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Produced by ANDREW COTTON, SAM COLLINS,
MIKE BRESLIN and DAVE OSWALD

Time and tide wait for no man. There is nothing so irresistible as the force of tide, but the bit that we are interested in is the time. And money. Despite the reduction of 10MJ from the fuel tanks in the LMP1-Hs at Le Mans this year, they are lapping at almost precisely the same speed as they were in 2016.

There are two ways to view this; the first is that it shows the incredible technical achievement of the manufacturers, despite the stable regulations. To have lost 10MJ, widely agreed to be around 4.5 seconds per lap, and make that all back in less than 12 months, shows the amazing rate of development for the battery technology.

The other way to look at it is that the amount of spending needed to accommodate the new regulations, and the on-going attempts to slow the cars, demonstrates the level of investment needed to compete at this level. Some fear that this is too much for a new manufacturer to consider entering the competition. New regulations will be introduced for 2018, and more for 2020/2021, that will bring in new fuel technology. Already, Toyota and Porsche have reached the upper limit of the stored hybrid energy, 8MJ, while Audi has reached its diesel-factored limit of 6MJ this season. The next step for the regulations in 2018 is to increase the upper limit to 10MJ, and for Audi to step up to 8MJ, which means more investment once again.

The underlying fear in the WEC paddock is that one of the three manufacturers will withdraw from the WEC on the grounds of cost, and so the introduction of a fourth is of paramount importance. BMW's programme has apparently stalled, but the continued presence of Peugeot Sport director Bruno Famin in the WEC paddocks

at Spa and at the Le Mans test day indicate that the French manufacturer is ramping up. Famin says that there would need to be 'structural change' to the cost regulations for Peugeot to consider a return. But how much will existing manufacturers compromise to ensure that this happens?

As the ACO continues to try to control the speed of the cars against the inevitable tide of technology development, the question remains; how financially sustainable is the WEC in its current guise?

ANDREW COTTON
Editor





Le Mans addicted



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Audi leads the way at Le Mans test day

Audi topped the overall lap times at the pre-race test day at Le Mans, but it was not all plain sailing for the German manufacturer, as a broken damper had to be cut out from the car, costing more than an hour in the pits.

Lucas di Grassi set a time of 3m21.375s in the number 8 Audi R18, while Mark Webber was second with a 3m22.270s for Porsche. The times compared favourably to last year's 3m21.06s, set by Porsche's Brendon Hartley. The cars run with a reduction of 10MJ from the fuel allocation, estimated to be around 4.5s of lap time, but the drivers agreed that the track was in better condition for this year's test than ever before.

However, looking at the stint times give a more accurate analysis of what actually happened during the test day. Each of the hybrid cars is supposed to be able to complete 14 laps on a tank of fuel, which was achieved by both Porsche and Toyota, but Audi was only completed 13 laps during the test weekend. That said, Audi's stint average was quicker than that shown by its two rivals, suggesting that it will be competitive.

Toyota confirmed that it was the bottoming out of the TS050 in Eau Rouge that caused stresses in the engine that led to the double failure at Spa, and did not anticipate a similar problem at Le Mans this year while Porsche confirmed that it would run a 2015 battery for the remainder of the season. All manufacturers are anticipating a race of attrition. It will be a gamble to decide who will go for outright speed, and who might hold back. With no third cars for the manufacturers this year, this decision will be more difficult than ever.

Audi topped the times at the test day but will the R18 have the reliability to pick up the winners' laurels after 24 hours of hard racing at Le Mans?



Rumours of the future of the LMP1 privateer category are still rife, and one team revealed that the DRS option was not even presented to the FIA World Council as a means to closing the gap to the LMP1-H manufacturer cars. The ACO is to host a press conference on Thursday, June 16, where further details are expected to be released.

In the GTE category, Corvette Racing was fastest with Antonio Garcia two tenths of a second quicker than Porsche's Nick Tandy. The

new balance of performance table was released on June 1 and amended post test. Ferrari was given an extra 10kg at the test, but post test had its fuel allowance cut by two litres. The Ford GT lost 20kg since Spa and then a further 5kg post test, Aston Martin ran at the test 20kg lighter, and has subsequently lost another 10kg but has a smaller air restrictor. Corvette also has a smaller air restrictor from since the test. Ford and Aston Martin have a greater fuel allowance post-test.

Test day details: LMP1

Car No.	Car	Drivers	No of Laps	Longest stint	Long stint average	Best lap am	Best 20% am	Best lap pm	Best 20% pm	Best 20% overall
1	Porsche	Bernhard/Webber/Hartley	90	14	3m 26.552s	3m 22.555s	3m 24.537s	3m 22.270s	3m 25.000s	3m 24.344s
2	Porsche	Dumas/Jani/Lieb	83	13	3m 27.293s	3m 22.334s	3m 23.682s	3m 22.453s	3m 24.768s	3m 23.608s
5	Toyota	Buemi/Nakajima/Davidson	82	14	3m 27.485s	3m 23.197s	3m 25.973s	3m 25.324s	3m 26.622s	3m 25.820s
6	Toyota	Kobayashi/Sarrazin/Conway/Wurz	97	15	3m 35.745s	3m 23.721s	3m 25.984s	3m 24.182s	3m 26.298s	3m 25.423s
7	Audi	Fässler/Lotterer/Tréluyer	52	7	3m 32.770s	3m 22.761s	3m 24.773s	3m 22.588s	3m 22.765s	3m 24.238s
8	Audi	Di Grassi/Duval/Jarvis	86	13	3m 23.859s	3m 22.797s	3m 24.603s	3m 21.375s	3m 23.797s	3m 23.484s
12	Rebellion	Piquet/Prost/Heidfeld	84	11	3m 35.400s	3m 27.117s	3m 30.277s	3m 28.624s	3m 33.979s	3m 30.678s
13	Rebellion	Tuscher/Imperatori/Kraihamer	89	12	3m 48.225s	3m 27.062s	3m 29.114s	3m 28.256s	3m 30.663s	3m 29.182s

New Sentronics fuel flow meter gains LMP1 homologation

British company Sentronics has had its latest FlowSonic Elite HT ultrasonic fuel flow meter homologated for the LMP1 category. The company claims that the new model increases the upper temperature limit from the original FIA specification of 85degC, to 120degC.

Both FlowSonic Elite models rely on state-of-the-art ultrasonics, a true 2.2kHz measurement rate, and advanced internal processing to deliver industry-leading

accuracy and repeatability. Data outputs include volumetric, mass, and cumulative flows, as well as running time, speed-of-sound, and diagnostics. The Elite HT can handle the full range of flow rates, temperatures, fuel types, and vibration conditions found in motorsport environments.

Having benefited from intensive development by teams and engine suppliers in both Formula 1 and LMP1, the FlowSonic's reliability and durability match its performance,

the company tells us. Since its formation in 2013, Sentronics has established an impressive record of engineering high-level custom solutions based on its innovative, patented core technology. Prior to developing the Elite HT for LMP1, the company responded to an F1 engine supplier's request to address measurement errors stemming from aliasing in the original FIA-homologated 1kHz sensor by more than doubling the update rate. The resulting FlowSonic sensor was

fitted to the winning car in the last four grands prix of 2015.

Sentronics managing director Neville Meech said: 'We are committed to responding rapidly to customer needs by adapting our technology to their specifications. We've done it for F1 and WEC over the last couple of years, and now again with the low-flow and high-flow sensors we launched for the OEM automotive testing market at the Automotive Testing Expo Europe in Stuttgart.'

Le Mans 2016

With each LMP1 manufacturer experiencing technical problems in the WEC so far this year Le Mans 2016 has been hard to call. We crunched the data to see exactly where the top P1 teams stand going in to the big weekend

By **ANDREW COTTON** and **PAUL TRUSWELL**



The Audi number 8 gained early bragging rights with a best time at the pre-race test day that was just short of a second quicker than the fastest Porsche, but this year's Le Mans could well be decided on reliability rather than outright pace

This year it looks like the Le Mans 24 hours will boil down to reliability as much as speed, as Audi, Toyota and Porsche have each suffered with technical problems through the opening two races of the World Endurance Championship.

For Porsche its weak point had been the battery, and the company has now reverted to its 2015 battery for reliability purposes. More positively, Porsche has also recorded pole position at both Silverstone and at Spa, and in both races has comfortably had the faster car.

As for Audi, it is the front motor that has caused the most problems, with issues in

testing, at Silverstone and at Spa, where the MGU split and filled the cockpit with oil. Audi says that it is not a concern, and that the part was beyond its life, but the rumours persist. For Toyota, two engine failures at Spa have been sorted but the PU is new. Also, with a completely new central nerve system for the car, it has a lot of learning to do ahead of the 24 hours.

Of the three cars, Porsche certainly has the best chance on paper. It comes with the same concept as the past two years; a 2-litre, V4 engine supported by two MGUs, one KERS on the front axle, one heat recovery system working with the exhaust. The energy is stored

in a battery, and the company has further extended its knowledge with battery provider A123 in the US. Two failures, caused by a manufacturing error, have encouraged the team to revert to the 2015 battery for the remainder of the season. To read our assessment of the new Porsche 919, download RCE V26N5 [here](#).

For Audi and Toyota, there are significant changes. Audi has changed from the flywheel energy storage system to a battery. That has allowed the company to switch to the 6MJ category, with 50 per cent more energy able to be released around a lap of Le Mans than in 2015. But the major changes are elsewhere. Audi

Maybe this year, more than any in the last 40, getting the right balance for Le Mans will be of paramount importance



Tyre wear management is very different at Le Mans than at Silverstone or Spa

has an all-new aero concept that has involved major re-working. The cockpit has been moved back to free up space at the front of the car. Air is now channelled through the car, with an emphasis placed on the nose area. A revised suspension system is in place, with the front and rear linked hydraulically, as last year, but with the roll and heave decoupled, allowing for adjustments to be made independently.

Also different for Audi is the hydraulically powered steering system and gearchange, moving away from the electro-magnetic steering of 2015. Audi reckons it is a lighter solution and has embraced it fully. For a full

analysis of the R18, download the latest edition of the magazine, RCE V26N7, [here](#).

Similarly, Toyota has switched from super capacitors to a battery storage system, and has made a jump in categories, from 6MJ to 8MJ for the first time. However, the company has also switched to a 2.4-litre twin turbo V6 engine, the green light on the development of the unit given around mid-season in 2015, for an engine that was originally supposed to be ready for 2017. That meant the team not only had to develop a new engine, but it also had to adapt the chassis and cooling to cope with the turbos. The learning around energy storage has

also been a steep curve, although with plenty of running the team is better prepared than it was at the start of the season.

Toyota has focused everything on Le Mans, to the extent of not producing more than the 300kW of power allowed at Le Mans at any point during the season. Le Mans is the only Class 2 track, as defined by the FIA, and therefore the only one on which the rate of deployment of hybrid energy is thus restricted. For more on the TS050 download RCE V26N6 [here](#).

Each of the LMP1-H manufacturers has been limited to just two cars at Le Mans. That has made it logistically easier to manage for Porsche



Table 1: Laps completed comparison

	Audi	Porsche	Toyota
Silverstone 2014	35.3%	58.4%	99.7%
Spa 2014	99.4%	93.0%	100.0%
Silverstone 2015	99.0%	60.9%	99.8%
Spa 2015	98.1%	99.2%	95.2%
Silverstone 2016	67.8%	68.0%	93.6%
Spa 2016	98.4%	84.4%	62.8%

Table 2: Fastest average lap times

Silverstone - Race		
	Best Lap	Average Lap*
Audi no. 7	1m 40.461s	1m 41.290s
Porsche no. 2	1m 40.303s	1m 41.367s
Toyota no. 6	1m 40.657s	1m 42.053s
Spa - Race		
	Best Lap	Average Lap*
Audi no. 8	1m 59.952s	2m 01.716s
Porsche no. 2	1m 59.140s	2m 04.050s
Toyota no. 5	1m 59.740s	2m 00.662s

*the average lap time is calculated by taking the average of the best 20 per cent of laps under green flag conditions

Table 3: Silverstone, the first 70 laps

	Best Lap	Average Lap*
Porsche no. 1	1m 40.309s	1m 42.175s
Porsche no. 2	1m 40.577s	1m 42.836s
Toyota no. 5	1m 41.076s	1m 43.751s
Toyota no. 6	1m 40.919s	1m 43.433s
Audi no. 7	1m 40.461s	1m 42.559s
Audi no. 8	1m 40.628s	1m 42.587s**

*Since all 70 of the opening laps were green, this is the average of the best 14 laps.

**The emerging hybrid problem is ignored by using only the first 42 laps for the comparison

Table 4: Average pit stop times

	Silverstone	Spa
Audi	1m 24.2s	1m 20.4s
Porsche	1m 23.8s	1m 18.1s
Toyota	1m 20.2s*	1m 13.4s*

*Includes one fuel only stop

Table 5: Top speeds. Average of fastest 10 times

	Silverstone	Spa
Porsche no. 1	280.5 km/h	301.7 km/h
Porsche no. 2	281.5 km/h	295.8 km/h
Toyota no. 5	291.5 km/h	299.1 km/h
Toyota no. 6	287.6 km/h	294.7 km/h
Audi no. 7	277.7 km/h	304.1 km/h
Audi no. 8	280.8 km/h	307.1 km/h



The number 1 Porsche 919 Hybrid was the quickest car at Silverstone. Porsche sticks with a 2-litre V4 ICE with two MGUs in support; a KERS on the front axle and one heat recovery system working with the exhaust



The TS050 struggled at the Silverstone season opener, particularly in the wet (this was its first run in the rain) but also in race traffic, due to issues with driveability. Toyota has said it is concentrating on Le Mans this year

and Audi, which each brought three last year, but has reduced their advantage numerically over Toyota. The old adage of 'one to crash, one to break down, the third to win', has now gone, and an emphasis will be placed on not having one crash, or break. That will be no small achievement!

In the opening two races of the WEC season, at Silverstone in April and at Spa in May, the privateer Rebellion team finished on the podium (albeit at Silverstone after the winning Audi was excluded for wearing the plank too much during the race). If the Rebellion cars are able to have a reliable, trouble-free run, given the performances of the LMP1-H cars in the opening two races, then there could be a shock result on the cards this year.

The ACO is looking at ways of increasing the speed of the LMP1 privateer cars, including increasing the fuel tank size and the fuel flow

delivery rate, as well as reducing weight slightly. The cars should also be quicker this year, as they have all switched to Dunlop rubber. That's no slight on Michelin, but the French tyres have been developed in conjunction with the manufacturers. The fronts are therefore designed to take 400bhp through the front wheels, which has meant that the non-hybrid LMP1s have struggled in low temperatures, particularly at night.

So, the stage is set, but how does the performance stack up between the LMP1-Hs? Toyota has made it no secret that it is chasing victory at Le Mans as a first priority. As mentioned above, the new TS050 has never delivered more than 300kW of energy from its hybrid system, in testing, race or qualifying, despite being allowed to do so at all circuits. Only Le Mans carries the 300kW limitation as it is a Grade 2 track, leading to a shallower acceleration curve. Audi says that it, too, probably hasn't exceeded the 300kW, despite a maximum capability of 350kW from its hybrid system, although it also says that the difference between 280kW and 320kW is

Each of the LMP1-H manufacturers has been limited to just two cars at Le Mans



Audi's R18 has changed radically for this year. The cockpit has been moved back to free up space at the front, and air is now channelled through the racecar, while a greater aero emphasis is now placed on the front wing



The battery is mounted high in the nose of the Audi R18, by the drivers' legs, in an effort to move weight further forward



Toyota has switched from super capacitors to a battery storage system for 2016, and has made a jump in categories from 6MJ to 8MJ for the first time. It has also made a late switch to a 2.4-litre twin-turbo V6 engine

negligible, suggesting that it is close to the Le Mans' artificial limit anyway.

Porsche's system is undoubtedly more powerful, and in qualifying at least this season has delivered more than the 300kW limit. What difference this will mean at Le Mans has yet to be seen, but Toyota and Audi might fancy their chances of a front row start now Porsche has decided to run its 2015 battery and cannot deliver more than 300kW in one discharge.

WEC analysis

While Toyota has focused its attentions on Le Mans this year, Porsche and Audi both used the races at Silverstone and Spa to try to garner as many points as possible towards the World Endurance Championship, and in so doing have encountered all kinds of problems. Whether this has been coincidental or as a consequence of this revised approach doesn't really matter: the fact remains that more accidents have happened and more reliability problems have affected the results than in either 2014 or 2015.

Table 1 shows the percentage of the actual number of laps completed compared to the

maximum possible number. At Spa last year, Porsche and Audi both fielded three cars, and Audi had three there in 2014 as well, which makes 100 per cent a harder target, as it would mean all the team's cars finishing on the lead lap. It seems that getting the car to the end of 24 hours' racing without a problem will be the key to winning at Le Mans.

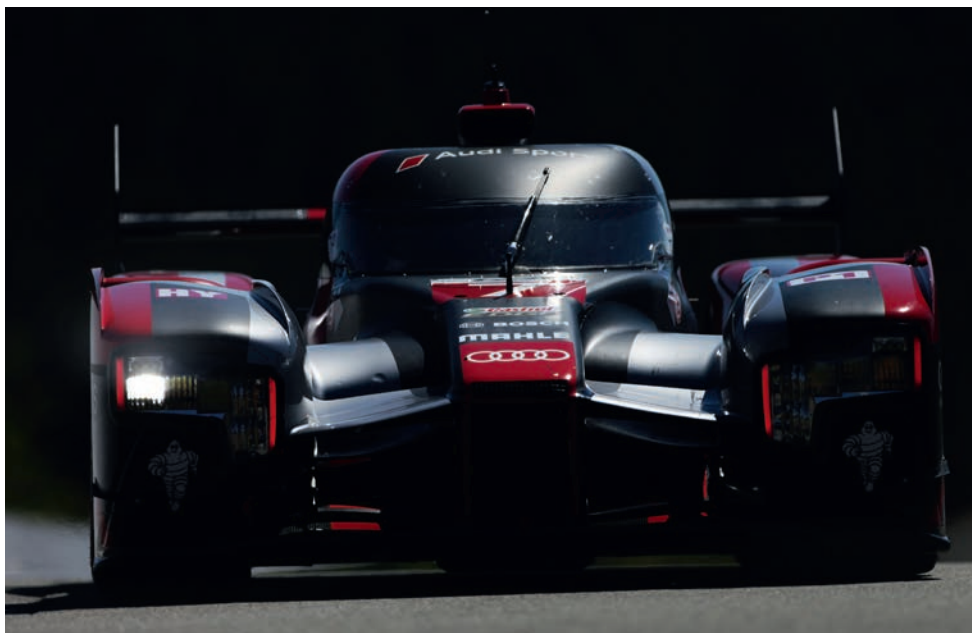
Of course, there are so many parameters to overall success, and outright pace is only one of them. In **Table 2**, showing the fastest average lap times for the best of the manufacturer cars, we can see that Porsche has a clear one-lap pace advantage over Audi and Toyota.

However, at Spa, once all the difficulties of Silverstone had been sorted out, the average lap time of the number 5 Toyota was faster, and that can be put down to the teams' confidence on its tyres. At Spa, the team saw that Stephane Sarrazin was setting competitive lap times at the end of his first stint, and therefore the decision to double stint early was a simple one to take. Had the car continued reliably, the plan was to double stint throughout the race. This has significant implications for Le Mans.

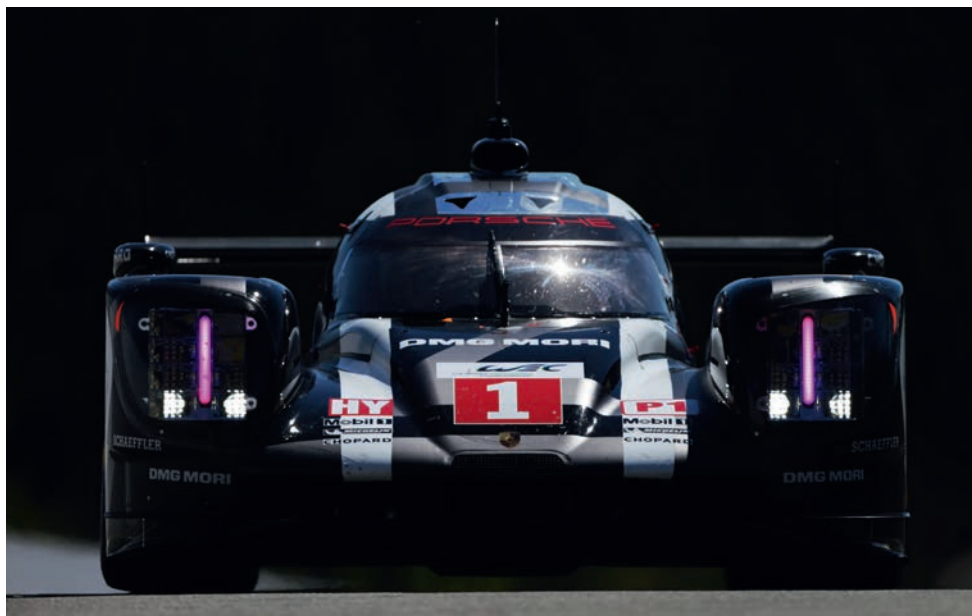
After the race there was no explanation from Porsche as to why one of its cars was substantially quicker than its other racecar

Yet although these tables give us some guidelines of what to expect, they oversimplify matters to a misleading degree. Let's take Silverstone first. In the first two hours of the race Mark Webber and Brendon Hartley established a healthy lead in the number 1 Porsche before its collision with Mike Wainwright's Gulf Porsche 911RSR put both of them into the gravel and out of the race. **Table 3**, of best and average lap times for the first 70 laps alone, tells a different story from the full race table shown in **Table 2**.

After the race, there was no explanation from Porsche why one car was substantially quicker than the other – comparing the two Toyotas or the two Audis shows no such difference between team cars. At Spa, no-one at Porsche believed that Marc Lieb, Neel Jani and Romain Dumas would be heading for second place when the hybrid problem manifested itself on the seventh lap of the race and the decision was made that fixing it in the pits would take longer than the time that would be lost by staying out and losing around five seconds a lap. On the assumption that this calculation was actually done (and not merely



Audi's Spec B kit at Spa. This is the Le Mans body kit and includes changes to the wheel arches, engine cover and the wings



Porsche Spec B kit, also at Spa. Porsche and Audi run with Spec A, high downforce kits, at the season opener at Silverstone



The TS050's Spec A kit at Spa. Toyota stayed with this set-up for WEC's round two in the belief it would help with tyre wear

guessed at), the implication is that at least 20 minutes would have been taken to diagnose and resolve this issue.

The other Porsche spent 1h 40m having the front axle ERS gearbox replaced, but when it was on track it was fast. Its best lap was a 1m58.431s (by Hartley), and a staggering 1.3s faster than the best lap that was managed by any non-Porsche. Although the team did not have to worry about managing its tyre wear, the average of the best 20 per cent of laps for the number 1 car was 1m59.997s – two-thirds of a second quicker than anyone else, and enough for it to have won the race by 1m45s, if you extrapolate its pace over the full race distance, with the Audis a full lap behind.

The danger in using any of these numbers to make predictions about the result of Le Mans is that the configuration – particularly the aero – of Porsche, Audi and Toyota has been adapted to suit the specific requirements of Silverstone and Spa to different extents. Each of the cars ran at Silverstone in their Spec A bodies, nominally the high-downforce configuration for the season. Spec B is for Le Mans, and includes changes to the major components such as the wheel arches, the engine cover and the wings, each expensive to produce, and there is a time limitation too – to produce a Spec B kit for Spa would require sign off earlier than for Le Mans, almost two months later. Spec C is nominally for the races post-Le Mans. Each configuration may be run at any point during the season, but they may not be mixed. A team may not run a Spec A and Spec C combo, for example. In 2017, the number of kits will be reduced to two.

Tyre management

At Silverstone, one of the problems for the Toyota compared to the Porsche and Audi was that its Spec A kit produced less downforce than the other two. The two cars therefore suffered in comparison, with drivers cautious off-line and in traffic. Although the outright pace was close, stint averages were slower. That was the reason Toyota went to Spa in May still with its Spec A kit, in the belief that it would benefit its tyre wear in comparison to the opposition. The results were pretty spectacular.

Audi and Porsche both introduced their Spec B kits for Spa, although they dialled in a little more downforce than will be seen at Le Mans. Dive planes and other, shall we call them inexpensive items to develop, may be introduced after final spec is signed off.

Tyre wear management, which went so horribly wrong for Porsche at Spa in 2015 and for Audi at Le Mans that year, is very different at Le Mans than at Silverstone or Spa. Even the difference between a triple and a quadruple tyre stint at Le Mans will only make the difference of 75 seconds at the end of the race – equivalent to a pace difference of less than 0.2s per lap – so if you can make pace count at the expense of additional tyre wear, then the chances are it will



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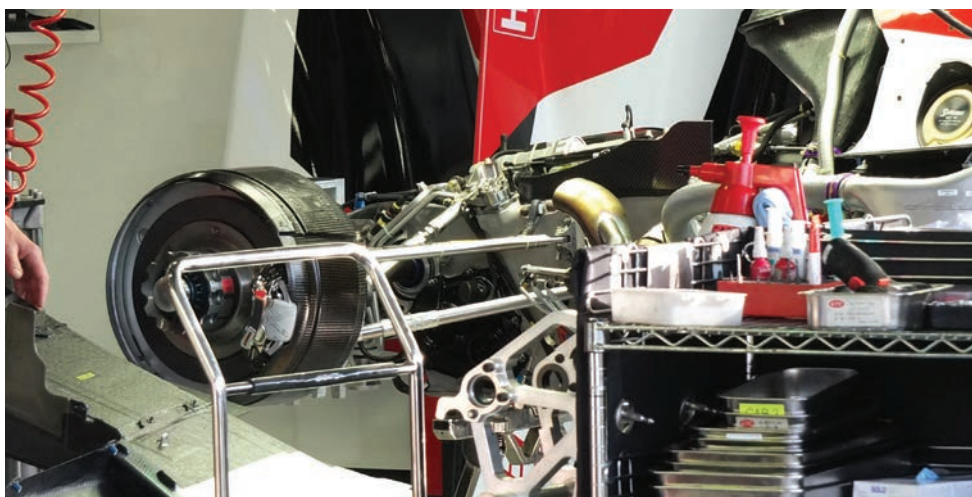
Audi has had problems with the front motor in testing, and at Silverstone and Spa, where the MGU has split and filled the cockpit with oil. The R18's front and rear suspension is still linked hydraulically, but with the roll and heave now decoupled



Porsche has suffered with some issues with its new batteries this year. This has meant that it has now decided that it will run with its 2015 battery for the 24 Hours and the rest of the season. This could affect its speed during Le Mans qualifying



Rebellion (left) has finished on the podium at both of the WEC rounds held to date, Silverstone and Spa (pictured). If it has a trouble free run at Le Mans, given the problems that the leading LMP1 cars have had this year, an upset could be possible



Toyota has also suffered with reliability woes. At Spa an engine let go when it was in a commanding position. The car then made use of a safety car period to complete a slow lap on electric power alone, gaining Toyota some manufacturers' points

be worth doing so. That isn't to say that pit stop strategy is not important. **Table 4** shows the average pit stop time for the best three routine stops at the first two rounds of the season.

Both at Silverstone and Spa, Toyota carried out a 'fuel only' stop early in the race, something that neither Porsche nor Audi did: suggesting that the Japanese marque is kinder to its Michelins than are the German cars. In any case, it shows that Toyota has more confidence running its tyres closer to their margins. Whether Toyota will be able to balance its tyre wear with the Spec B kit has yet to be seen. It will certainly be a point to watch, particularly during the cold night temperatures that are expected at Le Mans during the early hours of Sunday.

Equally clear is the fact that Audi, against the trend of recent years, has been slower so far this year in the pits than either Porsche or Toyota, even when comparing equivalent stops to change fuel, tyres and driver.

Car set-up is always a compromise – balancing the need for high speed on the straights, stability through fast corners and braking and acceleration for slow corners, but it is always interesting to compare the top speeds recorded by the speed traps. However, these are often inaccurate, and so in **Table 5**, the fastest speed recorded is ignored, and then the average of the next fastest 10 is taken. This should remove anomalous recordings and allow a like-for-like comparison. This should be further qualified; sometimes the positioning of the speed traps does not take into account the LMP1 hybrid's lift and coast functions! That may partially explain the Rebellion's high top speeds at the Le Mans test day.

Straight talking

If evidence were required of the different aero set-ups, however, surely this is it. Audi, from being slowest through the speed trap (on Hangar Straight) at Silverstone went quickest (on Kemmel) at Spa. The difference in top speeds achieved by Toyota was just 7 or 8 km/h between the British and Belgian tracks, seemingly indicating that it was dialling downforce into the TS050 as Audi and Porsche were removing it from the R18 e-tron quattro and the 919.

A look at the times through Sector 2 at Spa (from Les Combes to Stavelot) confirms this: the average of the best Porsche times was 56.4s, compared to Toyota at 56.6s and Audi at 57.4s. What Audi gains in straight-line speed, it then loses through the fast corners.

Aerodynamics has been crucial for years, but maybe this year more than any in the last 40, getting the right balance for Le Mans will be of paramount importance. But 'to finish first, first you have to finish', and the need to drive safely and without mechanical issues will surely continue to decide the outcome of the races, whether they are over six or 24 hours.

This could be one of the most interesting Le Mans 24 Hours in many a year.



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Dunlop and Michelin have engaged in open competition in the WEC, but have also found a cost-effective way of conducting their tyre war

By ANDREW COTTON



Tyre war. The words strike fear into any accountant studying a racing budget. Race tyre development is expensive enough, but when there is a war, the need to test and develop increases exponentially as demand grows for a performance advantage. With a limitation on track time for cars in the major series there is little appetite for dedicating time to developing tyres, but the WEC has found a way of encouraging a low-cost tyre battle.

Dunlop and Michelin supply each of the four classes at Le Mans. Michelin supplies the LMP1

manufacturers and the majority of the GTE grid, while Dunlop dominates in LMP2 and has this year signed a deal with Aston Martin to produce bespoke tyres for the British manufacturer.

It's no secret the ACO and the FIA are seeking a third tyre manufacturer and were close to signing a deal with Hankook to be sole supplier to GTE-Am. However, Dunlop and Michelin are against sole supply for a class, preferring open competition, and are supporting the WEC through selling customer tyres.

The two compete effectively side-by-side in the LMP1 category, with Michelin developing its

product with the manufacturer hybrid entries while Dunlop re-enters the LMP1 arena with the customer teams, Rebellion and ByKolles, having completed the move of its racing production from its historic UK base to Germany.

Competition in LMP1 is therefore limited between the two tyre manufacturers; the performance of the Michelin-shod hybrids and the development budgets put them in a different league to the Dunlop-shod privateer, although a lack of reliability of the manufacturer entries could see the privateers challenge for an overall podium at Le Mans in 2016.



With Dunlop's deal to supply Aston Martin Racing with its rubber from this year the first shots in a GTE tyre war have been fired. Both Dunlop and Michelin already go head to head in customer-based LMP2

The LMP2 category is also limited due to the emphasis on customer racing, although the market is much bigger for both manufacturers with the European Le Mans Series, the WEC and, potentially, the WeatherTech series that Dunlop also has a keen eye on for the future – although the Americans have agreed a deal with Continental for the supply of tyres.

The customer element has not stopped the two manufacturers bringing an all-new range of tyres to this, and other categories in the WEC as the competition steadily increases. LMP2 is solely for privateers, and therefore Dunlop

and Michelin have had to come up with a new method of ensuring development costs do not rage out of control. The solution, as proposed by Michelin and now supported by Dunlop, is that they do not use 'confidential' rubber, but instead must swap the tyres on demand.

Swap shop

Each of the tyre manufacturers must nominate three compounds of tyre at the start of the season. These three compounds must serve the teams throughout the year, and must on a race weekend be available for examination

by the other manufacturer. Dunlop had a clear advantage over Michelin in the early years, evidenced by Michelin having to swap two of its three nominated compounds early on in 2014, but this year Michelin has stepped up its involvement. 'In LMP1 we have confidential tyres where we can put the technology that we want,' says Pascal Couasnon, motorsport director at Michelin. 'In LMP2 they changed from confidential to commercial tyres, and I have to admit that we were conservative because we didn't want to run the risk that all the work that we have done for many years can be copied



Dunlop supplies Rebellion (pictured) and ByKolles in LMP1. Its P1 tyre is a development of its LMP2 rubber; the rear is similar in size to the P2 version while the front tyre is similar in its construction



Dunlop and Michelin are involved in a tyre war in LMP2, but it is a conflict that is based upon a degree of openness and there are checks in place to discourage a tyre development arms race

easily. We were protective, [but now] we are coming back and are getting some good results in the [European Le Mans Series], and maybe in Le Mans we will have some good surprises from ELMS teams.'

That change has meant a major change in design for the Michelin engineers. 'The car characteristics from GT to LMP2 is so different in terms of aero,' says Jerome Mondain, Michelin's Endurance Programme manager. 'We aim to be competitive in LMP2 and with this new range we had for the first time, since a long time, a proper winter development. With the different loops, starting on time, we have just started to see some encouraging results as a result of this development.'

'It is more complicated with confidential tyres, because we don't have the same raw material as in LMP1,' Mondain continues. 'And if we need to do double stints, that is due to the

technology. At least three stints at Le Mans [for the LMP2] is the basic goal and we would like to offer four stints, but Silverstone was the first time that we run with that range. Three stints we can do but we will find out more [at Le Mans].'

Tread carefully

For Dunlop, the opportunity to prove itself against Michelin in open competition has been welcomed and it says the idea of tyre swapping is that a close eye can be kept on the three nominated compounds, rather than a confidentiality issue. 'Would we copy the technology of Michelin? I am not a strong believer in that,' says Sebastien Montet, director of technology at Dunlop Motorsport. 'You can analyse the compounds, you can analyse the material, you can do a bit of reverse engineering, but at the end of the day the tyre is process based. If you copy something, you are already

late. By the time you copy, the other guys will have moved on. If you have a philosophy and it is the right one, it is your product.'

Jean-Felix Bazelin, director of operations at Dunlop Motorsport, agrees that the confidentiality argument is non-existent. 'All cakes are made with flour, eggs, butter, and sugar,' he says. 'Some are soft and some are hard. The difference is the process and it is the same for tyres. You cannot have exotic tyres. This rule has been requested by Michelin five or six years ago. I was not happy with that, but they probably know our tyres are made in the same factory by the same engineers, but theirs are made in two separate factories.'

GTE at war

However, the real war has only just started in the GTE Pro category, where both companies supply confidential rubber to manufacturers and there



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is no agreement to swap tyres. Dunlop has signed a deal to supply Aston Martin's Vantage, while Michelin provides its expertise for every other GTE operation, including Porsche, Ferrari, Ford and Corvette in both the WeatherTech SportsCar Championship, and the WEC.

There are particular issues with a GTE tyre war in the World Endurance Championship, not least when it comes to the balance of performance. Tyres are, of course, critical to the performance of a racing car, particularly over a long run, and so to extract the performance advantage or disadvantage of a tyre while balancing the cars is no mean feat.

'The balance of performance is not supposed to take into account tyre differences,'


says Mondain. 'It is based on aero balance, weight, speed or engine or whatever. As long as the balance of performance is not done with some tyres, we keep an eye on that. We are happy that Dunlop is there, because we like competition. The balance of performance is one thing, but the tyre is not supposed to be part of it.'

Each of the car manufacturers has the opportunity to work with its tyre supplier to produce a product that will yield a better lap time. As in LMP1, Michelin proposes a base tyre, and the manufacturers develop up from there.

Aston Martin is focusing on its own performance, and few doubt that the partnership with Dunlop will yield results.

So far, with just the one team, the learning is limited due to the mileage and validation and that has held back the flow of information.

'You have an advantage [by not supplying more teams] because you do something bespoke, but on the other hand you don't see the whole picture,' argues Bazelin. 'If you have three cars, and there is one day when a car doesn't work, you can prove that the problem is not with the tyres. If you concentrate on one chassis, one balance of car, one driving style, then you don't get as much information.'

Both tyre companies welcome the competition, and have found a way of waging war for a reasonable cost. Each opposes one-brand racing, which is a breath of fresh air. 



Dunlop's P1 tyre is good for LMP1 private teams, who struggled to get heat in to Michelin front tyres developed for LMP1-H



Michelin's cutting edge tyre tech is on show in the top LMP1-H categories of the WEC, where it has developed rubber suited to the unique demands of the hybrid cars such as the Toyota TS050 (above)

The WEC switch

Michelin has introduced its WEC tyre to the IMSA series in the US, and works with the GTE manufacturers to develop bespoke tyres for their cars. The two series ran with different tyres at the start of the season, the American series preferring a sprint-type tyre due to the teams being able to refuel and change rubber at the same time. In the WEC, tyre changes occur separately, and therefore there is incentive to double stint, or more.

However, at Laguna Seca, Michelin brought its WEC-spec endurance tyre to the American series, allowing Corvette to race on it for the first time this season ahead of the test day at Le Mans. 'We introduced the WEC range in Laguna to let Corvette have the first read of them,' Mondain

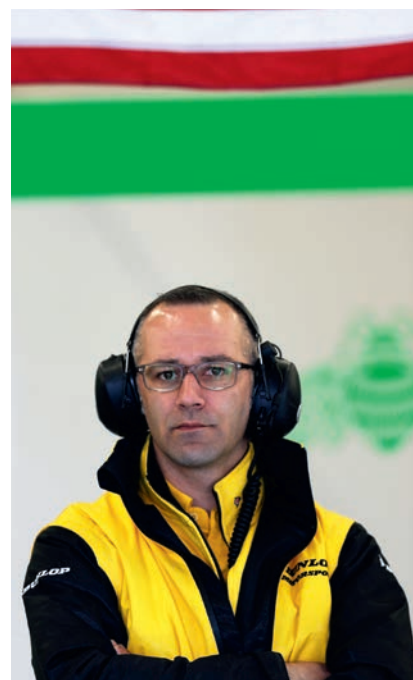
explains. 'They also test in the US and we shipped some tyres for them to get the knowledge.'

With Aston Martin having switched to Dunlop, Ferrari and Ford with a mid-engine layout, and Porsche with the engine at the rear, the Corvette is the only manufacturer with a front-engine layout and that needed some extra work with Michelin.

'Corvette is part of the development programme, managed by our American colleagues from our American base, but the first part of the year with the WeatherTech Championship, we did with the different tyres due to the characteristics for the first couple of races, but they were able to test the same tyres as we do in Europe with the continental manufacturers,' Mondain says.

'When they will arrive in Le Mans, it will not be the first time that they see the Le Mans tyres.'

'[For the rest of the US season] there will be no difference [between the WEC and IMSA tyre]. For the IMSA tyre we don't have the same regulation regarding tyre changes. We took into consideration that regulation, but it was more dictated by the track characteristics, so Daytona is unique, Sebring for a long time we did with the WEC range and it was also fine, but as long as we had the choice, Sebring can be more closer to Daytona, and so that's why we did the same tyre. It is a bit softer in terms of stiffness, but that is the characteristic of the track with low grip. It is more how the compound reacts to these changes and the tarmac,' Mondain says.



Sebastien Montet, director of technology at Dunlop Motorsport, says there is little chance that the open arrangement it has with Michelin in the WEC would lead to one company copying the other's technology



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The radical prototype was initially tested in the wind tunnel without some parts of the bodywork in place. The car's aerodynamic concept is based on a single seater and it will also make use of some active aero devices



Welter Racing (WR) has a long history of building innovative and unconventional sports prototypes to race at Le Mans. Its most famous assault was in 1988 (then under the WM banner) with the Peugeot-powered Project 400 P88, which hit 253mph on the then uninterrupted Mulsanne straight. Its 2008 LMP2 chassis influenced the design of the Audi R15, and more recently it has built the chassis for the Green GT H2. Over the years since

its first participation in 1976, WR has clocked up two class wins (in 1979 and 1993) as well as a pole position and fastest lap (both in 1995). However, WR has now been absent from Le Mans for some time; its last participation was in 2010. But during this time it has not been idle, and with its unconventional approach to racing the Garage 56 concept was almost tailor-made for the tiny team based near Paris. The Green GT H2, which was granted the 2013 Garage 56 entry, had a chassis and aerodynamic package

which was designed and built by WR. Power unit issues resulted in that car failing to take part in that year's race (or indeed any races to date) but the WR engineers were not discouraged, and deciding to go it alone in November 2013. It then started work on an all new car for the Garage 56 entry, which should now be ready for the 2017 race. At the heart of the project is a new engine concept using bio-methane fuel manufactured by recycling human waste, and with 250,000 people in attendance each year at



Route 56

How legendary Le Mans car builder WR is preparing to return to the great race in an experimental racecar propelled by a poo-powered (yes, really) engine

By SAM COLLINS

At the heart of the project is a new engine concept using bio-methane fuel manufactured by recycling human waste

Le Mans there is sure to be a plentiful fuel supply for this radical Garage 56 entry.

A 3-cylinder 1600cc turbocharged engine has been designed and built in-house by the engineers at WR under the management of Jean Pierre Boudy, a former Renault and Peugeot engine designer who was responsible for a number of Le Mans winning engines, as well as the first turbo engine to be used in F1.

'The engine has been developed in our facilities,' explains Thibault Dejardin, one of

the engineers at WR. 'The CAD file had been done here, but the machining of the engine components was outsourced to some suppliers. It is the same for internal components, we designed them, but they will be made by suppliers including Pankl, Farndon, Xceldyn, and Capricorn. The engine will be tested and then tuned on our own dyno.'

Running the human waste derived bio-methane fuel presents a number of special challenges, not least that to get the required

energy density the fuel has to be cryogenically stored. A tank will be mounted at the rear of the tub, which will store the fuel at 10bar and also at a very low temperature.

There are other issues, too: 'The main difference is the injector, because it has to run at minus 180degC, the compression ratio is also quite high, at 13:1, a bit more than a normal turbocharged engine,' Dejardin says.

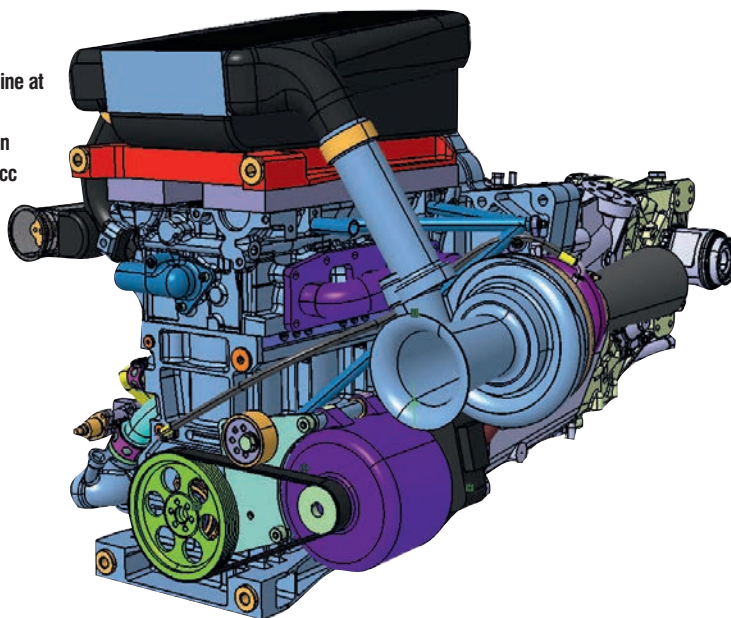
Of course, an innovative power unit needs a car built around it and WR, rather than opting for



Welter resisted the temptation of using an off-the-shelf prototype such as an ORECA or Ligier for the project and instead designed its own innovative car



The bio-methane fuelled engine at the heart of the project will run on fuel made from human waste. It's a 3-cylinder 1600cc turbo unit and it has been designed in house by the engineers at WR



‘This small floor with a big diffuser allows you to have a very stable car and it also reduces the risk of a car flying’

Welter talent

Welter Racing is not a large operation. Indeed, when *RE* inquired as to staffing levels, rather than offer a number the team replied with a list of names: Gerard Welter himself, Vincent Soullignac (technical director), Jean Pierre Boudy (engine director), Decoene Fabrice (workshop chief), Julien Herve (composites), Isabelle Piffret (accounts), Guy Audoux (engine fitter), Alipio dos Santos (dyno), Pierre Remond (team manager) and Thibaut Dejardin (CAD engineer), all of who make up the full time staff. Meanwhile, the volunteers include Delphine Gouget (fuel), Magalie Dessene (timing), Jean-Christophe Souvestre (brakes), Lawrence Lawler (electronics), Christophe Muller (electronics), Julien Leveque (pit stop assistant), Michel Barry (machining), and Pascal Coquin (communications).

The staff members do not just work on the WR LMP initiative, but also across WR's wider projects, including an electric city car, a hydrogen-fuelled version of the Renault Kangoo light van, and even an hydrogen-fuelled boat. Work with the Green GT also continues.

an existing ORECA or Ligier chassis – or even its own WR2008 LMP2 chassis – has instead created a highly innovative racecar, simply named the WR Bio-methane. It features a very unusual aerodynamic concept, as well as some active aerodynamic components.

‘This car is more like a single seater than an LMP,’ Dejardin says. ‘The principle of the bodywork is to have as little of it as possible, to save weight. Formula 1 has not a lot of bodywork and is still highly efficient.’

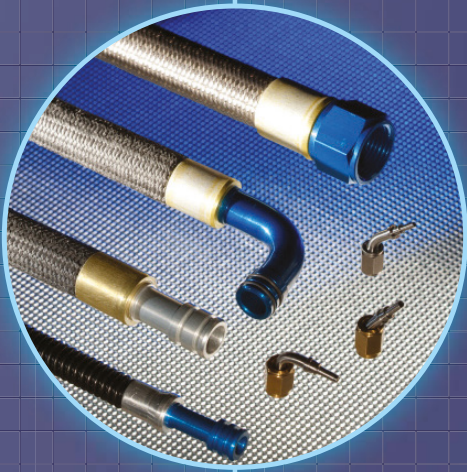
The car, which has already been subjected to extensive full-scale wind tunnel testing in France, is indeed unconventional. Looking from the rear there is very little bodywork around the rear face of the front or rear wheels. While more panels have been added to these areas since the tests were conducted, the intent is obvious. ‘You can cancel the disturbance of the wheel with small parts,’ Dejardin says. ‘[We first tried the racecar] in the wind tunnel without bodywork, because we wanted to know the cost of the

bodywork. However, we have changed the bodywork on the front and the rear of the wheel because we have now found a good solution with the floor.’

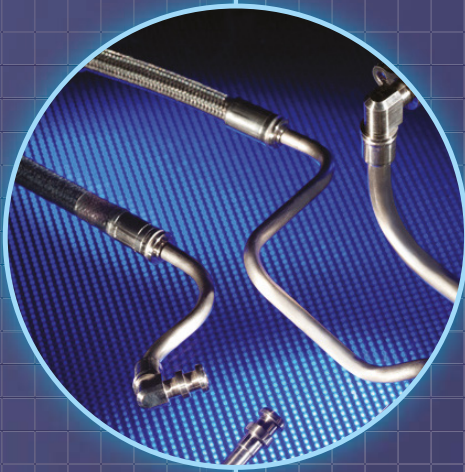
That floor is rather different to convention, too, with the full width section starting only about halfway along the side of the car and rapidly rising up over the rear suspension elements. ‘It’s a new concept, the floor is much smaller than an LMP1 or LMP2 floor,’ Dejardin says. ‘This small floor with a big diffuser allows you to have a very stable car and it also reduces the risk of a car flying. Around the rear wheels the idea is very much like a single seater, what you see in Indycar or Formula E. We also have variable aerodynamics across the car. It’s not just like the DRS you all know from Formula 1. Instead it is on both the front and rear of the car. This means that when it is used the car maintains balance, particularly at high speed.

‘Just having DRS at the rear does not give you good stability. During the wind tunnel runs

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Above: The new car is taking shape at the WR factory close to Paris. It will be the first all-new Welter racecar since the WR2008 LMP2 eight years ago

Right: While there's not much to see of the car beyond the tub right now, on completion it will house the methane-powered engine plus a Hewland LSFA 6-speed longitudinal gearbox, which should suit the radical floor concept




we were always working to have a 34 per cent front balance,' Dejardin adds.

This rear end aerodynamic concept also has an impact on some other components used, including the transmission. 'We have opted for the Hewland LSFA 6-speed ChampCar gearbox,' Dejardin says. 'We decided to do this because to get the best out of the floor we needed a longitudinal 'box, whereas most LMP cars use a transverse box, because the floor regulations lead them that way.'

The rear suspension picks up on the transmission casing in traditional single seater style, with pushrod actuated Sachs dampers also mounted on the transmission casing.

Busted flush?

While the WR Bio-methane may look like something of a dream project, the reality is that work is well advanced. The first complete monocoque and front impact structure has already been built by CARL Composites in Alençon, France. External crash testing has yet to be conducted but WR's work in-house suggests that the homologation process should go smoothly. The crash testing will take place at UTAC where a number of WR's volunteer team members work (see box out).

The new WR Garage 56 car should be shaken down later this year, but while the project seems to be on schedule it does not yet have all the funding required. 'When the first run takes place is according to budget, today we don't have the good partnership for all the programme, and we still need to find some partners,' Dejardin says. But with WR's long time collaborator Peugeot renewing its interest in the Le Mans 24 Hours, perhaps Gerard Welter does not need to look too far from home. 

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At what cost?

It's simple enough to say that costs must be controlled, but just how do you go about doing so? *Racecar* asked the top Le Mans teams for their take on the issue

By ANDREW COTTON



Toyota's technical director Pascal Vasselton has proposed a token system for the drivetrain, as is used in Formula 1, to keep spiralling costs in the World Endurance Championship in check



Former Porsche tech director Alex Hitzinger favours an outright cost cap, similar to that suggested by Max Mosley for F1, and says it could also add an engineering challenge that's road car relevant

Cost saving is a concept that dominates modern motor racing, particularly in this latest hybrid engineering era. Expensive racing is that in which more money is paid out than is being recouped, or that the money being spent is not seen as good value. That value can be seen in a variety of ways: be it transfer of technology, good racing, or in the case of series such as the Blancpain Series, racing GT3 cars on great circuits.

In the WEC, the regulations allow for different technologies, fuels and car design, but after a winter of incredible development between 2015 and 2016, costs are under the spotlight. The return on investment has been there for Toyota, Audi and Porsche so far, but to encourage a new manufacturer to join is likely to take another change in regulation to level the playing field. Peugeot is knocking on the door, and there would appear to be a strong will to get them involved. A fourth manufacturer would strengthen the series immeasurably.

Toyota's tokens

Toyota has made a proposal to the FIA that it adopts Formula 1's application of the token system in the drivetrain to keep a lid on the incredible development programmes currently underway. The proposal was made in September, 2015, and taken off the table shortly afterwards. However, at the Le Mans test day in 2016, it was back on the agenda and discussed ahead of the 24 hours.

The proposal would see the development of the engine and hybrid system limited by the number of tokens that are available to spend. Peugeot is thought to be in favour of applying the token system to the body kits available to the LMP1 teams. However, in 2016 this is limited to three kits, and in 2017 will be further restricted to two – one low downforce kit for Le Mans, and another for the rest of the season.

It is the hybrid development that has led to the highest spend. Toyota, Porsche and Audi have all switched to battery storage systems. The rate of development is daunting for a manufacturer looking at new regulations. Toyota had a speed advantage in 2014, but lost it in 2015, finishing half an hour behind

the winning Porsche at Le Mans on outright pace alone. This year, with 10MJ less in the fuel tank per lap, a drop of around 4.5s around Le Mans, the cars at the test day were still as fast as in 2015, suggesting another immense jump in performance. Admittedly, the track was in better condition than in 2015 and remained dry throughout, but the outright performance gain would still perhaps be enough to scare off a manufacturer such as Peugeot. 'We withdrew when the budgets were perhaps one third of what they are now,' said Bruno Famin, technical director at Peugeot Sport. 'That should give you some indication.' However, Peugeot is known to have started on its Le Mans programme in preparation for a return, and is campaigning politically to get the cost of competition reduced. Toyota's token system could go some way to reducing those development costs, although it would not necessarily reduce the running budgets for teams.

'Without a change in regulation, to see such a big increase is fantastic, but it is frightening because of the cost explosion,' said Toyota's technical director Pascal Vasselton of the improved performance between 2014 and 2015. 'What we see here is that not everyone will be able to follow this cost explosion.'

'The token system is good in principle to put under control the development costs,' Vasselton says. 'Within our new regulations, which are fantastic because they give a lot of room to several technologies, the negative side is the costs. This is the danger that is facing F1 and WEC. If we don't control the costs I don't think so many people will still be there in five years' time.'

Porsche's cost cap

For the 2016 race, both Audi and Porsche have reduced their effort to two cars at Le Mans, although the WEC has at a late stage introduced a ninth race in the schedule which would help to negate the effect of the two-car decision. When asked in 2015 of how Porsche would cut costs, the then technical director Alex Hitzinger suggested: 'With this whole cost containment thing, it is a very difficult topic because you cannot stop people from spending money. Everyone will always spend as much as they can have. Even with a very restrictive regulation,



Toyota struggled at last year's Le Mans in terms of pace and so targeted an improvement of around eight seconds per lap for 2016 – but how can the costs that come hand in hand with such ambitious development plans be controlled?

people can still spend a lot of money, and still get the benefit from it. If a manufacturer comes in and says "I want to win whatever it costs", you have a problem. What you can do is reduce the impact of what money has on performance gain. [A budget cap] needs to be done properly, but I am convinced that it can be done. For me, that would add another engineering challenge, which is road relevant. In a road car, you get a budget, and you have to develop in that budget, and hit that target. In motorsport we also have a budget, and you do the best you can with it. If you have someone who has an infinite budget, it is almost not a fair playing field.

'If you say long-term you want to increase the hybridisation, and we go the same speed, the same lap time with less fuel, that's the perfect message, but if I want to do that, I have to invest in hybrid development,' Hitzinger continues. 'If I save the money on aero testing because I am not allowed to do so much, I put it in to hybrid. It is the same budget. From that point of view, some of these things make sense.'

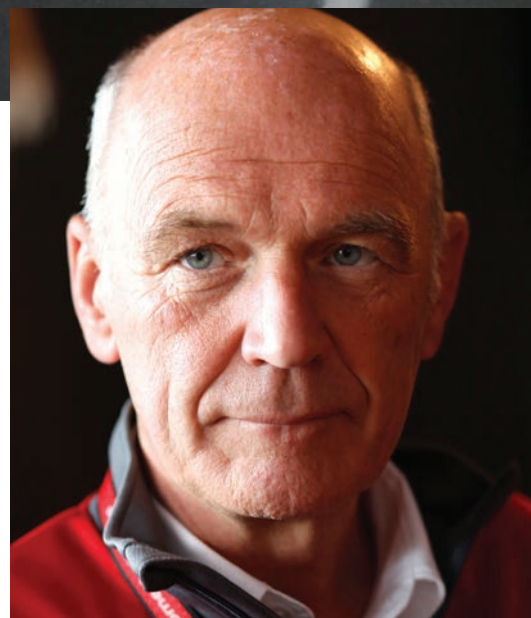
Budget secrecy

Audi's thinking is interesting, particularly in relation to the famously clandestine cost of competing in DTM. Like Porsche, in 2015 | Audi also did not want to comment on the issue of cost control, as the talks take place behind closed doors and there is an agreement not to discuss them publicly, apparently. However, Audi's head of motorsport, Dr Wolfgang Ullrich, did say that he believed an outright budget cap would not work as manufacturers all have different ideas on value.

'You need to find a solution to control several things,' he says. 'If you reduce wind tunnel time, first you try to optimise the use of the wind tunnel. The second is that if there is nothing against it, you try to do more simulation work and then you make the wind tunnel again more efficient, but it is something that, if you take these rules, it pushes you to investigate in stuff to bring more or less the same result with less money or less activity, which is the right solution.'

As mentioned above, as far as a budget cap is concerned, Ullrich was unequivocal: 'You can't do [a budget cap] because the systems of the manufacturers are organised to be so difficult that if you compare budgets you are completely in trouble. The system of how budgets are built up, and what you have as base costs, is so different in the manufacturer houses, that the real money available for development is too different to the teams themselves. No manufacturer will be happy to give an official number for a budget, because you will not get an official number for the other budgets of a big company either.'

'Even without that, if you have completely different structures, and you give them the same money, the money that is available for pure development is completely different. We favour solutions that are given by a rule book where we are all convinced that what comes out of reducing something is not more expensive than what we are producing. That is not easy, but it is possible. We have already done some [of this] and if you continue this way, then I think that it is good,' Ullrich concluded.



Wolfgang Ullrich, Audi's head of motorsport, believes an outright budget cap would not work as manufacturers are unlikely to want to go public with figures, while it would also be difficult to police

Cost control is not easy, as establishing the actual budgets is clearly a topic for within each individual company. But perhaps the simplest way to solve the problem of costs is to increase returns, and this is where those who are not successful are struggling. The base cost of competition is now so high, particularly in F1 where even the customer teams have to run hybrid engines, that there is a real pressure on finances. With this, it could be argued that customer teams in F1, as is the case in the WEC, might be allowed to run without hybrids.

As for the WEC, it needs to increase its value to the competing manufacturers. How it does that, with the clearly different approaches, is a matter of debate.

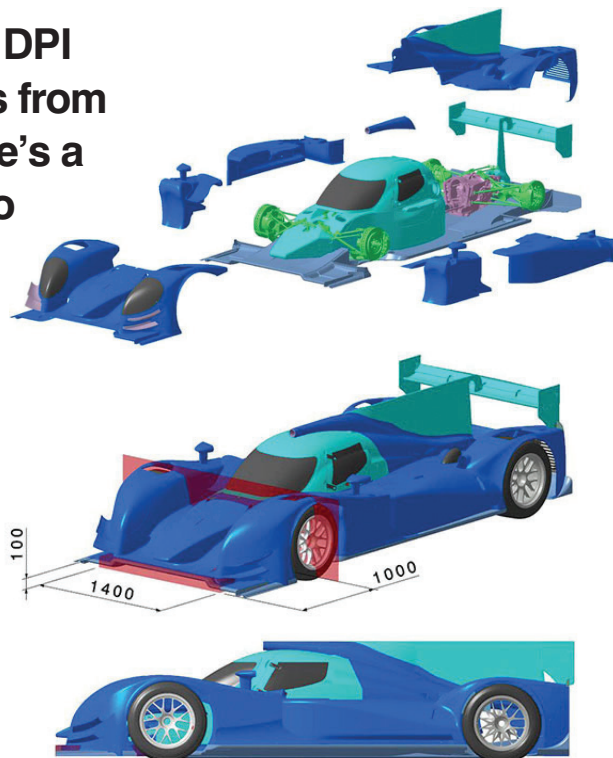
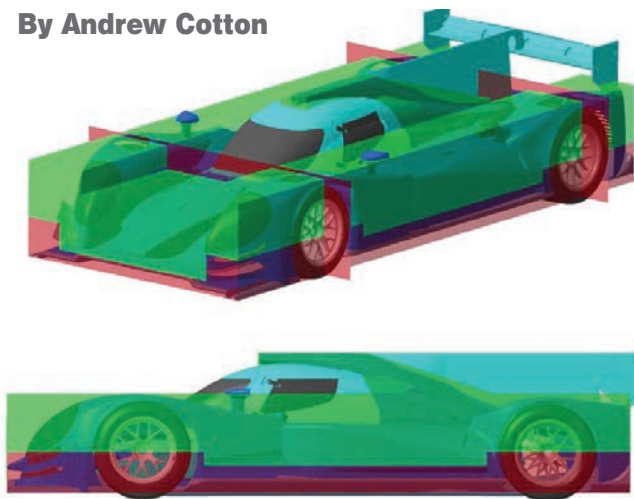


Perhaps the simplest way to solve the problem is to increase returns

Culture clash

The new-for-2017 LMP2 and its American DPI cousin are to use the same four base cars from next year – but dig a little deeper and there's a whole world of difference between the two

By Andrew Cotton



The aero kit for the IMSA DPI car will be based around the European LMP2 but a manufacturer will be allowed to develop the front, the sidepods and the rear deck to fit with its own design cues (above right)

Plans for a global prototype category, using P2 chassis regulations, are reaching fruition with the FIA posting draft regulations on its website early in March, while in the United States IMSA is now putting the finishing touches to its final specification. What has become clear is that, while the two have taken the same four chassis as specified by the FIA and ACO, the concepts have proven to be wildly different.

The idea was for teams to be able to race in the World Endurance Championship, IMSA and the Asian Le Mans Series with the same car, and that is still possible with the European-specification LMP2. That will be fitted with a standard Gibson engine and will be the reference car against which all the others will be performance balanced in Europe.

However, one of the main issues to overcome was that in the WEC, the LMP2 category was designed for the privateers competing in the second-tier of prototype racing, while in the US, the DPI category would be competing for overall wins at races such as the Daytona 24 hours, the Sebring 12 hours and the 1000-mile Petit Le Mans.

The four chassis manufacturers, three from Europe and one from the US, were selected last year and all are pushing ahead with developing partnerships with interested manufacturers to



IMSA's Mark Raffauf is confident that the LMP2 constructors and the OEMs can work with DPI regs

develop both the IMSA car, and the European-specification bodywork should any of them choose to race at Le Mans.

In IMSA, the engine regulations are far more open, with, for example, Honda claiming that they would run a turbocharged engine in their chosen chassis, which would then have to be performance balanced against the Gibson

should it race at Le Mans. The bodywork would also need to be changed for the French sojourn, with a European specification developed to take the cooling system required for the turbos.

'There are two things going on, the IMSA DPI and the ACO/FIA process,' says IMSA's director of series platforms, Mark Raffauf. 'Their process requires stamping by the World Council. We are working through details of points in this process that started in July last year. There is another meeting scheduled in May where there may be the final stamped FIA rules. Our constructors manual, which is the same process as the original Daytona Prototypes, gives the constructors and OE manufacturers what they need to do and how it is going to be done and what the process for certification and balance will be is sitting right here.'

'It is not new, it has been in process since August of last year, being slowly refined as the LMP2 regs have been defined, the key stuff that people need. We are comfortable that the four world-wide constructors and the OE manufacturers know what they need to do to build an IMSA car. We are ready to go with that. There are still some details on the car, where electrical circuits plug in that the constructors will continue to work with the ACO and FIA, the type of air conditioning unit, the type of clutch,

OAK markets the Ligier LMP2 car and is one of the four racecar manufacturers chosen to build the new generation of P2s, set to hit the track next year



but nothing that changes the material needed to build an IMSA car or a P2 car. They still have to go through crash testing certification and all that, but all the major stuff for now is in place.'

The chassis manufacturer will select the gearbox that must be mated to the manufacturer's engine but the majority have chosen to use the Xtrac gearbox. The aero kit will be based around the European kit, but a manufacturer will be allowed to develop the front, the sidepods and the rear deck according to its own design cues. 'It is a replacement body,' confirms Raffauf. 'The car is the splitter, floor, diffuser, wing, cockpit, tub and fin. The sidepods the nose and the tail are what make a DPI in conjunction with the same branding of the engine. You will have different cooling needs and exhaust, so there will be deviations from the standard LMP2 car.'

Le Mans costs

Opinions are split as to the cost of taking an IMSA car to Le Mans. If a manufacturer wants to go to Le Mans, they can spec-up their IMSA car with that in mind, including selecting the European-specification Cosworth ECU.

'The only way that you can go to Le Mans with our kind of car is with a hybridised car, which is essentially an LMP2 Le Mans kit car, with our engine in it, operated per the ACO's rules for operating that engine,' says Raffauf.

The IMSA-developed balance of performance system, introduced to the GT classes this year, will be used to balance the different engine and bodywork concepts against each other in the US series, and against the Gibson should anyone select this engine to race in the US. 'The data logger that the FIA uses is Magneti Marelli, we use Bosch,' says IMSA's vice president of competition, Simon Hodgson.

'Our system has dedicated sensors around the engine, and we are looking at selected data. We have developed our own data analysis in terms of timing and scoring, and have our own process for evaluating the car data that is supplied in scrutineering so the two work in collaboration with each other. The manufacturers always want trigger points to see when the BoP changes might occur, but we have every manufacturer's information. Of course, there was this insinuation that things were going on behind a curtain, but we have developed a process of sharing the data with each manufacturer. We have group calls with the manufacturers, they preview the BoP tables, and have the opportunity to speak on that call where their performance is and what adjustment they feel that they need. A manufacturer may defend their information, but we will not expose their proprietary information.

'The World car is the LMP2, that can compete anywhere and is welcomed in our series as a competitive option. For 30 years the philosophies of what we do here has been different. It's not universal in that regard. We have to create our own niche and grow it.'

For the chassis builders, OAK Racing, ORECA, Dallara and Riley-Multimatic, selecting an engine partner to work with is a priority. 'Of course it will be easier [in Europe with a single engine manufacturer], but we know that we are not doing an easy job,' says OAK's Jacques Nicolet. 'The more interesting thing is to compete. For me, I think that to have a different car for the global competition, it is a good thing.

'We are completely focussed on the new car and when we know exactly what we need to do for the DPI we can start, but we have also to know with which manufacturer we are working because the design is linked with the

manufacturer, not only with the rules. The basic car has to be the same in Europe and America ... for the moment!' Nicolet adds.

Time constraints

'We have to work together with the manufacturer to design what they want to be close to a sportscar, a road car, and to adapt this design with the aero we need to be very efficient,' Nicolet continues. 'But, if they do what they said, we will have afterwards a complete BoP between the engines, and the aero. It is a lot of work in a short space of time. If you consider that we have to be ready for middle of November, to run in Daytona, it is a short time.'

And will the cars be able to race at Le Mans? 'If they choose this way, it is impossible. The car will be too different because with the DPI, you can have turbocharged engines, and in LMP2 you have only a unique engine, normally aspirated, the bodywork will be completely different,' Nicolet says.

Max Angelelli, who is co-ordinating relations between Wayne Taylor Racing and Dallara, says that the global concept is alive and well. 'The WEC car can come over and race in Daytona,' says the Italian. 'There is a process to go through, and once they are eligible and once they have been through the process they can race. The

'The only way that you can go to Le Mans with our kind of car is with a hybridised car, an LMP2 Le Mans kit car'



While LMP2 is a secondary class in the WEC and at Le Mans, DPI will be the top class in IMSA, with its teams aiming for big wins at races such as Daytona. ORECA boss Hugues de Chaunac (above right) believes this will mean that manufacturer teams in the United States will not want to compete at Le Mans. ORECA is one of the four new LMP2 manufacturers

Gibson has to be balanced against the IMSA cars with regard to aero and so on. The Gibson will be very powerful, but I don't think that we will be as powerful as people believe. There are a lot of unknowns, but you have the WEC car, and you can race in IMSA. You have an IMSA car, and you can race in Le Mans, with changes.

'The exercise is; a chassis manufacturer has to design a WEC body that will fit a turbocharged engine. IMSA will have turbo so they have to consider while tooling and engineering the body, the intercoolers, plumbing and so on. If the chassis manufacturer doesn't want to do that, because their WEC will be penalised, that is their problem.'

Will the costs be a prohibitive factor? 'The point is that you are going to, say, Ligier, you buy a WEC body. That WEC body must fit your IMSA car. They have to consider the requirements when they design the WEC body. They need to be linked with an OEM, and consider that everyone knew by April last year, more or less, the path that people were going. They have had plenty of time to arrange themselves. ORECA already did it. I think they are right there. Dallara is right there I believe, and Riley is right there, too.

'Let's assume Mazda want to go to Le Mans, and assume they want to go with Riley, they can. Riley will fit the IMSA Mazda car with the WEC body, with 20 gear ratios, with the Le Mans electronics package, which is a Cosworth, and go to Le Mans. The choice of electronics is open, and you can use Cosworth. You can do what you want,' Angelelli says.

Second best?

For ORECA, the issue of an American manufacturer racing a P2 chassis at Le Mans is academic. 'I think that if Honda wants to run their engine at Le Mans, at that moment, they will see with the constructor that they have chosen how they can do the body side; everything now is fixed,' says ORECA boss, Hugues de Chaunac. 'For me, I always say that there is a one per cent chance that a car manufacturer wants to come to Le Mans. No one wants to come to Le Mans. They want to be first in the USA, and don't want to be in category two at Le Mans. I think there is no problem on that side because nobody wants to do it. I don't see a difficulty on that side because I don't see anybody who wants to come.'

So the global prototype category that they envisaged is the only link? 'The teams that are competing in the US are only teams, they are not works teams from the manufacturer. If one of these teams, like Action Express, for example, wants to compete in Le Mans, it is much easier for them to rent a European car to do Le Mans. That is all. I think it is a good compromise to have the same car in Europe and USA and the targets are not the same. In Europe it is category two and not category one. We keep the same base of car, and only four chassis manufacturers, so they try [to be different] and they improve,

but it is impossible to do a unique car. I think that the actual situation is reasonable.'

Bill Riley, one part of the American consortium building a P2 chassis, says that the link between IMSA and the ACO is as strong as ever. 'We do have to do a lot, and have to think about what you are designing for as the car does have to have multiple uses. You have to think about the engine mounts, what potential turbo intercoolers will look like, the turbo mounting, air intakes to the turbos; so there is a lot to think about way up ahead.

'I don't think it will be too far away [from a global car]. You have to change parts, but it is closer than it has been for a long time,' Riley adds. 'You will have boxes to do the stylised body and if you want to go to Le Mans, you have to put the WEC body back on. It is not a nightmare, but it is a lot of work, without a doubt. The work comes in stages. You have to do the WEC car, and then stylise the body after that, and the homologation is staggered. In our case, with the Multimatic Riley, you have two companies that can do it. If Multimatic can take one OEM, and we take another, and then do the LMP2 together.

'I would say that the aero will not be as good as a WEC car as they have to BoP the bodies to the lowest common denominator and that probably won't be a WEC car, so they will have to bring the WEC cars down a little bit.'

One twist in the tail came at the WEC Prologue at Paul Ricard. There, the ACO came up with another solution; to allow the IMSA cars to run in the LMP1 non-hybrid category, a solution that would fit with the US philosophy of campaigning for overall wins with professional driver line ups. Teams are hoping that all will become clear at Le Mans 2016.



'They want to be first in the USA, and don't want to be in category two at Le Mans. Nobody wants to do it'



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