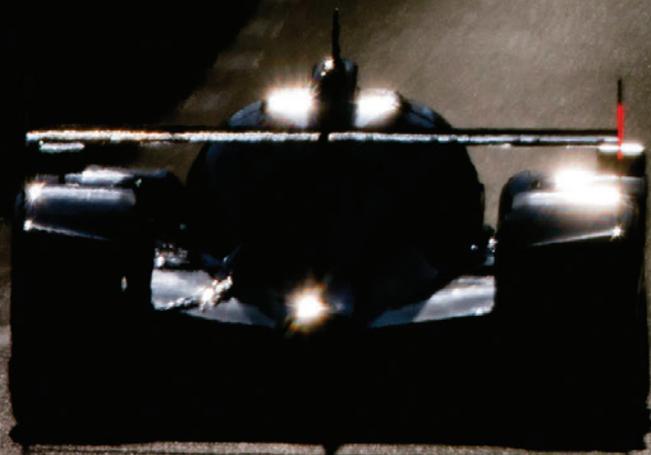


REVOLUTIONARY ROAD

William Kimberley discovers that, beyond the headlines, new regulations and fresh technical challenges have been the catalyst for a raft of exciting innovations



Porsche AG

LEFT Porsche returned to the summit of sportscar racing at Le Mans, playing its role in a cracking race

THE seventh **International Business Days** event, staged on the Wednesday and Thursday prior to race weekend, epitomised the fact that there is so much more to Le Mans than a 24-hour race.

At face value this was, in spite of the participation of a smattering of foreign companies, more of a French affair than usual. Yet, beneath the surface, the technology being showcased was striking: a new coating; some revolutionary powertrain developments; and a possible replacement for silica in the production of tyres.

On the first day, as tradition now dictates, the organisers arranged a private guided tour of the paddock, visiting AF Corse, Prospeed Competition, Rebellion Racing, Signatech Alpine and IMSA-Performance-Matmut. There was also a visit to Dunlop Motorsport. The second day featured the pre-arranged one-to-one meetings and included presentations by Toyota Motorsport, Peugeot Sport and Citroën Racing.

One new attendee to the proceedings was Marc Herve, technical sales, Europe for Sulzer. He announced that **Oerlikon** had just acquired **Metco** from Sulzer, leading to the newly-formed Oerlikon Metco. Along with Oerlikon Balzers, it is a part of Oerlikon's Surface Solutions, the largest segment of the Oerlikon Group, representing 34 per cent of group sales. Herve is now working in the same capacity for Oerlikon.

"Oerlikon and Metco being together is a great opportunity because Sulzer will have access to the full power given by the Oerlikon group and its knowledge about mass production, its experience in machines and coatings," he commented. "The Metco branch will bring to Oerlikon the knowledge of dedicated coating for niche markets. In the short-term, nothing will change and we need time to learn from each other before developing new synergies.

"Back to the racing segment, we have just launched a new coating with the aim of reducing the oxidation created by the high temperature on the exhaust valve. Due to the comeback of the turbo into the engine and globally the fact that all engines are pushed to their limit, existing coatings such as CrN are showing their limits in some applications. Our new coating is proposing similar properties in terms of friction and hardness but having a far better resistance to temperature up to 1100°C. This coating is already available in France and will be available in our facility in the US, located in RTP, NC, at the beginning of July."

Also present for the first time was Sébastien Vermeiren, the commercial projects and development manager of French company **TEOS Powertrain Engineering**. This is a joint venture between engine designer and builder Mecachrome and D2T, a leader in testing and calibration in France that is 100% owned by IFP Energies Nouvelles, a leader in engine research in Europe.

The company is currently working on an aeronautics project developing a jet-fuelled piston engine for a light helicopter with the aim of replacing the turbine, saving around 40 per cent fuel consumption. "We are using the knowledge we have gained in motor racing, particularly our work on the Le Mans-winning Peugeot 908 powertrain, although there's nothing in common between them, to develop a powerful, very efficient and light engine," said Vermeiren.

He also said that the company had been heavily involved in designing hybridised power units and had worked on the PURE Formula One engine before the project was cancelled. "We began the engine in mid-2011, designing an inline 4-cylinder to meet the-then 2013 regulations," he reported, "then worked on a V6 with Gilles Simon to meet those for 2014. This included the KERS and MGU-H integration. Unfortunately, the project stopped due to financial issues just as the engine was about to be produced."

Vermeiren also said that his company has produced an electric motor for a Renault city car, its version replacing the 10 hp/30 kg unit with its own 30 hp/10 kg version. "We've done this to show what we can do," he noted. "The reason we are attending the International Business Days is to publicise our existence. Not many people know about us and what we can do and we hope that by attending this event, it will raise our profile."

Another company presenting itself for the first time at IBD was French power electronics engineering expert **Brightloop**. It was promoting its technology, which is now being used in Formula One, to other motorsport areas.

"In the four years since our formation, we have specialised in producing products like AC/DC and DC/DC converters and everything related to energy management," said Florent Liffra, company CEO and president. "For example, we have designed, developed and manufactured a Formula One DC/DC converter for Renault Sport.

"There were two big challenges we had to address when developing it. One was the needs and the definition of the needs, because during the development period new things are discovered ▶



Jeff Bloxham/LAT

BELOW Six appeal: having opted for the 6 MJ category, compared to the 2 MJ Audis, both Toyota and Porsche had moments where they looked set for victory

that have to be incorporated into it. It means that it's a balance between introducing new features that weren't initially planned versus the fact that you have to develop the best product. The other challenge centres on logistics and the schedule, which is very tight. You have to deliver product very quickly and be very active. However, it's stimulating and the team is very happy to work in this environment.

"It's also in complete contrast to other industries where the development pace is much slower and people tend to be much more conservative. They don't want to put together too many different technologies, and in particular they don't really trust the software side of things."

Another French company attending IBD was **Sovitec**, which was using the occasion specifically to target the tyre companies. The manufacturer of glass beads for different products and industries, it believes it has the answer to replace silica in tyres, a compound that could find itself on the receiving end of legislation in the future. As every tyre comprises around 20 per cent of this material, work is underway to see what is best to replace it.

"We develop most of our glass beads by grinding recycled glass," said Thierry Reip, Sovitec's sales manager. "The strict selection of raw materials and the level of control over our manufacturing processes allow us to guarantee that our beads do not contain hazardous substances or traces of free silica.

Our glass is thus totally inert. At every step in the production process, everything is done to respect the environment."

The micro glass beads produced by Sovitec feature a maximum whiteness and transparency and reach a high percentage of roundness. "Many other parameters characterise our beads," continued Reip. "The surface of the smooth glass is closed and non-absorbent with the binder – oil absorption – thus making it a filler of choice in some paints with high solids. We believe that they are also the perfect solution for next-generation tyres."

At the circuit itself, against a backdrop of fierce battles in practice, qualifying and the race, several companies were on-site as a

back-up should their services be needed. One such was wheel manufacturer **BBS Motorsport**, headed up by Erich Gissler.

"With the return of the Porsche to Le Mans and the World Endurance Championship, we are back to supporting a factory team again in LMP1," he said. "Our first win with them at Le Mans was in 1979 with the Porsche Kremer car; our last win with them was with the GT1 in 1998, so we have a long and proud history with Porsche.

"Developing the wheels for the team has been really challenging, as you would expect, with a lot of secrets in stiffness, aerodynamics and rugged reliability, so there are plenty of new ideas. The rules are very unfavourable for wheel manufacturers due to the minimum weight imposition. From ▶



ABOVE GT racing is one of BBS Motorsport's main markets

FLAMEC

our point of view, such a thing is nonsense but the rulemakers say that it's a kind of cost reduction, which isn't really true. I think it's been implemented because it allows manufacturers that are not so keen on quality to make wheels for some teams."

BBS Motorsport also supplies Corvette Racing with its wheels, all the GT Porsches and around half the Ferrari runners. GT racing is one of the company's main fields, though it opts not to produce are low-tech cast items seen in LMP2.

When the wheels are returned by the teams, they are subjected to a run-out check and then a vehicle inspection prior to the paint being stripped. Then they are crack-tested, followed by being repainted if still in good condition. "In some cases we also check the remaining lifetime," said Gissler. "If we see that one is getting easily bent, we make recommendations to improve this."

There is often talk of technology transfer from racing to production cars, but in BBS Motorsport's case, it is at the highest possible level because the company supplies Bugatti. "They like the great flexibility we have in racing because each car is different from the other, whether it's a different design or colour, something that can only be done in a racing department not a production one," he explained.

ZF Race Engineering's clutches and dampers could be found on several cars at Le Mans, but with its decals plastered on

the Toyota, it was the team with which the German company was most affiliated. Asked whether a new clutch had been developed for the car, race engineer Michael Istschenko said that as the cars do not operate the clutch that often, the demand is not there for an extra-special one. "As you know, the Toyota starts with electrical power before the engine fires up, and while we need a special clutch for this, it doesn't need one to accelerate away from standstill," he said.

"The GTs, though, are heavier, so it's a different challenge as there's much more energy going through the clutch. When you also look at the LMP1 cars, there are three different types of cars. All have their own clutch operations, so they all have their own bespoke clutch."

ZF Race Engineering currently does not have a clutch suitable for LMP2 but Istschenko confirmed that it is working with Honda Performance Development on this. "We are actively looking to do more but LMP2 teams are far more cost-sensitive," he said.

TECH TRANSFER: NO MYTH

Commenting on the team before the race, **Corvette Racing** manager Doug Fehan was upbeat about the new C7.R they were racing this year. "I addressed the guys as we were preparing for the first day of practice," he reported. "I told them that in the 15 years we have been coming here to

Le Mans with Corvette, I don't recall having the sense of completion that I did this year and that we had done everything humanly possible on every level.

"We've exhausted every resource that we have, we've been able to integrate new suppliers, new operational methods and new materials into what I think is the best package we've ever brought here. This includes the guys from GM Powertrain and Pratt & Miller, our GM-based engineers and Bosch. We've come together as a unit more strongly and more comprehensively than we've ever done in the past. Having said that, you should never be so foolish as to count on a victory."

He then referred to the Bosch radar sensor that was developed by Pratt & Miller into the radar collision avoidance system, which won the Most Innovative New Motorsport Product of the Year award at the Race Tech World Motorsport Symposium in January this year. "It was a new level of technology with a new group of people that we had not met before, incorporating Bosch into the Pratt & Miller electronics division. It's like the roots of a tree growing out from our core business that makes the tree get stronger. Those are the things that I think this year really came to fruition."

Fehan was also delighted with the close cooperation between the racing and production departments when it came to the development of the new C7. "The C7's chief engineer Tadge Juechter – and I've had ▶



ABOVE The development of Corvette's new C7 has been notable for the close cooperation between the racing and production departments

Corvette's link with the lab

FROM the very start of its activities, Corvette Racing has worked with one particular supplier, the trust built up between the two enduring and solid. "We work with Mobil that has supplied our lubricants from day one," said Corvette Racing manager Doug Fehan. "No lap of racing or revolution on the dyno has been done with anything but Mobil 1. We also use Mobil products in our differential. However, it doesn't just mean that they supply us with stock and put a decal on the car because after every event we collect the oil from each engine and each gearbox and send it back to their lab in Virginia for analysis. They then file a report with us on what they're seeing.

"We've obviously used that for the engine guys, looking at bearing surfaces, rotational masses and the amount of material that's been collected, which all play a big role. We used to start racing with 10W50 but we're now at 10W0, so while reducing the viscosity we're also reducing the frictional losses." **IT**

the honour of working with every Corvette chief engineer with the exception of Zora Arkus-Duntov (he became chief engineer of Corvette in time for the 1963 introduction of the C2 Stingray Corvettes) – knew the

way, it's extended to other GM vehicles. We are providing support and engineering input into a wide range of products. The Corvette is like the tip of the technological spear.

"What Tadge has done in developing

“The Corvette now goes over 200 mph! There's no other vehicle inside GM that can even approach that”

importance that racing played, or could play, in the development of a great street car.

"When Doug Louth, Pratt & Miller's chief engineer, was assigned to the group overseeing the race car, Tadge recognised what he could bring to the production car. The relationship that Pratt & Miller struck up with him and his groups, whether it was design, aero or machining processes, meant that they all worked as one over the last three years to develop the C7 as a street car. We were consequently given a far superior race car. Having a great production car is critical to how you are going to perform at an event like Le Mans or in the TUDOR series in the US.

"Think of this: the Corvette now goes over 200 mph! There's no other vehicle inside GM that can even reasonably approach that, so consequently there's no library written or reference books inside the company that they can refer to for information, so where do you go to get that? The answer is the racing team and Tadge recognised that. So he's built a better street car and we got a better race car! It's what I refer to as cascade engineering – better street car, better race car, better street car and so on – and by the

this Corvette – the operations and methods he's used – have now been embraced by the Corporation. They see that when you empower people and give them a little freedom, there's no limit to what they can produce. Tadge is the

living and breathing epitome of that."

Fehan dismisses the idea of ever going into LMP1, believing that the race car should have a direct relevance to the road car. "We could do an LMP1 car tomorrow," he said, "but a lifetime in this business has taught me that there's nothing more effective than product relevance. When you can race something that you build, that's where you build the fan allegiance and that turns into a customer allegiance. That means selling more cars, which completes the circle – and that's our objective."

BROKEN HEART

Toyota's heart was officially broken at 4.53 on the Sunday morning when, having started from pole position and holding a 90-second lead with less than half the race remaining, the #7 TS040 HYBRID of Alex Wurz, Stéphane Sarrazin and Kazuki Nakajima retired after stopping on the circuit with an unexpected electrical problem related to the wiring loom. What made the anguish even harder for the team was that back at the pit they knew what the problem was but were unable to tell the driver as the communications system was down.

If there was consolation, and it barely registered in the circumstances, the #8 car of Anthony Davidson, Nicolas Lapierre and Sébastien Buemi went on to finish third. The result extended their lead in the World Championship and recorded Toyota's fifth podium finish at Le Mans. ▶





ABOVE The #8 Toyota heads pitward with accident damage

In fact, it had also originally been in contention for the lead until it was involved in a multi-car accident on the Mulsanne Straight after a brief downpour of rain on late Saturday afternoon. Around 50 minutes was lost to repairs, leaving the #8 eight laps down. It then suffered a further delay when, around eight hours in, aerodynamic balance issues prompted further bodywork repairs.

As the race wore on and problems hit other runners, including both Porsches, the Toyota moved into the top four. It was elevated into the top three within the last two hours, crossing the line for a bitter-sweet third place.

"We've never been so prepared," said David Floury, technical director of ORECA that is contracted to run the cars for Toyota Motorsport, before the race. "We have a very good car and the team is more experienced. Between the Le Mans test day and the race week we took the opportunity to run on the Bugatti circuit for one day just to expose the team and drivers to what they might face, but hope they won't, in the race."

ORECA is now so integrated with Toyota Motorsport GmbH (TMG) that it has a full-time team based in Cologne, Germany, the European home of the Japanese team. "This is where the cars are designed, developed and built and while ORECA is contracted to run the cars I am also involved in the technical side as well," said Floury. "Not necessarily hands-on in the design and development, but giving feedback on the cars' behaviour at the tracks and in which direction we would like to see them being developed."

TMG technical director Pascal Vasselon admits that while he has enjoyed the team's success in the first two rounds of the World

Endurance Championship, Le Mans remains the jewel in the crown, the car being designed with the 24-hour race in mind. "The basic concept of the car is done for Le Mans, which we then extrapolate for the other races in the series," he said.

It was when the regulations for 2014 were announced in 2011 that TMG first began its decision-making process as to what car and power unit it was going to develop.

"As soon as the regulations took shape, we started a series of simulations to define the concept of the car," explained Vasselon. "The actual design we started after Le Mans last year and right now are starting on the 2015 car. It's a series that is really demanding of simulation because it cannot be approximate. There is so much strong interaction between the systems that the whole thing needs to be correct. Something that's incorrect in one area can have a very serious impact on the whole."

The big story of Le Mans this year, though, had to be the return of **Porsche** as a front-running car. While this is not to disparage its GT cars, which have been the backbone of sportscar racing for decades, the fact that the Stuttgart manufacturer was returning to build on its 16 outright victories to date was a major factor in the huge spectator attendance.

For Wolfgang Hatz, member of the executive board, research and development, at Porsche and responsible for the factory involvement, it seemed to be business as usual such was his calm ▶



BELOW Sparks flew as Porsche announced its return to Le Mans by winning provisional pole in the opening qualifying session

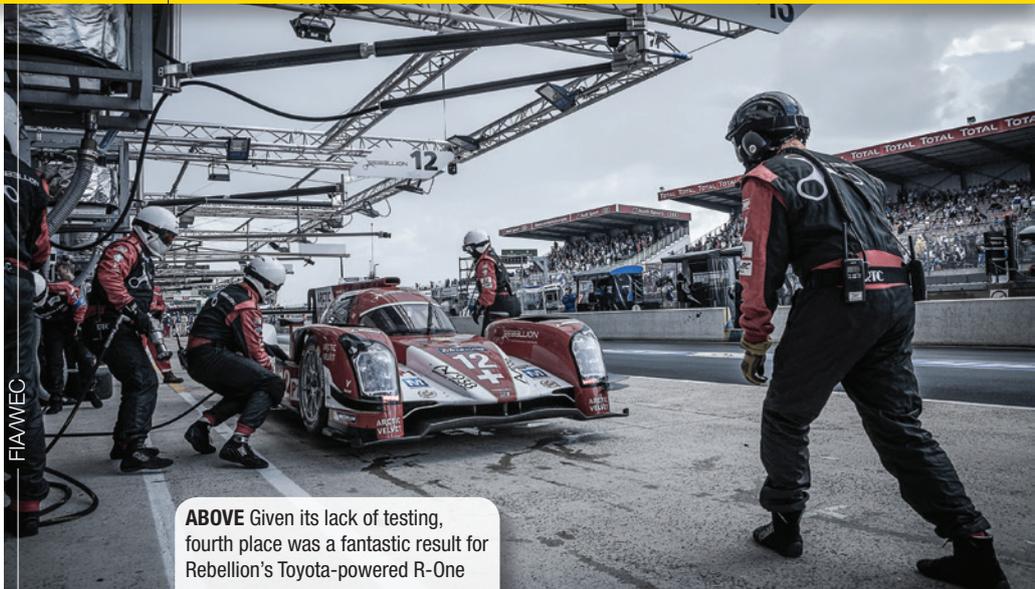
and relaxed demeanour. This was despite the enormous pressure that must have been on him – a fact exacerbated by his daughter getting married during the race weekend. “It’s only the civil one,” he said in a throwaway remark. “The proper church wedding is coming up.”

Hatz has enjoyed a long and varied career in the automotive and motorsport industry, having been an engineer and project leader in engine development at BMW. He joined Porsche in 1989 and was, among other functions, involved in the development of the Formula One engine. As an engineering graduate, he took up a post at Knorr Bremse in 1993, and in 1995 became technical director of motorsport at Opel before taking over as head of engines and transmissions development at Fiat in 1997. He joined the Volkswagen Group in 2001 as head of engines and transmissions development at Audi until 2009, having assumed the same function within the VW Group in February 2007.

This was the 14th time he has attended the race, acknowledging that perhaps this year was his most demanding one to date. “When I came back to Porsche in the autumn of 2010 it was clear to me that Porsche had to return to the highest level of motorsport,” he said. “So I convinced my colleagues that this was the right thing to do. This is when we started with a blank sheet of paper in 2011.

“However, it wasn’t just about building a new car, but constructing new buildings and creating a new race team to run the cars; I was very clear that the only way we would do this would be by ourselves. For me it’s very important that we are one team, no politics

BELOW Leading the race with just two hours remaining, Porsche seemed poised for a fairytale return



ABOVE Given its lack of testing, fourth place was a fantastic result for Rebellion’s Toyota-powered R-One

and we are all in it together, win or lose.

“I think the result to date hasn’t been too bad, although we still have a lot to learn about the car. However, it has a great deal of potential as we saw on Wednesday when it didn’t have the pace. We consequently made some changes, resulting in our wanting to fight for pole until the session came to a premature end with the yellow cautions. This shows one of our advantages and that is the quick way we make decisions: if we need to do something, then it’s done.”

His objective was that at least one of the cars should complete the 24 hours, which it did in a fashion. But when car #20 was leading the race with around two hours to go, it seemed as if the impossible dream might actually just come true. In the event, the cruel twist that is Le Mans only teased before coming down hard on the Porsche team, the leading #20 car suffering a powertrain failure. The sister #14 car likewise proved to be very competitive but was hampered by a drivetrain problem, although it still crossed the finish line under its own power to be classified 11th.

“This didn’t really work out, but at least we

have managed to show the huge potential of the 919 Hybrid and its innovative powertrain,” said Hatz. “We believe in our courageous concept and we will develop it further. We have already started work on the 2015 race car.”

Rebellion Racing repeated its success of 2012 with the #12 R-One, driven by Nick Heidfeld, Nicolas Prost and Mathias Beche, finishing in fourth place overall ahead of the Porsche. The only disappointment for the team was the retirement of the sister car just before the sixth hour with powertrain failure.

“We were thrilled to see the result posted by Rebellion Racing,” said Christophe Guibbal, director of the ORECA design bureau. “We started this challenge together a little over 14 months ago, and to see the R-One finish Le Mans in fourth place after such a short time was a real satisfaction. The car has progressed since its first laps and showed interesting potential for the race. To see the car arrive at the finish without having any issues at such a difficult race is really a positive thing. As good a result as it is, this is a step that places everyone in the right direction. We – Rebellion Racing and ORECA Technology – must capitalise on this performance.” ▶





ABOVE Audi celebrates its eighth Le Mans victory with TDI power. It has achieved a 38 per cent reduction in fuel consumption since the TDI era began in 2006

In the other classes, the Nissan-powered **Jota Sport Zytek** had a tense three-way fight with the brand new, good-looking Ligier JS P2, designed and built by Onroak Automotive, and Signatech-Alpine, also powered by the Zytek Engineering-prepared Nissans, to claim the LMP2 crown. It prompted Zytek Engineering boss Bill Gibson to wonder aloud why they need to be developing a new coupe when the old car is still capable of winning races. "It's a funny old world," he said reflectively while standing in the pit lane celebrating the Jota team's success.

The all-Danish-crewed #95 **Young Driver AMR V8 Vantage GTE** raced to victory in the GTE Am class, the Gulf-liveried car finishing two laps ahead of its nearest rival in what was the largest class of the race with 15 competitive GT cars. In contrast to the joy of the Am class victory, though, the team's race-long challenge with the #97 GTE Pro car finished with bitter disappointment as a power steering leak cost them five laps on track and left them in sixth place. Honours went to the **AF Corse Ferrari 458 Italia** with the #74 Corvette C7 a lap down in second place.

The victor's laurels, though, went once again – for the 13th time in fact – to **Audi**, much against the odds and even

their own expectations before the race. Once again, this formidable team came through with a 1-2 result. The feat was all the more remarkable for the fact that the second-placed car #1 was, in fact, a new car. The original #1 was totally destroyed in a massive accident during Wednesday's practice session.

"The G-forces were so high that we weren't able to use any of the hybrid system," said Thomas Laudenbach, Audi Sport's head of electric, electronic and energy systems, "but we'll look at it when we get back to base after the race."

Having joined the team from Porsche in the spring of last year, he adopted the hybrid system that had already been put in place – not that he would have changed anything anyway – but found that the flywheel system was the most challenging aspect. "From the control side I would say that this was more difficult than a battery system," he observed. "Bearing in mind, though, that it's in the 2 Megajoule class and that we can't add much weight to the car, the flywheel still has the best power density and therefore within our special case there wasn't a choice.

"And as you know, Ulrich Baretzky's engines are far too heavy, so we have to bring the weight down!" he continued, with a chuckle and metaphoric dig in the

ribs to Ulrich Baretzky standing beside him. Following a grimace from the engine man, he added, "As you know, a diesel engine will always be heavier than a gasoline one."

Responding to the question about the inevitability of further hybridisation, increased controls and "interference" with his engine, Baretzky sounded a note of caution. "I'm not sure that this is the future," he said. "We will see a level of complexity which can be handled and watched but then when you go beyond, we will be driving blind. Even today, when you look at an ECU, typically that for a road engine has something like 12,000 labels. Each one has a function and they partially influence each other. As you build upon the complexity year-on-year, the danger is that you lose sight of the original parameters so that if something does go wrong, it becomes very hard to trace, meaning that the development has to be reversed. While a race ECU is far less complex than a road car's, as there's far less functionality, it's still an important factor."

Commenting on Audi's win this year, Baretzky's parting comment was a telling one: "If you wish to win Le Mans, you need to have three cars in the team – anything less means that you aren't taking it seriously." **RT**

