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Is it really The future?

AS you will read in this issue, Craig Scarborough has done his usual brilliant job and presented us with real insight into the current and future state of Formula E. As the sanctioning body claimed when it released details of the second generation car that will be racing in season 5, this is the Future of Racing.

We have supported the series when it was just a twinkle in the eye, and have continued to do so as is proven by Craig's article, but I do take issue that Formula E is The future of racing, because it isn't, it is a part of the future of racing, or is it?

I was alerted today by a story by assistant editor Alan Stoddart about a story that broke this morning. Apple, it seems, has decided to buy a 5-year supply of cobalt direct from the mines rather than through an agency or broker because of the exponential demand for this essential material for lithium-ion batteries. There is serious concern that there isn't enough to go round when the production for electric and hybrid vehicles get into full stride.

According to Darton Commodities, which has become one of the largest, independent and specialised full service cobalt metal suppliers operating in the market today, cobalt use in electric vehicles and other lithium-ion products is set to increase from 75,000 tons a year in 2020 to 160,000 tons in 2025 and doubled to 325,000 tons five years later. The price per ton has already trebled in the last 18 months. This is why Apple has approached the mines directly, something that Volkswagen did last autumn but failed to reach an agreement on a five year supply.

The main source of cobalt by far, accounting for more than the combined output of rest of the world's producers is, wait for it, the Democratic Republic of Congo (DRC). According to a BBC report last December, the recent history of the country has been one of civil war and corruption and, until recently, at the centre of what some observers call "Africa's world war", with widespread civilian suffering the result. The war claimed up to six million lives, either as a direct result of fighting or because of disease and malnutrition. It's also where children are still working in the mines. Green energy for us and the rest of the world I suppose, but not for them and their wretched lives. Please think hard when you talk about saving the planet with such 'green' energy.

Russia comes in a very poor second, producing less than one tenth of the DRC, followed by Australia and Canada with relatively paltry amounts. China used to be ranked second but according to *Investing News*, the country didn't make the list when the US Geological Survey learned that its cobalt production numbers turned out to be much lower than originally noted in 2016. No comment.

What this tells me is the cobalt cannot be seen as a long term solution. Also taking into account the recycling issues and so on, it is but a short term fix, no matter what the fortune tellers and politicians are telling us. In fact, the more you learn about it, the worse it gets, Heaven only knows why we are so excited by it.

I do believe that other solutions will come along. One I have recently learnt about is the Ultra Fast Carbon Battery, an ultracapacitor that features vertically aligned carbon nanotube electrodes. It's a new generation of battery that has been developed by NAWA Technologies, an independent spin-off company that started life as part of the Commissiarat Energie Atomic (the French Atomic Energy Commission) than can be recharged in seconds for up to a million cycles. To make a simple mind like mine understand the concept, it was described using the analogy of Usain Bolt versus a marathon runner where the ultra capacitors are the sprinters, they can charge and discharge in seconds, great for bursts of energy. Lithium-ion batteries are more like marathon runners, slower to charge but give out that energy over a longer time.

The beauty as I understand it of them is that they are more efficient and powerful than lithium-ion cells, are safer and more eco-friendly to manufacture and are made of carbon and aluminium, so no real recycling issues unlike lithium-ion. They would be ideal, for example, in the forthcoming FIA electric World Rallycross series that is heading our way soon as a proof of concept.

So does electric racing even have a future let alone be The future? I think it does, but as I said, it's part of the future of motor racing as long as it shuns dirty technologies like lithium-ion and has the courage to embrace new technologies. RT

William Kimberley
EDITOR

ABOVE The thrust and cut of the World Rallycross Championship will change in 2020 when the premier class becomes all-electric

World Rallycross set for electric switch in 2020

Hal Ridge

PARIS, France: The World Rallycross Championship is set to switch to fully electric cars for the 2020 season it has been revealed. World RX promoter IMG disclosed last August that it was working with a number of manufacturers and the FIA on regulations for an electric category within the World RX Championship setup, but it has now been confirmed that the top-class Supercar category will switch entirely to electric propulsion for 2020.

"Electric cars will be the World Championship. They absolutely, categorically will be the World Championship," said a source. "15 cars are required to begin in 2020. Nine different manufacturers have been engaged in the discussions and negotiations so far, but the ability to buy the required components and build a car has to be open to privateer teams if they want to go that way too."

The sentiment was then clarified by the FIA with the release of an invite to tender for battery packs for the new cars, which opened with "The FIA's objective is to switch the FIA World Rallycross Championship to electric cars as from 2020."

While focused on the battery packs, the first of two expected invitations to tender confirms that the new electric world rallycross cars will be based on a common carbon monocoque tub. That chassis is expected to be supplied as a kit that will include suspension and braking systems, for which the FIA will release a second invitation to tender imminently. Composite body shells will sit on top of the carbon chassis, allowing for different models of car to be used.

The new cars will weigh the same amount as the existing internal combustion engine powered Supercars, at 1300 kg, while the dimensions will be similar to the existing machines at 4000 mm long and 1900 mm wide. The motors won't be provided by a single supplier and will instead be provided by each individual electric rallycross car manufacturer. A pair of 250 kW motors will be used, one on each axle.

"The aim of Electric Rallycross is to allow the development of electric technologies and race for the efficiency of the traction chain of the car, to showcase that electric cars are as fun and powerful as thermal ones," stated the FIA in its recently released battery pack tender.

"In order to maintain cost control with a high level of technology, the FIA is defining a battery pack that all car manufacturers will have to use in their cars which are then delivered to competitors.

"Volkswagen, Audi and Peugeot have all publically reiterated their interest in the electric rallycross series in recent months. The existing Supercar category, in which all three of the aforementioned marques currently compete, is expected to be maintained in some form; likely to be more than just the existing five-round European Rallycross Championship and potentially include travel to 'flyaway' events. The World RX series will travel to long-haul rounds in Canada, the USA and South Africa in 2018. RT

Audi increases World RX involvement with an eye on the future

Hal Ridge

NEUBURG AN DER DONAU, Germany: Audi has reaffirmed its commitment to Mattias Ekstrom's EKS team's World Rallycross Championship programme, and has an eye on World RX's electric switch for 2020. Double DTM Champion and 2016 World RX title holder Ekstrom and the EKS squad secured Audi's support for the 2017 World RX season, but despite winning four races didn't have the ultimate pace of Petter Solberg's Volkswagen-backed team and announced that its cars were for sale during the French round of the series at Loheac in September, throwing the future of the programme into doubt.

Audi has since confirmed that it will increase support, and is assisting with the build of new Audi S1 quattro Supercars for the re-named EKS Audi Sport team. "When we saw last year that we had some new competitors that raised the bar, I understood we had to build new cars," said Ekstrom. "We have been discussing that for quite a while, at the same time the engineers were collecting information from the cars we had. Now it will be a stronger cooperation than last year, which I'm really happy for. It wouldn't have been possible to build a new car in this time [without Audi's support]. Our aim for 2018 is clear: we're battling for the Drivers' and Teams' World Championship titles."

The team has signed Norwegian Andreas Bakkerud to drive a second car alongside Ekstrom. Head of Audi Motorsport Dieter Gass said: "We gathered very positive experiences in the World RX last year and are convinced of the series' growth potential. In the medium run, we hope to see electric cars being fielded in this racing series because electrification is a focus topic at Audi also in motorsport." RT

New Mini Cooper set for World RX events

Hal Ridge

MITCHELDEAN, UK: British team Xite Racing is building a brand new Mini Cooper S Supercar for a selected programme of events in the World Rallycross Championship this season. The new Cooper will be the first of its kind to be used in World RX and is being built by Gloucestershire-based firm, Simpson Motorsport.

Multiple British Rallycross podium finisher Oliver Bennett will drive the car that is being developed in conjunction with Liam Doran's LD Motorsports team, which is assisting with chassis and geometry knowledge.

"At some stages I thought it was just too big a mountain to climb to be ready for 2018, but Simpson Motorsport has managed to overcome some serious time hurdles," said Bennett. "We have partnered with LD Motorsports to help with the development of the chassis. With Liam's vast knowledge of World RX together with Simpson Motorsport owner Julian Smith's years of circuit racing experience, it's looking like it will be very impressive. We've selected the best possible suppliers to be as competitive as possible, but we know the level is very high."

The Mini will use a transversally-mounted 2.0-litre engine provided by Pipo, a 6-speed Sadev sequential gearbox and McPherson strut Reiger suspension. Xite Racing revealed a concept of the new car at the Autosport International Show in January, and expects to debut the Cooper S at the opening round of World RX at the Barcelona Formula 1 circuit. Minis have been used in World RX previously, but derived from ex-Prodrive WRC Countryman models, which incidentally Doran's team will run this year having acquired the cars from the JRM team. RT

ABOVE A new rallycross Mini is set to compete in the World Rallycross Championship this season

Lydden Hill to host Global Rallycross finale

PACIFIC PALISADES, CA: Red Bull Global Rallycross has confirmed the location of its season-ending double header at the end of the year. As has long been rumoured, Lydden Hill will host the event on 27-28 October, which comes after the Kent venue was axed from the FIA World Rallycross championship in favour of Silverstone.

"Bringing Red Bull Global Rallycross to Lydden Hill's historic venue makes perfect sense for the series' long-awaited return to Europe," said Red Bull GRC CEO Colin Dyne. "Our teams and drivers are looking forward to battling it out for the championship on the circuit where the sport first began, so fans will be sure to see some of the most intense racing of the year over this double-header weekend."

Lydden Hill is arguably the most important venue Red Bull GRC has ever raced at. The discipline of rallycross was invented at the facility near Canterbury in February 1967 as a made-for-TV event. The race, which saw tarmac and loose surfaces combined in a circuit race for the first time, was won by Vic Elford in a Porsche 911. Lydden Hill has since gone on to host British and European rallycross championships as well as the World championship from its inaugural season in 2014 until last year.

"I'm delighted to finally confirm Lydden Hill as the venue for the final round of the 2018 Red Bull Global Rallycross Championship," said Lydden Hill boss Pat Doran. "Lydden has been at the forefront of rallycross for more than 50 years and we've invested in the sport throughout that time.

"It's fitting therefore that the GRC's return to Europe is here, where rallycross fans will get the opportunity to see the best GRC has to offer, including the series' signature 70 ft table top jump, on our purpose-built rallycross track.

"We always receive great support from the motorsport fraternity, and I'm sure the fans will be out in force once again as we pull out all the stops to ensure the GRC season-finale is a sell-out success."

The event marks the first time since 2013 that Red Bull GRC has raced in Europe. That year events in both Barcelona and Munich took place, alongside rounds in Brazil and the US. RT

ABOVE Formula 1 drivers will be required to wear new race gloves that are fully sensored up

F1 drivers to wear gloves that monitor their condition

Alan Stoddart

PARIS, France: Formulating the ideal medical response in the event of a racing incident relies on access to the right data. In order to provide trackside doctors with that information, the FIA is set to introduce a new race glove which sends potentially life-saving data from car to the medical crew.

Stitched into the new glove is a flexible sensor measuring 3 mm in thickness. It is the sport's first biometric monitoring device and monitors a driver's vital signs during the race.

Primarily, the sensor is another weapon in the armoury of doctors at the track. So it is appropriate that the project is being led by two people who are on the frontlines of F1 medical care – FIA deputy medical delegate Dr Ian Roberts and F1 medical car driver Alan van der Merwe.

"We know that the monitoring of people is essential in terms of their medical care," said Roberts. "Drivers in incidents are no different. We would like to start monitoring and assessing them as soon as we possibly can. However, the equipment we currently use is relatively bulky and is only applied after the incident has happened. There are also times when the driver isn't immediately accessible to us, so if we can't see him or we're not actually next to him, there's limited information that we can get."

The idea is to incorporate this monitoring technology into gloves so the drivers have sensors on them at all times during a race. Prototype gloves have already been tested at the track and have passed the FIA's stringent fire safety requirements. The FIA is also about to publish the first Biometric Standard, that all 'biometrics' products wishing to be used on a racing car or driver will have to pass. The technology will be available for all glove manufacturers and initially the devices will use an optical sensor to measure 'pulse oximetry', or the amount of oxygen in the blood, alongside the pulse rate. This is potentially important in the context of a racing driver because if they have an injury that is affecting breathing, the oxygen content of the blood will begin diminishing immediately. Monitoring the data also offers a range of vital information for track doctors before they even arrive on scene.

The sensor uses a new industrial version of Bluetooth that can send information over a 500-metre radius. The hardware can send out 20 data packets a second and has a self-contained power source via a small battery. This battery can be charged inductively, so when the drivers take their gloves off they just lay them on a charging mat and it replenishes automatically. The data, which will be encrypted and secure, is also recorded on the gloves and can be downloaded by teams when the driver is back in the garage.

"We'll give access to the teams in year one and that will be on a download basis, so they'll have the data from the full race weekend to look at," says Van der Merwe. "Once we have done the initial roll-out the idea is that they will have a receiver on the car showing the drivers' pulse oximetry in real time." RT

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Gibson Technology signs LMP1 engine contract

William Kimberley

REPTON, UK: Gibson Technology has announced that it has signed a new contract with Rebellion Racing and chassis constructor ORECA to supply LMP1 engines for the 2018/19 World Endurance Championship (WEC) Super Season. The 2017 WEC LMP2 champions have confirmed their intention to contest LMP1 in FIA WEC in 2018, running a two-car team with an ORECA chassis and Gibson Technology GL458 engine. This is a return to the top category of WEC for Rebellion and will include competing in the gruelling Le Mans 24 hours.

The new LMP1 engine supplied by Gibson Technology will be based upon its successful LMP2 engine that was awarded the Race Engine Design of the Year at the recent Race Tech World Motorsport Symposium. The design, development and production of the new GL458 is taking place at Gibson Technology's Repton facility, with the first engine being scheduled for delivery to Rebellion in March.

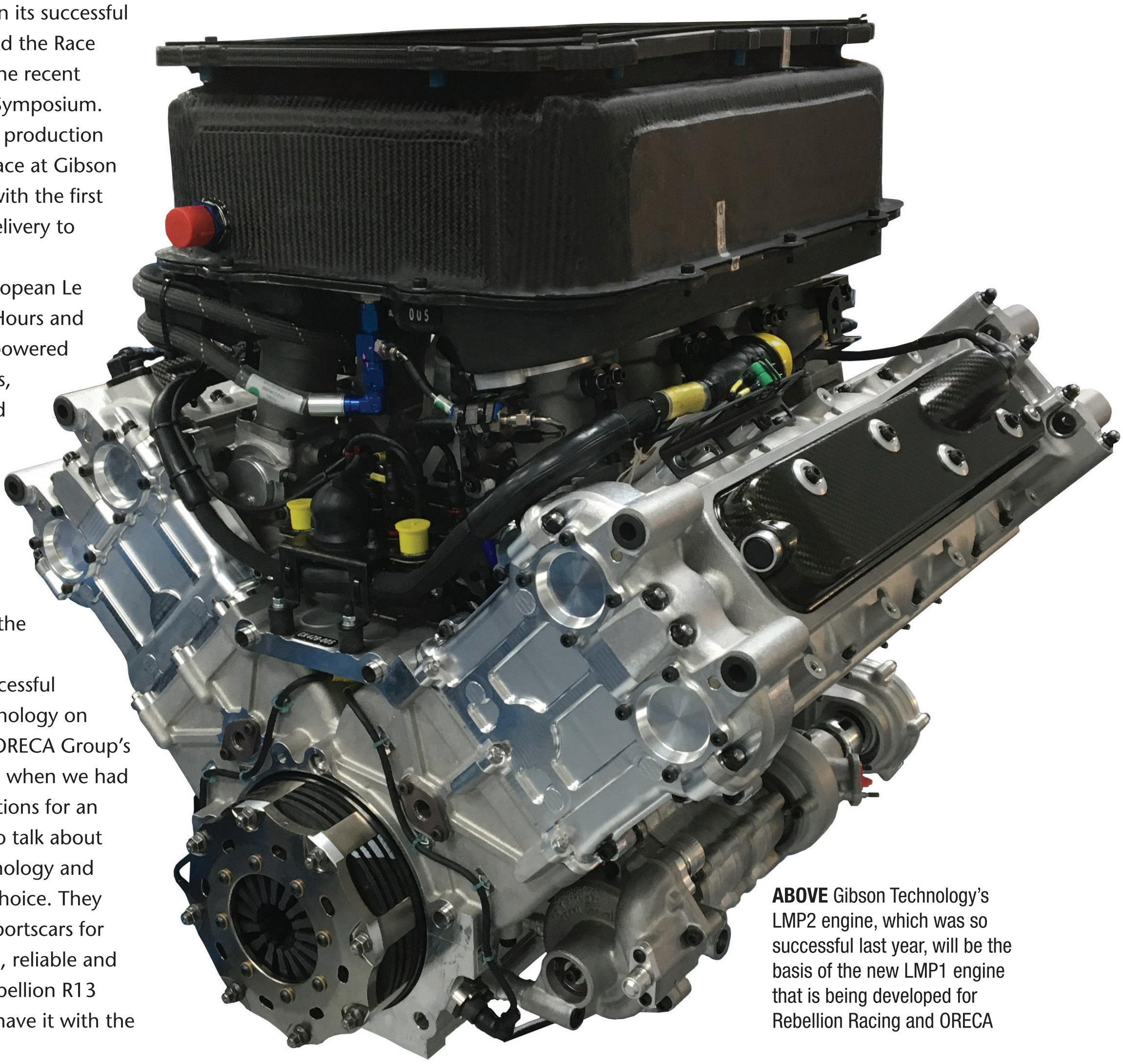
All LMP2 teams in WEC, European Le Mans Series, the Le Mans 24 Hours and IMSA in the US are currently powered by Gibson Technology engines, with over 600,000 km covered so far by the GK428 engines. The new LMP1 contract with Rebellion Racing is a natural progression for Gibson Technology's highly motivated engineers to prove their reliability and success at the top level of endurance racing.

"ORECA has a great and successful relationship with Gibson Technology on the LMP2 programme," said ORECA Group's CEO Hugues de Chaunac. "So when we had to investigate the different options for an LMP1 engine, it made sense to talk about this project with Gibson Technology and at the end it was an obvious choice. They have shown their abilities in sportscars for many years. We need a strong, reliable and competitive engine for the Rebellion R13 and we are confident we will have it with the Gibson V8. We will have a strong package and we are looking forward to it."

"We are excited to make our comeback in LMP1 and to do this project with both ORECA and Gibson Technology," said Calim Bouhadra, vice president of the Rebellion Group. "We had an excellent package in 2017 with the ORECA 07 chassis and the V8 Gibson engine and we made it successful by winning the FIA WEC title. We are really happy to continue this partnership. It was the natural step for Rebellion Racing and it will be for sure a great challenge. We all share the same motivation."

"Everyone at Gibson Technology is delighted that our engines have been chosen by yet another top-flight team and sportscar constructor to compete at the highest level of World Endurance racing," said John Manchester, Gibson Technology's operations director.

"The new LMP1 engine contract with Rebellion Racing and ORECA is a natural progression for our company and we are extremely pleased to continue with the successful partnership that we formed with them during 2017, which will further enable us to develop our engine technology to compete against some of the top sportscar and engine manufacturers at the pinnacle of world sportscar racing. We are all very much looking forward to the exciting challenge ahead." RT



ABOVE Gibson Technology's LMP2 engine, which was so successful last year, will be the basis of the new LMP1 engine that is being developed for Rebellion Racing and ORECA

Indycar

ABOVE The Chip Ganassi team gave the new IndyCar windscreen its first track test at the ISM Raceway

IndyCar windscreen's first track test

William Kimberley

AVONDALE, AZ: The new IndyCar windscreen has been given its first on track test. Installed on the Chip Ganassi Racing Honda, four-time Verizon IndyCar Series champion Scott Dixon drove the car at the ISM Raceway, scene of pre-season testing for all the IndyCar teams who were busy testing the new universal aero kit, clocking up 2,600 laps between them.

"It's a little bit different looking through something that's so thick, but I thought it would be worse with distortion, but there was nothing like that," said Dixon. "Your brain and eyes just need to catch up to it. The longer that I ran, I got more adept at it.

"The weirdest thing, though, is how quiet it is. You have no buffeting. The car feels very smooth. It feels like you're in a luxury well-damped car."

The only problem he reported was how little airflow there was in the car. It got hot in the cockpit, so cooling needs to be addressed, he said. He also said he remains unsure of what vision impairment might be like on street and road courses.

The windscreen, which has been under development for nearly two years, is made of a proprietary Opticor advanced transparency material by PPG, the same material the company uses in its production of fighter jet canopies. It has shown to be stronger, lighter and more impact-resistant than polycarbonate previously used, according to Jeff Horton, IndyCar's director of engineering and safety, who has spearheaded windscreen development with Dr Terry Trammell, IndyCar's medical consultant. RT

NASCAR rules tweaked

Alan Stoddart

DAYTONA BEACH, FL: NASCAR competition officials have distributed a handful of competition updates, most notably regarding the damaged vehicle policy and the national series qualifying format. The time limit for teams to make repairs will increase from five to six minutes. Furthermore, if a team has too many crew members over the wall while its car is on the crash clock, the team will be assessed a two-lap penalty instead of being parked.

NASCAR officials said those changes were developed from discussions with stakeholders, building on lessons learned from last season to better fit the spirit of the initiative. Competition officials also reduced the opening round of knockout-style qualifying at intermediate and short tracks from 20 to 15 minutes, offering a tighter window for the field to make initial qualifying attempts.

The news comes on the heels of NASCAR's competition department setting the stage lengths for races in all three national series. The group also indicated the NASCAR Air Titan track-drying system will have a revised look in 2018, with a red-and-white scheme replacing the silver-and-green livery. RT

Hyundai's upgrades target R5 frontrunners

Alan Stoddart

ALZENAU, Germany: Hyundai hopes its i20 R5 will be even faster when it competes in the FIA European Rally Championship this season after engineers from the team's Customer Racing department have uprated the car's powerplant, improved its variable valve timing and made a new engine map.

According to Hyundai Motorsport, this will 'gather more power from the 1.6-litre engine, as well as greater throttle response due to a reworked ALS strategy'.

In order to make the changes, which are outside of the original homologation, Hyundai used its final 'joker'. Away from the engine, the company also tweaked the handling, implementing new damper specifications for both tarmac and gravel rallies, and introducing a wider range of differential ramps. This, Hyundai reckons, will allow its customers to 'harness greater performance from the i20 R5 as they seek to be competitive in their respective championships.'

"In our efforts with the i20 R5 and our customers we are always aiming to make sure they can compete at the very front of whatever championship they choose," explained Hyundai Motorsport Customer Racing department manager Andrea Adamo. "The rapid pace of development within the R5 category means that we constantly have to be working in order to guarantee this. These latest improvement are the most important we have made since the car's debut, and will allow our customers to again challenge for rally wins and championship titles around the world. This season our customers are competing in a wider range of championships, so we have to make sure we continue our work in order for them to be on the pace in all conditions."

The latest developments will be fitted to all brand-new i20 R5 delivered following the 1 March homologation date. Existing customers, meanwhile, will be able to apply the changes to their cars from the same date as they prepare for their 2018 campaigns. RT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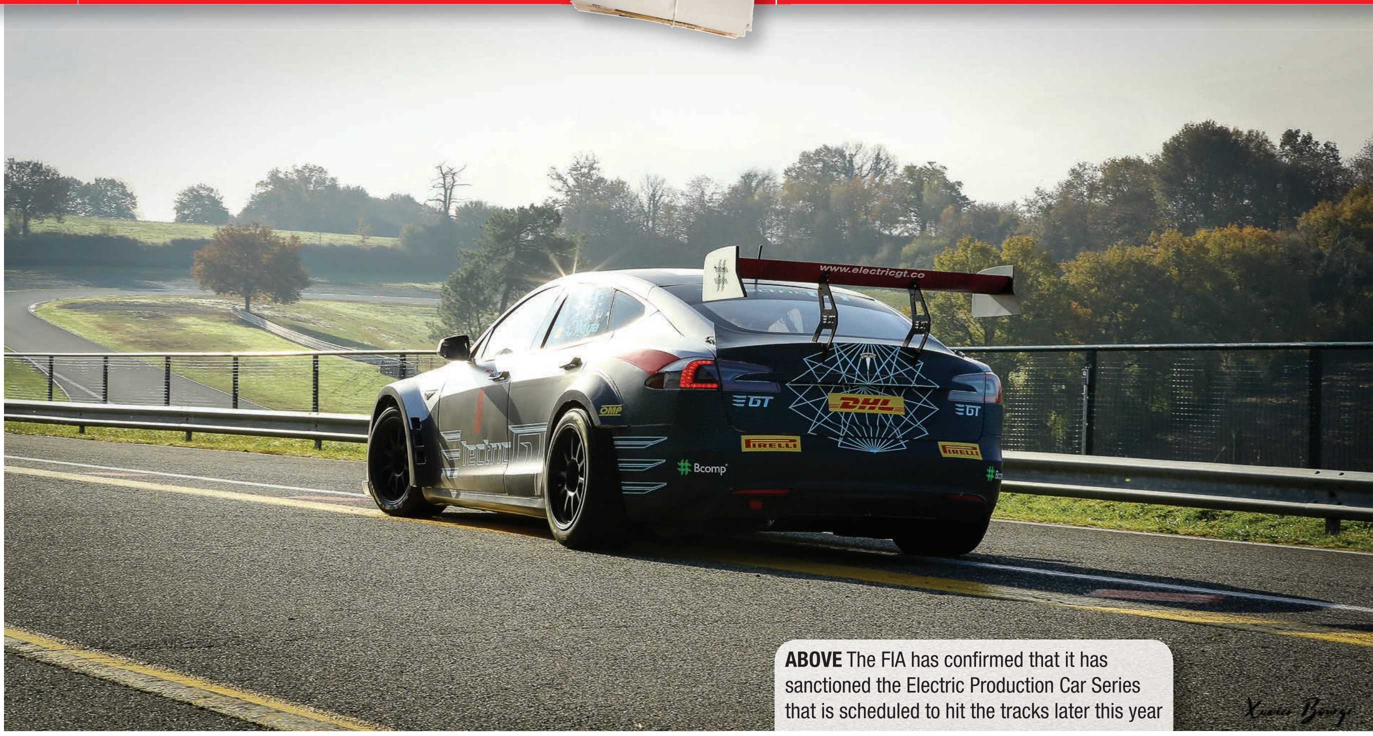


ABOVE The FIA has confirmed that it has sanctioned the Electric Production Car Series that is scheduled to hit the tracks later this year

Electric Production Car Series approved by FIA

Alan Stoddart

WILMINGTON, DE: Electric GT Holdings has announced that the Electric Production Car Series (EPCS) has been officially sanctioned by motorsport's world governing body, the FIA. The news of the series' approval followed the confirmation that the EPCS race-prepared Tesla Model S P100D passed its official FIA crash test (details in *Race Tech* 208).

Electric GT Holdings has also published details of the EPCS Sporting Regulations, which include a three-heat (585 kW) qualifying format. Rounds in the series will include a day race (60 km) and a dusk race (60 km) while EPCS race power will be set to a maximum of 585 kW (778 hp).

An innovative "Drift Off" competition will also take place at suitable circuits, where fans will see the top two finishing drivers plus two fan-voted drivers go head-to-head to complete a series of drifting challenges to secure three further championship points.

A FOCUS ON RACING

The Electric Production Car Series is the first all-electric, zero-emissions motorsport category from Electric GT Holdings. Up to 20 drivers will race the fully race-prepared Tesla Model S P100D in the series, running on bespoke Pirelli tyres and equipped with the latest OMP safety equipment, Alcon brakes, R53 suspension and composite bodywork from BComp.

"This is such an exciting day for us as we confirm that the Electric Production Car Series has been officially sanctioned by the FIA. We respect the FIA and we are honoured to have their support ahead of our inaugural season," enthused Electric GT Holdings CEO Mark Gemmell.

"We are also pleased to officially publish the Sporting Regulations for the Electric Production Car Series. We have put a lot of time into refining the regulations to allow for competitive and thrilling racing. With a three-heat qualifying system and two EPCS races, plus our eKarting and eSports races, fans will have a lot of racing action to get excited about." RT

Performance Projects to take on Silverstone premises

Alan Stoddart

SILVERSTONE, UK: Thanks to ongoing growth in several areas including Formula 1, engineering firm Performance Projects has decided to relocate to a bigger base and has committed to a 1500 sq ft premises at Silverstone Park. Moreover, the firm could soon be on the look-out to increase staff numbers. "Around 1100 sq ft of that will be dedicated to build and engineering development capability," explained Performance Projects co-founder Chris Horton. "We have a great track record in design engineering and it's clear some customers want to receive physical product at the end of it.

"Our new premises give us scope to build whole vehicles and generally deliver more work for our customers, particularly on the autonomous and niche vehicle side of things. We're primarily using the additional space for flexible build area and also to house a restricted zone where some of our most confidential work is kept." RT

IN BRIEF

FORCE India and Sauber have demonstrated confidence in Formula 1's new owners Liberty Media, and withdrawn a complaint to the European Commission about alleged anti-competitive practices. The complaints, which argued that the division of revenues and rule-making processes were 'unfair and unlawful', were made by the privately-owned teams in 2015, before Liberty's takeover of the sport. The two teams argued that the billion dollar sport was in breach of articles prohibiting cartels and the abuse of dominant market positions. The teams suggested that Mercedes', Ferrari's, McLaren's, Williams' and Red Bull's permanent positions on the sport's 'Strategy Group', along with the payments they receive in recognition of past performance amounted to a 'questionable cartel', and argued that the system favoured these big teams by allowing them to shape the rules and receive millions of dollars regardless of how they perform on track.

MONSTER Energy NASCAR Cup Series team BK Racing has filed for Chapter 11 bankruptcy according to a report by ESPN. The embattled race team has been battling financial difficulties for more than a year, which included hefty debts owed to engine supplier Race Engines Plus and Union Bank & Trust, among others. There is also a federal tax lien against BK Racing and the North Carolina department of commerce is also owed money. BK Racing current owns one of 36 charters, which guarantees the team a starting position in every Monster Energy NASCAR Cup Series race. NASCAR, in a statement to NBC Sports, said BK Racing continues to be the owner of the charter.

A new motorsport exhibition is being organised in Italy in late October. Called **Business Motorsport Expo**, it will be held at the Garda Exhibition Centre, Montichiari in Lombardy from 25-27 October. It will be open to every aspect of motorsport including builders of two and four-wheel vehicles, the supply chain, manufacturers, circuits, drivers and mechanics. Conferences, workshops, exclusive events and training courses for companies and professionals will also be organised during the event.

PRO-ALLOY has become an official distributor of PWR products that includes high-performance aluminium radiators, intercoolers and oil coolers for race cooling solutions in leading race categories such as Formula 1, the World Endurance Championship, the World Rally Championship, NASCAR and DTM. RT

PERSONNEL

Darren Sansum has joined IndyCar after a successful spell at Toyota Racing Development, which has won the past two Manufacturer championships in NASCAR's Cup series. He brings considerable experience to IndyCar, having also worked for Ford, Cosworth Technology and Ilmor Engineering. At IndyCar, he will oversee engine development and competition between Honda and Chevrolet in the Verizon IndyCar Series.

NASCAR has announced several new leadership appointments across its growing international business landscape and the NASCAR Camping World Truck Series. **Jim Cassidy** has been named as the group's chief international officer, reporting to **Steve O'Donnell**, executive vice president and chief racing development officer. Charged with growing the NASCAR brand of racing internationally, Cassidy will oversee all international competition and commercial operations, building on the success of NASCAR's three international series with the NASCAR Pinty's Series in Canada, NASCAR PEAK Mexico Series and NASCAR Whelen Euro Series.

Joining Cassidy in these efforts will be **Chad Seigler** in the new position of vice president, international business development. He will draw upon a decade of successful industry sales experience to oversee all international sales and partnership marketing. **Celeste Griffin-Churchill** in the new position of senior director, international, **Joe Balash** in his current role as director, international competition, and **Bob Duvall** in his position as senior director, international & weekly/touring business development will play key roles in this area.

NASCAR has additionally announced that **Ben Kennedy** has been named to the leadership position of general manager, NASCAR Camping World Truck Series. He will oversee all aspects of NASCAR's popular truck series, working closely with **Brad Moran**, NASCAR Camping World Truck series managing director, and **Jeff Wohlschlaeger**, managing director, series marketing to continue to deliver great racing, fan experience and marketing across this series. Kennedy will report into **Elton Sawyer**, vice president, competition and will work closely with Steve O'Donnell and **Steve Phelps**, executive vice president and chief global sales and marketing officer.

The International Motor Sports Association (IMSA) has appointed veteran race officials **Todd Snyder** and **John Maesky** to new race director roles for IMSA-sanctioned single-make and challenge series.

Maesky, a fixture in IMSA race control over the past several seasons, takes on new responsibilities as race director for both the Porsche GT3 Cup Challenge USA by Yokohama and the Ultra 94 Porsche GT3 Cup Challenge Canada by Yokohama for the 2018 season. Snyder, who currently serves as race director for two additional IMSA-sanctioned series, Lamborghini Super Trofeo and Ferrari Challenge, will add the role of IMSA Prototype Challenge Presented by Mazda race director to his responsibilities for the 2018 season.

Former Sauber F1 team principal **Monisha Kaltenborn** has announced plans to run her own Formula 4 team in 2018. To be called KDC Racing, it is a 50-50 partnership with a Franco-Monegasque businesswoman called **Emily di Comberti**. The new team will field two cars in the German and Italian Formula 4 Championships, working from a base at Granollers, close to the Circuit de Catalunya, near Barcelona. The team will race with a Swiss licence. RT

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

The most successful driver in rally history risks putting his reputation on the line when he stages a comeback in Mexico this month. **Anthony Peacock** ponders the big question…

WHY?

ABOVE Loeb admits he missed the buzz of rallying

BELOW The opportunity to drive the current generation of cars, the fastest in the sport's history, has lured back the WRC's most successful driver

Citroën

So, why do it? Aged 43 and with nine world rally titles behind him, Sebastien Loeb has nothing left to prove. Why step back into the ring now, especially when, after his original retirement from full-time WRC back in 2012, Loeb cited a certain ennui, along with a recognition that the risk to reward ratio was getting higher, as his reasons for stopping?

There were other things he wanted to try in life, and he wanted to do them before he got too old. So, it's a surprise that the Frenchman has decided to return to Citroën for a programme of three WRC events this year: Mexico, Corsica and Spain.

Especially because, as things stand, he's going to be stepping into what is reckoned to be the least competitive car out there, which finished last in the 2017 manufacturers' standings.

Heading back into the fray after not competing on a WRC round for three years is going to make the task harder still. The weight of history is crushingly against Loeb: other than Niki Lauda in 1984, no other driver has successfully made a comeback after such a long period of time out of their sport. And even then, Lauda only won that F1 title by half a point.

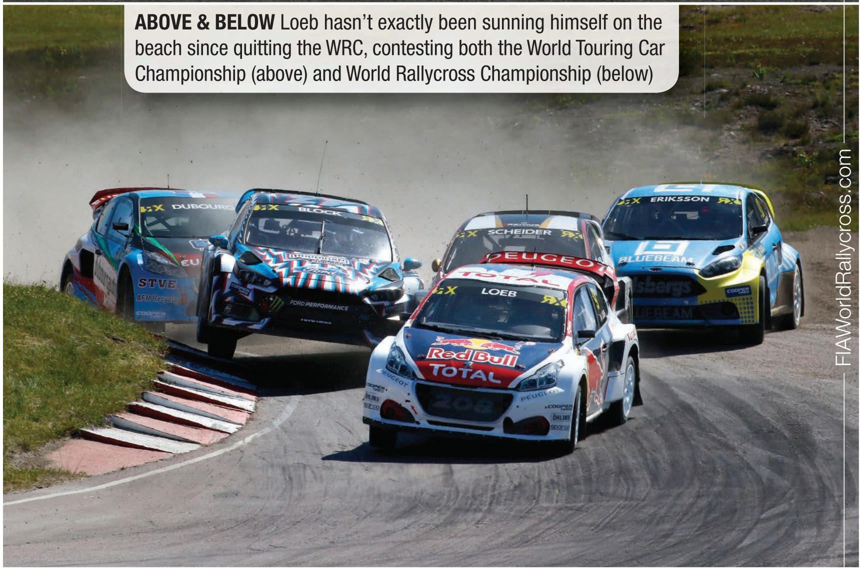
Of course, there are important differences. With just a trio of rallies comprising his schedule, Loeb has no designs on the championship. And he's hardly been out of motorsport since quitting the WRC, having variously contested the FIA GT Championship, World Touring Car Championship, Pikes Peak, World Rallycross Championship and Dakar. Somehow, he's also managed to find time to run his own team too: Sebastien Loeb Racing. On his rare weekends off, such as Rallye Monte-Carlo, he flew his helicopter down to Gap for a bit of WRC spectating.

But, with the exception of Pikes Peak five years ago – where he was in a class of his own – the inconvenient truth is that Loeb has never quite managed to recapture the form that led him to utterly dominate the World Rally Championship. Consider this fact alone to understand his breath-taking blitzkrieg on the WRC record books: he has nearly double the number of all-time wins than the next most successful driver, Sebastien Ogier.

Loeb's achievements since leaving the WRC have of course been at an astonishingly high level: third in the WTCC twice, fourth in the World Rallycross Championship and second in the Dakar last year; just five minutes away from what would have been an incredible win.

But compared to the stellar path of success that previously accompanied his progress, Loeb admits that his post-WRC career didn't quite work out the way he wanted. Nearly, but not quite. And his hopes of winning this year's Dakar in Peugeot's final season – which he described as "now or never" – were fractured along with co-driver Daniel Elena's coccyx as they plunged into a hole halfway through this year's event. Infuriatingly, they were lying second at the time and even after the accident, the car was good to go. The ▶

ABOVE & BELOW Loeb hasn't exactly been sunning himself on the beach since quitting the WRC, contesting both the World Touring Car Championship (above) and World Rallycross Championship (below)



same couldn't be said of Elena.

Loeb just shrugged in a typically Gallic fashion: such is life, these things happen. He drew pretty much the same conclusion when he had to retire from the lead of the Silk Way Rally with a banal finger injury, of all things.

The Frenchman is not necessarily less competitive a person than he used to be, but the swings, roundabouts and ravines of the last few years have made him more accepting of the fact that things can go wrong sometimes. In very relative terms, his fear of failure – in fact, his fear of fear – has diminished. And that's a sure sign that the man himself has changed too: along with quite a few other things, such as the specification of the modern World Rally Cars. That was the main pull behind him returning to the sport for a few cameo appearances this year, along with the fact that he simply missed it.

"I've tried quite a few things after I stopped my WRC career," he points out. "But none of them really gave me the same sensation, the same buzz as rallying. And obviously, I was curious to see what these new-spec cars are like. I don't think anyone who's a rally driver could look at this type of car and not want to try it."

Forget Group B: the current generation of rally cars are the fastest that the sport has ever seen. Loeb first tried out the recalcitrant C3 WRC in testing last year and liked what he saw; although he hasn't of course got any other current cars to compare it with. What he did conclude though – much to the relief of the regular drivers, who had been saying exactly the same thing – was that it wasn't by any means easy to drive.

"There's some potential and it seems quick, especially on asphalt, but it's quite demanding: there seems to be only a reasonably narrow operating window where the car is performing at its best," says Loeb. "Hopefully, I can use my experience to help improve that. These days, I'm just enjoying what I do, so the main thing for me this year on the WRC is to have fun. I know it's not going to be easy, but we've still got some knowledge we can use. We'll do our best and see what happens."

Even though he didn't exactly leave Citroën on the best terms at the end of 2015 (after effectively being ousted from the WTCC team), his motivation in coming back lies somewhere between curiosity, excitement and the desire to put something back. He may or may not recreate his previous form: the realistic expectation, with no disrespect intended on either side, is that he would struggle to beat his team-mate Kris Meeke – in exactly the same way that Michael Schumacher fought to get on terms with Nico Rosberg after returning to Formula 1 in 2010 after four years away.

But it doesn't matter. Loeb is coming back precisely because he has nothing to prove, not despite that fact. And for this, we should all be very grateful. A lesser man would have just stayed at home to bask in the glow of his trophies. RT

ABOVE Niki Lauda's successful F1 comeback for McLaren in 1984 remains a rarity: most returns have ended in anti-climax

BELOW Loeb tested the C3 WRC on gravel and asphalt before committing to a comeback

Citroën

FROM SAVING F1 FROM SELF-HARM, TO SAVING LIVES

F1's obscene costs, the brazen manipulation of races, and polemics with Ferrari – Max Mosley has seen it all. **William Kimberley** quizzes the former FIA president and finds him engaged in a new quest

Red Bull

ABOVE Red Bull's RB14 hits the track for the first time. With the big three expected to dominate once more this season, Mosley contends that F1's new owners should put cost capping back on the agenda in search of a level playing field

MAX Mosley may not have been on the Formula 1 scene as FIA president for eight years, but his influence is still keenly felt. While some of the policies he introduced have been replaced, more due to the advances in technology than anything else, others very much live on. One though, that did not reach the implementation stage, and one that Liberty Media, the new F1 commercial rights holder, has already said it wants to explore, is budget capping.

To most people, the cost of designing, developing and building two cars to go racing is virtually obscene. It is not until you have the privilege of seeing the inner workings of a Formula 1 team that it brings home just how that money, which runs into hundreds of millions of pounds, is spent.

As far as Mosley is concerned, though, it was and remains ludicrous. "The principle was that if you've got more money than me then you may as well have a bigger engine," he says. "There is no difference. The principle applies today as much as it did 10 years ago."

As is well known, the thing that derailed the budget cap he was well on his way to introducing was the *News of the World* story that brought a tidal wave of criticism to his doors, which left him powerless in his job as FIA president. He subsequently argued, and won, the case that lesser mortals would have balked at doing, and took the offending newspaper to court for invasion of his privacy. He won record damages in the process, but the damage as far as the Formula 1 budget cap was concerned was done. It died a death.

DIVIDE AND RULE

As he says, there were also strong vested interests against the proposal. "Bernie Ecclestone, for example, never wanted a budget cap because by playing the rich teams off against the poor it fitted with his whole business practice of divide and rule, with the teams on one side and the organisers on the other. Whether Liberty Media understands that is another matter. The rich teams have vested interests because their only competitors are the other rich teams, which cut down the competition dramatically.

"It was a shame, but sooner or later it will come in somewhere, but what you're up against are people who say, 'You can't check it. What's to stop teams having a wind tunnel in the Andes or China', that sort of thing, to which there is a complete answer."

Mosley talks about a meeting he had with senior management of the car companies while attending the Geneva Motor Show in May 2008. "I said there was no point in spending hundreds of millions if you could get away with tens. Nobody would be able to tell the difference and no team would be disadvantaged in any way unless their engineers were less clever. Dieter Zetsche, Mercedes-Benz chairman, asked how it could be checked, to which I replied that that was a matter for accountancy experts to say whether it was possible or not. I argued that let's say for now that it was possible, so would you agree it? Carlos Ghosn, CEO of Renault, spoke up and said that I was absolutely right as a matter of principle. Then the *News of the World* story broke."

He argues that Liberty Media should put cost capping back on the agenda again. "If you want competition, you need a level playing field and then once you've got the budget cap in, it means each team can be paid what it costs to actually go racing and any sponsorship they get is profit. The budget cap should therefore come down to the point where Liberty Media can give the teams the agreed amount and sponsorship is the icing on the cake.

"Of course Ferrari getting more money due to the Concorde Agreement is absolutely mad. I remember Jean Todt telling me that it was like a film and the Ferrari was the star. Absolutely not, and they also got more sponsorship than anyone. Their performance per dollar spent has never been that good. I remember we used to go there at the end of the '70s and early '80s and wonder how we could even begin to compete.

"The only way to deal with Ferrari threatening to withdraw from Formula 1 is to call their bluff. What are they going to do? Le Mans is an option because the publicity is fantastic, but it's only one race a ▶

ABOVE Even as the most influential man in motorsport, Mosley couldn't quite break through the vested interest of the top players

> *"The only way to deal with Ferrari threatening to withdraw from Formula 1 is to call their bluff"*

Ferrari

ABOVE Ferrari, here launching its new SF71H, is part of the sport's DNA. But Mosley argues that the Scuderia needs F1, more than F1 needs it year. If Liberty Media makes Formula 1 work, they don't need Ferrari and certainly not as much as Ferrari need Formula 1."

Mosley points out now, as he did when president, that manufacturer teams come and go. They come in for a purpose, usually affiliated to marketing although there are technology spinoffs as well, but when the time is right for them, they have no second thoughts about leaving. This has been seen in the very recent past in the World Endurance Championship with Audi then Porsche suddenly announcing their departure, leaving just Toyota in the LMP1 class in that particular championship.

"When it comes to manufacturers in Formula 1, they come and they go. It has always been like that because it's more a marketing exercise for them than anything else. We are seeing that with Formula E with all the manufacturers getting involved. It's all about winning and for a while, the manufacturer can fantasise about winning, if it's not this year, then next year. When they haven't after three or four years, they then pull out as it's not good for a manufacturer to demonstrate that they cannot get the job done."

When Mosley was president, he was always concerned that Formula 1 should have some relevance to the automotive industry and so as such he welcomes the increased electrification in motorsport. "Increased electrification in the sport is on balance a positive thing," he says. "I was one of the first to have a Toyota Prius and it was absolutely evident to me that to harness the energy and re-use it was the most sensible way to go. It was a battle getting such a system into Formula 1, but we did in 2009.

ELECTRIFICATION

"For the road it is undoubtedly the way to go although I don't think it will ever be to the exclusion of the internal combustion engine. However, there must be a place for the electrification of the powertrain in motorsport because there's no doubt that when you get a new technology, it does accelerate development providing the rules are sensible. There's no question that bringing KERS into Formula 1 accelerated all of that.

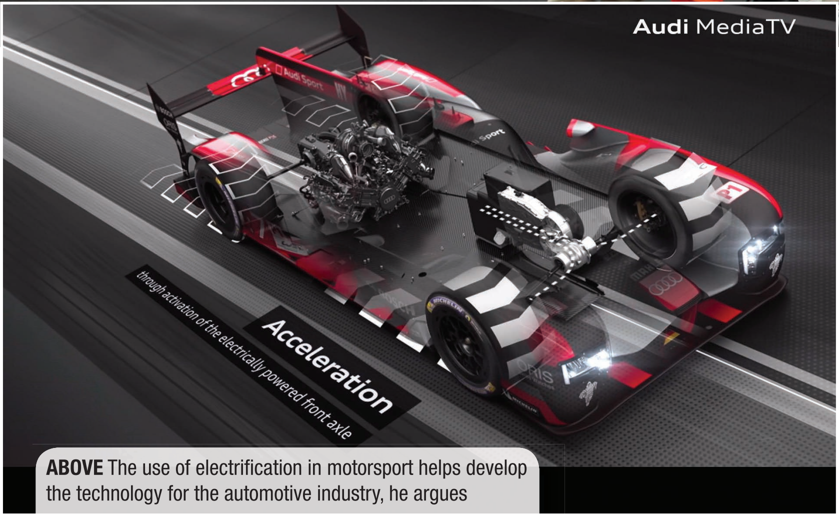
"The only problem I see with it is that in order to compete with Formula 1, Formula E needs to get up to those sort of speeds because that's the spectacle. I haven't been to a grand prix since 2009 but what used to really strike me was that if you stood on one of the fast corners, the cars were so fast compared to anything else. I haven't been to a Formula E race, but I know that they're not that quick. However, the problem is that if they were, it would be much more difficult to run in the middle of a city because you then start to think about run-off areas and the spectators.

"The only mistake I think that Formula E made was for the drivers to change cars halfway through the race rather than change the battery pack, although I am told that that is very difficult. The message, and one you don't want, is that electric cars don't have the range although battery technology is now at last advancing. So Formula E has problems as I see it, but fundamentally the more the public come ▶

FIAWorldRallycross.com

ABOVE Audi is amongst the manufacturers pushing rallycross towards electrification. Mosley believes the sport could offer the perfect platform for the technology

ABOVE Manufacturers come and go, he warns. Victories and defeats alike can hasten their departure



ABOVE The use of electrification in motorsport helps develop the technology for the automotive industry, he argues

to see electrification as part of motoring, I think it will become quite big."

Mosley believes that rallycross is also an appropriate arm of the sport for fully electric cars. "It's rough, the races aren't that long and the spectators can watch the action all the way round a circuit, and the lack of noise won't be so obvious. It's also not out of the question that new forms of motorsport will also be created for fully electric cars," he suggests.

"It's the same thing with autonomous vehicles. Everyone now understands that they're coming but 10 years ago you would have been considered a bit mad for saying that. 25 years ago we had discussions about computer aids on Formula 1 cars and I remember saying at the time that even then it would be possible to run a racing car around a circuit without a human being. It would be more difficult if there were other racing cars, but we were obviously getting there."

BANNING DRIVER AIDS

This brings Mosley to the point about driver aids in Formula 1 and how they came to be banned. "I had a nice little rule about driver aids, but there were strong objections to that so in the end I suggested that they be prohibited altogether at the Formula 1 Commission," he recalls. "Everyone agreed because they knew nobody knew what a driver aid was. None of them being lawyers, what they overlooked was that the vaguer the law, the greater the power of the judge. It meant we could define a driver aid to be whatever we liked. That was the first time I got away with something that I really shouldn't have."

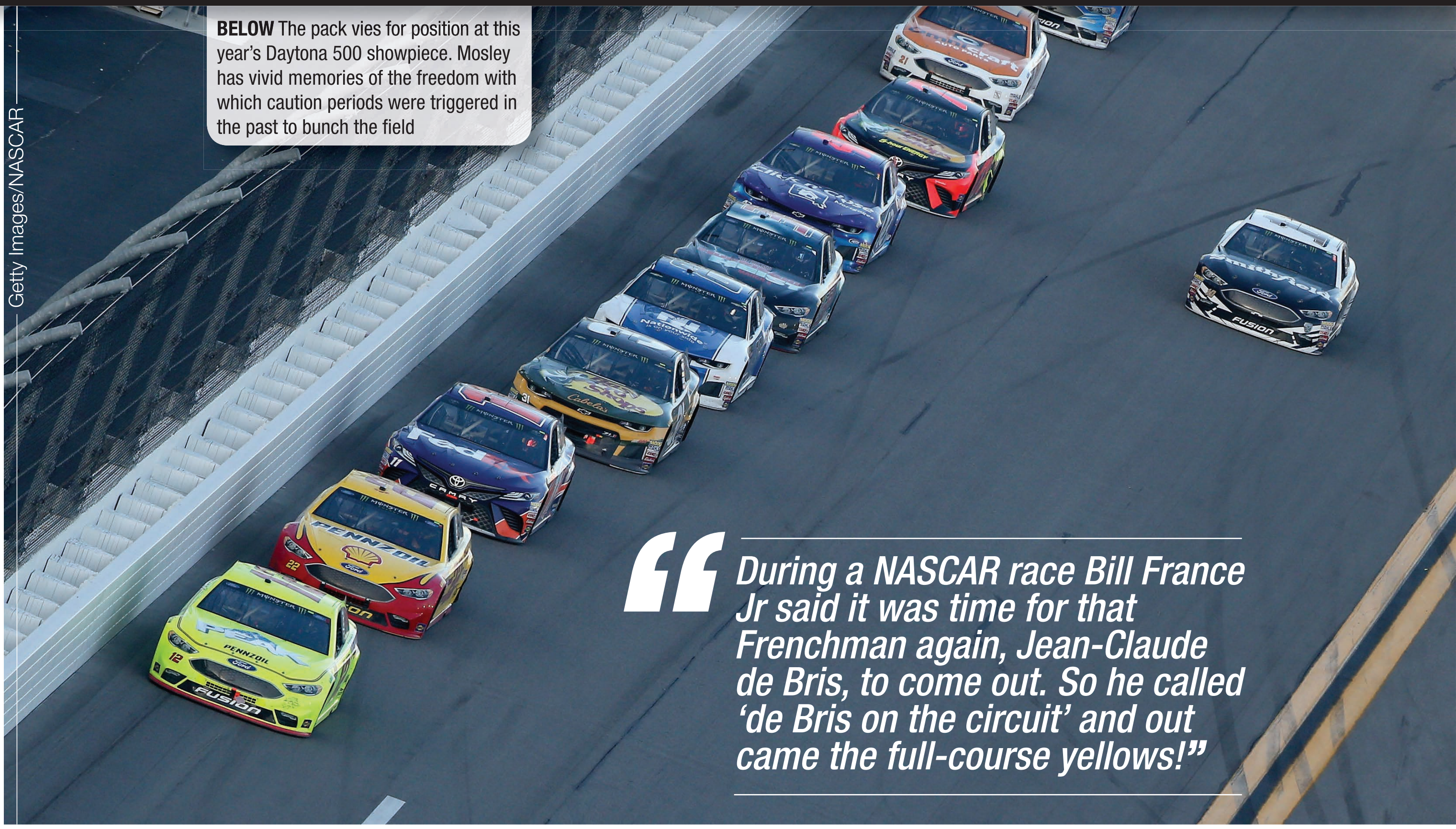
Under Mosley's and Ecclestone's collective reign, Formula 1 reached new heights in popularity. TV viewings were high, spectator attendance was healthy and sponsors were clamouring to part their money with the competing teams. Much of that has changed now due to more pay TV, decreased spectator attendances and sponsorship being much harder to find, so does Mosley think Liberty Media has a tough job on its hands?

"I may have views but I'm the exact opposite of an expert about what makes Formula 1 popular," he insists. "It may well be that Liberty Media knows. On the other hand there have been so many people in so many series who have "known" and failed, so they may have the answer, but we don't know just yet if they do.

"However, I must say that when you get things like the grid girls being stopped, it's silly because it's totally different to the Presidents Club." For those that don't know, this was a men-only fundraising dinner in London for the Presidents Club that caught the headlines when it was revealed by an attending undercover reporter who alleged that hostesses were groped and that it was nothing more than a meat market for middle-aged businessmen.

"Nobody touches, gets near or even talks to a grid girl, who are very often dressed more conservatively than the average person in the paddock," observes Mosley. "How this is objectifying anybody is beyond me. So you get this slight suspicion of political correctness of a very low grade. If this is typical then it doesn't augur very well although it may well have been a one off."

What the Americans are very good at, ▶



Getty Images/NASCAR

BELOW The pack vies for position at this year's Daytona 500 showpiece. Mosley has vivid memories of the freedom with which caution periods were triggered in the past to bunch the field

"During a NASCAR race Bill France Jr said it was time for that Frenchman again, Jean-Claude de Bris, to come out. So he called 'de Bris on the circuit' and out came the full-course yellows!"

though, is putting on a show and this is where Liberty Media may come into its own. However, Mosley has his concerns.

"Entertainment in the US is so different. Take the announcer at the last US Grand Prix who was somewhat over the top. Europeans tend to find such things embarrassing," he reflects. "The idea that you can just export American methods to other countries isn't necessarily going to work and secondly, I'm not sure that American methods work all that brilliantly anyway. We shall see."

MANIPULATION OF RACES

In his day, Mosley was sometimes accused of manipulating races to make them more exciting or to spice up the championship, but he vigorously denies this. Again, he points to the US as the arch manipulators of a race. "The way that some races were manipulated by NASCAR was something that Bernie quite approved of. I was in the tower at Daytona during a NASCAR race and Bill France Jr was in charge. I remember it like yesterday his saying that it was time for that Frenchman again, Jean-Claude de Bris, to come out. So he called 'de Bris on the circuit' and out came the full-course yellows. Bill did see the funny side of it, but that's their way of doing it.

"Things used to happen in Formula 1 sort of like that, particularly getting towards the end of the championship when I was often accused of manipulating the championship, but it absolutely wasn't true. I wasn't that clever. Occasionally we just got really lucky such as when Felipe Massa was World Champion for literally a few seconds before Lewis Hamilton claimed it on the last lap of the race in Brazil. We always used to say that if we could get the last corner of the last lap to be the decider, it was the perfect scenario."

Mosley's response to modern races being boring is to point out that in every era it has been the same: "When we talk about the modern era having too many boring races in Formula 1, we tend to forget that there have always been dull races. Nothing has really changed. It's a bit like school days when people tend to think they had a lovely time at school, but they didn't. They had a horrible time but just remember the good bits. I remember once talking to Luca di Montezemolo, boss of Ferrari, and confessing to him that I sometimes fell asleep when watching a race on television. He replied 'so do I'.

"The whole thing about genuine sport is that it's sometimes very boring but when it gets exciting, it can be amazingly exciting because it's real whereas the World Wrestling Federation, for example, is staged. It's entertainment, but that's not the same thing as competitive sport. Motorsport really depends on all the things that go into making a competition."

Talk comes to the Halo and whether it will ruin Formula 1 as some critics are asserting. "Whether it will and to what degree it will work I simply don't know, but I assume that after all the research and work that's gone into it that it will protect against the type of accident that claimed the life of Henry Surtees at Brands Hatch," he says. "I don't think it would have helped in the accident that claimed Jules Lucien Bianchi's life. As to the look of it, I think that in no time at all it will be accepted.

"I was recently at the Delhi Motor Show and there was a Formula 1 car on the Renault stand with all its ridiculous aero devices, but that's another story. Without the Halo, though, it looked kind of naked. I think this time next year people will think, 'Why wouldn't you have a Halo on a Formula 1 car?' Yes, it's enclosed, but then once upon a time racing drivers just wore linen hats and goggles, so we have to move on.

"The thing is that once you know about a problem and you have a solution, you must use it. There is no alternative. To put it the other way round, if you made Formula 1 more entertaining but more dangerous at the same time, you would be foolish to do it. If you presented two drivers with two cars and told them that one was really safe but the other was more dangerous but was two seconds a lap faster, then without doubt both drivers would go for that car. The governing body therefore has to protect ▶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FIA/Formula E

them from themselves."

Asked whether he would still like to be involved in running Formula 1, Mosley replies directly that he wouldn't: "I got to the stage in 2004 when I did the great resignation and it was said to be some manipulation plot by myself, but it absolutely wasn't. I had reached the stage when I had got fed up with the role. I was going to meetings and knowing what everyone was going to say, knew what we had to do, and knew what we couldn't do for all sorts of political reasons.

"Once or twice it was really entertaining such as in 2003 when we brought in the *parc ferme* rule. I will never forget that meeting. I had squared one or two people beforehand and then I announced at the meeting that we had no power to abolish qualifying cars, that it would continue although I thought it ought to stop. However, we were going to require all the cars to go into *parc ferme* immediately after qualifying and only be let out immediately before the race.

"The power to put a car in *parc ferme* had been in the Yellow Book since before the Second World War, so you couldn't say it was new. We were just exercising our right to put cars into *parc ferme*. We weren't abolishing qualifying cars, but if you didn't qualify the car you intended to race, you could find yourself at a disadvantage in the race.

"Two or three people were absolutely furious, but it stuck and if you went into the paddock now and asked everybody whether qualifying cars could be brought back, the overwhelming answer would be no. I was subsequently phoned by Frank Williams who told me that he had been changing his engine on a Saturday night for the last 40 years and I replied that he now belonged to the 'We've always done it that way' school of management and we laughed.

SUCCESSION PLAN

"That was quite entertaining but it got to a point in mid 2004 where I had already had enough after nearly 12 years and so I resigned," he says. "However, the FIA told me that I couldn't just walk away and that I had to finish my mandate and a succession was needed. I had already half talked to Jean Todt about being my successor even though he was the Ferrari team manager and that was more or less agreed, so I agreed to stay to the end of my mandate in late 2005. I told him that if he put himself forward, I would back him, which would enhance his chances of being elected. However, sometime at the start of the 2005 season he was offered the job of running not just the team but the Ferrari factory and Maserati as well, an offer he couldn't turn down. I therefore agreed to hang on although I told him it might just be for two years.

"What I should have done in hindsight was to tell Jean when he got offered the big job that I was leaving at the end of 2005 whatever and that if he wanted to stand, I would back him. Staying on another four years was pointless. I did the best I could with the cost caps, but on the other hand it was frustrating because you were doing all this for the competition but also for the small teams, which were then seduced by the big teams at the key moments, at which point I thought sod it!

"I was also tired of being held responsible for everything and that it was always my fault. I remember Kenneth Clarke when he was Home Secretary saying to me that the thing about being Home Secretary is that you only ever get bad headlines. You never get a headline saying that there are no terrorists on the roof of Buckingham Palace."

One of Mosley's principal legacies is not to do with Formula 1 but road safety. Safety was and is one of his prime passions in life. He promoted the European New Car Assessment Programme (Euro NCAP), the independent crash-test organisation described by the European Commission as the most cost-effective road safety initiative

FIA

ABOVE Mosley with Jean Todt at an FIA General Assembly in Paris. Both men will forever be linked with motorsport, yet their bigger legacy will be a role in saving lives on the road

ABOVE Formula E is playing a useful role in shifting public awareness but, he says, the mid-race car swaps sent the wrong message

> *"There have always been dull races. I once confessed to Luca di Montezemolo that I sometimes fell asleep when watching a race on TV. He replied, 'So do I!'"*

of the last 20 years, remaining chairman of Euro NCAP from 1996 until 2004. In late 1996, he also formed and served as the first chairman of the Formula 1 Safety Commission, which focused on the development of Formula 1 circuit safety.

He then adopted Formula Zero, a strategy devised by Swedish road safety expert Claes Tingwall for reducing fatalities and injuries on track and road. The policy document identified the safety synergies between motorsport and motoring and outlined an approach to road safety involving a zero tolerance approach to deaths or injuries.

In 2002, he proposed the establishment of the FIA Foundation and the FIA Academy, serving as a Trustee of the Foundation, a charity focusing on promoting road safety, environmental protection and motorsport safety worldwide. The FIA Academy was created to develop important projects to stimulate research and create the necessary framework to promote road safety and protect the environment.

FROM SAVING F1 TO SAVING LIVES

"By 2004 I had achieved what I wanted with safety in Formula 1 but I have gone on since doing the road safety thing a bit although the really heavy lifting is done by David Ward, secretary general of the Global New Car Assessment Programme," he says.

"If going to India, for example, as I have recently done and seeing the top civil servants in the road transport and industry ministries plus various manufacturers and the Indian equivalent of the UK's Society of Motor Manufacturers and Traders, can save one tenth of one per cent, it means 140 people a year won't be killed on the roads there. In total, 140,000 people are killed on the roads there every year. Putting it another way, in the three days that we were there statistically more than a thousand people died on the roads.

"If there were a succession of terrorist incidents in India resulting in 1,000 deaths and God knows how many injuries, the whole world would be in uproar. So I continue in this work not for fun but a sense of duty. People criticise Todt but he fully understands the responsibility of being FIA president.

"I remember pointing out to him when he took over that 3,000 people a day die in road accidents worldwide and if he saved one per cent, that's 30 people a day. To me if you find yourself in a position like that, then it becomes a duty. I know that Jean agrees. He travels the world working for road safety." RT

WHEN Halo was first seen on the track in March 2016, most of the discussion was surrounding the aesthetics of the safety device. Now however, as Formula 1 teams are readying themselves for the first race of the 2018 season, the adoption of the Halo has proved to be as difficult for the teams to install as it has been for critics to stomach.

When the FIA released details of the stringent tests that the Halo must undergo in September last year, the magnitude of the challenge facing the teams became apparent. According to Article 17.2 of the latest technical regulations, the FIA stipulates that the safety device must withstand loads as high as '116 kN vertically downward', '93 kN laterally inward' and '83 kN longitudinally rearward', which Mercedes' technical boss James Allison succinctly surmised is about the weight of a London double-decker bus.

IN SEARCH OF THE HALO EFFECT

The Halo is here to make racing safer, but does it offer any other benefits? **Alan Stoddart** speaks to McLaren's engineers to find out

According to McLaren's chief engineering officer, Matt Morris, getting the Halo to pass these tests hasn't been easy. "The loads are very, very high and we always knew it was going to be a challenge so we invested some time and money upfront to do quite a lot of test pieces," he explains. "We built various test pieces where we had dummy Halos, parts of Halos, full Halos, testing how the interfaces would behave. We found some issues, but we found them early enough so we could react to those issues and catch the main chassis."

Despite all this planning and preparation there were still some "heart stopping moments", Morris adds. "It was close, we didn't breeze through it in any way." The static test that comes in from an oblique angle proved to be particularly dramatic. "The amount of load that's going in there and everything's moving around... it's a bit scary."

Standing up to all these forces being distributed through the Halo's mounting points has meant that everyone has had to redesign their monocoques. In particular managing the load through the two rearward mounts has been difficult and has required some work to ensure they stand up to the job. The difficulty of this problem means that there is potential for people to use different solutions.

WEIGHT PENALTY

For McLaren, meeting these strength requirements means there has been some penalty in terms of weight, although according to Morris, the size of the actual increase is in fact hard to quantify because some of the material required to support the Halo is there anyway, while other weight savings have been made elsewhere to offset the additional weight of the new safety device.

"It's difficult to know what's just required for the Halo and what is normal chassis construction. But we've done a good job on this chassis," he says of the new Renault-powered MCL33. "The guys are more than happy with the chassis weight after all that... and obviously it's passed the test so that is the main thing, but it'll be interesting to see if anybody does have any problems."

Hopes that the addition of the Halo, and the extra structure that it necessitates, would offer designers an area to innovate in are however quenched by Morris. He says that because the chassis had to undergo so many rigorous safety tests, the team is very limited with regards to its ability to try new concepts. "There's so many squeeze tests and push tests and what have you that it almost designs itself," he says. "Then, once it's designed itself, yes there may be a little tweaking here and there but you tend to do that with bodywork and fairings." ▶


FIA

ABOVE The Halo was introduced only after exhaustive FIA tests. For the teams, though, the hard work was just about to begin

> *Can withstand the weight of a double-decker bus"*

McLaren

ABOVE Despite its Halo having to effectively support the weight of a London bus, McLaren's MCL33 passed all its crash and load tests. Shrouding can be added to the device to finesse the aerodynamics

If there are any benefits to be had, they could come in the form of improved chassis stiffness, adds McLaren's chief technical officer for chassis, Tim Goss, but he expects even these gains to be slight. "In truth that part of the chassis is pretty rigid," he explains. "It's actually where the chassis section comes down going further forwards that there is any compliance in the chassis… I think that's the main implication of taking the load from the Halo through the chassis."

AERO OPPORTUNITY

The other big question hovering over the Halo has been the effects on a car's precisely honed aerodynamics. McLaren already revealed one concept during tyre testing at the Yas Marina circuit in November last year, showing the importance of managing the airflow interrupted by the device. In that test, McLaren used an arrangement of three contoured winglets stacked above the top of the Halo, which were affixed to the Halo by a central spar. These tweaks to the Halo device are allowed under article 15.2.6 in the regulations, which permit teams to use a fairing of a 'prescribed laminate', which does not interfere with the 'helmet free volume template' and is nowhere more than 20 mm from the Halo itself.

Despite the stringency of these regulations, they do not mean that there isn't potential to make the Halo aerodynamically advantageous. "The scope's quite limited, but there is an opportunity there," notes Peter Prodromou, McLaren's chief technical officer for aero. However, at the moment he says it's "certainly not penalty free".

"I think everyone is going to be faced with the same type of challenges. How it affects the flow [of air] into the engine, how it affects the flow into certain cooling ducts that people have in the area, and the flow into the rear wing," Prodromou adds, suggesting that the first order of business was simply to mitigate the penalties incurred by the addition of the Halo.

"I think there is a challenge there to either cope with it in terms of damage limitation, and thereafter think about opportunity and exploitation. It does open up some avenues that possibly are interesting to look at. I'm sure there's going to be a variety of different solutions out there."

> *"We found some issues, but we found them early enough so we could react"*

These "different solutions" however won't translate into very meaningful differences in performance, especially in the longer term, cautions Prodromou. "There is an opportunity there to try and tap into that as we couldn't before, but in terms of the bigger picture it's just not that important.

"Give it half a season and I imagine everyone's converged."

BELOW Stoffel Vandoorne tries an example of the Halo in a McLaren MCL32-Honda at Spa last August. Implementing the device has, nevertheless, been a challenge


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INDYCAR PLAYS COURTING GAME

IndyCar heads into its opening race of the season with future plans dominating the agenda. **William Kimberley** talks to Bill Pappas, vice president of competition and race engineering

As we reported in the April issue (RT 208) of *Race Tech*, IndyCar is looking hard to find a third engine supplier.

Jay Frye, IndyCar's president of competition and operations, spoke at the North American International Auto Show in Detroit to say that he and the IndyCar team had been to see a number of companies, within the US and abroad. It was virtually a rerun of last year's message when the hope was for a third and possibly even a fourth engine manufacturer to enter the series.

The hope then was that by moving to a universal aero kit in 2018, rather than the bespoke ones that had been developed by both Chevy and Honda at great cost to them, it would be enough to encourage others to enter. In the event, though, no-one bit, so it was back on tour after the last IndyCar race of the season last year.

Both Chevrolet and Honda are very keen for a third engine supplier to be found as both are creaking at the seams in being able to supply the entire grid between them. This is something that Bill Pappas, IndyCar's vice president of ▶

ABOVE The test at ISM Raceway offered the opportunity to see how the universal aero kit would behave with cars running together

IndyCar

ABOVE A two-way flow of information between IndyCar and the FIA has marked the development of the prototype windscreen, just as it has the Halo

competition and race engineering, is very aware of. "Both Chevy and Honda have told us that they were very much in favour of finding another supplier, not only for the extra competition it would bring to the series but also to lighten their substantial load," he says. "We are working pretty close to round the clock communicating with different manufacturers and are aggressively pursuing getting a third engine manufacturer onboard."

LePage/LAT

ABOVE The universal aero kit, seen here on Josef Newgarden's Team Penske Chevrolet, has transformed the look of the Dallara DW12

NEW POWERTRAIN

Coming up over the horizon to be introduced in 2020 or 2021 is a new powertrain package. It might attract some new manufacturers, but devising new regulations is not that easy, says Pappas.

"Not only are we in discussions with our two engine partners but also taking prospective suppliers as well. I think that whoever gets involved, though, will have enough engine experience to understand what's come before them and quickly be on the same pace that Honda and Chevy have been for the last six years."

While the quest for a third engine supplier continues, the recent open tests at the ISM Raceway near Phoenix were important for two reasons. One was the testing of the new universal aero kit by virtually every driver in the IndyCar series this year; the other was to see how a driver took to the new windscreen that was being fitted to a car running on a track for the first time.

The new universal aero kit was well received by all the drivers. "It's different," said reigning series champion Josef Newgarden, driver of the No 1 Hitachi Team Penske Chevrolet. "I think there are definitely adjustments that need to be made from last year, obviously. It's useful to have this time and to be able to work through everything because I think we're all going to need it."

"We need everyone to buy in," says Pappas. "The entire paddock has had a chance to test and drive the car with the new universal aero kit. The drivers like the level of comfort but the test at Phoenix was a chance to see how it reacted in a pack. Importantly, it's also been a huge success from a fan perspective."

Meanwhile, Scott Dixon's car was fitted with a prototype windscreen, the first time it has been installed on a car at the race track. He made three short runs on the 1.022-mile ▶


IndyCar

ABOVE The windshield was tested in a variety of light conditions

> *"Kudos to the series for getting the screen out there and running it"*

oval to test his vision through the prototype in varying light conditions – in late afternoon sunlight and shadows, at dusk and at night under full track lighting. Previously the windscreen has only been tested on the Dallara simulator.

Frye stressed that as this was the first on-track test for the prototype, revisions will be made from what was learned and that there was no timetable for implementation to all Verizon IndyCar Series cars for competition.

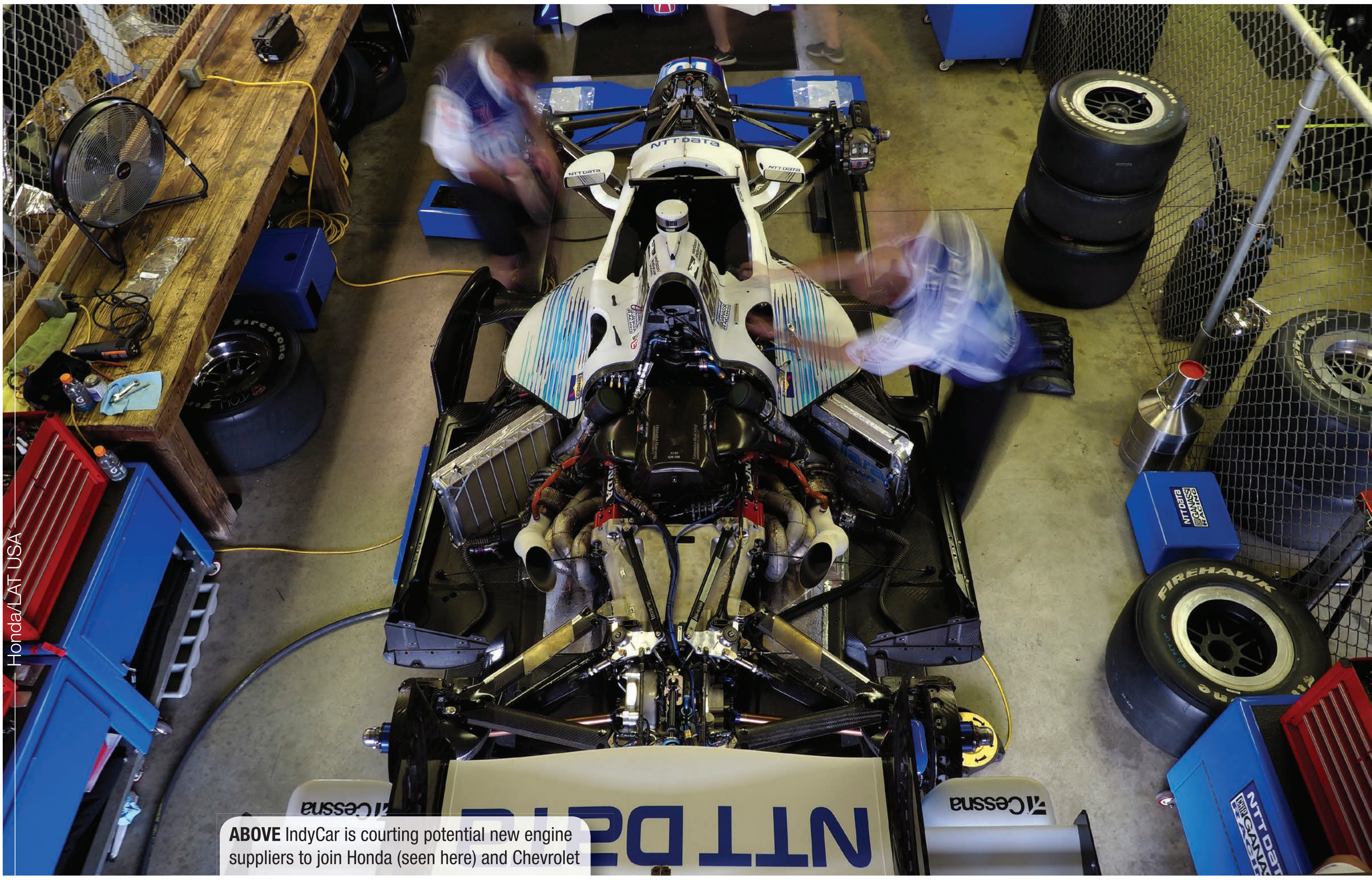
However, he echoed the sentiments of everyone within the sanctioning body when he said he was pleased with the outcome.

"We went through the biggest transition of lights," said Dixon after climbing from his PNC Bank Chip Ganassi Racing Honda following the third run. "The hardest was probably the first run where we had extreme sunlight to darkness right through turns 1 and 2.

"Out of all of them, the night time was the easiest – no visual transitions there. I think for us it was basically seeing if there was going to be glare issues or anything with the lights. However, everything looks very good. I'm very happy and kudos to the Verizon IndyCar Series for getting it out there and running it."

"We wanted to see what Scott thought about it as he's one of our most seasoned drivers in the series," says Frye. "So it was an exploratory exercise, and we haven't come to a final solution so can always go back to the screen manufacturers to address any of Scott's concerns."

With a new engine package on the near horizon and a new windscreen coming soon, the IndyCar series is undergoing a makeover. Fans get the chance to judge the first part of the package, the universal aero kit, when the series starts at St. Petersburg this month. RT



Honda/LAT USA

ABOVE IndyCar is courting potential new engine suppliers to join Honda (seen here) and Chevrolet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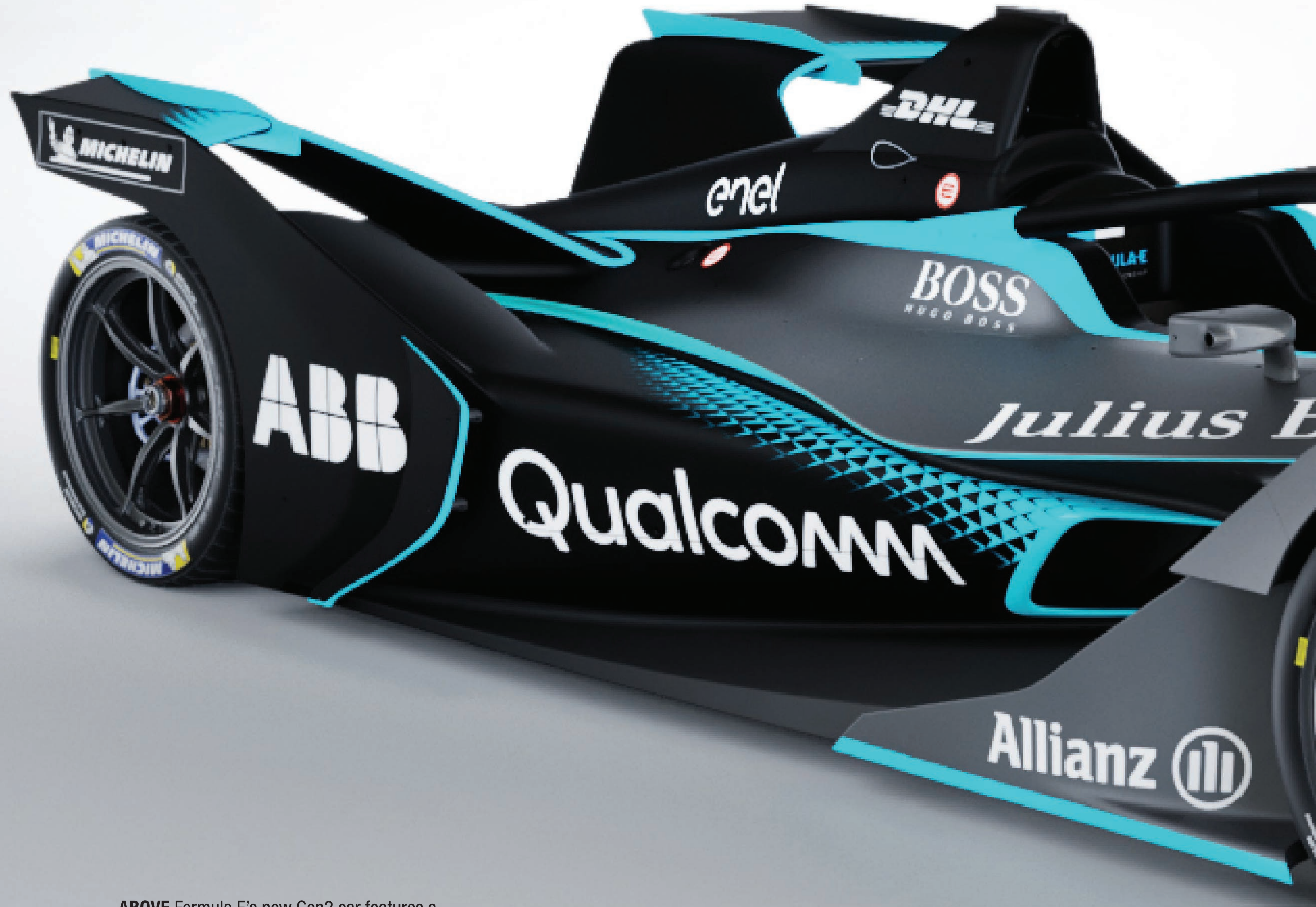
"THE FUTURE OF RACING"

That's the bold claim accompanying the release of Formula E's striking Gen2 car. **Craig Scarborough** reports on a machine that will consign the championship's embarrassing mid-race car swaps to the history books

AFTER much anticipation, the ABB FIA Formula E Championship has unveiled its car for the fifth season of the electric racing series.

Designed and styled by Spark Racing and produced by Dallara, now with a McLaren Applied Technologies battery, the dramatically 'Batmobile'-styled car is a radical departure for a single-seater formula. With partially covered wheels and a Halo, the SRT05e challenges many people's preconception of a monoposto, while at the same time moving on the performance for an electric racecar.

Not a series to shy away from publicity and changing perceptions, Formula E sought out a supplier for its Season 5 (2018-2019) car with the brief for a dramatic, but raceworthy machine, powered by a battery able to last a full race. The tenders were hard-fought, with the incumbent chassis supplier, Spark Racing



Photos: FIA/Formula E

ABOVE Formula E's new Gen2 car features a Halo and partially covered wheels as part of its futuristic look. The slim chassis beneath the wide bodywork could form a base for different aero kits in coming seasons

Technology, winning the first part and McLaren Applied Technologies prevailing when it came to the battery.

With the closed tender process won, the development and initial testing were also conducted in secret. So much so that when the first computer renders were released, most people outside the project had never seen the resulting dramatic-looking car.

BODYWORK

Clearly the striking thing about the Gen2 car is the bodywork. With Formula E being a spec chassis series, the cars can be styled to present a more exciting 'look' across the board, as long as the machine is still able to meet the basic performance requirements. Having this freedom, that has not been exploited by other series such as F2/GP3 etc, the designers have really gone to town on the Gen2 car. But it's far from being a functionless concept car: a lot of the ideas have real uses.

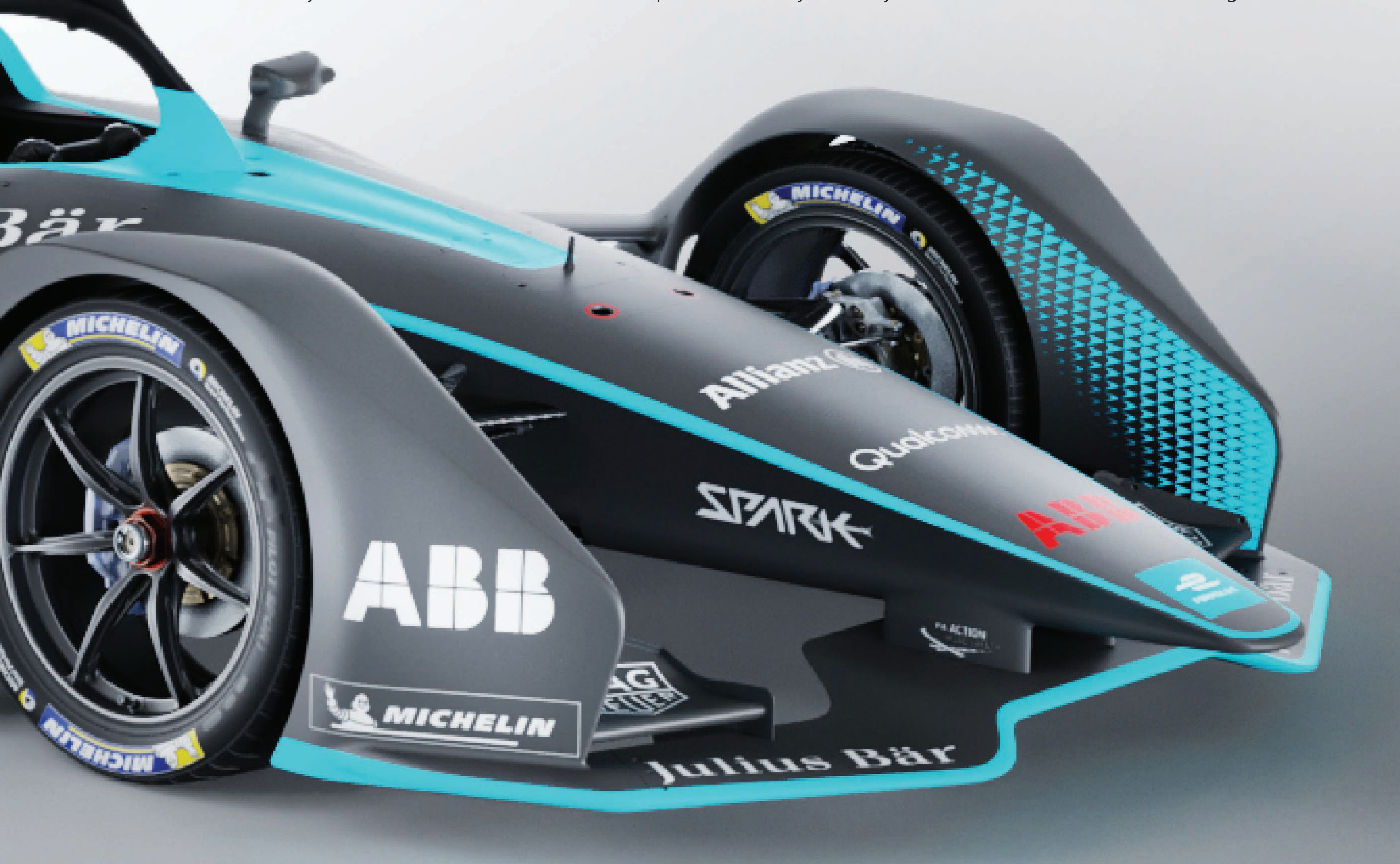
Controversially for some purists the Gen2 car covers the top of the front wheels. This feature challenges some people's view that a single-seater should have open wheels, but Formula E already stretches what a racing car is simply by the use of its electric powertrain. Now the fairings ahead of the front wheels, already on the Season 1-4 car, extend up and over the front tyres, the area behind the wheels now filled with a bargeboard-like device.

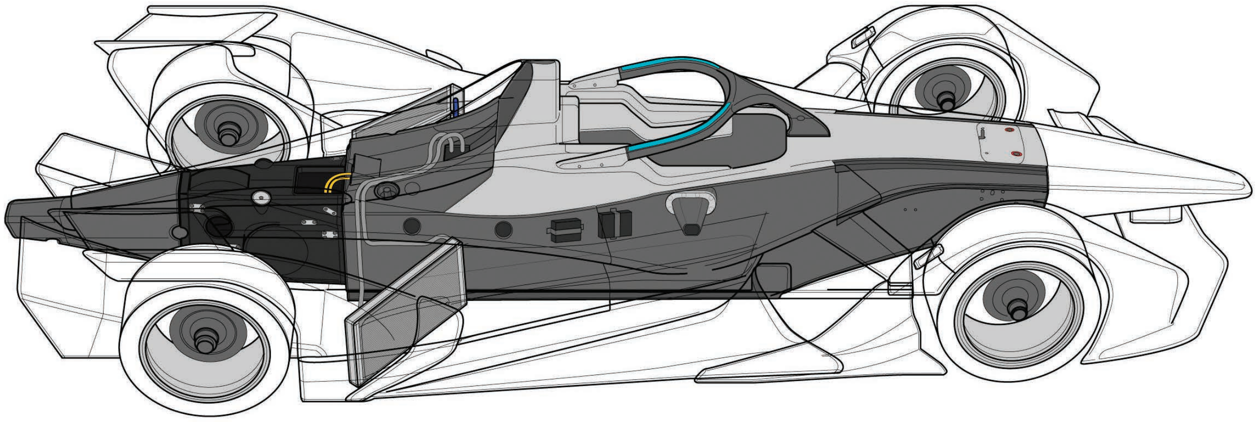
As Formula E is all about efficiency, running open wheels is a handicap, as the 18" rims shod with low profile Michelin all-weather rubber create a lot of aerodynamic drag. Covering the wheels cuts this drag and the vane behind the wheel helps push the tyre wake away from the rear of the car to keep the rear wing running in clean air. With the wheel fairings managing the tyre wake – unlike F1, where this is accomplished with extremely complex front wings – the cars should be able to follow in traffic much better.

Efficiency and overtaking is further improved with the rear wing being reduced to two small flaps over the rear tyres and by a huge diffuser. The old, larger, two-element rear wing has been removed and the flaps mount to an inner dihedral element, this part being simply a styling addition and not a downforce device. Having more downforce produced by the underfloor reduces the rear wing element, plus the drag and turbulence associated with them.

The central bodywork, which is less critical to creating the car's aero load, can also be much more styled and unconventional. These panels all bolt onto the inner monocoque, so even though the nose and central body is wide, there is a typical slim racecar chassis beneath. This will allow very different aero kits to be added in the future without forcing the introduction of a new rolling chassis below – a useful and cost-effective solution. This wider upper bodywork encloses the side impact protection spars, rather than them being housed with individual aerofoil fairings. ▶

> *"Our goal was to break the mould and challenge the status quo – this next generation car represents that revolution"*





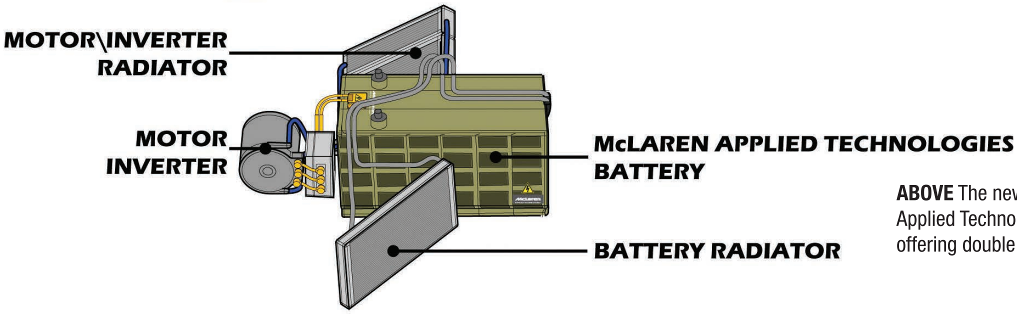


Illustration: Craig Scarborough

ABOVE The new battery from McLaren Applied Technologies is central to the project, offering double the range of the existing car

Sidepods remain the outwardly diverging shape of the Season 1-4 car, rather than sweeping in with a Coke bottle shape. But the ducts are now much longer, the inlet being quite far forward along the car. The right-hand sidepod once again houses the battery cooling radiator, with the left-hand sidepod being home to radiators for the motor and inverter. As teams are allowed to develop their own motor/inverter cooling packages, the duct and detail of the radiator packaging will be left to the individual outfits to revise, while the radiator and duct for the battery is fixed as part of the homologated car spec.

BATTERY

Aside from the bodywork, the big change for Formula E for Season 5 is the battery. The Williams Advanced Engineering battery was run for the first four seasons but now, under McLaren Applied Technologies, the specification has been stepped up to 56 kWh from 28 kWh.

With this change in spec, the battery remains a similar size, so the energy density is double. More importantly for the electric series, the range is also double, such that mid-race car swaps will no longer be a feature of events.

For the development of the battery it's known that McLaren Applied Technologies is partnering with Sony, which produces the cells, and Lucid, which will manufacture the battery packs. There's a change in cell format and voltage, with the ~150 flat cells of the Williams 700V battery changing to a 900V battery using cylindrical cells.

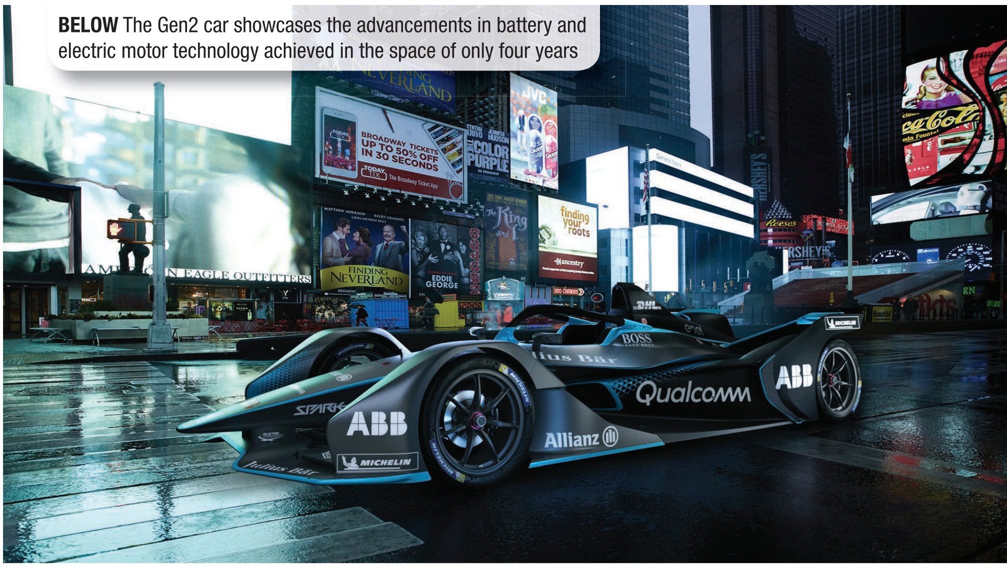
Little else about the battery has been revealed, but the shape and packaging concept sounds similar to McLaren's P1 hybrid road car battery and Lucid patents, with the cells stacked longitudinally in packs aligned along the car. The Formula E battery will require more powerful cells, though, and more of them than seen on the road car.

CHASSIS

With the change in bodywork and battery, the underlying Dallara chassis package has been revised substantially only in one key area. Whereas the STR01e used the battery as a stressed member, mounted between a truncated tub and the drivetrain, the SRT05e's tub extends all the way back to the drivetrain. The battery is housed wholly within the area behind the cockpit and will be dropped out through a hatch for maintenance. This structural change, and the difference in the battery layout, means the rear of the chassis is much slimmer but longer behind the roll hoop than before.

A small change is the DC output from the battery exits high up in the middle of the battery area, rather than the low-down outlet on the left-hand side of the Williams battery. This is a more convenient solution for the teams, which are able to run a shorter, thus lighter cable, from the battery to the inverter.

As with other FIA single-seater categories, the Gen2 runs a Halo over the cockpit area to protect the driver. The Formula E ▶



BELOW The Gen2 car showcases the advancements in battery and electric motor technology achieved in the space of only four years

incarnation of the Halo is subtly different, with the upper hoop angled up higher. The lower speed of the cars means diverting a large object over the driver's helmet needs a higher leading edge to the Halo than in F1. Never one to miss an opportunity, Formula E has also added LED lights to the Halo fairing. These will be used to communicate facets of the cars' performance to the fans, such as battery level, Fanboost being used or the proposed BoostMode. With no car swaps or tyre stops to shake up the racing, this latter concept is a means to temporarily alter the car's performance to a higher power mode for eight minutes in the race.

No details have been confirmed regarding the chassis specification. The suspension looks similar to the old car, with Alcon brakes and, for the first time, brake-by-wire. This will allow teams to automatically offset the regenerative braking effort from the brake callipers. Currently the drivers have to alter brake bias manually to account for the different contribution to rear braking between the pedal and hybrid systems. Already Season 4 has shown some dramatic range-changing incidents from drivers being caught out by the current manual system. The brake-by-wire system will be partly controlled from the XAP-made steering.

There remains a choice of dampers. Teams presently run dampers from a range of suppliers, such as ZF, Penske and Öhlins, the latter now developing a front damper specifically for the series.

DRIVETRAIN

Since Season 2 manufacturers have been permitted to produce their own powertrains. The motor, inverter, gears and differential can all be developed, along with the outer casing, rear suspension, cooling and electronics. Power levels are increased with 250 kW in qualifying and 200 kW in the race. Of course, with the increase in energy from the battery, only one car and powertrain is needed per driver. The duty cycle for the drivetrain therefore doubles, as the driver only has one homologated battery and drivetrain for the entire season.

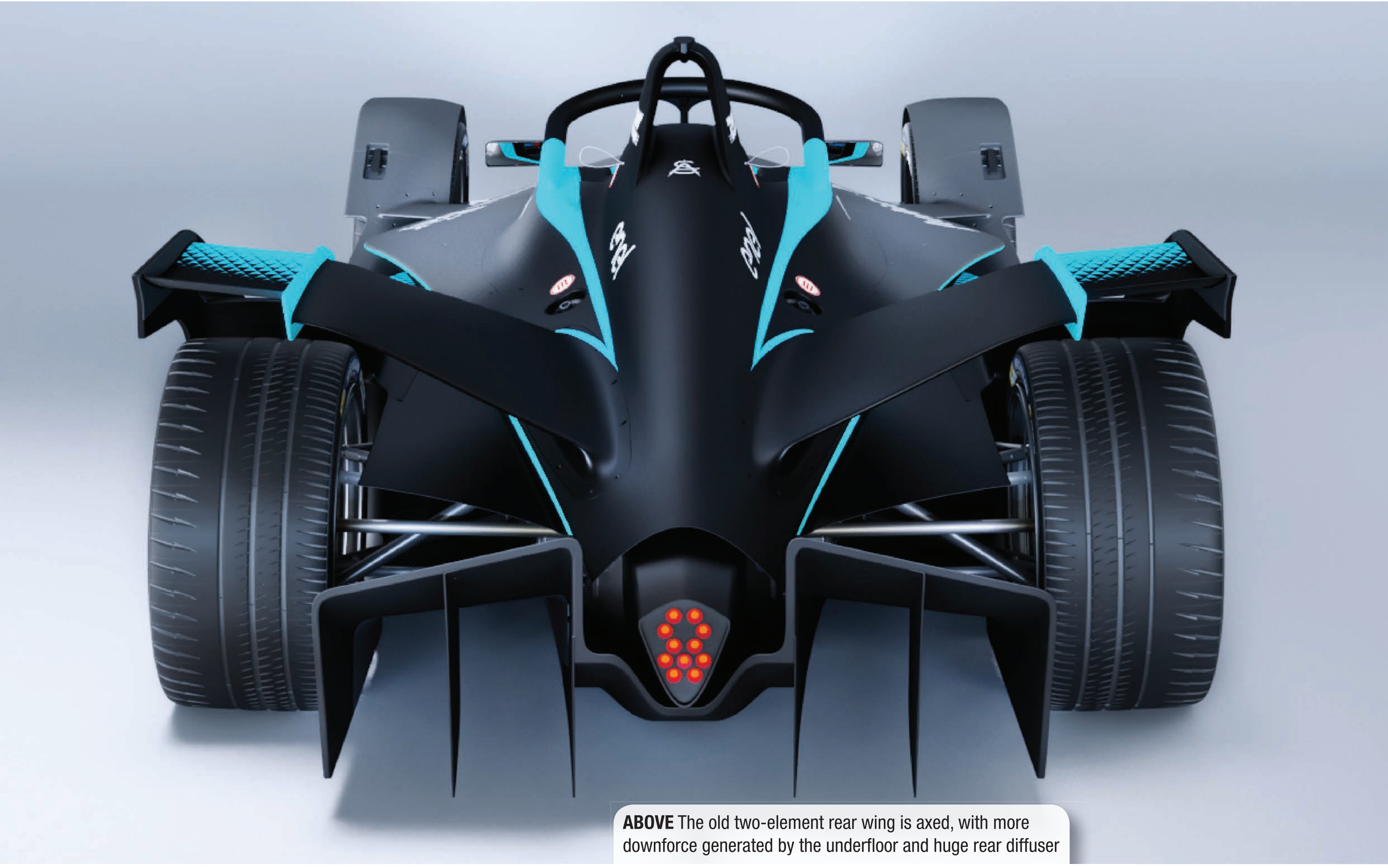
The envelope in which the teams package the drivetrain is little changed. There is no longer the large, flat space on top of the battery to package hardware, but most teams already housed everything inside the rear casing for a low centre of gravity.

Manufacturers with an agreement to make drivetrains from Season 5 are: Audi, BMW, DS Automobiles, Jaguar, Mahindra, NextEV NIO, Penske, Nissan, Venturi, Porsche and Mercedes.

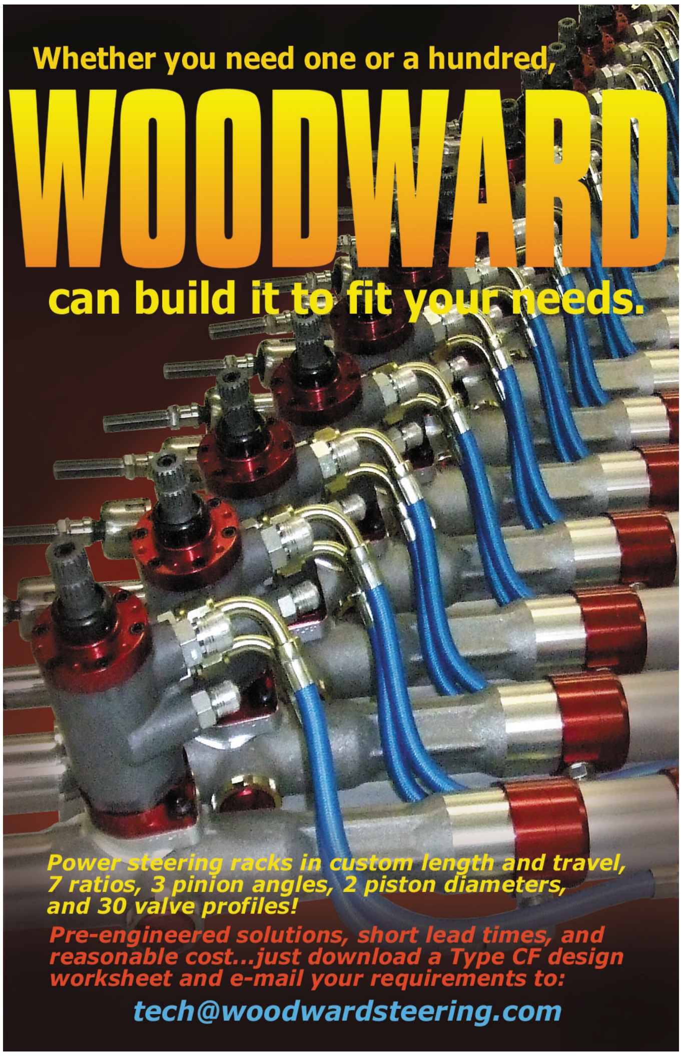
Initial track testing, prior to the delivery of cars to the teams, was conducted with the car and battery, using a temporary powertrain designed by Spark Racing Technology and harnessing Magneti Marelli hardware.

Although renders have been released, the physical car is due to be unveiled at the Geneva Motor Show this month.

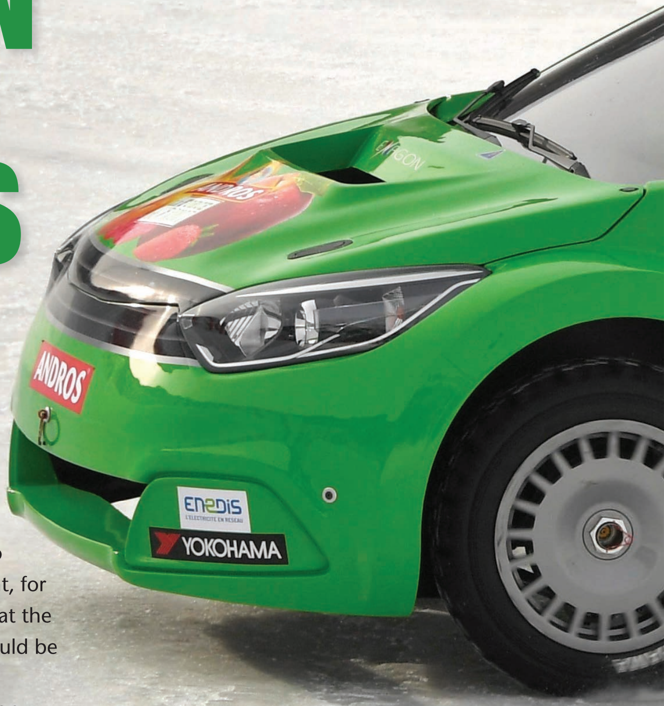
"This car represents the future of racing," claims Alejandro Agag, Founder & CEO of Formula E. "When we started Formula E, our goal was to break the mould and challenge the status quo – bringing a revolution to motorsport. This next generation car represents that revolution. The cars will be faster and will have almost double the amount of energy storage capacity and double the range, demonstrating the continuous evolution of battery technology." RT



ABOVE The old two-element rear wing is axed, with more downforce generated by the underfloor and huge rear diffuser



ELECTRIC VISION SLIDES INTO CLEARER FOCUS



With the Andros Trophy poised to become the first motorsport series to switch from ICE to electric, **Hal Ridge** reports that its prototype has impressed even Formula E regulars

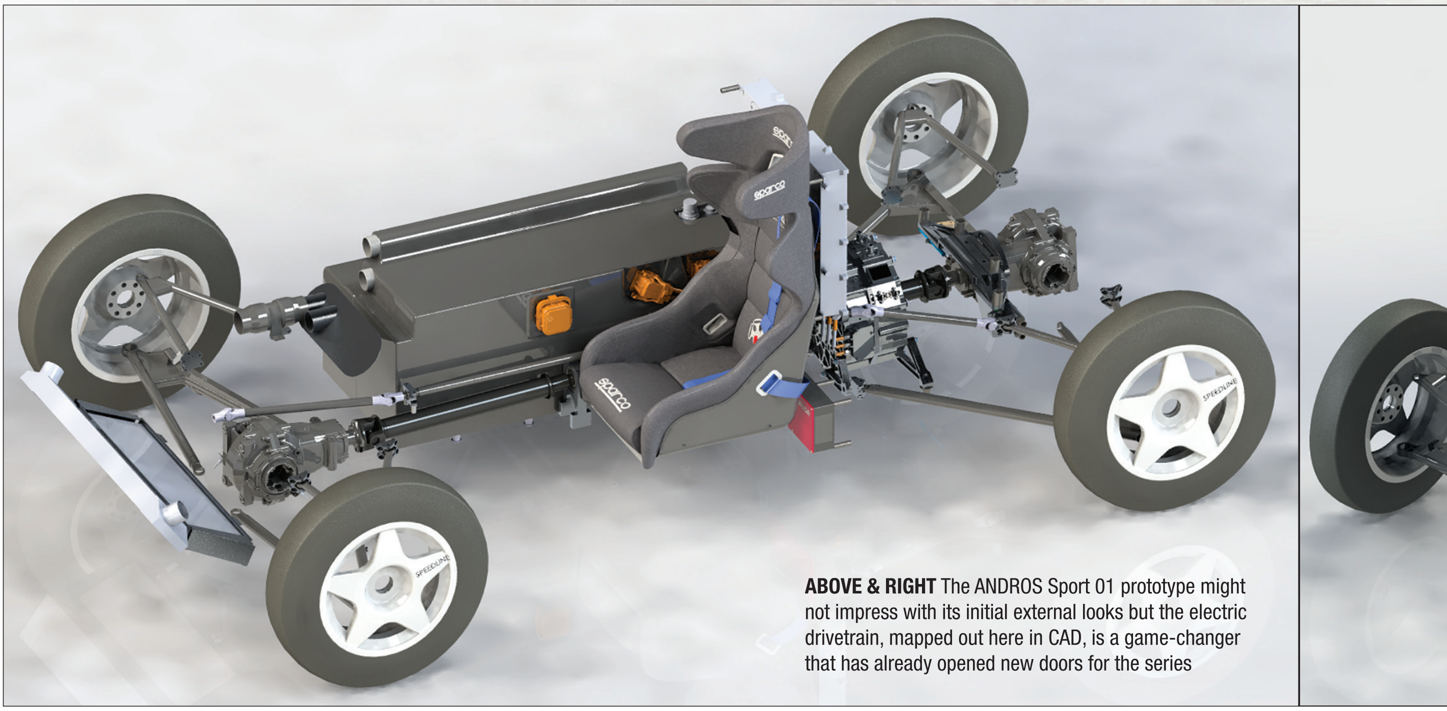
SINCE its inception in 1990, the Andros Trophy ice racing series, held in the Alps each winter, has attracted some big-hitting manufacturer entries, lured by the star name drivers, tough competition and the prime-time live television coverage.

But, as is the case in all motor racing disciplines, the manufacturers in Andros have come and gone at will. In recent years they have more gone, than come, unwilling to invest the budgets required in an era where being seen to burn fossil fuels for the benefit of sport is frowned upon from an increasing number of corners.

That could be about to change, however. Governments are putting the automotive industry under increasing pressure to become greener. The UK government, for instance, announced in mid-2017 that the sale of new petrol and diesel cars would be banned from 2040.

Manufacturers are having to develop new technologies quicker than they perhaps anticipated, but then there's the problem of making those cars attractive to the consumer. Formula E is all well and good, but like Formula 1, it's questionable whether your average millennial will be tempted by a Renault Clio because there's an ambiguous single-seater racing a field of near-identical ambiguous single-seaters around a city centre.

That's not to take anything away from FE, which continues to grow in strength. But what if the consumer could see an actual electric Renault Clio, aesthetically at least, racing against similarly-powered Mazda 3s and Skoda Fabias, producing the equivalent or better performance than their internal combustion engine predecessors?



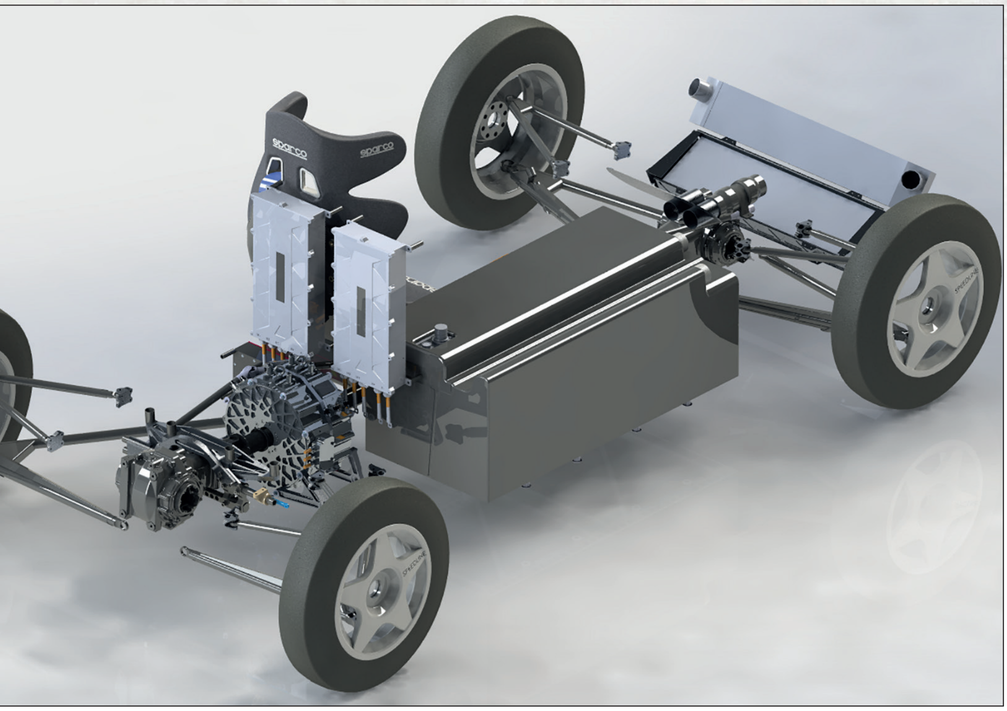
ABOVE & RIGHT The ANDROS Sport 01 prototype might not impress with its initial external looks but the electric drivetrain, mapped out here in CAD, is a game-changer that has already opened new doors for the series

ABOVE The prototype ANDROS Sport 01 testing. The fully-electric car will take over the top-tier Elite Pro category from the end of 2019

Soon, that prospect will be a reality, in both the World Rallycross Championship and the Andros Trophy. Last month, Andros Trophy organisers 2MO launched the first fully-electric car that will take over the top-tier Elite Pro category from the end of 2019. Before that though, Andros fans have arguably an even more intriguing prospect ahead next season. Before the new cars take over completely, they will race head-to-head with the current ICE machines next winter.

Conceived by Magny-Cours-based firm Exagon Engineering, the new ANDROS Sport 01 was revealed at Serre Chevalier at the end of January, where it was sampled by a number of drivers. Just a week later, Formula E racer and two-time champion of the Andros Trophy's two-wheel drive single-make electric support category, Nicolas Prost, gave the car its debut at Lans en Vercors and set a seventh fastest qualifying time. Another seven days further on, the new cars' development driver, ex-F1 racer Franck Lagorce, drove the machine to third fastest in timed practice at the season finale at Super Besse, in the 13-car field.

> "A 'plug and play' kit to create a near-seamless shift into a new electric world"



However, while there is much excitement around the all-new machine, it isn't actually a wholesale new development. This concept isn't about making a revolutionary car, it's instead to develop a power and drive system that can be accommodated in the existing chassis in the top-level Andros racers (covered in-depth in RT196).

Fundamentally, the tubular spaceframe chassis with four-wheel drive and four-wheel steering, clad by composite bodies, will stay much the same going forward, but the naturally aspirated V6 engine and six-speed ▶

ABOVE The motors are developed by British firm YASA

> *"The torque produced borders on ludicrous"*

sequential gearbox will be ousted for a battery and motor setup. The intention is to supply a 'plug and play' kit to teams and in doing so create a near-seamless shift into a new electric world.

Ignore the external appearance of the ANDROS Sport 01: that is irrelevant. This test mule is all about what's underneath the skin. Where the longitudinally-mounted V6 screamer would normally be housed in a conventional Andros racer, a twin-motor unit now takes its place, minute by comparison. The motors, also mounted longitudinally and weighing 37 kilograms each, are courtesy of British firm YASA, connected together by a central shaft to produce 250 kW, the equivalent to 340 horsepower from 1500 rpm to the maximum revs of 3600. The torque produced borders on ludicrous, at 1600 Nm from 0 to 2500 rpm.

"Officially, we have the same power output as the combustion car, but it's possible to be more. Around 600 horsepower is no problem. The torque has a very flat curve and at 2500 rpm it diminishes, but the power is a straight on the graph to maximum [3600 rpm], it's perfect," says Luc Marchetti, Exagon owner.

"The motors are not specially made, they are very similar to the ones used in other concepts, like Formula E, but they use only one. We used two."

The motors are mounted as far forward as possible in their mid-engine location to achieve a 52:48 weight distribution in the adapted "older" chassis. An impressively short propshaft connects the motors' output shaft to the rear differential.

The pair of inverters, weighing 10.9 kg apiece, sit on the rear of the cockpit's bulkhead. They are cooled by the same water system to that of the motors, via a radiator at the front of the car, with air drawn through the aluminium core by a pair of SPAL fans.

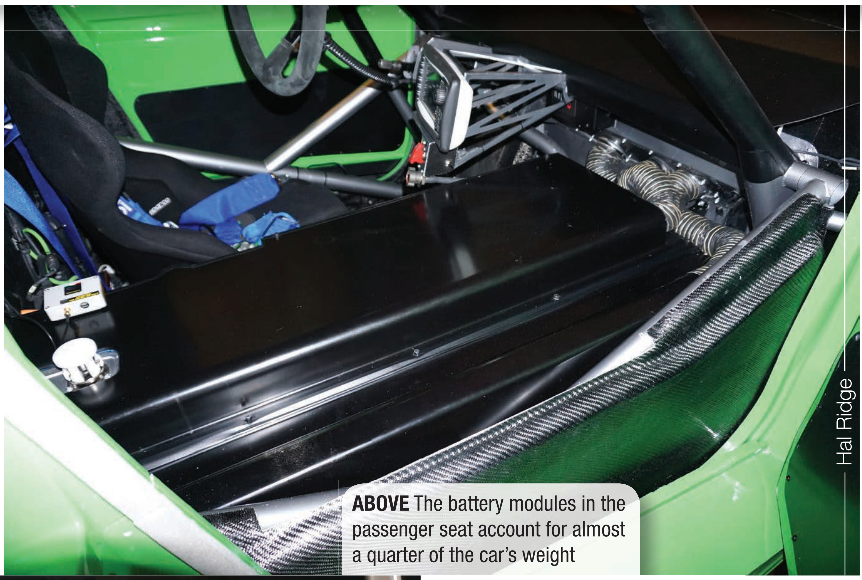
ABOVE Driving on ice without a clutch has its challenges

Hal Ridge

OPERATING AT -20 DEGREES

As mixing water with electricity only spells bad news, the battery, located where a passenger would usually sit, is cooled by an intercooler mounted above the water radiator in the front of the car, forcing air into the battery compartment. "We use an intercooler because it's more simple really and sufficient for this kind of racing, because the temperatures are every time -10 or -20, so it's no problem," says Marchetti.

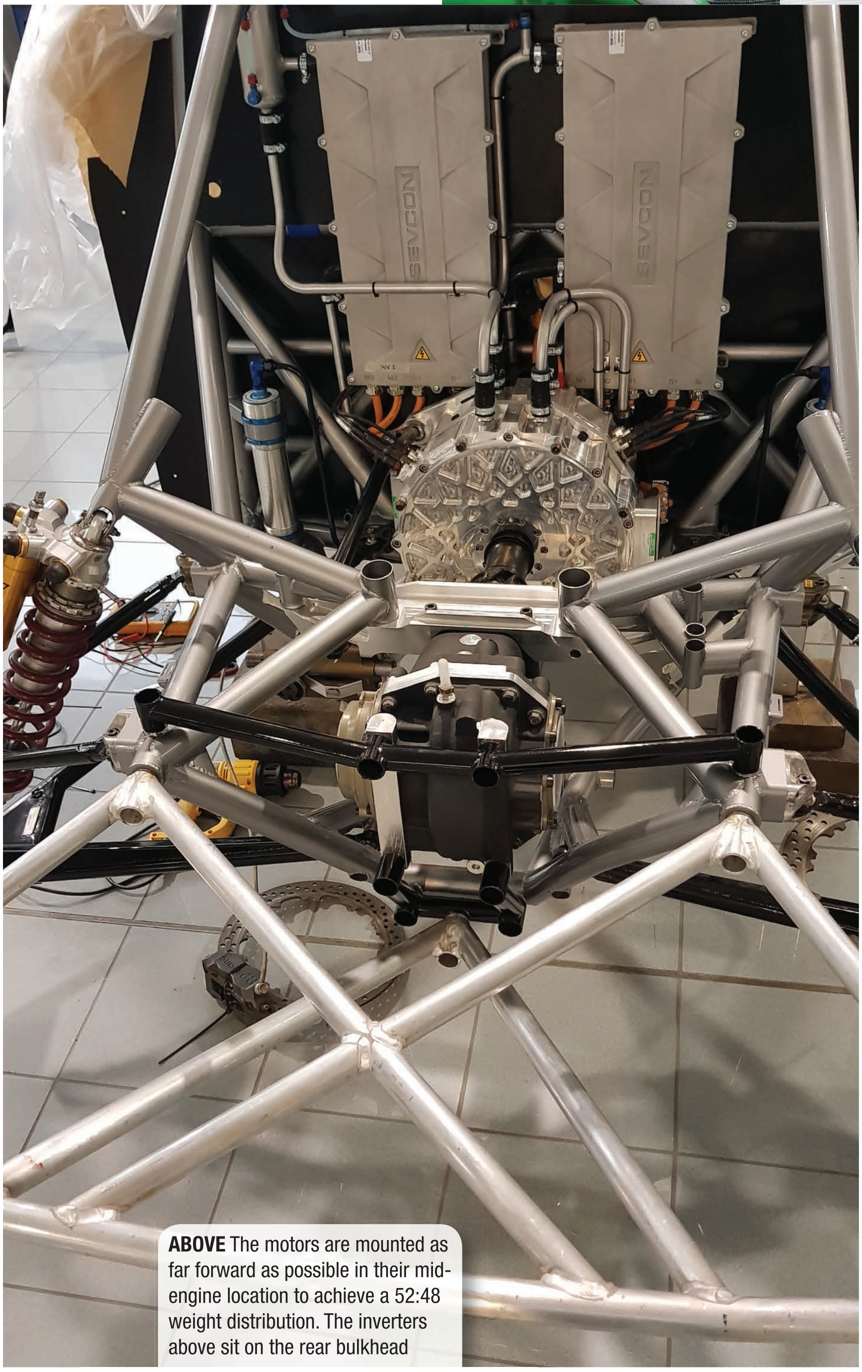
The 750V, 27 kWh lithium-ion battery is made up of 14 50V battery modules, a setup unique to this installation, weighing in at 240 kilograms, almost a quarter of the car's total 1000 kg weight. "The batteries are a new concept for us; we've put a lot of work into this," says Marchetti, protecting his new creation by not giving away further details. ▶



ABOVE The battery modules in the passenger seat account for almost a quarter of the car's weight

"The most important thing was to make the battery very compact and light, and to develop a very high level of maximum power and energy. But, of course we have to find a balance between power output and the total mass. It's good because Trophy Andros is not a long endurance."

Far from it, in fact. Races last for a maximum of 12 minutes, only slightly longer than a rallycross encounter, meaning full power can be deployed for the duration and even more, around 20 minutes. Exagon's battery has a recharge time of 50 minutes, using a 20 kW charger with a maximum load of 50 A.



ABOVE The motors are mounted as far forward as possible in their mid-engine location to achieve a 52:48 weight distribution. The inverters above sit on the rear bulkhead

Hidden under a cover, the battery is protected from potential side impacts by a utilitarian composite panel that is a combination of carbon fibre and Kevlar layers sandwiching 12 mm thick honeycomb. "This is just for the moment. It was made in a rush," admits Marchetti. "It's not beautiful; for next year it will be better."

It would defy a longstanding tradition if any motor racing company ever said they've had enough time to develop a car, for the industry is renowned for machines being created right up until the final moments before they are required for use. That is, in part, due to the constant desire to develop.

Now the ANDROS Sport 01 has been finished enough to make its race debut, things like the battery protection can be developed in the coming months. More critically, the car's management system can be a focal point for Exagon.

INSTANT DELIVERY

"There is no response time [driver input to torque delivery], I mean nothing, it's perfect," grins Marchetti. "We are working on different strategies for the driver. Of course we can open it to full power and full torque, but that's completely crazy on ice."

The person tasked with the software development is systems engineer Adeline Renault. While the major components have been sourced externally, the control VCU [vehicle control unit] has been adapted in-house, with software written from scratch.

"We are using parts from different manufacturers around the world, but mainly off the shelf parts," she explains. "Then we had to create a dedicated control system and to adapt ourselves. The main challenge was to adapt some of the parts that are ▶

not manufactured or engineered to work together; some parts that are not made for race cars or even automobiles."

The ANDROS Sport 01 is single-speed, drive engaged by pushing the 'D' button on the Wachendorff control panel ['N' and 'R' are for similarly self-explanatory functions]. But, despite only having a throttle and brake pedal (produced by AP Racing), and no clutch, the driver can control the car's map with potentiometers and other pre-defined settings.

"For the moment, it's a bit of a laboratory more than a car so we have to be able to change any parameters on the fly. We have three options for the driver to select at the moment, which changes things like torque repetition between motors, battery control and so on. Then you have options for [within] each of these modes so in the end it makes a big choice and you have lots of possibilities. Without stopping the car or anything you can navigate between several parameters," explains Renault. "Of course if the car is on big sticky ice it's not the same as if you are on more tarmac, or want to move in the paddock."

While giving the driver a degree of ownership over choosing the right parameters may induce human error and make for exciting racing, from an engineering perspective, Renault is excited about the possibility of programming the car to adapt itself, depending on where it is on a lap and what scenario it's in. "At the moment you have general setup and things are the same at each track," she says. "We do fine tuning, but we have a general setup. The thing [long-term] is to have the system adapt itself. We have lots of different types of corner and surfaces, like asphalt and ice for instance. The thing is to make it so the driver doesn't need to do anything on that. That's the challenge." She also alludes to the long-term possibility of torque vectoring with a four-wheel drive system.

Those current three modes are two more than the single-make rear-wheel drive electric car that Exagon first developed ahead of the 2010 Andros season and continues to run today. The rear-wheel drive 90 kW cars produce the equivalent of 122 horsepower and 200 Nm torque, weighing 800 kgs, and have been a good proving ground for Exagon and its technology in sub-zero conditions.

"We haven't developed many options into the [new] car for now, because it was the first test just a few weeks ago but we have a big evolution for the next year," notes Marchetti. "On the Andros [single-make] car we have just one throttle strategy; on this car we can have a lot more. We can also have anti-slip [traction control] on that car, but not on this one yet; that's the next step."

DRIVER IMPRESSIONS

Lagorce, himself a current and successful Andros driver, has been involved in electric Andros cars from the outset, and says developing the new car for professional drivers gives big satisfaction. "When you're a professional driver and you use technology, you learn all the time," he says. "With the Andros [single-make] car, the objective was to develop the car for everybody, but this is different, this is being developed for professional drivers. It's very interesting to try to find the best solution. You can feel the power and torque [with this car] but the chassis is not perfect so it's difficult to put the power down. ▶

ABOVE The test drivers have emerged impressed by their initial experience of the electric prototype

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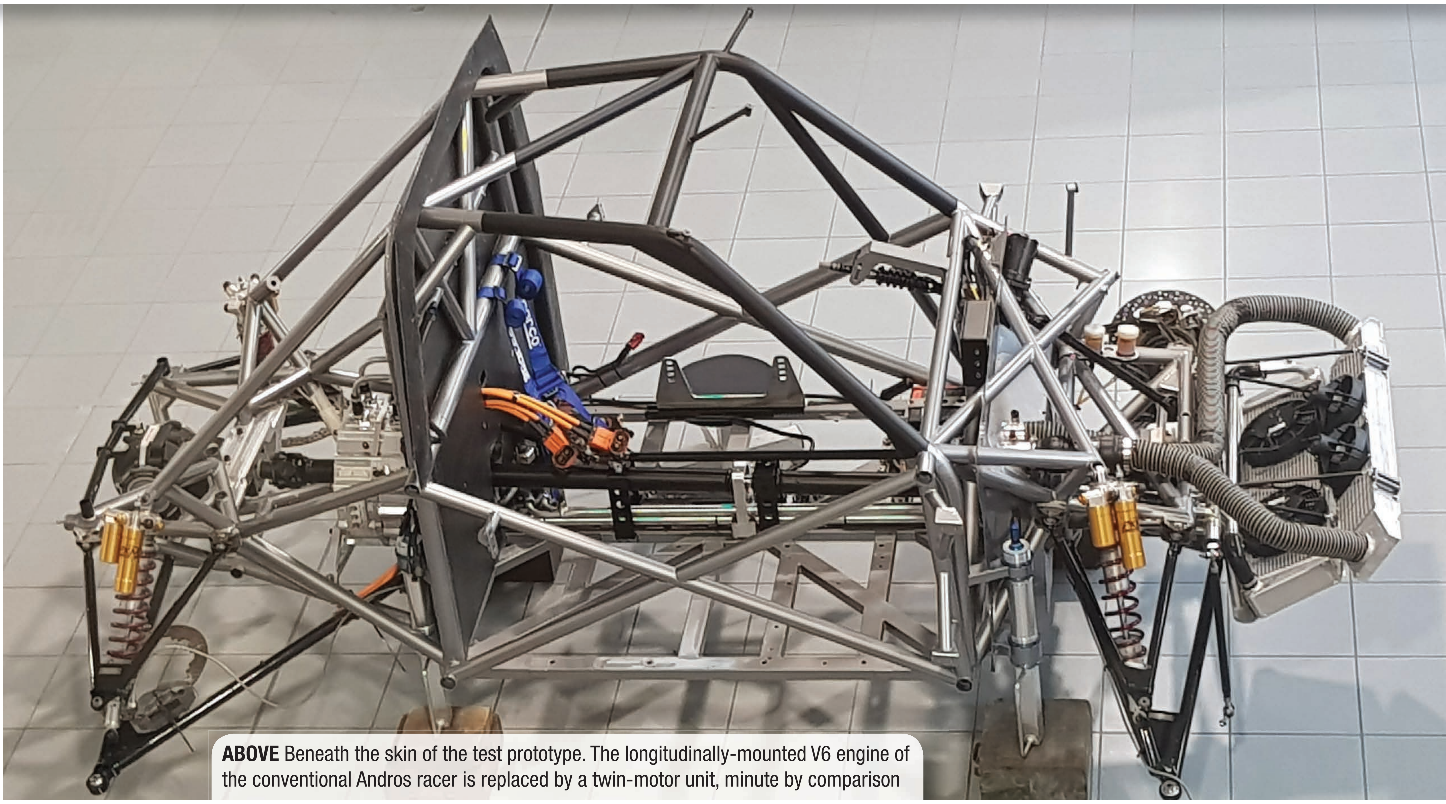


ABOVE Beneath the skin of the test prototype. The longitudinally-mounted V6 engine of the conventional Andros racer is replaced by a twin-motor unit, minute by comparison

"For sure if you put this technology in a good chassis, it will definitely be best. In one sense it's different to drive, that you drive only with your feet on the power and brake, there are no gears or clutch, but to go back in the corner you brake very hard to lock the wheels. It's different, but when there are 10 cars like this on track… I want this!"

Prost, the only man to have driven both a Formula E single-seater and the new Andros car, agrees that driving on ice without a clutch – which would usually be used in a conventional Andros racer to drop back from the apex of hairpins by breaking drive, touched on by Lagorce – has its challenges. But he says it doesn't hinder the overall experience.

PROST'S VERDICT: "INCREDIBLE"

"I wouldn't say it [not having a clutch] is a problem but for sure in the hairpins it's not easy to drive. The power and the torque is straight away incredible," Prost says. "I'm very impressed with the car. The chassis needs work but for sure it will be quicker than the other cars. In some ways it doesn't compare at all to the [other] four-wheel drive cars to drive because you brake left foot, have no gears and a lot of torque."

Comparing the new car to his Renault e.dams Formula E machine, Prost continues: "It's a different car, with different settings, but the power and torque of this engine is much more impressive. We [have even] limited the power to fight with the other cars to find a balance."

The drive in the ANDROS Sport 01 is transferred to the 16" OZ Racing wheels – clad with Yokohama tyres, each with 250 metal studs to dig into the ice, shrouding four-pot AP Racing brake callipers with 300 mm single-skin discs – from the motors via the same Sadev SP03 differential front and rear. The latter is tried and tested technology used in current combustion Andros and rallycross machinery. "We have the same ratio in front and rear. Sadev have made this for about 10 years; it's a simple way [to do it], we can adjust ramp angles and pre-load like normal, it's very simple," says Marchetti.

Differential adjustment for the constantly evolving track conditions as ice degrades or snow increases in the Andros Trophy is a key setup area. So too is geometry, using Öhlins dampers. But in this instance, during the car's early running, Marchetti isn't too concerned about the minor setup details of the chassis. That will come.

Exagon plumped for single speed drive, geared to achieve 150 km/h, similar to STARD's HIPER rallycross Supercar prototype, because simply, Marchetti says, more isn't required. "I think it's perfect. With our Furtive-eGT [Exagon's all-electric, rear-wheel drive, four-seater GT revealed as a pre-production car at the Geneva Motor Show in 2013] we have a gearbox with three ratios, but for ice racing, like rallycross, this is sufficient because the torque available is so much you don't need more.

"The aim is to make it simple for everybody

BELOW Air is drawn through the aluminium core by a pair of SPAL fans

Hal Ridge

> *"Even those who did not believe in electric were completely seduced by it after they drove it"*

and it's important for the other teams for next year that it's simple and not expensive. The driver can focus only on the driving and listen to the tyres and what grip they have, how the tyre degradation is working. You have feedback with the transmission: it's important that you're hearing the RPM for the maximum feedback for the driver."

CRAZY SCHEDULE

Exagon enjoyed a unanimously positive reaction from the 10 drivers that tested the car on its maiden public appearance, after it had been shaken down on Tarmac for just 10 kilometres of running. The schedule had been tight: initial planning and simulation began in March last year, before becoming physical reality seven months later, just three months before its first outing.

"It's completely crazy that the concept started in October and we drove in January. I have a very good team and they have very long days," says Marchetti. "It's perfect to have some different drivers in the car. The drivers that tested it all said it's incredible. Systematically they all came out of the car with a smile. Even those who did not believe in electric were completely seduced by it after they drove it."

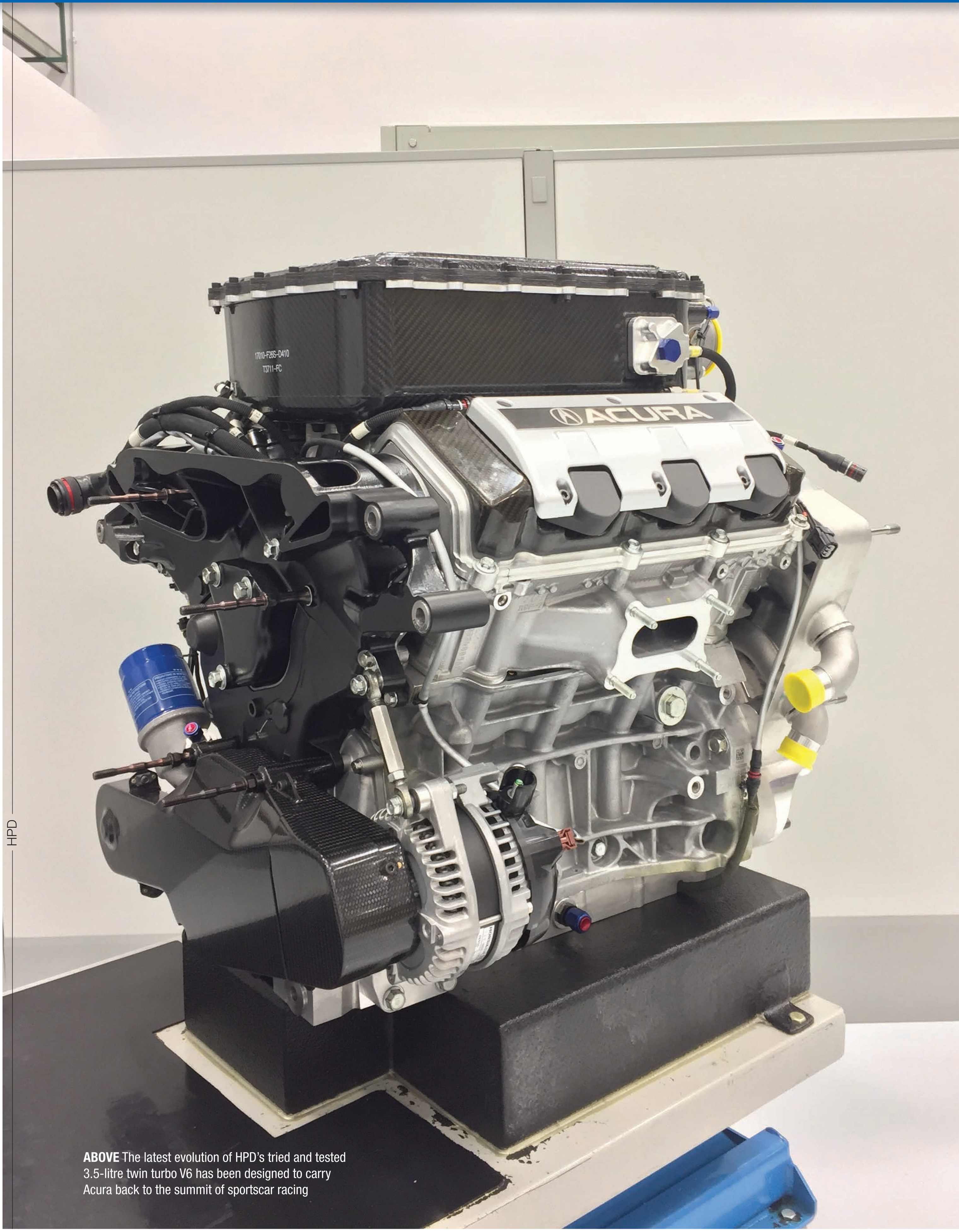
It's more a sense of excitement than relief emitted by Marchetti, a feeling shared by Andros founder Max Mamers. "One year ago this was only a project. Now it's real," he says. "It was a very big challenge because the performance has to be as close as possible to the combustion cars, but we can see it's a success. The drivers are all happy, so I am very happy."

Led by Mamers, Andros organisers are working with existing teams to run at least one electric car each next winter, as a transitional period, and testing of the Sport 01 will continue through the remaining wintery conditions. "The first version of the car is already quite perfect, but we need to adapt the chassis more to the electric system," he notes. Crucially though, this is about the bigger picture and there are early indications that things are heading in the right direction for the Andros series.

Manufacturer interest in electric technology is booming, and as a result there is a rejuvenated hunger to promote technology and products in the sport. This is highlighted by the news that the World Rallycross Championship will switch to fully electric cars in 2020 (see news). A few months prior to the start of that World RX season, Andros is set to become the first series in motorsport to make the wholesale switch from ICE to electric. "A few months ago we had no answers [for how to re-attract manufacturers]. But now some doors are already opening," concludes Mamars.

Marchetti too is excited by the potential of new technology. Asked if Exagon might take what it is learning in ice racing into other sectors, he says: "We are focused on Andros Trophy at the moment. But, I have many ideas and tomorrow is another day." RT

ABOVE The new cars will race head-to-head with the current ICE machines next winter



HPD

ABOVE The latest evolution of HPD's tried and tested 3.5-litre twin turbo V6 has been designed to carry Acura back to the summit of sportscar racing

MAKE ROOM, GUYS…

Cadillac, Nissan and Mazda are the IMSA DPi regulars but, having been in the hunt for victory on its Daytona debut, can Acura's factory effort eclipse them all at this month's Sebring endurance classic? **Chris Pickering** examines the powerplant in Penske's ARX-05 prototypes

HONDA Performance Development (HPD), the racing arm for both Honda and Acura in North America, has been a major force in the American sportscar racing scene for more than a decade. After setting up the Acura NSX GT3 programme in 2017, the Californian outfit has returned to IMSA's premier prototype racing category – its first full factory effort since 2009. Using an evolution of its tried and tested 3.5-litre twin turbo V6, the company aims to challenge the domination of the big Cadillac V8s.

First impressions are promising. While bad luck ultimately befell the Acura ARX-05 prototypes of Team Penske during the opening round at Daytona, both showed strong form during the race. The number 7 Acura qualified just behind the leading Cadillac and the two cars ended up running first and second for a time. So could this engine propel Acura back to the top spot in 2018?

The origins of the current AR35TT unit date back to 2011. For the start of that season, the ACO changed its engine regulations, forcing HPD to move away from the purpose-built 3.4-litre V8 it had campaigned up until that point. Under the new regulations, LMP2 engines would have to be production-based and HPD swiftly found a solution in the form of Honda's naturally aspirated J35 engine.

The fundamental layout was carried straight over from the production engine, with an all-aluminium construction, a 60-degree V6 layout and a single overhead cam valvetrain with four valves per cylinder. Unlike the production engine, the decision was taken to use forced induction for the race unit, with twin Borg Warner turbochargers, closely related to those used in HPD's IndyCar programme. The capacity was also reduced from 3.5 litres (in road-going trim) down to 2.8 litres to make the most of the regulations at the time. In most other respects, however, it remained remarkably close to the production unit.

The intention was to create a cost-effective engine for customer racing programmes, so simplicity was key, recalls Matthew Niles, senior engineer and project leader at HPD:

"The initial philosophy was basically, 'Let's add some turbos to the production engine, adjust the fuelling and ignition, put it on the dyno and see what it'll do'. It met the power targets we'd set at the time pretty much straight off the bat."

That philosophy endures to this day, with a high percentage of the components shared with their road-going cousins. The cylinder heads, for instance, are completely stock with the same combustion chamber geometry and porting as the naturally aspirated road car. Niles acknowledges that there is still a development opportunity there that's yet to be explored, but he says it's tempered by the costs involved. Similarly, while HPD has now added its own induction system, it still uses a single throttle body and a relatively simple plenum design.

"It's hard to justify spending money on increased power in a performance balanced series where it's potentially going to get taken away," he notes. "What we've tried to do is make a very strong base engine that will provide good reliability. That's now a prerequisite, when you look at the other DPi engines out there; they'll run all day long. After that it's really about how we take advantage of that strong base to take it to the maximum level at the race track."

Niles and his team are still working on their durability targets for the 2018 iteration. The baseline, he points out, is a full 24-hour event, but it's advantageous if it can be stretched further.

EVOLUTION OF THE SPECIES

Over the years, the AR35TT has evolved gradually, taking on a few more race-specific components, but ultimately remaining true to the production-based ethos. The biggest evolutionary step to date was the adoption of direct injection (DI) – carried out relatively early on in the programme to mirror changes to the road car engine. Again, the combustion chamber geometry was taken straight from the production unit, but we're told it did result in a meaningful fuel economy improvement for the endurance racing engines as well.

> *"We're operating the engine so far out of its original design capabilities that the production engineers have taken a very keen interest"*

"We had to make some changes on the electronics side to control the fuel injection when we switched to DI, and that opened the door for us to change some of the tuning work we were doing. Physically, though, the combustion chamber geometry just followed the change in the production parts," explains Niles. "We consulted with the Honda production engineers in Ohio on how to get the best out of the new configuration, but it coincided with the switch to DI on our IndyCar programme, so we also had plenty of expertise in-house."

Not long after the move to DI, HPD began developing a variant of the AR35TT for use ▶

in GT racing. Destined for the Acura TLX GTs campaigned in the Pirelli World Challenge, it used a larger 3.5-litre capacity to meet the new car's power and torque demands. Mechanically, this amounted to little more than a revised crankshaft.

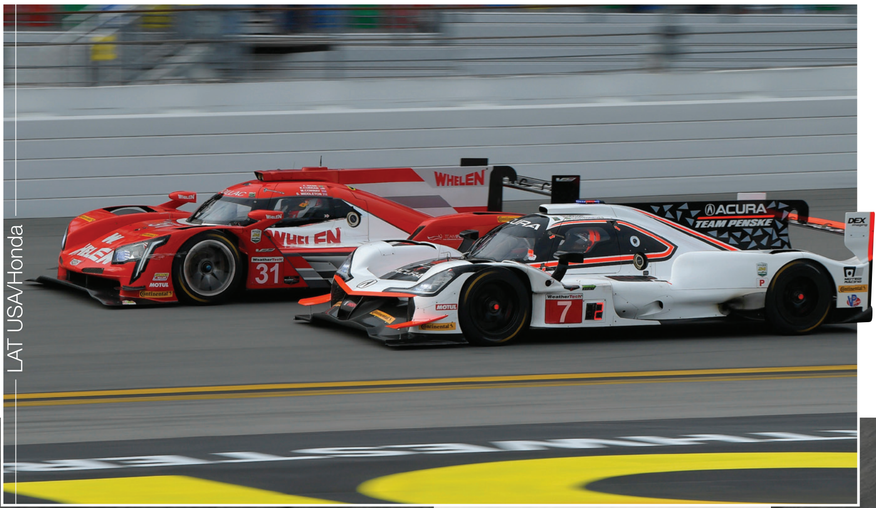
Initially, the prototype cars stuck with the original 2.8-litre capacity. But in the run up to the 2016 season, HPD petitioned IMSA to allow it to bring the larger engine from the TLX into the prototypes. The idea was to help the customer teams using LMP2-based cars to keep up with the Daytona Prototypes (then run as a separate sub-category). It's essentially this variant of the engine that has returned for the new season (following a year out from the prototype class in 2017).

Although the cylinder blocks start life on the road car production line, they are now somewhat reinforced to cope with the increased cylinder pressures. HPD carries out its own boring and honing of the stock liners and the sleeves to get the tolerances down, while a deck plate was added to the GT racing engine in 2017.

"When we first started racing the engine, we basically had a production induction system on the car, along with a stock block and heads. We swapped the crankshaft, the pistons and the rods, but the injectors, the alternator, the oil pump… they were all stock," says Niles. "As the engine has evolved the only updates we've really made are to improve reliability as the power output has gone up. We started with 480 bhp with the 2.8-litre and today we're pushing 600 bhp for the current DPi variant. That's quite a power increase, but we still use a lot of stock components."

BOOST CONTROL

When the engine was originally conceived, the European Le Mans Series (ELMS) and the American Le Mans Series (the forerunner to today's WeatherTech SportsCar Championship) both used air restrictors as their primary means of regulating engine performance. As such, a lot of the early work went into the choke control, with the engineers attempting to ensure the wastegates and the turbos still worked as effectively as possible once the airflow through ▶



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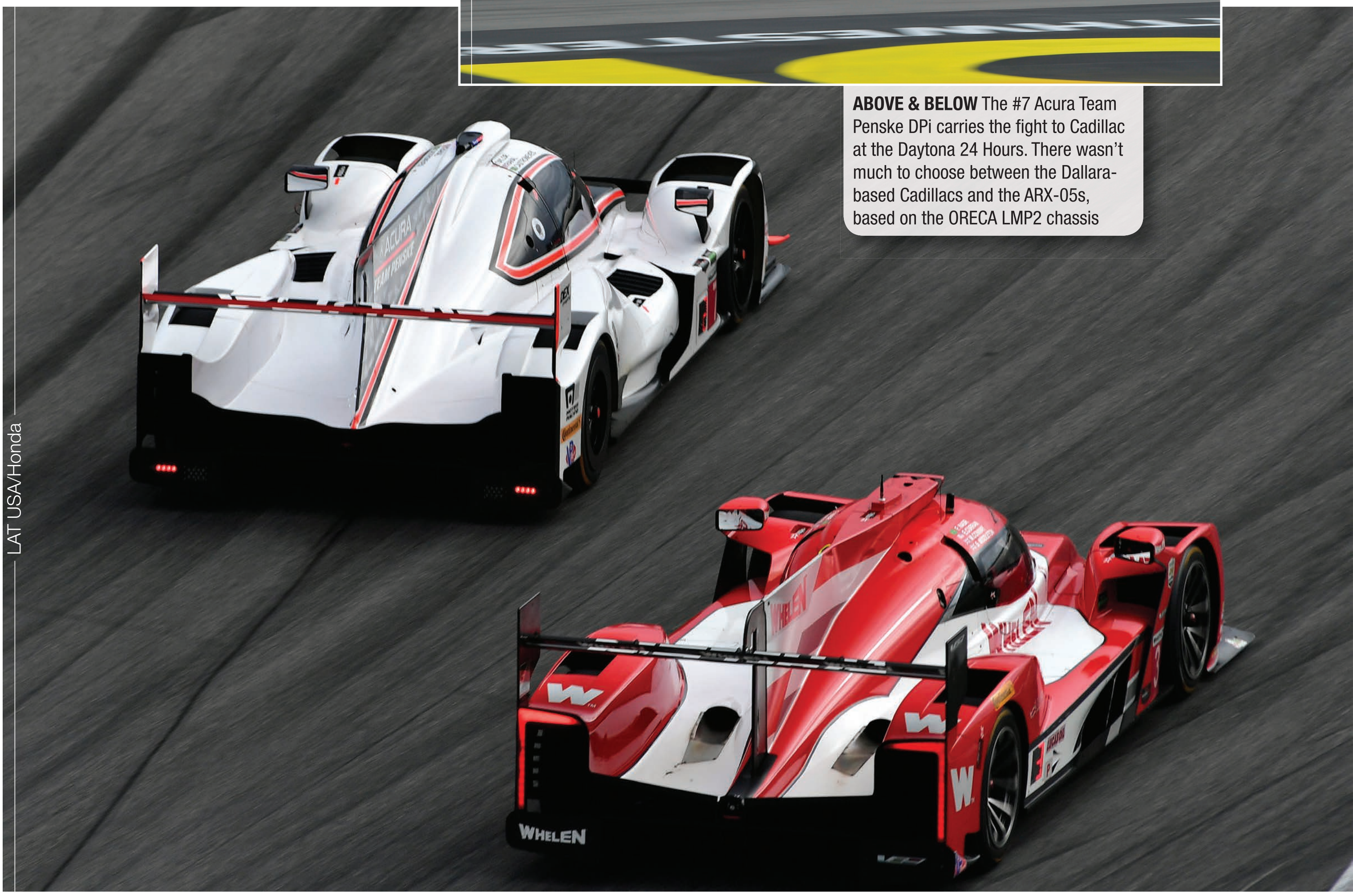

LAT USA/Honda

ABOVE & BELOW The #7 Acura Team Penske DPi carries the fight to Cadillac at the Daytona 24 Hours. There wasn't much to choose between the Dallara-based Cadillacs and the ARX-05s, based on the ORECA LMP2 chassis


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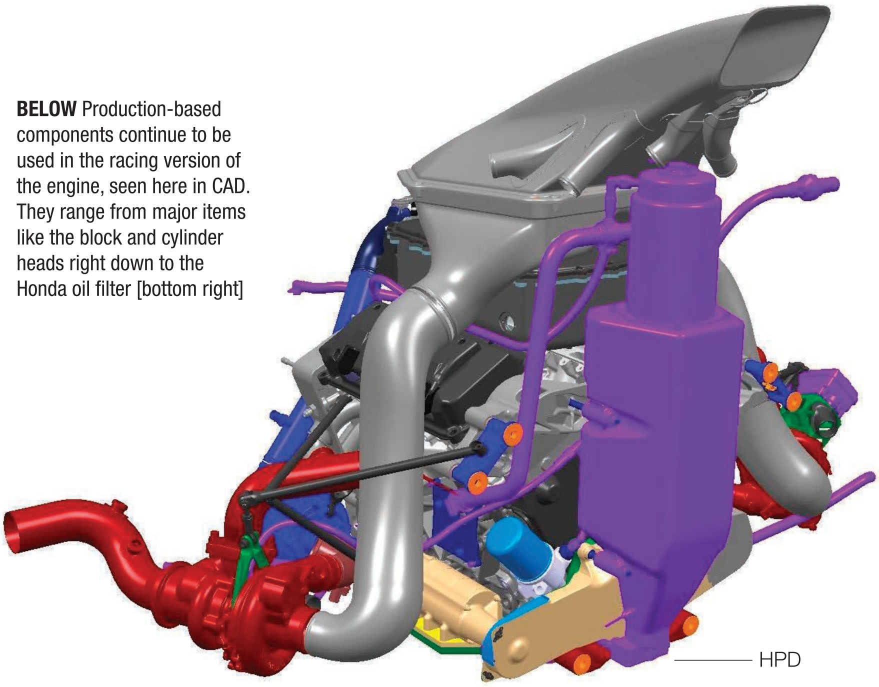
the restrictor has reached its maximum.

To control these functions – and indeed the engine as a whole – HPD runs its own software inside a McLaren Electronics TAG-400 ECU. Following on from the work done to accommodate the DI system, the next major revision was to optimise the turbo control for the boost tables that IMSA now uses as the primary means of performance balancing for turbocharged engines. Under this system, the boost is now limited right through the rev range, in an attempt to match the power curve of the naturally aspirated engines, which run traditional air restrictors.

"When we had a restrictor, our main focus tended to be on how we opened and closed the wastegates when we ran into choke. That actually gives you a little bit of extra power; once you've reached the flow limit of the restrictor there's no need to harvest the exhaust energy to the same extent," comments Niles. "But it's not an easy thing to get right; we lobbied to go to the boost tables, because it would give us a closer match to the torque curve of the other cars. Once you make that switch it's all about hitting the very maximum boost allowed by the table. IMSA gives us a boost curve, and the better we can match that boost curve the more performance we will be able to extract over the rev range."

Logistically, making tweaks inside the ECU calibration can be easier than fabricating a new inlet restrictor, especially if you have several balance of performance (BoP) changes in a row. In some respects this also simplifies the boost calibration, he points out, but there's still the potential to end up going down something of a rabbit hole, chasing incremental gains within the BoP.

BELOW Production-based components continue to be used in the racing version of the engine, seen here in CAD. They range from major items like the block and cylinder heads right down to the Honda oil filter [bottom right]



HPD

FACTORY SUPPORT

There's often a belief among engine builders that the compromises that stem from starting with a production engine mean it's more cost-effective to develop a clean sheet design. Needless to say, Niles isn't convinced.

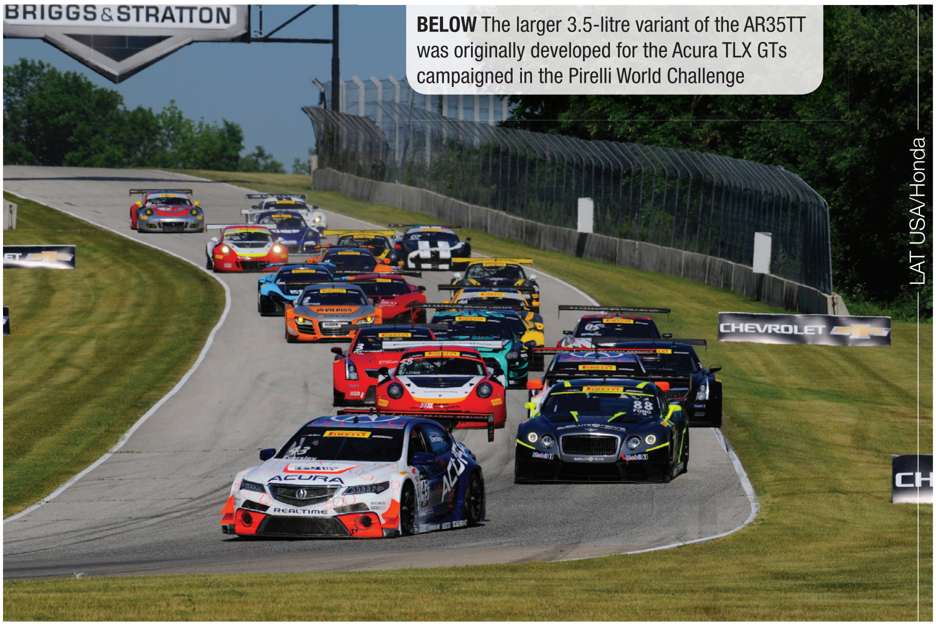
"I've heard that comment a few times, but to be honest, I think a lot of that is the engine builder wanting to have it their way," he jokes. "Admittedly, it does help if you have access to the engineers who developed the original engine. In the early days, we were in contact with the Honda production engineers a lot as we identified potential issues. If you're a private engine builder you don't necessarily have access to that level of information, so I can see how the clean sheet approach might work in some instances. I don't think it's an argument you're likely to hear from any of the manufacturers, though."

Early on in the project, for instance, HPD experienced some issues with the durability of the main bearings on the 2.8-litre engine. This was reported back to the engineers at the Honda R&D centre in Ohio, who recounted the decision-making process that had faced them in the original design and were able to recommend an alternative approach.

"It works both ways," comments Niles. "The road car engine makes 300 bhp and we're now at twice that [for the race engine]; the fact that we're operating the engine so far out of its original design capabilities means the production engineers have taken a very keen interest in our progress. When we first started this project, for instance, there were people outside of Honda who said there was no way we could get the cylinder pressures we'd need out of a production-based engine, but it seems to be working out for us so far."

Ultimately, the availability of a suitable base engine is one of the things that allowed HPD to remain in sports cars. After many years supplying customer teams, HPD is now back with a full factory effort, but the budget is still very much finite, Niles points out. In fact, mechanically, the AR35TT remains virtually unchanged for 2018.

"I think a lot of people thought, 'Now it's a factory programme they'll change ▶



BELOW The larger 3.5-litre variant of the AR35TT was originally developed for the Acura TLX GTs campaigned in the Pirelli World Challenge

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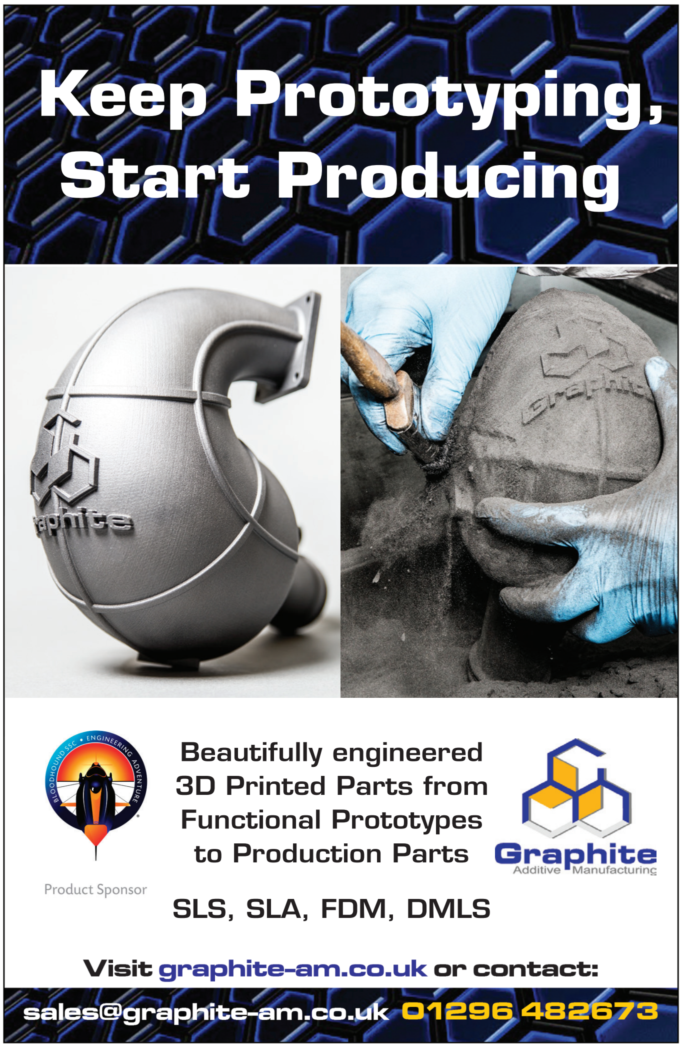
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everything!'," he jokes. "Based on the IMSA rules we really focused on the reliability, though. For instance, we were still running with the stock crankshaft when we first started building the 3.5-litre engine, but we've now developed a race-specific crank."

What it has allowed the engineers to do is carry out a more thorough testing and evaluation programme, he admits: "Being a factory programme makes it a little bit easier to compete for resources. We've been able to do more dyno testing here at HPD and more track testing with Team Penske."

THE FUTURE

The beauty of the IMSA technical regulations is that they allow a huge variety of different engine designs to compete against each other. From the Mazda AER with its highly-turbocharged inline four, to the Cadillac's naturally aspirated pushrod V8; it's hard to think of another series with quite the same diversity in its ranks. In theory, almost any configuration can be performance balanced to give it a shot at success.

The Acura engine looks well-positioned to take advantage of these rules. With 3.5 litres and two turbochargers it shouldn't be unduly stressed at its power target of circa 600 bhp. What's more, this configuration should mean it's well-placed to match the low-end torque that's rumoured to be part of the key to the Cadillac's success.

> *"Good reliability is now a prerequisite. When you look at the other DPi engines out there, they'll run all day long"*

Plus, of course, the HPD unit comes with a proven track record. In its earlier iterations, this engine scored outright victories at Daytona, Sebring and Petit Le Mans, not to mention a class win at Le Mans and multiple ALMS LMP2 titles. Its key rivals can trace their roots back to a similar era too, so it's not as if it's competing against newer machinery.

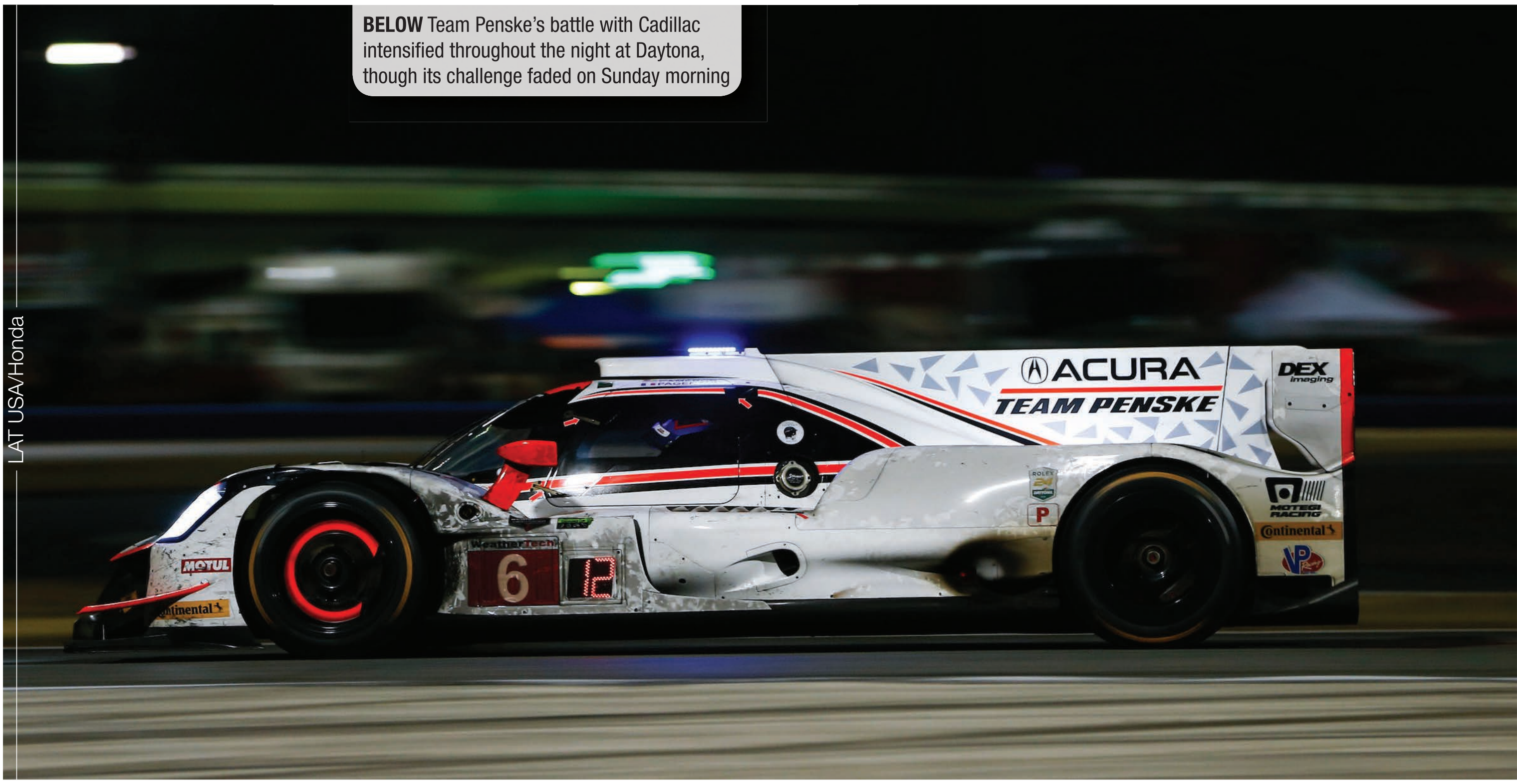
Niles is philosophical in the wake of this year's Rolex 24 at Daytona, which saw one car delayed due to crash damage and the other losing laps while in the garage due to an electrical problem.

"It was a bittersweet race for us. We were looking strong and I think we would have had a good chance to be up at the front if we hadn't run into [those] issues," he says. "We had what appeared to be an alternator issue with the #6 car. The same part has been on the engine for several years now, so we're investigating what happened. Beyond that, we hadn't run the car in the rain much during testing, so it was interesting to see how the car worked in the wet – the powertrain calibration plays a part in that, through the drivability maps and traction control."

For now, the Cadillacs and the Nissans remain the cars to beat. However, Niles points out that it's hard to gauge where the Acuras fall into that just yet, as the only time all three were running together at Daytona was in the early stages of the race when the teams don't tend to go absolutely flat out.

"We still feel the Cadillacs and the Nissans are very strong, but we certainly seem to be in the right ballpark," he says. "Our initial BoP settings were perhaps a little conservative, but I think IMSA realised that after the Roar and adjusted appropriately for the race. We're now submitting our feedback to IMSA ahead of the next round at Sebring and that's the way these things tend to pan out… it can take a couple of races to get everything exact."

The ex-Air Force base in Florida is a very different circuit. With its long straights, fast corners and notoriously bumpy surface the demands are so different that Niles likens the pre-race test to doing the Roar all over again. You could almost say it's the second start to the season. And it's just possible that this time the tables will be turned. RT

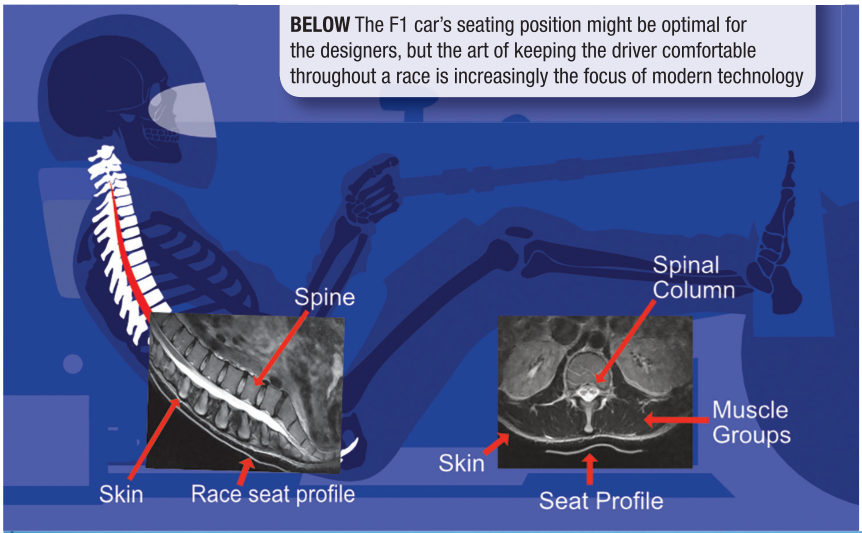


BELOW Team Penske's battle with Cadillac intensified throughout the night at Daytona, though its challenge faded on Sunday morning

LAT USA/Honda

THE SCIENCE OF SEATING

Working environments don't come much more hostile than a Formula 1 cockpit. **Alan Stoddart** reports on two men harnessing their expertise to make drivers' lives easier



BELOW The F1 car's seating position might be optimal for the designers, but the art of keeping the driver comfortable throughout a race is increasingly the focus of modern technology

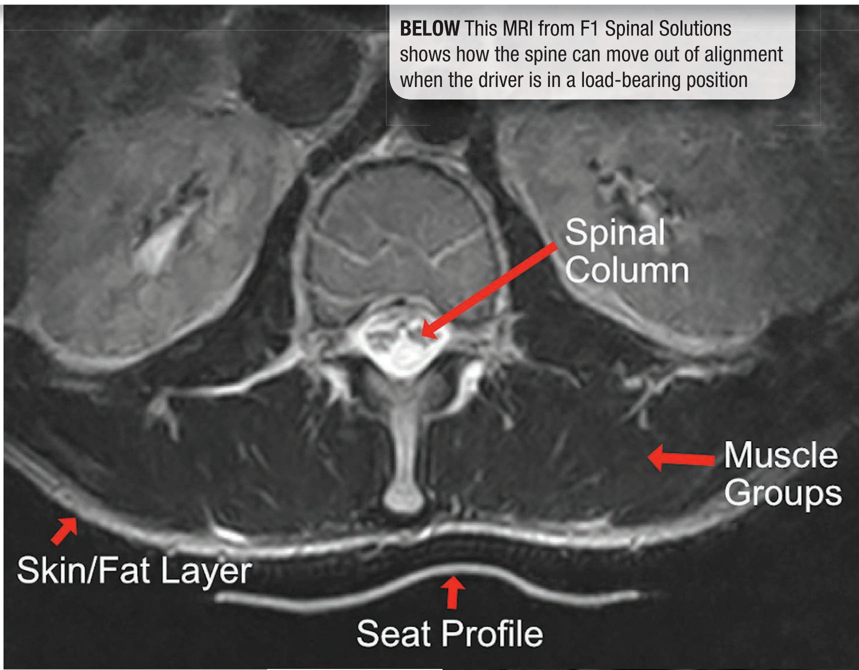
THERE are few places where the fit of a seat is as critical as the cockpit of a Formula 1 car. Even the slightest misalignment can cause serious problems when the astonishing g-forces drivers experience are factored in. Offering a solution to counter this is F1 Spinal Solutions, which has a unique way of ensuring a driver is properly supported.

The brainchild of radiologist Dr Steven Morgan, and lean process consultant Tim Scurlock, the company utilises a special upright MRI scanner, which allows drivers' spines and their musculature to be scrutinised whilst in a weight bearing, race position. This gives much greater insight than the tunnel-type MRI scans that are more usually used to diagnose and manage back problems, and enables F1 Spinal Solutions to offer much more specific and much more actionable advice to drivers and teams.

Morgan's medical expertise is crucial to the consultations, especially because there is such limited space available in Formula 1 cockpits. "The dimensions of the F1 cockpit are essentially fixed, with very little room for change, thus there is no scope to significantly alter the seat profile," he says. These restrictions mean that it is very precise work, heavily dependent on the company's technical know-how.

This knowledge even stretches as far as

ABOVE F1 Spinal Solutions has worked with several F1 drivers and their teams



BELOW This MRI from F1 Spinal Solutions shows how the spine can move out of alignment when the driver is in a load-bearing position

recommending what kind of foam teams should use for support pieces. Morgan says this knowledge comes from a series of experiments, in which F1 Spinal Solutions not only identified the best foam to use in terms of compressibility, but also saw how the foam itself degrades over time and the differences between virgin and used foam. "We found drivers were happy with inserts, but often found that back pain returned after a few races," Morgan explains. "From this we could infer that, not unsurprisingly, there was significant foam degradation within the hostile driving environment. We advised the teams to fit new inserts every 2-3 races, solving the issue."

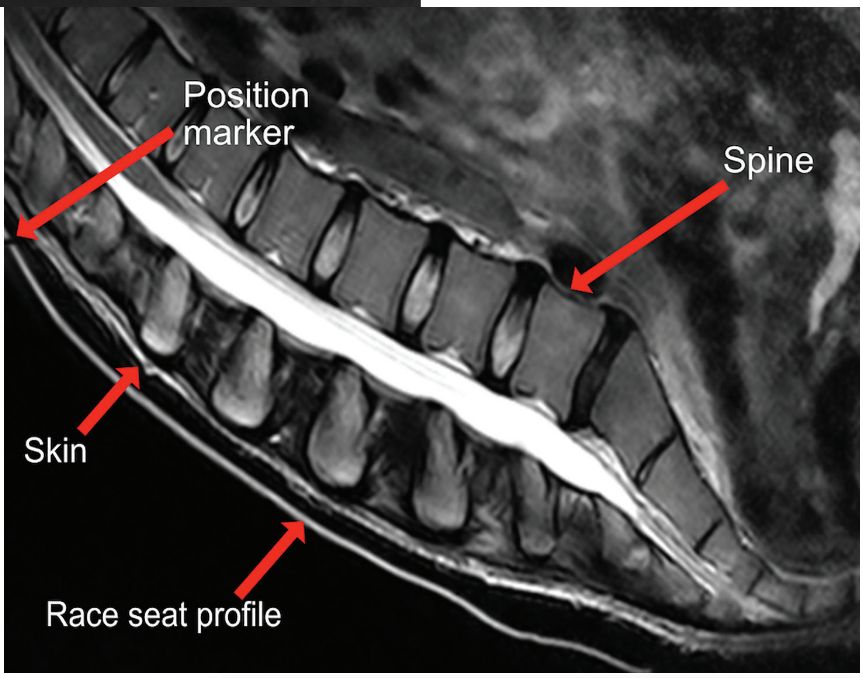
So far, in the two years since the company was conceived, F1 Spinal Solutions has worked with several F1 drivers and their teams, including one who was suffering from submarining during rapid decelerations – not surprising given the 6+ Gs the drivers undergo during heavy braking.

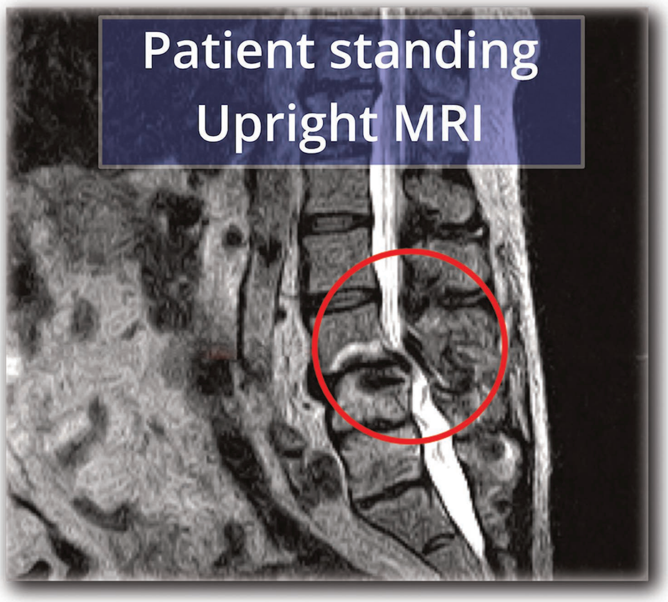
"He was moving within the harness, so after each corner, he was stretching back up his seat, with his low back muscles doing significant repetitive work. It's the difference between being slumped in the beanbag where it is static, and a dynamic situation of the seat under race conditions," Scurlock explains. But, by analysing the MRI scan of the driver in a racing position, the company was able to identify the cause of the problem.

"When muscle groups are working hard, their blood flow increases dramatically, resulting in muscle engorgement... In a tight fitting seat, there is no space to accommodate this swelling, which can therefore result in pain," Scurlock says. "The team had had cutouts made in the seat, but they were in the wrong places and were reducing the support and adding to the discomfort."

Knowing this, F1 Spinal Solutions was able to identify the correct placement for cutouts and padding for the driver. This helped the driver to sit more comfortably and more securely in his seat, which in turn enabled him to focus 100 percent on the racing line and operate at ten tenths for longer. This is indicative of how F1 Spinal Solutions is able to use an innovative methodology to apply medical expertise in a unique way.

"The concepts are relatively straightforward, but what we are doing is adding science to the dark art of seat fittings," Scurlock concludes. RT





ABOVE & RIGHT By scanning drivers in a seated position (above) rather than standing (right), the company can assess the cause of a driver's discomfort mid-race

ABOVE & INSET An exclusive supply deal for the FIA Junior World Rally Championship, which began in Sweden, is a foundation stone of Pirelli's return to top flight rallying

HITTING THE COMEBACK TRAIL

Toby Jennings looks into the return of Pirelli to the FIA World Rally Championship after a sabbatical from top-tier rallying

IT'S *La Dolce Vita* once more for Pirelli when it comes to rallying. The Italian tyre manufacturer announced its return to the World Rally Championship towards the end of the 2017 season, exclusively supplying the FIA Junior World Rally Championship this year, as well as the FIA Junior European Rally Championship.

So why did it depart in the first place? And why did it come back? The reason for leaving that was announced at the end of 2015 was that the sport was no longer in line with Pirelli's marketing objectives. But with increased promotion of the WRC this year (including live streaming from practically every stage) that relevance is there again. In truth it never went away: the Italian firm simply wanted a hard reset after dwindling into a relative lack of competitiveness with drivers whose finances sometimes exceeded their talents. Now the accent is firmly on youth, with a new deal and new products that look to the future.

The latest Italian tyre range contains new constructions and compounds that Pirelli claims: "provide more grip and performance than ever before, thanks to a selection of patented technologies." That's quite some boast. So, with Pirelli being involved in the championship since it started in 1973, but having last won a title in 2010 (the final season of its three-year single-supply deal with the WRC) is this a sign that the glory days – of legendary Pirelli-equipped champions such as Colin McRae, Richard Burns and Petter Solberg – are on their way back?

"There aren't any plans to supply any manufacturers for the moment, but never say never," comments Mario Isola, Pirelli's head of car racing. "For the time being, we're focusing on the WRC2 series and the Junior World Championship, but you never know what the future might bring. We've been out for a year so obviously we have to start again somewhere…"

A brand-new P Zero RK5A hard compound together with a soft P Zero RK7B will be

Why rally tyres are the closest relatives to road-going rubber

THE latest rules surrounding tyres in WRC stipulate that tyre manufacturers must homologate one asphalt, one gravel, one snow and one winter tyre. Each of these homologated tyres can be available in two different compounds such as hard and soft.

For asphalt tyres, additional criteria must be adhered to: they must be E-marked, grooves must make up at least 21% of the surface area and they must have two radial grooves. Additionally, the tread depth of an asphalt tyre must be equal to or greater than 1.6 mm across 75 per cent or more of the tread pattern over the course of an event.

The rules are restrictive, but they ensure that rally tyres are among the closest relatives to their road-going equivalents in all of motorsport. And that's the appeal for tyre manufacturers like Pirelli. RT

used this year for asphalt stages, while the Cinturato RWA rain tyre is for wet asphalt stages. The latest line-up of gravel tyres consists of the Scorpion K4 Reinforced and a softer Scorpion K6 Reinforced, with both sets receiving new tread pattern designs that are focused around improving driveability and handling.

For ice and snow stages, Pirelli introduced two different sets of Sottozero tyres. These tyres are rally-specific, with the Sottozero B used at the Monte-Carlo Rally and the Sottozero Ice intended for the more extreme Rally Sweden. The latter tyre is equipped with long studs using patented technology, which Pirelli claims helps ensure stud retention – a perennial challenge in Sweden – and "deliver optimal grip throughout the length of the stage."

Introducing such a wide variety of new tyres in such a short space of time is no mean feat, explains Pirelli's circuit activity manager, Matteo Braga. "The tread pattern is historically one of the most difficult things of all to design, especially under the latest rally rules," he points out. "The tread pattern is not only the tread pattern, but actually part of the tyre construction, together with the carcass of the tyre, the compound and the sidewalls."

Unlike circuit racing, of course, any tyre for rallying has to be road legal as well, because the cars drive on normal roads to get to every stage. This is partially a constraint but also offers the opportunity to develop tyre technology that is genuinely road-relevant: one of the key factors that enticed Pirelli back.

"Especially for asphalt, we are very limited," adds Braga. "There are parameters in which we can design innovatively but it's not that much. For gravel we've got more flexibility to do something different, and we've based our tread pattern on our previous experience. We have designed many tread patterns so now we know which are the designs that we can use on different surfaces. This also helps the product for the road, which is the interesting part."

A WISE JOKER

The latest WRC rules allow tyre constructors to register one replacement asphalt and one replacement gravel tyre specification once per season, also known as the 'joker'. But the joker tyre permanently replaces its predecessor, so tyre manufacturers can never go back to the original – meaning that in tyres as much as poker, it's important to play your joker wisely. ▶

ABOVE Pirelli triumphed in WRC2 on Rally Sweden with its Sottozero Ice tyres

Testing of joker tyres is heavily regulated and restricted to a maximum of two consecutive days, preventing a mid-season tyre development war. To some extent, it's shooting in the dark: and that was also one other reason why Pirelli left the WRC back in 2016. Especially when it comes to the notorious vicissitudes of gravel.

"On gravel, outdoor testing on actual surfaces is the real proving ground," continues Braga. "You can simulate different types of gravel surface, but it is always very theoretical compared to the real surfaces. One of the parameters that is very difficult to produce indoors or in a simulation is the temperature of the actual tread and compound, for example. That is something that you can only really have when you are outdoors. So, for rallying, having the ability to test properly is key."

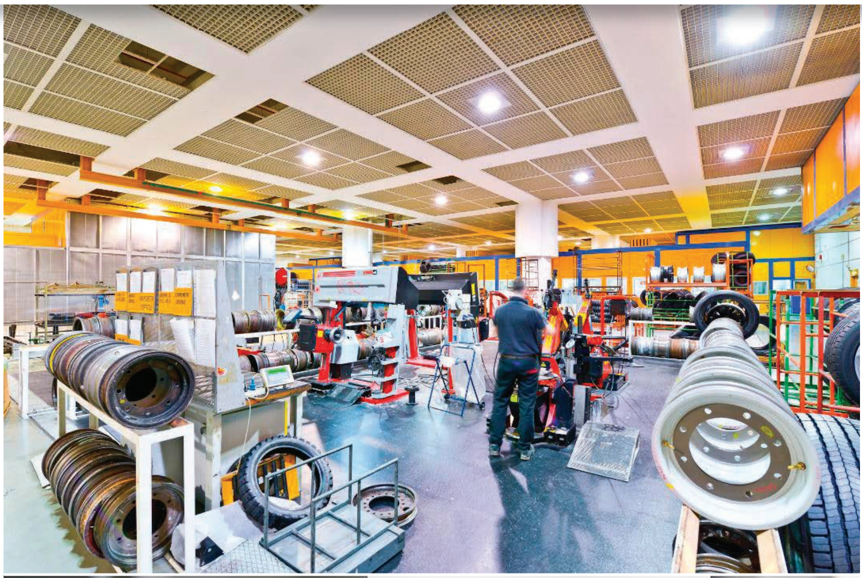
FOCUS ON TECHNOLOGY

In the past, tyre testing was almost unrestricted: teams used to spend literally months testing for the specialised events such as the Safari, for example. But now, everything is restricted: both the number of different types of tyre available, and the amount of testing allowed. It's forced a focus on technology, versatility and efficiency.

"Today, due to the WRC regulations, you can only have one carcass and two different compounds," continues Braga. "One is usually for very hot and abrasive surfaces and the other one is for muddy and soft surfaces. Because you can no longer modify the tread pattern by hand-cutting anymore, we need to design a tread pattern that is a compromise: a tread pattern that can survive in the most aggressive conditions with a hard compound, as well as give good grip in cold conditions and muddy surfaces like Wales Rally GB. That's the biggest challenge."

It's even tougher when you think that the rally environment is continuously evolving. Consider any one stage: the shape, consistency, texture, density and moisture content of the surface is always changing – and these changes can be swift and dramatic. All things considered, getting a tyre to work within its comfort zone isn't impossible. The art lies in getting a tyre to work *outside* of its comfort zone.

These are some of the conditions that Pirelli has been developing and designing its new tyres around, as Braga summarises: "We use different development tools for rallying; some of them have been derived from our experience in Formula 1. So, we have a modelling department and R&D department that are always working together. First, we try to simulate what can happen in the real world. Second, once we have a few interesting solutions that go in the direction of the integrity and performance that we are expecting, we go testing."



ABOVE & BELOW Pirelli's latest rally tyres are made in the company's 'Factory of Champions' at Izmit in Turkey

> "More grip and performance than ever before"

Pirelli's latest rally tyres are made in the company's 'Factory of Champions' at Izmit in Turkey, which has been responsible for the company's (non-Formula 1) motorsport products since 2007. It was there that the WRC tyres from Pirelli's most recent spell as single supplier from 2008-2010 were created, but of course the championship has changed beyond recognition since then. Yet the chance to revisit an arena of motorsport with a direct link to road cars inspired Pirelli to return to the WRC this year, joining Michelin and DMack as the official tyre suppliers. The Italian firm is currently committed to Formula 1 until 2019, but after then everything is open. And for Pirelli, rallying makes a lot of sense…

"Every weekend we have the chance to test our technologies and processes through rallying which are then translated to our road car department," concludes Braga. "Through motorsport, we have so many people driving our products in many conditions. This means that if we want to test new technologies we can have a lot of feedback within a short period of time. It is like a global test programme: motorsport is the natural proving ground for any of our technologies. And by choosing to put the focus on young drivers this year, we are investing in the future of the sport."

Happy days are here again. RT

Image: Jakob Ebrey Photography

TICKET TO RIDE

William Kimberley considers some of the latest developments, and enduring favourites, in spring and damper technology

THE role of the spring in a car's suspension is often misunderstood. Basically its principal task is to isolate the majority of the vehicle's mass above the wheels, known as the 'sprung mass' from direct interaction with the road surface. It adds compliance to the vehicle's ride and handling characteristics by storing and releasing energy that would otherwise be transmitted directly into the body of the vehicle through changes in the road surface.

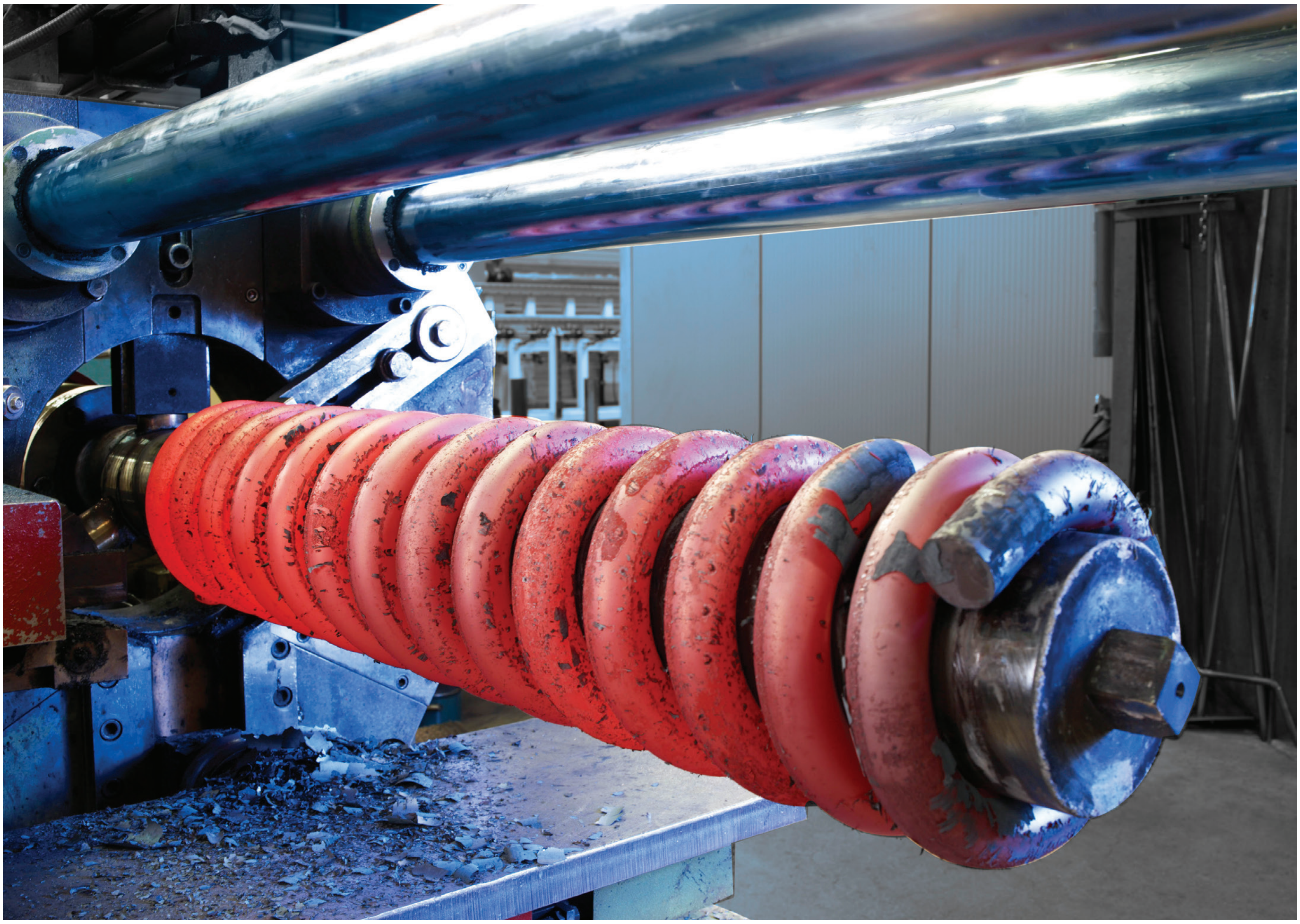
Springs must also be matched to the suspension dampers which work to dissipate some of the energy continually stored and released by the springs, which have to fit the suspension assembly.

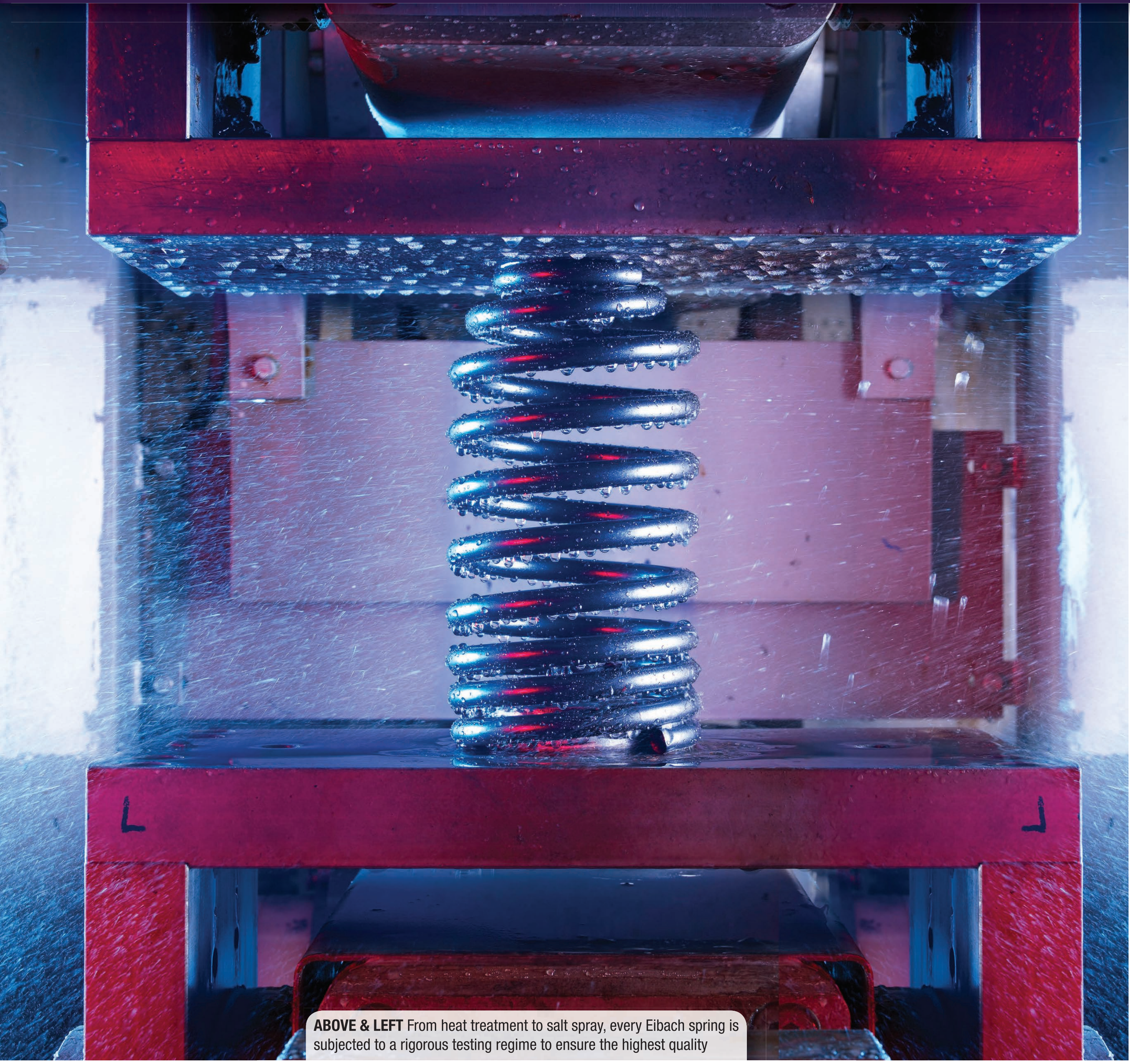
Given the targets for rate, travel and a host of other constraints, a suitable wire diameter can be calculated and a prediction for the spring's resistance to yielding and its long term durability can be compared to the specific requirements of the application or to industry standards.

When it comes to high-performance motorsport, the technology is very similar whether it's for a Formula 1 or a World Rally Championship (WRC) car according to the experts at **Eibach**. Both applications tend to use closed and ground ends which allow a simple, universal seating arrangement. Both tend to use high-strength silicon chrome vanadium steel (SiCrV) which is oil hardened and tempered to provide a superior combination of high yield strength and durability.

However, in terms of design there are differences. For example, Formula 1 springs are often short, high rate springs that are dimensionally toleranced to fit inside enclosures, such as within a heave spring assembly. WRC wheel rate requirements often include more than a single rate with rate transitions occurring at discrete positions along the suspension travel.

This is normally realised by adding two springs in series, with a 'tender' spring fitted to the top of a 'main' spring using a seating 'adapter' between the two.





ABOVE & LEFT From heat treatment to salt spray, every Eibach spring is subjected to a rigorous testing regime to ensure the highest quality

Both springs working in this fashion give rise to a single combined rate and travel characteristic that can be modified by selecting different individual springs. By using different combinations of springs it is therefore possible to generate many different characteristics. Eibach can usually provide the solution to a bespoke WRC wheel rate requirement by combining existing tender and main springs from the Eibach Race Spring (ERS) catalogue.

Although Eibach has made titanium springs in the past, the current focus is to improve the performance of steel springs and in parallel to develop the Eibach composite spring technology. Over the years the company has invested heavily with the steel mills that it buys from, in developing the high-strength silicon chrome vanadium steel that it uses. It isn't exclusive to Eibach as such, but it buys this particular formula in such high volumes that it could be considered so. It has proven to be very successful with Eibach's in-house Quality Management System. It offers product longevity, versatility and the tightest quality tolerances along with all the data and knowledge on the material that Eibach has collected over the years. It says that for now the future still lies mainly with steel.

One obvious concept for improving the conventional steel coil spring is to shift from a solid wire section to a tubular section. This allows for 'shape optimisation' where material is effectively migrated from the centre of the bar outwards, so that it can be better utilised and consequently the weight of the spring can be reduced. This principle is already employed in anti-roll bar technology with high-performance examples not only using tubular section steel but pushing the shape optimisation principle further by designing variations in wall thickness to re-distribute material stresses uniformly. The tubular section coil spring still retains the conventional helical shape of a suspension spring; as such, they are suited toward performance OEM where they can ▶

ABOVE ZF Race Engineering's Racing Damper System

occupy existing spring seat arrangements.

There are a number of examples of suspension springs made from composites which retain the conventional helical coil spring form. Eibach's composite development makes are a departure from the conventional shape, which is highly amenable to production in steel, to a design that utilises the inherent strengths of the composite.

These designs place the composite material in bending as opposed to torsion, which is the primary mode of stress in a conventional coil spring, since the composite material behaves well under this mode of deformation. Current designs are being road tested and this technology is likely to find application in motorsport and high-performance road vehicles.

LIGHTWEIGHT DAMPING

At the beginning of last year, the merger of **ZF Race Engineering** with ZF TRW Conekt was announced, with one of the goals of the new alliance being to refine further ZF Group products, such as gearboxes, electric motors, steering and brake systems for motorsport applications. At the same time, however, work continues on further and new development for the existing product portfolio, such as its Matrix damper systems. The RD 45 and RD 36-2 form part of this.

The RD 45 racing damper is the first choice when it comes to Touring Car racing where long strokes and high vehicle weight require a more powerful damper design. The biggest advantage is the possibility to adjust the bump (compression) damping forces individually for low and high piston/shaft speeds.

The RD 36-2 damper's performance values are similar to those of the RD 45, but optimised even further for weight and size, which means it can be used where the RD 45 would be too large. It works on the single tube gas pressure principle, but the internal pressure can be kept low by using a remote reservoir with adjustable bump valve.

Both the RT 45 and 36-2 are gas pressurised mono tube dampers, with independently adjustable rebound and bump damping forces. They are available with different damping force characteristics and adjustment ranges – allowing them to be adjusted to all individual customer requirements with full precision and reliability.

ZF Race Engineering is working on a lightweight damper, with an integrated piston rod allowing dual adjustment. In addition to the wide adjustment range, the development goal has been an extremely low hysteresis of the damper; optimal damping should be purely damping speed-dependent.

BLAST FROM THE PAST

The **Öhlins** TTR40, a 4-way fully independent adjustable aluminium damper, was first seen at the Autosport Show in 2011 since which time it can be found on cars in a good many high end series.

In addition to light weight – just 975 grams without the spring fitted – features include a precise valving system that allows both high and low-speed damping to be zeroed externally to ensure an accurate synchronisation between dampers, while at the same time maintaining discernable reference clicks.

The TTR40 unit combines top performance with user-friendly handling. For example, valving can be changed on-event in around one minute. The unit also comes complete with valving simulation software, drastically reducing development time from conception to race-ready damper, whilst also allowing engineers to make infinite, graduated adjustments during testing, set-up or racing. RT

ABOVE The Öhlins TTR40 4-way damper has been around a long time but is still a popular choice

ABOVE & BELOW The difference between cams which have and haven't undergone the MSE finishing process is clear to see

TWEAKING FOR PERFECTION

Camshafts have been used in almost every internal combustion engine, but as **Alan Stoddart** finds out, companies are still discovering ways to improve them

CAMSHAFTS have, in one form or another, been around for far longer than the internal combustion engine. With this being the case you might think that there can't be anything more to be done to improve them, but as is so often the case, innovative companies find a way to offer something different and improve upon technology that has been continually honed for so many years.

One such company is **Newman Cams**. David Newman, the company's founder, explains that the big changes have been not to the camshafts themselves, but to the manufacturing processes that are used to grind the cams. Instead of the mechanical "hand mangles" that were traditionally used, Newman has always pushed for the use of CNC milling in the manufacture of camshafts, which brings many benefits to the final product.

"It's the total accuracy," he says. "The difference between a mechanical ground camshaft and a CNC ground one is purely that you can come in at a given speed, cut, spark out at some many revolutions, come out then do the next lobe. Every one of those will have the exact same treatment all the way along. They will be identical to within about 20 microns."

This accuracy is essential when Newman works with clients to design the perfect profiles for their engines, something he has been doing for 52 years. These five decades of designing cams have bestowed Newman with a knack for knowing what works, even before it has been tried. He also knows about what doesn't work, something himself and his company have to share with customers.

"Normally the average person comes in and they want a cam lobe that's bigger than everyone else's," he says. "They think that more lift and more duration has got to mean more power, so for us it's a case of sitting down with the customer and talking to them and explaining that OK, you can get another 10 brake horsepower at 8000 rpm, but at 5000 rpm you're losing 15.

"Every time you get that extra 10 brake horsepower, you're going to lose 15 getting there, so you can end up being five brake horsepower worse off than when you started." Additionally, Newman adds, because you have to go through the mid range to get to the top end, and because people have a tendency to kill the mid range in order to squeeze more from the top end, this means that "people start revving the lights out of the thing" which has a dramatic impact on reliability.

A FINISHED PRODUCT

This search for reliability has been critical to the improvements that some camshaft companies have made, doubly so for those that see their cams in action at endurance races. This quest led **Comp Cams** to look at the techniques used in industrial diesel engines, as they are designed for good endurance and high-load camshafts. "That's because the industrial diesel market has million mile warranties," notes Billy Godbold, Comp Cams' valvetrain engineering group leader. Comp used to grind its roller profiles absolutely flat, he adds, until the company took advantage of the industrial diesel companies' investigations into cam surfaces and subsequently put a bit of crown on them.

"So we started playing with different crown in the grits, trying to get a better finish. Then about three years ago, when we were basically looking at R_a [one measure of surface roughness], I talked to some of my

BELOW You won't see the name written on a box, but Polgain is known throughout the racing, classic and automotive industries for its fast turnaround prototype camshaft department

friends in the research world. They hardly looked at R_a at all, instead they were far more focused on bearing area and contour."

So this is what Comp started looking at. "Bearing area is expressed as a percentage out of depth," Godbold explains. "If you go back 15 years we were only at about 10 per cent at 10 microinch depth affected bearing area... So we started making the changes and once we started looking at those it was easy to get it up from 10 per cent to 15 per cent." Since then Comp has changed its dress and its grit and is now able to machine cams to around 30-40 per cent. "But," he adds, "every grind, no matter how good a grinding you do, is going to look something like a mountain range. There's going to be peaks and valleys."

This is where Comp Cams' new MSE Finishing process comes in. After grinding, you end up with valleys on the surface that are 30-50 per cent deeper than the peaks, so if the peaks are 20 microinches, then the valleys might be 30 microinches. The MSE process plateaus off all these microscopic peaks and brings the average down, that means the resultant surface now has valleys 18-20 microinches deep, and peaks that are just five microinches tall.

"So," says Godbold "you get a much better surface, but the bigger deal is instead of 35 per cent bearing area at ten microinches, it's going to be 50 per cent plus. And instead of being 50-60 per cent at 20 microinches, it's going to be 90-95 percent. What that means is that when the roller lifters ride it, it has so much more area to spread the load out."

Or as Godbold explains succinctly, it's the difference between having your toe stepped on by someone in a flat shoe and someone in a stiletto.

Increasing the bearing area in such a way has a huge effect on reliability, he says: "When you look at a camshaft that's failed, it's easy to say it just blew up on you because the camshaft looks destroyed, but if you catch the failure early enough you can see that every macroscopic failure started microscopically as a tiny, tiny, tiny imperfection in the iron steel lattice.

"That imperfection will crack and grow and will spread through the lattice and form a crack in it and all of a sudden that crack will start expanding and then at some point there will be enough force to cause the crack to go across the plan and then you'll have a spalling type failure... this will get worse and worse and sooner or later you'll have a huge macroscopic problem."

The real benefit of Comp Cams' MSE finishing process then, is that the load is sufficiently spread across the surface that there won't be enough force on a single point to create such a macroscopic failure.

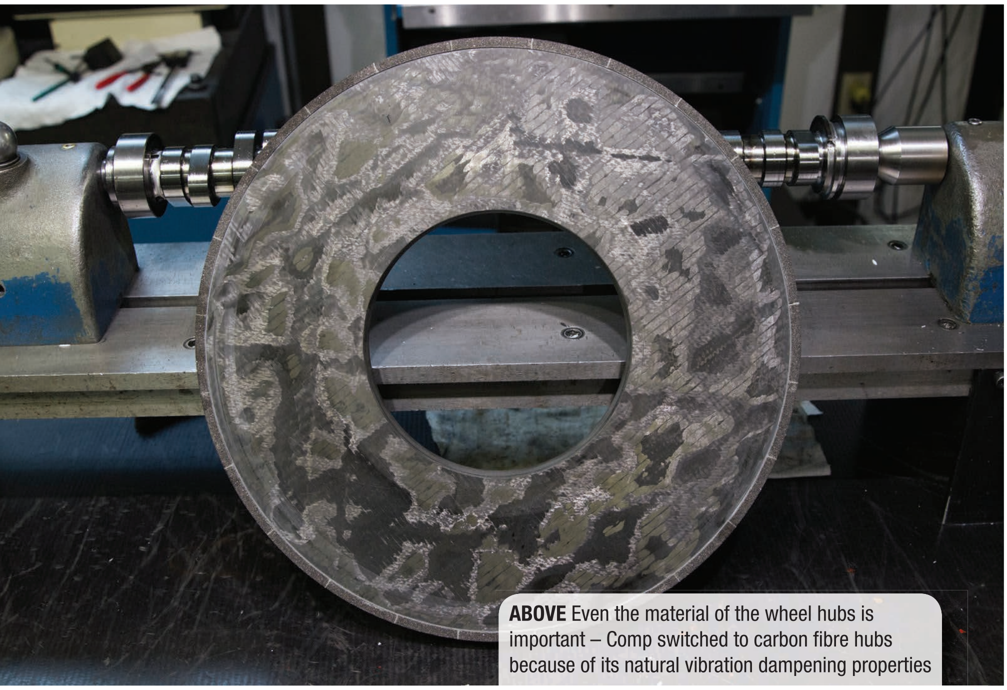
PERSONAL PROFILE

It's not surprising that some customers want to harness this level of technical expertise exclusively for their own particular products. This typifies what **Polgain** does. "We don't have our own product, so you can't buy a box with Polgain on it," explains the firm's factory manager, Adrian Bond. "We only manufacture to customers' requirements, so much of our work seems to be development work for some of the larger companies like Ricardo and Jaguar."

Usually, continues Bond, the customers that Polgain works with are the ones that need more support and a more bespoke, adapted solution. "What happens usually is that a designer sends in a customer's camshaft and we'd measure it on our new Adcole camshaft contour measuring machine, so we can output the data, the phase and angles, the peak to peak and the profiles.

"We'd fire those over to the camshaft designers... and he'd mod the profile and send it back to us for us to manufacture from his modified profiles."

What precisely is done by Polgain, and to what ends is very much dependent on the specific aims the clients are hoping to ▶



ABOVE Even the material of the wheel hubs is important – Comp switched to carbon fibre hubs because of its natural vibration dampening properties achieve. For example, when doing the work for rally engines, the customers tend to want a good spread of power, but delivered in a way that doesn't cause them to be continually digging up the dirt or spinning off. Speedway riders, meanwhile, are looking for a cam profile that lets them hold the bike flat out on the line so they don't get valve bounce, which means they can launch off the start and get into the first corner better.

The bespoke nature of Polgain's work means that it has also been involved with some very innovative and cutting edge projects. "We seem to pick up quite a bit of work where people are doing slightly more radical stuff, real breaking new ground kind of prototypes," Bond says. "Things like switching tappets, different types of injection, different lobe packets as well when you have a plunger run on the centre profile for economy and then retract and allow the follower to run on the outer profile for performance. All those sorts of things."

This innovative approach has even led the firm to work with a company developing a type of engine which is better known for powering German torpedoes. Polgain originally got involved when the company developing the engine needed advice to perfect the swash plate cam used by the engine, but has since invested in the company. This development on an engine which "works back to front", as Bond points out, is indicative of Polgain's ability to turn its hand to anything, whatever a client asks for.

ABOVE Polgain's Adcole Cam Contour Measuring Machine

IN-HOUSE DESIGN

A dedicated focus on meeting the client's precise needs is also important to **Piper Cams**, which boasts a 50-year history of making bespoke items for all kinds of vehicles. Justin Buckman, Piper's sales manager, says that this is helped by doing all of the design process in-house. This means the company can better consider what the customer needs.

"It's what we are presented with," he says. "When we are producing something bespoke, whether that's an older vehicle where the items aren't produced anymore but someone has an old sample that might be damaged or old or worn in some way, we are then tasked with making that cam like it was when it left the factory.

"Or, it might be that you are producing a race engine and you need our expertise in order to get the profile right, in which case you would design the profile and then design the cam and build it accordingly."

Similarly to the other companies mentioned here, Piper also makes a point of properly advising its customers. This is hugely dependent on what the customer intends to use the cam for, whether it is for endurance racing, rallying, or simply those looking to give their daily drive a bit more pep. "Our job isn't just to take someone's money; they are making an investment in their engine. It's our job to make sure they are advised correctly, so that they get absolutely the right thing," he insists.

Cams are necessarily different when they are being used for different purposes. In this world of specialism, a range of companies are using ever more technically refined processes to ensure that when a customer buys a cam for a special task, it's up to that particular job.


BELOW Piper offers cams for all manner of engines, including the boxers found in the Subaru BRZ and Toyota GT86

ABOVE Innovations made by ETS mean it has been adopted as the control fuel for the China Touring Car Championship's Super Cup and China Cup

FUELLING GROWTH

The Middle East's premier open-wheel series and the China Touring Car Championship offer ETS Racing Fuels prestigious proving grounds, reports **Alan Stoddart**

FUEL maker ETS Racing Fuels is in the midst of expanding its presence at racing circuits.

Last year that took the form of being the control fuel supplier for both the Super Cup and China Cup categories in the China Touring Car Championship, and for the Formula 4 in the F4 UAE series. This focus has continued into 2018 and has recently seen ETS nominated for the Thailand Super Series 2018, where it will supply the top categories such as GTM, GTM+ GTC, GT4 and S2000 along with providing trackside refuelling at the Bangsaen street circuit event.

In addition to this, ETS will also provide analysis of fuel samples, to ensure that none of the competitors get an unfair advantage.

A range of factors have contributed to these strides, explains ETS' global product manager Yann Labia: "The consistency of our premium fuels, paired with our solution-oriented approach to meet the service needs of event organisers, makes us very confident to also be considered as control fuel supplier in other world-class racing circuits."

Of course, the fuels themselves are also crucial to the motorsport moves ETS has made. In the upcoming Thailand Super Series 2018, ETS will introduce the Extra Blaze IRF 102 which was designed as a cost efficient fuel, but one which is still a high quality fuel for the purposes of racing. In keeping with its intended purpose, the new fuel is ideally suited for turbocharged engines as well as naturally aspirated engines with a high compression ratio; ideal for the engines used in touring cars, supercars, GT or Formula 4.

The fuel utilises a unique technology, which allows finer fuel spraying, critical to effective combustion in the cylinder. It also means that injection adjustment is much easier to manage, as well as reducing the combustion temperature and helping the engine run more efficiently. Other benefits offered by the fuel are its anti-friction molecules, which help reduce wear, while cleaning additives help to prevent deposit build ups within engines.

"The use of specific additives and selected chemical molecules allows us to work more specifically on engine performance," explains Labia. RT

ABOVE The F4UAE Championship utilises the Tatuus chassis with Abarth turbo engine

ACO'S LMP1 RISK EARNS ITS REWARD

Ginetta

ABOVE The pair of Ginetta-Mecachrome G60-LT-P1s run by Manor will form part of a resurgent field of LMP1 privateers

Sergio Rinland says a record entry for the 2018/19 World Endurance Championship is just reward for the ACO's drastic overhaul of the LMP1 regulations

ONE of the stars of this year's Autosport Show, at the Birmingham NEC in January, was the new Ginetta LMP1 car. Had it been launched one or two years ago, we would have said, 'That's the spirit – competing for participation's sake'. But not in 2018.

Many times we have cautioned in this very page that LMP1 was treading dangerous ground by neglecting non-OEM teams. I would not like to say that we knew better: Vincent Beaumesnil and his team at the ACO know the sportscar racing scene, and LMP1 in particular, better than anyone and they also saw it coming, even before Porsche dropped their untimely bomb.

This time they managed to anticipate the damage and change the LMP1 non-hybrid regulations to allow privateers to compete, at least in theory, with the hybrid brigade. Not a minute too early. This year, the 'Lone Ranger' is Toyota Gazoo Racing.

To put it into numbers, in 2018 an LMP1 non-hybrid is not only 45 kg lighter, as last year, but the amount of fuel hybrid rivals can use per stint is reduced by 25%, from 44.1 kg to 35.2 kg. It will allow the non-hybrids a fuel flow of 110 kg/h, 35% more than the hybrids and 8% more than last year. Thirty five per cent more fuel flow equates to nearly 150 HP extra to use all the time, unlike the hybrids that can use 300 kW (402 HP) for only a few seconds after every corner.

Non-hybrids will also be allowed to use 69% more fuel per lap, a 34% increase from last year. So those 150 HP will be used right up to the end of the straights, achieving higher speeds than the hybrid cars. Fuel consumption should not be a great concern.

On top of all the power and fuel consumption allowances, the non-hybrids have also been granted some aerodynamic concessions. These will translate into more downforce and potentially higher cornering speeds.

All in all, the ACO have listened to the sirens screaming from the deep seas and allowed the privateers the possibility, in theory as we said before, to compete with the big boys (big boy, I should say) of LMP1-Hybrid. The reward for their policy is a record entry for the 2018/19 World Endurance Championship superseason.

It is exactly 10 years ago that I was called to run and develop the Epsilon LMP1 project, a truly quixotic effort (to keep it in the Spanish spirit) from Joan Villadelprat and his team. In those days, not so long ago, before the 'invention' of WEC and the 'help' from the FIA, we had a horde of very interesting and adventurous privateers in LMP1, venturing to compete with the big boys of the day, Audi and Peugeot. We had, as well as Epsilon, Dome with a great car, Lola-Aston Martin, Pescarolo, Courage, Creation and Lola-AER. There were 24 LMP1 cars at Le Mans!

In those days, we were, theoretically, in with a chance. At Le Mans the Lola-Aston Martin split the last two Audis. At Silverstone, the last race of the season that year, we were, with the Epsilon, only three-tenths off the Audis in qualifying; in the race we were even more competitive, after a mammoth development programme during the season that took us from nowhere to that position. It was possible then and with only a fraction of Audi and Peugeot's budget.

With eight privateer LMP1 cars going up against Toyota at this year's Le Mans 24 Hours, could it be that we are in for a repeat of history? As the Le Mans fan that I am, I sincerely hope so. RT

BELOW Back to the future? Le Mans 10 years ago. The Epsilon Euskadi-Judd EE1 tracks a P1 Lola-Judd at the start of the race in an era where have-a-go privateer efforts were similarly encouraged

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