catapult centres are a network of world-leading centres designed to transform the UK's capability for innovation in specific areas and help drive future economic growth.

In recognition of his services to the automotive industry he was awarded a CBE in the Queen's birthday honours list in 2011. **RTI**



LEFT Deciding to introduce the Halo might have seemed like the hard part, but producing it involved a number of challenges

HIDDEN TREASURE

It looks unassuming but this piece of bent tubing will change F1's DNA. **William Kimberley** reports

IT would have been easy to have walked by without noticing it as it was relatively innocuous. But for those who were either observant or knew what they were looking at, the bent tubing on the SST Technology stand was one of the most interesting things on display at the Autosport Show.

This bent tube was no less than the Titanium Driver Protection System, otherwise known as the Halo - Additional Frontal Protection Halo (AFP-Halo) - that will be seen on every Formula 1 and 2 car this season and then on Formula E cars when its new season starts next autumn. Employing its extensive experience in the design, development and manufacturing of high precision fabricated components, tube manipulation and precision machining to meet the unique challenges that this project presented, SST is the only UK manufacturer of this type of system.

RACE AGAINST TIME

"We've been working on the Halo for the last 18 months, our first communication with the FIA being at Silverstone in 2016," said Nick Henry, SST Technology's engineering director. "A few weeks after the Shield was unsuccessfully tested and failed at Silverstone in 2017, we got a call to say that the Halo was all go for

next year (2018), so it's been a hectic few months since then.

"The FIA had the Halo quite well defined as to what it needed to be so we put forward our manufacturing and quality control proposal. The key task was really developing this manufacturing process and while it looks on the face of it as being quite simple with a few machined bits and a bent tube, it's been quite a challenge to fabricate.

"We took the design intent of what had been validated and ensured that we were

“The accuracy between the mounting points of initially around 50 microns was something that really stood out”

translating that into something that could be manufactured in some volume and at a sensible cost. Titanium was the material of choice, initially having to decide what would be the best grade because what's good on paper sometimes isn't the best for trying to bend a tube, but ultimately it resulted in Grade 5 titanium, which is significantly stronger than commercially pure titanium while having the same stiffness and thermal properties.

"We did a lot of work in the development of the bending process and obviously the

welding parameters being fundamental to the success and structural integrity."

The FIA did a great deal of investigation and R&D into the Halo's stress areas, looking back at old accidents and how it would behave if it was on the car at that time. "We came in off the back of that," said Henry.

"The analysis was done and we had the data and drawings so it became a question of how we made it. The key welds were the rear mounts to the main hoop on both sides.

"Another big challenge was that the accuracy between the mounting points of initially around 50 microns, and being a fabricated component, was something that really stood out on the drawing when we were first assessing it. We developed the various elements of the process in isolation and then brought them together. This culminated in the homologation test, which is essentially 125 kilonewtons applied on the front of the Halo with no significant deflection, followed by the ultimate failure test consisting of a load

coming in from the side with no permitted failure below 125 kilonewtons.

"We looked at it in a number of ways to ensure that we kept to the very tight tolerances as set by the FIA and took a few iterations in a few areas and got to a point where we got the accuracy and hitting the load requirements of the homologation test."

The Formula 1 teams have now started to receive the first definitive examples of the Halo in recent weeks, giving them the first proper chance to assess the device's impact on the 2018 cars. **RT**



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THE LURE OF THE 200 MPH CLUB

CRP USA's Stewart Davis tells **William Kimberley** about a project which led to a place in the record books

Photos: Victory Motorsports Team



ABOVE The streamliner ready for its first pass



ABOVE Home-made meets high tech: the NACA duct in Windform SP on the engine, which had been salvaged from a junkyard

CRP USA is used to dealing in rather unusual projects. Often they are motorsport-related but they can also be in aerospace, an area in which it is finding increasing interest in its products. When Burton Brown of Victory Motorsports approached the company at the PRI a year or two ago, little did any of them know that it would take them to the Bonneville salt flats and a place in the record books.

The original project concerned a V8-powered Datsun 240Z that Brown was preparing for some record breaking. CRP USA was asked whether it could help build some velocity stacks for the car. The answer, of course, was yes, no problem and they were duly delivered. Then there was radio silence, so Stewart Davis, CRP USA's director of operations, put through a tentative phone call to follow up. The reply was that the

project was currently on hold but Brown was on to something even more adventurous.

The Streamliner is a 3.0-litre diesel-powered car with which Brown hoped to join the fabled 200 mph Club at Bonneville, but he needed help, so Davis' call was extremely fortuitous. What was needed was a NACA duct, which sounds simple enough, but not on a car exceeding 200 mph on the less than

smooth salt flats.

"The most interesting thing about it was its unusual shape. The part at nearly 28 inches long, with a complex interior design, was an interesting challenge," says Davis. "The design had some extra complexity to help the airflow at the base of the turbo inlet that did look a bit daunting. We had to build it in three sections, but our finishing team was able to apply its

“ I am completely amazed at its strength ”

knowledge and skill to give an expert polish.”

The part made of CRP’s Windform SP material was completed but when it came to be fitted, a complication arose when the newly-painted fairing arrived. The scan data had been developed using the exterior surface of the fairing rather than the interior, so the new NACA duct did not fit.

“The fit to the engine was great but the curvature to the body from the scans must have been off a little, which created some challenges getting it to fit to the body,” says Davis. “Burton had invited me to come and see the Streamliner so we reviewed the fitment issues. Attempting to force the part was not working. Windform SP is a very tough material, so the decision was to fracture a section of the part to allow a little give, so it would match the curve of the fairing, and then reinforce it by riveting an aluminium backing plate.”

This work was carried out at Bonneville where the team had relocated prior to the record attempt. Come the Sunday, the car passed tech and everyone prepared for a Monday morning run. The opening Speed Week passes on Saturday had yielded two runs above 400 mph, so Brown knew that the potential for breaking the record in their class was a possibility. Conditions were good Sunday, but the track had started to get rough in some areas.

On the first pass, the car withstood some damage to the fibreglass due to the roughness of the salt/silt surface, but the exit speed at mile 6 was 234 mph. The radio announced that the team had qualified for the record, and the car was placed in impound where they have up to four hours to inspect the car for safety for the follow-up run.

The following day, the car had its second run, setting a time that saw a new F/DS class record being set at 212 mph, and as importantly, enabling Brown to become a member of the Bonneville 200 mph Club.

While there were many elements that allowed this success to happen, Brown paid special tribute to CRP USA and Windform SP, saying: “The Windform SP part performed extremely well, and held up to all of the abuse, even being heavily modified while on the salt flats, with limited tools and time. I am still completely amazed at its strength.



ABOVE & BELOW The intake duct, seen here at Bonneville, was a key component. It is pictured below on a test fitment



“It gave us no issues withstanding the speed and the rough track and vibrations and is a very light and strong material that can also take the extreme heat generated in the very tightly fitted body. A few years ago, I wouldn’t have dreamed of having something like this on the Streamliner.”

“It was great to be a part of the team’s record-setting run, and we congratulate

Burton and his team on the record,” says Davis. “Now we are all looking forward to seeing more with both the Streamliner and 240Z when the new engine is completed. We are fortunate to work with teams that are dedicated to their sport, and the Victory Motorsports team is a great example of the hard work and determination it takes to be successful.” **RT**

AS ever, the National Exhibition Centre in Birmingham was the focus of the motorsport industry for a few days in January, with enough stars and cars to satisfy the fans while it was business as usual for the industry, although there were some important names missing for various reasons.

"OEM fuel tanks tend to be under the rear seats so we make fuel cells to fit accordingly. They are the handmade flexible bladders but are quite design intensive as the shape of the floor needs to be taken into account and it is also necessary to manufacture a cover to protect it from underneath. In the short

STARS AND CARS ON SHOW AT ASI

William Kimberley and Alan Stoddart report on the stories behind the scenes at the NEC

Prominent, though, was **Aero Tec Laboratories (ATL)**, which has been a stalwart of the show for years. It was showing a selection of its products including an LMP2 custom bladder, illustrating some of the technology that was used at Le Mans last year, along with some of its grassroots products such as the popular Saver Cell and Racecell ranges.

"We have here a customised Saver Cell with an internal collector level sender and some other equipment," said James Gornall, ATL's head of sales & marketing. "The reason why these are quite important right now is that we are seeing a lot of regulation changes. Recently the FIA mandated that any vehicle competing in an international FIA event must have an FIA safety fuel cell, and, at the end of last year the World Motorsport Council decided that all rally cars in R1, R2, R3 and Group A and Group N now need to have FIA safety fuel cells, which is a big deal.

"We have a wide range of ready-made fuel cells that can also be customised for times when teams need them quickly. Our custom fuel cells are handmade and certified at the time of manufacture so it's not a case of knocking them out quickly. There's also an element of design in many of them as well. So the Saver Cell is perfect, especially our newest addition; a 60-litre D cell that goes into the rear wheel well of a car, but which also has an overhang to get that extra capacity. It was designed and made with the new regulation changes in mind, as people need more than just a small amount of fuel in a rally car. It has also been designed to fit most cars.

timeframe that many people have as a result of the late regulation changes, the Saver Cell is the optimal solution. They can also be inset into the floor if the regulations allow body modifications to be made.

"We are, of course, also well underway in supplying custom made tanks for customers who are a little further ahead of the curve in getting ready for the new season."



ABOVE Sunoco E20-R is a response to the use of 20% ethanol in sportscar racing

There were a number of new products to be found on the **Anglo-American** stand, including Sunoco E20-R, which was a response to other such products on the market and direct requests from its customers. "20% ethanol is used in the World Endurance Championship and the WeatherTech SportsCar Championship, which prompted us to make it," said Anders Hildebrand, ▶



BELOW ATL's Saver Cell range is coming to the rescue for those adapting to rules changes in a short timeframe

founder and CEO of the Anglo-American Oil Company that distributes Sunoco Race Fuels on an exclusive basis in Europe and the Middle East.

“Sunoco E85-R is blended to consistently contain 85% ethanol. Conventional E85 can vary from about 51% to 83% ethanol or so but rarely contains 85% ethanol. Conventional E85 can also vary seasonally; the composition of Sunoco E85-R race fuel does not change. The non-ethanol portion of Sunoco E85-R is comprised of highly-refined race fuel hydrocarbons for stability and consistency.”

Driven has introduced Driven DI, a special high-performance oil for direct injection engines. Lake Speed Jr, Driven’s general manager and a certified lubrication specialist, finds that the use of calcium in a lubricant’s detergent package can cause a catastrophic failure in worst case scenarios in certain conditions, such as high load and low engine speed when the engine is not fully warm.

“It happens on road and race cars and is due to the combination of the fuel and the oil, mainly the latter,” said Hildebrand. “Lake has therefore devised a formula to counter this problem with a full range from 5W-20 to 10W-60.”

“DI engines are different than normal gasoline engines or normal port injection engines in a few ways,” said Speed Jr. “There is typically higher compression and there’s less time for the fuel to vaporise, in terms of crankshaft degrees of rotation between the time the fuel is introduced to the time the spark event occurs; you can’t burn liquid fuel, it needs to be vaporised. So what happens in a DI engine is that there’s more fuel dilution of the oil on the cylinder wall. After a while, the fuel and the oil mix together, which creates this third thing that’s neither fuel nor oil, which is a lower octane value and causes detonation/knock, which can contribute to destroying the engine.

“High load and low engine speed is more prone to detonation, and the oil formulation can impact that. Our new DI oils are designed to reduce the frequency and possibility of low speed pre-ignition. The second thing, also from incomplete combustion, is that DI engines create soot just like diesels would. Normal oils — racing oils especially — are not designed to handle soot, because soot doesn’t happen in normal carburettor engines or port injected engines. Our engine oils are designed to handle soot to keep them from causing excess wear in



ABOVE Driven’s DI is a high-performance oil for direct injection engines

the engine. Additionally, DI engines don’t have fuel to wash the intake valve clean, so they’re prone to having heavy build up and deposits on the back of the valve.”

Driven’s own R&D has found that the formulation of the oil can determine how difficult it is to remove the deposits, as well as how big they are. “We can’t eliminate it,” he says, “but you can reduce it and make it easier to manage and clean.”

Another longstanding exhibitor is **ARP**, which primarily uses the show as a focal point for its distributors. As Chris Brown, ARP’s director of specialty products explained, the Californian company is on an upswing.

“We are investing pretty heavily in new equipment, more resources and a new building as we are out of space,” he said. “Because of the expansion, we are buying more equipment, more machinery and ▶



ABOVE Tilton displayed its 79-Series spherical bearing-mounted master cylinder

hiring more people in an effort to try and keep up with demand for the product. The biggest drive is for catalogue product, but business is increasing on the bespoke side of things as well. We're moving into new markets while expanding our presence in existing markets - industrial, oil and gas. However, motorsport and performance automotive are always going to be our core."

Supertech, another regular exhibitor, also from California, was showing its usual range of valves, such as its solid steel ones for normally aspirated engines, Inconel solid valves for turbocharged engines and sodium-filled Inconel valves for some rallycross customers.

"There were issues with valves warping after a few races because of the high temperature from the exhaust gases and the high boost application," said company president Willy Tagliavini. "We ended up changing the size, finding a solution with the sodium-filled valves, that seems to have cured the problem along with a change to the seat material."

The Ford EcoBoost engine continues to be a major source of business for Supertech, the company supplying a wide range of valves for different applications along with conrods and pistons in some instances. "The EcoBoost engine both here in Europe and in the US is proving to be a very popular engine and is very good business for us," he noted.

Fellow Californian company **Tilton** was displaying its new 79-Series master cylinder, a spherical bearing-mounted master cylinder that is ABS compatible.

"We have been working with Audi Sport as it has been seeing some pretty heavy seal damage from the ABS system on the

Audi R8GT and Lamborghini Huracan GT3 cars," said Kirk Skaufel, Tilton's director of sales and marketing. "The issue was that the fluid goes one way then comes back through the master and that pressure tries to extrude the seal through the cut-off port, so it starts to damage the seal. The 79-Series master eliminates the cut-off port and it goes to a compensation port with a valve system, so there's no cut-off port to worry about damaging the seal. The valve opens and the pressure is equalised. Elimination of the cut-off port therefore greatly reduces the chance of seal damage caused by high pressure pulsations from the ABS system.

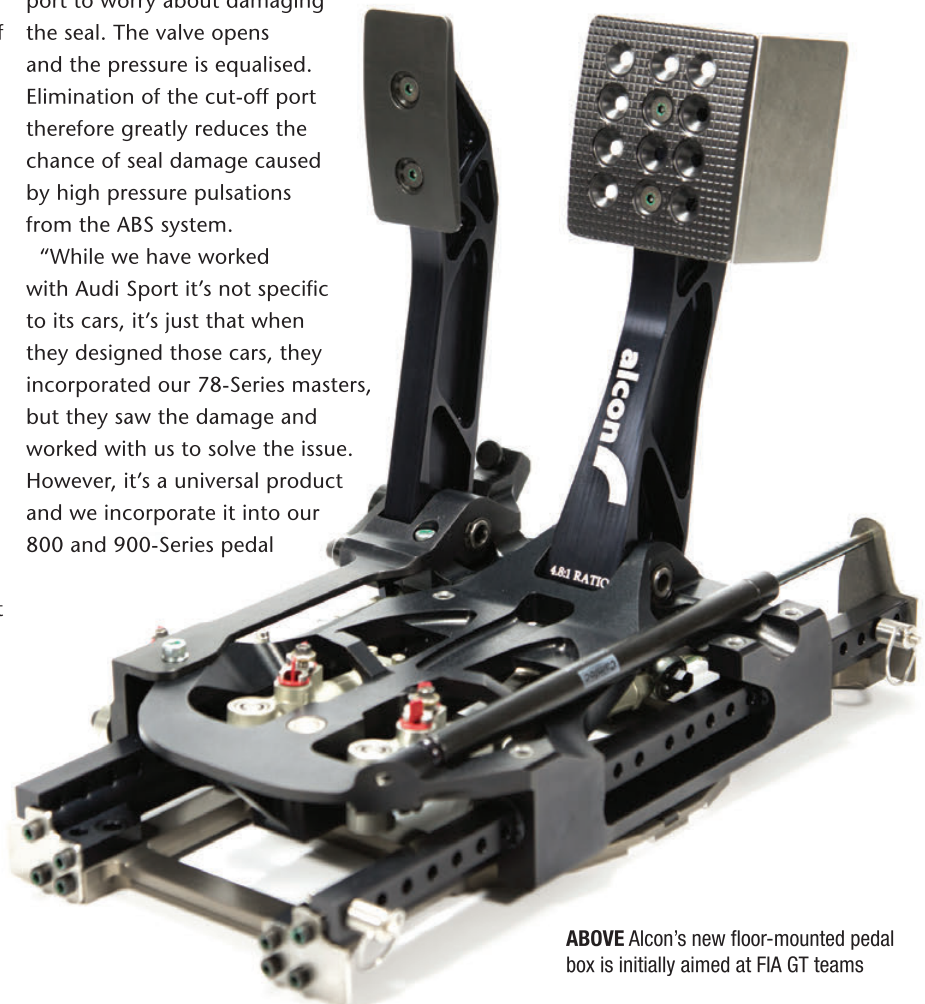
"While we have worked with Audi Sport it's not specific to its cars, it's just that when they designed those cars, they incorporated our 78-Series masters, but they saw the damage and worked with us to solve the issue. However, it's a universal product and we incorporate it into our 800 and 900-Series pedal

assemblies. We've now extended our range of 800-Series pedal assemblies, introducing them last year.

"We had them in the floor mount, overhung at firewall/bulkhead mount configuration, but we have now made the 800-Series underfoot, so basically you can get an underfoot pedal assembly and new spherical bearing-mounted masters for the brakes. Those pedal assemblies will either work with our 78-Series non ABS or 79 ABS."

Alcon announced the PBA800 sliding pedal box and MAR96 ABS compatible master cylinders, the latest additions to its motorsport range. Designed to meet the FIA fixed seat regulations, the company claims that this new floor-mounted pedal box is the most competitive in weight and stiffness on the market.

The new pedal box is initially aimed at FIA GT teams, and is currently being used by GT manufacturer teams such as Aston Martin Racing and Bentley Motorsport. Available in three configurations – one pedal (brake), two pedals (brake/clutch or ▶



ABOVE Alcon's new floor-mounted pedal box is initially aimed at FIA GT teams

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brake/throttle) or three pedals (throttle/brake/clutch) – this modular pedal box is mounted on two linear bearing rails using high-performance polymers as a sliding surface, providing smooth adjustment and a maintenance-free mechanism.

As denoted by its names, **CNC Heads** specialises in cylinder heads for a wide variety of cars including the Cologne Capris, Nissan R35 GTR and Mitsubishi Evo IX among many others. However, there is more to the company than that as it also designs and builds cars as well.

“We mainly build Cologne Capris, copies of the original three cars, and make the engine from scratch,” said Rick Woods, CNC Heads owner. “We also built the Zakspeed Capri as displayed on the ProFormance Metals stand.”

The big news, though, was that Woods was busily at work on bringing Mega Bertha back to life. This was the car, based on a Vauxhall and due to be raced by Gerry Marshall, that was meant to continue the mantle set by his saloon car adventures in Big and Baby Bertha, two of the most iconic “big banger” racers of all time in the UK. Baby Bertha was a 5.0 V8-powered Firenza built around the running gear left over from Big Bertha, a Vauxhall Ventura that Marshall wrote off following a brake failure at Silverstone.

Mega Bertha featured a John Taylor-penned Mark 1 Cavalier fibreglass body stretched over a spaceframe chassis designed by former McLaren designer Jo Marquart. The car could be powered by either a 2.5-litre turbocharged Opel engine or an 8.1-litre Reynolds Aluminium-Chevrolet engine used by the all-conquering McLarens in the US Can-Am race series. Sadly, though, the project was cancelled in mid-1977 when Vauxhall lost interest as its attention turned to the Chevette HS project and rallying, leading to the abandonment of Mega Bertha which was left to languish.

However, it is now being revived. “We are currently in the middle of bringing Mega Bertha back to life” said Woods. “We have the original body and the mock up chassis that we have remade as it was rusty and no good. It will be powered by the original Reynolds Aluminium Chevrolet engine, complete with its special axle and suspension. The intention is to run it at the next Goodwood Festival of Speed. Failure is not an option!” ▶

Technology showcase

Racepak aims for the Clouds with new data kit

AS we have reported before, Racepak has been making waves with its Vantage CL1 cloud-based data kit, which has been further refined since its launch at SEMA in November last year. Sensor data is transmitted via Bluetooth from the CL1 data box to a steering wheel-mounted, D3 app-equipped mobile device, displaying sensor and lap timing data to the driver, while automatically uploading all data to Racepak’s secure cloud service via the phone’s cellular connection. Data is stored locally on the mobile device for immediate analysis upon return to the pit area.

Racepak president Tim Anderson said that it was now going through a further phase of refinement and what started out as a kartist’s driver aid is now making its way into other areas of motorsport.

“The app for whichever type of motorsport you want is the same,” he said. “We developed it and tested it for kartists, but it’s now suitable for Junior Dragsters, drag racing and track and circuit drivers. The difference between them is the amount of information that is displayed. For example, there will be less information displayed for kartists and Junior Dragsters than for circuit drivers. This is because they need more information and so they can select all 12 OBD2 inputs.

“You can pull out a lot of useless information from OBD2 that we know the customers don’t care about. We just want to limit it to the priorities which are the engine parameters, engine rpm, water temperature, throttle positioning and intake air temperature, things that are relevant to vehicle performance. No-one cares about the emissions-related data, so we just limit what they can access.”

Anderson is adamant that this new product is a driver aid and not an engineering tool. “One of the things we’ve discussed is that we want to make sure that people understand that fact,” he said. “At the Autosport Show, we were frequently asked about the EFI interfaces and my response was that you don’t want to confuse us with the dash digital instrumentation. That’s not what this is as it’s more of an advanced driver aid utilising the cell phone and all its processing power to our advantage.” **RT**



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ABOVE & BELOW Taiwanese company XING Mobility publicised its electric powertrain and drive systems technologies

One of the innovative new products on display at the Autosport show that is applicable across the motorsport spectrum was focused not on absolute performance, but on reliability. **KA Sensors'** latest offering measures the amount of ferrous particles in the oil shed by gears or any other transmission components.

The Hall effect type sensor has a magnetised tip which attracts particles. This build up of metallic debris causes the magnetic field of the sensor, and therefore the sensor's output, to change proportionately. By measuring the amount of ferrous particles in this way, the sensor can be an early indicator of transmission problems, as well as revealing wear over time to help engineers manage reliability.

The sensor mounts in the sump plug, but can be fitted elsewhere in the sump depending on the application. This versatility runs through to the ways in which the sensor's output can be used, explained KA Sensors' founder and director Peter Trevor. "What we are giving out is just an analogue voltage proportional to the amount of debris that is collected, so that could go into anything really," he said.

"I think that dashboard manufacturers could be feeding it into the dash, so like shift lights it could go green to red depending on the condition of the oil. The

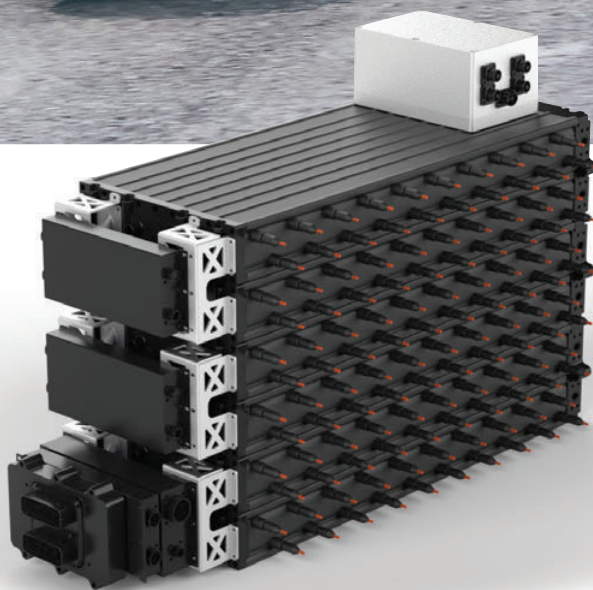
data logging guys meanwhile could just log it for trending purposes in order to analyse data after an event. I think each part of the industry is going to use it in a slightly different way."

Furthermore, because of the many different ways the sensor can be mounted and the variety of ways its output can be read, the range of vehicles on which it can be installed is endless, said Trevor. KA already has the sensors on big Dakar trucks, and has been fielding inquiries from top-tier single-seater teams along with historic racers. "It could go right across the industry," said Trevor, "We don't really know where it's going to go to yet but I've got a good idea it's going to be a bit of a flier."

New to the Autosport show was Taiwanese company **XING Mobility**, which was there to publicise its expertise in ultra-high output electric powertrain and drive systems technologies. Its mission is to provide tightly integrated electric powertrains to commercial and industrial vehicle manufacturers.

An important component of its drivetrain solutions is its modular battery pack that has been specifically designed for low to mid volume applications. The Lego-like design caters to a wide variety of shapes, sizes and power requirements, enabling the company to deliver a one-off custom pack design in as little as two weeks.

The 'XING Battery System' consists of ►



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ABOVE The 2018 World Rally Championship challengers were officially unveiled

stackable battery modules which house 42 lithium-ion cells, all of which sit directly in 3M Novec 7200 engineered fluid, its "secret sauce". It allows sufficient battery cooling to achieve extremely high performance, higher charge and discharge rates, extended battery life and a greater level of predictability, claims the company. The pack is currently one of the highest power density electric vehicle battery packs on the market, using exceptionally lightweight packaging material to offer up to 50% weight saving in comparison to rivals.

The company, which was only founded in 2015, has produced an electric supercar that it states is set for competition later this year as a proof of concept. 'Miss R', as it is called, is described as a vehicle designed for performance driving, boasting four-wheel torque vectoring and capable of staggering speeds. Powered by four independent 350V motors, it has a projected performance of 0-100 km/h in 1.8 seconds, 0-200 km/h in 5.1 seconds and a max speed of over 270 km/h.

"Miss R is the embodiment of the paradigm shift of EVs surpassing traditional combustion engine cars in both performance and capability," said Royce YC Hong, XING Mobility's co-founder and CEO. "The core idea behind the prototype is to achieve game-changing performance levels and driving experiences that are otherwise impossible to achieve in a gasoline-powered vehicle."

At last year's Autosport Show, Edward Little, **Ferodo Racing's** technical and product manager, explained that he had been taking a fundamental look at the structure of a brake pad and its composition, stripping it back to basics and rebuilding it to see if any preconceptions about it were

correct. The aim, as he explained, was to develop something a little bit better with the intention of being present in some of the top levels of motorsport, particularly GT3.

As Little explained, he was leading the research into trying to understand if there were chemicals that were not traditionally thought of as brake pad components that could be evaluated. He had come up with what he called an exotic material that had quite a startling effect on performance.

He said that the company was following two development strands. One was making something in the style of its existing materials, but better, and the other producing something that was a little bit different in style in terms of having a very, very high coefficient of friction.

Fast-forward one year, and what was at the research stage is now being tested and the ambition to be in GT3 and other major race series is coming close to being realised. Sadly, Little was not at the show



ABOVE No driver required: the Robocar was displayed at ASI

this year having just lost his mother a few days before, but Sergio Bonfanti, managing director of the Racing & Motorcycle Division, explained how the company had been successful.

"We have seen an approximate improvement of around 20% in performance while life is now three times better than the original," he reported. "It looks like being a well balanced friction material that allows us to enter many different categories. Initially the aim was to concentrate on GT3, but we are now finding characteristics of the friction material that allows us to think on a wider scale."

He explained that the friction level does not change dramatically at different temperatures: "This allows us to give modal ability to the drivers. In other words, it's more temperature uniform; that gives consistent feedback to the driver. This is one of the topics that has changed over earlier formulations, although there are quite a few other differences as the material is brand new and was started from scratch. Even the pedal feel in comparison with the previous generation materials is quite different."

In-house dyno testing has been complemented by on track testing in different categories. "We've had a good base from which to start the winter testing and have run up quite extensive experience with the GT3 cars with more than decent results," he said. "We've also had a few tests in R5 and R3 cars in the rally environment along with endurance off-road cars."

"If the test results continue to be positive in the next few months we are going to start building up the stock and see the product come to market quite soon." **LT**



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Ben Bowlby bids farewell to one of the sport's true greats



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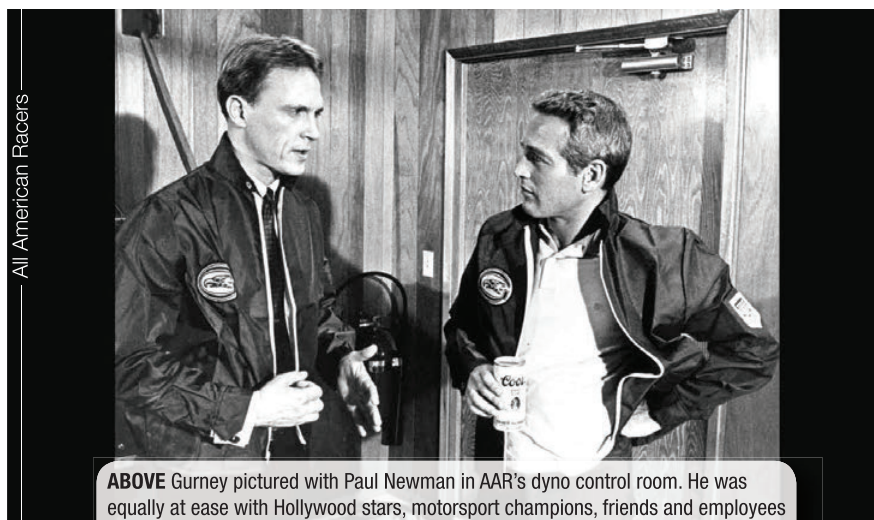
formats of races and with profound sportsmanship that he was unmatched for his combination of talent, craft, leadership and understanding. He was an exceptional racer, a blend of driver and engineer, an innovator. He was driven by an inquiring mind and a broad interest, an avid reader; fascinated by the power of engineering coupled to extraordinary human endeavour – and of course always with an eye on the ever-present politics of any situation.

The fact that he was such a talented driver made his appreciation for the engineering so much more significant. He always recognized and celebrated the machine's contribution to on-track achievements.

He was all about the fast car, the machine, and dedicated himself to creating the best possible weapons of speed within his close knit team of loyal employees and family. Intelligent to a genius degree, he

was perceptive and artistic, an inspirational motivator whose enthusiasm overcame hurdle after hurdle. "Only one miracle a day," he would say while meeting the needs of unrealistic customers – commercial byproducts of deep technical abilities forged on the track and still within the walls of AAR

“Only one miracle a day,” he would say while meeting the needs of unrealistic customers”



ABOVE Gurney pictured with Paul Newman in AAR's dyno control room. He was equally at ease with Hollywood stars, motorsport champions, friends and employees

in Santa Ana to this day.

Dan Gurney is a human I *want* to remember and I am forever grateful to have spent two extended periods working on wild projects from his All American Racers California base. I lunched with him just about every day and the discussion was always completely fascinating. He attracted great people from all aspects of motorsport as well as aviation and beyond, and each had a story to tell, a contribution to make... Dan's genuine interest brought these people back time and again – you never knew who you would bump into around the shop.

Dan was opinionated and had a cutting wit. He did not suffer fools gladly: you weren't invited back if you were found wanting after a cross-examination. Still in earshot, he would remark, "Who needs enemies when you have friends like that!"

Fortunately he and I had stayed in touch ever since my time out in California. We spoke as recently as the day after Christmas, for an hour about ongoing projects and future ideas. He shaped my career and gave me experiences and opportunities that I will never forget and always hold as some of the most intense of my life. Thank you Dan, you are my hero.

He leaves a legacy of youth and vitality built on his extraordinary history of success. Evi, his children and extended family and all the wonderful people for whom DSG was the real Commander in Chief – you loved and supported him and he loved and supported you – your grief at his parting has my deepest sympathy. **BT**



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