



Laps of honour

It might not have had much in the way of competition but Toyota allowed its two cars to race and thoroughly deserved its long-awaited Le Mans triumph – as *Racecar*'s in-depth race analysis clearly shows

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

Toyota's much-needed victory at the 2018 Le Mans 24 hours came at the end of a very carefully executed race.

Yet while the 12-lap margin over the nearest non-hybrid was substantial, this wasn't a slow cruise to the flag. The two Toyota team cars, prepared at TMG in Cologne, were allowed to race each other, and only late race penalties and a driver error confirmed the result.

Kazuki Nakajima overcame his nightmare of 2016, when he stopped on the last lap having done all but take the chequered flag, Sebastien Buemi scored the biggest victory of his career, while Fernando Alonso took a step towards his dream of winning the triple crown; with wins in the Monaco Grand Prix and Le Mans he now has only the Indy 500 left for this.

But the biggest winner was Toyota itself. For the Japanese manufacturer this was the culmination of more than eight years of

investment – which included developing two engines, one normally aspirated and one turbo, and two hybrid systems, one super capacitor the other battery. With no competition from old rivals Audi and Porsche, who withdrew from the WEC in 2016 and 2017 respectively, Toyota concentrated on improving reliability and systems for this year's Le Mans, and has long since abandoned plans to develop an exhaust energy recovery system for this season.

After eight

The winning No.8 Toyota finished the race two laps ahead of the sister car of Kamui Kobayashi, Mike Conway and Jose Maria Lopez, which had its turn in the lead during the night but did not have a good balance in the cooler night temperatures. Third placed, and 12 laps down, was the Rebellion of Thomas Laurent, Matthias Beche and Gustavo Menezes. But the winning

margin was as much about a combination of rules that favoured the hybrid and reliability as it was about the private teams not having enough race mileage with their new racecars.

For those who say that this was an easy win for Toyota, the winning TS050 completed 5286km, the furthest since Porsche's first win in 2015 (5383km). This was only nine laps shorter than the overall race winning distance set in 2010 by Audi with 5410km (**Table 1**). Yet by regulation the TS050 had to stop more often and spent more time in the pits, eight minutes longer than the winning Porsche in 2016 in fact.

It's clear then that this was not a race that Toyota treated as a show, even though everything was stacked in its favour and the race could never be described as exciting – the two TS050s were never headed throughout the race. They were able to go further during every stint than their non-hybrid rivals, were

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Main picture: The No.8 Toyota took the initiative during the cooler conditions of the night, when its sister No.7 car was unable to find a good balance
Left: Toyota was able to stage a formation finish for the cameras thanks to the two-lap gap between its cars at the end, but it had let them race throughout

able to refuel faster and had a pace advantage, all built into the regulations. Yet the regulations were not designed to artificially give Toyota an advantage, rather they were designed to reduce the advantages that the car had after years of development, while not eliminating them altogether. The hybrids were restricted from executing the performance shown last year; they were limited to 11 laps when in 2017 the car could do 14 laps, and could refuel even faster.

New non-hybrids

The non-hybrid cars run by SMP, Dragonspeed, Rebellion and Ginetta were all new this year, and did not have the test miles that Toyota had racked up since it started its hybrid programme in 2012. And they did not have the reliability to even test the Equivalence of Technology (EoT).

The average 20 per cent of the laps completed by the winning No.8 Toyota was

Table 1: Winning car data since 2010

Year	Race average lap	Best stint average lap	Best lap	Average of best 100 laps
2010	3m32.5s	3m21.5s	3m19.074s	
2011	3m58.8s	3m28.8s	3m25.289s	
2012	3m42.3s	3m27.1s	3m24.189s	
2013	4m00.4s	3m25.8s	3m22.746s	3m25.310s
2014	3m29.1s	3m24.9s	3m22.567s	3m24.912s
2015	3m33.6s	3m20.2s	3m17.475s	3m19.154s
2016	3m39.1s	3m24.3s	3m21.445s	3m23.015s
2017	3m39.6s	3m20.4s	3m18.604s	3m19.848s
2018			3m17.658s	3m19.680s

Note: Race average laps are affected by safety cars, since 2014 by slow zones, and by the weather

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Rebellion finished third and fourth and headed the non-hybrid LMP1s but it will be disappointed with a lack of pace and its slow refuelling stops

3m19.895s; the No.17 SMP BR1 was 3m22.137s, 0.95 per cent slower than the hybrids and therefore 0.45 per cent more than the EoT allowed. The Rebellions were even slower by the same comparison, the No.3 setting 3m22.425s as its fastest 20 per cent of laps (**Table 2**).

All week the No.8 Toyota had a pace advantage over the No.7. Nakajima was on pole comfortably, setting a time that was close enough to Kobayashi's extraordinary lap in 2017 to be credible. They undoubtedly could have gone faster, but that would have served no

purpose as the two cars comfortably filled the front row of the grid. The non-hybrid cars could reach the mid 3m17s, but stood no chance of challenging for pole at 3m15s. The race for the non-hybrids was for the final spot on the podium, unless a Toyota broke down, so there was no point in them attacking for pole, either.

The turning point of the race was during the night following an extraordinary stint by Alonso against first Conway, and then Lopez. The Spaniard closed more than two minutes on the leading car following a penalty for speeding

in a slow zone. 'It was the set-up of the car, it was better in the cold temperatures, and I am used to stress the tyres,' said Alonso after the race. 'When it is hot I overstress the tyres but when it is cold conditions I switch on the tyres very quickly. I like driving in cold temperatures and damp temperatures and the night is closest to damp.'

Race data

The data shows that only when Alonso got in the car with ten and-a-half hours of the race gone, did the No.8 suddenly start going a lot quicker than the No.7. Up until that point average lap times were around 3m23s, then suddenly Alonso was in the 3m21s bracket. Kobayashi was quicker in No.7 when he got in with nearly 14 hours on the clock (4:40am), and started closing in on Nakajima again, but when Buemi got back in No.8 again he was quicker (**Table 4**).

Alonso's laps were on average two seconds faster than Conway on the first stint of what was a quadruple stint, and almost a second per lap faster than Lopez. The Spaniard was also requesting to go for a fifth stint on the same set of tyres, but the team instructed him to stick to the schedule and he had to get out of the car.

His stint brought the car right back into contention, and as the temperatures dropped the balance of the No.7 car started to worsen, and the drivers were struggling with the handling. 'There were no reliability issues at all,

Table 2: Average of 20 per cent of laps completed

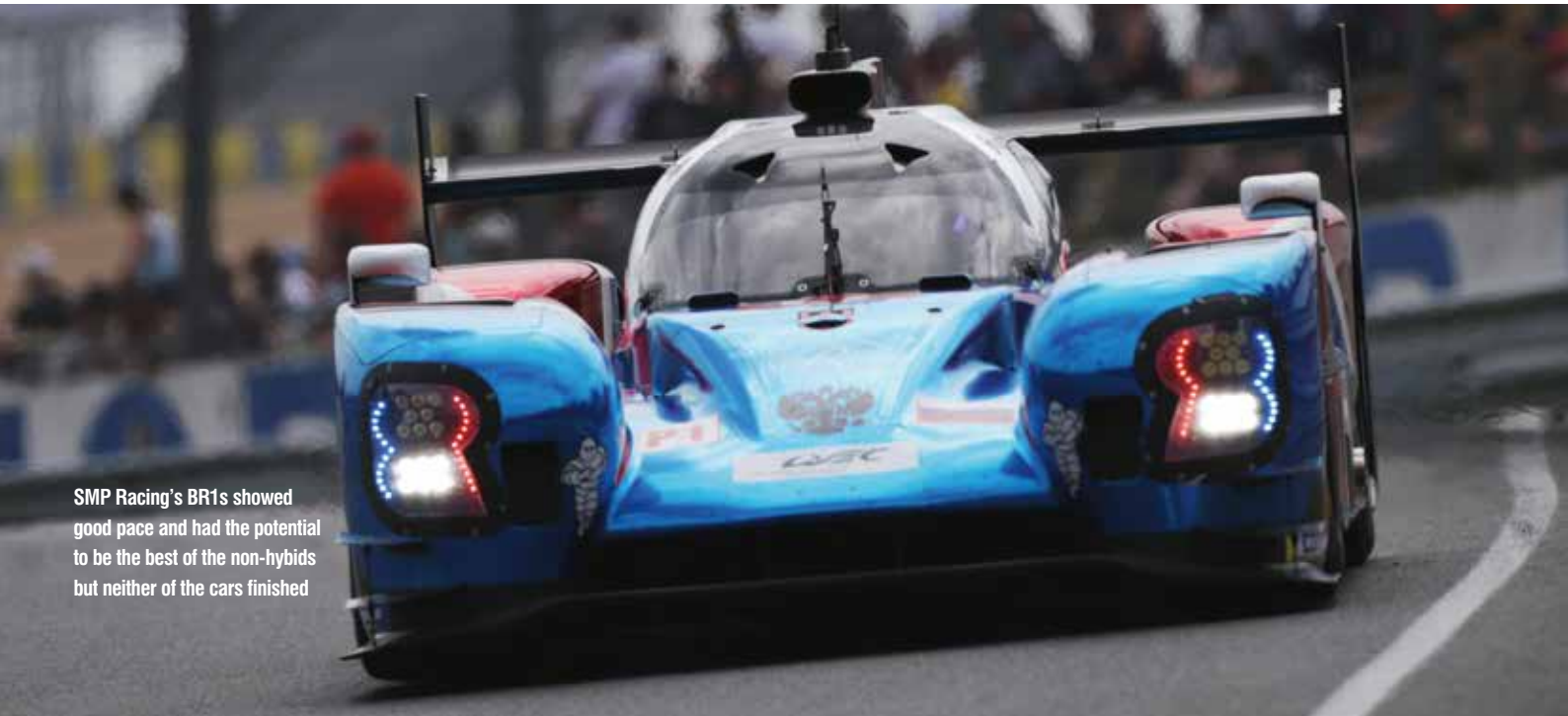
Toyota No.7 average of fastest 77 laps (20% of 386): 3m20.236s
Toyota No.8 average of fastest 77 laps (20% of 386): 3m19.895s
Rebellion No.1 average of fastest 77 laps (20% of 386): 3m22.820s
Rebellion No.3 average of fastest 77 laps (20% of 386): 3m22.425s
SMP BR1 No.17 average of fastest 24 laps (20% of 123): 3m22.137s

Note: In terms of a percentage this means that the SMP BR1 was 0.95 per cent slower than the slower of the two Toyotas, rather than the ACO recommended 0.5 per cent

Table 3: Average of fastest 100 laps

Toyota No.7 average of fastest 100 laps: 3m20.511s
Toyota No.8 average of fastest 100 laps: 3m20.134s
Rebellion No.1 average of fastest 100 laps: 3m23.153s
Rebellion No.3 average of fastest 100 laps: 3m22.719s
SMP BR1 No.17 average of fastest 100 laps: 3m46.577s

Note: This is a somewhat unfair comparison, since the SMP only covered 123 laps, compared to the Toyota's 388 and 386 and the Rebellion's 376 and 375



SMP Racing's BR1s showed good pace and had the potential to be the best of the non-hybrids but neither of the cars finished



Dallara redesigned the front wheel arch on its BR1 following a spectacular Spa flip. The larger hole added a little drag but it also reduced the impact of rubber build-up on the downforce

The non-hybrid cars could reach the mid 3m17s, but stood no chance of challenging for the pole, which was in the 3m15s

Table 4: The fastest (average) 50 laps of the Toyota drivers and the drivers of the non-hybrid cars from Rebellion and SMP

Toyota No.8	
Buemi:	3m20.802s
Alonso:	3m20.260s
Nakajima:	3m20.892s
Toyota No.7	
Lopez:	3m20.838s
Conway:	3m20.965s
Kobayashi:	3m21.202s
Non-hybrids	
No.1 Jani:	3m23.329s
No.3 Menezes:	3m22.665s
No.17 Orudzhev:	3m21.942s
No. 11 Petrov:	3m23.704s

and everything went smoothly,' said Conway. 'It moved around in terms of gaps, and penalties really weren't ideal and when you have high competition you can't afford those things.

They [the No.8] seemed stronger in the night in the cooler conditions and we lacked [grip at] the front end, so they were strong all night and we dropped pace. That was the turning point of the race, really. We lost our buffer, but they have been strong all week.'

Rebel yell

During the race Toyota was able to lap in the 3m19s, as it had during the test day, while the Rebellion team was in the region of 3m22 to 3m25s on its way to third and fourth places. Both of the team's cars had clutch pressure sensor failures. One of them had the rear of the plank come off and needed repair, while the team's refuelling was also far from perfect (Table 5). Rebellion estimated that it was losing

eight seconds each stop compared to Toyota and knows it has work to do on its new car.

Reliability was key to the result, and the two Rebellion ORECA simply reached the finish of the race. The first of the two Rebellion cars finished third, one place ahead of the sister ORECA Gibson driven by Andre Lotterer, Neel Jani and Bruno Senna. Jani had a long final stint as his driver's door was coming open, and the team's repair meant that once opened, it was unlikely ever to close again.

One flaw in the EoT is the ability to deliver the power where required; a trait of the hybrids that have a push to pass system, while the non-hybrids do not. Jani, who drove for Porsche previously and has now switched back to Rebellion, estimated that the non-hybrid cars would lose an average of three seconds per lap compared to the Toyota, only through the lack of this system. Also, tyre selection weeks ahead of the race meant that Toyota had an advantage having run Michelin tyres for many years, while for the privateers it was all new.

Fast but fragile

However, even among the privateers, the ORECA was not the fastest of them. The SMP team had the potential having tested its Dallara-designed BR1 extensively pre-season, enough for Toyota to complain about the EoT based on the rumoured top speeds seen in testing, and lobby to have the non-hybrid cars slowed. The BR1 ran well in the early stages but a series of unfortunate events put paid to the team's race.

Vitaly Petrov was the first to hit trouble early on when a suspected throttle body sensor caused a long stop. 'We changed a lot of things, but think that it was the throttle body,' said team principal Dmitry Belousov. The team managed to get the car back out, but had lost



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Table 5: Pit stop times

No.	Car	Number of stops	Total time in pits	Average stop time (excluding penalties and SC stops; also non-standard stops)
No.8	Toyota	37 (incl 2 penalties)	46m10.637s	1m05.8s
No.7	Toyota	38 (incl 3 penalties)	44m37.873s	1m06.3s
No.3	Rebellion	39	1h09m08.093s	1m14.6s
No.1	Rebellion	42	1h07m16.778s	1m12.4s

Note: Obviously, the Toyotas had more 'standard' stops than the Rebellions, but Rebellion was losing at least six seconds per stop, and often more. An extra 23 minutes in the pits is between four and five laps

Porsche in the pink

Porsche won a disappointing GTE-Pro category after opening out a comfortable lead in the fourth hour due to luck with a safety car. It then held on to it until the end of the race. The No.92 Porsche took the lead on lap 54 of the 344 it completed, as its closest competitors pitted under the safety car and were held until a second of three safety cars had passed by.

Under GTE regulations, the stint lengths were limited to 14 laps, under all conditions,

refuelling was limited to 35 seconds per stop, although Porsche's stops seemed faster, and refuelling and tyre changes could take place at the same time, so there was nothing to be gained from stretching the tyre allocation.

There was nothing that the No.92 Porsche's rivals could do other than hope for luck with a slow zone, safety car, or a reliability issue for the leading Porsche. Nothing happened, and so the procession to the chequered flag was dull. Performance-wise, Aston

Martin was the only car far outside the lap time window, closely followed by BMW and Ferrari. Ford, Porsche and Corvette were relatively well balanced, which conversely meant that no one had the on-track pace to close the gap to the Porsche either.

With 17 cars, 51 pro drivers and no weak links, this could and should have been the battle of this year's race. Unfortunately, luck with a safety car for Porsche and over-regulation in the pit lane turned it into a procession.

GTE-Pro race data

No.	Team	Laps completed	Best lap	Average best 20%	Percentage difference
92	Porsche GT Team	344	03:50.406	03:51.582	0.21%
91	Porsche GT Team	343	03:50.201	03:51.222	0.05%
68	Ford Chip Ganassi Team USA	343	03:50.108	03:51.099	0.00%
67	Ford Chip Ganassi Team UK	343	03:50.180	03:51.339	0.10%
63	Corvette Racing	342	03:49.448	03:51.278	0.08%
52	AF Corse	341	03:50.569	03:52.025	0.40%
95	Aston Martin Racing	339	03:52.318	03:54.007	1.26%
81	BMW Team MTEK	332	03:50.917	03:51.920	0.36%



Good fortune with a safety car did play its part in the 'Pink Pig' Porsche RSR's win but it also ran faultlessly to the finish

almost 50 laps, and eventually it pulled off and retired in the final hour with an engine issue.

His team-mate Matevos Isaakyan, the driver who crashed heavily at Spa in May, had another high-speed accident in the Porsche Curves during the night. The Russian slid sideways across a new run-off area, and eventually hit the barriers with the rear wing, ending a strong run for the car shared with Stephane Sarrazin and Egor Orudzhev. Belousov was disappointed with the EoT, claiming that his cars could not get within four seconds of Toyota's race pace over the course of the race, and that any development would be penalised by regulation.

Enter the dragon

The Dragonspeed version of the BR1, fitted with the Gibson engine, had an off on Saturday afternoon when Renger van der Zande suffered a broken floor, although whether that was cause or effect had yet to be determined by the team at the time of writing. The race was ended for them on Sunday morning when the team's other professional driver, Ben Hanley, crashed in the Porsche Curves and broke the gearbox, bellhousing and left rear suspension.

The Ginettas, that had effectively missed the Spa race, had a Le Mans baptism of fire. The two cars lost much of Wednesday's running with electrical problems brought about by new software it had brought to the race. The same issue hit both cars and it was eventually fixed, along with a new engine on one of the cars.

However, in the race more electrical gremlins struck one of the Ginettas, while the other suffered the majority of mechanical dramas around the suspension, steering and bodywork. The team was pleased that the No.5 of Charles Robertson, Michael Simpson and Leo Roussel finished and was classified fifth, although this was 99 laps behind the leader.

The only other starter in the LMP1 category was the Enso CLM P1/01 NISMO of the ByKolles team. While that was the slowest of the non-hybrids, it had potential to be reliable and pick up some useful points before Dominik Kraihamer crashed in the Porsche Curves after contact with another competitor. The car briefly caught fire and was retired in the fifth hour.

EoT phone home

It could be claimed that the EoT was wrong, but this calculates the potential best lap time according to simulation, not according to the ability of the team to execute this performance. Nevertheless, with Rebellion, SMP and Ginetta all failing to get what they needed out of their cars, the ACO and FIA must make a change for future races along with the private teams needing to step up their preparation.

The 2018 24 hours will not be remembered as a classic. It was, however, an old-style Le Mans race, one of reliability rather than outright speed. And it has been a long time since that was the deciding factor.



