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# NEVER TOO LATE

**HAVE** had the same milkman for 20 years. He delivers the milk to me in reusable glass bottles, and when they are empty, I leave them on the doorstep for him to collect and load onto his electric milk float. Without knowing it, both of us have been green for years.

Being green and using battery power is the way to go, it seems. In London, the extension to the Ultra Low Emissions Zone is being considerably widened this time next year. So if your vehicle does not meet the emissions regulations, that's £15 a journey, thank you very much. The hardest hit, of course, will be those who cannot afford to upgrade to a vehicle that meets the regulations, so well done Sadiq Khan, the Labour mayor of London.

Motor manufacturers are having to adjust their plans to bring out electric vehicles more urgently than before. The pressure is on to meet the UK and many other governments' policy of banning the sale of new petrol, diesel or hybrid cars from 2035.

This enforced swing to battery-powered cars is being reflected in the new race series that are now beginning to emerge. The latest, called SuperCharge, will adopt a rallycross style of racing. Jumps, mixed surfaces, low friction surfaces and a 'Joker' lap on a circuit that can be viewed from wherever you watch, have all been part of rallycross since its creation in 1967. Now, though, there's a new kid on the block offering pretty well the same format but all-electric.

The original rallycross championship was, without doubt, an exciting series. Its rules freedom, unparalleled in the top tier of modern motorsport, led to the development of some exciting cars such as Martin Schanche's four-wheel drive 'Xtrac' Escort, which really pushed the boundaries. SuperCharge intends to do the same thing: not with transmissions, but with battery technology development.

SuperCharge may be the last out of the starting blocks, but the relevance to car manufacturers and battery suppliers will ensure that the series has a strong chance of being very successful.

William Kimberley
EDITOR



MOTORSPORTS PROFESSIONAL



# **F1 PLOTS DIFFERENT TECHNICAL DIRECTION**

#### Honda's bombshell withdrawal could lead to greater electrification of F1's engines. By **Mark Skewis**

**ONDA'S** decision to withdraw from Formula 1 leaves the sport at an uncomfortable crossroads. Not only does one of its star teams face an imminent engine supply crisis, but F1 itself – still years away from its next planned set of engine rules – is confronted by the question of which technical direction it should head in.

Manufacturers come and go from the sport – this is the fourth time Honda has quit Formula 1. But where its previous exits were sparked by the likes of a Japanese financial crisis, then a global downturn, this departure is more worrying still. Rather than just cite the COVID-19 pandemic, which most people would have accepted without question, Honda blamed a "once-in-one-hundred-years period of great transformation" of the road-car industry, which has seen a huge shift in focus towards electrification.

Formula E founder Alejandro Agag believes that ICE technology will continue, but that the march of electrification is "an unstoppable trend". He should know: it's his vision for the all-electric single-seater series that has sucked in many of the manufacturers that would normally be candidates to replace Honda in the top tier.

So where does this leave F1? Fighting for survival, is the obvious answer. But how?

Cyril Abiteboul, managing director of the Renault F1 Team, suggested that faced with competition from Formula E, F1 must find its own style and space if it is to prosper again. "Technology is only good enough if you also manage to get your message across and that's what we are failing to do," he said of F1's current 1.6-litre V6 turbo hybrids.

"I have a concern that when you lose a battle of perception, it's very difficult to turn this around. We may have to accept a sufficient departure from the current engine/powertrain such that we can also reset the perception of what we do."

Writing in his Last Lap column for this month's RACE TECH, Sergio Rinland warned that F1 must juggle the often conflicting demand of providing entertainment for the fans, with the technical battlefield desired by manufacturers with their own interests at heart. "F1 has to decide what it wants to be," he said. "Otherwise it is risking extinction."

#### WHY DID HONDA REALLY QUIT?

In its official statement, Honda said it will strive for the "realization of carbon neutrality by 2050".

To that end it will funnel its corporate resources in research and development







into "areas of future power unit and energy technologies, including fuel cell vehicle (FCV) and battery EV (BEV) technologies, which will be the core of carbon-free technologies."

It accepted that motorsport is in Honda's DNA and within 24 hours of the F1 bombshell dropping, Honda's American arm, Honda Performance Development, had reaffirmed its commitment to IndyCar. Notably, the US single-seater series is to adopt hybrid technology in 2023...

At face value, the Japanese car-makers' collective attitude towards electrification suddenly a guiding light for Honda - would appear to be contradictory. The country's automotive giants wrote off EVs years ago, deterred by the high cost of batteries and also by 'range anxiety'. Instead, hybrid powertrains offered a cheaper and far more practical way to quickly cut emissions and boost fuel efficiency.

So why would Honda abandon F1 with its powerplant becoming competitive, much of the hard work seemingly done, and the sport's hybrid engines beginning to boast hugely impressive levels of thermal efficiency?

A clue to the puzzle, and the intense pressure to which Honda now finds itself subject, perhaps lay in the comments last

> LEFT Making a point: Max Verstappen's championing of Honda's cause wasn't enough for the manufacturer to resist external pressure

He suggested that achieving that aim Japan's major industries - including automotive - that can transform the challenge into a path for major growth. His statement ratcheted up the pressure on the likes of Honda, for delivering zero-emission vehicles will mean the car companies revisiting their long-held scepticism about the viability of batterypowered vehicles. That route now looks more attractive than it once did, with battery costs dropping quickly and advanced battery chemistries beginning to erase concerns about range.

It's no coincidence that SuperCharge, the latest EV motorsport series to launch to huge fanfare, is heavily promoting the freedom within its rules for manufacturers' R&D departments to pursue groundbreaking battery advances.

#### WHAT ARE F1'S OPTIONS?

The hybrid route that F1 helps promote still looks the best option for non-urban motoring. But it is rendered less attractive by countries' legislation increasingly being driven by tailpipe emissions, rather than proper Life Cycle Analysis. So, given the huge pressure to achieve carbon neutrality, how should F1 respond?

One option is that attack is the best method of defence. F1 could go for broke with its next generation powerplant, due



for 2026, including new technologies that might appeal to manufacturers.

Electric technology is not sufficiently developed to power a vehicle at F1 speeds for the duration of a grand prix, so the sport's highest category cannot go fully electric.

It could, for the sake of argument, if it wanted to usher in a revolution, consider introducing hydrogen into the equation. After all, the manufacturers turning to hybrids did so in the belief that they would eventually give way to the ultimate power source: hydrogen-burning fuel cells.

Many other industries believe hydrogen could be the ultimate solution to their problems, and the momentum behind it is increasing. Recently the first trial commercial flight using hydrogen took place in the UK. So too, the first hydrogen-powered train journey was undertaken.

The go-for-broke strategy is a highly unlikely scenario, though. Japan's auto industry has sold only a few thousand hydrogen-fuelled cars to date. That's well below the government's hope of 40,000 sales by the end of this year.

Ultimately, if the world's automotive powerhouses don't know the direction in which the technology roadmap will unfold, how can F1, for all its brains, predict the magic path to the future?

To do nothing, however, is no option at all. With Renault currently supplying only its works team, F1 could effectively find itself down to just two manufacturers. That is, as demonstrated by the woes of the DTM, a precarious position.

On the plus side, Mercedes has just



reaffirmed its commitment to hybrid technology, and to F1. Ferrari, meanwhile, is an ever-present. But If F1 chooses just to freeze its technology, stick with what it has, what message does that send to the industry? What would the attraction be for other potential manufacturers to enter what is effectively a 'closed shop'?

More likely, perhaps, is an intelligent halfway house. F1 could delay the introduction of its next generation powerplant. That would buy it time to see where disruptive industry trends headed, but that time would not be wasted.

The likelihood is that F1 will retain the existing engine technology but still look to advance the package. The use of 'E-fuels' remains very much on its radar. These synthetic fuels, which capture carbon from the atmosphere in their manufacture and are therefore carbon neutral, remain a central plank of F1's sustainability plans. Many in the industry also believe such fuels offer a route to retain the existing automotive infrastructure across the globe, rather than ditching millions of cars in a



ABOVE Honda has vowed to pursue further glory before walking away at the end of the 2021 season

LEFT Honda's hybrid engine may yet continue in F1 after the manufacturer's departure kamikaze dash towards EVs.

F1's original intention was to transition to E-fuels for 2023. One of the biggest drawbacks with this option is the supply chain, though, so that timescale is likely to slip back.

Another likely option, that would appeal to manufacturers eager for electrification, would be to progressively introduce more electrification into the existing engines. Front axle recovery, for instance, and a slightly bigger battery to enable more power to be produced by the electrical machines rather than the ICE engine, which could be downsized.

#### WHERE NOW FOR RED BULL?

In the meantime, Honda's departure leaves Red Bull and Alpha Tauri needing to find an engine supplier.

Red Bull team principal Christian Horner said: "The shifting focus within the automotive industry has led to Honda's decision to re-deploy their resources and we understand and respect the reasoning behind this.

"Their decision presents obvious challenges for us as a team but we have been here before and with our strength in depth we are well prepared and equipped to respond effectively, as we have proven in the past.

"Our joint focus for the remainder of the 2020 and 2021 seasons are unchanged, to fight for victories and challenge for the championship."

One option, being investigated, is for Red Bull to continue to use Honda's engine. The biggest obstacle to any rebadging or further development of the unit is likely to be the issue of IP.

Another possibility is for Renault to ride to the rescue with a supply deal. Though the two parties split in acrimonious fashion at the end of 2018, you never say never in F1.

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New SuperCharge EV series launched

Engineering







# Battery innovation a key feature of new EV series

**AN** all-new global motorsport series based on 670 bhp electric crossover road cars has been revealed.

Called SuperCharge, it aims to provide a vision of future technology and sustainability that will engage young, urban and environmentally-conscious fans.

Big claims, perhaps, but some heavyweight names from the motorsport industry have been involved in its conception over the past 18 months.

SuperCharge will be managed by ex-Stewart and Jaguar Formula 1 team commercial director Rob Armstrong, who latterly served as the global head of motorsport for World Rallycross promotor IMG.

His fellow co-founder is Max Welti, formerly of Sauber F1 and a man who played a prominent role in Michael Schumacher's rise to F1 through the Mercedes-Benz junior team in the World Sportscar Championship. A former professional racing driver, Welti has directed global motorsport programmes for Audi, BMW, Ford, Lamborghini, Mercedes, Porsche and Volkswagen. SuperCharge has been created, in consultation with some of the world's leading car manufacturers, to showcase next-generation electric road cars in the volume and growth part of the market – compact SUVs and crossovers – as well as leading-edge battery technologies.

The series aims to be located in bustling urban environments based around an access-all-areas, fun, informative, festivalstyle atmosphere.

"Motorsport is at a crossroads," said SuperCharge Managing Director and co-founder Rob Armstrong. "Alejandro Agag and Jean Todt have done a great job pioneering electric motorsport. With many countries and cities already announcing plans to ban internal combustion-engine cars in the coming years, the need for road car-based electric motorsport is becoming more and more compelling. We believe it is only a matter of time before there are more electric motorsport series. Given this rapidly increasing EV momentum, we believe the timing and appeal of SuperCharge is ideal and see a clear space for it as the road carrelevant motorsport series.

"We have carefully conceived SuperCharge to take into account these







societal changes and to consider the needs of car companies, fans, commercial parties and venues in order to make a truly sustainable and commercially viable new series. SuperCharge takes motorsport into a new and hugely relevant arena."

With a planned 2022 start, the inaugural series is targeting eight events taking place right across the globe, in cities from Asia-Pacific, China, Europe, Middle East and USA.

The SuperCharge race cars, codenamed SC01, will share a standardised tubular frame rolling chassis but offer spectacular performance. With similar acceleration to a Formula 1 car, they will adopt an electric motor drivetrain on the front axle and one on the rear axle, generating peak power from the battery of up to 500 kW (equivalent to around 670 bhp) and accelerate from 0-100 km/h in just 2.5 seconds.

#### **BATTERY DEVELOPMENT**

To ensure competitive racing, the technical regulations of the series will mean the only ways of gaining improved on-track performance come from a combination of driver skill (driver aids including launch control, traction control and brake-by-wire are outlawed), mechanical set-up (including suspension and differential adjustment) and team development of battery technology systems. The latter will span power drawdown, battery geometry, cooling and battery management systems.

Commenting on his involvement with SuperCharge, Welti added: "I've been involved with many ground-breaking race series as both a driver and promoter and realised that motorsport as we know it has to change. SuperCharge has been developed to be an intrinsic part of that change, and we are working closely with leading manufacturers and key suppliers, like German car constructor Holzer, in turning this exciting concept into reality. Undoubtedly, it is an exciting time to be involved in revolutionising the next generation of motorsport."

SuperCharge – which will adopt a digital-first media strategy – is working closely with both the British Automobile Racing Club (BARC) and Motorsport UK as it seeks to apply to become an FIA International Series.

## SuperCharge vs Rallycross: Spot the Difference!

**RALLYCROSS** fans might find some of the new format familiar: a knockout system featuring a series of 15 quick-fire races, with a maximum of six laps each. The track itself will ring a few bells too: a 2.5m ramp for jumps; mixed surfaces for sliding and drifting; water gantry to create a wet/dry surface transition; and a once-per-race 'joker' lap extension.

No surprise, then, to learn that some of the figures behind the concept, including the MD Armstrong, have experience of working in World RX. Or that Tanner Foust, a former US rallycross champion, was among the drivers who offered input into the new series.

Teams will be able to adapt the standard specification car in two ways: bodywork and battery technology system development, that can in turn enhance the underlying battery performance of road-going EVs. The intention is to give manufacturers the scope to develop, test and hone electric car battery technology innovations (including smart energy management systems) and relevant software in real-world racing.

The focus on battery development illustrates the changing trends within the EV sector. World RX's first, abortive, attempt to transition to electric technology saw manufacturers seek freedom to develop motors. Now, just a few years on, the clamour – addressed by SuperCharge – is for R&D departments to reap the benefit of battery innovation.



many cues from rallycross



**DAVID** Mountain, the founder of Mountune, together with a group of experienced industry investors, has completed the acquisition of the Mountune Performance and Racing business.

The move safeguards a large number of jobs at the Essex-based facility. In addition to safeguarding the company's work on ICE projects, the new capital also raises the enticing prospect of an expansion into electric powertrains.

The new-look Mountune will continue to deliver racing engines and road-car performance hardware and software for its global customer-base. At the same time it is to address the issues faced in recent years and, in particular, throughout the downturn which has affected so many businesses in 2020.

"It's widely recognised that the success of the road-car group, predominantly, led to a situation where the demand was outstripping the previous business's ability to supply and support our customers," explained Mountain, who resigned from his original role, frustrated with the situation. "COVID-19 simply served to compound the problem further.



**ABOVE** "We want to get back to what we do best – making power!" says David Mountain

"It gives me enormous pleasure to be able to secure the brand both now, in its 40th year, and for the future. We can't wait to get back to supplying and supporting our customers and dealers properly and also embracing new technologies that will enable us to take Mountune forward for decades to come."

While Mountune will be returning to business as usual, there will also be an eye to the future, with Mountain and the investment team keen to bring their expertise and relevant knowledge to pursue the planned development in next generation powertrain technology. Mountune will look to repeat the success it has had developing the internal combustion engine and begin its own march towards delivering clean, ultra-high performance electric powertrains to racing and road-car builders worldwide.

Formerly part of a global group structure, together with businesses in the USA, the new UK setup is now completely independent and is once again able to solely focus on racing and performance operations from its UK facility in Essex.



# **Rosberg joins Extreme E**

**THE** momentum behind Extreme E continues to grow, with 2016 F1 World Champion Nico Rosberg renewing his rivalry with former Merc F1 team-mate Lewis Hamilton by entering his own team.

Rosberg Xtreme Racing (RXR) is an evolution of Team Rosberg, founded in 1994 by Nico's father and 1982 F1 World Champion, Keke Rosberg. RXR builds on the team's success in the German Touring Car Masters (DTM) as well as Nico Rosberg's post-F1 career as an entrepreneur in the field of sustainable mobility.

Since retiring from F1, Rosberg has invested in numerous successful sustainability start-ups and is also an early investor and shareholder of the all-electric racing series Formula E. In 2019, Rosberg founded the GREENTECH FESTIVAL, a global platform to showcase pioneering green technologies.

"Extreme E represents an amazing opportunity to not only drive awareness but also inspire action in the fight against climate change – the single biggest threat to our planet today.," said Rosberg. "Since retiring from F1 I have dedicated my career to sustainable technologies so to be able to combine these endeavours with my passion for racing is incredibly fulfilling. " Extreme E's three key pillars –

electrification, environment and equality – were highlighted throughout its Virtual

LEFT Rosberg is the La second F1 World the Champion to join the fray with a team

Launch, which came hot on the heels of the Rosberg announcement.

The presentation provided details on the championship's sustainability goals, Legacy Programmes and commitment to raising awareness of the climate crisis.

Extreme E Founder and CEO Alejandro Agag hosted the event, alongside presenter Nicki Shields, and delivered the series overview, including a revised Season 1 calendar which now incorporates a season finale in Argentine Patagonia.

"Our team has been working really hard behind the scenes and despite the pandemic and the challenges it has provided, we are on track for our first race in March 2021," said Agag.





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# **Cloud over DTM's future**

**THE** DTM has outlined a GT-based future as it bids to halt its terminal decline.

With Audi announcing its withdrawal in April to concentrate on Formula E and similar programmes, leaving BMW as the sole manufacturer, it seemed the series was in dire trouble. However, it has published details about how it is going to survive.

The DTM will become a 'GT3 plus' racing series from 2021 onwards and will no longer be contested by factory teams, but by private racing outfits. Its latest round of cost-cutting measures includes a ban on ABS and traction control. The standing start, meanwhile, will also be replaced by the grid rolling in close double-file formation towards the starting lights that will release the field for the race.

However, many important elements of the current DTM regulations remain in place, including the format with a sprint race of 55 minutes plus one lap on Saturday and Sunday. Unlike most other GT race series, there will be no driver changes in the DTM in the future, while the timed pit stop will be maintained as well.

While Audi and BMW are committed to providing cars for customer teams, both car companies have sold their shares in ITR eV, DTM's parent company, so that Gerhard Berger, ITR chairman, has full control. However, its future is still very uncertain. According to motorsport.com, series promoter ITR GmbH, a subsidiary of ITR eV, is suffering extensive financial problems, recording a loss of  $\notin$ 2.74 million in 2017 and  $\notin$ 5.09 million in 2018. The accounts for 2019 have yet to be published at the time of going to press.

DTM no longer has the Porsche Carrera Cup and European Formula 3 support races in the programme, while Deutsche Post did not extend its contract as the DTM's sponsor this year. Furthermore, ARD, the German broadcaster, used to pay for TV rights for the DTM, but since 2018, TV coverage was taken over by private channel Sat.1. Another blow to the finances is the COVID-19 crisis, which has kept paying spectators away from the races.



LEFT The DTM as we know it is playing out its final days before switching to a GTbased category

# Alfa Romeo extends Sauber Motorsport partnership

**ALFA ROMEO** and Sauber Motorsport are extending their partnership for the 2021 Formula 1 World Championship, continuing the relationship that started in 2018.

"The extension of our relationship with Alfa Romeo is a true statement of intent from both parties," said Frédéric Vasseur, team principal Alfa Romeo Racing ORLEN and CEO Sauber Motorsport. "In Sauber, Alfa Romeo found a committed, performance-driven partner to which they could entrust their brand: we are honoured to carry the heritage and past success of Alfa Romeo in our name. Both parties always intended for this relationship to bear fruit in the long term: we have laid some solid foundations in the last three seasons and we aim to reap the rewards of this work in 2021 and beyond." The Alfa Romeo and Sauber Group partnership also extends beyond racing. The collaboration allows the Sauber Engineering technical expertise to be transferred to Alfa Romeo road car production, leveraging the know-how of Sauber's engineering and aerodynamics departments as well as its proficiency with



ABOVE Alfa Romeo: statement of intent

composite and additive manufacturing. The Sauber Engineering wind tunnel has also been used for aerodynamic research for the GTA, looking at the effects of the manually-adjustable front and rear wings on the Giulia GTAm, as well as the fully faired underbody and rear diffuser.

"Racing and performance are at the core of Alfa Romeo's DNA," said Mike Manley, CEO FCA: "The brand was practically born on a racetrack and today we continue to compete at the most technologically advanced level of motorsport. The partnership with Sauber also allows our customers to benefit from exclusive racing know-how, as in the case of the all-new Giulia GTA and GTAm, which incorporate Sauber Engineering's technical input particularly as it relates to advanced aerodynamics."



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# Honda and Chevrolet commit to IndyCar's hybrid era

WITHIN a day of Honda announcing its withdrawal from Formula 1, it was revealed that Honda Performance Development had, along with Chevrolet, agreed a multi-year extension to continue in IndyCar.

The US single-seater championship's introduction of a new hybrid engine formula has, of necessity, slipped back a year due to the pandemic. Its 2.4-litre, twin-turbo V6 engines with hybrid technology will now be introduced for the 2023 season.

So was the timing of the two Honda announcements – one a body blow to F1, the other a huge boost to its US counterpart, to which the two manufacturers are now committed until nearly the end of the decade – merely a coincidence?

"That's a good question," acknowledged HPD President Ted Klaus. He went on to suggest that the timing was "just kind of a serendipity that the announcements came so close together".

That said, all parties remain acutely aware that IndyCar must avoid the soaring costs and complexity that have dogged the introduction of hybrid technology to F1.

IndyCar will pursue the same route as other cost-conscious series by adopting a spec hybrid unit. The announcement of its new

plans also revealed, time and again, the need to avoid an expensive arms race.

"Any time we do anything, economics matter in a big way," said Jay Frye, President of the NTT IndyCar Series. "That's one of the criteria data points that we'll look at as we go forward on what it does cost, how it works, how we spread it out over a long runway now, which actually helps. So cost matters, and that will be a big factor in what we do going forward."

Another area in which IndyCar must do better than Formula 1 is in conveying the messaging behind the introduction of hybrids. F1 has only belatedly underlined



**ABOVE** IndyCar has been buoyed by its manufacturers signing multi-year extensions

the fact that its hybrid powerplants boast in excess of 50 per cent thermal efficiency.

"I think the formula that we're talking about is relevant to the times," said Klaus. "We need to build a bridge to the future. We need to emotionally connect, not only with customers, but hopefully to some young technically-minded people that might want to come hitch their wagon to Honda and Honda Engineering."

The IndyCar announcement aligns Honda's North American racing programmes with the company's product development activities. Globally, Honda expects two-thirds of its new vehicles sales to be electrified by 2030. In the US, Honda and Chevrolet are working together both on EVs and on autonomous technology.

Mark Reuss, President, General Motors, said the move to hybridisation "fits well with GM's vision of transitioning the automobile industry to an electric future".

With its immediate future secured, IndyCar will have a better platform from which to entice new teams an also, crucially, the third engine manufacturer that all parties desire. "OEM participation is the lifeblood backbone of any series," said Frye. "Another OEM partner would not necessarily be a luxury, it would end up becoming a necessity because we have so many new teams coming into the sport. So we're very bullish about new teams. We know there's some that are currently exploring the series."

# **Salters to be next HPD President**

**HONDA** Performance Development (HPD), which leads all Honda and Acura high-performance racing programmes in North America, has announced that



**ABOVE** Salters has been with HPD since 2015

David Salters will become the seventh president in its history. He succeeds Ted Klaus, who will retire on Dec 1 after a 30year career with Honda.

Salters is a veteran race engineer with more than a quarter of a century of experience in Formula 1 – including serving as the head of ICE power unit development for Ferrari and head of engine development at Mercedes-Benz

High Performance Engines – and IndyCar. He will lead HPD into a new era that includes the development of a new electrified power unit for IndyCar. "Ted Klaus has been an incredibly inspirational leader and a true personification of Honda's Challenging Spirit, something we will draw upon in the days ahead," said Salters.

# BorgWarner completes Delphi acquisition

**TWO** companies with proven motorsport pedigree, BorgWarner Inc and Delphi Technologies, have joined forces to address market trends towards electrification.

The acquisition of Delphi Technologies is expected to strengthen BorgWarner's electronics and power electronics products, capabilities and scale. It will create a leader in electrified propulsion systems that BorgWarner believes is well-positioned to take advantage of future propulsion migration.

"Through this combination, BorgWarner is even better positioned with a more comprehensive portfolio of industry-leading propulsion products and systems across combustion, hybrid and electric vehicles," said Frédéric Lissalde, President and CEO, BorgWarner. "We expect that the combination will also strengthen our commercial vehicle and aftermarket businesses."

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# Camaro to join Supercars grid in 2022

**THE** Chevrolet Camaro ZL1 will join the Supercars Championship grid in 2022, under the category's new Gen3 rule package.

Supercars and Chevrolet parent company General Motors have confirmed the American muscle car will take on its traditional rival, the Ford Mustang, in a new era for the sport.

With GM electing to shut down Holden's operations this year, the current Commodores will race on in 2021,

before the Gen3 Camaros debut the following season.

Current Holden factory team Triple Eight is spearheading the project, having been charged with the design of the Gen3 Camaro race car body by Supercars under the endorsement of GM. The Intellectual Property for the race car will be retained by Supercars, meaning other teams will also be able to race Camaros, either by purchasing complete cars from Triple Eight or by building their own.

Renders of a Gen3 Camaro Supercar dressed in Red Bull, Penrite Racing and Walkinshaw Andretti United colours have been released by Supercars as part of the announcement.

Category boss Sean Seamer said: "It's great news to have GM continuing their presence in Australasia's leading motorsports category. The Camaro will play a key role in the development of our new generation of race cars, so when it hits the track, it's sure to excite not only our younger fans, but importantly, all those who remember the nameplate's rich history in the sport."

GM president Mark Reuss added his backing of the project, saying: "We at GM are thrilled to continue an involvement in Supercars in Australia and New Zealand. Chevy Camaro will be an exciting addition to the track, and we have every confidence Triple Eight will ensure the race-going version will be a faithful representation of the road-going Camaro ZL1's DNA."

The Roland Dane-led Triple Eight has run Holdens in Supercars since defecting from Ford in 2010, taking over factory team status in '17.

"It's very pleasing to bring such an iconic car, the Chevrolet Camaro, back to Australia's racetracks," said Dane. "The Camaro looks fantastic as a road car and there's no doubt that it will make a spectacular, aggressive race car."

# Hyundai reveals 2021 WRC support category car

**HYUNDAI** Motorsport has unveiled its new challenger for the FIA World Rally Championship's WRC 2 and WRC 3 support categories.

The i20 N Rally2 is a replacement for the current R5 car and is intended for private teams. First deliveries to customers and final homologation are scheduled for 2021.

The car, which is being developed by Hyundai's customer racing department at its German base in Alzenau, is derived from the i20 N road car. Design work began in January this year.

The five-speed sequential gearbox from the R5 car has been carried over but almost every other part of the i20 N Rally2 is new, including the 1.6-litre turbocharged engine and revised suspension.

Learnings from the R5 car since its debut in late 2016 have been carried forward, but the switch to a new chassis brings a big step in nearly every aspect of the new car's design.

The R5 was the first car built by the

customer racing department and Hyundai Motorsport team principal Andrea Adamo said the i20 N Rally2 showed the progress made in the five years since the department was created: "Every area of the new car is an improvement over the original."









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**FOLLOWING** a year's hiatus due to the effects of the COVID-19 pandemic, the Indy Lights series will re-emerge in 2021. The rejuvenated series will feature a number of technical and financial changes, aimed at cementing its place as the stepping-stone to the pinnacle of American open-wheel racing.

Enhancements in 2021 include an increased value of the champion's

scholarship award to \$1,250,000. A guaranteed entry for the champion into at least three 2022 NTT IndyCar Series events, including the Indianapolis 500, will remain. Also new in 2021, the top three finishers in the Indy Lights championship will each receive an Indy car test at the conclusion of the season.

The Cooper tyre-shod Dallara IL-15 with a 450-horsepower AER powerplant



will see the addition of a Dallaradesigned and installed titanium Halo in 2021 for increased safety. With similarities to an Indy car, the equipment package provides the appropriate training for drivers to take the next step including a six-speed, paddleshift transmission, a 50-horsepower push-to-pass feature, drive-by-wire throttle control and advanced engine management electronics.

"From top to bottom, the entire team recognizes the role and commitment Indy Lights has played in bringing new talent to the NTT IndyCar Series," said Mark Miles, president and CEO of Penske Entertainment. "We are firmly committed to ensuring its continued success."

Twenty-three of the 33 starters in this year's Indianapolis 500 were Indy Lights graduates, including eight Indy Lights champions.

The 2021 Indy Lights calendar ill remain a 10-event, 18-race schedule featuring all three circuit types: oval, road course and street circuit.

# Landmark for Hyundai Veloster N ETCR car





**HYUNDAI** Motorsport marked a milestone in the development of its first electric racecar, the Veloster N ETCR machine, when it completed its first systems integration at Williams Advanced Engineering (WAE).

Activities included four days at the WAE workshop for the integration of the electrical

systems and three days of shakedown and calibration testing at Great Tew circuit, in the Cotswolds (pictured above right).

The integration was performed with the help of an ETCR lab-car built by WAE that was used to replicate and resolve any issues that may possibly occur during the race car integration process.

All the E-Kit components – MAGELEC propulsion power train, BrightLoop DCDC12L converter and Marelli Power Box – performed well, as expected.

Over 300 km were completed during the dynamic shakedown, during which the car proved both safe and reliable.

"We are delighted that the physical testing phase of the programme with the Hyundai Veloster N ETCR has gone so well," said Alec Patterson, ETCR senior programme manager at WAE. "It validates all the preparation work the engineers completed in the digital environment and on the electrical lab car beforehand. The teams now head to Italy for further track testing, allowing them to correlate their analysis tools in a simulated race environment, optimising all the electrical systems prior to final delivery of the batteries for the start of the programme in 2021."



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# **Jaguar Racing renews GKN deal**

**JAGUAR** Racing has confirmed a longterm partnership renewal with GKN Automotive, the global automotive technology company, within the ABB FIA Formula E World Championship.

As Official eDrive Partner, GKN Automotive will work closely with Jaguar Racing's technical partners to apply its design, manufacturing and software development expertise to the Jaguar I-TYPE 5 – the team's new all-electric Formula E racecar.

GKN Automotive will play an important role in the electric powertrain development. Software engineers will be integrated into Jaguar Racing's headquarters, providing extensive knowledge. The British team will utilise GKN Automotive's expertise to develop advanced powertrain cooling technologies for both the inverter and electric motor in pursuit of enhanced system efficiencies.

The partnership with Jaguar Racing

will also feed into development of GKN Automotive's world-leading eDrive technologies for electrified road vehicles. "Pushing our technologies to the



**ABOVE** The camouflage development racecar breaks cover

limits on the race track will speed up innovations, further advancing knowhow," said Liam Butterworth, CEO, GKN Automotive. "Therefore, I'm delighted that our expert eDrive engineers will be working in the Jaguar Racing team."

"The partnership goes beyond the race team as GKN Automotive also plays an important part in developing automotive products across a variety of Jaguar Land Rover models," said James Barclay, Jaguar Racing Team Director. "Together we've had a very successful partnership over the last three years, and we look forward to continued success in the future."

GKN Automotive has roots in motorsport that stretch back to the 1930s. Its long-running partnership with Jaguar dates back to 1935 when GKN Automotive supplied driveline technology to the first SS Jaguar saloon. Today, GKN Automotive supplies every Jaguar model on the market with a range of driveline technologies, including high performance CV Joints and intelligent all-wheel drive systems.

# FIA seeks new promoter for World RX after IMG exit

**THE** FIA has reaffirmed its commitment to the electric revolution of rallycross in the wake of IMG, the commercial rights holder, revealing that it will quit World RX at the end of the year.

'The FIA remains committed to ensuring the ongoing success of the Championship,' it said in a statement. 'The FIA is committed to the evolution of Rallycross with World RX in 2021 alongside RX2e – the first-ever FIA electric Rallycross Championship.

'From 2022, World RX will become fully electric as part of the FIA's long-term vision for the sport.'

The governing body has launched a tender process for the promotion of the FIA World Rallycross Championship.

When IMG first concluded a deal to become the promotor of FIA rallycross, back in 2012, expectations were high. Many insiders viewed the mixed-surface discipline as one of motorsport's best kept secrets and were eager to see an organisation with financial and commercial muscle carry it to new heights.

In many respects, IMG delivered. It

won World Championship status, sealed broadcasting deals, and delivered rallycross to new territories within Europe and further afield, like North and South America, Asia and later Africa and the Middle East.

It also attracted a host of big names, including former WRC champions Sebastien Loeb and Petter Solberg, joined by DTM great Mattias Ekstrom and Ken Block as permanent entrants.

The manufacturers followed suit. By 2017 four squads – Team Peugeot-Hansen, EKS (Audi), PSRX Volkswagen Sweden and Hoonigan Racing Division (Ford) – were running works-supported programmes.



**ABOVE** At its height World RX attracted the big manufacturers

However rallycross, like its more glitzy circuit counterparts, has discovered that manufacturer involvement can be a doubleedged sword. When the planned transition to electric technology didn't suit them, or was not completed to their timescale, the same manufacturers that had expressed so much enthusiasm promptly pulled the plug on their involvement.

The series' electric strategy has since been revised, with EV technology planned to be introduced to the discipline's top class from 2022. Notwithstanding the manufacturer exodus and onset of the Coronavirus pandemic, World RX has continued, salvaging a makeshift calendar this season from the confusion.

IMG was acquired by William Morris Endeavor, a leading global entertainment agency, in 2013 for \$2.4 billion. Although the company operates in more than 30 countries, representing some of the world's greatest sports figures and fashion icons, there has been industry speculation that Endeavour's financial situation has played a role in IMG's decision to abandon World RX.





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D2H Engineering

# KISS GOODBYE TO THE WIND TUNNEL?

**Chris Pickering** investigates the Computational Fluid Dynamics success that has underpinned some giant-killing feats in NASCAR's top tier

**IFTY** TWO thousandths of a second. That was the margin by which Ricky Stenhouse Junior of JTG Daugherty Racing beat Alex Bowman to pole position at this year's Daytona 500. For comparison, that's about a fifth of the time it takes to blink an eye. And yet that can be an eternity in NASCAR.

Success at this level of racing requires a monumental effort on the part of the engineers as well as the drivers. That much perhaps is obvious. But what you might not realise is just how crucial aerodynamic development is in the series.

"A subtle gain can make a big difference in NASCAR. We look at gains and losses to an extra significant digit than engineers would in IndyCar or Formula 1," explains Noah McKay, engineering director of D2H Advanced Technologies – the Anglo-American CFD firm that worked with JTG on its aerodynamic development.

With offices in North Carolina and the UK, D2H has a truly international outlook. Founder Darren Davies has spent much of his career working in Formula 1, and he echoes McKay's comments: "NASCAR pushes aerodynamic development faster and harder than any other series that we're involved in. It's relentless. The very top WEC teams might bring one or two new packages each season – in NASCAR it can be twice a month, and more often during the play-offs. As a result, the development gains from beginning to end of season are generally in double digits for the leading teams."

Budgets, however, are not quite as outrageous in NASCAR – at least, not for the smaller outfits like JTG. The team's director of engineering, Dave Charpentier, points out that the level of CFD support they've received from D2H wouldn't normally be available to a team of this size. "It's helped us put cars on the track that are the equal of much larger teams with significantly deeper pockets," he comments.

According to D2H, the root of these giant-slaying performances lies in a fundamental rethink of the CFD process. "Traditionally, there's been a bit of a twotier approach to CFD," comments Chris Hebert, D2H aerodynamics engineering director. "The mentality in Formula 1, and other series with that sort of money, has been to channel a lot of time and effort into CFD. Elsewhere, it's been seen as something that's quick and dirty, and not entirely trusted. What we've set out to do is bring a Formula 1 quality process to the commercial arena."

This process begins with the CAD data, he explains. Generally the 3D models used as the basis of a CFD study contain a number of tiny imperfections. These could be surfaces that don't quite meet or small holes in the geometry. It sounds simple, but even 3D models that have been put together by skilled CAD designers often end up with these tiny flaws – particularly if parts of the model have been cut back or extended frequently as the design evolved. The high-end approach has traditionally been to get a dedicated CFD engineer who can sort through the model, manually correcting these myriad imperfections. This can be a time-consuming and expensive option. Alternatively, dropping a three dimensional 'wrapper' over the CAD geometry allows you to bypass this process, but it also tends to cover up some of the details, which can significantly reduce the accuracy of the simulation.

D2H's approach has been to develop its own software to automate the CAD checking process. This is by no means a new idea, but the company says it has channelled decades of top-level CFD **•** 

ABOVE D2H Engineering's Computational Fluid Dynamics expertise has helped JTG Daugherty Racing punch above its weight in NASCAR's top flight. Here the CFD streamlines are superimposed on the real car We've refined CFD to the point where we are literally on the verge of replacing the wind tunnel"

experience into a script that performs more than 50 different types of checks. It's also frequently updated to take advantage of the latest developments. "Accurate CAD geometry is very important to CFD. As with any simulation, if you put rubbish in you get rubbish out," comments Hebert. "Better CAD leads to a better mesh, which has a direct impact on the speed and accuracy of the solution."

The reason for this comes down to the fundamental mathematics of CFD, which relies on a set of equations converging towards a common solution. A CFD code solves at a number of points on the vertices of the mesh. If those are well spaced then the code can interpolate reliably across the width of the cell, but if they're highly distorted then the interpolation breaks down. "If you're having to look after these deformed cells you have to start slowly and make sure that each iteration doesn't change too much, but with a perfect mesh you can iterate far more aggressively. That's why good meshes give good solutions quickly," notes Davies.

What's particularly eye-opening is how high quality meshing can break down the trade-off that's normally accepted between solution speed and accuracy. The last NASCAR model that the company ran had some 520 million cells yet solved in just under four hours, McKay points out. A number of tools, including the company's all-important CAD checker,

have been written in-house, but ANSA from Beta CAE is used for the meshing, We look at gains and losses to an extra significant digit than engineers would in IndyCar or Formula 1"





ABOVE The team's post-shutdown performances, including this dramatic secondplace photo finish at Talladega in June, proved Daytona was no fluke

LEFT Ricky Stenhouse Jr's Chevrolet leads the NASCAR Cup Series pack at the Daytona 500 while the solution itself is carried out in Ansys Fluent. For most studies, a RANS (Reynolds-averaged Navier– Stokes) turbulence model is used, but DES (detached eddy simulations) is occasionally used for validation. ("Even with our automation, a DES run takes 20 times longer than a RANS run so it's very computationally expensive," notes Davies. "We occasionally use DES to check that everything is working, but RANS is far more efficient.")

#### **SUBTLE GAINS**

It's this methodical approach to CFD that has helped the company play such a significant part in JTG's NASCAR programme.

Under the current Generation 6 rules, manufacturers are given the freedom to homologate their own bodywork, within a series of constraints laid down in the rules. This design is then tested in the wind tunnel by the governing body to ensure it is within the maximum limits set out for aerodynamic performance. Once approved, the homologated design from each manufacturer is released as a reference to the teams, who are then allowed to apply their own modifications. The rules allow a tolerance of  $\pm 150$ thousandths of an inch ( $\pm 3.8$  mm) on metal surfaces and  $\pm 200$  thousandths of an inch ( $\pm 5.1$  mm) on glass. Within this offset, the teams are free to develop the design of their own individual cars. To enforce these rules, each car is optically scanned during its pre-race technical inspection using a 17-camera system from vision processing specialist Hawk-Eye. The teams typically also have their own scanning systems on-site to guarantee that new designs will meet these criteria before they head to the track.

Although the teams aren't allowed to run flat floors, they are allowed to optimise the aerodynamic properties of the underbody and the running gear, which accounts for more potential gains. The combined effect can be significant, particularly on a pack of cars that are bundled close together at speeds of nearly 200 mph.

"Getting the pole lap at a superspeedway like Daytona or Talladega takes a monumental effort in aerodynamics. Small changes can make all the difference when you're talking thousandths of a second between first and tenth," comments McKay. "By playing around inside those



dimensional tolerances we can generate upwards of 10 per cent more downforce as we optimise various parts of the car over the course of a season."

Without a flat floor, it's particularly important to use the surfaces that you can modify in order to clean up the flow underneath the car, he points out. That's one of the reasons that NASCAR meshes require such high cell counts, with upwards of 500 million cells used to capture the fine detail on the underside.

The bumper-to-bumper racing style also poses challenges – particularly with the high downforce packages that have been used in recent years. Multivehicle CFD studies can be tricky to perform, but the D2H engineers believe they have refined what was once an academic exercise into a practical tool. "We're very happy now with the car-to-car simulations that we've done. It's enabled us to give something back to the driver, explaining how to handle situations that they might encounter. For instance, putting them in a better position to line up a pass," comments McKay.

Another unusual challenge posed by NASCAR is the nature of the circuits. The long sustained corners mean that the cars maintain a fairly constant yaw angle (relative to the air) for significant portions of the lap, often in close proximity to the wall. Likewise, the vehicles themselves are heavily asymmetric. All of which makes the approach to simulating aerodynamic performance somewhat different to that of a symmetrical car on a road course. ► ABOVE A side-on image of the JTG Daugherty Racing Chevrolet from D2H's high fidelity CFD analysis, showing the detailed surface flow characteristics and strong vortex plumes



LEFT Ricky Stenhouse Jr (right) and fellow front row man Alex Bowman with their qualifying awards for the 62nd Daytona 500

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#### **RULE CHANGES**

The past four or five years have seen a series of rule changes in NASCAR, aimed at maximising the series' entertainment value. These have kept the aerodynamics engineers on their toes, with a small change to something like the spoiler and splitter heights having the potential to set off a chain reaction right across the car.

"The body and underbody of the car is comprised of hundreds of separate features that work together to optimise its aerodynamic performance," says McKay. "It's not unknown for us to have to reverse all the refinements we've made once a new rule change comes in. For instance, in the middle of this year NASCAR decided to cut an opening in the right-front window to help bleed interior to exterior air in order to cool the drivers. That's a massive aerodynamic change, particularly at high yaw angles."

Recently, there's also been a logistical shift, with a major reduction in the amount of wind tunnel testing permitted. This has put a lot more pressure on the CFD engineers, but it has also demonstrated just how far the technology can go.

"We've refined CFD solution now to the point where we are literally on the verge of replacing the wind tunnel," comments McKay. "That's something that was highlighted this year with the COVID-19 crisis where a lot of the wind tunnels were closed yet CFD carried on. You could see the product of that work on the race track. It prompted a lot of people to ask whether or not they needed to go back to the tunnels when they opened up."

He cites his contribution towards JTG's pole lap at Daytona this year as one of the proudest moments in his career so far. And the team's post-shutdown performances prove this was no fluke, including a dramatic second-place photo finish at Talladega in June. It just goes to show that in a series often decided by hundredths or thousandths of a second, small changes can add up to a big difference.

## **Tin-top challenge**

#### Small margins also make a big difference in the UK's top racing series

**LIKE** NASCAR, the British Touring Car Championship has a fairly restrictive set of aerodynamic regulations.

The cars are subject to various limits on the types of aerodynamic devices that can be employed and the dimensions of the modified surfaces. Likewise, each must run a standard single-element rear wing at a set angle, which is determined by testing carried out on the standard production car shell in the wind tunnel at MIRA.

That's not to say that there aren't gains to be made, however. D2H Advanced Technologies was called in at the end of last year to assist with the aerodynamic development on the Toyota Corolla run by Speedworks Motorsport in the series.

The results speak for themselves, according to D2H's aerodynamics engineering director Chris Hebert: "There's always performance tucked away where parts of the car come together, whether that's the splitter to the front bumper or the interaction of the wing and the roof. Our CFD process enables us to identify those areas quickly and accurately. The end result of our work on the Corolla was a lap time improvement of three quarters of a second when average virtual lap times were tested over a number of UK circuits."

D2H acted as a one-stop shop for the project, analysing the car, designing a new aero kit and manufacturing the revised parts. But perhaps the biggest accomplishment was the timescale in which the project was delivered.

"Our whole approach is about providing high-quality CFD within a budget and timescale that wouldn't normally be possible," comments Hebert. "In this instance, the car was scanned at the beginning of January and the bodywork was delivered in the middle of March, two days ahead of schedule. And I think you can see its benefit in the results. Tom Ingram has frequently been one of the fastest front-wheel drive competitors in the BTCC this season."



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# **BRAKE** WITH TRADITION

Nobody had ever dared run 24 hours at Le Mans without a brake change – until Aston Martin and Alcon hatched a bold plan that would carry them to GTE glory. **William Kimberley** and **Chris Pickering** discover how the feat was achieved

**VERY** second counts in motorsport. When it comes to endurance racing, these precious moments are just as likely to be won or lost in the pits as they are on the track. And so it proved at Le Mans this year, with the #97 Aston Martin Vantage AMR of Maxime Martin, Alex Lynn and Harry Tincknell locked in a battle with the #51 Ferrari 488 GTE Evo of James Calado, Alessandro Pier Guidi and Daniel Serra for most of the race.

In the end, Aston Martin Racing came away not only with the GTE Pro win, but also the World Endurance GTE manufacturers' title. All this came down to the lead car's trouble-free race – and one key aspect in particular.

Racing twice around the clock at Le Mans is notoriously hard on the brakes. GTE cars typically manage something like 12-to-18 hours before a brake change. Historically, this hasn't been a great problem as the World Endurance Championship (WEC) teams have got this procedure down to a fine art. The whole brake assembly is changed, complete with discs, pads and calipers, in a process that can take as little as 35 seconds. In practice, it's often closer to a minute, with crews attempting to handle red hot brake discs under the pressure of a racing pit stop. Nonetheless, it was quick enough to add little or no time to the overall pit stop duration under the previous rules.

That all changed at the start of the 2019-2020 WEC super season, with a new set of regulations that stated that the teams could no longer work on the car while refuelling. This effectively meant that a brake change would now add a minute onto the pit stop time – easily the difference between winning or losing in this highly competitive class.

No one had ever won the GTE class at Le Mans without a brake change. But having spotted the time that could be made up, Aston Martin Racing began working with brake manufacturer Alcon and pad supplier Endless to see if it might be possible. ►

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LEFT The Holy Grail of endurance racing, running 24 hours without a brake change, was the key to Aston Martin's GTE victory

5

## The drivers didn't believe me when I said we could do the whole race on one set of brakes!"

"The drivers didn't believe me when I said we could do the whole race on one set of brakes," jokes Gus Beteli, head of performance at Aston Martin Racing. "We were pretty confident, having done extensive testing, plus the WEC race at Spa and 10 hours of running earlier in the week at Le Mans, but we didn't know for sure until we'd done it."

Even as the race unfolded, it wasn't entirely clear whether the Aston Martins would make it to the finish without a brake change. With the #97 car fighting for the lead, the team decided to carry out a precautionary brake change on the #95 sister car after 18 hours, using this as an opportunity to inspect the discs and pads. A thumbs-up from the engineers gave the team the confidence to press on with the #97 car, just as the rival Ferrari called into the pits for a brake change.

"That was the deciding factor in winning the race," comments Beteli. "A 60-second pit stop at the time would have dropped us behind the Ferrari."

#### WIDER WINDOW

The original aim of the project was not necessarily to eliminate the brake change completely, but rather to give the team a wider window on when it was done. This was part of a concerted effort to improve the overall performance of the brake package, Beteli recalls: "The balance of performance changes after the 2018-19 super season made the car more competitive, but this led to us struggling with the brakes a little bit compared to Porsche and Ferrari. Some of that is due to the characteristics of a front-engined car, which tends to be a little harder on the brakes. It meant that we only managed to do eight or nine

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**ABOVE & LEFT** The calipers were optimised for weight, air flow and stiffness

**RIGHT** Attention to detail and a collaborative approach between Alcon and AMR underpinned the success hours on the brakes last year before we had to change them."

There's no magic ingredient in the Vantage AMR's brake package, he explains. Instead, it's been a question of carefully honing proven technology. The calipers, for instance, use a broadly conventional design, but they have benefited from Alcon's proprietary topology optimisation process that helps to optimise weight, air flow and stiffness. At the front, 390 mm cast iron discs are gripped by six-piston calipers, while four-piston items are paired with 355 mm discs at the rear. Both caliper designs are manufactured from solid billets of aerospace grade aluminium using fiveaxis machining centres and finished with electroless nickel plating.

The front discs can account for more than 70 per cent of the braking effort on a front-engined car like the Vantage, which means that their ability to dissipate heat is particularly critical. Alcon developed a new disc casting, which incorporated patented cooling vane geometry developed in CFD.



This is said to have resulted in a brake disc with a lower number of cooling vanes and reduced overall mass compared to a conventional design, while also offering improved cooling.

"We did a lot of work with Alcon on their brake dyno," comments Beteli. "The main focus was on **>** 

**ABOVE** Even as the race unfolded, it was unclear whether Aston would be bold enough to sanction going the full distance without a change


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











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**HE** last edition of an automotive literary classic: the technical analysis of Formula 1 penned by Giorgio Piola. After 25 years of publication, the historic draughtsman brings the curtain down on this experience with a volume that examines the last three seasons, from 2016 to 2018, as always reviewing the principal technical innovations in the spheres of chassis and engine design. This three-year analysis is appropriately completed with a retrospective of some of Piola's most important drawings from a 50year career that began back in 1969.

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LEFT Extensive work behind the scenes, on the brake dyno, ensured that by the time AMR arrived at Le Mans it had a plan it could execute to devastating effect understanding exactly what the car needs in terms of friction curves. We wanted to match the performance as closely as possible front-to-rear and give the drivers something that would be consistent throughout the race. Once you've got that you can focus on the wear, and understand the temperatures that the brakes need to run at so you can adjust the cooling ducts accordingly."

Much of the dyno testing was based on real-world data collected from running the car on track. This allowed Alcon to put together Vantage-specific lap simulations for the front and rear brakes covering a number of different circuits, including, of course, Le Mans. Using this, the engineers were able to analyse both frictional performance and durability.

"We used multi-lap dyno simulations to show how the caliper, disc and pad performed together over a stint," comments Jonathan Edwards, Alcon Group Sales Director. "Running the simulation for an extended period of time was important to get an accurate prediction of pad and disc wear."

The test schedule included highly detailed performance and characterisation tests, as well as

**G** One particular area of focus is 'fallback', the clearance between the disc and the pad once the pedal has been released"

> fatigue studies and destructive testing (all based on the specific car and track requirements). One particular area of focus, Edwards explains, is 'fallback', which is the clearance between the disc and the pad once the pedal has been released.

"Fallback is critical because it needs to minimise brake drag while still providing the shortest possible pedal travel," explains Edwards. "It is essential to get the balance of drag versus pedal travel correct, and even more essential that it performs consistently. Brake drag is not only a performance drain on the car, but it also serves to reduce the durability of the brake discs (among other things). Having said that, a short and consistent amount of brake pedal travel is essential in creating driver confidence, which plays a big part in delivering good lap times; that means you can't just create lots of running clearance – that would be easy – we have tune the level of fallback to deliver just the right amount of clearance."

#### **INTO THE NIGHT**

This year promised to be a Le Mans like no other, with nearly 12 hours of darkness and autumnal weather conditions rather than the usual June heat. The challenge this posed was primarily a human one – with the team personnel and the drivers both facing a tougher mental and physical test. ►



"The aim this year was the same as normal – to go as fast as possible for 24 hours," comments Beteli. "The time of year didn't really make much difference to our car performance or our approach to the race. Initially, the weather forecast looked pretty bad, but the rain that we were expecting never really got to us. The peak temperatures during the day weren't as hot as usual, but the only real difference was the extra four or five hours of darkness. It definitely makes things harder."

The key to Aston Martin Racing's victory was a well-planned race that ran according to plan, he explains: "It all went very smoothly for the lead car. That's what you need in this race, to be honest. It was so close with the #51 Ferrari that any small issue could have cost us the win. Once you allow a small gap to form it builds up with every slow zone and every safety car even if your pace is the same on-track."

Things didn't go quite so smoothly last year. Most notably, a last-minute balance of performance (BoP) change robbed the team of the promising pace it had set in qualifying. This year, the Vantage AMR received a slight increase in boost pressure across the rev range, along with a 1-litre increase in fuel tank capacity.

Meanwhile, the Ferrari 488 GTE's BoP remained unchanged and the Porsche LEFT Every second counts – be it out on the circuit or, as at Le Mans this year, in the pit lane

**RIGHT** The front discs can account for more than 70 per cent of the braking effort on a front-engined car like the Vantage, putting the emphasis on their ability to dissipate heat

**BELOW** A precautionary brake change on the #95 sister car, 18 hours in, offered the chance to inspect the discs and pads. A thumbs-up paved the way for the #97 car to press on



911 RSR-19 received a 20 kg weight increase and a 0.3 mm restrictor decrease compared to its predecessor that raced in last year's event.

"That basically put us back to where we'd been in qualifying last year," comments Beteli. "We had roughly the same pace as Ferrari this year, which meant we could concentrate on the car not the BoP. It helped that we'd done a lot of testing to get the Le Mans aero kit, the brakes and the tyres all working as well as they could."

### **STRATEGIC MOVES**

There were murmurings from the Porsche camp after both the Aston Martins and the Ferraris appeared to show significantly quicker race pace than the 911 RSR-19 that had outqualified them, but Beteli dismisses any suggestion of sand-bagging: "We had a really strong pace in the first qualifying session, late in the afternoon on Thursday, which put us into first and second. For hyperpole [on Friday morning] we used a different tyre

compound on both cars. That was partly in an attempt to save our tyre stocks for the race, but the new compound didn't work as well as we expected it to probably because the track had been unused for so long before the race. That was enough to drop us to third and fourth on the grid, but it was only two tenths off our time from the previous day."

The battle between Aston Martin and Ferrari began the moment that the flag dropped and it was nip and tuck for most of the race. Only when the Ferrari pitted for its brake change did the #97 car begin precedent in the GTE category remains to pull out a sizeable lead. Meanwhile, the #90 Vantage AMR run by TF Sport put in a commanding performance to win GTE Am – also without a brake change.

The driver feedback was very positive from both teams. Alex Lynn set the fastest GTE lap of the race nearly 12 hours into the event. Beteli asked the drivers to manage the brakes for the last six hours, but the only issue that was reported was a long pedal due to knockoff in the closing stages.

"Winning the GTE class at Le Mans is massive," comments Edwards. "GT

racing is without doubt one of *the* most competitive classes of racing today. It has manufacturers from the major sports car brands and as such carries huge kudos. For a client of ours to win and to use not only the performance of our product as an advantage but also its wear resistance to such great effect is big.

"Any 24-hour race is a war of attrition, a compromise between outright performance and longevity - to win and not change brakes shouts mission accomplished!"

Whether or not this will set a new to be seen.

"It's every team's dream to run for 24 hours without a brake change, and this result proves that it's possible," observes Edwards. "But to do that when running at such pace is really exceptional. What we have now is a setup that we can learn from on track and develop further."

To change, or not to change? Whatever the decision taken from now on, this year's Le Mans certainly provided a stark illustration of how one small improvement can prove decisive in the close-fought world of endurance racing.

## **BACK IN BUSINESS**

Already buzzing from success in the Indy 500, Öhlins continued its strong post-Lockdown showing by grabbing glory at Le Mans. **William Kimberley** reports

**OUNDED** in 1976 by Kenth Öhlin, Öhlins or Öhlins Racing AB, is a Swedish company that develops suspension systems for the automotive and motorsport industries. It supports performance teams in F1, Formula E, NASCAR and MotoCP racing, amongst others.

By 2012 it had won more than 300 World Champion titles in motorsport and continues its success story to this day in the various series in which its products are used. The roll of honour includes being on the winning and thirdplaced cars in this year's Indianapolis 500, while the Aston Martin Vantage that won both its classes at Le Mans this season was also equipped with Öhlins 5-way adjustable TTR dampers.

Aston Martin Racing has been using Öhlins' top level GT damper for some time, enhancing its performance. "It's been a very useful programme for us," says Öhlins' Emil Sällberg, "especially as Prodrive has been very open. That's enabled us to test different ideas and



RIGHT Aston Martin en route to Le Mans glory. The collaboration with Prodrive has worked well on and off-track



BELOW LEFT Öhlins' impressive line-up of racing products, including F1, LMP, Formula E, GT and Touring Cars

concepts in regards to optimising our valve technology for the moderntype high aero GT car, making both themselves and us deliver even better performance.

"We started the programme in 2017 when our technology was adapted to fit the car and to match the requirements given to us by Prodrive and Aston Martin. During 2017 and '18 we launched a development scheme where we did both static and track tests, basically developing the basis and foundation of the damper technology for the GTE car. With our collaboration with Prodrive, we could also bring that technology in to the TTX dampers for the Aston Martin customer GT3 and GT4 cars as well.

"The technology is very similar to what we are bringing into other GT programmes as well, but the specifics we



have developed with Aston Martin stays with them. However, the technology as a whole is something we already use in other products as well, all the way from road cars to top-tier race cars."

In early January 2019 Öhlins was acquired by Tenneco. The US company stated that the addition of the Swedish firm would accelerate the development of advanced OE intelligent suspension solutions, while also fast-tracking time to market.

### PREMIUM PRODUCTS

As reported at the time, Brian Kesseler, co-CEO of Tenneco, said that his company's 20-year relationship with Öhlins had delivered world-class product in the intelligent suspension market: "It provides a strategic entry into advanced performance communities with premium branded products and proprietary Continuously Controlled Electronic Suspension Valve (CES) technology."

The key components are the four shock absorbers featuring Öhlins' controllable

*World-class product in the intelligent* suspension market"

CES valves, position and acceleration sensors monitoring the movements of the wheels and body, and an electronic control unit realising the control functionality and managing the necessary communication between the shock absorbers, the different sensors and other systems in the vehicle. At the heart of the system is the CES valve, a hydraulic pressure controller specifically designed to fit the requirements for use in a suspension system. The CES valve combines a small size with a very wide working area and an extremely quick reaction time.

Öhlins offers a wide range of valve products for shock absorbers of socalled uniflow type, plus matching coils, meeting the demands of even the most challenging customers and applications. In addition to CES valves designed for external mounting on uniflow shock absorbers, Öhlins is also developing single- and dual-valve CES solutions for mounting on the piston rod in monotube and doubletube shock absorbers, actively controlling the oil flow in the shock absorber in both compression and rebound.

# ONE HELLOF APROVING GROUND

Boons

Temperatures down to 5 deg C, very heavy rain and probably the least-forgiving circuit in the world" Where better for Bcomp and Porsche to put natural fibre bodywork to the test than at the 'Green Hell' of the Nürburgring Nordschleife? **Chris Pickering** investigates

**VER** since the earliest days of motorsport, engineers have been asking themselves a simple question: Could there be a better way of doing this? Increasingly, it's a question that relates not just to performance, but to environmental impact as well.

Natural fibre composites are a great example of this. The combination of the flax-based ampliTex fabrics and the powerRibs reinforcement developed by Bcomp is said to offer comparable weight and stiffness to monolithic carbon fibre, but it costs up to 30 per cent less in raw material price, and it won't shatter in an impact like traditional carbon composites. And perhaps most significantly in the current climate, its carbon footprint is estimated to be 75 per cent lower than that of traditional carbon fibre parts.



**ABOVE** Manthey Racing's prototype Cayman 718 GT4 Clubsport blazes the trail at the Nürburgring

LEFT In such a costconscious category, a direct substitution from carbon fibre to natural fibre was considered the easiest solution These materials are gradually gaining acceptance in motorsport. At the beginning of 2019, Porsche began using natural fibre materials for the doors and the rear wing on the Cayman 718 GT4 Clubsport. More recently, the German giant partnered with Bcomp, Manthey Racing and Four Motors to develop a full lightweight bodywork kit for the Cayman 718 GT4 Clubsport MR, which debuted at this year's Nürburgring 24 Hours.

"This is the most comprehensive application of natural fibre bodywork that we've seen so far," comments Johann Wacht, motorsport manager at Bcomp. "GT4 cars normally stick very closely to the road cars, but here the whole front end bodywork and all the aero parts are in composite, including the front and rear bumpers, the splitter and the diffuser."

Manthey Racing already supplies a carbon fibre lightweight



bodywork kit that enables customers to homologate their Cayman 718 GT4 Clubsport to full SRO GT4 race specification. The new car effectively replicates that kit in natural fibre. It's a one-off prototype at present, but the plan is to offer a similar kit to customers in due course.

"We basically took every part that was in carbon fibre and substituted it for natural fibre," comments Jan-Helmut Brakhage, project leader for motorsport parts at Manthey Racing. "The geometry of the surfaces is all unchanged and we've used the same tooling to keep things simple."

The sheer percentage of the bodywork that's been converted to natural fibre poses its own challenges. Speak to Bcomp's engineers and they refer to a 'sweet spot', where the properties of the material and its innovative construction concept compare favourably to traditional carbon fibre, but there are limitations. Although Bcomp is capable of acting as a structural material, it's generally used for lightly-loaded panels, such as bumpers, wheel arches and rear quarter panels. In the case of the Cayman, the rear deck lid takes the aerodynamic loads from the wing, while the front bonnet has to tolerate mechanics scrambling over it during pit stops.

### **EVOLUTIONARY APPROACH**

To keep things simple, the plan was to use the same tooling that Manthey Racing uses for the carbon fibre parts and the same basic processes. ►

LEFT Improvements are already planned: preimpregnated material, for instance, could reduce the resin content



A carbon footprint estimated to be 75 per cent lower than that of traditional carbon fibre parts"

BELOW This was the most comprehensive application of natural fibre bodywork yet seen, including the whole front end bodywork



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For the doors, lightweight balsa wood serves as the core of the composite material, with outer layers of Bcomp's ampliTex fabric created using a form of resin transfer moulding (RTM). The rear wing, meanwhile, was produced in an autoclave using layers of ampliTex reinforced with Bcomp's powerRibs structural concept.

A fairly cautious approach was taken to the design of the new parts, Wacht points out, to ensure that the un-tested kit would withstand the rigours of a 24-hour race. The next step, he says, would be to take the experience gained from that project and push it further: "At the beginning of the project, we decided that we would have to keep the existing [vacuum infusion] moulds to limit the cost, as well as the environmental impact. These prototypes parts are mostly created using the same vacuum infusion process that's used for the carbon fibre counterparts, but it's possible that we might switch to pre-preg materials, for example, if we wanted to go further."

With the current process, the resin accounts for 60 to 65 per cent of the weight of the finished part. A pre-impregnated material could reduce the resin content down to around 44 per cent, with a corresponding reduction in mass. Beyond that, Wacht believes that further savings could be found by optimising the ply books with the findings gained in the Nürburgring 24h race.

These improvements would still need to fit in with the Cayman's role as a relatively low cost customer racing car, Brakhage points out: "At the end of the day, customer racing is driven by price, so we had to consider that maybe a direct substitution from carbon fibre to natural fibre would be the easiest solution. This car was the prototype for that, and I think we learnt a lot. Now we start to understand the changes we might want to make if we moved towards production." ► ABOVE The eyecatching design, with swathes of the car left in bare fibre material, makes a real statement

**BELOW** The project offers a glimpse of what is to come as environmental concerns become ever more pressing



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the troubled tale of the futuristic Ford designed to win Le Mans in '66

The current prototype is said to have cost around the same amount to manufacture as the regular carbon fibre kit. According to Wacht, however, there's scope to improve this too: "I think we'd need to produce a few more kits before we could give an exact figure on the price. The materials are a relatively small proportion of the total cost of producing a composite part; most of it is labour. At the moment, the technicians who are laying up these parts are dealing with something new, so they have to keep checking the ply book."

Further testing is currently being carried out on the body kit, and it's expected that the detail design will change before it's offered to customers. Broadly speaking, it's expected to be comparable to the carbon fibre kit in terms of weight, stiffness and price, but the biggest benefits are to be found in its environmental impact.

"We're adding this ecological thinking into racing now," comments Brakhage. "The main aim is still to win races, but at some point we're going to find a regulation that says we have to use natural fibres, so we want to be ready for that. It's like using catalytic converters in the exhaust – that's accepted as a requirement in a lot of categories these days. We want to build the best car that we can with that technology if that's the way the regulations go."

#### **RACE AT THE RING**

In a classic motorsport 'dash to the finish', the car was only completed a week before the race, so it went to the Nordschleife event without any prior testing. Despite these time pressures and some typically challenging weather, the car finished without any issues.

"It wasn't ideal conditions for the debut," notes Wacht. "The team had to face temperatures down to 5 deg C, very heavy rain and probably the leastforgiving circuit in the world. It was a very tough test."

There was even an authentic racing incident to add a bit of spice. During one of the practice sessions, the Cayman was hit by another car. Fortunately, the shatter-resistant Bcomp material maintained its shape and the only damage was a small crack to the front fender. Having inspected the part, the team elected to keep it on the car, explains Wacht: "We kept a careful eye on the crack throughout the rest of the weekend and it remained totally stable. From a repairability perspective, it's the same as carbon fibre, so you can patch it or use a little extra resin."

The car was driven at the event by Matthias Beckwermert, Henrik Bollerslev, Nicola Bravetti and Marco Timbal. It finished a respectable 48th overall (out of 97 starters) despite horrendous weather



ABOVE RIGHT The legendary circuit provided a great test for the innovative package

LEFT The bodywork has been produced as a one-off prototype at present, but the plan is to offer a similar kit to customers in due course

**RIGHT** The project was comparable to the carbon fibre kit in terms of weight, stiffness and price, but with huge benefits in terms of environmental impact

50





### At some point we're going to find a regulation that says we have to use natural fibres, so we want to be ready"

conditions that led to the race being suspended on no less than seven occasions.

Due to COVID-19, the race was run behind closed doors, which denied the Cayman 718 GT4 Clubsport MR the debut that its creators were hoping for, but Wacht vows that they will be back. "We really want to show this car to the fans," he comments. "The people around the track are what make the Nürburgring 24 Hours so special. The design is very eyecatching, with the whole of the front of the car left in bare fibre material – it's a real statement. It's a shame that people didn't get to see that, so Four Motors is going to leave the car like that for the whole of the 2021 NLS (Nürburgring Langstrecken-Serie) season."

Natural fibres may be a substitute for traditional carbon composites rather than an improvement in outright performance terms, but in these cost-conscious and environmentally aware times they could represent a significant step forward. The chances are we'll be hearing a lot more about them in the future.

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## SEARCHING FO SANDARIA SEARCHING FO

**Hal Ridge** reports from a rallycross paddock grappling to adjust to COVID, electrification and the loss of its World Championship promoter

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**HE** words 'electric' and 'rallycross' have been used in unison for almost half a decade but now, finally, this year, all-electric cars have seen competitive action in the discipline.

The Projekt E series was created as a support category, to be introduced into the World Rallycross Championship's structure, when the original effort to bring electric technology into the discipline's top level fell short. Now it is underway, with cars using electric powertrains developed by Austrian firm STARD.

While the much-delayed (due to Coronavirus) opening round in Sweden comprised solely of STARD-built Ford Fiesta MK8s, a car covered in RT228, a second model was introduced for the second event in Latvia. Not only did the debut of the Citroën C3 ERX in Riga bring diversity to the grid, it also highlighted the return of manufacturer involvement in the paddock: Citroën Racing is supporting STARD with the creation of the allelectric, four-wheel drive C3 ERX.

While the Fiesta programme had already received Ford Performance backing for STARD to build and deliver customer race cars, the C3 ERX is based on Citroën's latest R5 (now Rally2) rally chassis. All components, including the electric powertrain items, are available to customers via Citroën's revered Racing Boutique store.

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The C3 uses approximately 80% of the 'standard' R5 components, outside of the powertrain, while the Fiesta is more of a bespoke rallycross car. Similar to STARD's 2019 World RX Supercar, the Ford features revised geometry and weight distribution, and continued damper development from TEIN, carrying over from the Supercar programme. The C3 uses Reiger dampers, while the two different cars are fitted with AP Racing (Fiesta) and Alcon (C3) brakes respectively.

At least one other marque, probably from the VAG group, is expected to join the Projekt E grid before the end of the campaign with multiple Super1600 Champions Volland Racing.

Following its reveal just over 12 months ago, STARD's triple-motor, four-wheel drive 'REVelution' powertrain – producing 450 kW combined power and 1,002 Nm of torque with a twospeed transmission at both axles – has remained pretty much as it was when it was launched. The refinements have been made to chassis setup, software functionality, and therefore performance.

STARD also announced earlier this year that it had joined names like Williams Advanced Engineering and McLaren Applied Technologies in passing the FIA's HV crash test with its in-house-developed motorsport battery system. Design, FEA analysis and crash simulations were all carried out at the company's base in Austria prior to the

completion of the liquidcooled and heated battery

> **ABOVE** Electric rallycross has finally become a reality this season, with Projekt E up and running



pack, which uses individual "ultra-highperformance" lithium ion cells and is housed in a prepreg carbon fibre casing.

The Projekt E machines are not the only electric rallycross cars to hit the track this year. The test mule for the new RX2e category (that will be introduced into the World RX event structure from next year) was launched at the opening round of the RallyX Nordic series in Sweden. It has subsequently been testing in Denmark and Spain.

Projekt E, like the plans for World RX's top tier, is based around kits that can be retro-fitted into steel body-type Supercar machines. The RX2e cars adopt a similar tubular spaceframe chassis to that used in the RX2 category in recent years, developed by OlsbergsMSE and Avitas Motorsport. In a tie-up between OMSE and Spanish electro-mobility outfit QEV Manually balancing the distribution of torque or brake bias, while side-by-side at 150 km/h, will truly showcase a driver's skillset"

Technologies, cars will be built and run by the series for the first two years, on an arrive-and-drive basis.

The four-wheel drive machines, aimed as an entry point into World RX events, will feature a pair of motors, joined at each axle by an inverter, producing 250 kW of power. A 32 kWh battery, mounted next to the driver, has been placed to give an almost perfect, it's said, 50:50 weight distribution.

"Not only will the degree of torque available make the car considerably

quicker than the current RX2 model, but it will also be more challenging to drive, especially on the limit, which will be a key factor in helping to prepare competitors for the subsequent step-up to Supercar level," says QEV's Joan Orus.

"One of the aspects I like most about the RX2e car is all of the additional areas in which the driver can make a real difference, from the distribution of the torque to brake bias, which simply isn't possible with an internal combustion engine vehicle. Being able to manually balance the car and its





performance mid-race, while travelling side-by-side at speeds of up to 150 km/h, will truly showcase a driver's skillset and technical understanding."

### THE COVID EFFECT

While electric rallycross is at last becoming reality, the switch to electric technology in the highest class will have to wait a little longer. The FIA has announced that its introduction has been delayed until 2022,

due to the pandemic.

Much like the Projekt E concept, World RX's revised electric concept will be for existing-type Supercars to be fitted with electric powertrain kits, which will allow for continued diversity in suspension suppliers and architecture, for example. Austrian firm Kreisel is developing those four-wheel drive, twin-motor 500 kW kits, using single-speed, single-spec Xtrac transmissions and a 52.65 kWh battery. In collaboration with the ▶ **ABOVE** STARD'S REVelution Projekt E powertrain is at the vanguard of the sport's electric transformation

**BELOW** Safety has been paramount throughout the process. Here a STARD engineer prepares the battery pack for a deceleration test



ABOVE The sport once again boasts a degree of manufacturer involvement, with Citroën working with STARD to produce the C3 ERX, based on the

marque's R5 rally car

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Baumschlager Rallye Racing squad, Kreisel is working on the development of a mule car called the Fabia REX, based on a Skoda Fabia R5 chassis. It could compete in the Janner Rally early next year.

Orders for the World RX kit need to be placed in the first quarter of 2021 for the electric transition as laid out by the FIA to go ahead as planned. At circa €400,000, though, the kit cost is twice that of the already active version in the Projekt E cars.

Should Kreisel compete in the Janner Rally, it would do so with the full World RX kit – not the slightly different rally concept it plans to also introduce – but detuned to around 220 kW to ensure the range requirements between each service halt can be met.



**ABOVE & BELOW** The test mule for the new RX2e category, aimed as an entry point into World RX events, has been accruing mileage. The four-wheel drive machines will feature a pair of motors, joined at each axle by an inverter

**BELOW LEFT** Austrian firm Kreisel, tasked with producing the electric powertrain kit for World RX, is developing a Fabia mule car

#### **PHONEY WAR**

The delay in World RX's transition isn't dissimilar to that of the regulation change postponement from 2021 to 2022 in Formula 1. It too will result in limited development and innovation for a twoyear period. 2020 was always expected to be quiet on the development front in World RX ahead of the looming electric introduction. While there's little radically new from a technical perspective in

the paddock, it's widely regarded that standing still in motorsport is akin to moving backwards. Accordingly, every team has brought updates, some more significant than others.

The GRX Taneco team's WRC-derived Hyundai i20 was arguably the fastest car of the 2019 campaign. It could well

have won the drivers' title had Niclas Gronholm, son of double world rally champion Marcus, not missed a pair of rounds through illness. For 2020, the team's cars are much the same, using Pipo engines and Sadev transmissions, but the major evolution has been a switch to BOS Suspension, the same French marque that supplies the Toyota WRC team.

The relationship is more than just a supplier deal: it's a collaborative development effort. GRX team manager Jussi Pinomaki has previously worked with BOS for SET Promotion (the team that operates GRX's Super1600 machines), and even had Steven Bossard – the son of BOS's owner and a motivating force behind the company's



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58

The squad back-to-back tested the new BOS MacPherson hardware against the previous term's Reiger dampers at Loheac in France back in March. "We got a good opportunity to have support from BOS and that suits us really well. We switched because of being able to work together really," explains GRX engineer Andrius Scerbakas.

"At the moment we're looking for start performance. That's the main goal because the start is 50% of the job in this kind of discipline. If you can have half a car advantage into the first corner, that makes a big difference."

The only other main change on the Hyundai is to the carbon fibre cooling ducts in the engine bay.

GCK has also switched two of its cars to BOS dampers over the extended winter. Its Renault Clios now use BOS,

### Start performance is the main goal because it's 50% of the job in this kind of discipline"

while its other three cars – the Renault Meganes originally conceived and developed by British firm Prodrive – have all switched to the Bilstein dampers as used by Anton Marklund in their development term last year.

The Clio and Megane have each been developed since the 2019 season, the evolution of both cars centring around weight distribution, dampers and engine. The Clios' engine upgrades have been to bring them in line with the Meganes, using the latest ORECA motors. On the Megane, the engine upgrades have specifically surrounded the start procedure and the 'cut' in ignition required for flat-shifting with a sequential gearbox.

One of the three Meganes, raced by British driver Liam Doran, continues to feature the Prodrive engine, although it has received the same front geometry updates. The sister cars, piloted by Andreas Bakkerud and Marklund, feature weight changes at the front, while the packaging for the ORECA engine instigated for 2019 is now refined.

"When we switched to the ORECA engine last year, we didn't have time to work on the weight so much, but now we're back to where we want to be. Prodrive also had some trouble in 2018 with the battery, so we have gone to a stronger battery. It's more reliable and has more amp hour, but it's heavier," says ►



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RIGHT & BELOW Notwithstanding positive work from Öhlins over the winter, the ex-works Hansen Peugeots have encountered stiffer opposition this campaign



### It's unlikely that the next brandnew, top-flight car to appear will be internal combustion engine-powered"

engineer Stephan Orre.

While running five cars from owner Guerlain Chicherit's awnings, Orre says there's little crossover between the Clio and Megane: "They are so different, so we are just comparing some key points on the geometry, roll stiffness and differential balance, just to have an overall view of the set up in rallycross. They have different suspension (Clio MacPherson; Megane double-wishbone) and that means the weight at the wheel is very different, so it's hard to compare." The cars also feature different engine orientations, the Megane being one of the few new cars to be built in recent years with a longitudinally-mounted engine. The switch to BOS dampers with the Clio was to combat traction limitations in 2019, specially at corner exit on high grip circuits, compared to other cars in the field.

#### **PEUGEOT PROBLEMS**

ORECA engines are also used by Team Hanssen. Running ex-works Peugeot 208s, the squad won half of the rounds in 2019 on the way to both the Teams' and Drivers' titles. But after the opening six rounds of the 2020 season, it had achieved just three podiums between its two drivers.

While engineer Graham Rodemark is coy about where the squad is struggling to match the pace it had, he does allude to engine management as being a factor. "The cars are pretty much the same [as last year]," he says. "In 2019 we were on a bit of a learning curve with where to fine-tune. We tried a few different things at the start of this year before the season, with the limited testing we had, and we've learned what to pursue. There are a couple of upgrades on software that we perhaps didn't appreciate how much difference that could make, but we have tested again to try and get on top of things in that one area, where we felt we struggled to get on top in the first few events."

The 208 has also received geometry changes, both architecturally and in the setup. The chassis is one area where Rodemark says gains have been made. "I've been in this game many, many years and we've done thousands of kilometres of testing, and you can always come away with good and bad points. But, nothing is ever particularly concrete in rallycross; it's often so different to a race environment," he explains. "From the very little testing we have done this season, we have come away with an absolute positive, with the chassis now we are genuinely quite happy. Öhlins has done some work over the winter with the dampers. We've got a different setup and we're happy with that." ▶

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The British engineer maintains that there are benefits as well as drawbacks to now working as a small private effort instead of with the might of Peugeot, as the Hansen team did increasingly from 2014 to 2018, before Peugeot withdrew. "It's much easier to try different things now," he says, "but obviously we don't have the resources to look at the data quite in the same way after trying those things, so there's pros and cons."

With a revised and condensed COVID-led 2020 calendar, the first four weekends of World RX were made into double-headers, making consistency more important than ever, both from man and machine.



### IMG heads for the exit

### Hal Ridge reflects on the withdrawal of World RX's promoter

**IMG**, the series' commercial rights holder since 2013, will withdraw at the end of the current season.

While the news has brought uncertainty to the series' future in the immediate term, it could, and hopefully will, help progress rallycross to where it has the potential to be.

IMG's leadership has received heavy criticism from some parties in recent years. While it's true that the four manufacturers that were heavily involved by 2017 and 2018 departed amid conflicts around the discipline's electric transition, the blame should not lay solely at the promotor's door for what happened then.

Of course the promotor will always hold a certain degree of responsibility in such situations, but the initial electric plans for carbon monocoque, single supplier chassis and batteries were dreamt up by the FIA and its technical working group. Many of the manufacturers were a part of those discussions, but then still left.

The commercial investment may also not have been what it ought to have been from the promotor in recent years either. Nevertheless, IMG managed to continue World RX in 2019 with solely privateer entries, and in 2020, despite the evident Coronavirus-related complications. Prior to IMG taking rallycross on in 2013, the top flight (then European Championship) was made up from around 10 single-round organisers, each with their own agenda. IMG has progressed the discipline's direction 10fold. It created the World Championship, massively increased the broadcast production and reach, and attracted some major players in all areas.

Now, it's time for another entity to carry the baton further still.

ONECO

While the Hansen team isn't challenging for the title, those fighting at the front are Johan Kristoffersson, returning to the series in the Volkswagen Motorsport-built, WRCderived Polo in which he won the title in 2017 and 2018, and Mattias Ekstrom. The latter hadn't planned to race in the series with the KYB Team JC outfit running his Audi S1 cars, but began filling in for a driver with a budget shortfall at the opening weekend and continued.

The EKS-built Audi S1 has stepped up in pace from 2019, thanks to improved drivability from its Lehmann engine and constant development with its KYB dampers. Ekstrom's vast experience has



ABOVE The series boasts FIA World Championship status thanks to IMG's efforts, but the promoter's withdrawal is a blow

LEFT Changes to the ES Motorsport Skoda Fabia's bodywork have improved aero efficiency



**RIGHT** The WRC-derived VW and the Ekstrom Audi, the latter now with improved drivability, are the cars to beat

also proved vital in him challenging Kristoffersson for the top honours.

It can't be denied that the Kristoffersson Motorsport-run, works-built and supported Polo is the class of the field, but the leading lap times are closer than the final results show, with the top contenders separated by just tenths. It's consistency during the launch procedure, and on track, that makes the difference. That's where Kristoffersson and the Polo excel.

The KMS team is supported by three VW Motorsport personnel: a chassis engineer, an engine engineer, and a mechanic. The Polo is much the same as when it left the series in 2018, but for the regulatory changes, the requirement of an interior V-net, and moving the brake lights from the middle to the rear of the car.

"The only external technical evolution is that we fitted the 2015 rear wing from the WRC Polo," says Kristoffersson's chassis engineer Richard Brown. "It was something we tested at the end of 2018. Johan preferred it, Petter [Solberg] preferred the old, bigger one we had before [in 2018], and as we're only working with Johan this year he feels this one suits his driving style better. "The difference was difficult to see on the data in testing, but combined back then with both Petter and Johan's comments, because both of them are on a different level in terms of feedback, we went with the change. We have some shims for adjustment, but we're using pretty much max rear wing and that's it.

"The rest of the car is very similar. It has adjustability built into it but using the same [setup] window as before."

#### **BIGGEST CHANGES**

Possibly the most changes though, have been to a car new to the series last year, which has only made selected appearances in 2020.

ES Motorsport's Skoda Fabia is based on an R5 rally car from the Czech marque, using an ORECA engine, Sadev transmission, Reiger dampers and Alcon brakes, which like the majority of the cars in the field, are housed inside OZ Racing's 17" wheels. For this term, the Fabia's water-cooling radiator, made by PWR, has been moved from the front to the rear "to stabilise the temperature more, because at some tracks we had some problems last year," says team manager Robertas Maneikis. "There are definitely advantages to a front cooling package, but the big problem is keeping the temperature down, and the cost of the development was a lot."

The only other cars in the paddock to use non-conventional front-cooling are VW's Polo, and Munnich Motorsport's SEAT Ibizas. "The balance of the car is still similar," says Maneikis. "We kept the same intercooler as last year in the front, just changed radiator size for the rear."

The Fabia's bodywork has also changed, to improve aerodynamic efficiency around the front bumper and with louvres in the rear of the front and rear arches. The car's geometry, which is based on Super2000-specification Fabia suspension components, including arms and uprights, has also been refined for rallycross use.

With regulations stable for 2021, similar small-scale refinements can be expected for World RX next term. But, it's unlikely that the next brand-new, top-flight car to appear on the rallycross scene will be internal combustion engine-powered. At this stage, the next all-new machines are set to be electrically driven.

## HANILTON VS ROSBERG THE SEQUEL

Extreme E has two world champions fighting its corner as it focuses on electrification, environment and equality. **Hal Ridge** reports as the teams' ODYSSEY 21 SUVs are readied for battle

ACH of the five rounds in the inaugural Extreme E series next year will be run behind closed doors. That's already been decided. But unlike so many elite sports that have been forced to run without spectators in order to operate during these most unprecedented of times, amid the Coronavirus pandemic, it was never the intention for Extreme E founder Alejandro Agag's new vision to host fans at events.

In part that's because the series is visiting some incredibly remote parts of the planet. Its ethos in racing in areas that have suffered environmental damage is to highlight the result of climate change. Not only are those locations difficult to access, but in a bid to limit personnel on site, fans won't be in attendance. The series has instead been tailored to suit a live broadcast. Its format is not dissimilar to the traditional rallycross concept of qualifying stages, building throughout the event weekend to a crescendo.

Environmental concerns have never been more newsworthy than in the present day. The Extreme E

#### – Photos: Extreme E

vision, by a combination of both good judgement and fortuitous timing, could be arriving at just the right moment for the series to boom. In its wake, it will leave legacy programmes. An intrinsic part of the series' concept, they have been created to support local communities' conservation efforts. Forced by government objectives to meet new emissions targets in the coming years, car manufacturers are under substantial pressure to transition to battery-electric vehicle technology, as soon as possible. Agag's Formula E series was the first top-level electric class and now XE is following in those footsteps as it bids to not only use sport to highlight climate issues, but to be a climate positive series. But, while FE single-seaters have little road relevance to the uneducated eye, its offroad cousin hits the sweet spot by tapping into the trend of cars that manufacturers are currently taking to the market. Extreme E's ODYSSEY 21, developed by Spark Racing Technology, is based on the popular SUVtype machinery that is currently enjoying such an explosion of popularity.

The cars will be used in races of around 16 kilometres, the exact length of the course determined by the broadcast timings (each race due to take  $\blacktriangleright$ 

#### ABOVE & LEFT Two

of F1's most vocal champions lock horns again as the squads entered by Nico Rosberg (left) and Lewis Hamilton (above) prepare for Extreme E's inaugural season

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around 15 minutes). Competitors need to pass through virtual waypoints along the route, having been allowed the opportunity to walk the track the day before the competition. They can choose from alternatives such as more difficult and slower but shorter, or longer but easier terrain and faster.

Each race will comprise of two laps, which brings with it another of XE's calling cards: every car will be driven by two drivers (individually, not in a driver/ co-driver arrangement), one lap completed by a male, and the other by a female driver. On top of the environmentally sound narrative, there are equality boxes well and truly ticked here too.

It's those kinds of credentials that have attracted two of motor racing's most vocal exponents of wider matters, such as diversity and sustainability, former world championship-winning team-mates Lewis Hamilton and Nico Rosberg. Hamilton has set up the X44 outfit, while Rosberg has provided the latest team announcement with his Rosberg Xtreme Racing (RXR) squad.

They join fellow ex-F1 racer and double Formula E Champion Jean-Eric Vergne, Michael Andretti and



LEFT The original plan was for two dampers at each corner of the car, but testing revealed one was sufficient

**BELOW** Many of motorsport's powerhouses have signed up for the series



Zak Brown, and Chip Ganassi, among others, as team owners in the series. The first deliveries of new cars to teams commenced at the end of last month.

The five 2021 rounds will be held in Saudi Arabia (Desert X Prix), Senegal (Ocean X Prix), Greenland (Arctic X Prix), Brazil (Amazon X Prix) and Argentina (Glacier X Prix). Each poses a different challenge in terms of environment and terrain.

The cars and infrastructure will be transported to each event on the freshly revamped St Helena cargo ship. Sea was thought to be the lowest carbon emitting solution for getting to the race locations. Any travelling after docking will be overland, with locally-sourced vehicles.

The only variable between the cars in season one will occur should teams – especially those with manufacturer links like the ABT CUPRA effort – wish to produce their own bodywork.



#### MAXIMUM PERFORMANCE

With the races run over such short distances, there are no concerns about range, just a focus on maximum performance.

Each ODYSSEY 21 is fitted with a pair of identical 275 kW motors front and rear, made by Integral Powertrain in the UK, accompanied by a pair of inverters. But, with the 800V Lithium-ion battery – developed by Williams Advanced Engineering to withstand -30 degrees to +40 degrees centigrade temperate variation and up to 100% humidity – rated to 400 kW, the motor output is capped.

"The front motor is too big for the job it has to do really," explains Spark's lead engineer Theo Gouzin. "With weight transfer and so on there is less grip at the front, but we have used the same [motor] mainly to have a reduced number of spares, and reduced weight too. Some cars are designed with two motors at the back, or one motor at the back and a smaller one at the front, but for the rear drivetrain that is not as optimum as the one we have here. So the maximum 275 kW you have at the rear, and at the front you have the remaining power."

Delivering the equivalent of 550 horsepower, the car can accelerate from 0-62 mph in 4.5 seconds, and climb gradients of up to 130%.

Cooling for the motors is via separate radiators front and rear, fed cool air by intakes in the front and on the roof.



There is no inboard cooling system for the battery. With the races being so short it gets by with using its own thermal inertia, but during charging cold air is blown up special ducting over the rear of the machine. Charging for the batteries will be provided by hydrogen fuel cells, developed by British firm AFC.

The drivetrain is single-speed, which was always the plan for the ODYSSEY 21, with drive delivered to the wheels from the motors via GKN driveshafts. "The motors have enough torque to spin the wheels from a standing start, whatever the grip level is in off-road. And it's enough to reach 200 kph top speed," says Gouzin. "If you drove the car on asphalt, you would need a slightly lower reduction ratio to have tyre slip, but as soon as you go off-road in sand, gravel, mud, grass, whatever, you have way too much torque anyway, so single-speed is enough."

#### **DIRECT DRIVE**

Being direct drive, the car has no neutral. The only system in place is a button in the cockpit which replicates neutral. This stops accidental contact with the throttle pedal causing unwanted motion – in the paddock, for example.

At the other end of the driveshafts, the ODYSSEY 21 is fitted with 17" x 9" OZ Racing wheels, shrouded with 37"x12.5" Continental tyres. The latter were developed in parallel to the car **RIGHT** CEO and Founder Alejandro Agag reaffirmed the series' ambitions at its Virtual Global Series Launch, just under six months before the first race in March 2021



specifically for purpose, each tyre weighing 25 kgs.

Within the wheels sit six-pot Alcon brakes at each corner. While a braking regen system was originally planned, it hasn't been required. Gouzin almost grins at the discoveries made during the development process: "We haven't installed a handbrake and we were planning to use the regen just to move overall torque bias backwards to rotate the car under braking, but this stressed the driveshafts a lot. Especially with the speed at which the torque can carry from positive to negative. So in the end, after a few driveshaft failures in testing, we thought it was best not to do that..."

The tubular steel spaceframe chassis is of bespoke design. Spark initially evaluated using a Safari-style WRC-derived car concept, but when Agag's vision matured it became clear that Extreme E would be more rally raid than rally.

Inspiration was taken from Dakar, FIA cross country and "some American stuff," Gouzin notes. "We picked up the safety bits from all of them, then for performance we chose bigger wheels usually used in two-wheel drive Dakar cars, and two-wheel drive suspension, so we have lots of travel, around 350 mm instead of 250 mm for four-wheel-drive [Dakar cars]; it's a big difference. Some buggies have more than that, but we were not able to package for more." **>** 

BELOW The spectacular fourwheel drive electric SUV has racked up extensive test mileage



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The chassis was of clean-sheet design, largely to accommodate the volume of the battery. But despite appearances, with the powertrain narrow and tall, the car is 100 mm shorter in wheelbase than its Formula E cousin.

The ODYSSEY 21's three-way adjustable dampers are provided by French firm BOS Engineering. It was chosen by Spark after research in the rally raid community, as "the products are very reliable and efficient,' says Gouzin.

The chassis architecture was designed to accommodate a pair of dampers at each corner. But through testing and evaluation, based on the short duration of the races, just four dampers have been deemed effective.

"Obviously you have lots of travel, so you try to reduce the bump steer," he says. "The tricky bit was to package for two dampers per wheel, plus a driveshaft, while maintaining huge travel. In this car we ended up with one damper because it's enough."

Valving spec will be frozen for teams, but setup adjustments can be made to compression and rebound.

#### WEIGHT-WATCHERS

The car weighs in at 1,750 kilograms, 400 kg of which is the battery, located behind the driver compartment, mounted from underneath and sitting on its own subframe. The car has a 45:55 front to rear weight distribution.

Gouzin is happy that despite the perception that electric machines are always heavier than their ICE counterparts, the XE vehicle is lighter than a Dakar equivalent: "For a buggy in the Dakar, tanks empty they are 1,700 kgs, but most of the time at the start of a stage they have 300-400 litres of diesel, so it's quite a lot, and with spare parts, spare wheels etc. Overall, we will be lighter [than that] when racing."

Where the ODYSSEY 21 excels though, is in its toque distribution. The concept started with fixed torque distribution, more of a torque bias, adjustable by a dial in the cockpit. That simply reduced torque to the front axle, with control over the rear axle down to the driver's right foot. But that has been advanced somewhat, and the car's software is constantly measuring a range of parameters, including motor speed front and rear. The car never has



**ABOVE** The series will shed fresh light on the climate crisis by racing in damaged environments. This is the recce of the Amazon 50:50 torque distribution though, because the front would generate too much wheelspin.

Motor sensors are accompanied by g-force and steering angle sensors, for example to measure the attitude of the car and ascertain if it is understeering or oversteering. Once that is determined, the car can deliver more torque to the required axle: either to the front to pull it out of a corner, or to the rear to help with rotation, effectively making it into a modern Mk2 Escort. Well, sort of.

"At the beginning it can be, not annoying, but it feels different to other cars, but once you're used to its reaction and you understand how to drive it, it's very efficient," says Gouzin. "If you are close to the ideal target distribution, it means you are maybe 70% of the torque at the rear, if that's the ideal distribution in ideal conditions."

**RIGHT** The ODYSSEY 21 concept takes many of its cues from the Dakar Rally Raid machines Sensors on the front and rear wishbones also measure the bump and droop of the suspension. This information can be used to assist with setup data, but also to distribute torque, in part to help with drivetrain reliability.

"When you are in static position with the car standing on the

LEFT The ODYSSEY 21 package was designed from a clean sheet of paper for extreme terrains ground, the wheels spin," he says. "You don't have enough vertical load to avoid the tyres spinning. If you were pressing enough on the tyre, at some point you don't have enough torque and the tyres will grip. So what we do is as soon as the car as above static, like in a hole, we reduce the torque."

That can help in preventing unnecessary tyre wear, controlling any fishtailing from the rear when it is grip-limited, and avoiding breaking driveshafts and CV joints on jump landings, for example, when the wheels have been fully unloaded.

Inside the cockpit, the drivers have a few adjustable settings. The most used are expected to be the manually-adjustable torque bias, to suit the traction available over specific terrains, and the steering loads, which works much like city parking in a road car.

**RIGHT** The St Helena cargo ship will serve as a floating base for the series The constant software developments required to develop these systems have been among the biggest evolutions in the ODYSSEY 21 since its inception. Initially, of course, the design had to be adapted to house the Williams battery instead of the McLaren unit used in the Gen 2 Formula E machine. The motors have also had an update, the two units now running rotor cooling.

With the kind of gremlins that need to be overcome with any brand-new build also sussed, the calendar finalised and cars being delivered to teams, the final details like driver confirmations are taking place ahead of the series' first term.

Now wouldn't it be great if Messrs Hamilton and Rosberg could be persuaded to rekindle their rivalry at the wheel, as well as in their team owner roles?







### Sergio Rinland says the Japanese

giant's decision to quit Formula 1, in pursuit of electrification, will have big ramifications for the sport



**OR** the fourth time in 53 years, Honda is leaving F1. The first time round, from 1964 to 1968, the manufacturer conceived very interesting designs, like the 1500 cc transverse V12, a jewel of engineering, with which Richie Ginther won the last 1.5-litre Formula 1 race. Honda stopped F1 in 1968, due in part to Jo Schlesser's fatal accident in Rouen, but also partly because of marketing reasons: it was tackling the US market.

Honda's philosophy with motorsport, and in particular F1, has been to benefit from it on three fronts: technology synergy with their products; training their road car engineers in the demanding world of F1; and, ultimately, marketing.

In the decade between 1983 and 1992 this was precisely the case within their own engineering offices, initially at Williams where I witnessed it first-hand, and then at McLaren. That was Honda's second foray into F1 and by far the most successful: two constructors' championships with Williams and four with McLaren; 69 race wins between Williams, McLaren and Lotus. That time, Honda left F1 as a consequence of the Japanese financial crisis of 1992.

In 2000 they decided to come back, first as an engine supplier to BAR and Jordan, and from 2006 to 2008 as the Honda F1 Team after purchasing the outfit from BAR. Even though they finished second to Ferrari in the 2004 season, they never achieved the level of performance and dominance enjoyed during the Williams/McLaren years. By the time of the 2008 financial crisis, this time at a global level, Honda employed 700 people and spent \$300m a season, which was deemed unsustainable by the second largest Japanese manufacturer. **RIGHT** Honda was an innovator when it entered the sport the first time around. This is the 3-litre V12 RA300, which won its very first world championship race in the hands of John Surtees at Monza 1967

**BELOW** The feelgood factor of Pierre Gasly's giant-killing win at Monza, in a Honda-powered Alpha Tauri, faded quickly with news of the manufacturer's withdrawal They sold the team to Ross Brawn and Nick Fry for  $\pounds$ 1.00. The irony won't have been lost on them when Brawn promptly won the 2009 World Championship with what would have been Honda's new car, but running a Mercedes engine...

During the 2015 season, Honda was persuaded to return to F1 as an engine supplier for McLaren in the hope of reviving past glories. It was not to be. Honda was hampered by coming in late to the new hybrid formula, and McLaren was no longer the powerhouse it had been in the '90s.

By the time the partnership started to show some progress, the relationship was so strained that Honda stopped supplying McLaren and started a strong relationship with the Red Bull teams: first supplying Toro Rosso (today Alpha Tauri) and then the Red Bull team itself. From the beginning of that partnership the performance was there, perhaps not to the level of the mighty Mercedes, but enough to be the best of the rest.

'Best of the rest' is not enough for Honda's pride. Nevertheless, their decision to exit their 57-year love affair with F1 for a fourth time was down to reasons are more profound:

- The cost of participation in F1, even as an engine supplier, is enormous. Although Honda has deep pockets, they were not deep enough.
- The automotive industry has accelerated the




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one-in-a-100-year transformation with the advent of Battery Electric Vehicles (BEVs) and Hydrogen Fuel Cell Vehicles (FCVs). Honda has been an important player in those technologies from the beginning and wants to become Carbon Neutral by 2050. That would cost them a lot of money in R&D.

- Even though F1 is contributing to the R&D and engineering training of their personnel, it comes at a great expense. The R&D contribution is limited because the technology developed to win in F1 is somehow on a different track to what is needed for the development of BEVs and FCVs.
- From the marketing point of view, it is a similar story. If Honda wants to sell electric vehicles, the mainly ICE-powered Formula 1 machines are not sending the right message to their potential young buyers.

Honda's withdrawal may not initially look that significant, other than for Red Bull and its future engine supply, but it will have an enormous impact on the future of F1 and motorsport in general.

It is sad, but as I have mentioned several times, the conundrum F1 is in at the moment is that it needs to define its identity. I do not think the EV technology will be ready to power a Formula 1 machine for two hours any time soon: that will take at least another five to eight years. So, if we want to see the fast and spectacular machines F1 is renowned for, ICE should be a central part of its technologies.

So, the question is: do we want to enjoy the sport by allowing the fantastic drivers to catch our imagination? Or do we want to follow the capricious desires of car manufacturers who use the sport to advertise their brands, regardless of the impact on F1's health?

HONDA

I do not think we can achieve both. As we are seeing now, F1 has to decide what it wants to be, otherwise it is risking extinction.

From 2021, F1 will have someone new at the helm. It will be in the very capable hands of a true racer, Stefano Domenicali. From the bottom of my heart I hope that this is not a poisoned chalice for him. **ABOVE** Honda suffered after arriving late to F1's hybrid party



F1 has to decide what it wants to be, or risk extinction"

**LEFT** Ayrton Senna inspired Honda's golden era







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