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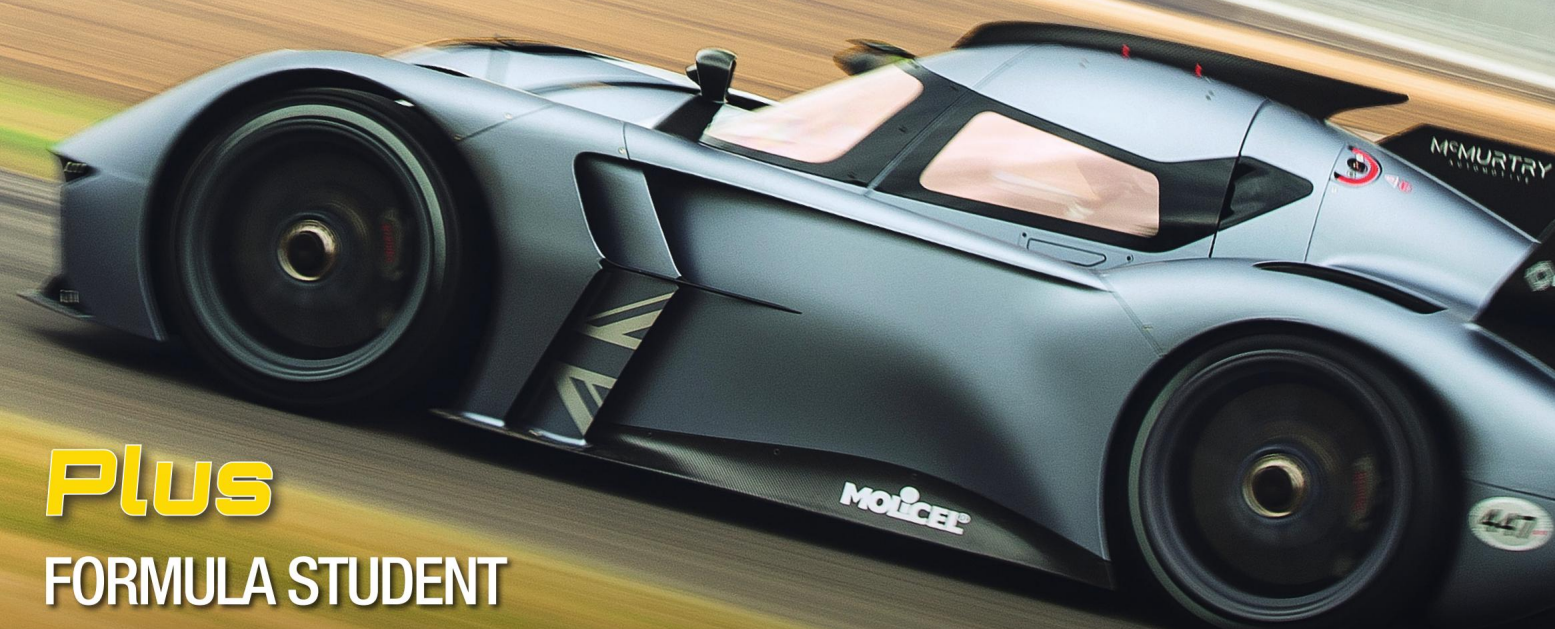

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ACCOUNTS
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MANAGING DIRECTOR
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Soheila Kimberley

RACE TECH INTERNATIONAL
Motorsport Engineering

841 High Road, Finchley
London N12 8PT
Tel: +44 (0) 208 446 2100
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ARE WE BEING HANDED A *FINAL WARNING?*

THE world has endured a chastening few weeks. Swathes of Europe have been in flames; temperatures hit new record highs in the UK, topping 40 degrees C.

As temperatures soared, it really did feel as if the planet was sending us a final warning. Any climate crisis non-believers in evidence near you?

It appears that we have been caught by the perfect storm. Just as the need to decarbonise becomes more pressing than ever, the energy crisis set in motion by Russia's invasion of Ukraine has forced some EU countries to reactivate coal-fired power stations. Desperate times; desperate measures.

It's not only temperatures rising fast. The soaring cost of living is dampening the appetite to invest further in the pursuit of the renewable (green) energies we urgently need.

So what can motorsport do to help? As Porsche's head of motorsport, Thomas Laudenbach, suggests in his interview elsewhere in this issue, we need to be part of the solution, rather than part of the problem.

As well as heading down the electrification route, Porsche has invested in the quest for a greater supply of e-fuels. It's a theme echoed elsewhere in this magazine, with Formula 1 confirming that it will be using sustainable fuel by 2026.

Motorsport has the power not only to accelerate the technical development of these drop-in fuels, but, crucially, to showcase their use in order to win 'the hearts and minds' of a public that will need to be persuaded to use them. In fact, we need a public that *demands* to use them!

More than ever before, there is a pressing need for motorsport to sort out its act – on so many levels – and to show the world the progress it is making. Which is why this December's RACE TECH World Motorsport Symposium will be titled: 'Sustainable Motorsport 2030 – from Race to Road'.

Just as some people insist they don't believe in the climate crisis, others will try to tell you that tech transfer from the racetrack to the road is also a myth. But as Laudenbach points out, we might not transfer a modular component directly from the racecar to its road counterpart, but we do frequently take the approach, the software solutions, the cooling concepts, the manufacturing methods and all sorts of things that we learn. It will be the same as we make breakthroughs in our push towards a sustainable future.

All of these issues will be on the agenda at the Symposium. There is so much to do. And so little time. Join us there. RT

Mark Skewis
CONSULTANT EDITOR

REVIVAL OF A LEGEND

Reborn Lola Cars to focus on new cutting edge technologies for the wider automotive industry and beyond. By **Mark Skewis**

LOLA CARS is an iconic name from motor racing history, but its new owner's ambition is to transform it into a leading design and engineering force of motorsport's future.

One of the most successful manufacturers of customer racing cars of all-time, the constructor has been dormant for a decade since the death of Martin Birrane. But now Till Bechtolsheimer, a businessman, part-time racing driver and enthusiast, has purchased the still-functioning Technical Centre in Huntingdon, Cambridgeshire, UK, full rights to the Lola name, plus the designs and IP of every Lola model since its founding in 1958.

"Motorsport across the board, from top to bottom, is going through an awful lot of change at the moment," said Bechtolsheimer, 40, the founder of New York-based investment firm Arosa Capital. "All of the major forms of motorsport are seeing new regulations come in and pretty fundamental questions are being asked on the approach to the next century of racing.

"That creates an interesting moment in time to try and do this, especially coupled with the automotive industry at large going through probably its biggest change since the Model T."

Bechtolsheimer cited his own business background – his company specialises in energy, energy efficiency and renewables, including emerging technologies in the transport and automotive worlds – and the example of Williams Advanced Engineering as influences on how he thinks a relaunched Lola can succeed.

"Our plan is to re-establish Lola as a leading design and engineering force in modern motorsport," he said. "I have built a career investing in energy efficiency and see motorsport playing a significant role in the innovation and testing of new solutions. Through Lola, we hope to develop and provide investment for some of these solutions.

"When you look at the success WAE have had, they have demonstrated that the innovation that takes place through racing has a much greater application than just into motorsport, and I think that's a big part of my interest in Lola as well."

Daunting but exciting prospect

For the new owner the opportunity to acquire and steer one of motorsport's most iconic marques was one too good to waste.

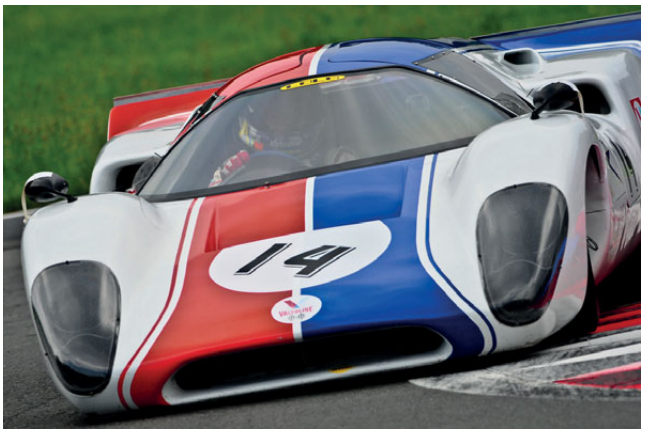
"I have had a lifelong passion for motorsport and,

ABOVE Nigel Mansell's 1993 CART title triumph: a time when Lola could do no wrong

like most motorsport fans, have always loved the Lola brand," said Bechtolsheimer. "What both Eric Broadley and Martin Birrane achieved with Lola is awe-inspiring. It is a daunting but exciting prospect to try and rebuild Lola in their footsteps and do justice to their legacy."

Amanda Birrane, Chairman of Peer Group plc, the Birrane family property company based in London, said: "My family is very pleased that the Lola brand is in the ownership of a businessman and racer who will write the next chapter for this long established British motor racing icon. My father would be delighted to see Lola back in competitive motorsport and especially back at Le Mans. We wish Till every success."

RIGHT Iconic cars like the T70 helped the company achieve success around the world



BELOW Integrating new software and systems into the wind tunnel is a priority already being addressed

Wind tunnel upgrades

There are immediate plans for substantial upgrades to the Lola Technical Centre, in particular the wind tunnel, which has remained as a functioning business since 2012 under the company name of Wind Tunnel Developments. Long-time Lola employee Chris Saunders, who has maintained the business, remains on board and Bechtolsheimer has already made other hirings, mostly on a consultancy basis so far, to kick-start the revival.

"The intention is to bring Lola back to a version of what it was," said Bechtolsheimer. "To me, it was always at the forefront of motor sport and whenever there was a new evolution of motor sport Lola was always there trying to put its mark on that. Its DNA was always the customer offering, and secondly, partnerships with automotive OEMs (manufacturers). That is ultimately what I'd like to get Lola back to.

"I'm deeply aware that's a bold statement and it's not an underestimation of the motorsport industry. I have a huge amount of respect for the industry and it's going to take a lot of time to get there. But it's something to build towards."

Above all, the new owner is taking a grounded approach. The first priority is to rebuild Lola's infrastructure, in particular the wind tunnel, composites and manufacturing capabilities.

Inevitable links with a return to Le Mans and even IndyCar abound, but Bechtolsheimer says: "We need to be careful not to get engrossed in a vanity project. My main goal is making sure that we're chasing the right opportunities rather than starting off by chasing the spotlight." RT

F1 ramps up sustainability strategy with 2026 fuel commitment

FORMULA 1 has confirmed that a 100 per cent sustainable fuel will be used from 2026 as it steps up its push to hit its Net-Zero Carbon by 2030 target.

Following the successful introduction this season of E10 fuel, comprising 10 per cent ethanol, Formula 1 is working with partner Aramco and all the major fuel manufacturers to develop a 100 per cent sustainable synthetic fuel to power the next-generation hybrid engines introduced for 2026.

It will be a drop-in fuel, so-called because it can be used in the same form in road cars in normal internal combustion engines. The likelihood is that the synthetic fuel will be trialled first in the junior series, F2 and F3.

In a statement F1 said: "Whilst racing fuel represents less than 1% of our emissions, sustainable fuel is the area where F1 can have the greatest effect on the global transportation sector."

Three years ago, F1 set ambitious targets from "factory to flag" as part of a sustainability push to be Net-Zero Carbon by 2030. Since then, it has reduced its carbon footprint through remote broadcast operations, which has enabled the company to reduce freight, while redesigned freight containers mean more efficient aircraft can be used to transport the equipment.

Its offices are now using 100 per cent renewable energy, with the company earning the highest sustainability management accreditation (3*) awarded by the FIA.

In the future, there are plans to build race calendars to improve freight and travel logistics so the sport is moving more efficiently around the world. Carbon reduction measures for fans travelling to F1 events are also being investigated.

'With eight years to go, we are racing towards our target and aiming to show the next generation of fans how innovation and teamwork can tackle the challenges of our time' F1 said in its statement.

ABOVE Nigel Mansell's title-winning FW14B ran with a fossil-free fuel for Vettel's demonstration

Glimpse of the future?

The use of sustainable fuels was highlighted at the British Grand Prix, where Sebastian Vettel demonstrated a Williams FW14B as a tribute to mark the 30th anniversary of Nigel Mansell becoming F1 World Champion. The iconic car was fuelled with P1 Racing Fuels' P1 Eco100 RS, a carbon-neutral fuel.

"I asked myself the question: Can you have fun with a Formula 1 car and at the same time pollute the environment as little as possible?" explained Vettel. "Given that we didn't want to change anything about the engine, could we find a fuel that would replace traditional fossil fuel?

"With this future technology, we are able to keep an old-school platform alive like a traditional racing car and without leaving any ecological traces to drive."

"P1 Eco100 RS is our 100% fossil-free fuel, that can be used without any modifications or alterations to the car," said P1 Racing Fuels CEO Martin Popilka. "Carbon-neutral fuels not only make it possible to keep the vast heritage of motorsports alive but more importantly serve as a means to decarbonise road car fleets by cutting CO2 emissions by up to 90% while reusing current infrastructure.

"We're both very humble and proud, not only to be selected and trusted by Sebastian Vettel, but also that our racing fuel is being used to fuel the legendary and technical marvel the Williams FW14B."

The move stirred a debate on social media, where the irony was not lost on some observers that one of the FW14B's trump cards was active suspension: a technology that would cure porpoising!

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Why AI is F1's "new frontier"

ABOVE The use of AI is increasingly widespread in motorsport's data-rich environment

FORMULA 1's "new frontier for innovation" was underlined last month when Alfa Romeo F1 Team ORLEN revealed that it is harnessing the power of Artificial Intelligence (AI) in an attempt to find an edge on track.

The Hinwil-based team has struck a partnership with SenseTime, a leading global AI software company. As part of the deal, the team and SenseTime will explore innovative applications of AI in the world of motorsport. SenseTime branding is to be featured prominently on the sidepods of the C42 cars of Valtteri Bottas and Zhou Guanyu.

"Artificial Intelligence is the new frontier of innovation and it is something that will influence every field of application – motorsport included," said Frédéric Vasseur, Team Principal of Alfa Romeo F1 Team ORLEN.

"Our partnership with SenseTime will allow the team to work with a global leader in this growing sector, making sure we explore every opportunity to gain an advantage in our competition and continuing to push the boundaries of technologies together."

Racing offers a plethora of opportunities for artificial intelligence to provide an advantage. From parsing through millions of strategy permutations to sifting through the extensive data generated by the car, AI can help analyse the team's own performance – and its competitors' – to help drivers and engineers make the best decisions and optimise the outcome of each race.

In addition to setup and strategy, AI is playing a role in build and simulation in an increasing number of motorsport disciplines. In the World Endurance Championship, for example, Peugeot's new 9X8 Hypercar benefits from a relationship with Capgemini. The multi-national company's data and AI applications expertise will optimise the performance of the revolutionary hybrid Hypercar, both in the simulator and on the racetrack.

Xu Li, Co-founder, Executive Chairman of the Board and CEO of SenseTime, commented: "SenseTime is leading the way in leveraging AI technology to empower a wide range of industries. Our partnership with Alfa Romeo F1 Team ORLEN will unleash the potential of AI to transform the motorsports industry by taking its performance to new heights. We look forward to combining our latest SenseAuto technology with F1's brand to revolutionize motorsport experience."

"Utilising AI technology to enrich people's lives is a step forward toward our vision of 'AI for a better tomorrow'," explained George Huang, CEO of International Business Group, SenseTime. "Our partnership is a great addition to our portfolio of AI solutions for our clients in EMEA, including the Kingdom of Saudi Arabia and the United Arab Emirates." RT

FIA's move to control flex floors is delayed

THE FIA's attempts to control porpoising and the flexibility of F1 cars' floors were thwarted – for a time at least – when the teams resisted the move at a meeting of the F1 Commission ahead of the Austrian GP.

That opposition, led by Red Bull and Ferrari, means the introduction of a technical directive to control bouncing and other related technical matters on the cars has been delayed until the Belgian Grand Prix. The FIA had wanted to introduce a new metric to measure bouncing, and a way to restrict the flexibility of the cars' floors, at the race in France.

The FIA said the delay was 'in order to allow the teams to make necessary updates to the plank and skid assemblies, which will ensure a fair application of the metric used to measure oscillation across all cars'.

One move that has been approved, is an increase in F1's budget cap to reflect the global inflation crisis. Teams will be permitted to spend 3.1% more than previously – this year's cost cap figure had been set at $140m. The figure will be compounded for subsequent years.

A statement also revealed that the 2026 engine regulations are "close to finalisation". Once announced, VW Group brands Porsche and Audi are expected to confirm their entries into F1 from 2026. Porsche is reported to be joining forces with Red Bull as an engine supplier, while Audi is expected to enter its own team, by buying an existing outfit, tipped to be Sauber. RT

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How motorsport can "influence the hearts and minds of consumers"

DAVID Richards CBE, Chair of Motorsport UK, believes motorsport's ability to influence consumer purchasing gives it a key role to play in encouraging the public towards more sustainable technologies.

He addressed the subject as Motorsport UK and the All-Party Parliamentary Group for Motorsport presented 'Our Eclectic Future' at British Motorsport Day in the Palace of Westminster. The event was designed to showcase the vision of a world powered by a range of use-appropriate systems and fuels.

"If the world is to avoid the serious effects of climate change, then we must consider what the future of mobility looks like for the automotive industry," Richards said.

"Motorsport has the power to influence the hearts and minds of consumers. Time and time again motorsport has seized the opportunity when it comes to innovating new technologies that transcend into the wider automotive industry, delivering benefits to consumers globally.

"Motorsport engineers are pioneering both new and existing forms of propulsion to meet the challenges of climate change by creating an eclectic range of solutions.

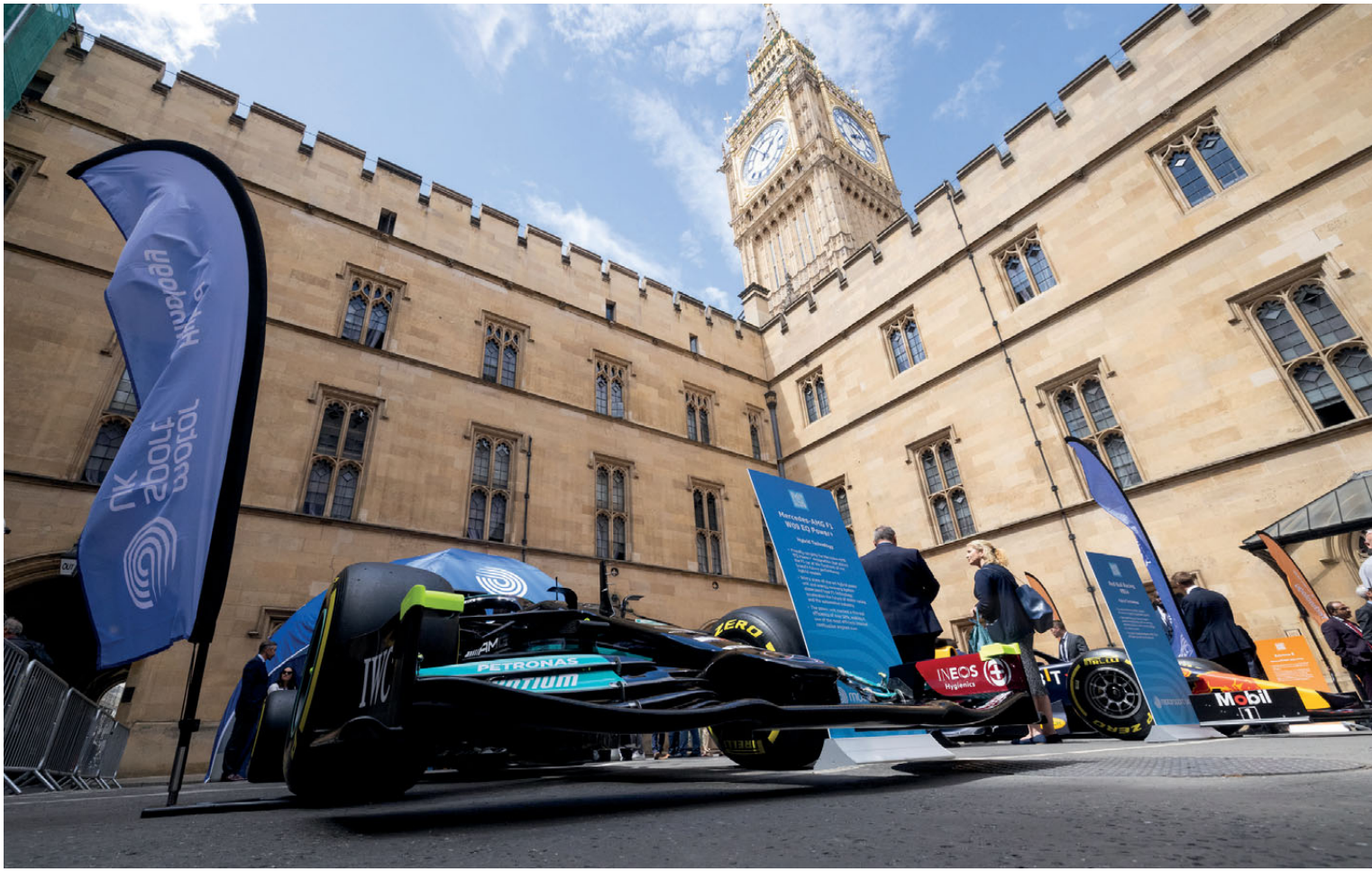
"Fossil fuels will continue to power existing vehicles around the world for quite some time. As the long-term reliance on hydrocarbons begins to shift, hybrid technology, sustainable fuels, battery electric technology and hydrogen technology can provide a solution to a variety of transportation needs.

"The future of mobility relies on these methods of propulsion being promoted equally to showcase that our future is not solely one form, it is all of them working together to provide a sustainable future for the

RIGHT Paddy Lowe, Stefano Domenicali, Sir Lindsay Hoyle, David Richards CBE, Karun Chandhok, James Allison, James Sunderland MP and Greg Smith MP

BELOW RIGHT For once the MPs weren't the star attraction

BELOW The display in the Palace of Westminster



mobility and the motorsport community."

Fossil-fuels will continue to power existing vehicles around the world for quite some time, and therefore solutions are needed to shift to alternative net zero fuels, as well as new technologies that promise a cleaner and more sustainable future.

At the start of British Grand Prix week, Motorsport UK held a vehicle display in Speaker's Court within the Palace of Westminster, and a reception in Speaker's House with key motorsport officials and parliamentarians in conjunction with Mr Speaker, The Rt Hon Sir Lindsay Hoyle MP.

The vehicle display demonstrated the innovations of motorsport engineers who are pioneering new forms of propulsion to meet the challenges of climate change by creating an eclectic range of solutions.

Hybrid technology and battery electric technology are already a presence on UK roads, while others such as sustainable fuels and hydrogen are yet to be made more widely viable for consumers. However, all four technologies feature prominently in the world of motorsport and are being developed at pace.

The continued innovation of these technologies can ultimately benefit the wider automotive sector, as motorsport technology transfers to road cars.

The vehicles on display showcased the technology in action at various levels of motorsport. They included: hybrid F1 cars from Red Bull and Mercedes-AMG; a hybrid British Touring Car from Motorbase Performance; fully electric vehicles including Mahindra Racing's Formula E car, Extreme E's 2022 SUV, and Bambino karts developed by Total Karting Zero; a 1963 Jaguar E-Type and Caterham Seven Roadsport that can run on sustainable fuels; and the Prodrive Hunter that competed on this year's Dakar Rally powered by sustainable fuels.

Alongside learning about the vehicles, parliamentarians had an opportunity to meet Steve Sapsford, Managing Director at Southern California Edison (SCE), an automotive industry expert on future propulsion systems and the role sustainable fuels can play in powering the large number of existing international combustion engine vehicles that are already on the road. He was joined by Paddy Lowe who, following technical roles within Williams, McLaren and Mercedes-AMG PETRONAS F1 Team, founded and is now CEO of Zero Petroleum.

Sapsford presented the scientific data behind 'Our Eclectic Future', explaining that life-cycle analysis shows that battery electric vehicles are part of the solution. They are ideal for inner city urban environments that require zero emissions at point of use, but they are not in fact zero emissions either in terms of lifetime impact, or daily use unless the electricity sourced is itself 100% renewable.

Lowe explained that synthetic fuels are going to become ever more widely available with cost and scale becoming concerns of the past.

Karun Chandhok, Sky Sports F1 pundit and Motorsport UK broadcaster, hosted a Q&A session that included Richards, Lowe, Stefano Domenicali, Formula 1 CEO, and James Allison, Mercedes AMG-PETRONAS F1 Team Chief Technical Officer.

Richards underlined the fact that few industries contain so many highly-skilled engineers who are all motivated to continue innovating and pushing boundaries when it comes to creating sustainable solutions.

Domenicali noted the significant progress Formula 1 has already made in utilising sustainable fuels, including the announcement that a synthetic sustainable fuel is to be introduced in 2026 as part of its programme to be net-zero carbon by 2030.

The Formula 1 boss then emphasised that the series has created the world's most efficient hybrid power units – technology which can only benefit consumers in the wider automotive sector as the best elements are extracted from Formula 1 and into road cars.

Allison reinforced Domencali's point, noting that the Mercedes High Performance Powertrain featured in the team's Formula 1 car is the first to reach 50% thermal efficiency – meaning it extracts more power from gasoline than ever before. Allison confirmed this technology will transfer to the company's road car with the Mercedes-AMG Project One featuring a version of this engine.

The Rt Hon Sir Lindsay Hoyle MP, The Speaker of the House of Commons, said: "It was interesting to hear how motorsport engineers are introducing new technology to help the wider automotive world tackle climate change." RT

Peugeot reveals lure behind WEC comeback

PEUGEOT delivered a ringing endorsement of the innovative Le Mans Hypercar regulations ahead of its 9X8's maiden competitive appearance at last month's 6 Hours of Monza.

When LMH became the new premier class in world-championship endurance racing and at Le Mans, North America's WeatherTech IMSA race series aligned its own regulations with those introduced by the FIA and the ACO (Automobile Club de l'Ouest) by creating an LMDh category (Le Mans Daytona hybrid) with a view to ensuring even bigger grids.

In addition to running chassis supplied by one of four approved makers, competitors in LMDh also share hybrid components. Indeed, one of LMDh's chief differentiating features is the fact that manufacturers bring their own internal-combustion engine (ICE) expertise and body designs to the table but take their chassis and electrification systems from outside suppliers.

IMSA's plan has been vindicated, with five manufacturers having committed to programmes. However, Peugeot has underlined that what attracted it back to top-flight endurance racing with an LMH car was, more than anything else, the electrification aspect and the overall control it gave over the design of the complete drivetrain, and not just the internal-combustion engine.

The Dare Forward plan championed by the Stellantis group effectively targets the whole company becoming entirely decarbonised by 2038 and a halving of its carbon footprint by 2030. The electrification of its production vehicles is clearly poised to play a fundamental role in achieving these aims. Mastering the associated technologies is of course crucial and it is this progress in the fields of electrified powertrains and the related control software that is, claims Stellantis, guiding its evolution from a carmaker into a tech company.

100 per cent Peugeot

"On the one hand, the LMH class enables us to race a car that spectators can immediately recognise as a Peugeot," says Stellantis Motorsport and Peugeot Sport Director Jean-Marc Finot. "The successful collaboration between our motorsport engineering team and the styling department has produced an elegant, racy and uniquely-stylish car. More than that, though, LMH gave us the ability to design and develop a car that is 100 per cent Peugeot. True, we profit from the expertise of some key partners but, importantly, we had complete control over the car's design and complex, four-wheel drive, electric-hybrid system. We had no hesitation whatsoever in opting for the LMH class which will enable us to extend and demonstrate our knowledge in a competitive arena against other major automobile-industry players."

Hybridisation is a primary feature of the Peugeot 9X8's drive system which combines an internal-combustion engine that drives its rear wheels and an electric motor for the fronts. The challenge is to make sure the two function together flawlessly, despite the extreme mechanical and thermal stresses involved, while at the same time delivering uncompromising efficiency, response and reliability.

"As with any hybrid vehicle, the 9X8 is complex. Around two-thirds of its power is provided by the ICE, and the other third is generated by the hybrid system," explains Finot. "The system we use is a 100-per cent Peugeot solution, while the powerful, high-density, 900-volt battery is the fruit of a combined research programme involving TotalEnergies, Saft, ACC and Peugeot."

Meanwhile, the 2.6-litre, 520 kW (710 hp), biturbo V6 that drives the rear wheels, and the 200 kW/270 hp electric motor at the front are the work of Peugeot Sport's research department in Satory, near Paris, under the responsibility of Technical Director Olivier Jansonnie and Powertrain manager François Coudrain.

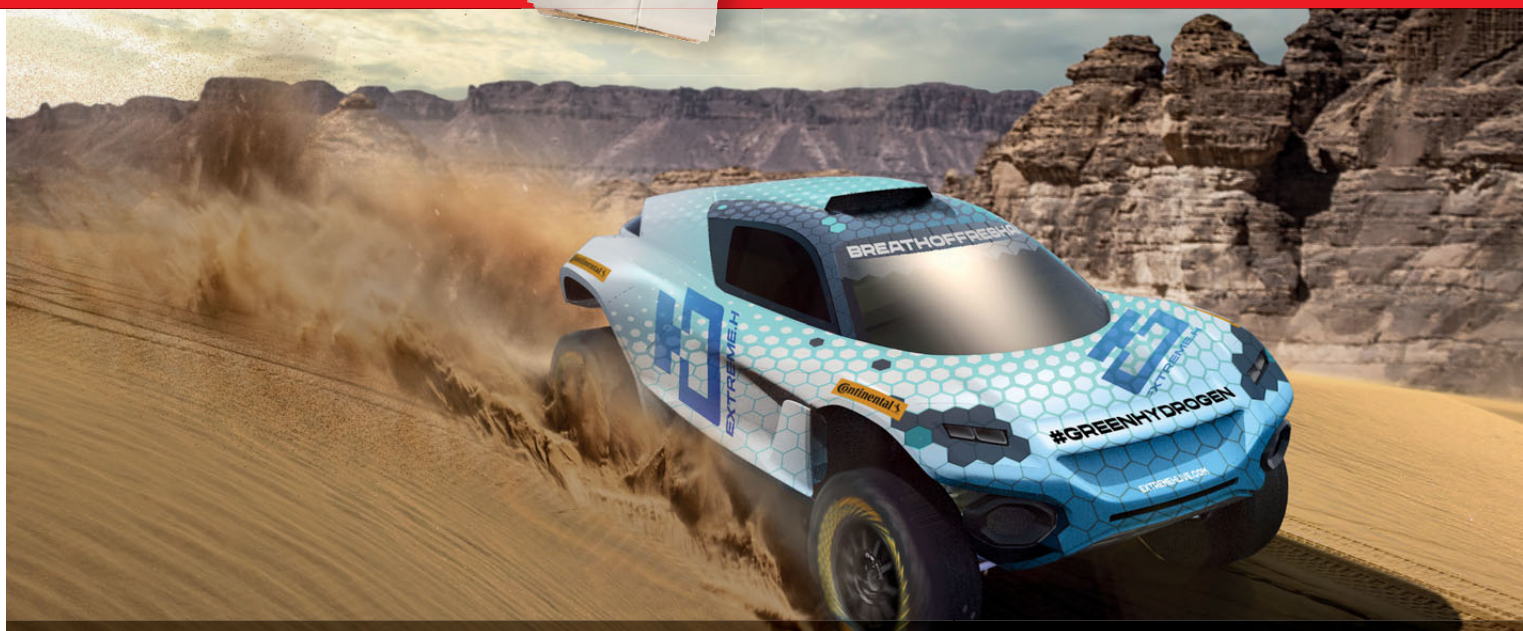
Hybridisation

Although the 9X8 didn't make its maiden competitive appearance until last month's race at Monza, it has already made valuable contributions to the brand's focus on hybridisation. For example, the Peugeot 508 PSE – which was developed by the same engineering team in parallel to the 9X8 – is equipped with a 265 kW/360 hp hybrid system and smart management system derived directly from the Hypercar programme.

Technologies stemming from the 9X8 are already in the process of being carried over to other Peugeot models too, notably in the essential field of electrification.

Ironically, it had been the 9X8's lack of a conventional rear wing that attracted the most column inches ahead of its competitive bow. RT

ABOVE Electrification was the lure behind Peugeot's WEC comeback



NEOM's ENOWA to boost Extreme E with green hydrogen power

EXTREME E has announced a multi-year relationship with ENOWA, NEOM's energy, water and hydrogen subsidiary, to introduce green hydrogen power to its global sustainable racing series.

NEOM, a sustainable region in northwest Saudi Arabia being built from the ground up, has also become the title partner of the McLaren Formula E and Extreme E racing teams under the banner of 'NEOM McLaren Electric Racing'.

ENOWA is the engine room for sustainable energy, water and hydrogen at NEOM. Green hydrogen is widely seen as the most promising green energy carrier for the future to fight climate change. This technology supports the transportation of renewable energy over long distances and the decarbonisation of major industries and infrastructure.

By partnering, Extreme E and ENOWA aim to implement innovative green hydrogen-based technologies to not only power the championship towards a 100% "leave no trace" ambition but also to showcase the opportunities around this technology. ENOWA will play an active part on the scientific advisory board of Extreme E and together ENOWA and Extreme E will develop educational programs intended to excite young generations about climate positive solutions.

Alejandro Agag, Founder and CEO of Extreme E, said: "The work undertaken by ENOWA is extremely ambitious and an exciting prospect. NEOM, much like ourselves, pushes the boundaries of environmental sustainability and we are delighted to be partnering with ENOWA to go even further in our objective to raise awareness of the climate crisis.

"ENOWA plans to lead the development of world-class, sustainable energy, water and hydrogen systems which I am sure will become a reference point in the future, and our series will also benefit from this greater focus on technology and innovation."

ABOVE Innovative green hydrogen-based technologies will be showcased in Extreme E and the forthcoming Extreme H series

Commenting on the relationship, Peter Terium, CEO of ENOWA, added: "Business decisions in NEOM have sustainability at their core, which is why we are delighted to partner with Extreme E. Our partnership is aimed towards both creating visibility to the most urgent problems the planet is facing but at the same time demonstrating solutions that deliver meaningful impact. Together we can accelerate innovations in clean technologies powered by green hydrogen, contributing to hydrogen mobility markets and the future of global decarbonisation."

NEOM is the first to produce green hydrogen at scale, paving the way for the hydrogen economy globally. Due to the abundance of solar, wind and water resources in NEOM, ENOWA and its partners will provide large quantities of green hydrogen that many industries can use. ENOWA benefits from NEOM's greenfield site, which has no legacy infrastructure, to advance energy, water, and hydrogen innovation while providing sustainable fuels like green hydrogen to international users.

At the Season 2 opener of Extreme E in NEOM in February 2022, the series revealed its plans to launch an off-road hydrogen championship in 2024. Named Extreme H, the championship will sit alongside Extreme E, its existing electric racing series, and will be a world-first for motorsport – further reiterating the commitment to showcasing the possibilities of new, sustainable technologies in the race to fight climate issues.

Development for the Extreme H vehicle is already underway, with the aim being the launch of a prototype in early 2023. RT

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FIA introduces first-ever electric rally category

A NEW class for fully electric vehicles has been added to the FIA's rally pyramid, allowing road-going EV cars to be converted for rally use in FIA-sanctioned competitions.

Renault and Opel are among the manufacturers which have been pushing for the introduction of an all-electric category at the bottom of the existing rally pyramid, which had spanned five levels: from the basic Rally5 models to the hybrid Rally1 cars that make up the World Rally Championship's top category.

Now the FIA World Motor Sport Council has ratified a set of technical and homologation regulations for road car-based electric rally cars, branded Rally5e, which will be split into two subdivisions depending on whether a car's battery power is above or below 60 kWh. The new division is seen as the equivalent of the Rally5 category for ICE cars. RT

Stellantis

BELOW Opel, which is entering its second season with the Corsa-e, had lobbied for a new category

KWSP sets up 'skunk works for OEMs' facility

KWSP, a renowned high-performance engineering consultancy, has relocated to Silverstone Park, establishing a 'skunk works for OEMs' facility.

The company was previously based at Bicester Heritage.

Its all-new 28,000 square-ft facility combines a modern and expandable office space with a significant and adaptable workshop space and assembly area. The hope is that it will prove a draw for customers looking to outsource or 'Skunk Works' end-to-end design, development, production and testing of niche vehicle programmes and motorsport projects.

"Relocating to new headquarters at Silverstone Park will deliver a step-change in capability for our customers," said Kieron Salter, CEO of KWSP. "The new office will house our rapidly growing engineering team, while the hybrid workshop assembly area will give us greater capacity than ever before to deliver high-performance road, track and motorsport projects – not to mention the substantial development and testing advantage of being located next to Silverstone Circuits."

The move coincides with KWSP's 10-year anniversary, celebrating a decade of consultancy work with blue-chip companies including F1 teams, automotive OEMs, the aerospace and defence sector and professional sports. Projects have ranged from complete niche vehicle programmes to mule vehicles, show cars and Olympic sports.

KWSP's sister company, the Digital Manufacturing Centre (DMC), is also located at Silverstone Park and has experienced significant growth since opening in 2021.

The DMC is a state-of-the-art commercial additive manufacturing facility that will also continue to produce parts for use in KWSP projects. Co-locating the two businesses will enable greater collaboration, leveraging each other's capabilities.

"After 10 years of specialist, high-performance engineering and a myriad of fantastic projects, we are now working on some of our most exciting programmes yet," said Salter. "All will be revealed later this year, but this new move marks the beginning of a bold new chapter for the business." RT

LEFT The move opens a new chapter for KWSP

Riches to retire as BTCC tech chief

KWIK Fit British Touring Car Championship series organiser, TOCA, has announced that Technical Director Peter Riches will be retiring from the position at the end of the 2022 campaign.

Riches' illustrious BTCC career spans an impressive four decades. At at the end of the year he will have worked in more than 320 race events, 820 races and 30 seasons. His expertise has been paramount in technical developments within Britain's premier motorsport series over the years, while his involvement within the motorsport industry goes back to the 1970s.

Riches, who originally joined TOCA as a scrutineer in 1993 from Lotus, where he had worked since the '70s, is one of the most recognisable and familiar characters in the BTCC. He has also been a key figure in the success of touring cars on the world stage, through his role on the FIA Touring Car Technical Working Group and as a Super Touring technical delegate.

He helped devise the BTC Touring regulations that replaced Super Touring in the BTCC in 2001 and has been instrumental in making the current NGTC regulations such a huge success. Riches has been mulling retirement for some time, but was persuaded to stay on in order to smooth this season's transition to hybrid technology and a more sustainable fuel.

Throughout 2023 Riches will be retained as a consultant in order to assist the TOCA technical team. His retirement will see Sam Riches – his son – step into the role, having also worked within the BTCC for more than 20 seasons himself, importantly providing a seamless transition moving forwards.

Peter Riches said: "This is something we've been preparing for, and I feel ready to retire, the world is so different now to where we started. I had a set of scales in the pit lane and a boost control system and that was it basically, and now we've got a 40-foot trailer full of kit, the world has moved on!

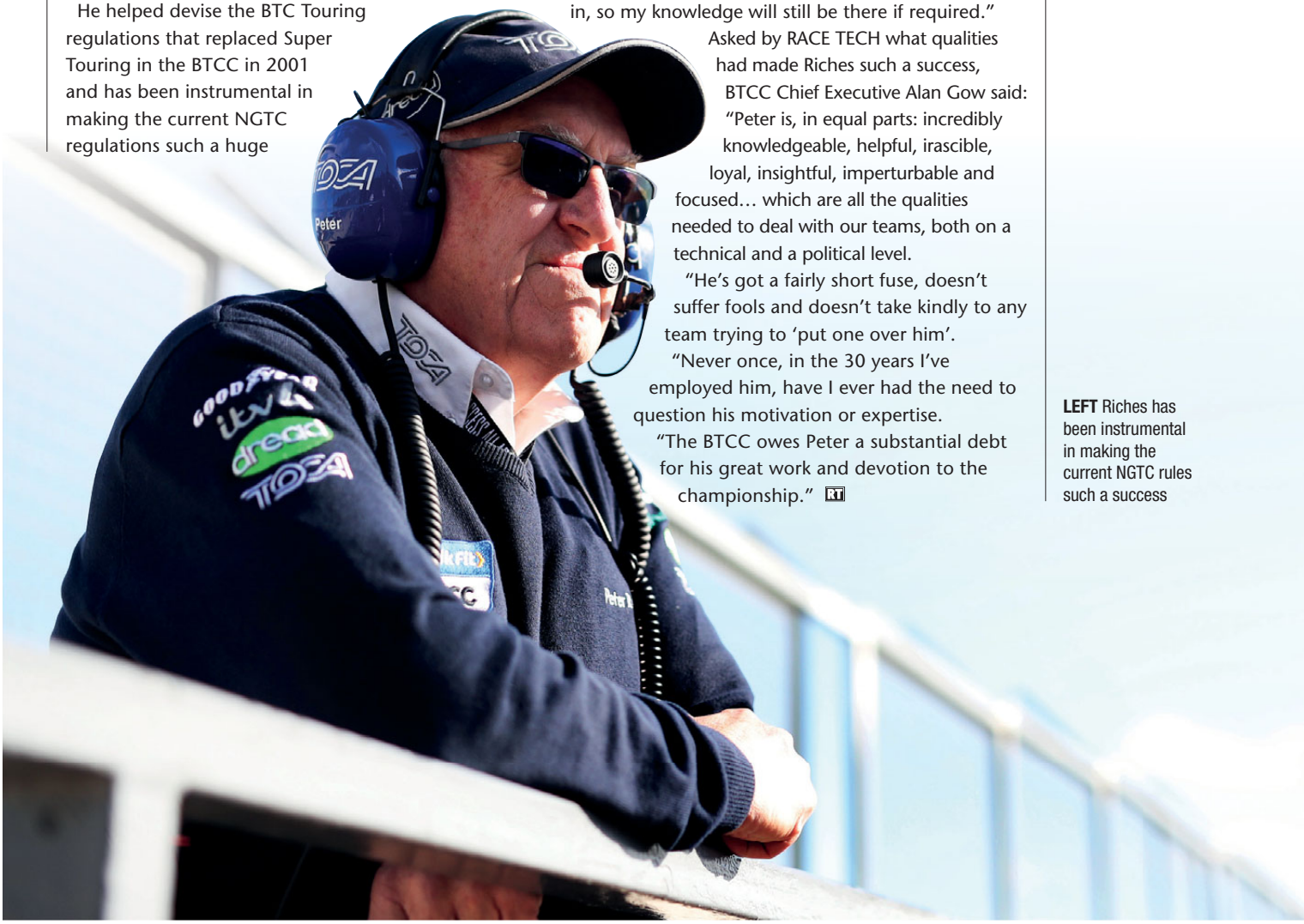
"[As a consultant] next year, I'll be in more of a guiding role, maintaining the things we've done in the past and ensuring the wheel doesn't get reinvented and become square in order to have a smooth transition. What we don't want to do is change the direction we've been going in, so my knowledge will still be there if required."

Asked by RACE TECH what qualities had made Riches such a success, BTCC Chief Executive Alan Gow said: "Peter is, in equal parts: incredibly knowledgeable, helpful, irascible, loyal, insightful, imperturbable and focused… which are all the qualities needed to deal with our teams, both on a technical and a political level.

"He's got a fairly short fuse, doesn't suffer fools and doesn't take kindly to any team trying to 'put one over him'.

"Never once, in the 30 years I've employed him, have I ever had the need to question his motivation or expertise.

"The BTCC owes Peter a substantial debt for his great work and devotion to the championship."



LEFT Riches has been instrumental in making the current NGTC rules such a success

Michelin reaches over 50% sustainable materials in tyres

A MICHELIN racing tyre containing 53% sustainable materials equipped the Porsche 718 Cayman GT4 ePerformance at last month's Goodwood Festival of Speed.

The tyre was first showcased on GreenGT's hydrogen fuel cell prototype at Le Mans, but Michelin sees Porsche's all-electric programme as a first-class opportunity to further accelerate the move towards sustainable mobility. The company is looking to increase its share of the high-performance electric-vehicle tyre market thanks to bespoke solutions.

At last August's Le Mans 24 Hours, Michelin revealed the new tyre containing 46% sustainable materials it had developed for GreenGT's prototype. Now, it has taken the proportion of biosourced and recycled raw materials to 53%, with no detriment to performance and safety.

The sustainable raw materials that go into these tyres range from natural rubber and carbon black recycled from end-of-life tyres, to orange and lemon peel, pine-tree resin, sunflower oil and scrap steel. In keeping with its Michelin In Motion policy, Michelin plans to make all its tyres exclusively from sustainable materials by 2050.

Porsche's all-electric motorsport programme will provide Michelin with a chance to evaluate its sustainable solutions in the extreme conditions associated with top-flight racing. The French firm is determined to accelerate the development of its technologies and their carry-over to production electric-vehicle tyres, while the energy transition provides it with a valuable opportunity for growth.

Matthieu Bonardel, Director, Michelin Motorsport, said: "Our close work with Porsche on the new, fully electric 718 Cayman GT4 ePerformance race car is concrete evidence of the progress Michelin has made in the fields of sustainable materials and electromobility. Just as it does in the FIA Formula E World Championship and motorcycling's FIM MotoE World Cup, our involvement in the new all-electric championship alongside Porsche will enable us to accelerate the development of sustainable innovations that are ultimately accessible to all." RT

BELOW Michelin has upped the proportion of sustainable materials in its racing tyres

Firestone returns to Indy Lights

FIRESTONE will become the sole tyre supplier for Indy Lights in 2023.

The move will mark a return for Firestone to IndyCar's developmental series as the Bridgestone brands Firestone and Dayton supplied tyres for Indy Lights from 1991 to 2013.

"Firestone continues to be a phenomenal partner," said IndyCar President Jay Frye. "Their attention to detail, safety and performance is unmatched. Supplying their world-class product to the NTT IndyCar Series and Indy Lights reflects Firestone's commitment to IndyCar's present and future."

IndyCar assumed total control of Indy Lights operations in the autumn of 2021. The 2022 season began a more inclusive atmosphere with the NTT IndyCar Series, with integration in marketing, digital assets and race officiating.

"We want to thank Cooper Tires, who has been a partner with Indy Lights since 2014," said Indy Lights Director Levi Jones. "Their assistance while IndyCar assumed operational control was crucial to our success."

The deal was announced at the grand opening of Firestone's Advanced Tire Production Center (ATPC) in Akron, Ohio. RT

Griiip enters sim market

GRIIIP, the Israeli motorsport technology company, has made its entry into esports and simulator racing, after announcing the acquisition of United Racing Data (URD) – a telemetry web service for simulator racing.

As part of the acquisition, Amir Meshulam, URD's founder, Joined Griiip as its new Chief Of Technology.

"I am very excited to Join forces with Griiip and merge my passion for racing and technology to help Griiip in its mission to make racing data accessible for the entire motorsport ecosystem, both real and virtual," said Meshulam.

The platform would allow Griiip to introduce new features into simulator racing leagues, before implementing them in its growing network of "real" racing leagues, including DTM and Porsche Carrera Cup North America. It also brings closer the unification of performance data analysis among the two types of racing, both from professional development and fan-engagement aspects. RT

Goodwood record-breaker announces strategic tech partnership with Molicel

GOODWOOD sensation McMurtry Automotive and Molicel have signed a strategic technical partnership designed to demonstrate and improve current and future generations of Molicel power-optimised battery cells.

The two companies will introduce new cell technologies using the McMurtry Spéirling as a high-speed test bed. The high power running at over 200 mph when in grand prix circuit configuration, combined with rapid charge and discharge cycles, is seen as a natural fit to accelerate cell technology and application knowledge.

The two companies' technologies are complementary. Molicel delivers niche, advanced, energy dense, high charge and discharge rate cells in applications such as sports cars, motorcycles, VTOL, aerospace and heavy-duty tools. McMurtry Automotive is industry-leading in overall battery design and cell integration techniques with proprietary technology in thermal management, busbar design, structural integrity, safety and overall pack geometry, including pending IP protection.

The combination of the two is seen as a natural fit for achieving high performance in an electric vehicle.

Molicel's cells have been powering the McMurtry Spéirling which first debuted at Goodwood Festival of Speed 2021 and has just set the all-time record there in 2022.

Thomas Yates, McMurtry Automotive Director, said: "The battery pack is a defining element of our unique car concept. The cell capability within that has a first order effect on the mass and packaging volume of the entire car, plus the obvious power output to the drive motors. Therefore, in the heart of our car, we are leaving no stone unturned to deliver a power dense, compact and lightweight battery.

"The Molicel cells have delivered a competitive advantage in achieving these aims and they have powered the novel performance that the world has just witnessed at Goodwood. I'm also looking forward to integrating the next generation of Molicel cells into our future products."

The battery pack is engineered and built by the McMurtry team in the UK using a P26A cylindrical lithium ion Molicel product to achieve a 60 kWh capacity.

The key requirements for the cells are high power, low impedance and fast charge/discharge. One benefit of a low impedance cell is a comparatively small temperature increase during high current drain, therefore thermal design at pack system level can be simplified, making the resulting battery pack smaller and lighter.

Molicel representatives from Taiwan and Canada were at Goodwood to meet interested parties throughout the weekend and support the team.

Molicel's future developments include an even higher power cell capable of delivering 5C fast charge (6 mins = charge up 50% capacity). These could feature in future McMurtry and customer applications. RT

LEFT The McMurtry Spéirling will be a high-speed test bed for the introduction of new cell technologies

Super GT Championship introduces 100% renewable fuel

ETS Racing Fuels, a leading fuel development partner for the racing industry and a brand of HCS Group, has been selected by the GT Association (GTA) to supply its 100% sustainable fuel to Super GT racecars from the 2023 season onwards.

Super GT is the first Asian series to introduce a fully renewable gasoline.

The fuel, Renewablaze GTA R100, is produced from a number of different sources of sustainable biomass and consists of 100% plant-based raw materials. The feedstock is derived from cellulosic material that is converted into hydrocarbons and oxygenates. It contributes significantly to the reduction of greenhouse gas (GHG) emissions by reducing CO2 emissions through the CO2 absorption of the growing plant and from avoiding the release of CO2 held within more conventional fossil feedstocks.

Masaaki Bandoh, Chairman of the GT Association, said: "The motorsport industry is strongly committed to a low carbon future and is putting all its efforts into implementing sustainable fuels. For the Super GT series, we have decided to introduce a 100% renewable fuel as one of the key approaches to environmental sustainability."

"As a strong partner to the motorsport industry and a pioneer of fuel development, we are committed to support the racing sector on its journey to going greener," said Dr Bruno Philippon, Senior Vice President Business Unit Mobility, ETS. RT

Motorsport UK launches StreetCar

GRASSROOTS competition is undergoing a major rebrand in the UK to help uncover 'motorsport's best kept secret' for everyone.

Motorsport UK, the national governing body, has launched 'StreetCar' to encourage more people to get behind the wheel and enjoy the sport; overturning the age-old perception that it is out of reach for most people.

StreetCar will showcase the existing vibrant grassroots motorsport scene, demonstrating that a wide range of low-cost disciplines are available that provide a wide variety of format and challenge.

"It is really, really important that we raise awareness of grassroots motorsport because to those of us who are involved, we know all about it, but that is not the case for many people on the outside," stressed Laura Cooledge, Club Development Officer at one of StreetCar's first approved clubs, Anglia Motorsport Club (AMSC).

Segmented into Autotest, Trials & Cross Country and Rally, the 12 StreetCar disciplines are:

- Autotest, AutoSOLO and Production Car Autotest
- Trials and untimed Cross Country events
- Rally including Touring Assemblies, Treasure Hunts, Navigational Scatter, Navigational Rally, Road and Historic Rally, 12 Car Rally and Targa Rally

All 12 disciplines can be participated in with a standard unmodified road car without special safety kit and to drive only a free Motorsport UK RS Clubman licence is required.

Motorsport UK will work with its Regional Associations and motorsport clubs to promote clear pathways into the disciplines, demonstrate the ease in which newcomers to motorsport can get involved and how existing community members can try something new for the first time.

Hugh Chambers, Chief Executive Officer at Motorsport UK, commented, "StreetCar is motorsport's best-kept secret. The 12 disciplines are affordable, can be enjoyed in any legal road-going car, and there are events held across the UK throughout the year.

"Our StreetCar campaign will help bring these events and our community to life, showcasing their vibrancy whilst providing a framework for our clubs to attract new audiences, increase participation and deliver new club members.

"From the buzz of an AutoSOLO, to the uphill challenge in Trials and the exploration of a Navigational Rally, there is something for everyone in StreetCar. We strongly encourage anyone who's been wanting to get involved in motorsport to get in touch and start their journey today."

So far in the launch phase, eight Motorsport UK clubs have received StreetCar status including Anglia Motor Sport Club, Basingstoke Motor Club, Devizes and District Motor Club, Farnborough Motor Club, Isle of Wight Car Club, Loughborough Car Club, Middlesex County Automobile Club, and The Sporting Car Club of Norfolk.

Motorsport UK will provide guidance and help to all StreetCar clubs. They will all receive a StreetCar toolkit, outlining how to welcome new participants, organise events and ensure best practice is applied in their marketing and communications.

Motorsport UK will also provide clubs with customisable branded assets, promotion of their events in Revolution and on Motorsport UK's digital channels as well as physical branding to bring their StreetCar events to life.

By the end of 2022, it is planned for up to 50 clubs to be active in StreetCar across the UK. A dedicated StreetCar website and Facebook Group have been established and will act as the first touchpoint for those wanting to get involved. RT

ABOVE & BELOW
The StreetCar MINI will showcase the initiative throughout the UK

NEOM partners with McLaren on electric racing

A STRATEGIC partnership between NEOM and McLaren Racing is to bring the UK team's Formula E and Extreme E teams under the same banner: 'NEOM McLaren Electric Racing'.

Commenting on the partnership, Nadhmi Al-Nasr, CEO of NEOM, said: "Our partnership with McLaren Racing complements NEOM's commitment to driving sustainable solutions and tackling some of society's most pressing challenges. The partnership will allow us to share our collective resources and experience to yield exciting results, not only for our own organizations, but also for the broader automotive and sports industries. NEOM is an economic engine for the Kingdom of Saudi Arabia and will be a hub for innovative businesses like McLaren Racing to conduct cross-industry research, incubate, collaborate and bring new technologies to the world."

McLaren will collaborate with NEOM across multiple areas, becoming a founding partner of OXAGON, a city in NEOM set to be a blueprint for the future of advanced and clean industries and a hub for innovation. McLaren will be located within OXAGON's Research and Innovation Campus, which is being designed by international architects, Grimshaw. The campus will provide cutting edge facilities and collaboration spaces, accelerating ideas from labs to market to develop industries and products of the future.

McLaren will lend its digital and analytical expertise as a technical partner of OXAGON's advanced and clean manufacturing ecosystem.

A further significant element to the partnership will be rolled out during 2023 when, in line with NEOM's commitment to developing Saudi talent, McLaren and NEOM will create a bespoke program to nurture engineers and students; 20 Saudi graduates from NEOM's Graduate Program will each take part in a one-year placement with McLaren Racing at the McLaren Technology Centre in the UK. RT

ABOVE McLaren partnered with NEOM to step up its electric racing assault

McLaren lands Nissan powertrain

NISSAN and McLaren Racing have announced a multi-year technical collaboration, which will commence at the beginning of the 2022/23 ABB FIA Formula E World Championship season.

The partnership will see the Japanese automaker supply its Nissan EV powertrain technology to the famous British team for the entirety of the Formula E Gen3 era. Nissan will also continue to compete in Formula E with its own factory team, having recently acquired the e.dams squad.

"Our new partnership with McLaren Racing will be a powerful one, as the association will inspire collaboration and knowledge sharing," said Ashwani Gupta, Nissan's chief operating officer. "The pioneering spirit and drive to innovate are characteristics Nissan and McLaren Racing share, making them an ideal partner for us in Formula E and as we continue to electrify our vehicles."

Zak Brown, CEO, McLaren Racing, said: "As we are shaping the team for its first season as McLaren in Formula E, we are naturally seeking the best partnerships and opportunities on every front – with the technical aspect being one of the key areas. Nissan have proven their knowledge, craft and commitment over the last four seasons in Formula E, and heading into the Gen3 era, we have full confidence that the collaboration will bring both parties much success. This will be a true partnership that will drive both the team's performance and the development of the Nissan Formula E powertrain technology."

Tommaso Volpe, general manager, Nissan Formula E, and managing director, Nissan e.dams Formula E Team, commented: "Formula E's exciting new Gen3 regulations will see the performance of the all-electric race cars reach incredible new heights. At Nissan, we are in Formula E not only to race, but also to showcase to a diverse range of viewers just how impressive, powerful, and efficient our electric vehicles are. Our collaboration with McLaren will provide us with even more opportunities to accelerate the development of our technology and showcase it to fans all over the world."

As part of its goal to achieve carbon neutrality across its operations and the life cycle of its products by 2050, Nissan intends to electrify every all-new vehicle offering by the early 2030s in key markets. RT

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THOMAS KRAEMER, Director Motorsport Quality Management, Porsche Motorsport

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FROM *OLD* AMBULANCE TO *NEW* KING OF THE HILL!

Chris Pickering talks to the UK squad propelled into the limelight by record-breaking feats at Goodwood with a spectacular machine inspired by Brabham's F1 fan car

THE McMurtry Spéirling is quite unlike anything else in motorsport. Styled like a miniature Batmobile, it sits a full four feet shorter than a Formula 4 car and roars into view with a noise like a jet fighter on full afterburners. It also happens to be electric, although it's not the 1,000 hp twin-motor powertrain making all that noise – it's the two 60 kW fans sucking it down onto the track. Combined, they can produce over 2,000 kg of downforce in a car weighing less than a tonne. And they can do it right from the starting line.

It's this miniature marvel that now holds the outright record at the Goodwood Festival of Speed hillclimb, beating the unofficial record set by the might of Volkswagen Motorsport and the Pikes Peak-winning I.D. R. The Spéirling, however, wasn't designed solely to break records. It's been built to lap circuits, and its creators hope they will one day see it racing wheel-to-wheel.

The team behind the project is led by engineer and entrepreneur Sir David McMurtry. Having begun as an apprentice in the aerospace industry, he worked on the engines for Concorde before co-founding metrology specialist Renishaw. In 2016, he created McMurtry Automotive and began assembling a small team of ex-F1 engineers. Their brief was to create a car that went against the trend for bigger and heavier vehicles – something that would use its compact stature to giant-killing effect.

"We set out to deliver a car that would be amazing in a small package," recalls McMurtry Automotive's managing director Thomas Yates. "Our target was to build something that was similar in size to a 1960s Formula 1 car, but absolutely ludicrous in terms of performance."

Of course, there are very sound reasons for the increase in size that Formula 1 cars and the like have seen since the 1960s. Top of the list is aerodynamics, with a large footprint being a necessity if you want to achieve high levels of downforce using conventional techniques.

"If you look at the Volkswagen I.D. R, which the Spéirling has been compared to since Goodwood, it's a much, much larger car, and it uses a huge amount of conventional aerodynamics. To get sufficient downforce in a small package, we had to think outside the box," notes Yates.

Again, it was motorsport history that led the engineers to a most unusual solution. Inspired by the Chaparral 2J Can-Am car and the Brabham BT46B that applied a similar principle in Formula 1, they decided that the answer was to suck the car down onto the track using a fan system.

"Nobody has raced a fan car since 1979, when the BT46B returned for a one-off non-championship event at Donington Park. And certainly my feeling was that the reasons this technology got banned had more to do with politics than credible ▶

BELOW & LEFT The noise, generated by a twin-fan setup, was almost as impressive as the McMurtry Spéirling's record-breaking time

technical challenges," comments Yates. "It was actually voluntarily withdrawn from Formula 1, just because it was clearly a huge competitive advantage to have this technology. So we set out to see what we could do to revive the concept."

Call an ambulance

The first experiments began with static test rigs, followed by trailer-mounted systems that were towed behind a separate vehicle. Next, the team bought and converted an old ambulance – the only van that they could find with a large engine and heavy-duty air suspension to cope with the two tonnes of additional downforce that they planned to develop. This somewhat unlikely test mule was taken to Thruxton, where it lapped at over 80 mph, producing strong levels of downforce.

With the proof of concept validated, work began on the car itself, with the compact footprint and the fan system as the two main pillars of its design. The biggest challenge was miniaturising the fan system, which had taken up half of the ambulance in its original incarnation. Dozens of different design iterations are said to have gone into the packaging before the team found a solution that they were happy with.

"To build a good electric car, it's really fundamental that you have control over the chassis design and the battery design," comments Yates. "The battery is obviously the biggest, heaviest item within an electric car. So having the freedom to make micro-level changes to get your centre of gravity as close to the right place as you can and package all of the ancillary components – and, in our case, some of the not-so-ancillary components like fan systems – is hugely challenging. The team has delivered an absolute masterclass in packaging."

The finished car uses a twin fan system. That configuration was largely chosen for its ability to deliver redundancy – if one fan were to fail mid-corner, the car would still retain a majority of its downforce. It sits in a small cavity behind the rear bulkhead, occupying a tiny fraction of the space taken up by the fans used on the original Brabham and Chaparral cars.

RIGHT Yes, that is 190 mph on the dash! Without the downsides of relying on conventional downforce, the car is well-suited to close racing

BELOW Brabham's BT46B fan car was one of the inspirations for the project

LAT/Newspress

Detail development

The Spéirling was first unveiled at Goodwood in 2021, but it only performed a series of short demo runs. Since then, however, a huge amount of development work has gone into further optimising the all-important fan system. Much of this was carried out using CFD, Yates explains.

"It's basically a fluid system that takes air from underneath the car and transfers it out of the back," he points out. "And anything that you put in that fluid path that generates loss or pressure drop or anything like that gives you a significant penalty. So we did a lot of work on trying to improve that aspect of the system, but also the way that we do the seals underneath the car and through the system. We were then able to go back to Goodwood this year with a car

RIGHT Max Chilton, who witnessed the previous official record being set when he was just eight years-old, described the run as one of the most memorable moments of his career

> *"A masterclass in packaging"*

that genuinely has more than two tonnes of downforce, which was very exciting to be able to say. We'd always been aiming for that figure, but we wanted to be super conservative with the numbers until we'd done it on the actual car."

The control of the fans is relatively straightforward. For the Goodwood runs, a target fan speed was set and maintained all the way up the hill. However, using electric fans does open up some intriguing possibilities. On the straights, the fans can be deactivated, not only eliminating 60 kW or so of power drain, but also significantly reducing the rolling resistance of the lightly-loaded tyres.

"If you're travelling at somewhere in the region of 150 to 200 mph, a huge amount of the energy produced by a car with conventional aerodynamics is going into driving wings through the air to generate downforce. The fan system is an order of magnitude more efficient," explains Yates.

Efficiency is key to all electric cars, and Yates emphasises that the Spéirling is designed to lap circuits for whole sessions, not just set flying laps. There's also a road-going version in development, which could be another area – indirectly, at least – where this technology plays a part.

"In our experience, when you look at WLTP range numbers for an electric car, roughly 70 per cent of the energy that's consumed is down to aerodynamic drag," comments Yates. "So, if you can de-couple drag and downforce to a large extent, then you have this wonderful freedom to deliver a car that's very fast on the track but also capable of travelling very far on the road."

In the case of the Spéirling, the team's target is a 300-mile WLTP range for the road-going variant. Perhaps more importantly for a single-seat track day weapon, it should translate to a reasonable duration on track. McMurtry has yet to give an indication of how long the battery will last under racing conditions, but it's likely to be long enough to give the average amateur driver a pretty thorough workout, with cornering loads of more than 3G and nought to 186 mph in under nine seconds. ▶

Signed and sealed

The Spéirling's footprint is so compact that there's little room left for conventional underbody aerodynamics, but Yates says there's nothing to stop traditional concepts being applied alongside the fans.

"We think the ideal way to deliver this system would be in combination with a light touch of conventional aerodynamics," he comments. "If you're trying to run a seal system underneath the car, you start to get a reduction in downforce if it's going right across a serrated kerb. That's a good thing, in some respects, as it would help to enforce track limits – something that's a bit of a challenge in Formula 1 currently. And having a bit of conventional aerodynamics on the car, such as the small rear wing that we've now added to the Spéirling, gives you a nice level of stability even if you're going over the kerb."

The patented sealing system uses moving skirts. It has been tested on a wide range of circuits in the UK, ranging from billiard table-smooth grand prix tracks to club racing venues (and, of course, the Duke of Richmond's driveway at Goodwood House). Surface quality does have a measurable impact on the effectiveness of the system, but we're told it's fundamentally compatible with anything you might find on a racetrack. That includes rain – in fact, the team were amazed to discover that the car was almost as quick around Silverstone in the wet as it was in the dry.

But what about roads? Yates is careful to point out that the road-going version of the Spéirling will very much remain a track-focused machine, and the fan system is not designed for road use. He likens it to a Track mode for the ESC system or the suspension on a conventional hypercar.

"It'll be a track system that's included in a road-legal car," he notes. "But it's already going to be ludicrously fast, even without that."

It should be safe too. The chassis is a full carbon monocoque, built to the 2018 LMP1 safety standards, with composite crash structures. Taiwanese manufacturer Molicel provides the cells for the battery, which are integrated into a semi-structural pack that sits in a U-shape, either side of the driver's legs. Its total capacity is broadly similar to a Gen2 Formula E battery at 60 kWh, but it produces nearly three times the power.

"Normally, there's a pretty severe trade-off between power density and energy density in a battery, but the cell design that we're using seems to be one of the few that can deliver both," notes Yates. "We've got a proprietary approach to combining those cylindrical cells into battery packs that allows us to produce quite unusual shapes. It's about the way that we approach the cooling and the structural design, plus how we arrange the modules to get the right parallel and series streams for the output and the capacity that we want."

There's said to be a significant amount of proprietary technology in the motor design ▶

RIGHT Conventional aerodynamics, such as the small rear wing now added to the car, help provide stability over kerbs

LEFT Vital data will be harnessed in the car's new role as a test bed for battery cell technology

BELOW Propelled by a 1,000 hp twin-motor powertrain, the car eclipsed the feats of an F1 car and VW's I.D. R

> *"Our target was to build something that was similar in size to a 1960s Formula 1 car, but absolutely ludicrous in terms of performance"*

too, although the exact details are still under wraps. What we can tell you is that each rear wheel has its own motor and inverter driving through a single-speed transmission. Unlike a lot of high-performance EVs, there's no drive to the front wheels, but traction is presumably less of an issue when you have the weight of a fully-grown rhinoceros pressing down on each set of tyres (and it may also allow the car to run a more rearward bias for its regenerative braking).

Record breaker

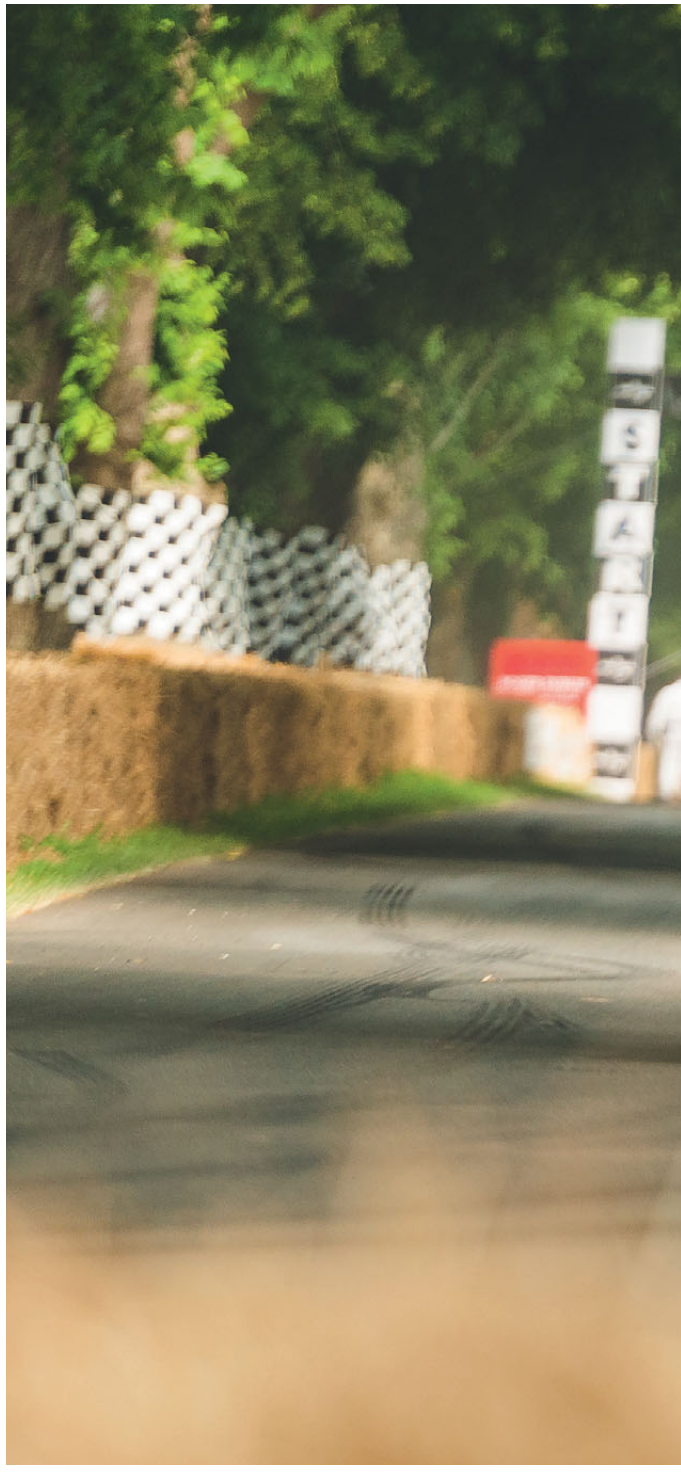
The McMurtry team used their factory development car to set the record at Goodwood. It was effectively standard, apart from a set of shortened gearbox ratios that capped the top speed to 150 mph, but brought the nought to 60 mph time down to less than 1.5 seconds – around a second faster than a modern Formula 1 car.

"The first year that Volkswagen made an attempt on the Goodwood Festival of Speed hillclimb they were running a 45 kWh battery; the second year they came back with an 8 kWh battery, so they took a lot of weight out between the two years. We broke the record on our standard 60 kWh battery," comments Yates.

Simulations had shown that it was theoretically possible for the car to break the record, but it would rely on the drivers stringing together a near-perfect run. Factory development driver Max Chilton would be available for the timed shootout on Sunday, but he had a long-planned personal commitment for the qualifying runs on Saturday, so former British Hillclimb Champion and friend of the company Alex Summers was drafted in.

He set a blistering time of 40.056 seconds – just 0.157 seconds adrift of the unofficial record set by the Volkswagen I.D. R during a practice session in 2019. That's also more than a second inside the official long-term record set by Nick Heidfeld in a V10-powered McLaren MP4/13 Formula 1 car back in 1999. Chilton returned on Sunday with an inch-perfect run that

ABOVE The Goodwood triumph opened many doors. Here Sir David McMurtry meets with Marcos Saito, Director of Sales - N.America and Europe, at E-One Moli Energy



RIGHT The McMurtry Spéirling eclipsed an official record that had stood since 1999

saw him cross the line in 39.08 seconds. The former F1 star, who witnessed the previous official record being set when he was just eight years-old, described it as one of the most memorable moments of his racing career.

So what next? McMurtry plans to continue its record-breaking exploits, as well as developing the road-legal version and getting it out to customers. But racing could be on the cards too.

"We'd really like to see the car circuit racing," comments Yates. "Given the pressures on the motorsport industry as a whole to achieve energy efficiency, it seems to be a bit of a golden opportunity to deliver a vehicle that uses a lot less energy for the same performance or one that goes a lot faster for the same amount of energy."

Some have voiced concerns about the system – notably its potential to dramatically increase speeds through slow corners – but Yates doesn't see this as a problem, and he believes the concept could actually offer safety benefits.

> *"The weight of a fully-grown rhinoceros pressing down on each set of tyres"*

"It's the only car I'm aware of that can still develop maximum downforce if it's heading backwards towards a wall," he comments. "Plus, it's not susceptible to losing downforce if you're following another car very closely. In fact, the nice thing about the fan system is that you get all the usual slipstreaming effects, without the downsides of following a car that relies heavily on conventional aerodynamics, so it really lends itself well to close racing."

Overwhelmed

The team at McMurtry have been overwhelmed by the response to the car since its exploits at Goodwood – the relatively little-known British company reportedly received over a thousand additional emails in the first week after hitting the headlines. And Yates believes there's a real desire to see this innovative technology return to motorsport.

"It's something very novel, and it's particularly relevant to electric vehicles," he says. "Not only are there performance benefits, but it makes a really nice noise. When we've taken it to test days it's on a similar level to the internal combustion-engined cars, and there are actually options that we're aware of to make it even louder. So it does certainly answer a few of the challenges that are facing motorsport at the moment, including the lack of drama with the sound of traditional EVs."

And perhaps that's why the Spéirling has turned so many heads? Yes, it's an underdog that has quite literally punched above its weight in the hillclimb at Goodwood, but it's also inescapably different in a world where – alternative powertrains aside – most racecars appear increasingly generic to casual observers. The rule-makers in other forms of motorsport would do well to take note. RT

Motorsport should be part of the solution, rather than part of the problem

Thomas Laudenbach, Porsche's head of motorsport, talks electrification, endurance racing and e-fuels with **Chris Pickering**

THOMAS Laudenbach might just have the best job in racing. As the new head of Porsche Motorsport, he oversees an incredibly diverse portfolio that includes the world's largest customer racing programme, a works Formula E team and the new 963 sports car project that's targeting outright victory at Le Mans. And that's before we mention Porsche's much-anticipated return to Formula 1.

You might expect a man with that many commitments to seem a bit overwhelmed, but Laudenbach clearly relishes the challenge. He's upbeat, straight-talking and brimming with enthusiasm.

"It really is an honour to be able to do this job," he says. "As human beings we're always solving problems. And, yes, what we do here is also a business and it's done very professionally, but when I sit back and think about it, it's great that we still have such a strong and clear commitment to the sport that we all love, despite all the challenges that the world is facing at the moment. No matter whether it's Formula E, LMDh or GT racing, I still love this kind of competition and I can't imagine doing anything else."

It's a refreshingly positive message. As we speak, there are wildfires raging across northern Europe, the UK is experiencing its hottest day in human history and the Tarmac outside the Race Tech office is starting to melt. The car industry is facing unprecedented technical challenges as it begins its own race towards Net Zero. Laudenbach is very much aware of these issues, but he's determined that motorsport should be part of the solution rather than part of the problem.

"From an OEM perspective, motorsport is all about relevance. I see maintaining that relevance to Porsche as my biggest task," he comments. "Obviously, we don't take a module from the racecar and bolt it straight into a road car. But we do frequently take the approach, the software solutions, the cooling concepts, the manufacturing methods and all sorts of things that we learn on the motorsport side and apply them to the road car."

Laudenbach comes from an internal combustion engine background. He raced motorcycles as a student, began his career as an engine test engineer and rose to prominence as Porsche Motorsport's head of powertrain during the RS Spyder years. But since then he's worked on electrification at both Audi and Porsche, and he sees this as a key technology for the coming years.

"We all know the strategic plans of the automotive industry for the next years," he says. "Electrification is coming – for sure, it looks different depending on what vehicles you're talking about and where you are in the world, but EVs and hybrids are the big topic. So, to me, it would be a mistake if motorsport failed to embrace that."

Porsche has more invested in the future of the internal combustion engine than most brands. The company famously boasts that more than 70 per cent of all the cars it has produced since 1948 are still in service, which means that there are literally millions ▶

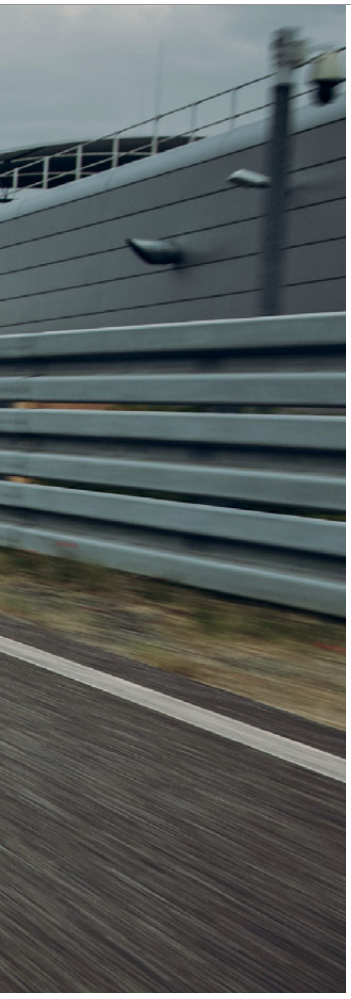
LEFT & BELOW As Porsche's head of motorsport, Thomas Laudenbach is keeping a lot of plates spinning at the same time – one being the introduction of the new 963 for endurance racing

of loyal owners looking to keep their pride and joy on the roads. It's also just announced a second major plant for the production of low-carbon e-fuels, which may yet safeguard the future of the internal combustion engine. In fact, if these fuels were to become available sufficiently cheaply in large quantities, they could – somewhat ironically – see everyday road cars returning to gasoline.

But the key point about electrification, Laudenbach emphasises, is the timescale: "It's difficult to say what will happen in the long-term future. What we do know is that electrification is happening right now. So, hypothetically speaking, even if we had enough sustainable fuel to power every racing car on the planet, I don't think we should ignore what's happening on the road car side. Right now we're supporting both solutions, because it will be years before we know which way this is going to go."

Some believe that hydrogen is also a potential contender, but Laudenbach is sceptical when it comes to high-performance applications: "From what we know now, fuels cells aren't really the best solution for sports cars. Don't get me wrong, we're looking at all the different options – that's one of the advantages of being part of a larger group with a lot of different R&D activities – but fuel cells are not something we currently consider to be an ideal solution for a sports car or even a passenger car."

RIGHT Porsche invested $75 million to acquire a long-term stake in HIF Global LLC, a holding company of internationally active project developers of e-fuel production facilities. Projects include the Haru Oni e-fuel pilot plant



LEFT Porsche was the first squad to rollout the new Gen3 Formula E, the most efficient – and sustainable – electric racecar ever built

> *"We don't take a module from the racecar and bolt it straight into a road car. But we do frequently take the approach, the software solutions, the cooling concepts, the manufacturing methods"*

New powertrains

For its LMDh programme, Porsche Motorsport has just engineered a new competition variant of the 4-litre twin-turbo V8 found in various examples of the Cayenne and Panamera road cars. It's also about to release a new flat six-powered 911 GT3 R that will become the top tier of both its works and customer GT racing programmes once the GTE class is phased out.

As for Formula 1, Laudenbach jokes that we'll have to put that question to his bosses instead, but there's intense speculation that Porsche could well return as a powertrain supplier there too. So the engineers at Weissach will certainly be busy on the combustion engine side.

Meanwhile, electric powertrains are edging closer to reality for their customer racing programmes. Last year, the company unveiled the Porsche Mission R – a 1,088 hp all-wheel drive electric GT racer that's said to preview the future of its customer racing activities. While that was very much a working concept car, last month's Goodwood Festival of Speed saw the arrival of the Porsche Cayman GT4 e-Performance, which is said to be a significant step closer to production.

"The Cayman GT4 e-Performance is still a prototype, but it's one that could really race properly. The next step on from that will hopefully be an electric racecar that we can sell to customers, but that will take some time," comments Laudenbach. "Customer cars need to be affordable, so the most important thing is that you have a good base road car."

And it won't be long before they have one. Porsche has already confirmed that its Boxster and Cayman road cars will be going electric in 2025, so it seems highly likely that a customer racecar and a new one-make series will be launched around that time.

There are also technical challenges to overcome before electric customer racing becomes a reality at this sort of level – principally around the batteries. Laudenbach acknowledges that storage capacity is still an issue, and that has a knock-on effect on the powertrain design. For instance, Porsche's GT racecars have always been rear-wheel drive, but an electric model might require a front-mounted MGU – not so much for its traction benefits, but to maximise the amount of energy harvested during regenerative braking.

Of course, strictly speaking, Porsche is already gearing up to support a customer team in another form of electric motorsport. From the start of Season 9, the company will be supplying powertrains to Avalanche Andretti in Formula E, alongside its own works team. This also marks the start of the series' Gen3 era, which promises new technical challenges and a significant step up in performance. ▶

The new Formula E cars have 40 per cent more power than the outgoing machines, yet the spec battery that they use is smaller and lighter. To keep that topped up, the cars will be able to recuperate more than twice the energy that they do currently, using an additional MGU on the front axle (used as a generator only for the foreseeable future). For the teams, this means there will be far more energy flowing around the system, and Laudenbach believes the way this is managed will be one of the key technological battlegrounds for the new season.

"Harvesting energy under braking is not an easy task. It'll be very much down to who can handle it in the best way so that the driver still feels confidence in the car," he comments. "The amount of energy that we recuperate and re-use is going to be *huge*, which I think is exactly the right step, because that's the right message. You make a smaller battery, take less energy on board at the start, and you still have a great race."

Formula E's next move

With a top speed of over 200 mph, the Gen3 machines promise to be the most dramatic Formula E cars yet. But do the new regulations go far enough to maintain the technical challenge after eight years of all-electric racing?

"For sure, the challenge is still there. It's still the only all-electric series at this sort of level," he replies. "I think it's very important that Formula E considers the next steps, and for me, it's heading in exactly the ▶

ABOVE Although not officially launched until the Goodwood Festival of Speed, the 963 has been testing for months. Though subject to Balance of Performance, it will be the best sorted car on the grid when the new category begins

LEFT One of Porsche's responses to the electrification of the industry was to enter Formula E with its 99X Electric

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right direction with these new regulations."

Looking further ahead, Laudenbach says he would like to see some degree of freedom around the battery for Gen4, but he's mindful that it would need to be controlled: "If you just let everyone do their own battery, there would be a cost explosion. And if you applied a cost cap that was too low, you would risk forcing people into solutions that aren't really suitable for racecars. So I think the solution would be to offer freedom in certain, clearly defined areas."

One possibility might be to allow the manufacturers to assemble their own batteries based on standard cells. A more extreme option would be to allow them to design their own cells, but with the materials and the chemistries restricted to those that offer genuine road relevance at a sensible cost. Alternatively, opening up the design of the cooling system or the battery management system (BMS) could be a more manageable first step.

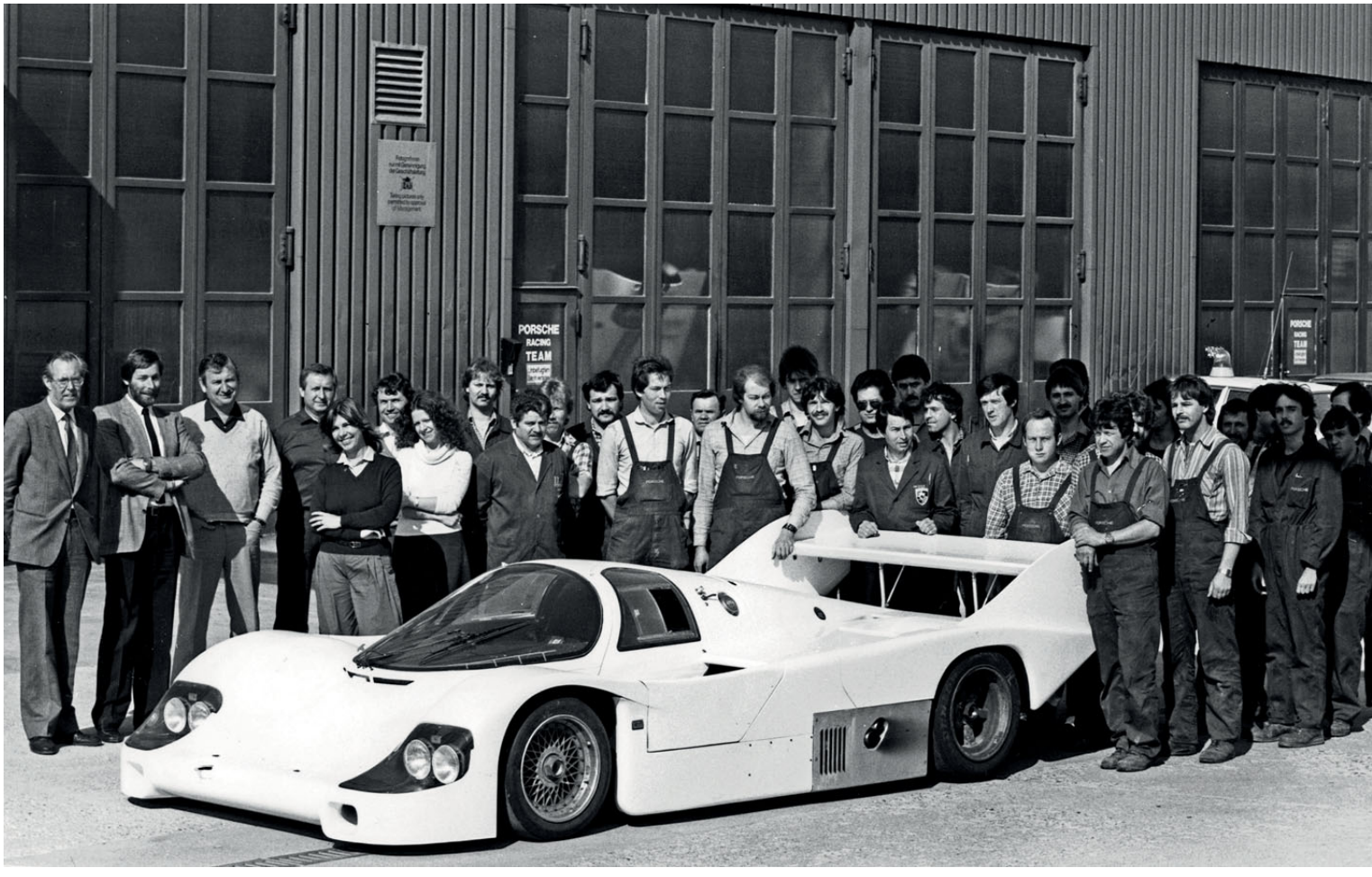
Elsewhere on the car, it's possible that the front MGU could also be opened up to function as a motor, although there are no specific plans to do this currently.

LMDh hybrid

Porsche's other halo project, the new 963 LMDh car, also has an electrified element to its design, with a spec hybrid system running alongside the company's own twin-turbo V8. It's this car that the brand hopes will power it to an unprecedented 20th outright victory at Le Mans, along with success in the IMSA WeatherTech SportsCar Championship and the World Endurance Championship.

Throw in other blue chip events like Daytona and Sebring, and the LMDh car has the potential to capture a lot of prestigious silverware for a relatively modest budget. Its cost is said to be roughly in the same ballpark as the current GTE programme, which is only eligible for class wins at such events. Not surprisingly, Laudenbach says this was a significant ▶

ABOVE Mission R (middle) represents Porsche's vision of a fully-electric GT racing car for customer motorsport in the future. This is no idle concept, though: testing of the technology components has already commenced, using the 718 Cayman GT4 ePerformance as a donor car

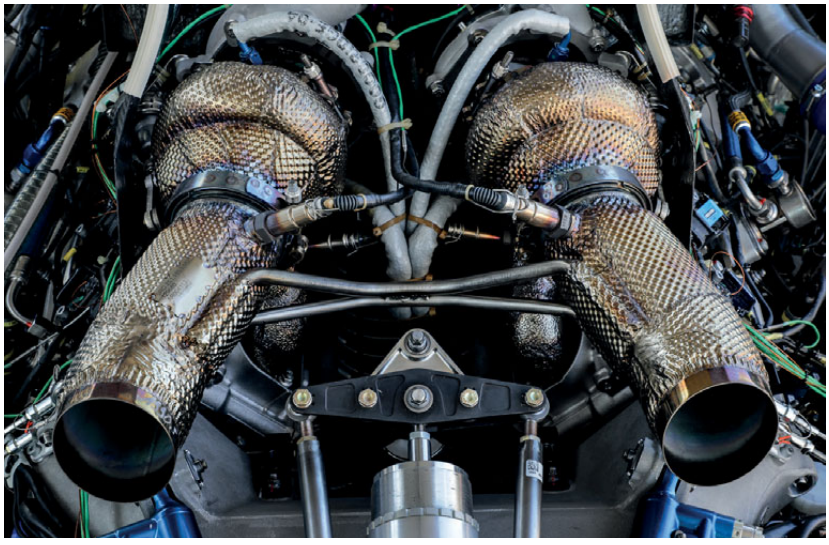


BELOW Porsche's new 963 evokes a previous era of turn-key customer sports prototypes. Here the first 956 for a customer is seen in the racing department at Weissach in 1983

factor in the decision to go with LMDh rather than the LMH Hypercar class.

"This way, it's possible to compete for outright victories on a much smaller budget," he points out. "And the other big factor for us was that LMDh allows you to compete in IMSA and the WEC with the same specification. If this possibility and this framework had been in place earlier, I can well imagine we'd have seen some of the Hypercar manufacturers going down the LMDh route. Plus, it still gives you enough freedom to showcase your technical abilities – it's restricted, yes, but it's not a spec car by any means."

The logic of using an LMDh car in both championships, however, rests very much on the ability of the organising bodies to balance them with the LMH cars. Laudenbach pauses slightly here.

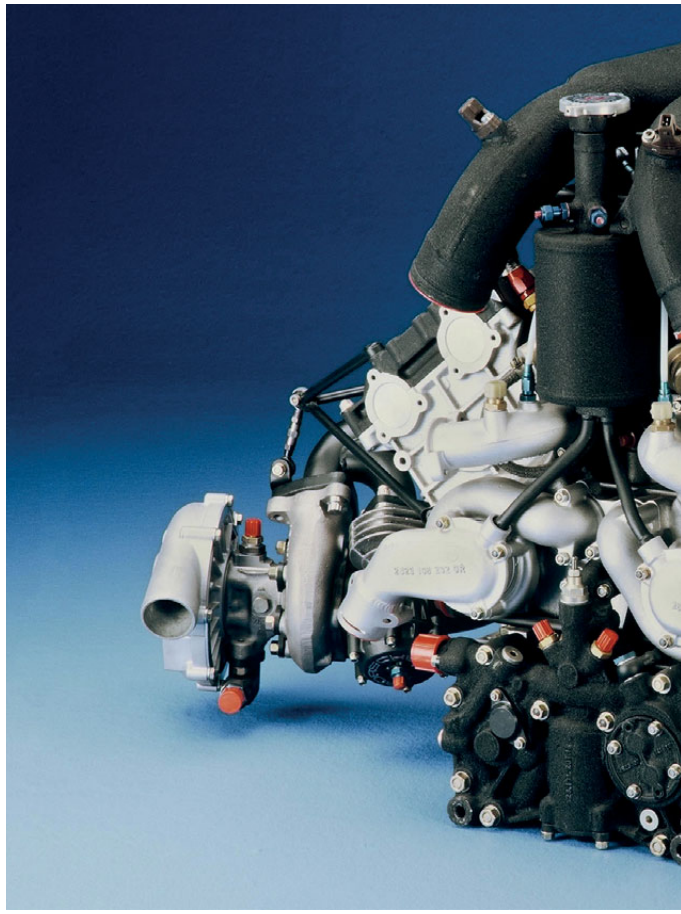


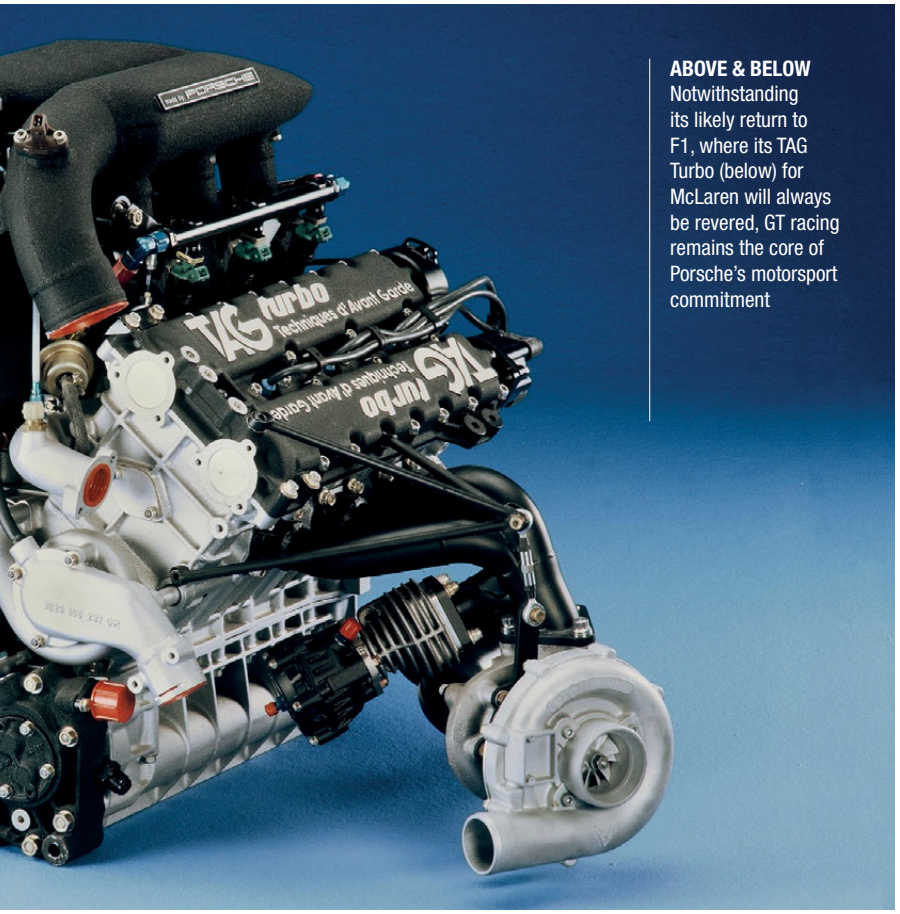
BELOW At the heart of the LMDh powertrain lies a twin-turbo 4.6-litre V8 based on the high-performance 918 Spyder hybrid sports car

> ***"LMDh still gives you freedom to showcase your technical abilities – it's restricted, yes, but it's not a spec car by any means"***

"Let me put it this way: if we didn't think it was possible to balance these concepts, we wouldn't have entered. So from a technical point of view, it is clearly possible, with all the sensors on the car and all the simulation techniques that are available these days. But from a political point of view – and when it comes to the details of how exactly it's done – that's much more complex," he says. "It's certainly something that I sometimes stop and think about, but we are happy to work through that with the other manufacturers, IMSA and the ACO."

As with Formula E, he's open to the idea of bringing more technical freedom into the LMDh regulations in the future. Perhaps, for instance, allowing manufacturers to build their own hybrid systems to





ABOVE & BELOW Notwithstanding its likely return to F1, where its TAG Turbo (below) for McLaren will always be revered, GT racing remains the core of Porsche's motorsport commitment

a carefully-defined set of specifications that were designed to ensure road relevance and cost control. First, though, he says the category needs time to establish itself and find stability.

GT racing

It may be the big budget categories like LMDh and Formula E that make the headlines, but customer racing remains the bread and butter of Porsche Motorsport. In particular, there's the hugely versatile 911 GT3 Cup, which will soon be eligible for everything from regional single-make events up to Le Mans, Daytona and the World Endurance Championship under the ACO's new rules.

Next year, the GTE Pro category, in which Porsche currently competes with a works team, will be axed. The GTE Am class, which requires each team to have at least one bronze-rated driver, will remain for 2023, but after that, both categories will be replaced by a GT3-based format.

These 'GT3 Premium' proposals would see a fully-reversible kit of parts applied to each car, differentiating it from those in less prestigious GT3 events. Laudenbach, however, isn't a fan of the idea.

"I'm really looking forward to GT3 coming to Le Mans. That, in itself, is a great idea, but I'm not in favour of the idea of developing special kits," he comments. "These are proper racecars that don't need any additional modifications, and they look great already. We will have to adjust the gear ratios, as we do already for Daytona, but there's no need for a whole kit of parts. Why should we do all that engineering work just to make them different?

"GT racing might be top-level customer racing, but it's still customer racing, therefore it should be affordable for the teams. And from the manufacturers' side, where's the business case? Each manufacturer will, at the most, have a handful of cars on the Le Mans grid, so you would have to sacrifice some of the resources spent on the base car's development for that. I can't see how you'd cover the cost, let alone make any money."

At present, those resources are nicely matched to the projects that Porsche has underway. Although the two have overlapped, LMDh will effectively fill the gap left by GTE Pro next year, balancing things out. The company's Formula 1 plans have yet to be finalised ("as our CEO said, the most important thing is that the rules are in place. And they aren't, so there's no decision," notes Laudenbach). But as things stand currently there's no intention to scale back any of Porsche's current motorsport activities if (or when) it does make a return to grand prix racing.

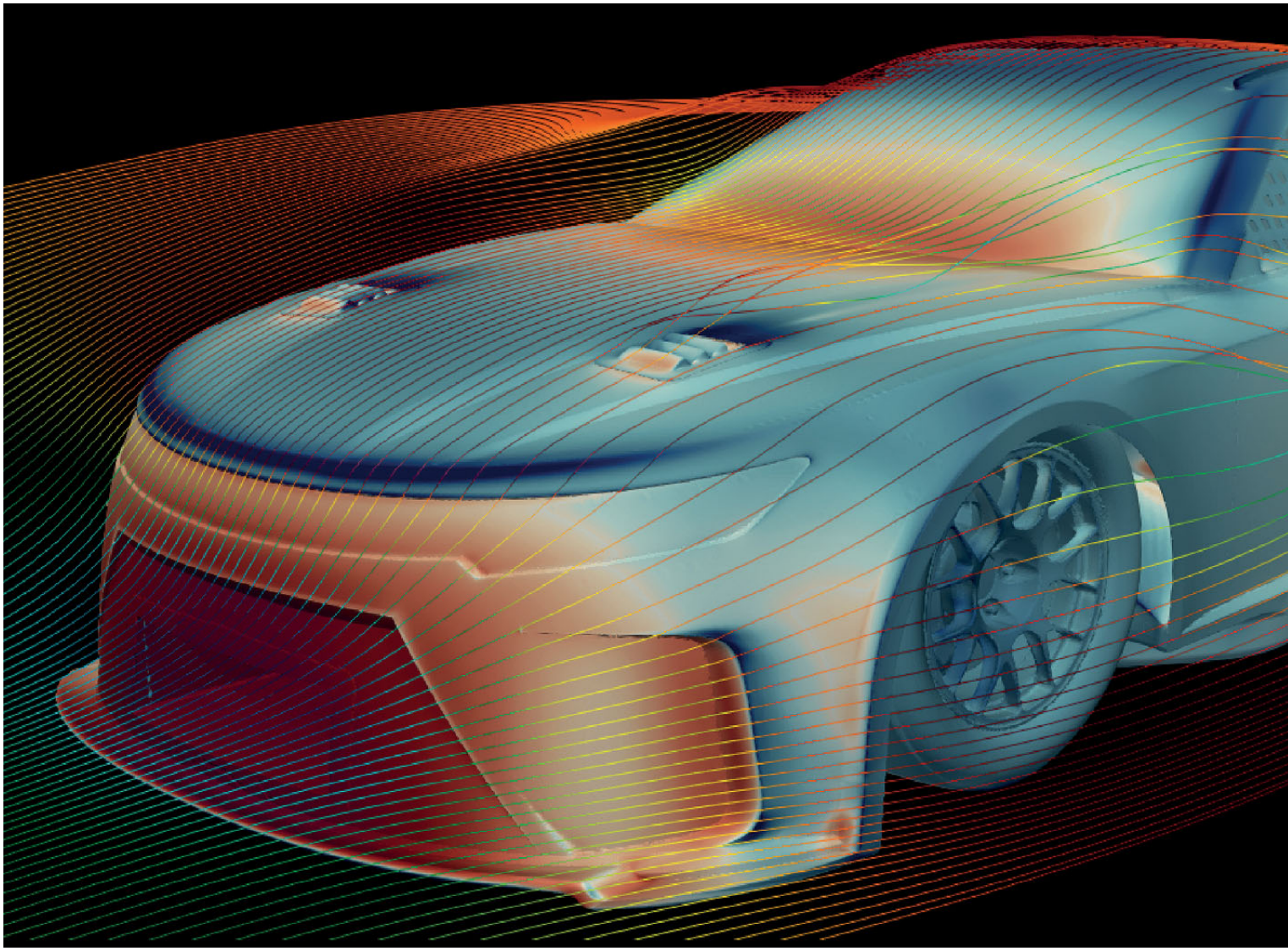
And so, Thomas Laudenbach's job doesn't look set to get any easier. But he seems more than up to the task – greeting each new challenge with energy and enthusiasm. After all, as he points out, he has one of the best jobs in the world. RT

WINDS OF CHANGE SWEEP THROUGH NASCAR

Eric Jacuzzi, managing director of aerodynamics and vehicle performance at NASCAR, talks **Chris Pickering** through the aero development of the Next Gen racecar

THE arrival of NASCAR's new Next Gen format earlier this year was the series' biggest technical shake up in half a century. Perhaps the most significant changes – and certainly the most noticeable – relate to the car's aerodynamics.

Gone are the old hand-beaten aluminium body shells, which hugged the ground with a markedly asymmetric shape. In their place, there are new composite-bodied cars, each of which has its own recognisably different silhouette, with a symmetrical design and a genuine resemblance to its road-going counterparts. Things are even more radical under the skin, with flat floors, rear diffusers and new



aerodynamic safety features.

The flat floor, in particular, represents a major shift in NASCAR's aerodynamic philosophy. The previous Gen 6 cars theoretically had no underbody aerodynamic devices at all. Instead, they sat extremely low, with a front splitter and deep side skirts to seal the car to the track. As is often the case in NASCAR, however, a technological arms race developed as the individual teams attempted to optimise the detail design of the underside.

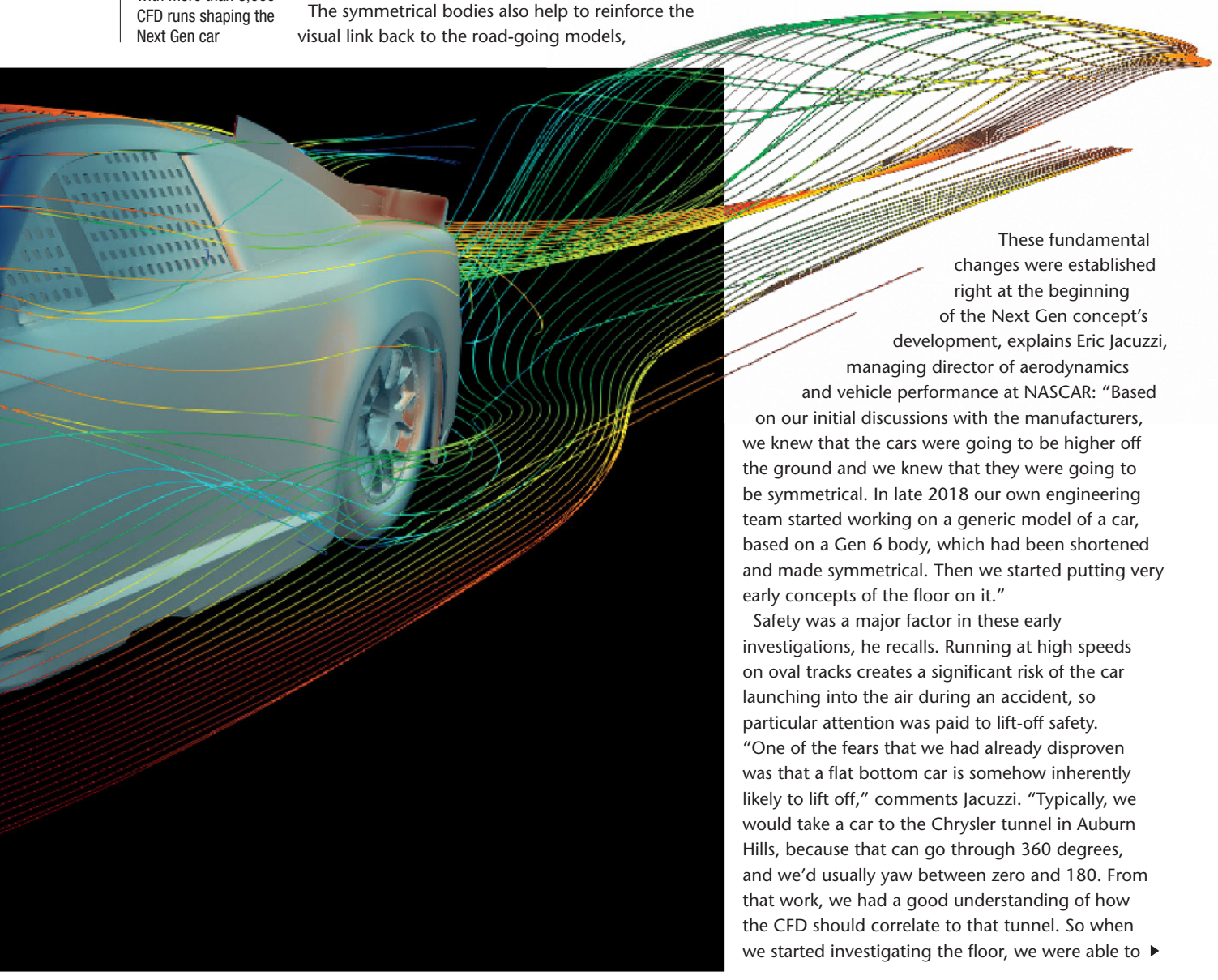
The top teams became very adept at harnessing the ground effect and manipulating the geometry of surfaces exposed to the air flow – aided by significant CFD capabilities and access to full-scale wind tunnels.

But rather than attempting to divert the air flow away from the underside, the Next Gen cars work with it. They ride twice as high on low profile tyres and production-style 18-inch wheels (as opposed to the old 15-inch balloon tyres) to give a more 'stock' appearance.

The symmetrical bodies also help to reinforce the visual link back to the road-going models, as well as improving the racecar's performance on road courses. In contrast, the Gen 6 cars raced everywhere with the tail offset to the right by 2.5 inches. As with the current regulations, the Gen 6 rules allowed for small dimensional tolerances, which the teams could use to trim the side force generated by the asymmetric bodies on the ovals. This didn't necessarily have a major impact on lap times, but it could be used to improve stability, giving the driver more confidence in the car's behaviour.

> *"One of the fears we had already disproven was that a flat bottom car is somehow inherently likely to lift off"*

BELOW Extensive use of Computational Fluid Dynamics played a key role in NASCAR's new era, with more than 3,000 CFD runs shaping the Next Gen car



These fundamental changes were established right at the beginning of the Next Gen concept's development, explains Eric Jacuzzi, managing director of aerodynamics and vehicle performance at NASCAR: "Based on our initial discussions with the manufacturers, we knew that the cars were going to be higher off the ground and we knew that they were going to be symmetrical. In late 2018 our own engineering team started working on a generic model of a car, based on a Gen 6 body, which had been shortened and made symmetrical. Then we started putting very early concepts of the floor on it."

Safety was a major factor in these early investigations, he recalls. Running at high speeds on oval tracks creates a significant risk of the car launching into the air during an accident, so particular attention was paid to lift-off safety. "One of the fears that we had already disproven was that a flat bottom car is somehow inherently likely to lift off," comments Jacuzzi. "Typically, we would take a car to the Chrysler tunnel in Auburn Hills, because that can go through 360 degrees, and we'd usually yaw between zero and 180. From that work, we had a good understanding of how the CFD should correlate to that tunnel. So when we started investigating the floor, we were able to ▶

> *"It was really important, at that early stage, to make sure we didn't commit to something that was going to be a disaster"*

compare the numbers to those of the old car and it became clear that it shouldn't be any worse. It was really important, at that early stage, to make sure we didn't commit to something that was going to be a disaster. If anything, the results were better than the old car."

Having proven that the basic concept was sound, NASCAR could go back to the OEMs and start working on the greenhouse shape. This essentially involved all three manufacturers submitting their preferred windscreen and roofline geometry, so the organisers could find a compromise between them. From there, common elements such as the decklid and the wheel arches could also be defined. Other parts of the geometry, however, would be free to the manufacturers, providing the finished car sat within a narrow window of lift and drag figures.

Aero balance

At the same time, NASCAR began track testing and simulator work with a test vehicle fitted with a generic body and the first iteration of the new floor. This began with a traditional aero balance of around 30 per cent front versus 70 per cent rear downforce.

After the first round of physical testing, it was felt that the design could probably go back to a more traditional stock car aero balance of 40 or 50 per cent front downforce. A new splitter was designed, along with a more efficient rear diffuser, adding downforce to both ends of the car.

"During testing, we then found that the car was always on the oversteer side, so we would end up running it with the nose off the ground and the back down. In essence, that took us back to the 30 per cent balance that we started with, so for the final version, we undid some of those changes, taking downforce out of the front and adding it to the rear," notes Jacuzzi.

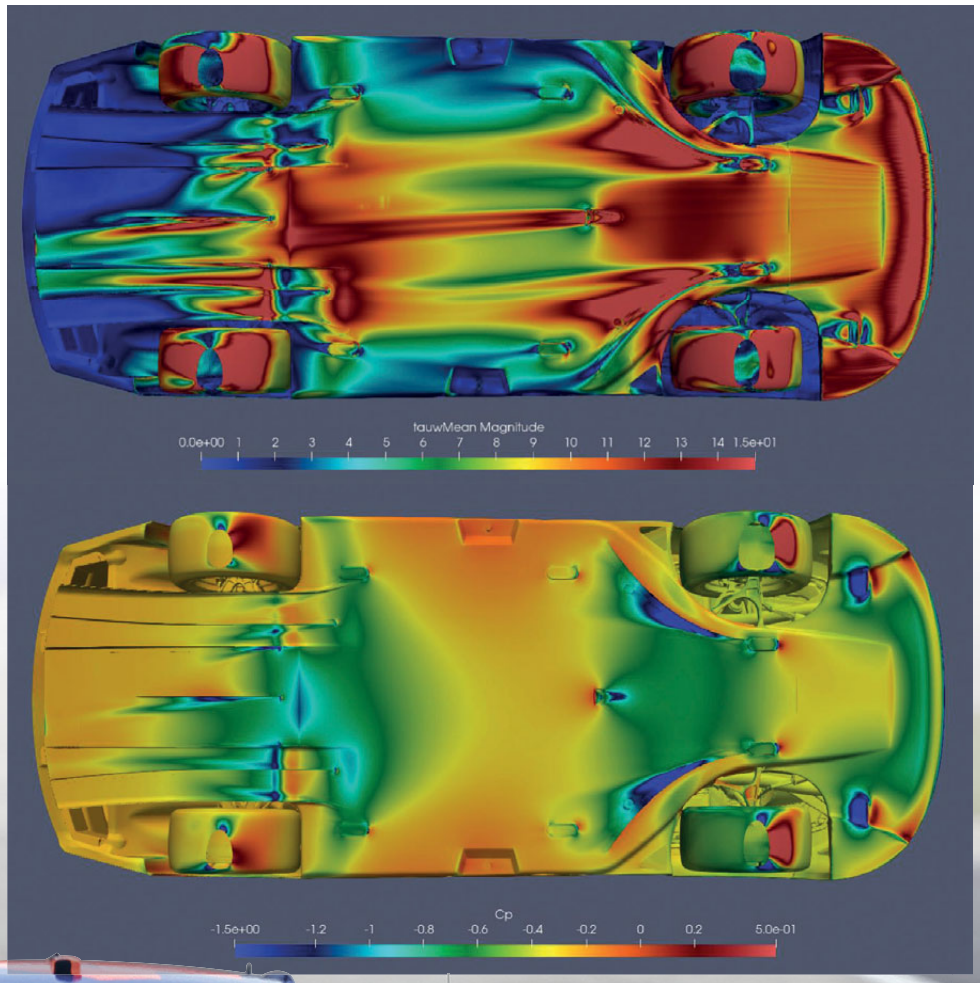
Along with the front-to-rear balance, the other big dilemma was the design of the floor. This was to be the first time that NASCAR had run with a diffuser, so the initial template was quite conservative, followed by a more aggressive design for the second iteration.

"We had some advice from people with open-wheel and sports car experience. The biggest thing – and this is something that you can see in the current F1 season – was not to go down a road where the car is very highly-strung aerodynamically. That can result in a car that's very erratic and difficult ▶

James Gilbert/Getty Images/NASCAR

RIGHT The flat floor represents a major shift in NASCAR's aero philosophy. Underbody skin coefficient and pressure coefficient are displayed here in CFD. You can see (top) how the vortices drive attachment up the diffuser ramp. Painstaking work ensured that, despite initial fears, the Next Gen is better than its predecessor from a lift-off standpoint. The diffuser flaps, triggered when the right-hand roof flap activates, provide an extra layer of safety

BELOW As with F1's new era, NASCAR's Next Gen cars were conceived with the benefit of meticulous aero research. In both cases, the intention was to promote good racing while avoiding an arms race



to diagnose when you have an issue," recalls Jacuzzi.

"So we did the best we could to keep it conservative and make sure that our CFD wasn't doing anything crazy. And we learned how our CFD would compare to the tunnel and how a steady state run would compare to a transient run."

NASCAR worked with TotalSim US, which helped to generate a baseline CFD model from the generic CAD data. Jacuzzi and his colleagues then iterated on that design in-house. Every major iteration was run on a 14-point development map in CFD, including sweeps for heave, pitch and ride height, which were then mirrored in the tunnel. In total, around 3,000 runs were carried out in CFD.

There were still concerns from some outside of the organisation that a flat floor could lead to safety issues at high yaw angles, so the engineers set out to find any potential weak points. In CFD, the Next Gen design performed better all the way from 0 to 180 degrees. To build on that, they tried placing a flap on the diffuser to accelerate the flow and prevent high pressure air blowing in from the back.

Multi-body dynamics and transient CFD were coupled to produce a simulation of the flap deploying by itself. This showed a potential gain, so a car was fitted with the system and run backwards at the Aerodyn wind tunnel in North Carolina. Initially, the idea was to have a spring-loaded system that would be deployed solely by the air flow underneath the car. Later on, former NASCAR engineer Don Krueger came up with the idea of linking it mechanically to the flap on the roof (an anti-launching feature that the series has used since the mid-'90s). When the right-hand roof flap activates, a cable pulls open the diffuser flaps.

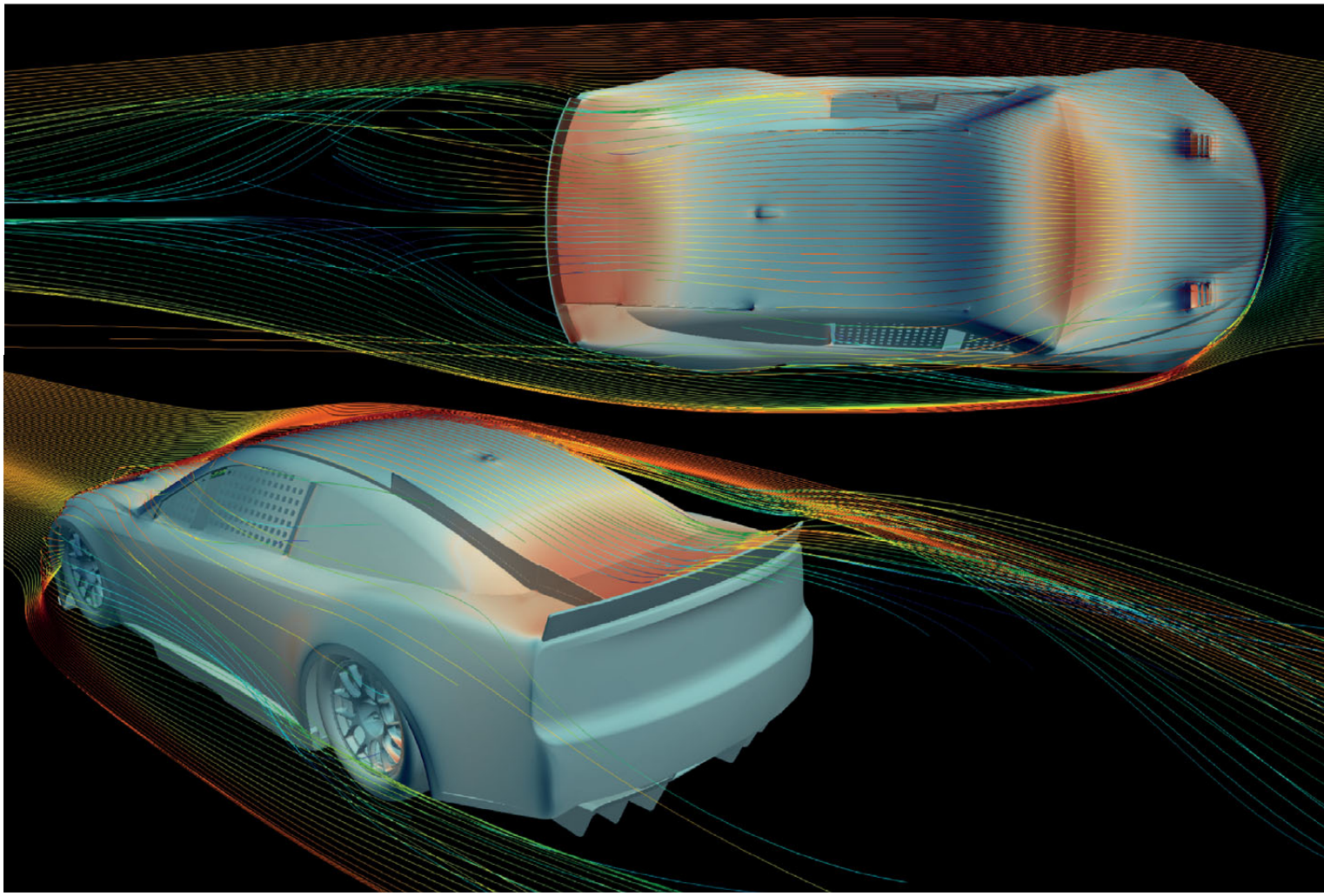
Validation tests followed at the Chrysler tunnel and at the ACE facility in Canada, Jacuzzi recalls: "It was a two-day test, and it was really interesting. We took a Gen 6 car along with the Next Gen and compared the two. In most cases it was better, and it gave us a chance to try various different solutions when it wasn't. We ended up with a car that was actually better than its predecessor from a lift-off standpoint."

Another, perhaps surprising, target was to increase the drag of the new cars. While low drag is clearly beneficial in most forms of racing, NASCAR found it was struggling to control the speed of the cars. By the end of the Gen 6 era, closely bunched fields of 40 cars were hitting 208 mph at Talladega.

"The only recourse we had was to add spoilers to the car, which is very effective for a single car, but

RIGHT The finished designs were tested in the wind tunnel to ensure they sat within NASCAR's mandated lift and drag aero windows. Here Ford's car is seen in the Aerodyn tunnel

BELOW The new cars feature less downforce than their predecessors, in a deliberate move designed to improve the racing




NASCAR

it's ineffective once you get in traffic, so you end up with big accelerations, which makes the pack really unwieldy," comments Jacuzzi. "And the opposite is true if you have a really small spoiler, where the field is kind of low energy, so they can't really move around very well and they can kind of be manipulated by the car in front."

NASCAR's response was to engineer more drag into the new front fascia designs (common to the whole field). Careful consideration also went into the surfaces around this feature in an effort to ensure that the teams couldn't do anything to reduce its impact.

Geometry differences

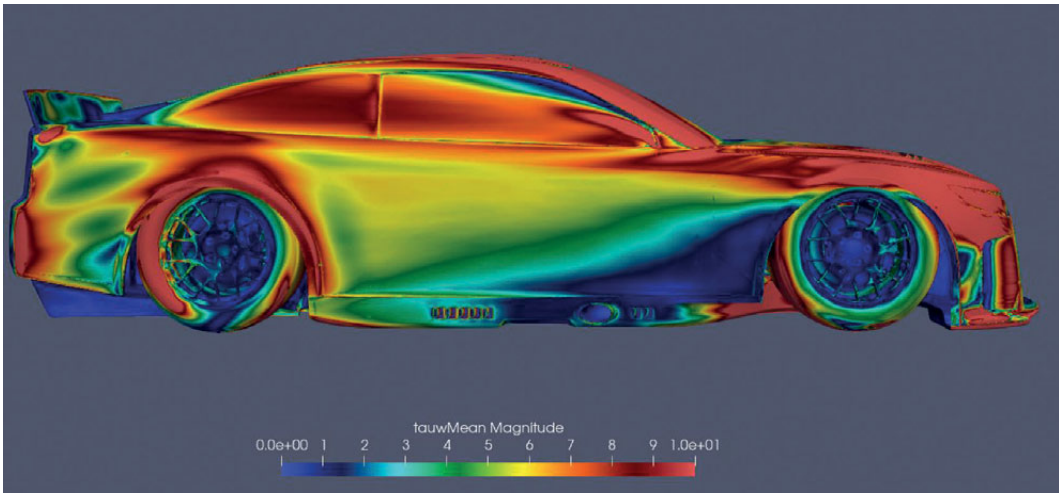
Once its in-house development was complete, NASCAR created a CAD model that defined the geometry of the generic vehicle. This is outlined in the technical regulations with a series of colour coded drawings: common areas of the car, where the geometry is shared by all three manufacturers, are shown in green; minimum surfaces, where the bodywork must allow room for chassis constraints or safety features underneath are in blue; maximum surfaces, which the extremities of the car must lie within, are shown in red.

> *"Every major iteration was run on a 14-point development map in CFD, including sweeps for heave, pitch and ride height"*

There are also additional boxes to define the location of specific elements. For instance, a grey box on the bonnet denotes position of the hood flaps, which open during a spin to vent pressure from the engine bay and reduce the risk of the car taking off.

Similarly, a brown box shows where the manufacturers can position the radiator outlet. This feature is significant in itself, as it marks a departure from the Gen 6 design, where the flow passed through the radiator and exited into the engine bay as it would on a typical road car. The downside to doing this was that running the radiator completely open would lose around 250 lb of downforce, so the engines had to be specially developed to cope with elevated temperatures. As a result of this, a Gen 6 NASCAR would run at roughly 270 deg F, while a prototype might be less than 200 deg F. The same principle led to teams taping up the grilles.

NASCAR now directs the air up and out through the bonnet in order to sever this undesirable link between temperature and downforce. A small perforated 'throttle plate' is still allowed behind the spec radiator and oil cooler package, but its aerodynamic effect has been slashed. Now – depending on the design – the car actually gains a small ▶



RIGHT NASCAR worked with TotalSim US to create its own generic body shape. This was used to define the aerodynamic boundaries within which the cars from all three manufacturers must lie

ABOVE NASCAR continues to take big strides forward with its safety measures, here evaluating anti-launch safety systems in the FCA aeroacoustic tunnel. When the right-hand roof flap activates, a cable pulls open the flaps in the rear diffuser

> *"NASCAR now directs the air up and out through the bonnet in order to sever the undesirable link between temperature and downforce"*

amount of downforce when the radiator is run fully open (albeit at the cost of a small amount of drag). It also opens up the option of running more production-based engines in the future, which simply aren't compatible with these temperatures.

The area around the bonnet allows a considerable amount of design freedom, both in the shape of the surface itself and the design of the radiator outlet. Ford has a set of protruding louvres, which direct air over the top of the outlet, creating a low pressure area to help extract flow from the engine bay; Toyota takes a similar approach, but uses a single large flick ahead of the vent; while Chevrolet has a series of slats that are set into the vent, relying on a naturally-generated area of low pressure close to the nose.

The regulations also define what's affectionately known as the 'tyre potato'. This is the three-dimensional volume that marks the maximum extents of the tyre in all possible combinations of suspension geometry, wheel travel and steering angle. Manufacturers need to be mindful of this to prevent the tyre ever fouling the bodywork.

Homologation process

NASCAR created its own generic body shape, based on the common elements and the dimensional constraints laid down in the rules. It was this shape that was used to define the lift and drag window within which the cars from all three manufacturers must lie.

The nominal design for all body shapes must sit within eight counts of drag (Cd) and 20 counts of downforce (CL). To put that into perspective, peak downforce might be 800 counts and peak drag 550 counts, so that represents a maximum difference of approximately 2.5 per cent and 1.5 per cent respectively. In reality, you're unlikely to find two cars at the extreme ends of the range, so the differences are likely to be smaller still.

The finished designs are tested in the wind tunnel to ensure they sit within these boundaries, but the homologation process begins long before that. It starts with the manufacturers sharing photos or renderings of the proposed racecar, along with the production model that it's based on. This is largely to check that there's sufficient resemblance between the two, which can be tricky if it coincides with the very early stages of the road car's development.

"We've had cases where the road car didn't actually exist at that point. The Camry was probably the best example of that, where we had to travel to Toyota's design studio in Ann Arbour, Michigan to look at clay models of the production car," explains Jacuzzi. "So there's usually a little bit of hand waving there, with us saying 'Okay, why is this feature like that?' or 'We want to see this line here'. So we really try to get them on the right track with regards to our expectation for that car."

Later on in the process, the road and race versions of the car are then reviewed side by side in full-scale.

"We've had those be very cordial and nice, where the head designer was there to show us the production car and why they did certain things. And then we've had them where we weren't pleased with what we saw and we had to demand a lot of changes to make it look more like the road

car," reveals Jacuzzi.

Once the design of each car has been finalised – taking into account its aerodynamic performance and its stylistic links to the production car – the finished geometry is submitted as a CAD model. It's this approved model that's used as a reference point when the car's bodywork is scanned for dimensional tolerances at the track.

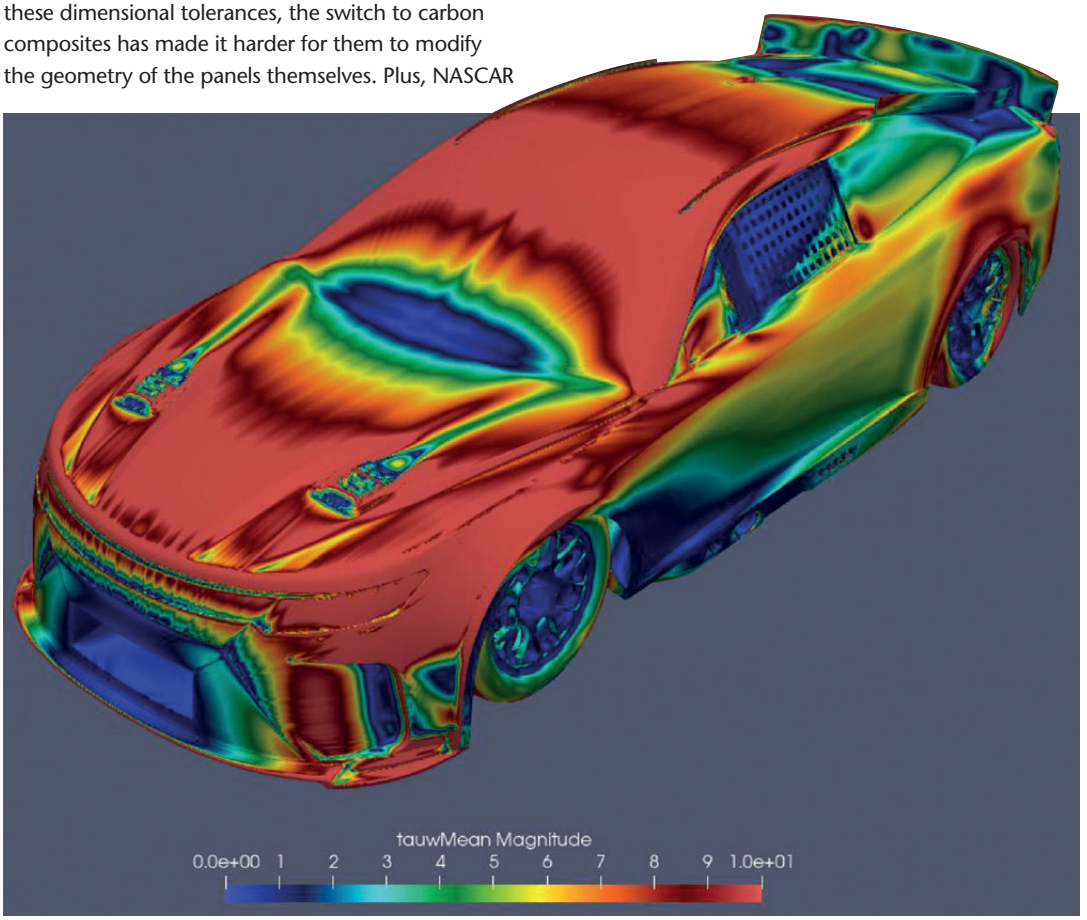
"In the past we've had people cooking parts and changing the shape, but we've taken steps to try to ensure that doesn't happen. For instance, defining the repair processes," notes Jacuzzi. "Essentially, the teams are allowed ±150 thousandths of an inch on all non-glass surfaces, including the underside. So, typically, what they're doing is optimising the build of the car for a specific track within those tolerances. We allow ±200 thousandths of glass because it's very thermally sensitive. If you build the glass at +160 thousandths and then it sits in the midday sun for 10 minutes, it risks failing. That's what we saw at Talladega where everyone was covering the car with umbrellas. There's a similar thing on the underbody, where they will try to get the diffuser as low as they can."

Most of the larger teams have their own optical scanning equipment, plus NASCAR allows its own facilities to be used to check the cars prior to each race.

Although teams continue to play with the mounting of the bodywork to take advantage of these dimensional tolerances, the switch to carbon composites has made it harder for them to modify the geometry of the panels themselves. Plus, NASCAR has measures in place to deter the larger teams from ordering vast numbers of parts and selecting the most advantageous production tolerances.

Overall, the new cars feature less downforce than their predecessors, in a deliberate move designed to improve the racing. It seems to be working too, with 13 different winners in the first 19 rounds of the season. This, of course, is just the start for the Next Gen era in NASCAR. With renewed rumours of a fourth manufacturer joining the series, hybrid engines slated for 2024 and a Box 56 entry planned for Le Mans next year, it seems that there will be plenty more changes to come. RT

ABOVE The new car appears to have achieved NASCAR's objective of levelling the field. Certainly Daniel Suarez believes so: the 30-year-old became the first Mexican-born driver to win a NASCAR Cup Series race, finally triumphing in his 195th career start



LEFT NASCAR deliberately engineered more drag into the new front fascia designs common to all the manufacturers. The skin friction coefficient here shows where flow is attached – and where teams would attempt to chase an advantage

EVs and autonomy accelerate as Formula Student celebrates 25th year

Sara Kimberley quizzes Formula Student chief design judge Dan Jones after an event that mirrored the trends witnessed in the wider automotive and motorsport spheres

BELOW With COVID restrictions lifted, this year's competition saw UK teams joined by international opponents and thousands of spectators

AFTER a virtual event in 2020 and a stripped-back hybrid contest in 2021, the Silverstone paddock was once again bustling with teams last month as The Institution of Mechanical Engineers' full-scale Formula Student event returned.

Which teams impressed you – and why?

"All Formula Student teams have faced various challenges over the past two and a half years as we've navigated through the global pandemic.

"Without speaking to all teams it's impossible to say how badly each has been affected; it's entirely possible that a team who only just made it to Silverstone and to scrutineering on Sunday morning could be categorised as the most impressive feat.

"This year's winners, UG Racing from the University of Glasgow, deserve a mention for their solid progression in both the static and dynamic events from last year, demonstrating how important it is

to score well in all events, rather than sacrifice any to focus on another.

"It was incredibly close between second and third this year, with the University of the West of England beating the University of Malta to second place by a single point: each and every point really does matter."

Most improved team, in your opinion?

"It's difficult to single out any one team. Many of the well-established teams made the transition from ICE to EV this year and struggled to either bring a running car to the event, or to get through all stages of scrutineering.

"There were several notable 'firsts', such as Southampton transitioning from a spaceframe ICE to monocoque EV in a single year and Salford making it through scrutineering for the first time ever to name just two of these.

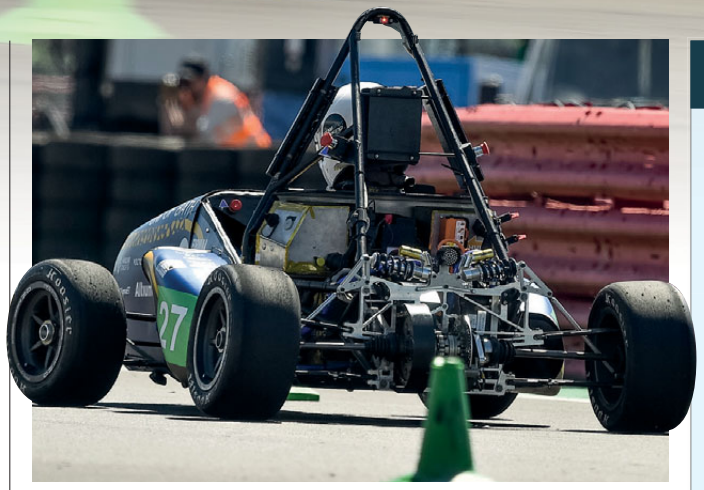
"Coventry and Edinburgh deserve a mention for the impressive progress in the FS-AI dynamic events this year, with both successfully completing the acceleration, skid-pad, sprint and track drive events."

What were the emerging trends that captured your attention?

"Just as we're seeing in mainstream automotive and professional motorsport, the expansion of EVs continues at pace, with an almost 50:50 split between ICE and EV entries at FS this year. ▶

ABOVE Glasgow's internal combustion car overcame strong competition and the July heat to secure victory

LEFT The Glasgow squad was overjoyed to lift the trophy and validate its hard work and steady improvements in recent years



"This year also saw our greatest number of entries to our autonomous vehicle category, along with the impressive progress in successful completion of the dynamic events."

The knowledge gap between the 'have' and 'have not' teams has expanded greatly in recent years. To your mind, have the entries in the bottom half of the field closed the gap, stayed static, or dropped further behind?

"The wide-ranging impacts of the global pandemic and the shift from ICE to EV for many teams have distorted the 'traditional' picture somewhat.

"FS2022 was our first return to a conventional fully live event with first year vehicles since 2019, and it was evident across the board that teams have struggled with the loss of experienced hands. The teams that capture all the learning from this year and generate sensible plans to make improvements for next year will likely be those that make the most progress at FS2023." ▶

ABOVE & TOP
The EV ranks continue to grow, with a number of universities abandoning ICE competition

Heading down the EV route

"**IT** feels good to be back," admits Andrew Deakin, the chair of the organising committee.

"Last year was reasonably busy, but there were only UK teams. Now we've got the international contingent back, which is always good to see," he says. The international teams bring "different ideas, different ways of doing things," he adds.

Dr Deakin helped bring the competition to the UK after starting a Leeds University team in 1995, which competed in the US. A lot has changed between the first iteration in 1998 and the 25th annual event.

"The level of sophistication has changed, going from a lot of carburettors in the very early years to everyone [using] fuel injection and that sort of stuff," he notes. "There were some monocoques in the early years, but now there are a lot of monocoque cars. Teams have tried active suspension, CVTs and all those sorts of things as well, so lots of different technologies have been tried, and some of them are quite complex to do in a year for a student project. Some of them succeed very well, some fail. It's part of the competition."

The changes go far beyond the evolution of the internal combustion (IC) cars. This year's event saw more than half of the teams use electric powertrains.

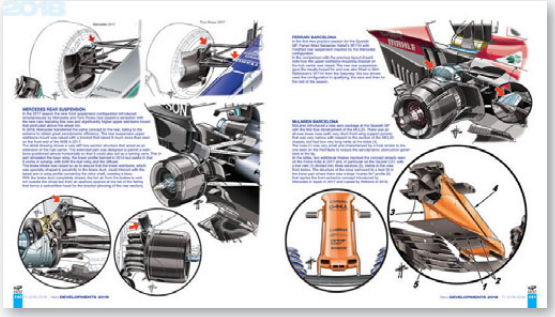
"We're hoping to go more and more towards the EV (electric vehicle) side of things, because that's what industry wants; it wants engineers with that kind of experience," says Deakin.

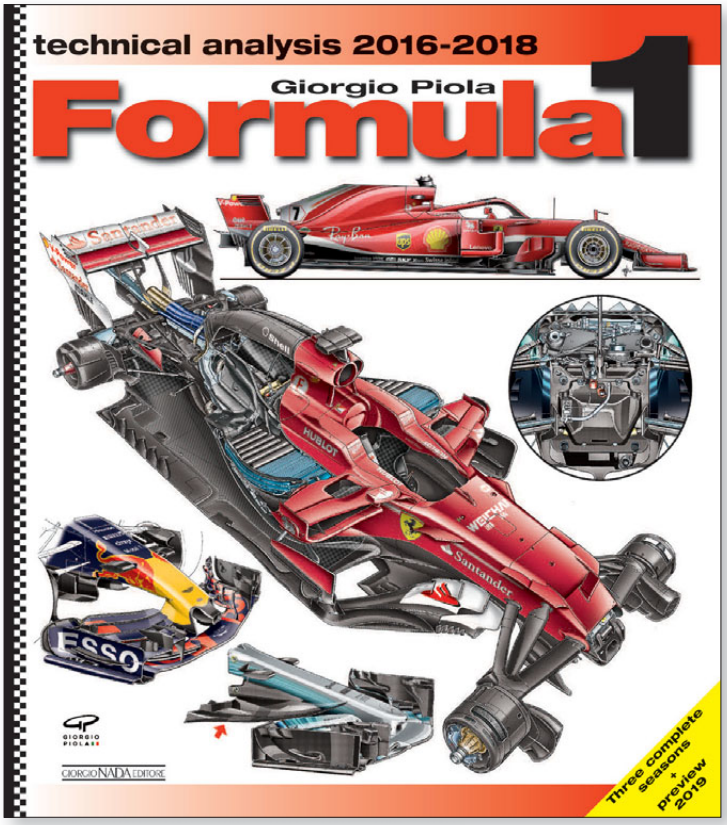
"It's a different technology to get used to. You can't just go to a scrapyard and pull an engine out of a broken motorcycle these days – you've got to design your own battery system and talk to a number of electric motor companies to select an electric motor, and then work out how to fit that all into the car with all the control systems and everything else." RT

Giorgio Piola

NEW

FORMULA 1
2016-2018 Technical Analysis
(with 2019 preview)





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What do you think has been the result of the COVID hiatus?
"There are two main factors which have impacted teams: the loss of continuity in experienced team members and increased lead times and costs for components."

Any sign that the 'mortal sins' - rod ends in bending, lack of understanding of load paths and compliance etc – are back in force?
"I wouldn't say this was any better or worse than usual this year. Non-conformances to the rules, however, definitely were more prevalent, which I believe to be a consequence of the loss of continuity of experienced team members."

Any evidence of the current financial squeeze taking its toll?
"Not this year. We had several new partners and sponsors of the event this year, demonstrating the recognition in industry of the importance of Formula Student in developing our engineers of the future.

"It's more likely to impact teams over the next year, as the seemingly ever-increasing costs squeeze their budgets."

The youngsters are often given a hard time for their attitude – how did you feel they responded to constructive criticism?
"I had several teams ask me for feedback on their cars: all were open to my suggestions on how they could improve both their general approach to Formula Student and specific design points on their cars.

"Every year I'm impressed by the comradery between teams. They may be fierce competitors, but they are always willing to do what they can to help another team out, admirably demonstrating the positive spirit of Formula Student and in stark contrast to how young people are often portrayed in the press."

LEFT Vital experience gained is the true reward, but a trophy truly validates all that hard work

BELOW The University of the West of England was runner-up in the main event

Female engineers are a hot topic at the moment: did you notice any shift in the balance?
"As part of the IMechE's broader Diversity and Inclusion policy, FS2022 marked the first time we've actively collected data during registration to track trends such as this.

"This sets our baseline for comparison in future years, so we won't have objective data until next year, but from walking around the paddock and talking to the teams, a strong step in the right direction was evident. ▶

The year FS-AI 'thrived'

THE 2022 competition attracted record numbers of FS-AI participants, with more than a dozen teams from the UK and oversees taking part in presentation events of their work and on-track activities designed to test their team's autonomous driving systems across a number of real-world driving simulations.

Some brought their own car and software, while others added their own software to a base model developed by the IMechE.

"This is the year FS-AI truly thrived," says Holly Watson-Nall, FS-AI chief judge. "With six teams making great attempts at the dynamic events and two teams completing the dreaded Trackdrive event, 2022 has demonstrated the clear progress all the teams have made in their autonomous driving systems.

"The rookies impressed with Imperial Driverless, Formula Trinity and UPMRacing excelling in Statics, showing that good understanding of simple systems and reasoned decision making can beat complex solutions in engineering, and getting time on the ADS-DV cars. Oxford Brookes Racing Autonomous led the way in Design and Simulation Development by giving excellent presentations and showing their detailed understanding of what they built."

"We were delighted to welcome Girls on Track to the FS paddock this year. Initiatives like this are essential to increase the number of females choosing to study engineering and participate in Formula Student in the future."

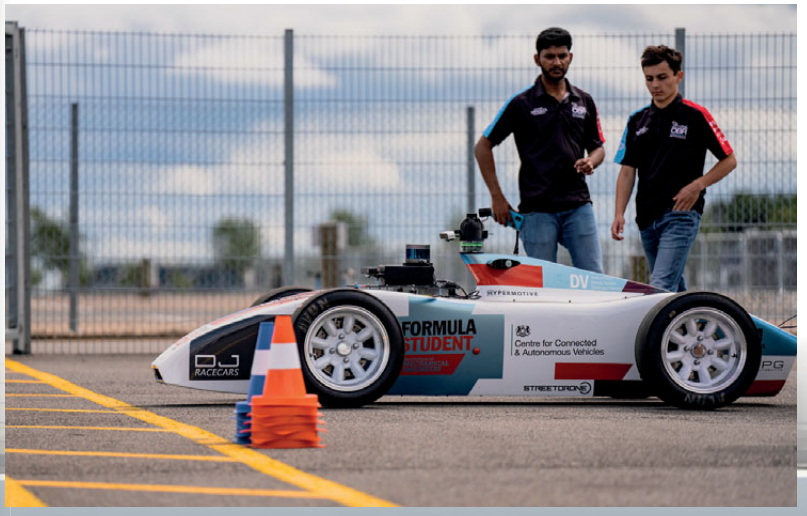
What caught your eye in the 'alternative' ranks?

"In addition to the increased number of EV entries this year, we had the hybrid entry from Modena. Unfortunately, they were not able to pass scrutineering due to technical issues with their battery pack, but I'm sure they will continue to develop the powertrain and I look forward to seeing how it performs on track relative to the ICE and EV entries in future years."

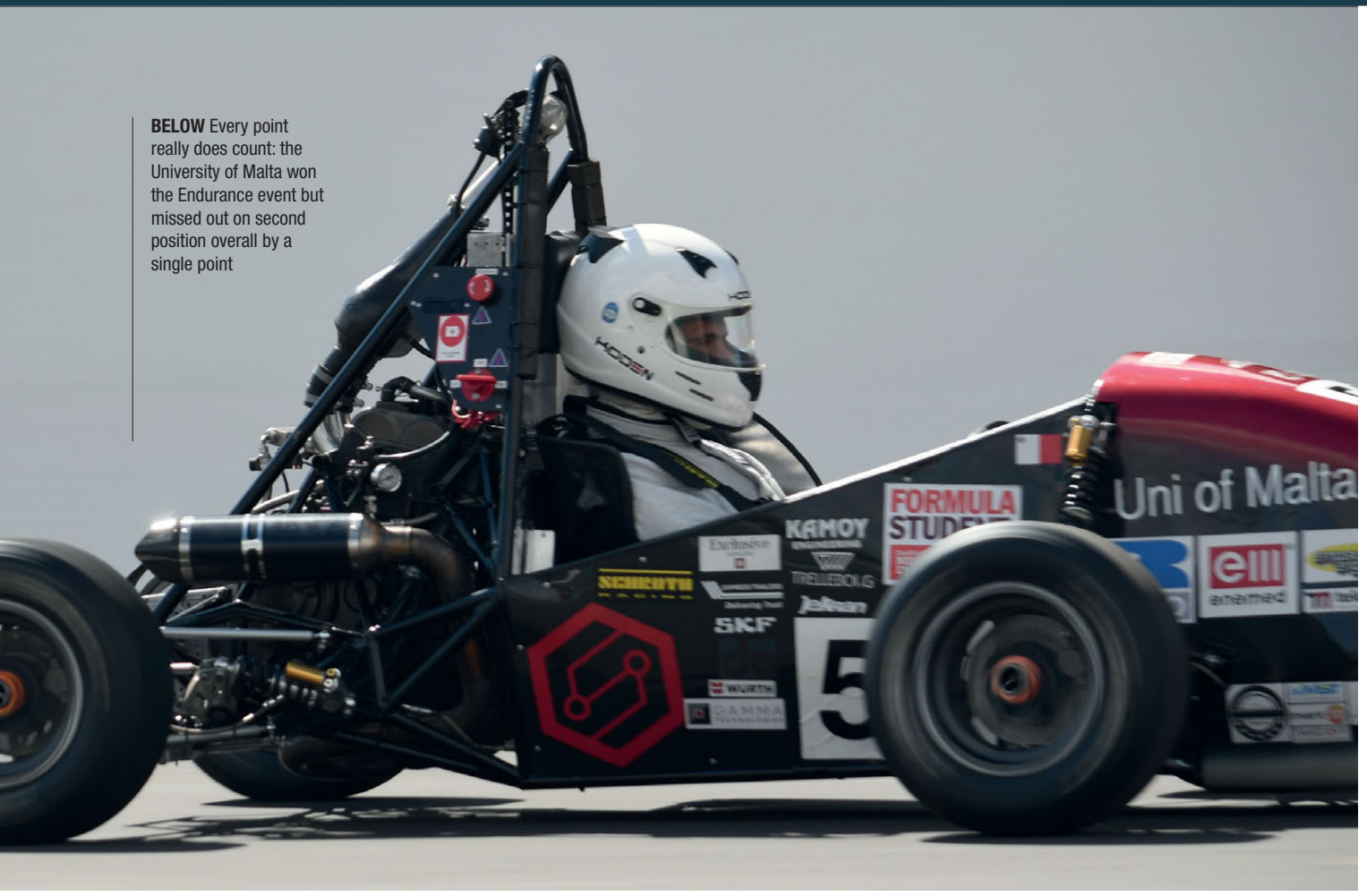
What did you make of progress in the AI class?

"In general terms I was very pleased with the continued growth in entries to our autonomous category.

"Oxford Brookes were very strong in the static events, and both Coventry and Edinburgh made impressive progress in the dynamic events, successfully completing all the events for the first time."



BELOW The autonomous event is rapidly growing in popularity



BELOW Every point really does count: the University of Malta won the Endurance event but missed out on second position overall by a single point

Given the potential German move to self-driving cars only, can you reassure us that Formula Student will – and should – continue to cater for ICE 'conventional' tech?

"FSG's move to driverless is well intentioned, but we believe this unnecessarily introduces a barrier to entry to both new and smaller teams.

"Formula Student will continue to allow 'conventional' ICE entries for the foreseeable future. We are actively investigating options for fully sustainable fuels for this to remain palatable from an environmental perspective.

"The powertrain is just one element of the broad range of skills and experience that students pick-up from competing in Formula Student, maintaining the option for low cost and relatively simple vehicles ensures we offer this opportunity to the greatest possible number of young engineers."

> *"The positive spirit of Formula Student is in stark contrast to how young people are often portrayed in the press"*

BELOW Salford celebrated making it through scrutineering for the first time ever

Looking ahead to 2023, what are your expectations?

"With teams now having members who've been through the competition cycle, I expect we'll see more finished cars making it to the competition, more cars through scrutineering and more cars on track, in similar numbers to 2019, our last event pre-COVID.

"I also expect to see continued growth in the number of EV and FS-AI entries, and hopefully another year of the wall-to-wall sunshine we were blessed with this year!" RT

THE END OF AN ERA?

Could Ken Block's 'Hoonipigasus' be the last big-budget ICE project ever built for the Pikes Peak Hillclimb? **Hal Ridge** examines a car with a vintage silhouette, packed with the latest technology

IF previous form gives any indication of future potential, it has become increasingly expected over recent years that projects from Ken Block's Hoonigan concern will not only be extreme, but even more so than their predecessors.

From originally adapting rally and rallycross machines to shoot its viral videos, Hoonigan has evolved into producing clean-sheet design, blue-sky thinking machines. Look no further than the Hoonicorn, a hugely modified 1965 Ford Mustang; the Hoonitruck, a similarly wild Ford F-150 pickup; and the Ford Escort RS WRC Cossie V2, a modern take on the rally icon.

The Escort aside, most of those vehicles haven't been used in competition, outside of the Gymkhana-style events for which Block is famed. He has instead adopted proven machinery for his competition efforts. But this latest creation, the Hoonipigasus, was built from scratch, specifically to take on the world's most famous hillclimb.

The foundations of the effort were laid 12 months before the car's debut, at the 2021 edition of the famous Colorado event. The California-based firm BBi Autosport had just claimed victory in the Porsche Trophy Class, first place in the Open Class and third in the Time Attack category with a trio of different Porsches.

"The race was over, I was interviewing [BBi Autosport founder] Betim Berisha and I said, 'Okay, you've podiumed in three classes, what's next?'" recalls Hoonigan co-founder Brian Scotto.

Berisha's response was immediate: "I

ABOVE The car's distinctive livery is a tribute to the famous 1971 Porsche 917/20 'Pink Pig'

LEFT The car features GPS height-adjusted suspension, based on the previous year's telemetry

want to build the SVRSR with Scarbo," he replied.

Joe Scarbo, an engineer-designer, had already sowed the seeds for what would become the Hoonipigasus, an idea for taking a vintage silhouette and giving it the performance and technology of a modern car, the SVRSR. But, as with everything under the Hoonigan banner, "We pushed that to a whole other level: the concept for the Hoonipigasus is to be the ultimate Pikes Peak 911 special ever built," says Scotto.

> *"The concept for the Hoonipigasus is to be the ultimate Pikes Peak 911 special ever built"*

Original plans were discussed without Block's involvement, but when the kind of budgets required to execute the effort became apparent, the commercial value needed to be increased. Simultaneously, Block was in the process of signing a deal with the VAG group and Audi. With a childhood love of Pikes Peak, the stars aligned for the former DC shows tycoon turned viral gymkhana video sensation, rally and rallycross driver to be involved.

The project was given the green light in the closing stages of 2021. That made the already ambitious programme an even bigger task in order to deliver the car for Pikes Peak in June 2022.

Following extensive computer-aided design work in-house at Scarbo Performance in Southern California, ▶

the real-life build began at Scarbo's base with creating the chassis' spine. The main hoop for the roll cage was the first major vertical asset to be added.

Over 300 feet of chromoly tubing made up the chassis, put together in an incredible 14 days before being shipped to BBi.

Berisha has a rich history of building competition Porsches, having worked for the German marque before going it alone with BBi. But even for him, the Hoonipigasus has been a unique undertaking.

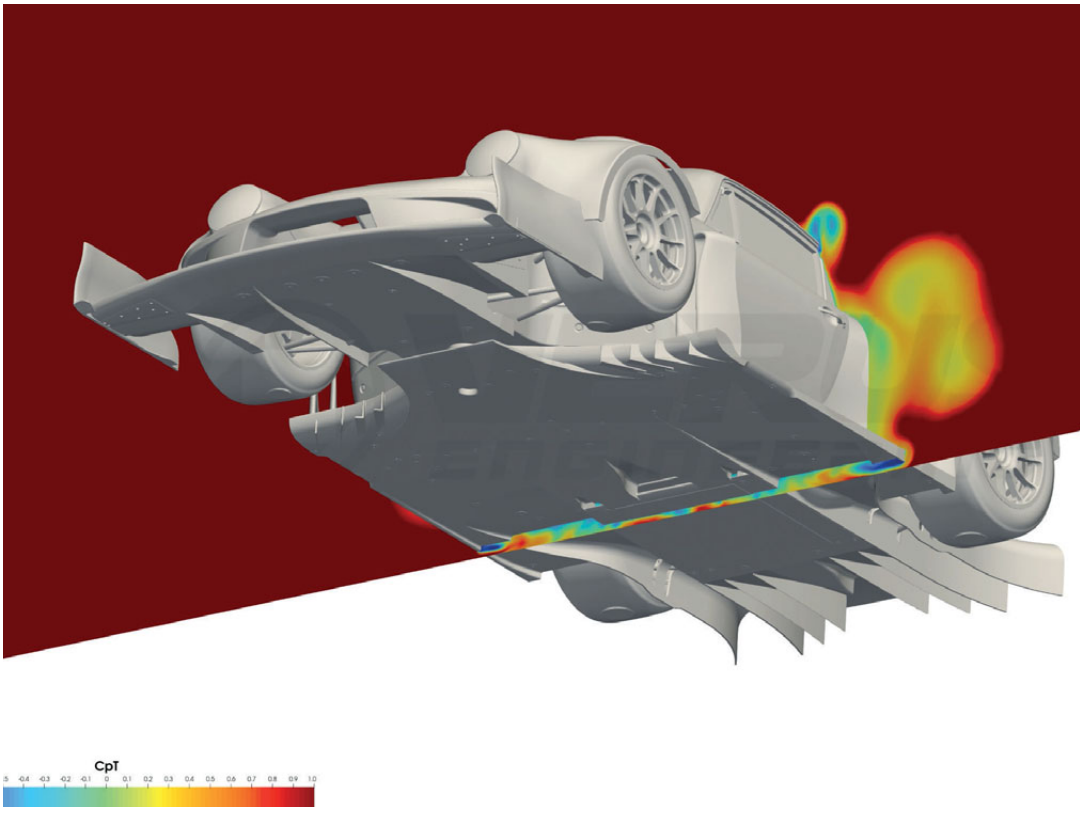
"The evolution of it going from an extremely rusty bodyshell of a 1973 badass vintage-capable race car that you could drive on the street, to a full-on competitive Pikes Peak contender, everything had to happen in parallel," he explains. "Like building a chassis, redesigning the chassis, moving an engine while the bodywork was already being made. So [for example] we cut the moulds for the front of the car, because that wasn't going to change. That's how this went."

Right first time

Designed in the US, the carbon fibre bodywork was produced in Sweden, from drawings, and shipped to California while the chassis was still being evolved.

Fortunately, such was the accuracy of both the initial design and the production, that the bodywork fitted first time. The Hoonipigasus' only non-composite panel remains the roof.

In an initially unintended nod to Porsche racing history, the pink livery that adorns the carbon bodywork – created by renowned artist Trouble



LEFT Creating an aerodynamic package to perform across the entire 156-corner route is key

LEFT Beneath the skin of one of the last big ICE projects ever destined for Pikes Peak

Andrew – pays homage to the famous 1971 Porsche 917/20 'Pink Pig'.

The bodywork production was a critical element to the final form of the 911, with substantial effort given to the aerodynamic efficiency of the car. Block had driven up Pikes Peak before in a Rally America event, first at the wheel of a Group N Subaru Impreza, and later with the 1,400 hp, twin-turbo, methanol-fuelled Mustang Hoonicorn for the Hoonigan 'Climbkana: Pikes Peak' film in 2017. But his Hoonigan team knew that it was this kind of specific detail on a "proper" Pikes Peak machine that made the Porsche project so appealing, giving it the best chance of challenging for the open category or even overall success.

With air density on the 12.42-mile Colorado course being between 30 and 40% less than that at sea level, creating an aerodynamic package to perform across the entire 156-corner route is key. At sea level, the Hoonipigasus' front splitter, strong enough to hold the weight of a grown adult, produces about 4,000 lbs (113 kilograms) of downforce at 160 mph. With an average speed of 80 to 85 miles per hour on the course, BBi increased the radiator size compared to what would be required at sea level. Air is forced through the front-mounted unit by the intake above the splitter, and then out over the bonnet, also helping the airflow over the car.

The car's designers had much discussion over roof cutter rails, the offset of maintaining 911 authenticity over improving the aero flow. Ultimately, the nod to the car's origins won out.

> *"Ride height is constantly monitored by lasers front and rear within the GPS-led system"*

At the rear side of the roof, the air flows across the scoop at the rear-screen area that feeds the intercooler, and over the large dual-element rear wing. Incidentally, like a World Rally or World Rallycross machine, the rear wing endplates are profiled to help maintain aerodynamic efficiency even at extreme yaw angles.

Buttresses on the extremities of the front splitter force air into cooling ducts at the sides of the front bumper, and over the front arches, where the air is also met with the outflow from the vent above the front wheel.

Bargeboards behind the front wheel area straighten the air down the side of the car, over the rear arch and to the rear wing, also passing the inlets for the two turbocharges via the rear window on each side. Lower ducts on the side feed cool air to the exhaust manifolds.

Lips on the side skirts have, following much research at various ride heights, "almost eliminated all porpoising," notes Berisha, adopting the trendy language to describe the aerodynamic issues facing the 2022 specification Formula 1 cars.

Underneath, from the driver's footwell area, the diffuser tunnels lead to the rear of the car. There the rear bumper is non-existent in a bid to optimise the rear diffuser's exit, following extensive analysis not only of the airflow outside the car, but through it too.

Created in harmony with the bodywork, the 911's suspension, developed in-house at Scarbo Performance, is fully active. While the Pikes Peak course is today only asphalt, rather than its mixed-surface construction of yesteryear, the surface is far from that of a silky-smooth race circuit. That means a compliant chassis with just the right amount of body roll is required.

Keeping the contact patch active

"Scarbo did a lot of work with roll centres and he actually has a really long control arm package on this car, so you have very little toe change and a little bit of camber gain under compression, but we have about six inches of wheel travel which is more than any car we've ever done for Pikes Peak," says Berisha. "The idea for that is when you're hitting the big bumps, the tyres can go down to the ground and you're not catching air so you're keeping that contact patch active."

Those 18" wide tyres have been created ▶

specifically by Toyo Tires, in a choice of a soft and a medium compound, with unique sidewalls to deal with the challenges of the famous hillclimb. The tyres shroud bespoke 13" Rotiform wheels, weighing 8.6 kilograms each.

BBi is secretive about the unique ceramic disc and pad construction of its brake setup, with one of the major challenges in hillclimbing for brakes to work from cold initially but also when red hot at the end of the run. The discs and pads are, however, activated by PFC-designed six-piston callipers.

Hydraulic ram

The car uses bespoke billet aluminium uprights, with shim packs for changing camber quickly. At the other side of the rocker arms, inboard dampers have been developed by KW. The firm's new solid shaft design is four-way adjustable, with adjustment options for both low- and high-speed compression and rebound.

Sitting between the dampers, a hydraulic ram is operated via a pump and control valve, controlled by a MoTeC M142 system to maintain ride height as the relatively soft chassis changes across the course, especially at higher speeds with increased aerodynamic loads. The ride height is constantly monitored by lasers front and rear within the GPS-led system. The whole course can be mapped with target ride heights to achieve ultimate performance, based on telemetry from previous runs.

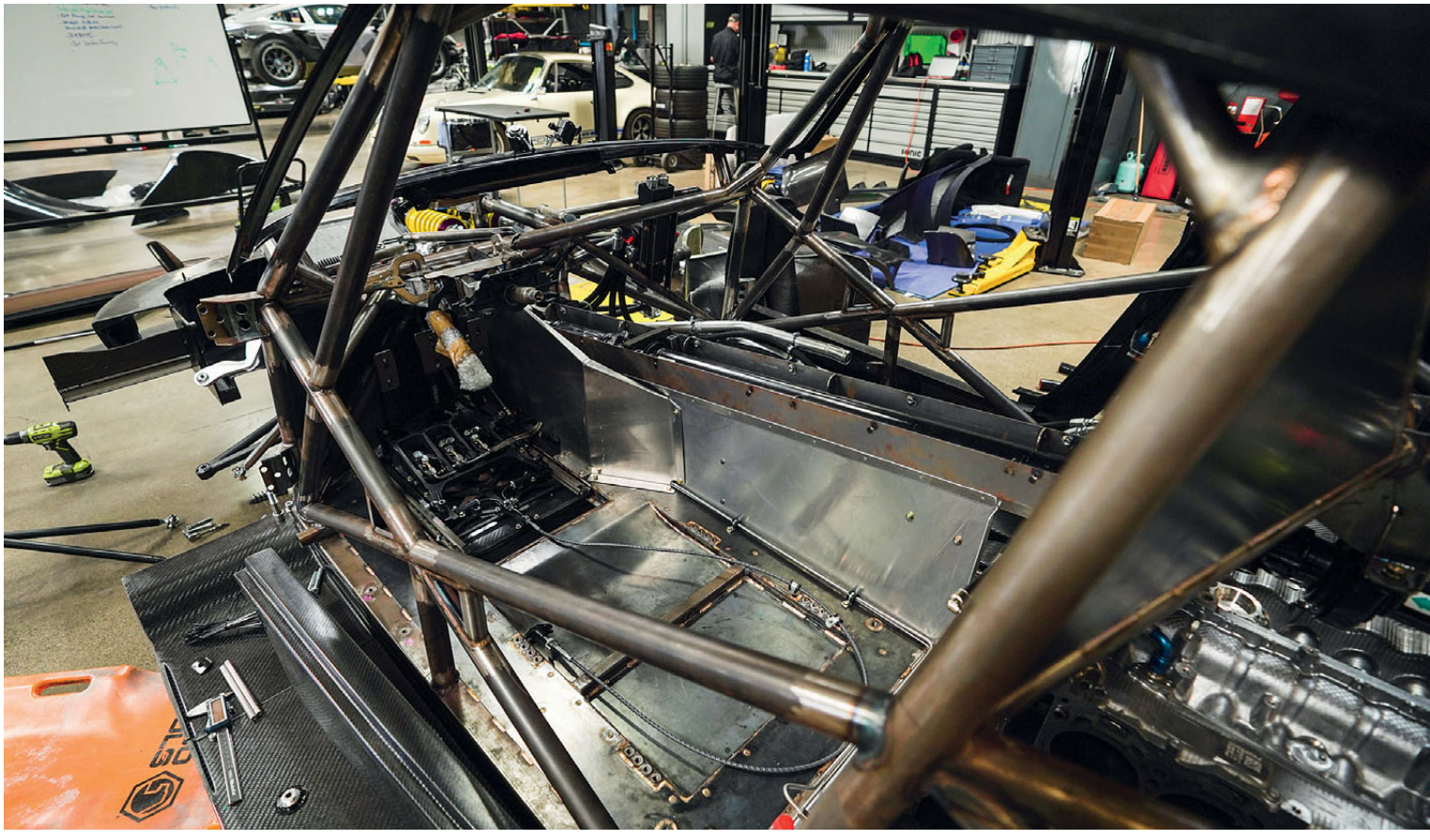
That system is part of 4.5 miles of wiring loom inside the car, including a pair of MoTeC ECUs, a Bosch PDM and a Vbox data logging system. Berisha opines that the car features what must be one of the longest CAN bus systems ever created by wiring experts KSV Looms in Florida.

A 21-gallon Premier-made ethanol fuel tank, where the passenger seat would conventionally be located, is also inside the cockpit, while the driver sits aboard a RaceTech seat, on the other side.

But arguably, it's also inside the cockpit, above the ▶

ABOVE The Hoonipigasus' only non-composite panel remains the roof

BELOW Moving the engine from the rear to a mid-position necessitated running the propshaft through the middle of the cockpit



LEFT The Hoonipigasus comes together in the workshop

BELOW As with a WRC car, the rear wing endplates are profiled to maintain aero efficiency even at extreme yaw angles

> *"Everything was a bit of give and take. The big take, which sucked, was that the driveshaft had to run through the centre of the top of the engine"*

car's battery and Lifeline fire extinguisher system, where the Hoonipigasus' most interesting feature resides.

"We very loosely started with a 1966 912 and as we took the engine from the back to the middle, that presented a huge issue: how do you run the driveshaft to the front of the car?" says Berisha. While a 'normal' Porsche 911 has the transmission in front of the engine, with the Hoonipigasus the Sadev sequential gearbox sits behind the engine, operated by a steering wheel-mounted paddle shift system.

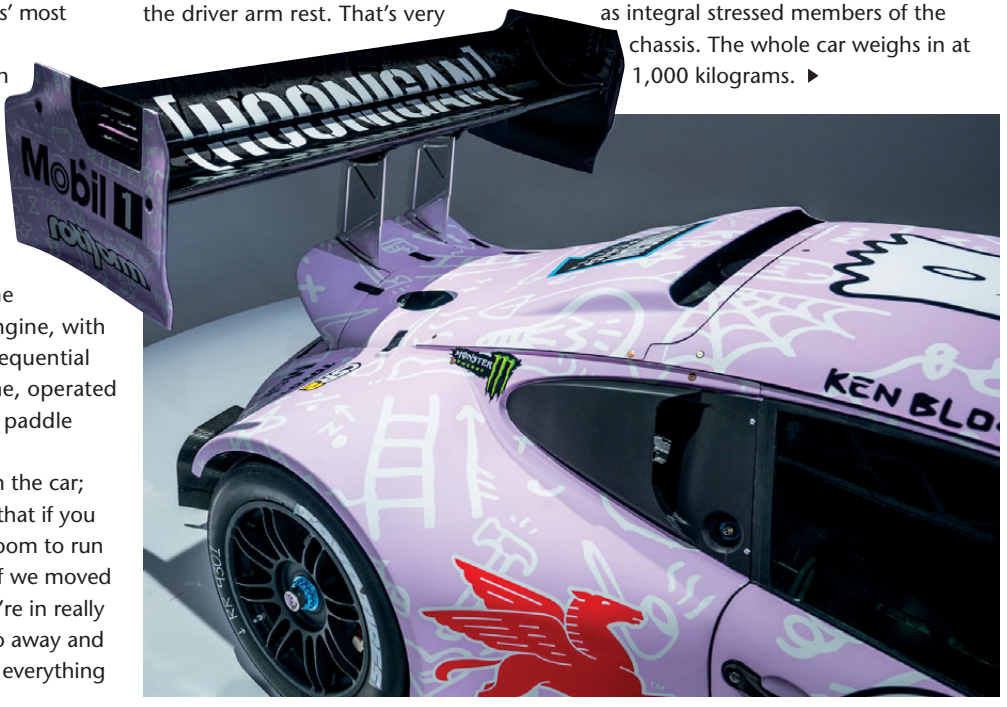
"There's no room underneath the car; our centre of gravity is so low that if you look under there, there is no room to run a driveshaft," he points out. "If we moved the engine up a little then you're in really bad shape: your axle angles go away and everything. So [with] packing, everything was a little bit of give and a little bit of take. The big take, which sucked, was that the driveshaft had to run through the centre of the top of the engine."

The result of the shaft running across the top of the horizontally opposed engine, and needing to get back down the axle level to meet the front differential, meant the propshaft runs through the middle of the cockpit, next to the driver at elbow level.

"We always talk about the driveshaft tube being the 'Chorizo Tunnel', but that tunnel houses a driveshaft spinning at 8,300 RPM," notes Berisha. "It's basically the driver arm rest. That's very unconventional and we had to raise the front diff just to get the driveshaft angles correct. And when you do that, you have to raise the rack up and now you have to move the radiator forward, so every single thing is about as close and tight as you can do it."

Stressed members

Like the gearbox, the front differential is supplied by Sadev, the same specification as the unit used in the rear of Block's Hoonicorn, but the car has no centre differential. Both engine and gearbox are without a subframe to support them, as integral stressed members of the chassis. The whole car weighs in at 1,000 kilograms. ▶



The engine itself, a twin-turbocharged 4.0-litre flat-six, produces 1,400 bhp. It started life as a 2016 GT3 R engine in the factory Porsche racecar run in IMSA and GT3.

"We decided to go that route because the engine is wild," says Berisha. "It spins at 9,000 RPM, has massive ports and a very, very robust oiling system. This is a dry sump system. They call it an MA family engine, and a cool part is that we got to retain one of the carbon fibre oil tanks from the GT3 R programme, which holds about 12.6 litres of oil."

Continuing the work done with Porsche through much endurance testing for the GT machines, the Mobil 1 partnership for lubrication is maintained into this programme.

For boost, the rear quarter window ducts on each side feed a pair of Garrett Motorsport turbochargers. "They're quite large, they're the biggest actual Garrett Motorsport turbo that they've produced, and they're unbelievably light, so that's why we went with them," says Berisha.

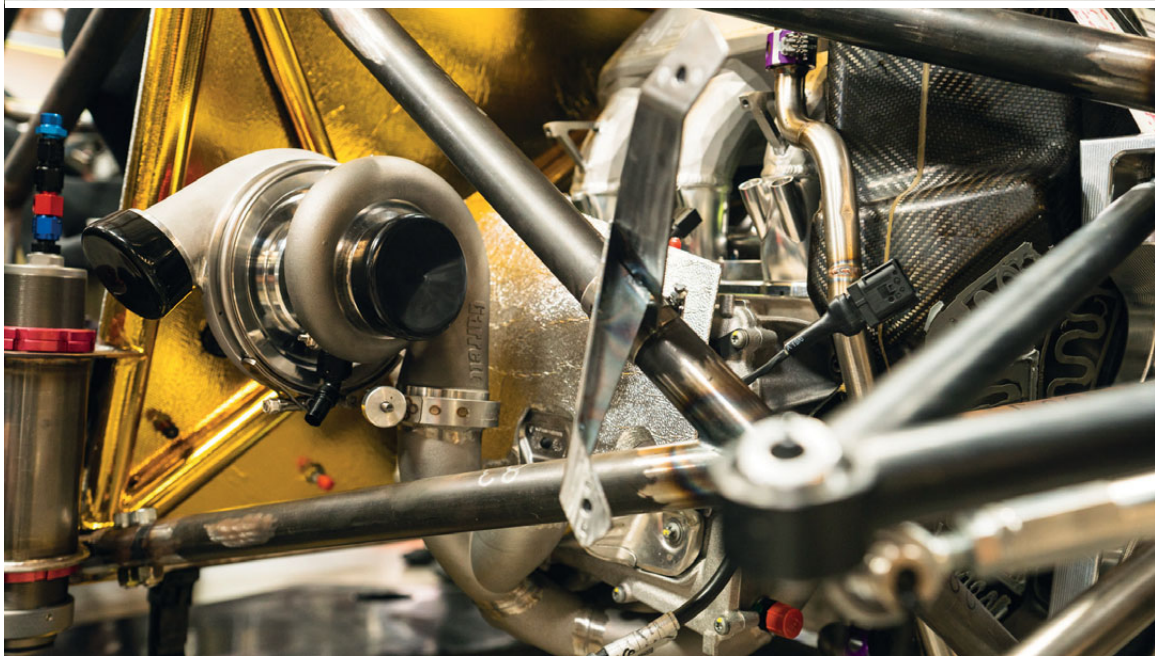
"They are fed from the engine by 3D printed Inconel headers and a Garrett wastegate. Using methanol, we have three injectors per cylinder, two of which are port-mounted, and one direct injection, which came original on the GT3 R package. That had a tremendous cooling effect: the exhaust gas temperatures are about 300 degrees cooler than we were running last year on E85, so we know it's doing its job and keeping a real cool combustion chamber."

Tight timeframe

Derek Dauncey, head of the Hoonigan Racing Division, has worked with Block for 17 years. He notes that the build schedule for the Hoonipigasus was tight, especially at a time when supply chain issues are hitting all areas of the automotive sector.

"The timeframe for the car was extremely challenging. We've always

LEFT The build programme was tight, especially given the global supply chain delays



LEFT Packaging is extremely tight throughout the car

> *"The future of Pikes Peak is electric, whether you like that or not"*

been on the limit, we call it the second 59 of a minute, but we've been right on second 59.9," says Dauncey. "To be fair to everybody involved in the project, to build a full prototype car in four months is incredible."

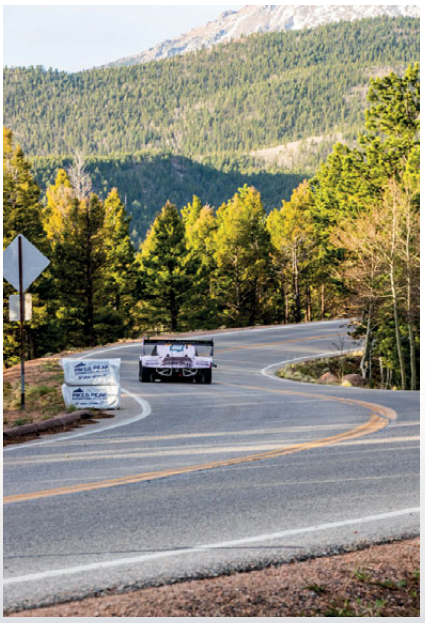
Despite that effort, though, engine issues plagued the final testing of the car in the week before Pikes Peak. They included dropping an exhaust valve and a damaged cylinder head and piston, on top of a broken bespoke turbo. Even though the team did everything in its power to resolve the problems, Block was unable to take to the hill competitively – this year at least.

"The good news is, we have a year to think about this thing, to develop it further, build a spare engine, and look back at what we've learned in the last five-six months, apply that to the next year so we'll come back stronger and better," says Berisha.

That return in 2023 will give BBi, Hoonigan and Block an opportunity to be part of what Scotto believes could be the end of an era.

"The future of Pikes Peak is electric, whether you like that or not," he observes. "Electric engines just work better at altitude. They don't have all the problems that you run into with an internal combustion engine, when you're dealing with air density and all these different things, and that's one of the reasons we wanted to build the Hoonipigasus.

"We knew that the Hoonipigasus might be the last of an era. It might be the last big, huge budget [build], because no factory [team] is building a car like this anymore. I just think those are going to go away and it's one of the reasons why it was so cool that not only did we do that, but we built it in a vintage silhouette. This may be the last ridiculously-built gas engine [car] as we know it for Pikes Peak." RT



ABOVE The world's first mid-engined, AWD, twin-turbo vintage Porsche 911

BELOW Engine issues in testing mean we have yet to see the car's potential

Photos: Porsche AG

PORSCHE IS BACK!

Porsche's unveiling of its 963 at Goodwood raised many issues for debate, but **Sergio Rinland** believes there is one thing we can all agree upon: we're on the brink of a golden era

PORSCHE unveiled their latest prototype offering, the 963 LMDh, at the Goodwood Festival of Speed (where else?).

Unlike their last Le Mans winner, the 919, this latest model will try to emulate what the German manufacturer did with prototype racing's top category in the 1960s, 1970s and 1980s – win with customer cars. The last of those efforts was, significantly, the Porsche 962 in the 1980s.

The Porsche 919 LMP1 Hybrid was a truly works effort that ultimately proved to be too expensive even for one of the richest car manufacturers in the world.

But, for the first time in history, the FIA, ACO and IMSA are working together to legislate and sanction a set of regulations – albeit with the phantom of Balance of Performance (BoP). The new rules will equalize cars built under two distinctly different philosophies: one (LMH) for true prototypes where the manufacturers build the whole car; the other (LMDh), a sports car built around a homologated chassis, hybrid system and gearbox and where the engines will be derived from some sort of production vehicle.

Two completely different animals, but which will have the fundamental performance differentiators – weight, aerodynamic downforce and drag and power at the wheels – measured and limited to be the same for all. Those three factors alone are the best BoP we can hope for, but on top of that, IMSA and the ACO will monitor and adjust the secondary performance differentiators, particularly for the LMH competitors, i.e. how and where to apply the electric power so they will not benefit (much) from a better power deployment and tyre management.

It won't be easy, but it is worth the effort. We will have three manufacturers in LMH and five or more in LMDh. It could be fantastic to see all those diverse cars competing against each other, just like in the old days.

In typical fashion, Porsche started testing earlier than any of their competitors, even ironing out the common parts' reliability issues for the benefit of ▶

ABOVE & BELOW
Porsche's 963 harks back to a time when privateers could buy a turn-key 962 and compete for victory

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those still absent. This time around, Porsche don't have the luxury of solving those problems themselves, which lands in the lap of the chosen suppliers.

Not ideal, conceded Thomas Laudenbach, head of Porsche Motorsport, and Urs Kuratle, LMDh Director of Factory Racing, at Goodwood. But they will have to live with it if they want to participate in such a controlled series.

> *"The regulations are now very tight. Unlike the three pages of my beloved Can-Am!"*

Porsche are confident that even with the controlled power and aero and any other BoP thrown at them, they will succeed. According to Laudenbach, you don't need the fastest car to win in long-distance races. It helps, but is not a *sine qua non* condition and Porsche knows a thing or two about winning in sportscar racing.

I actually disagreed with Thomas over the fact that more BoP limitations, beyond power and aero, will be acceptable. I don't believe it's right to penalise the LMH cars if they can be faster with the same limitations of power and aero but a different way of putting that on the ground. But by the end of a lengthy conversation with Thomas, Urs, Larry Holt and David Clark, there was at least one thing that we could all agree upon: it was great to have Porsche back!

ABOVE Porsche's 917/30 Spyder killed Can-Am

BELOW Porsche's extensive testing of the LMDh car has actually helped remedy the category's technical teething problems for rivals too

This time around, Porsche will not participate with an official entry. It has handed over those responsibilities to Penske Racing, to try to repeat what they did in the '70s with the 917 Can-Am and the 2000s with the Spyder LMP2. Only this time around, there is no risk of killing a series as they did with Can-Am.

The regulations are now very tight. *Very*! Unlike the three pages of my beloved Can-Am. They are counting on many private teams buying 963s to compete (and win!), just like they did with the 917, 956 and 962s. It's a welcome return to a golden era of sportscar racing many of us have yearned for.

If I were Toyota and Peugeot, I would be concerned… RT

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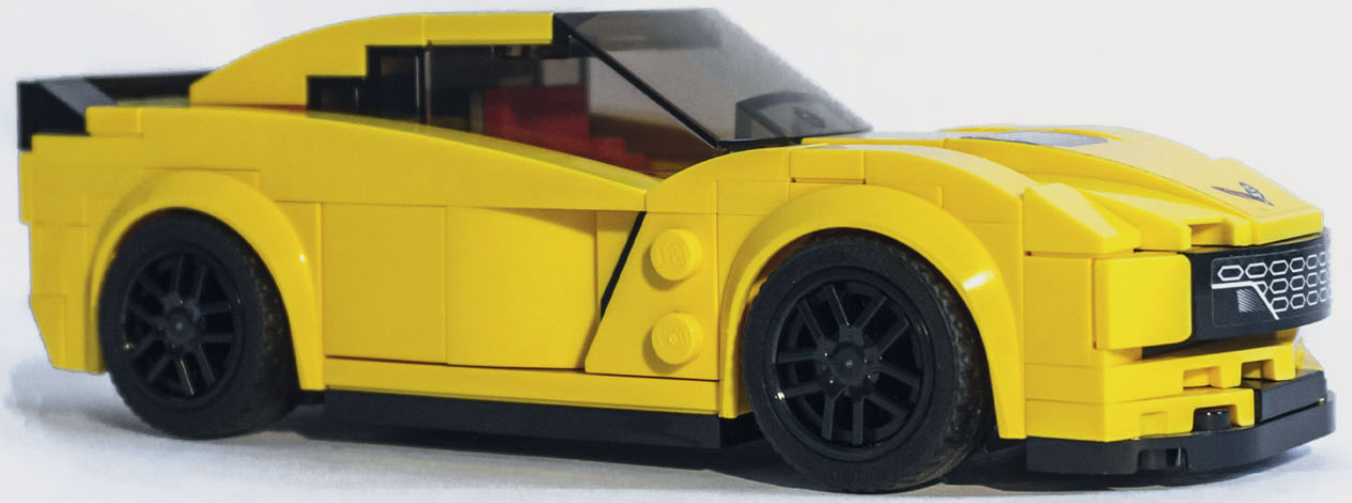

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