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EXCLUSIVE REPORT FROM JAPAN

Behind the scenes of Japanese motorsport

Super GT

We take the wraps off the Lexus SC430 GT500 contender

British champion
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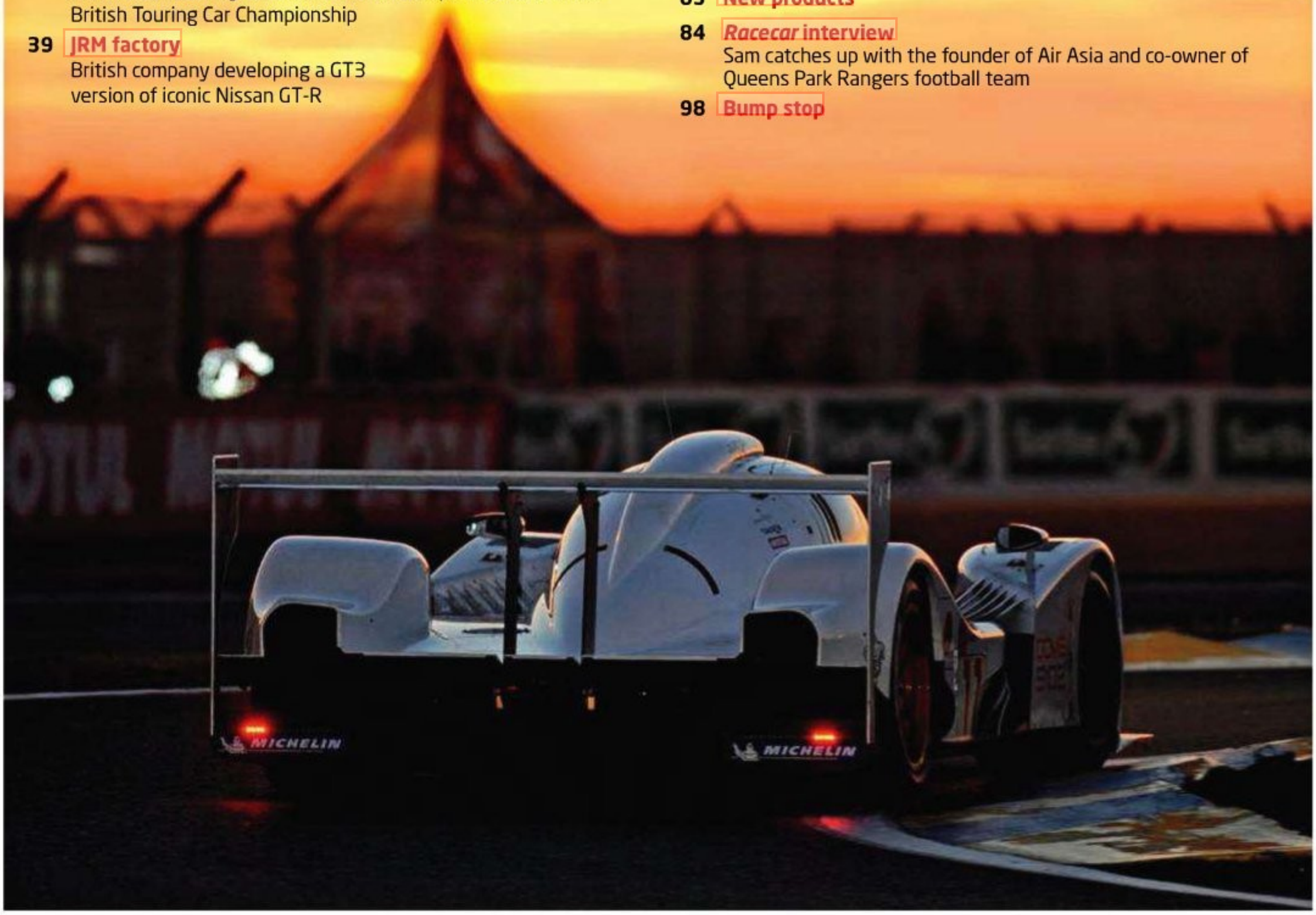

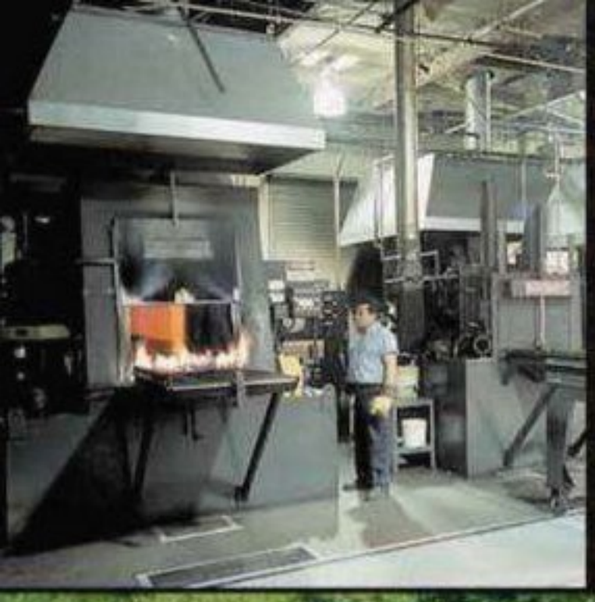

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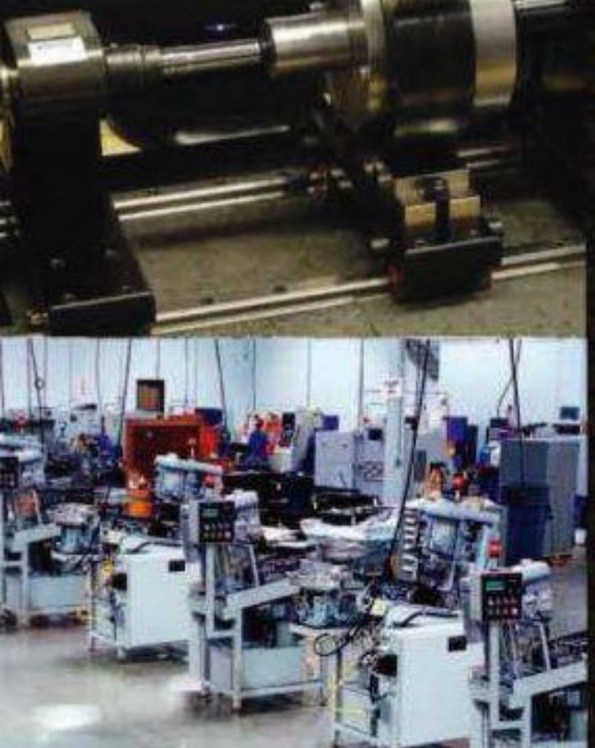

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Why I don't like BoP

Sam Collins: better performance should be better rewarded

There is a growing fashion amongst motorsport organisers at the moment, and it essentially renders innovation and good engineering pointless. It is called Balance of Performance, or BoP for short, and yes, I know it isn't exactly new, but it is increasingly annoying. Don Panoz once said in an interview, 'This is not socialism, it is racing. Who gives a damn if the cars are equal? If one is left behind then they should do a better job.' I could not agree more, yet BoP means that if you do a bad job of the engineering, you simply get the organisers to slow everyone else down to your pace. And if you do a good job, you get slowed down to the pace of somebody who didn't do such a good job. Where is the sense in that?

If you are balancing performance in this way, you may as well have a spec series. And nobody likes a spec series, apart from those drivers who lack the technical ability to improve a car, and feel hard done by when they get beaten by a driver who does. Not even Dallara, which makes more spec racers than anyone else in the world, likes spec series and much prefer racing against another design because winning 'means more', according to its founder.

None of this is to say that BoP does not have its place. It does. If you look at how Super GT is looking to change the GT300 rules and balancing its JAF-rules cars with GT3 cars then it kind of works as you are balancing regulation sets and not individual models. Success ballast also works, as is seen in many current series. So why balance individual designs?

"What Japan does in the next two years could define the future direction of motorsport"

The problem is there is a growing reliance on BoP instead of proper technical regulation. Organisers seem petrified of one organisation actually having a technical advantage over another, but in a technical sport this is unavoidable.

Again, looking at the future of Super GT, the organisers are worried about the performance of the new DTM cars, and how it might impact GT500 if they turned up in Japan. But let's be serious, this is racing. If you want to know who is faster, why not just have a race? Isn't that sort of the point? Besides, who would not want to see the 'G-3' and the J-3 slugging it out on track?

Japan is at the forefront of this issue, as all its major series are facing major upheaval, and Formula 4 is the first to have gone through the process. The adoption of a low-cost, locally-made, single spec monocoque with wide ranging technical freedom and a cost cap is a great idea in the situation that country is in. GP2, GP3, F2, World Series and Formula Renault should all take note. DTM has gone a similar way too, and it has reportedly cut costs by an astonishing 48 per cent (though whether the price list for parts is realistic is another question).

Obviously, it would not work in every scenario. In some series the manufacturers demand much larger technical freedom, Formula 1 being the prime example of this. But Formula Nippon certainly looks to be heading in the right direction – freeing up the areas of the car where there is an interest from technical partners and sponsors to do so, but keeping costs under control in other areas. Perhaps it, too, could follow F4?

What Japan does in the next two years could define the future direction of world motorsport, and right now that future is looking bright. Let's just hope it's not too heavily balanced.

Wth identical specification cars it's down to the drivers to make a difference on track, but is that what the crowds really want to see?

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F1 buys F1?

Paul J Weighell: an abject lesson is business, the hard way

It appears that the F1 team association (FOTA) have hired DC Advisory Partners as consultants to check the feasibility of purchasing some, or all, of the commercial rights to the Formula 1 business empire currently majority owned by CVC Capital Partners, and run by Bernie Ecclestone.

It is only a few months since Exor, a group which owns 30 per cent of FIAT, which in turn owns 100 per cent of Ferrari, was also thought to be interested in such a purchase. Perhaps Ferrari have been sounding out the other teams, though, as the prevailing mood appears to see them publicly wanting not just the 50 per cent of commercial profits they now have, but 75 per cent.

To many, it may seem a bit late to close the door, several decades after the commercial horse trotted off, led by Mr Ecclestone, with the teams' agreement. If the teams had wanted to earn from the TV rights side of the business then perhaps they should not have signed them away in the first place? Just a thought.

In the 1970s, the commercial TV rights were not even known as such, and little was done with them. Some TV stations showed clips of races, but global coverage was sporadic, advertising almost non-existent and income minimal. Likewise, the race series itself was not a very professional endeavour, with some teams not competing in all races and some drivers also taking part in non-Formula 1 races. Rule making seemed very biased towards the manufacturers and against the upstart '*garagista*' teams from England – an Italian word used disparagingly by Enzo Ferrari to describe British teams as car repair garage owners and mechanics.

Those underdog *garagistas* created a group called FOCA and, over the next few years, Mr Ecclestone and Mr Mosley spearheaded a war against FISA, the then governing body. They won, and the end result was the first Concorde Agreement, the inclusion of Ecclestone and Mosley within the sport's ultimate authority (FIA) and the acquisition by Ecclestone of all the rights to film and televise races.

Some teams did little to help Ecclestone, and seemed perfectly content for him to lift away the corporate marketing and sales burdens from their day-to-day work of running a team. Happy or not, they signed over the rights that Ecclestone needed to grow the business that the teams now rely upon. The rights to televise F1 races also supported much of the advertising control, and therefore the money, so once cars were on TV the teams could gain sponsors and they all benefited from the new regime. From a humble start, the commercial side of the sport flourished as a professional, commercial entity under Ecclestone's leadership.

"from a humble start, the commercial side of the sport flourished"

McLaren, Williams and Tyrrell did object to a later Concorde Agreement, which put even more power into Ecclestone's hands, but eventually they gave in and signed up, for their own commercial benefit.

It must be remembered, however, that back then teams ran with much fewer staff and operated out of less than the glitteringly appointed headquarters they have today. Imagine then, a bunch of little more than enthusiastic amateurs having enough trouble organising resources to create and ship cars to global races, let alone trying to persuade TV companies to pay them, sort out trackside advertising and arrange circuit contracts for years ahead. That level of business needed a different sort of chap from the classic British team owner. Ecclestone was, and is, just that sort of man.

From a neat and tidy office, he sent and received the thousands of faxes that fixed the contracts, travelled seemingly endless distances cajoling sponsors, TV companies, track owners and even entire national governments to support F1 with serious amounts of money. The business did not grow overnight, nor was it founded on the endless credit that modern business now says is its lifeblood. Instead, it took decades of building, bit by bit.

Now a mature cash cow, it is hardly surprising the teams want back in to share the cream. One is tempted to say, 'Well, where were you all when it was being built?' but that moral argument no longer matters as the price the teams will have to pay for what they signed away decades ago will have to be enough to satisfy CVC, not a firm known for under pricing assets.

In the author's view, it serves FOTA right. If the teams had got their acts together 35 years ago, and been prepared to put their own work and effort into the paperwork, sales and marketing then it would have been so much cheaper for them now to reap the rewards. But then again, without Ecclestone, those same rights could have remained as unsaleable and as worthless as they were when he found them lying about the paddock.

And Ecclestone's view of FOTA? 'I try not to think of them. It's an unnecessary association of people who should put their sole emphasis on getting competitive cars onto the grid. It's just more of what they don't have to think of. I look after that so there are enough financial resources.'

However, when Ecclestone last said he was not looking to sell his Queens Park Rangers footy club, it was sold within days...

The business lesson? If you let someone else develop your business then, by the time you want it back, a) it will be dammed expensive and b) it may be past its peak, or else why would it be for sale at all?

A role reversal for the puppet master? All proceeds going to charity, of course

Game boys

Characterised by its extreme aerodynamics, the Japanese Super GT series is the nearest thing in motorsport to a real life computer game

BY SAM COLLINS

The Sony Playstation became the must-have gaming console when its headline piece of software was released around the world. *Gran Turismo* exposed the world to the Japanese obsession with racing modified street cars, and the ultimate cars in the game were the ones raced in Super GT. Originally conceived as the Japanese GT Championship in 1993, it catered for ever-more modified cars and, by the time it had morphed into Super GT in 2004, there were minimal components from the original road car required. Then, in 2009, a new generation of cars was launched, which shared no parts at all with the original models upon which they were based, other than a vague external resemblance. Composite chassis, full racing engines and sequential transmissions are now the norm and some, like Honda's current entry, the HSV-010, do not even have a street legal counterpart.

Toyota is one of the staple manufacturers in Super GT, and it enters the GT500 class with its premium brand, Lexus. The SC430 model is the base car and, under the new regulations, it has proven to be very strong, winning numerous races and one championship, and its engineers are currently working hard to improve the racecar further still.

Rear end shot of one of the Lexus SC430s shows just how open the aero regulations are. It's not hard to see why the series is appealing to the DTM series

'With the current regulations we have many freedoms – the carbon fibre monocoque chassis is free, so each manufacturer can design and construct its own tub,' explains Hiromi Hayashi, Toyota's Motorsport Division project general manager. 'The lower section of the chassis is a carbon fibre monocoque with a steel roll hoop attached to the top. Most of the stiffness in the chassis comes from the monocoque section, and not from the roll structure, which is really only there for driver protection. It is not really heavily stressed.'

Hayashi's part of the Toyota Motor Corporation sub-contracts its composite work, including the chassis, to Toyota Technocraft (TRD) in Japan. It is one of three of Toyota's satellite motorsport operations, the others being TMG in Cologne, Germany, tasked with the firm's LMP1 and Formula E projects, and TRD in Costa Mesa, California, which handles NASCAR and circle track programmes

Bolted directly to the carbon fibre tub is the SC430's powerplant, which is derived from the Toyota RKV8 Formula Nippon engine that, in turn, is the basis for the Toyota RKV8LM LMP1 engine fitted to the Rebellion Racing Lola's racing in the ILMC. The engine, in its standard Formula Nippon trim, produces over 600bhp, but has to be de-tuned for use in the SC430. 'We are restricted on capacity and airflow via a pair of 29.1mm restrictors,' reveals Hayashi. 'This means it produces around 500bhp, giving the class its name – GT500.

"The engine, in Formula Nippon trim, produces over 600bhp, but has to be de-tuned for use in the SC430"

'Under the previous regulations the engine was a free part, but now we have to use a version of the Formula Nippon engine. One of the reasons the engine regulations were changed was the amount we were spending in developing the different types of engine. If we use the Formula Nippon [engine], the development costs are much lower, so budgets were reduced significantly. But we can still do development on the engines now, it is not a frozen specification. We have done work on the intake system, the exhaust system, these sorts of things this year. On the run up to the summer time, we changed a lot of parts on our engine, and we are always changing small parts here and there. We make a big upgrade at least once per year. This year we have focussed that upgrade on the intake system and cam, and that was to get better torque and improve the driveability of the engine.'

With the engines broadly derived from the Formula Nippon units, you may think that the design of the three engines would be similar, and that would certainly be true for the Toyota and Honda motors, but Nissan, which does not take part in Formula Nippon, has a somewhat different approach: 'The Honda is not too different from ours, but I have not seen the Nissan. I have heard that it is derived from a production unit, and ours is not,' admits Hayashi.

A BIG HEADACHE

The V8 engine is mounted directly to the front of the carbon tub but, as the gearbox is mounted in the rear of the car, drive is transmitted rearwards via a torque tube. 'All of the manufacturers in GT500 use the same Ricardo gearbox. It is a six-speed sequential unit with paddle shifting from Zytek. We also have carbon fibre driveshafts, which are a big headache,' Hayashi continues.

The suspension of the SC430 is closer in design to that of an open wheeler than a conventional GT car, with the three dampers mounted horizontally above the gearbox casing at the rear, and the fronts mounted either side of the engine.

'We have five tyre manufacturers in this class and our cars use three of them!' explains Hayashi. 'All these

TECH SPEC

Lexus SC430 (UZZ40)

Class: GT500

Chassis: carbon fibre monocoque by TRD with tubular steel roll over structure

Engine: Toyota Technocraft RV8KG 3399cc, DOHC, 32 valve, normally aspirated
Bore: 93mm
Stroke: 62.5mm
Power: over 460PS
Restrictor: twin 29.1mm

Transmission: Ricardo six-speed sequential; Zytek paddle shift; carbon triple-plate clutch

Brakes: steel disc; six-piston calipers front, four-piston calipers rear (multiple suppliers)

Wheels: 13J-18 front; 13J-17 rear (multiple suppliers)

Tyres: 330-710 R18 front 33-710 R17 rear (multiple suppliers)

Weight: over 1100kg

Dimensions:
Length: 4535kg
Width: 1825mm
Height: 1355mm
Wheelbase: 2620mm
Front track: 1550mm
Rear track: 1530mm

different tyres make it very difficult for us to develop the balance of the car correctly, with different characteristics of the compounds and constructions. We don't do a different suspension for each tyre, but we do have a range of suspension options, and teams can choose which they want based on what the driver feedback is. The different packages consist of different dampers, different springs, geometry changes, things like that. There are six Lexus SC430s racing at the moment in GT500 and each one of them is different in a number of ways, but especially the suspension.

'The teams will do a lot of rig testing. TRD has its own seven-post rig, so we use that and share the data with the teams. But with five different tyre manufacturers it is difficult.'

Rig testing and other

The three shots here of various SC430s show the different rear-end treatments used at different circuits. Top has a full diffuser, middle has a minimal diffuser and the bottom shows a half-way house version. Referring back to the lead picture in this feature, you'll see that at some tracks cars run with no diffuser at all

The SC430's rivals. Top: Honda's HSV010, a pure bred Super GT racer that has no production car version whatsoever. Bottom: Nissan's NISMO GT-R. Interestingly, all three cars had their aero development done in the same wind tunnel

simulation techniques are increasingly important for the GT500 teams, who face limitations on real-world testing. 'There are only very few test days. There were not really enough last season, but we had a three-day race weekend. This year we only have two-day race weekends, and that limits the amount of running and development time we get. We have two data systems on the car. One is from Denso for the engine management system and engine logger. The other one is from Cosworth Electronics for the chassis logging,' Hayashi explains.

EXTREME BODYWORK

Whilst the mechanical design and construction of the SC430 and other GT500 cars is impressive, the thing that really captured the imagination of the Playstation generation was the look of the cars. Defined by extreme bodywork, the aerodynamic development race was one of the toughest in motorsport. Even now, with more modest looking cars (due to tighter regulation) they still appeal to fans and gamers, and the development war is no less intense.

'I think the big differences between the cars come in the aerodynamic department as there are great freedoms there. The floor should be flat between the front and rear axles. In front and behind those axles we have free areas that we can work in. The diffuser size is restricted though,' Hayashi states. 'So the aerodynamics have been a big area with the SC430. This year we have been wind tunnel testing around twice a month and have made many detailed changes to the bodywork of the SC430. At every race we have brought new parts, and at each track we have different bodywork to suit the circuit, particularly at Fuji Speedway with its very long straight. It is a very special track because we need a much lower drag concept.

"the aerodynamic development race was one of the toughest in motorsport"

'In Japan, only Dome has a proper wind tunnel, so you have this strange situation where you have all three manufacturers in GT500 – Honda, Toyota and Nissan – all developing their cars at the Dome wind tunnel.'

The 2011 season has not been a great success for the Lexus teams, the best of which finished sixth in the teams' championship. With a single win from the eight-race season, it's a far cry from the strong performances of 2009, when Lexus won the title, and 2010, when it missed out by two points.

Despite sharing a facility with is arch rivals, the aerodynamic package of the SC430 seems to be the root cause of this, and the car is still not quite honed to the behaviour the teams want.

BIG CHANGES

'Last year the drivers were complaining about too little downforce on the front end of the car, so we did a lot of work in the wind tunnel to increase front downforce and we succeeded,' explains Hayashi. 'We made the parts and installed them on the car, and it worked, but now the drivers are complaining about too little downforce at the rear, so we have made a big change to the balance. The current problem we have is that the car's balance is actually not very good. It is difficult for us to set the car up because the weight distribution and aero balance are not quite right. It is still confusing. We are not able to change the wheelbase by regulation either.'

Despite the freedom offered by the regulations, many in the GT500 establishment want to see a change in the way the class is run. Hayashi is amongst them: 'In GT500 we have many freedoms, but one of the big limitations we have at the moment is the cost of the car – it is too expensive. This is one of our biggest problems, particularly in the current economic situation. It will be very difficult to continue under these kinds of regulations. In 2014, we hope to change to a more restrictive set of regulations.'

Masaaki Bandoh is the chairman of Super GT, and he too is aware of the need for change, but for different reasons: 'I think

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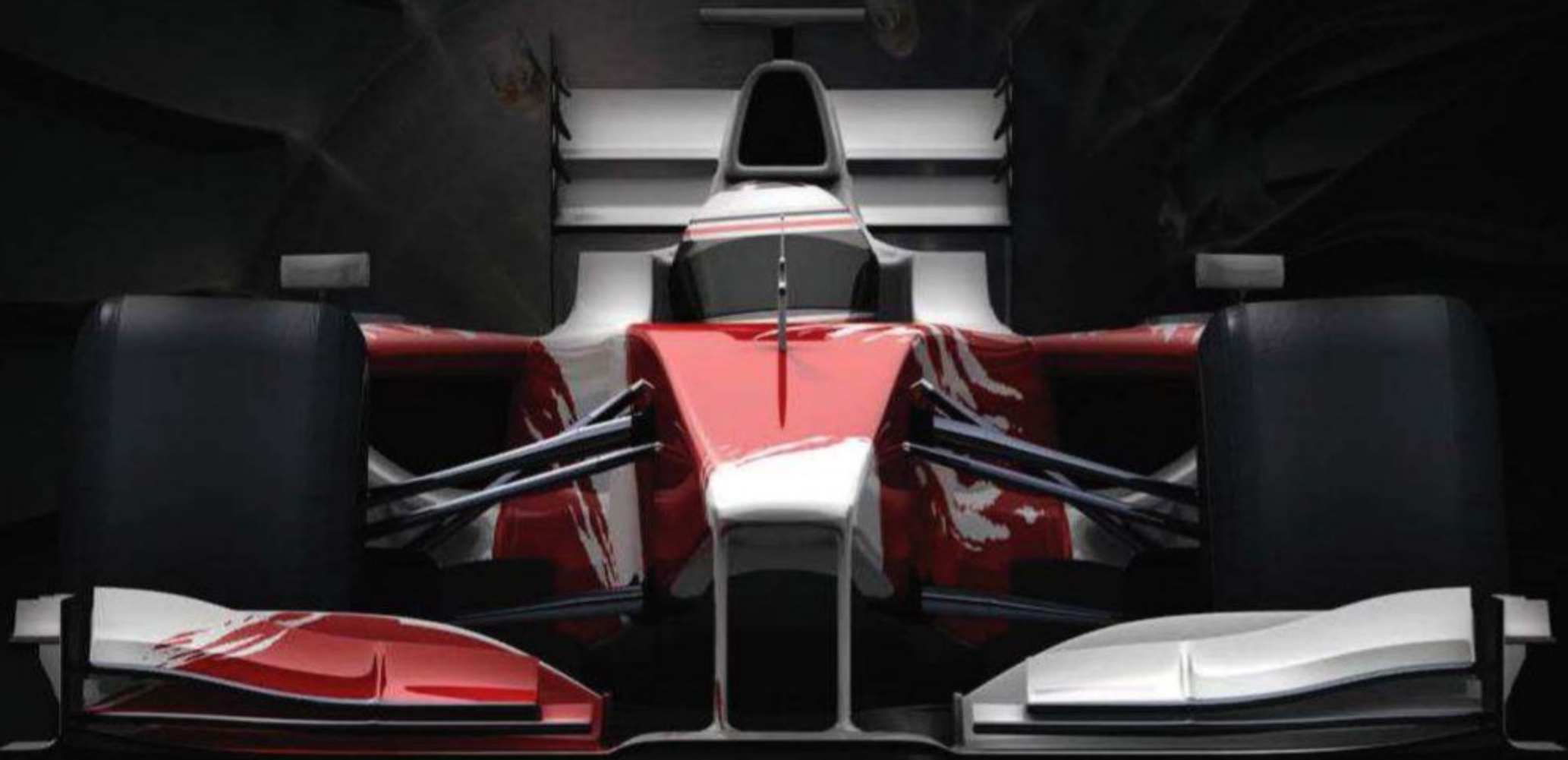

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currently the GT500 cars are still on a development curve, so they have not yet peaked. Right now, the teams and constructors are all trying to get the most out of their cars within the current regulations, so we have not yet reached the point where we will change things.'

GT300

Super GT has two classes: the fully bespoke GT500 class and the more eclectic GT300 category. Here you can find everything from FIA GT3 racers to one-off prototypes, including one based on a Riley Daytona Prototype.

In reality, there are three sub-groups in this class – FIA GT3, JAF GT300 and the curiously named group of 'Others', into which the DP-based design falls, as well as the Mosler previously featured in *Racecar Engineering*.

Toyota fields two models in the class, both of which fall into the JAF GT300 group – the Lexus IS350 and the seemingly unlikely Corolla. 'The Lexus IS has the same engine as the GT500 car, but runs with a much smaller restrictor,' explains Hayashi. 'The Corolla uses a bespoke V6 mounted in the middle of the car. Both use production line chassis, but the back and the floor are removed. For us we use these cars in our driver development programme.'

Both cars have had heavy aerodynamic re-workings, leaving the base cars barely recognisable. Subaru and Honda also compete with JAF GT300-spec cars, and Proton is also known to be developing one.

One of the cars contesting the GT300 series is this Toyota Corolla, powered by a mid-mounted and bespoke V6 engine

From Toyota's Lexus stable comes this radically re-worked IS350, which uses the GT500 engine, breathing through a smaller restrictor

THE GERMANS ARE COMING...

But with new rules on the way, Lexus may also face new opposition from an unexpected location. Audi, Mercedes and especially BMW have expressed interest in using their DTM cars in GT500 races, pitching the big three German concerns against the so-called 'J-3' marques.

Looking to the West, Bandoh has seen the new-for-2012 DTM rules package as potentially a way to spice up the races, whilst simultaneously cutting budgets. 'The DTM cars presented at Frankfurt this year represent a 48 per cent cut in costs compared to the old DTM car,' says Bandoh. 'We would like to do a similar process with the GT500 cars. If ITR can bring some parts of the car to Super GT, and if the price is good, we would be very interested. But I do not want to see the Japanese supply chain companies lose the business they have right now. If we were to buy all our parts and cars from Europe, then maybe we would lose the engineering and manufacturing ability we currently have, and companies around Japan would close. We absolutely do not want that.'

"I see no reason why in this class we should not welcome the European constructors"

Some rumours have linked the coming new generation of GT500 cars to the spec carbon chassis used in the new DTM cars, but the reality is not that simple. 'It is no problem if a manufacturer wants to use the Dallara DTM chassis, but we want to leave it open for manufacturers to make their own chassis. Our chassis are different to DTM anyway, and we do not do sprint races like DTM. But we can accept things like sharing the same car dimensions and maybe some other parts.'

Despite the reported wishes of the European car manufacturers, GT500 will not accept a shared set of technical regulations, as Bandoh believes the demands of the two series are very different, but he is clearly keen on collaborating with the German marques.

'I see no reason why in this class we should not also welcome the European constructors. The difference between Japanese racing and European racing is that in Europe the brands use the racing projects to sell cars. In Japan they only use the racing to develop technology for the cars and do not use it to sell or market their cars at all. My vision is that in the future Japanese constructors who take part in Super GT will do it the same way as the European constructors do,' Bandoh enthuses, continuing, 'But with DTM we have yet to find a good solution with the engines because the DTM engine is bigger than ours. Also, with the tyres we have, five manufacturers fighting, we will not change that to a single make of tyre. Another thing about DTM that we cannot accept are the aerodynamic regulations, because European, and particularly German fans, are different in what they want to see compared to the Japanese fans. They have different tastes and we promote a series in Japan for the Japanese fans. So whilst we can certainly collaborate with DTM, we have not found a solution yet to match the performance of the cars.'

CHALLENGE RACES

There could, however, be potential for a series of challenge races around the globe with the GT500 cars, which have less power but corner much faster, taking on the new generation of DTM machines, and possibly even Daytona Prototypes. 'As a racing series, we will never go to Europe, but we will go all over south-east Asia, and we hope in the future Hyundai, Proton or some Chinese constructors will join us, with everybody running to the same regulations. It is a fantastic opportunity for us,' says Bandoh enthusiastically.

It looks likely then that at some point in the future GT500 cars will take on the premium German racing machines, and it also seems likely Toyota will send a new model to do the job. It sounds like something you might do when playing Gran Turismo. Trial Mountain anyone?

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What's in a name?

After a rush job with the Lotus Racing T127, Team Lotus improved greatly with its 2011 T128, but says the best is yet to come

BY SAM COLLINS

Whilst the Lotus T127 of 2010 and T128 of 2011 have similar liveries and team base, the lineage of the two cars could not be more different. The T127 was designed and built in a very short space of time, with the sole purpose of complying with the regulations and making it onto the grid. Mike Gascoyne, the technical director of what was then dubbed 'Lotus Racing', penned the car in offices in Cologne, Germany, and the composites work was also undertaken in Germany by Capricorn. It was only run and developed by the team in Hingham in Norfolk, England. The T128, on the other hand, was designed, built and developed in Norfolk, just like nearly every car to be run by Team Lotus.

'Like last year, it is a totally new car – new engine, new gearbox and new design team,' says Gascoyne. 'Nothing was carried over at all. The T127 was designed in Germany at very short notice, but this car had a more complete programme. But being all new again, we've been stuck with some of the same problems. The new car is a big step forward, as it is a much more current design of F1 car. The T127 did its job, it got us on the grid for the first race, and it got us 10th place.'

The 2011 car, however, would have an entirely new rear end, with the championship-winning Renault RS27 engine and a transmission from Red Bull Technology, based on the gearbox fitted to the 2009 Red Bull RB5. This meant that the T128 had to adopt the pull-rod rear suspension layout that is becoming increasingly popular in Formula 1. 'Rear end aero is critical, and the pull-rod layout frees up space. We were offered a lot of gearboxes, but the Red Bull solution works out best for us. It is not the same transmission as the RB7. It's a carbon 'box that has won races in the RB5 and it is quite a bit lighter than the Xtrac 1044 we used last year. Just on analysis on weight, it's a touch better aero wise.'

SURPRISING STRUCTURES

The T128 surprised many when it was launched. It lacked a roll hoop, instead employing a solid blade-type structure for roll over protection. The concept is essentially the same as that employed on the Mercedes MGP W01 in 2010 and relocates the intakes for the Renault RS27 V8 engine to lower on the

"it is a totally new car - new engine, new gearbox and new design team"

engine cover, whilst fulfilling the requirement for a roll over structure with a solid central section. It is said that this approach gives better airflow to the rear wing.

After the Mercedes was revealed at the Spanish Grand Prix in 2010, queries were raised about the safety of the concept, some wondering whether the blade would dig into the ground in a roll over. The rule makers took heed and the following appeared in the 2011 technical regulations: *15.2.4 The principal roll structure must have a minimum enclosed structural cross section of 10,000mm², in vertical projection, across a horizontal plane 50mm below its highest point. The area thus established must not exceed 200mm in length or width and may not be less than 10,000mm² below this point.*

Many took this as an outright ban on the blade concept, but Gascoyne and his team thought differently. The result is that the T128 version is notably thicker than that used on the W01 and meets the new regulation fully.

'It is all composite, so it's a lighter solution. You had the Mercedes last year, people weighed it up but I think often these things that are visual get more weight put on them than they really deserve. They may look very different but actually it is quite a fine line. We have a chassis with slightly less fuel volume as the Renault uses less than the Cosworth. The rear bulkhead is in the same position but it's all 15kg (33lb) lighter. We were 15kg under the weight limit with the T127 at the end of last year and, when the weight limit went up 20kg (44lb) in 2011, we went 20-30kg the other way, because we hade more time to engineer things properly.'

From the car's first test at the Valencia circuit in February it was clear that the new Lotus was more than a match for the

TECH SPEC

Team Lotus T128

Class: Formula 1 2011

Chassis: carbon fibre monocoque

Engine: Renault RS27

Battery: Yasua

Suspension: double wishbone and torsion bar with push rod-actuated dampers at the front and pull rod-actuated dampers rears; Penske and Multimatic dampers, depending on set up

Transmission: Red Bull Technologies seven-speed sequential; AP Racing clutch

Brakes: carbon - carbon with AP Racing calipers; Hitco or Carbon Industrie discs, depending on set up

Electronics: McLaren Electronics ECU and data logging

Wheels: BBS

Fuel cell: ATL

offerings from the two other new teams, Virgin and HRT. But it could not keep pace with the more established runners. 'It's been slightly frustrating,' Gascoyne continues, 'because we've been consistently two seconds quicker than them, so we've made a step forward there, but we're still a second off the other guys that we're racing. So I think again it's done its job, but we're probably still a second behind where we want to be.'

Towards the end of the season, the gap to the bigger teams had shrunk substantially, with the cars able to stay on the lead lap throughout a Grand Prix, even at times scrapping for non-points scoring positions with the likes of Sauber, Williams and Toro Rosso, but on outright pace the Lotus cannot keep up. 'I think there's a little bit mechanically we are giving away,' says Gascoyne. 'Obviously we have no KERS and we're still catching up aerodynamically, but we still don't have the same resources as the other teams. I think also probably where we lacked a lot this year was in blown diffusers – we didn't have one last year at all, we had one for this year, but everyone took a big step forward and developed that technology, and I think that is probably the key area where others made strides that we didn't expect. We struggled to get on top of that technology. It took a long time with our wind tunnel to do

gas simulation, so I think we're still a long way behind, though actually next year the banning of blown diffusers will bring the others back to us. I mean it was double diffusers, then blown diffusers, both of which have had big effects and we've been slow to catch that, which has made it difficult for the team. If you just turn blown diffusers off, you'd probably get the best part of a second on those top teams, and maybe we would get three or four tenths with KERS, so that's almost a second and a half we're giving away to everyone. If we had that, we'd be in the middle of the pack which is where we want to be.'

"we're probably still a second behind where we want to be"

One of the most public issues with the cars has been driver Jarno Trulli's struggle with the T128's power steering system. The notoriously sensitive Italian lacked confidence in the car and was under performing, but a mid-season upgrade changed that.

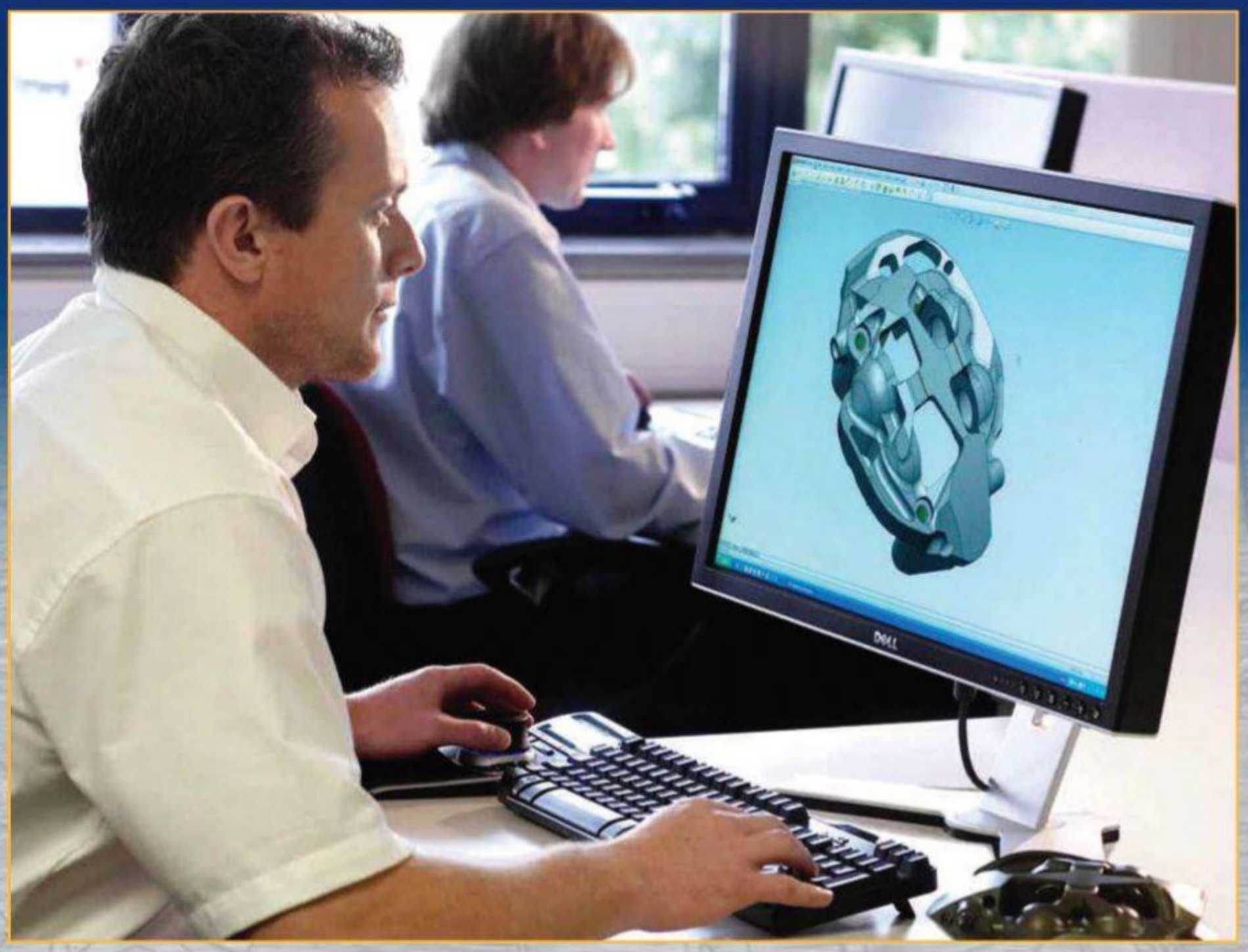
'It was a problem. We were trying to do something to help the drivers, but it turned out that it made the problem worse and it's just taken time to put right. The drivers asked for lighter steering on the T128 so we changed the level of the systems and that changed the friction and feedback to the drivers. Jarno was sensitive to that. So we have now reduced the level of the systems and that's given better mechanical characteristics and he's much happier. Unfortunately, it means that because of the suspension geometry we've got, in a corner like 130R at Suzuka it saturates and can't give enough assistance.'

Tyres were always going to be one of the most important things about the 2011 season, with the arrival of new rubber from Pirelli, but the issues suffered by some teams do not seem to have been problems for the T128. 'There have been times when there has been very high degradation, but we tend to suffer less from that than most teams. I think both drivers have adjusted to it very well and been able to look after their tyres – that's a benefit of having experienced drivers. I think where teams have had high degradation it's because they're putting too much work into the tyre. We go slower and have less downforce, so obviously we're putting less energy into the tyre and are therefore better off. I think if you get a situation like you've got here where people are struggling to warm the tyre up, we have more problems than others because we can't work them as hard. Where there's been high degradation we tend to be better than teams who are racing in front of us, and that's allowed us to race with the Williams and Toro Rosso on occasions, and do fewer stops than them.'

LOOKING FORWARD

With the T128 still struggling to find its way into a points-paying position, Gascoyne has now turned his attention to 2012. He has the task of ensuring the team is securely into the mid-field and regularly fighting for points. 'There will be a huge amount of carry over from the T128, which allows us to focus on the important things. In addition to that, we've got a bigger design team and more experience. We're ahead of the game, we don't have to do a new engine installation, we're going to have KERS and we've got double the wind tunnel capability with the Williams partnership.' Moving up the grid will not be easy for Gascoyne's team as his rivals will likely move forward too, but the team has certainly come a long way since its creation in late 2009.

podium finishes start here



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Unfulfilled promise

The record books do not do the Dome S102 justice, but maybe the future will...

BY SAM COLLINS

A sleek, white Le Mans Prototype sits in the entrance hall of a large engineering facility in a little known town near Kyoto, Japan. It only raced once, finishing as the last classified car at Le Mans in 2008, but even in that short racing career, the Dome S102 attracted its own mythology – 'It's a toe-in-the-water exercise for Toyota or Nissan,' the rumour mill claimed. But the truth was it was Dome showing off its capabilities as a constructor, in an attempt to attract a major customer.

At Le Mans the car impressed many by qualifying eighth, the second fastest petrol runner that year, but the project was abandoned soon after when the world was hit by the economic downturn of 2009. Or so it seemed. But quietly, work on the S102 continued, bringing the design into line with the latest regulations, featuring the mandatory fin and small rear wing.

'There are still some enquiries about this car,' reveals Hiroshi Yuchi, project manager at Dome. 'Mainly we talk to teams from Europe, but it is difficult to make it happen because the exchange rate is not good, and this is an expensive car anyway.

'We have installed the current rules rear wing on the car, but have not put the fin on yet because that requires further modification to the bodywork. Everything is designed and has been tested in the wind tunnel though, so if someone came along with enough money we could go racing.'

ADVANCED CONCEPTS

One of the most striking elements of the S102 was its use of advanced aerodynamic

TECH SPEC

Dome S102

Class: ACO LMP1 2008 (updated to 2011 specifications)

Chassis: Dome Carbon Magic composite monocoque coupe

Engine : Judd GV5, 5,496cc normally aspirated gasoline V8.

Suspension: Double wishbone front and rear with pushrod actuated dampers

Brakes: Carbon ceramic

Transmission: Xtrac 6 speed sequential gearbox

Electronics: Dome / Cosworth

Tyres: Michelin LMP1

Weight: 900kg

Dimensions:
Length: 4650mm
Width: 1995mm
Height: 920mm
Wheelbase: 2900mm

concepts, developed in two wind tunnels over three years. Interestingly, the two tunnels were different scales. 'It was easier to change the shape of the model quickly with the quarter-scale tunnel. We could test concepts like the separated fenders, and fix the general shape of the car that way,' Yuchi reveals. The quarter-scale model was also critical in making the choice between an open car and the lower drag coupe. 'With the 60 per cent scale model you need to use a sting attached to the top to support the model in the tunnel, and that interferes with the area you are looking at, but with the quarter-scale model we just use a wire. We found that on paper there was not much between the two concepts. If you did very well with an open car you could get to within 0.5 per cent of the efficiency of a closed car, but at Le Mans 0.5 per cent is huge!'

The choice to build a coupe was further influenced by the limited range of engines available to the project. The popular 5.5-litre Judd V10 was chosen, but it was no match for the works' diesel and petrol engines. Instead, the emphasis was placed on aerodynamic efficiency, and there the larger wind tunnel programme came into play.

Using its well-regarded, on-site 'Furyusha 'tunnel, Yuchi's team started to hone the S102's shape at 60 per cent scale.

'Once we had fixed the shape we switched to the large tunnel. The small scale had allowed us to see trends, but you need a larger tunnel to do better detail. You can also be more accurate with a larger model. The repeatability of the data from the quarter-scale model could be plus or minus 0.3

The Dome S102 scale wind tunnel model, updated to 2011 spec, with mandatory fin and narrow rear wing package

per cent so, if you are looking for a 0.2 per cent gain, you have to use a bigger model. At 60 per cent, it could be 0.1 per cent, so you can make those gains.'

MISSED OPPORTUNITY

After the S102 and its engineers returned from Europe, they had a chance to reflect on the car's performance and look for ways to improve. 'When we took the car to Le Mans it was very young, just two or three months old,' admits Yuchi. 'We couldn't do enough development on it in the time we had, not even enough to find a good set up. After we got back we did two more track tests, and even then we were finding better set ups all of the time. Also at Le Mans we had a traction problem, but we fixed this very quickly afterwards. So we knew that if we went back in 2009 we would have a much better mechanical set up, but it was not to be.'

The lessons learned from Le Mans in 2008 were many and, with the car still having a lot of development potential, it does not seem unreasonable to suspect that the S102 could have mixed it with the works' diesels in 2009. 'We have not had an opportunity to show what the car can do,' complains Yuchi. 'I still have some ideas about changing the packaging. I have ideas about a whole new car – the S103. We know we can make the monocoque much lighter, as we have made some steps there. We also did a loading test, to see how much it could take. We simply loaded that up until it broke. Normally in a crash test you stop before the chassis breaks up but, for our knowledge, we destroyed a car. We went way beyond the maximum loads and found our chassis was overspec'd. The tub currently weighs just below 90kg but we think we can match the 75kg of the Audi R18.'

The 2008 Le Mans chassis currently resides in Dome HQ's foyer in Japan, but with its rear wing updated to 2011 spec, with swan-neck suport

"We know we can make the monocoque much lighter"

Despite the project slowing after 2008, it has never stopped entirely, and the car in the lobby at the Dome factory is fitted with some 2011-spec components. 'At the front of the car we are happy. Other people have copied us, too. In 2005 we were testing concepts in the wind tunnel at quarter scale that we saw on the Audi R15, so we are confident with the front end. At the rear, however, there is much more development, getting more downforce for no more drag. We can make the rear deck much lower and look at some of the mechanical packaging of the car, like Adrian Newey with the rear of the Red Bull.'

Regulation changes since 2008 have also moved the focus to the rear of the car, notably because the big Judd V10 in the back of the S102 has been effectively outlawed, or at best rendered uncompetitive against new-rules engines.

'On our car the engine was mounted much further forward than others, because the regulations stated that the engine and primary rollover structure should not overlap. But on a coupe there is no primary roll structure, such as the hoops on a roadster, so we discussed

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The S102 made up for what it lacked in traction in outright top speed, the combination giving it eighth position on the grid, the second fastest of the petrol entries. Dome believes it could have substantially improved on that

JAD SHERIF

The Red Bull RB7 rear end could serve as an inspiration for a revised S102 or an all-new Le Mans car from Dome

this with the ACO and they let us mount the engine with an overlap. But now we don't need this layout with the smaller engines because that approach made the chassis slightly heavier than it could have been, [and this is] one of the ways we can save on chassis weight. Doing that did mean we could put more weight on the front axle, and we achieved 48 per cent of the weight on the front. We had already started discussing with Michelin about using larger front tyres in 2008 because we had experience of it from our work in Super GT. Then, when the rear wing size was cut, that actually suited us, and the balance on the car would have been much better.'

Other teams independently discovered many of the developments planned by Dome for the S102, such as wider front tyres, but there are some that Yuchi is still keeping to himself, perhaps to employ on any new Dome LMP1. Suffice to say, he is already thinking about some advanced concepts. 'Looking at the rear of the Red Bull F1 car, there are some ideas there – like the suspension. You could even do a blown diffuser, but it would destroy your fuel consumption. But as Le Mans is such a long lap, maybe it is something you could consider for the end of a stint. I suspect the ACO would not be too happy about it, even though it is within the rules!'

"for our knowledge, we destroyed a car"

Dome continues to work on other racing projects, notably designing, building and developing the Super GT Honda GT500s. And whilst many of its other projects are confidential, we can now say with certainty that rumours of it being involved in the Toyota Le Mans project are wide of the mark.

DOME AT LE MANS

Since 1979 Dome has been a fairly regular feature of the Le Mans 24 Hours, either under its own name or that of Toyota. Here are some of its more memorable entries

Dome's first Le Mans car ran in 1979. It qualified 15th but did not finish

In 1982 Dome entered the RC82, which qualified 20th and failed to finish

In 1984, Dome forged a partnership with Toyota and built the 84C. It did not compete at Le Mans, though its successors, the 85C, did and qualified 22nd. One of the chassis entered finished 12th

The best ever finish for the S101, which raced at Le Mans between 2001 and 2007 in both LMP1 and LMP2 categories, was sixth in 2003

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THE DESIGNERS
MASAO ONO

"I was born in the year of the boar, and that makes me stubborn"

Brought up on comic books without a car in sight, Masao Ono's rise to Formula 1 designer and beyond is the stuff of dreams], and natural born engineering talent

BY SAM COLLINS

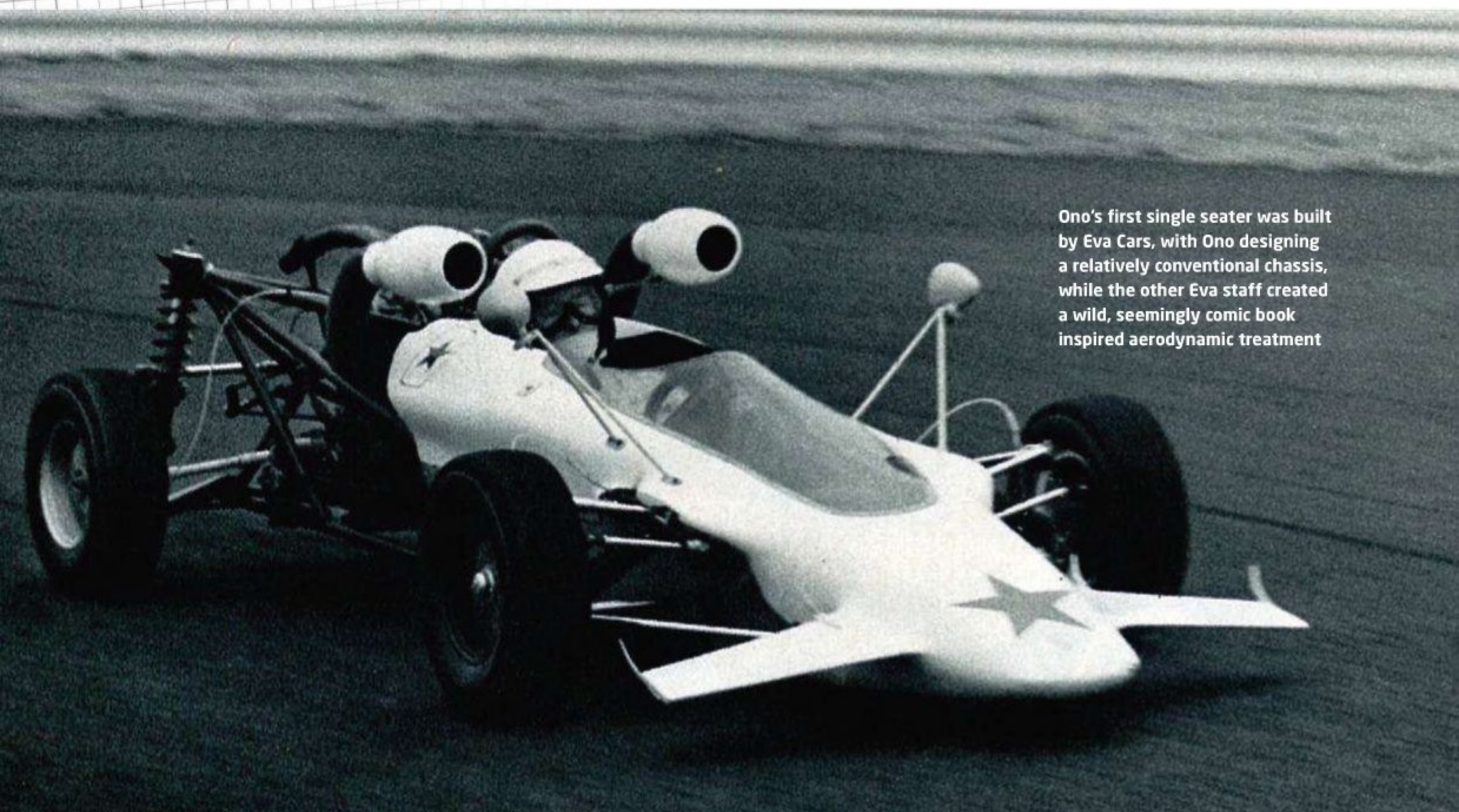
Masao Ono is not a well-known figure in European motorsport, yet his cars have raced in Formula 1 and at Le Mans. But as a child growing up in the rural Wakayama Prefecture he had no knowledge or interest in motor racing. 'I was interested in science, the Soviet Union had just launched Sputnik, and I enjoyed reading comic books about robots, especially *Astro Boy* and *Iron Man 28*. I wanted to make robots or rockets. But one day, in one of these comics I read, there was an article about the crash that killed De Portago at the Mille Miglia, and another about Juan Manuel Fangio who won his final championship in 1957. From that point, aged 10, I wanted to be a person who made racing cars. The problem was that the only cars I ever saw were a bus and the Jeep my father used. I just had no information about motor racing. I looked for any information I could and was very excited to find a book on cars one day, but I was very disappointed that it only covered American road cars and had no motor racing in it.'

As a teenager, Ono was moved, along with his family, to Tokyo, and there he found an international bookshop, which had exactly what he wanted. 'Amongst the foreign books and magazines was *Automobile Year*, which had an article about the 1961 Formula 1 season in it. It had lots of pictures of the 1.5-litre cars, especially the shark-nose Ferrari. There was also a story about Le Mans. But I also discovered a magazine called *Motor Fan* and this had comprehensive road tests using advanced technology and measuring instruments, which was unusual at the time. The testing was all done by Professor Kondon at the Tokyo Institute of Technology, and he was a specialist in vehicle stability. As a result of these articles, I decided I had to enter Tokyo Institute of Technology to study, which I did. That was in 1966, by which time Honda had started racing in Formula 1. I thought maybe I could get a job designing racing cars with them.'

Ono's time at Tokyo Institute of Technology was crucial in his future career, but the dream of joining Honda's Grand Prix programme was not to come true. It was clear to Ono that he could not always do things how he wanted. 'I had joined the automobile club and I learned how to drive and I learned how to repair cars. For the annual student fair the club always prepared some sort of special car and senior students that year made a sort of sports car, but it was based on a micro truck chassis. I did not want to use a truck chassis so I decided to design my own chassis. We did, and in 1968 made the chassis by ourselves. It was a very basic steel tube frame chassis, fitted with components from an old Mitsubishi 500. We never even gave it a name.'

In 1968, Honda was taking part in its final grand prix season and student protests were sweeping the world. Tokyo was no exception. Indeed, the ongoing unrest lead directly to Ono's childhood dream coming true, and he suddenly found himself working in motorsport: 'The students were protesting about everything. They were protesting about the treaty with America, they were protesting about the university, they were protesting about anything. At that time, one of the junior students in the automobile club was working as a delivery driver and he came to see me one day and told me that he had found something interesting. Some people who looked like they were making a car. So we went together to see them and it looked like they were making racecars. We were standing outside of the workshop watching them and

"I design with my mouth these days – not the CAD system or drawing board"



Ono's first single seater was built by Eva Cars, with Ono designing a relatively conventional chassis, while the other Eva staff created a wild, seemingly comic book inspired aerodynamic treatment

Growing up during the Space Race of the late 1950s, Ono was heavily influenced by science, and science fiction comic books, including *Astro Boy*. 'I wanted to make robots or rockets. But one day, in one of these comics, there was an article about Fangio winning the title in 1957... From that point, I wanted to be a person who made racing cars.'

they spotted us and asked us what we were doing there. I told them we are from the automobile club at the Tokyo Institute of Technology and that my major is mechanical engineering. They became interested and asked me to design them a chassis as they could only do bodywork. Of course I agreed. Soon after I met them, the protestors blockaded the university, so even if I wanted to go to class and study I could not because the gates were sealed. Instead, I had to go and work for this small racecar constructor.'

FROM MICRO ACORNS...

The result of the chance meeting was the Eva Mk2, a scaled down Can-Am affair with a two cylinder, micro car engine. 'It was quite an advanced car, with a glass fibre monocoque, but it had a very small Honda engine. In 1969 we entered a race for cars in that class and we won the race because it was racing against standard micro cars with the same engine. So the first car I designed won its first race, but when I look back at some of those old pictures and I look at the current formula student teams I am ashamed.'

Further Ono-designed cars from Eva appeared and, on the face of it, the company was a commercial success, but that was not the case. 'We sold about 50 cars, but we lost money on every single car we sold. When I graduated, I decided to enter this company full time, but my course professor said I should not do it and that I would be better off at Honda or Toyota. But I was born in the year of the boar, and that makes me stubborn. I decided I would stick with this company, and I joined them. One year after I entered the company full-time, the company went out of business, despite winning races.'

Despite being a jobless graduate with only one year's industry experience, Ono was not short of work, and soon found himself on a very rapid career path indeed. 'I had many offers to design racecars for small teams and, in 1972, Mr Kato, the owner of SARD (Sigma Automotive Racing Development), asked me to design a car for Le Mans. That was the Sigma MC73. We entered Le Mans in 1973 and the car qualified 14th, behind big names like Porsche and Chevron. It was the first Japanese car to enter that race, but we did not finish.'

Clockwise, from top left: Ono's first ever racecar, the Can-Am-inspired Eva 02; the Kojima KE009; the Dome Zero RL 1979 Le Mans car; the Dome Toyota Celica Le Mans car, 1980; the Kojima KE007 at the Fuji Speedway

MAKI OR BREAK

Soon afterwards, Ono left the Sigma project, but it would not be the last time he designed a car for Le Mans. His next task was almost unbelievable for such a young engineer. It was an opportunity that today's young graduates would do almost anything for. But it serves as something of a cautionary tale, as doing too much with too little can only end in disaster... 'An engineer who worked with me on the Sigma asked if I was interested in designing a Formula 1 car. Of course I said yes. That was the beginning of the Maki. We designed and developed it ourselves and took it to Europe, setting up in a rented workshop in Slough, England. Howden Ganley was the driver, but the problem was that we did not have any money. We could only afford to enter two races – the 1974 British Grand Prix at Brands Hatch and the German Grand Prix at the Nürburgring. We did not qualify for either and, at the Nürburgring, the suspension failed and Ganley broke his legs as a result. It was my fault. We returned to Japan.'

Despite the difficulties of the 1974 season, Ono and the Maki team persisted and returned to England with a new sponsor on board and the budget to do six races in the 1975 season. 'We had sponsorship from Citizen watches, and so we updated the car. We entered the Dutch, British, German, Austrian and Italian world championship rounds and the non-championship Swiss Grand Prix at Dijon. The only one we qualified for was the Swiss Grand Prix, where we finished in last position, six laps down.'

KOJIMA

It is very hard to gauge the success of Ono's next project. The Maki was clearly something of a disaster, but it did not deter him, or those willing to hire the young designer. 'A man from Tokyo called Kojima came to me and wanted a Formula 1 car to race in the 1976 Japanese Grand Prix. I designed the car using the experience we gained from the Maki. It was a pretty simple design – compact and lightweight.'

The record books show that the Kojima KE007 entered one race in 1976 and set the fastest lap – a lap time faster than that of Ferrari, McLaren and Team Lotus – with a novice driver at the wheel.

"it was an opportunity that today's young graduates would do almost anything for"

But Ono plays down the amazing statistic. 'The rain was very heavy and the race was very chaotic, so perhaps it's not really fair to use that as a comparison. In Friday qualifying, the car was fourth, but at the end of the session Masahiro Hasemi had a big crash at the final corner. Everything was destroyed, even the chassis. We did not have a spare so we made a new chassis from scratch in the garage. We started work that Friday night and just made it onto the grid on Sunday, where the time from Friday gave us eighth position.'

Despite showing some very strong form at Fuji, the car did not race anywhere else until it returned at the 1977 Japanese Grand Prix. This time two were entered, the 1976 car in the hands of Noritake Takahara and an updated car, the KE009 driven by Kazuyoshi Hoshino who finished 11th. The Kojima F1 project came to an end shortly afterwards, instead turning its attention to Formula 2, where it had some good results before closing its doors. Ono joined Dome to design its 1979 Le Mans car, the Zero RL79.

TOKYO R&D

'We did some Formula 3 cars too, and one of them won the 1981 Macau Grand Prix. But there was some friction between myself and Hayashi, the owner of Dome. We had a different way of working. Everybody has their own way of doing things, and I found my way of doing things was different to how he liked doing

Clockwise, from above: a youthful Ono at his drawing table; The Hayashi Racing Formula 3 car which was one of a series of cars designed by Ono that had a string of good results, including victory at the Macau Grand Prix

things. So I left Dome, wanting to do something outside of the racing business. That is why I founded Tokyo R&D. The idea was to apply the knowledge and experience gained in racing to other industries – not just cars, but industrial production, cycling, boating, anything.'

Over the years, Tokyo R&D has become a relatively well-respected consultancy in Japan, and even though it has developed a number of competition cars such as the Vemac RD320R GT300 Super GT car, and the same company's current F4 and Super FJ projects, the company really found its niche with electric and alternative powertrain vehicles, via sister company, Pues Corp.

'In 1984, a guy from the Japanese Environmental Protection Agency visited us and he had a device for checking air quality. He was also a big motor racing fan, and was doing research about electric vehicles at the time as well. He believed that although at the time nobody was really interested in them, EVs would become very important when the oil prices increased. Back then, the only available and practical battery chemistry for EVs was lead acid, and the general feeling of the automotive industry was that it was not possible to achieve the required performance using batteries. But we thought it was possible, and would not accept that it was not. If you paid enough attention to reducing aerodynamic drag, using lightweight structures, minimising losses in the transmission, reducing rolling resistance and reducing the consumption of energy you could do it, and that was exactly what we were doing in racing every day. I had been designing a carbon fibre trials bike at the time and decided after that to make it electric. When it was announced, we got so much response from energy companies and car companies, we realised this was a good business to be in, and we soon had many projects.'

Few of these projects were motorsport programmes. Most focused on public transport and detail work for OEMs, but utilising their motorsport knowledge, Tokyo R&D and Pues Corp were soon creating a number of very high performance technology demonstrators. 'In 1991, we developed a car for Tokyo Electric Power, and it was the highest performing passenger car in the world. In 2003, we did a road car that had eight wheels, each with its own power motor, that could do 400km/h. We applied that technology to a range of eight-wheel buses, so that gave the performance in a different way.'

Despite his clear love of engineering, Ono is no longer a hands-on designer, leaving that to his younger employees. 'I design with my mouth these days – not the CAD system or drawing board. My time is taken up running the company. But maybe when I retire I will design racing cars again. I still have interest in engineering details and basic concepts we are working on, but today only about 10 per cent of our work is racing.'

His rapid progression from graduate to Formula 1 designer, and then to company owner, gives Ono a good perspective on how the industry has changed over the years. He is also the chief design judge at the Japanese Formula SAE competition, and points to the digital revolution as the single biggest change in the industry. 'When we did not have access to computers, we had to rely on slide rules and working things out by hand on bits of paper. The calculation we could do was very limited. I think it was 1981 when I got my first computer. The first thing I did was to make a very simple programme to look at how the suspension moves up and down. Compared to a modern tool it was very crude, but still it was very useful compared to what we had before. Without a computer, what we could consider was very limited, but a computer calculates many alternative options and helps optimise everything.'

However, that endless optimisation process may have gone too far, thinks Ono, reducing creativity amongst young engineers. 'The students now rely heavily on computer tools. They can analyse the stress and the characteristics of everything. When I was doing that with my slide rules in the past, I had to rely very much on my instinct. I think you could say young engineers today lack that instinct because they rely too much on the computers. Maybe we should find a better way of working with the computers and the latest tools because I think we can create something much greater than we do now.'

"the company really found its niche with electric and alternative powertrain vehicles"

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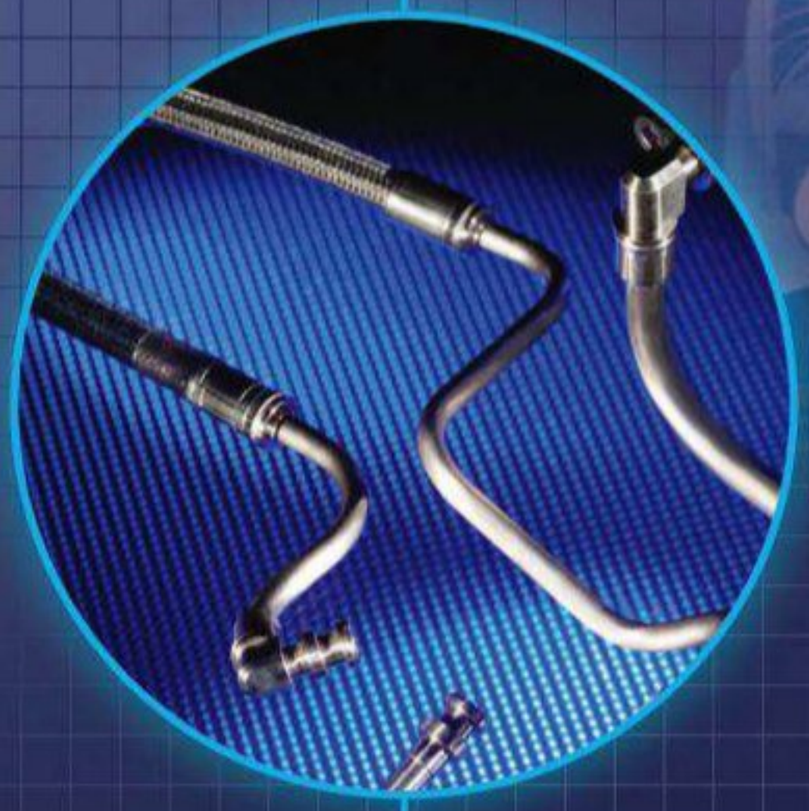

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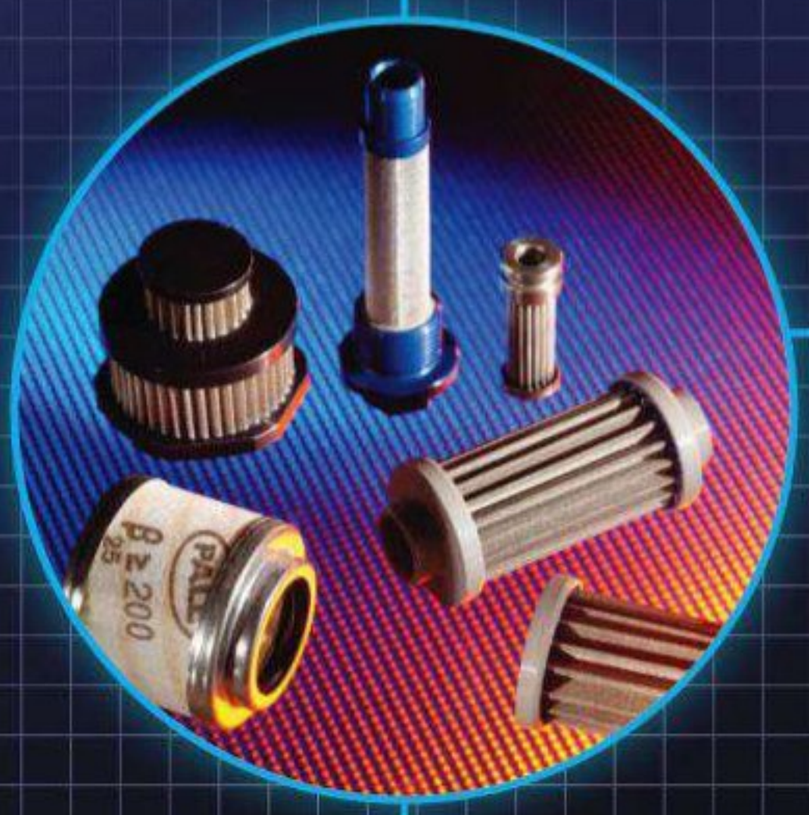

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Academy award winner

Blancpain GT4 champion car with a gaming whizz behind the wheel

BY ANDREW COTTON

The GT world has been largely shaped by the ever-changing fortunes of what is now the FIA GT1 World Championship. As interest dipped in 2000, series organiser, Stephane Ratel, introduced the N-GT category. That developed into what is now the most popular GT category in the world - GT2.

In turn, the success of GT2 led to the rise of another entry-level formula, GT3, which, in the space of five years, has grown to flood the GT market.

As the level of professionalism and costs rose, suddenly there was a need for yet another entry-level GT category, so Ratel introduced GT4. At the time, it seemed there was no end - that soon there would be a GT5, 6 and 7 before we would start to see rental cars given their own races.

Now, with the category being adopted for national championships, an international GT4 Cup and a GT4 section of the Blancpain Endurance series, there finally seems to be a market.

Bob Neville's RJN Motorsport team, which ran Nissans in the European Touring Car Championship between 2001 and 2003 and developed and built the Nissan Motorsport Europe Rally Raid Challenge cars, was one of the first to enter the GT4 series. After the funding dried up for his GT2 350Z project after only a couple of outings, including the Spa 24 hours, he received a telephone call from Ratel introducing him to the new concept of the GT4 class.

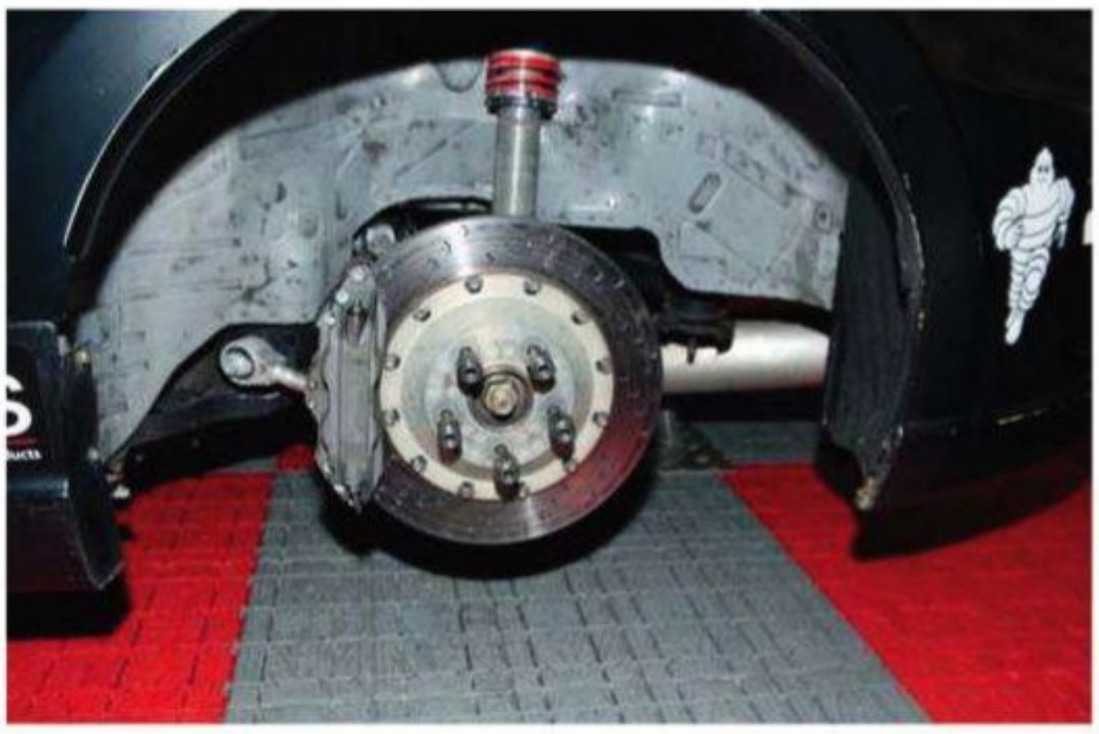
The 350Z scored race wins, and a few were even sold, before the marketing needs of Nissan changed, and the manufacturer wanted to develop an all-new car - the 370Z. Working closely with Nissan's Motorsport arm, NISMO (Nissan Motorsport International Limited), and with Nissan itself, the car entered and won its first full campaign.

The road car is available in the US, and the rest of the world, but not yet in the UK. The car has slightly longer front bodywork than the 350Z that it replaces,

"It has aluminium doors, boot and bonnet, so you don't have to re-make all of that in Kevlar"

"You have to be fast enough for them to slow you down"

Lightweight body has minimal exterior modifications, but 'shell is seam welded and a substantial rollcage added



Building adjustability into the rear suspension, and equipping the cars with Bilstein dampers and Alcon brakes is part of the RJN Motorsport upgrade

3.8-litre V6 (4.0-litre for the longer Endurance races) comes direct from NISMO in Japan as a complete package. Power output is said to be 440bhp

"Everyone thinks GT4 is a cheap little formula, but it isn't. Not if you are trying to win"

and a small rear wing, but its biggest change is to a 3.8-litre engine, stretched to 4.0-litres in the car that contests the long-distance races such as the Nürburgring 24 and Silverstone 24-hour races.

The engines and rear differentials come directly from NISMO in Japan, while Neville's company prepares the 'shell, and makes the near standard suspension adjustable. 'We never have had the luxury of starting with a bare 'shell, we always have to strip them,' says Neville. 'They did provide bodies in white with the 350, but it is nice to have a car, because then you have all the door handles and everything. The production 370Z is a lovely car. It has aluminium doors, boot and bonnet, so you don't have to re-make all of that in Kevlar. It is a very good basis for the car.'

PLAYSTATION GT

It certainly seems to be. It is a car that has won the Blancpain GT4 title this year, with Nissan PlayStation GT Academy winner Jordan Tresson, Alex Buncombe and Chris Ward winning the drivers' title, and RJN the teams' title on the back of a strong victory at the Spa 24 hours in July.

The Academy takes the most successful drivers from a computer gaming competition and puts them into a training programme. From there, one is selected to enter a full racing series. Lucas Ordonez was the first graduate, and he went on to win the ILMC teams' title with the Signatech Nissan team.

Tresson was champion in 2010, and was given the chance to race in GT4 this season with RJN. This year, Jann Mardenborough will start his career as a graduate by contesting the Dubai 24 hours with the team.

The Academy provides the funding for running the GT4 Nissan team, though the development costs are met by RJN, which hopes to start selling GT4 370Zs later this year in preparation for next season. 'That is what it is all about, bringing these guys on with drivers like Alex,' says Neville. 'Generally, we have good drivers and we are just bringing them on.'

GT racing has become almost a by-word for balance of performance, which would suggest that the development costs of the 370Z are relatively low. With a base weight of 1270kg (2800lb), it's around 200kg (441lb) lighter than the production car and, with a sales price of £120,000 ($189,950), similar to the Aston Martin and Lotus Evora that the car faces in competition. 'The car has fewer aero devices than the Evora,' explains Neville. 'That has diffusers and splitters and we haven't got any of that, so I doubt our downforce is equal to theirs. Our straight-line speed is okay though.

'You have to be fast enough for them to slow you down. They never slow everyone else down enough to let you catch up, but you have to build the fastest car you can, and then fight the balance of performance side as best you can. Everyone thinks that GT4 is a cheap little formula, but it isn't. Not if you are trying to win.'

With the costs of GT3 escalating, and the category spreading from domestic and European to the global stage next season as part of the GT World Championship, will GT4 find its niche in sportscar racing?

'GT3 is now the international currency of GT cars, and so the level will just go up and up. Now they have semi-works teams in the series, so that could open the door for GT4,' opines Neville. 'But it is still possible for three or four guys to go out, buy their cars and go racing.'

TECH SPEC

Weight: 1300kg (2866lb)

Chassis / body: lightened and seam welded with weld-in rollcage

Engine: 3.8-litre V6 VVL Nissan

Power: 440bhp

Transmission: Xtrac six speed

Suspension: Bilstein double adjustable dampers

Brakes: Alcon Racing six pot, 380mm x 34mm front discs, 355mm x 32mm rear discs

ABS: Bosch

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Stuff of dreams

A dedicated programme of development produced the star of the BTCC. Unsurprisingly, Honda wanted in on the action

BY CHARLES ARMSTRONG-WILSON

The Honda Racing Team (HRT) has been on the British Touring Car Championship (BTCC) grid for just two seasons, yet made a clean sweep of the series in 2011. The reason? Because behind the operation is Team Dynamics, a remarkable English racing outfit that has been in the series for 20 years and, in recent years, has put a great deal of work into perfecting its Honda Civic racecar.

"one area has proved key - the rear suspension"

Team Dynamics caught the eye of the Japanese manufacturer after winning the Independent Team's cup four times and the drivers' title twice in the last decade – something previously thought impossible for a privateer team in this fiercely contested series.

This giant-killing performance, and the fact that it was achieved with an S2000-spec Honda Civic, led Honda UK to establish a works-supported partnership with Team Dynamics in 2010 under the banner of Honda Racing Team. That year it won the manufacturers' and teams' titles, and it was with this car it completed a clean sweep in 2011.

By the end of the 2010 season, the team knew the car extremely well, but 2011 was the start of a two-season transition period from S2000 to the new Next Generation Touring Car (NGTC) rules. These include the introduction of four-cylinder turbocharged engines and a new style of chassis that allows some freedom within subframes that bolt to mandated pick-up points on the bodyshell.

OPTIMUM APPROACH

Steve Neal, team principal, recognised that mastering these new cars early would yield benefits, but he also realised that developing the engine and the car at the same time could compromise an otherwise front-running team. He decided the optimum approach would be to run the new engine in the old chassis for a season to keep the unknowns to a minimum whilst still making progress.

The basis of the turbo engine is the outgoing Honda V-Tech engine fitted with the TOCA turbo package supplied by Owen Developments in Oxfordshire, UK, but with design, build and development done by Neil Brown Engineering in Lincolnshire.

The regulations give a boost limit of 1.8bar, but the organisers advised them to map the engine down to 1.5bar. With the requirement to keep an even field across cars built to the different regulations, there was always going to be the need to adjust performance.

Despite some concerns about how the engine would work in the old car, team manager Peter Crolla has high praise for the units: 'They ran without any problems all season. We knew the turbo installation would produce a lot of heat, so we put a lot of effort into the packaging to ensure the engine bay and surrounding area was well protected.' This included having the exhaust manifolds ceramic coated by Zircotec and using a copper wrap product on other areas of the system.

The turbo installation also put more weight on the nose, so the fuel tank was re-designed in conjunction with Premier Fuel Systems, while the exhaust was re-routed to try and correct the balance. Another concern was the effect the different torque characteristics would have on the chassis dynamics, and particularly on tyre life. 'The tyres held up well and were never a major issue,' said Crolla. It may be this that caught the organisers out, who perhaps hoped the tyres would compromise the turbo cars enough to balance performance with the normally-aspirated cars. As it turned out, others claimed this was not the case.

To transmit the power, the team upgraded to the Xtrac 1046 from the 516-specification gearbox. The older gearbox could have taken the power, but when the turbo cars are given their full boost, the new unit will be

required to manage it.

With many road-standard parts on the car it would be easy to assume there is little room for innovation on the S2000 car, but one area has proved key to performance – the rear suspension. Most of the front-wheel drive racecars in the series are based on models that use simple beam rear axles (rules dictate that cars have to use the same type of suspension as fitted to the base model). Coupled to this is the problem that the front wheels on a Touring Car are saddled with most of the work – transmitting power, steering and most of the braking, too. In contrast, the rears of the cars are under-utilised. 'The problem is they generate too much grip,' explains Plowman. 'The usual approach is to lose as much grip as possible to get a balance.' This is traditionally done by picking the inside rear off the track completely, or generating large amounts of camber change. 'Our approach has been to keep both rear wheels generating grip, but to employ it usefully.' To achieve this, the Honda rear beam has been cleverly designed to steer in roll, moving the rear of the car around the front, helping the front wheels achieve their objectives. This is, in fact, what happens in the production version of the car, but is much harder to achieve on a racecar as the loads are bigger and much less compliance can be tolerated, yet all the geometry has to be achieved through compliance of the beam. Optimising this has been an ongoing process since 2007 and Crolla admits, 'this is the first year it worked perfectly.'

With driver, Matt Neal, behind the wheel, Team Dynamics scooped the Independent teams' cup four times between 1993 and 2000, before forming a relationship with Honda UK in 2004

Now the car is working so well, it seems a shame that it has now been retired. While it could have been run for the second transition season in 2012, work has already begun on the new car built to the NGTC regulations.

The team has universal praise for the support from Honda and it took delivery of the first bodyshell before the new Civic was even unveiled. They have also been given CAD files for the car, something that is believed to be a first for a Honda-supported BTCC project. They now have three bodyshells and, at the time of writing, the design of build is already very advanced ahead of testing in early 2012. Everyone will be watching closely to see if they can maintain their momentum next season.

Nissan's new baby

British company, JRM, develops Nissan NISMO GT-R GT3 for the global market

BY ANDREW COTTON

The Autosport International show in January 2010 heralded the birth of a new FIA World Championship team, as James Rumsey Motorsport (JRM) bought into Stephane Ratel's GT1 ideal and set itself up to run Nissan GT-Rs in the series.

On paper, there was nothing right about this set up. Rumsey had bought two Nissan GT-Rs, built by NISMO and run by Gigawave in 2009 as a shakedown for the GT1 World Championship. There were no staff, the factory was in Rye, on the south east coast of England, and there were no sponsors on the car. The team owner was a shy, tattooed man who wore dark glasses and who funded the team with private money. It looked as though it had the potential to be a disaster.

Since then, the team has won races in the FIA GT1 World Championship, and is now the development partner with NISMO for the GT3 version of Nissan's GT-R, and will be supplying the car and customer support around the world.

JRM signed former Ferrari employee Nigel Stepney to head up engineering and oversee the running of the two GT1 cars. Peter Dumbreck, Jamie Campbell-Walter, Michael Krumm and Warren Hughes joined the driving squad, giving the team instant strength in numbers.

At the end of the season, Krumm and 2011 recruit Lucas Luhr are on the verge of claiming their first World Championship titles with the team, and the factory in Daventry, where the GT3 and rally programmes are housed, is busy ramping up its activities to begin the build process for 15 GT3 cars over the next four years.

The JRM team will sell to the UK, Russian and Middle East markets, while NISMO's identical cars, developed in conjunction with JRM, will be sold to the rest of the world, including New Zealand, Australia and Japan.

JRM's GT3 development team's rapid expansion saw them take on the former ADR rally team premises in Chesterfield, in the midlands of England, before they moved to Daventry, close to the silicon valley of motorsport, around Banbury and Brackley, UK.

'When James bought the company there was talk of staying in ADR's facility in Chesterfield but, after some persuasion, we moved to this area because I know it well,' says John Barnes, JRM's GT3 project manager. 'We have all the facilities for composites and a race team and there is a whole skill set we can pick up here – inspection, composites, car building and so on.'

The car has raced three times already, in the Blancpain Endurance series at Magny Cours, the British GT Championship at Donington and the BES again at Silverstone.

'Essentially, the relationship between us and NISMO has progressed because of the success with the GT1 programme,' says JRM managing director, Andy Barnes. 'We put it

While the road car it is based upon is four-whel drive, the GT3 car will run in two-wheel drive format, using the twin turbocharged, 3.8-litre, VR38DETT V6

Though the car has only competed in three races in the Blancpain series in Europe so far, it is showing great promise

The GT3 cars are a joint development between JRM and NISMO. JRM will build cars for UK, Russia, and the Middle East, NISMO the rest of the world

at the front of the grid. Nissan is looking to put the GT-R in customer hands around the world, and needed someone to help them develop the car. This programme is a joint development between JRM and NISMO, whereas the GT1 was solely NISMO. With the GT1s, we bought the cars and ran them. Essentially, they could see that we were going to be a strong partner, and they know there is a lot we can bring to the party.' Two prototypes have been built, one testing in Japan, the other in Europe in JRM's hands, and the British team is busy building a third, this time left-hand drive. 'This was delivered to us in its prototype spec, and we decided that it needed 'European-ising',' says Andy Barnes. 'In Japan, if you crash into each other you get points and black flagged. Here, crashing into each other is normal. When this car first arrived, the oil coolers were in the front bumpers and other bits were in areas where they could get smashed off.

'Our involvement has been in performance development and to localise the car. One of the changes we needed to make was the ergonomics, including the rollcage, bearing in mind the size of the Japanese drivers that had been driving the car. Here drivers are a bit bigger and we had to accommodate that and produce a global car suitable for all markets.'

NISMO representatives base themselves at the JRM factory, and insist that they have the smaller desks. No one, it seems, is allowed to have a bigger desk than the president of NISMO. It is one of the things that baffles the British team, but their working relationship with their Japanese colleagues is strong.

The programme was given the green light in the UK before the summer, and the first car was ready to race at Magny Cours in September. The design work had been carried out in Japan for nearly a year before the green light was pushed with the British company.

"Here, the drivers are a bit bigger and we had to produce a global car suitable for all markets"

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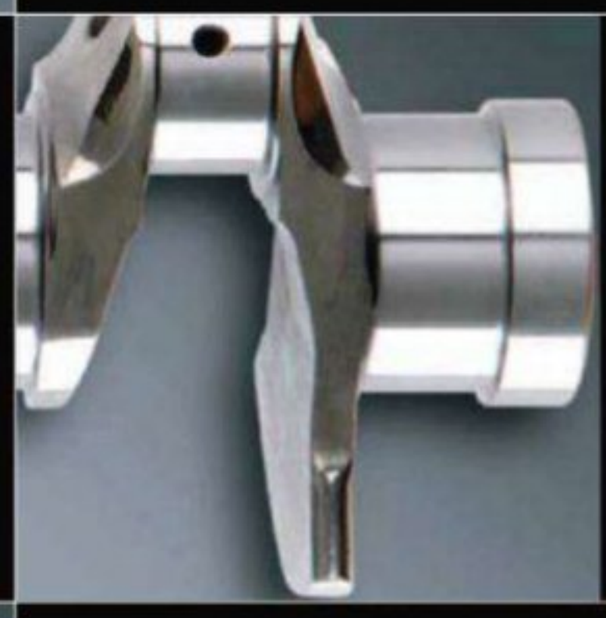

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Two prototypes have been built so far, one is being tested in the UK, the other in Japan, while a third prototype is currently under construction

NISMO's engineers worked on the design of the car for nearly a year before starting the customer programme with JRM

CUSTOMER PROGRAMME

'This is the first time NISMO has created a customer programme but, from a JRM perspective, we are already doing that with the Mitsubishi rally programme,' says Andy Barnes. 'While this is a completely different discipline, the production line we have already blueprinted with rallying, so the customer support, parts supply and so on we know. With GT1, we didn't know anything about it. We put together a team and, within a month, were testing at Paul Ricard and went on to win races.

'We have to sharpen the GT3 car up a bit, but essentially it is a very good car and we have the staff to make it so.

'The most interesting and challenging element is the customer support programme, so having the right engineers, development drivers and the right parts system is crucial.'

The team is planning to sign off the spec of the car following a final endurance test in November. The build process will commence immediately afterwards with first deliveries expected in March next year.

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The one that got away

Nissan's R90 programme was the Japanese manufacturer's best chance to win Le Mans. Only it didn't...

BY ALAN LIS

For 1989, Nissan forged a new partnership with Lola Cars for its Sportscar racing programmes in Japan and Europe after several years of working with March Engineering. Andy Scriven, who had previously worked on the design of the successful TWR Jaguar Group C racecars, was recruited by Lola as the chief designer for the new project, while existing Lola men, Clive Cooper and Clive Lark, were respectively responsible for CAD design, bodywork and mechanical design. Lola Cars founder, Eric Broadley, was also involved in various aspects of the project.

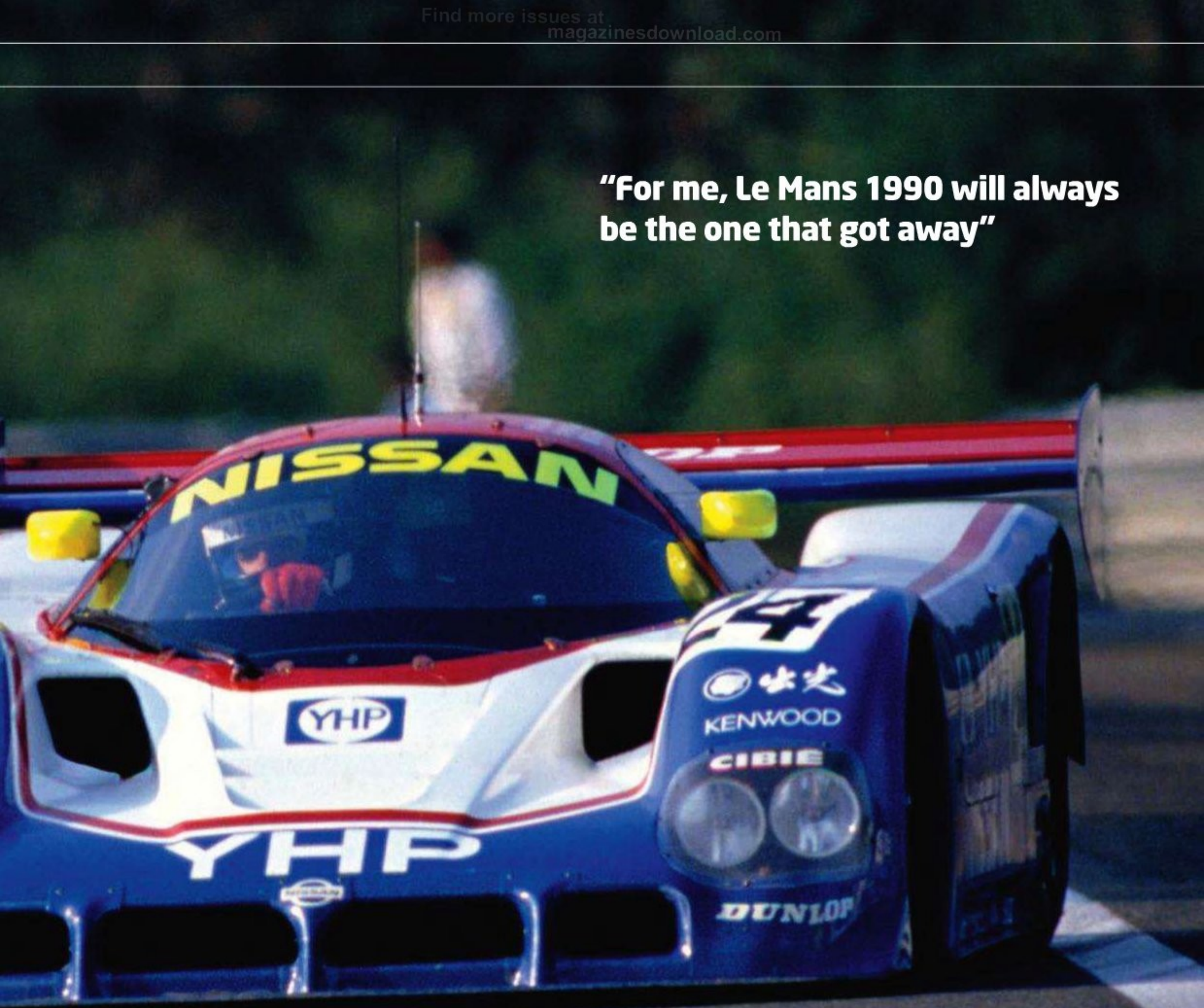
Some sources suggest that Nissan only became fully engaged in the World Sports Prototype Championship (WSPC) in 1989 to meet FISAs stipulation that only manufacturers and teams running in all the rounds of the WSPC would be allowed to race in the all-important Le Mans 24 Hours. Not necessarily so, says Scriven: 'Eric and Mike Blanchet [Lola's commercial boss] had convinced Nissan that they were never going to have the success they were looking for until they did the job properly and ran a full programme, and that while Lola could build them a car with the potential to win at Le Mans, they had to run it and run it.'

From the beginning of design work to the first car on its wheels it took only about four months. When Scriven arrived at Lola in late September 1988 a start had already been made on the design of the car – decisions had been taken on the location of the water radiator and intercoolers and the shape of the greenhouse. It had also been decided that the car would have a full-width monocoque, like the TWR Jaguars. The pressure was then on to have the car ready for testing by the end of January.

AERO INTERACTION

The wind tunnel test programme, which used a third-scale model, was carried out at Cranfield University. 'We had two configurations for the car – low drag for Le Mans and high downforce for everywhere else,' explains Scriven. 'Since we had roughly 12 days of testing, which was a lot in those days, there were a lot of parts and configurations tested. We did

"For me, Le Mans 1990 will always be the one that got away"



The Nissan R90CK gave Mark Blundell a wild ride to pole position at Le Mans in 1990. Blundell is convinced that, had the car been properly set up to handle the 1100bhp that the engine was generating - due to a failed wastegate - the lap could have been five seconds faster yet.

a lot of work on the underside of the car, the area between the splitter and the front of the chassis, lower downforce tunnels for Le Mans and high-downforce tunnels for other tracks, tunnel interaction with the tail and wing, duct exit size and location.'

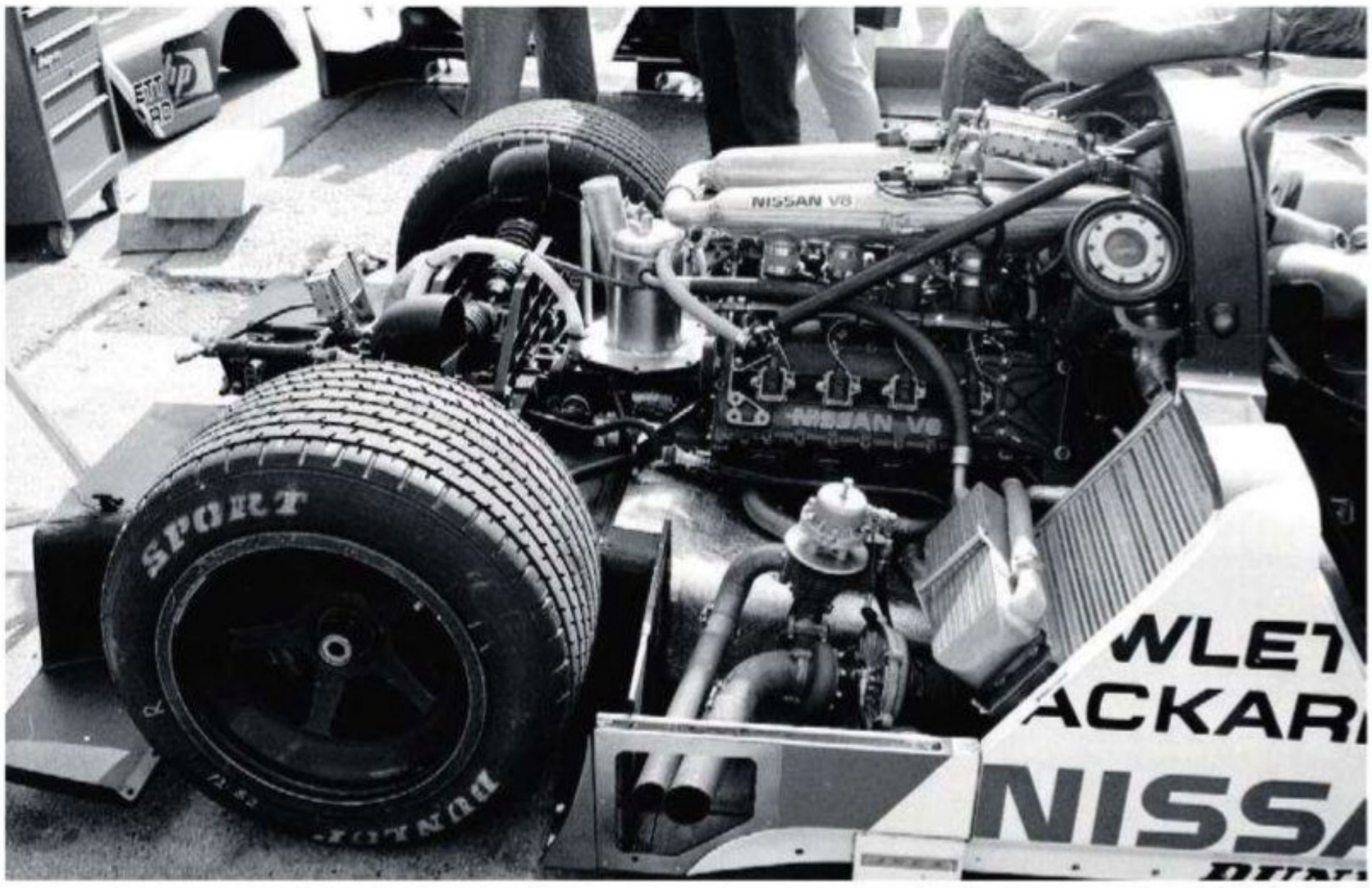
A feature of the R89s original aero spec was 'doors', which covered the rear wheels and cut drag, helping with downforce. 'They made the tunnels work slightly better because there was less air moving inside the wheelarches,' says Scriven. 'They were held on by sliding Dzus fasteners so they could be taken off to change the wheels. And of course, they were another thing that could fall off.'

The first complete car was ready to run by the end of January 1989 and was shaken down at the Millbrook test track – minus bodywork – by Julian Bailey. Further testing followed at Snetterton, UK, then in the USA at Nissan's Casa Grande, Arizona proving ground, and there was a three-day test in France at Paul Ricard, prior to the R89C's first race.

NISMO in Japan had represented Nissan in the opening round of the 1989 WSPC at Suzuka with its old March racecars. Nissan Motorsports Europe (NME) entered a single R89C for its debut at the second round in Dijon, France, where it qualified sixth and finished 15th after the windscreen blew out due to a build up of pressure in the cockpit.

Following the Dijon race, larger roof vents were added and the metal clips that retained the screen were strengthened and three weeks later three R89Cs were entered at Le Mans – one car each for NME, NISMO and the American NPTI team. Julian Bailey's accident early in the race, in which he ran into the back of a Jaguar while challenging for the lead, brought the R89s brake system under scrutiny. 'They were another feature of the design that had been finalised before I joined Lola, and they weren't the best,' comments Scriven. 'Because the master cylinders were mounted quite high up, there was an intermediate rocker between pushrods from the pedal and the master cylinders, and the drivers complained that sometimes the pedal felt 'dead'.

'The brake pedal issue may have been a factor in Julian's



After the end of Group C, variants of the Nissan VRH35Z engine, shown here in the R89C chassis, were used in subsequent Nissan LMP and GT projects and also formed the basis for the Infiniti Indy Racing League engine

accident, but the actual reason why the NME car was retired from the 1989 race was down to another design issue that I should have picked up on but missed. The front top wishbones were machined from solid aluminium billet, which made them very strong. I even remember looking at them and thinking they might be too strong but, in the rush to get everything ready in the gap between the races at Dijon and Le Mans, there wasn't time to do anything about it, so I decided they would probably be okay. When Julian had his accident, if the top wishbone had been fabricated in tubular steel, it would have just bent and it could have been replaced as the car could have been driven back to the pits. But because the machined wishbone was so strong, it punched a mounting point out of the tub.'

Of the other Nissans in the race, the NISMO car made it up to fourth place before its engine failed, while the NPTI car had reached fifth when it suffered a terminal oil leak.

In seven starts in the 1989 WSPC, the NME R89C finished five times, with a season-high third place at Donington Park, UK, where the car raced for the first time on carbon-carbon brakes and with a six-speed version of the Hewland VGC gearbox. It also, notably, had the rear wheel doors removed, as their benefit was primarily at Le Mans.

REVISED FOR 1990

For 1990, Scriven and the Lola design team produced a revised version of the car called the R90CK. 'I would have liked to have built a new, smaller chassis, instead of the full-width chassis, but we had to stay with the 89 tub,' recalls Scriven. 'I designed a new casing for the VGC internals that incorporated the bellhousing too, so it was a very large casting, and I made the lower outer casing as smooth as possible so it became the centre body of the tunnels. That eliminated the bodywork in that area and, because it was in the airstream, it also improved the cooling of the gearbox to the point where we could usually dispense with the oil cooler. We also tidied up the aero'.

Whereas there was a special low drag aero kit for Le Mans in 1989, for 1990, with chicanes newly installed on the long straight, we worked on a medium downforce package, which was pretty much a case of taking the high-downforce elements of the shorter track aero set up, such as the dive planes on the front bodywork, and fitting slightly different tunnels.

'In 1989, the top speed at Le Mans was around 245mph, but in 1990 we were looking at 205mph, which could be achieved by the basic car in a near normal set up.'

NISMO again represented Nissan at the opening round of the 1990 WSPC, where one of its R89Cs placed third. The R90CK made its debut in round two at Monza, Italy where, as it would throughout 1990, NME fielded two cars. One placed seventh while the other ran out of fuel three laps from the finish. Ironically, at Silverstone later that year one car suffered a suspension failure, while the other ran out of fuel.

Fortunes improved at round four at Spa, where one car placed third before Nissan made a supreme effort at Le Mans in 1990. Five R90CKs were entered – two each for NME and NPTI and a spare car – backed up by a NISMO R89C sporting a different aero package developed by NISMO aerodynamicist, Yoshi Suzuka. There were also two regular, privately entered, factory-supported R89Cs and a Nissan engine installed in a Courage chassis.

"We had two configurations for the car – low drag for Le Mans and high downforce for everywhere else"

BRUTE FORCE

NME's lead car set a sensational fastest time in qualifying when Mark Blundell, with more than 1100bhp under his right foot, wrestled his R90 round the track 6.5 seconds faster than the opposition, on a lap during which his car was clocked at 236mph before the braking point for the first of the new chicanes. 'Something happened with the wastegate control on the previous lap,' remembers Scriven. 'It either failed completely or it had jammed and was allowing large amounts of boost. As Mark came towards the end of that lap the Nissan engineers were saying, "We must stop the car immediately," whereas the team just told him to keep going. The engine held together for the next lap and Mark's time was pretty amazing considering the changes to the track. It showed what sheer horsepower could achieve but, even with that much power available, the driver still has to put the lap together, and Mark did a superb job.'

As it had in 1989, NME posted the first retirement at Le Mans in 1990, its second car stopping at the side of the track on the parade lap with a transmission failure. 'There was a small drive gear on the mainshaft that meshed with a similar gear on the gearbox oil pump,' explains Scriven. 'On this one occasion, when the gear cluster was put back in after a clutch change, these two gears went tooth to tooth, and being relatively light, the one on the pump broke. This happened after the warm up, so there was no way of knowing that the oil pump wasn't working before the cars went off on the parade lap. With no oil circulating, the pinion gear melted off the shaft, and that's why the car failed before the start of the race. It really wasn't the fault of the gearbox, just one of those really unlucky events that happen.'

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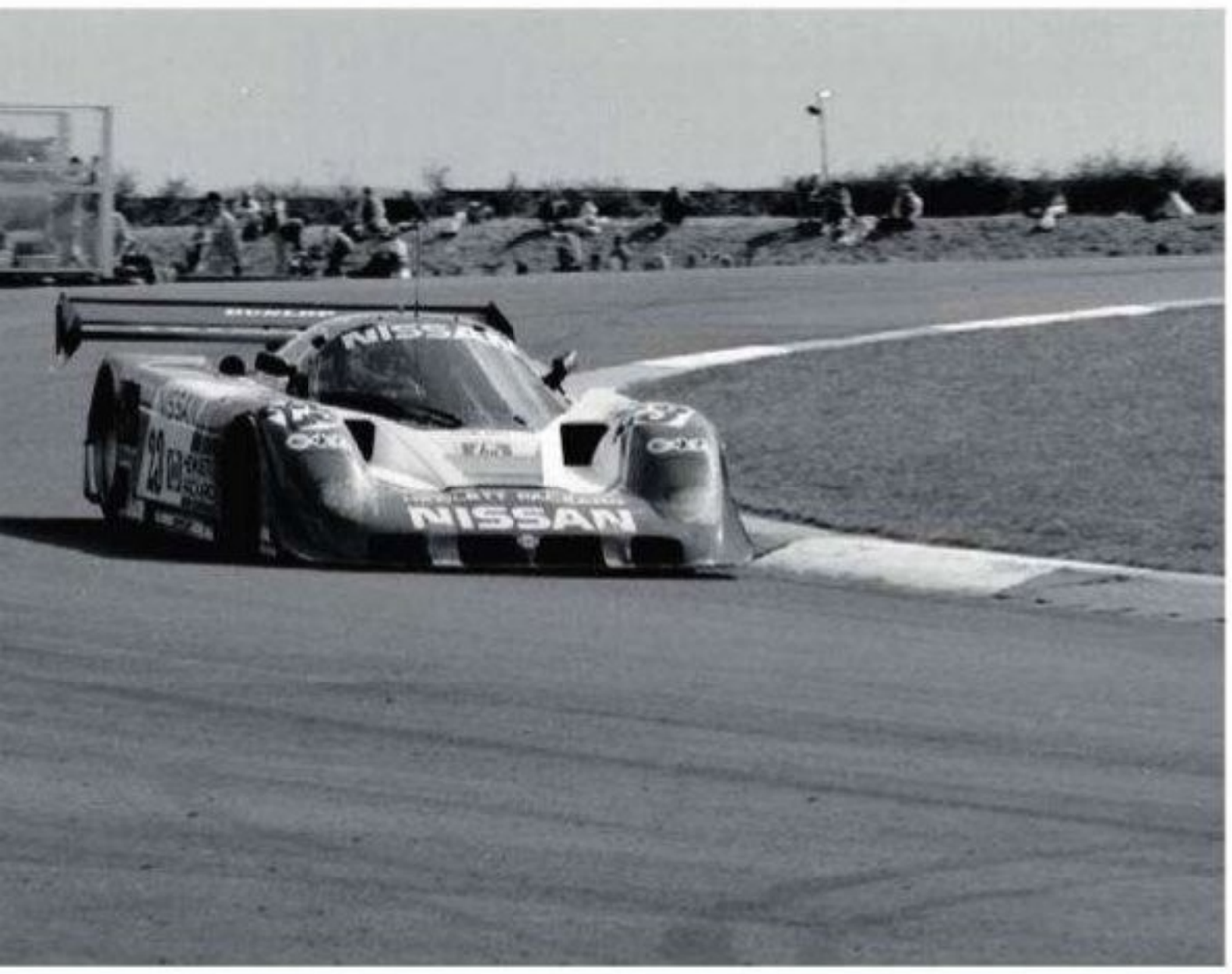

Nissan's Group C breakthrough result was a third place at Donington Park in 1989, where the R89C raced for the first time with carbon brakes and a six-speed version of the Hewland VGC gearbox

The sister NME car lasted until after midnight and was on the lead lap when it too suffered gearbox problems. NPTI's lead car, running on Goodyears, put together an impressive run that looked likely to win the race for Nissan. Scriven: 'They had set out a complete plan of how they were going to run the race, and I think it was coming to them when they had the fuel cell problem. For me, Le Mans 1990 will always be the one that got away.'

In the remaining WSPC races of 1990, the NME cars achieved a 100 per cent finishing record, with second places in Montreal, Canada and Mexico City. At home in Japan, NISMO won the national Group C series with its updated cars but, after Le Mans 1990, it became clear that Lola would not be involved in the forthcoming Nissan 3.5-litre Group C project. Furthermore, the manufacturer decided to withdraw from the 1991 WSPC and await the new car – to be built in the USA by NPTI – rather than race on with turbo cars carrying a 100kg weight penalty. Of course, this meant Nissan would not be eligible to race at Le Mans in '91.

Nevertheless, chassis and engine development continued on the turbo cars. In Japan, NISMO successfully defended its national championship in 1991, while NPTI raced its R90CKs in the Daytona 24 Hours in '91 and '92, and it was at the '92 race that a NISMO RC91, based on the original R89C, finally won a 24-hour race for Nissan, although it wasn't the one it really wanted...

ANDY SCRIVEN – A 2011 PERSPECTIVE

After leaving Lola Cars at the end of the Nissan project, Andy Scriven moved to the USA where he worked on the design and engineering of CART and NASCAR racecars for Penske Racing and later, working for Crawford, he returned to designing Sportscars. Looking back on the Lola Nissan project today, Scriven has mixed memories: 'Eric Broadley always liked to have an input on every project, but I always thought he viewed Sportscars as his speciality,' recalls Scriven. 'As it was originally designed, the R89 had quite a low front roll centre and quite a high rear roll centre, which made the rear end feel rather nervous, especially on turn in. That was something I addressed quite early on. While doing that, I started to have discussions with Eric about geometry and what the tyres needed. At that time I was young and probably rather arrogant, so when Eric gave me what seemed to be waffly answers to my questions, like "Well, you need to design lots of options into these cars, give yourself lots of wishbone points so you can try lots of things", my reaction was, "So you're telling me that you don't really know what's needed?" I couldn't understand, at that time, how someone with Eric's experience couldn't have a better idea of what tyres really needed. Twenty years later, I now know exactly what Eric was talking about. I just wish he could have explained it to me better.

'To me that was the saddest part of the whole project. As a result of some of our conversations, I got off on the wrong foot with Eric and, of course, he didn't have as much time to devote to the project as would have been good for it. Had we sat down and talked more about the car, and had I listened more, I think we could have done a better job and the car would have been better. But, in my youthful arrogance, Eric didn't inspire me with much confidence.

'Even today, tyres are still something of a black art, and when you see F1 teams getting lost, with the resources they have available, what hope did we have back then? It's not a simple thing and, as Eric rightly said, you *do* need to give yourself plenty of geometry options. But at that time I just didn't believe it, and that set us on a collision course. To his credit, Eric didn't demand I do things his way, he left me to it, and I'm grateful for the opportunity he gave me to learn.

'Before I started at Lola, it had already been decided that the car would have a full-width chassis, and that the intercoolers would be in the sidepods alongside the engine. I wasn't a great fan of the full-width chassis because it committed you to too many things that you couldn't change. I'd have preferred to design a car like the current LMPs, with a double width central cockpit and separate sidepods that could be changed to make them shorter, longer, taller, lower, waisted, or however you wanted them. But the R89 was a full-width chassis, like the TWR Jaguars, and, of course, in 1988 they were the cars to beat. It was felt that a carbon fibre monocoque could save weight on body panels if it was full width, but I'm not convinced it was a good trade off. I think there was also a theory that a full-width monocoque gave you massive stiffness, which is all well and good, but a car is only as stiff as its weakest point.

"Had we talked more about the car, and had I listened more, I think we could have done a better job"

'The Nissan VRH35 engine was a nice piece but, looking back, I think we suffered from the fact that it was smaller in displacement than the Mercedes V8. That meant it had to be driven hard, and that ultimately hurt fuel mileage. That slowed us down in numerous races where we were fast enough to win but we couldn't match the Mercedes on fuel economy. When the Mercedes drivers went into fuel save mode they could miss out gear shifts and use the wide torque band of their engine to haul the car out of the corner, while our drivers had to change down and burn extra fuel.

'Had Group C continued with turbos, we would have tried to get Nissan to build a bigger version of the engine. If we could have had a 4.0 or 4.5-litre engine, we could have saved some fuel mileage without giving up performance, and that would have made a real difference.'

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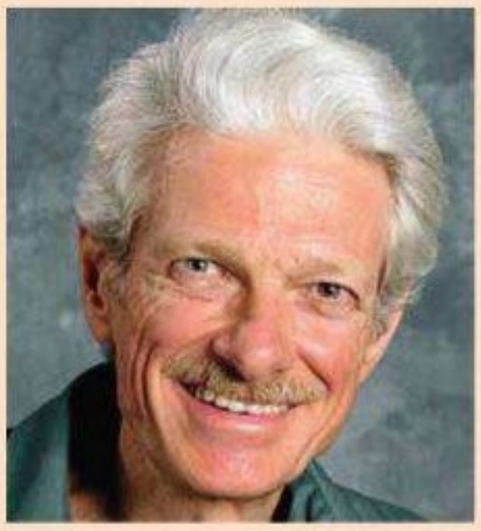

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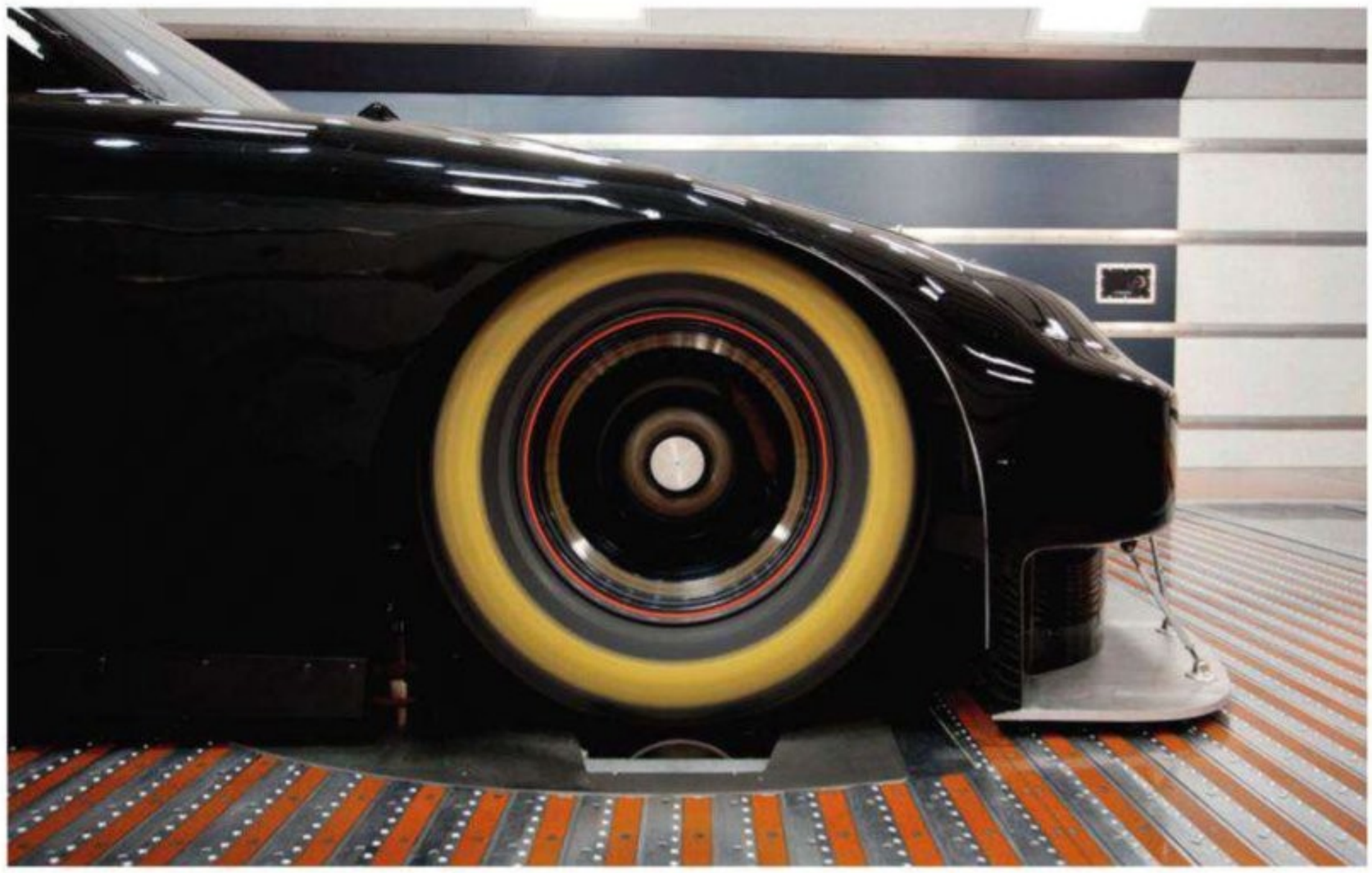
A lot of hot air?

Wind tunnel testing of ground-effects cars without a rolling road



The AeroDyn wind tunnel blows air under the car to simulate a rolling road. Much of the validation work for the tunnel has been done using a COT Cup car

It has been considered necessary, up until now, to use a rolling road to accurately simulate the under-car aerodynamics that occur when a car is actually running. Before rolling roads were developed, automotive wind tunnels would deal with the floor-level boundary layer by sucking floor-level air in under the tunnel floor through a slot just ahead of the car, and blowing it out again just behind the car. This is not too bad for road vehicles that have large ground clearance and do not generate significant negative lift (downforce) with the underbody, but it doesn't really do a good job of replicating under-car effects, as the boundary layer at the tunnel floor is removed ahead of the car, but a new one forms again a bit further aft.

In April of this year, I was invited to visit the AeroDyn wind tunnel in Mooresville, NC, to view some test results from an open-wheel car with ground effects, using the company's unique wind tunnel. The tunnel uses a succession of suck-and-blow stages, most of them the width of the car but each only a few inches long, all along the tunnel floor and most of the length of the car itself. The idea is to keep the ground-level air moving, much the way a rolling road does. The car's wheels are supported on rollers, allowing them to spin. The rollers feed the gravitational and aerodynamic z-axis (vertical) forces into a balance under the tunnel floor.

Apart from being cheaper than a conventional rolling road, this design offers the advantage of allowing the car to be yawed on the rollers. It also offers the advantage of allowing an array of static pressure taps to be added to the tunnel floor, in between the sucking and blowing slots.

NARROW TRACK

In practice, the car tested could not be yawed, because it was barely possible to get the tyres to ride on the rollers at zero yaw. The reason being the AeroDyn tunnel's rollers are not adjustable for track width, and are designed to accommodate upper-division NASCAR vehicles, whereas the test car had a wider track than a Cup car, so the outboard portions of the tyre treads were off the rollers. However, it did prove possible to run the test by setting the wheels at considerable negative camber, so they ran on their inboard edges (the rollers can tilt a bit to track the wheels' camber).

"The idea is to keep the ground-level air moving"

There is considerable adjustment for wheelbase on the rear rollers, and there needed to be for this test. The section of the floor around the rear rollers does not have suck and blow, nor pressure taps as that all ends just forward of the rear wheel section. Although confidentiality precluded my being told what kind of car this was, the information regarding its size would strongly suggest that it was an IndyCar.

It should also be noted that the adjustment limitations of this tunnel are not inherent in the type of tunnel, and might even be amenable to modification in this particular tunnel, if demand warrants the outlay involved.

The ability to look at pressures on the tunnel floor has considerable potential. It isn't quite the same as seeing pressures acting on the actual car underside but, when the car runs within two inches or less of the ground, pressures on the tunnel floor give us a good

Force Increment due to wheel rotation of an open-wheel racecar

Drag increment,%	Lift increment, %	Front lift increment, %	Rear lift increment,%
4% decrease	14.3% increase in downforce	15% icrease in downforce	13.8% increase in downforce

Wheels stationary

,224	,304	,386	,457	,502	,528	,511	,458	,394	,297	,246
,235	,329	,462	,588	,673	,719	,680	,609	,454	,357	,235
	,358	,504	,638	,729	,770	,740	,673	,495	,379	
	,357	,443	,684	,789	,864	,802	,728	,540	,375	
,225	,328	,546	,724	,846	,888	,846	,730	,519	,346	,222
	,298	,496	,697	,821	,825	,817	,751	,562	,315	
	,281	,375	-1,389	-1,079	-,906	-,995	-1,273	,379	,361	
,113	,202	-,648	-,598	-,611	-,570	-,635	-,617	-,690	,194	,185
	,080	-,433	-,400	-,475	-,399	-,419	-,427	-,470	,099	
	-,062	-,312	-,392	-,441	-,372	-,392	-,364	-,399	-,084	
-,009	-,299	-,378	-,391	-,443	-,462	-,471	-,398	-,350	-,327	,005
	-,498	-,398	-,400	-,400	-,350	-,397	-,404	-,370	-,599	
	-,572	-,377	-,511	-,499	-,482	-,472	-,453	-,412	-,502	
-,235			-,407	-,442	-,404	-,428				-,215
-,389			-,435	-,408	-,390	-,402	-,445			-,356
-,409			-,430	-,426	-,427	-,426	-,446			-,355
-,399			-,453	-,442	-,420	-,436	-,439			-,374
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-,098	-,201	-,298	-,297	-,291	-,244	-,243	-,251	-,249	-,110	-,061
-,131	-,221	-,246	-,296	-,260	-,247	-,288	-,298	-,299	-,150	

Wheels rotating

,223	,304	,388	,458	,504	,529	,514	,461	,396	,298	,247
,239	,327	,462	,589	,673	,720	,681	,609	,465	,357	,235
	,357	,508	,632	,729	,770	,741	,674	,497	,380	
	,354	,440	,683	,785	,864	,801	,729	,540	,373	
,222	,323	,543	,724	,847	,882	,848	,732	,519	,344	,223
	,292	,494	,696	,820	,825	,816	,750	,561	,313	
	,271	,367	-1,386	-1,070	-,901	-,991	-1,269	,377	,349	
,101	,189	-,656	-,600	-,614	-,571	-,636	-,617	-,698	,190	,152
	,058	-,444	-,401	-,481	-,401	-,421	-,428	-,473	,092	
	-,108	-,323	-,398	-,445	-,377	-,398	-,367	-,402	-,098	
-,087	-,365	-,386	-,391	-,444	-,466	-,474	-,400	-,358	-,353	-,087
	-,596	-,384	-,405	-,402	-,350	-,398	-,407	-,379	-,648	
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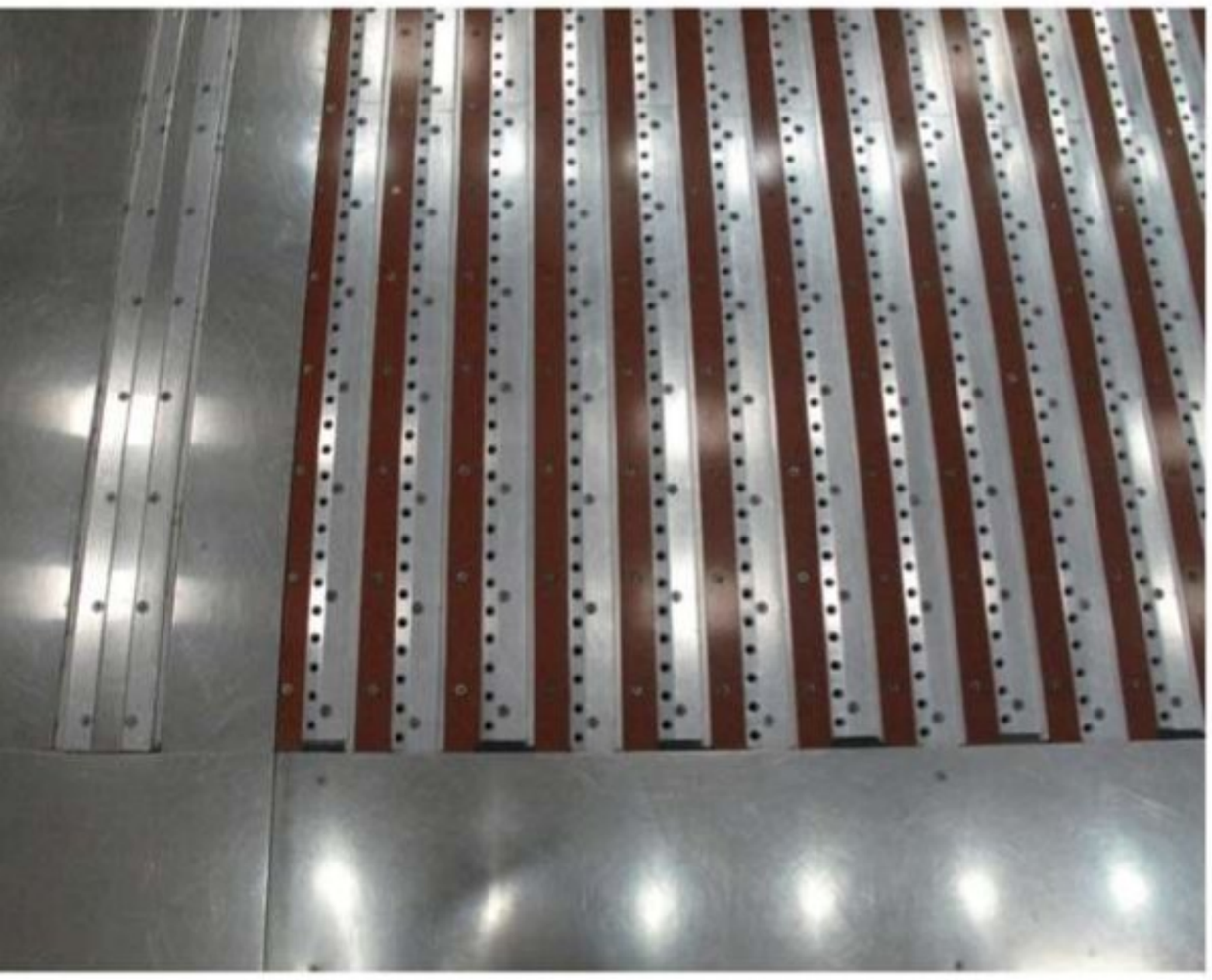
-,127	-,230	-,243	-,290	-,258	-,244	-,291	-,288	-,247	-,179	

Delta

,000	,000	,001	,001	,001	,000	,002	,002	,002	,001	,001
-,002	-,002	,000	,001	,000	,001	,001	,000	,001	,000	,000
	-,001	,000	,000	,001	,000	,001	,001	,002	,001	
	-,004	-,008	-,002	,000	,001	,000	,001	,000	-,001	
-,003	-,006	-,008	,000	,000	,000	,001	,001	,000	-,001	,000
	-,006	-,002	-,001	-,001	,000	-,001	-,001	-,001	-,002	
	-,010	-,008	,002	,009	,005	,004	,004	-,008	-,002	
-,012	-,013	-,008	-,002	-,008	,000	-,001	,000	-,002	-,004	-,002
	-,022	-,011	-,001	-,005	-,002	-,002	-,001	-,008	-,007	
	-,041	-,010	-,002	-,008	-,005	-,001	-,008	-,004	-,013	
-,028	-,066	-,008	-,001	-,001	-,004	-,002	-,002	-,008	-,027	-,012
	-,098	-,016	-,004	-,002	,000	-,001	-,008	-,009	-,049	
	-,088	-,027	-,011	,000	,001	,001	-,006	-,018	-,074	
-,019			-,010	,000	,001	-,001				-,020
,038			-,008	-,010	-,004	-,005	-,010			,025
,050			,012	-,005	-,001	-,001	,000			,030
,031			,008	,002	,001	-,001	,008			,033
,035	,006		,005	,003	,008	,006	,002		,009	,039
,051	,014	,003	,002	-,001	,000	-,008	,001	,000	,005	,030
,017	,008	,012	,005	,003	-,001	-,001	-,002	,005	-,013	,002
,008	-,006	,016	,007	,008	,006	,005	,002	,013	-,021	-,006
-,007	-,005	,009	,006	,007	,010	,015	,006	,012	-,024	-,005
,000	-,081	,003	,004	,005	,007	,004	,007	,004	-,084	-,002
,004	-,009	,003	,006	,003	,008	-,008	,010	-,008	-,029	



The AeroDyn tunnel has a series of suck-and-blow stages along the tunnel floor to keep the ground-level air moving, the idea being to accurately simulate the under-car aerodynamics that occur when a car is running

"We don't want a racecar with wheels that don't turn"

indication of where pressures on the car are low or high, and where they are increased or decreased by a change to the car. This lets us check the validity of CFD modelling more effectively than merely seeing changes in wheel loads. It may also possibly point us to the most productive portions of the car's underside to make changes to in the search for more downforce.

BAY CITY ROLLERS

The plots above show the effect of having the wheels of the open-wheel car rotated by the rollers vs having them stationary. The red or pink regions are those with lower pressure than ambient or, as seen in the right-most displays, those with lower pressure when the wheels are spinning than when they're stationary. Blue regions are those with higher pressure, while the white regions are where the front wheels are (the rear wheels are further back than the rearmost pressure taps). Forward of the front axle, the rows of taps are at three-inch intervals, aft of the front axle, they're at nine-inch intervals.

From these, we can note a number of interesting things:

- **It helps downforce to have rotating wheels. After all, we don't want a racecar with wheels that don't turn. Wry humour perhaps, but it is worth noting that in a ground effects car, if we lock the wheels in braking, not only are we breaking traction at the contact patches, but losing downforce as well.**
- **Wheel rotation increases downforce very little when the underside of the car is not close to the ground. On the Cup car, the only region that showed a serious improvement from wheel rotation was the front splitter, and even there, the improvement was mainly in the area directly in front of the wheels.**
- **A rotating open wheel by itself is widely reported to generate some lift. The downforce gain from wheel rotation in an open-wheel car with ground effects is happening in spite of this. This would suggest wheel rotation should make even more difference in a closed-wheel, ground effects car, such as an LMP car.**

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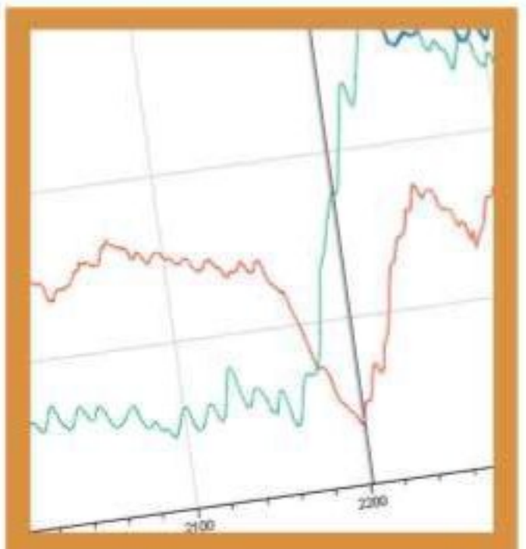


Databytes gives insights to help you improve your data analysis skills each month as Cosworth's electronics engineers share tips and tweaks learned from years of experience with data systems. Plus we test your skills with a teaser each month

To allow you to view the images at a larger size they can now be found at www.racecar-engineering.com/databytes

Master and servant

Rather than just using a simple data logger, how about making the most of the extra benefits offered by a Master Control Unit?

Most people consider data loggers to be passive systems in the general operation of a racecar – that is to say they are just there to measure and monitor various aspects of the car. In some instances, however, the loggers are more of an integral part of the car's systems and can, for example, output data on to a live display to inform the driver, or output data to a telemetry system to relay information back to the pits. But there is a third aspect that is generally only on more advanced data loggers, or Master Control Units (MCU), and that is the ability to directly control some of the on-car systems. In most instances, control is an area reserved for the ECU – not only is it expected to control the engine operations but often also the gearbox and possibly other systems, too.

AUXILIARY SWITCH

Having a data logger that is also capable of controlling various aspects of the car can be an extremely useful tool for the racecar engineer. For example, if the team is not allowed any access to the ECU, or if an original road car ECU is used, the data logger can be used to switch auxiliary equipment if needed. The data logger has also, in some cases, more information or more *accurate* information to base the control strategy on. An example would be using GPS for distance-based control, or a simple control might be to switch on an auxiliary radiator fan. For this, the logger will need some inputs for the control to work. In this case, the logger needs to know what the water temperature is and at what temperature the output should switch. As the data logger is a more generic control tool than an ECU, it is necessary to write a simple maths channel to activate the output. In this case, the maths channel could be [Water Temp] > 90, so that the output would switch the auxiliary fan on when the water temperature rises above 90 degrees. This could then be easily tuned using the data from the logger. Similarly, the logger outputs can be used to switch on brake lights based on brake pressure, air conditioning pumps based on the temperature inside the cockpit, auxiliary fuel pumps based on fuel flow rate and many other useful things.

"the ability to directly control some of the on-car systems"

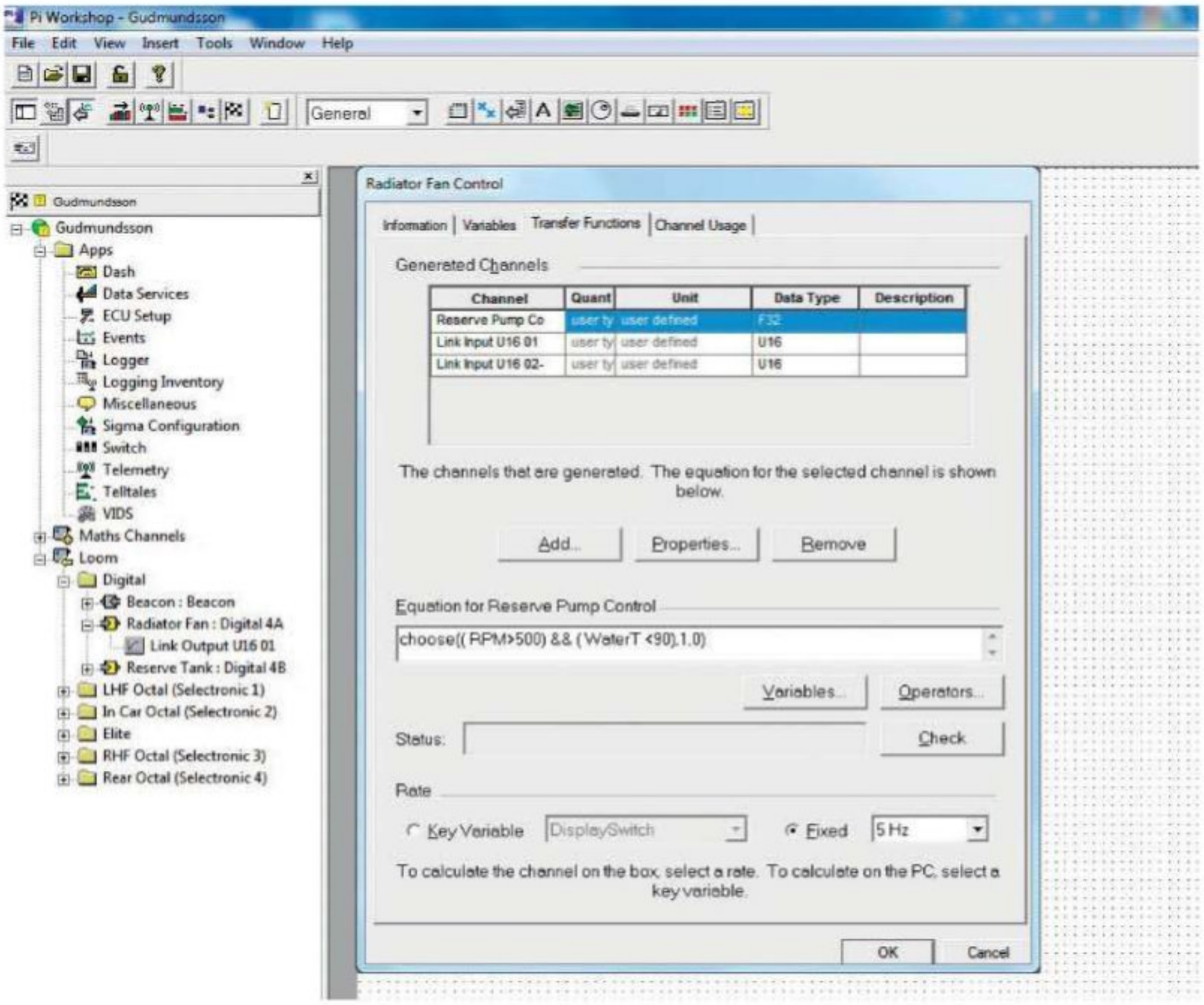


Figure 1: a Master Control Unit (MCU) is used to control a radiator fan based on rpm and water temperature qualifiers. The control equation is then linked to a specific output that switches the fan on at the appropriate points

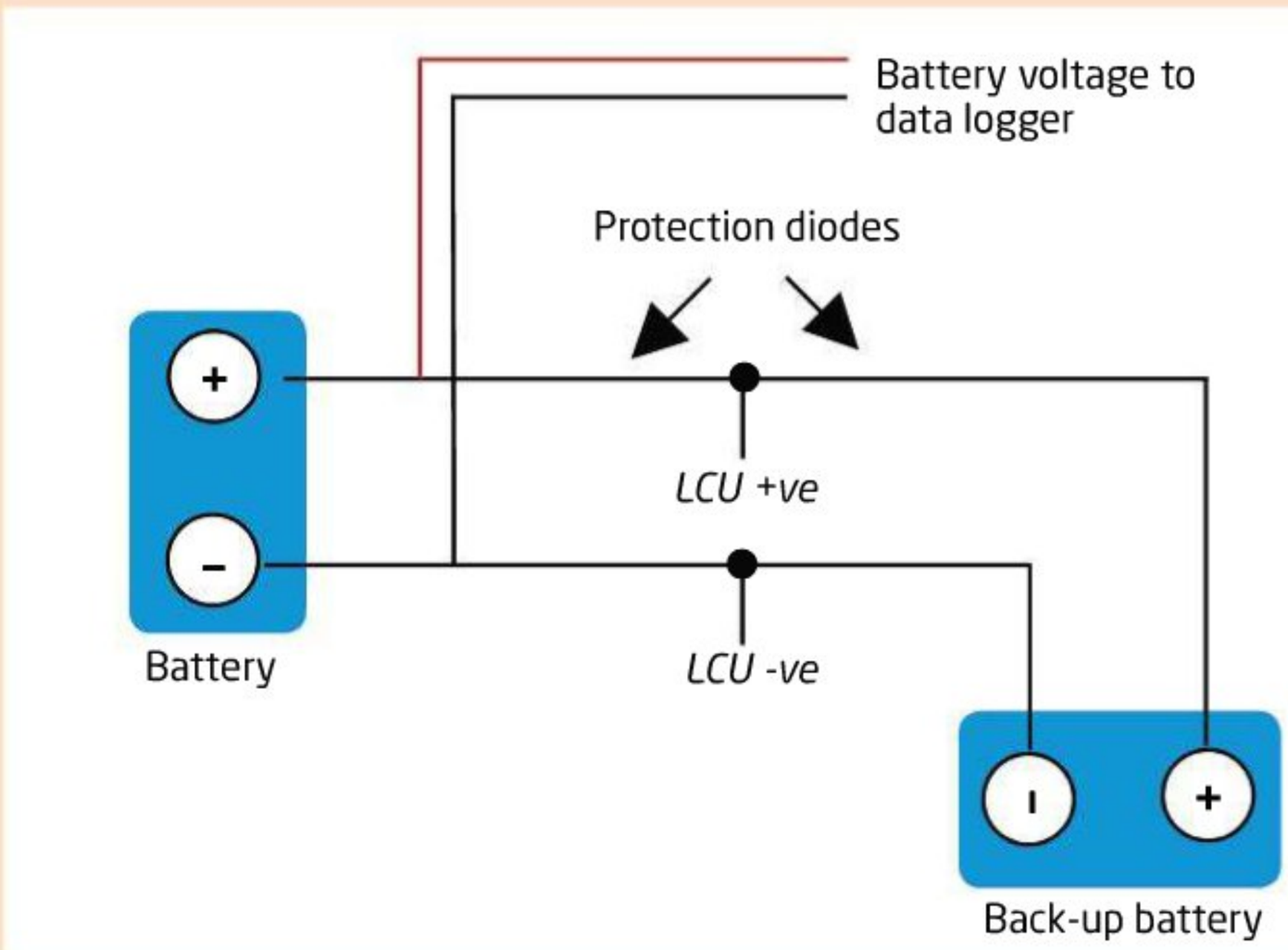
Figure 2: temperature control in a closed-cockpit coupé. The air con is switched on at 30degC and off at 28degC to create a stable environment for the driver

Alarms are another function that the data logger can easily control, if it is connected to a display. A simple control function to set off an alarm could be triggered in the same way. For example, [Water Temp] > 100. In this case, a control is not necessary, but the logger will send a message to the display to trigger an alarm instead. This same event can also be recorded on the data logger so that it is clear in the data that the alarm event occurred.

These are just basic examples. Of course the data logger is capable of more elaborate control functions, and it is possible to create a maths channel that allows variable limits based on other events, so it is possible to trigger events based on the lap beacon, or on distance and there are many instances when it can be beneficial to use this to control or trigger events. The data logger generally has accurate systems to determine distance and is therefore an ideal candidate for this type of control. Some examples of distance-based control could be ride height, where motors could be controlled by the data logger to reduce the ride height at a suitable point on the circuit. Similar control strategies could be implemented for other aerodynamic devices, provided they pass scrutineering of course.

CHALLENGE ANSWER

Last month the challenge we set you was to work out why multiple data files were created during a single outing. It would seem that the data logger is losing power for some reason but this is difficult to troubleshoot as data is missing. One way of keeping the data logger running is to fit a battery to back it up, but this might not be enough in order to find out what is going on with the power supply. For this, a small circuit is needed so the battery is only active when the car power supply goes down, and also feeds the car power to one of the analogue ports of the data logger so it is possible to see exactly what is occuring when the power goes down. It may be necessary to fit a voltage divider on the analogue signal in case there are big spikes in the voltage or if the data logger can only accept a 0-5v signal.



CHALLENGE

A strategy for pumping oil out of a catch tank on a Sportscar is needed. A sensor in the catch tank measures the amount of oil in the tank, but we need to ensure the oil level remains within limits and uses minimal amounts of pump time. What could be a useful strategy and maths channel to implement this?

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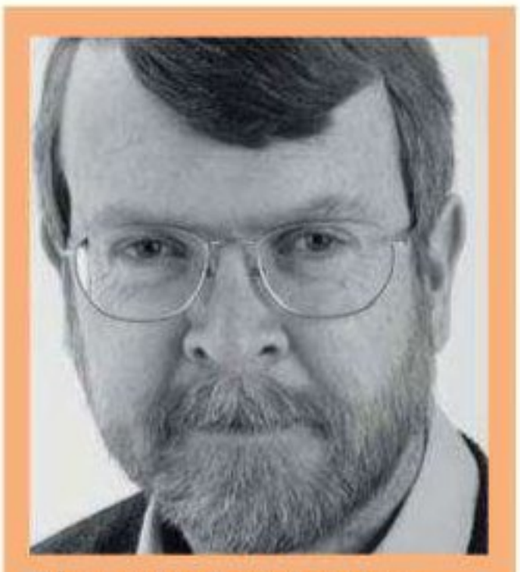


Simon McBeath offers aerodynamic advisory services under his own brand of SM Aerotechniques – www.sm-aerotechniques.co.uk. In these pages he uses data from MIRA to discuss common aerodynamic issues faced by racecar engineers

The balancing act continues...

...this month with the other of the two sports racers on test

This month we continue with our examination of data obtained in the MIRA full-scale wind tunnel on two completely different sports racers, CTR Developments' Arachnid closed coupé and the Force LM of Force Racing Cars. Our focus shifts to the Force this month as we follow the process from the first baseline run to achieving a better balanced set up.

The Force and the Arachnid are not only very different in aerodynamic concept, but the first runs on each also demonstrated that we were dealing with very different starting points in terms of aerodynamic balance, as expressed by the '% front' value (see table 1). This indicator tells us what proportion of total downforce acts on the front wheels, and one of the main aims during our all too brief Aerobytes sessions is to try and achieve a per cent front downforce value that approximates the static front weight percentage. While this approach doesn't deal with dynamic changes of ride height, pitch, roll or yaw, it does provide a better balanced steady-state set up that's usually in the right ballpark. This can later be fine tuned on track. The MIRA wind tunnel's fixed floor, even with its boundary layer control fence in place, tends to reduce the downforce generated by low-mounted front wings, splitters and underbodies, relative to their performance out on track, so this needs to be borne in mind when establishing a balanced set up in this wind tunnel.

"the logical first move was to increase rear downforce"

So table 1 reminds us of the baseline data on both cars. Last month we followed the process of balancing the Arachnid and, because that car, like many sports racers, had limited adjustability at the front, it was necessary to shed some rear downforce in order to achieve the desired balance (in that case about 48 per cent front). The Force started out with over 57 per cent front with a target figure of around 36 per cent front to match the rear-biased weight distribution typical among hillclimb cars. But with an adjustable dual-element wing at the front, as well as the rear, and less concern about increases in drag than was the case with the circuit-bound Arachnid, the Force offered more tuning options.

FORCE BALANCING

The immediate options with the Force were to either shed front downforce or add rear downforce and, bearing in mind its competition environment, the logical first move was to increase rear downforce. Table 2 shows the first two steps, which saw the overall rear wing angle increased. The changes to the coefficients are expressed in table 2 in 'counts', where a coefficient change of 0.100 = 100 counts. The Greek letter Δ

Table 1: starting coefficients at 80mph

	CD	-CL	-CLfront	-CLrear	% front	-L/D
Arachnid	0.534	1.084	0.115	0.969	10.60%	2.030
Force LM001	0.676	1.263	0.725	0.539	57.40%	1.868

Table 2: the effects of increasing rear wing angle

	ΔCD	Δ-CL	Δ-CLfront	Δ-CLrear	Δ% front	Δ-L/D
Rear wing from min to mid	+20.5	+93.0	-23.0	+115.0	-5.635	+78.5
Rear wing from mid to max	+33.0	+76.0	-30.5	+106.5	-4.880	+16.5

Table 3: the effects of increasing lower rear wing angle

	ΔCD	Δ-CL	Δ-CLfront	Δ-CLrear	Δ% front	Δ-L/D
Lower rear wing angle increase	+17.5	+26.5	+4.0	+22.5	-0.58	-11.0

Unusually among sports racers, the Force LM offered adjustable front and rear wings. Notice the flow from the front wing encountering the rear wing

(delta) represents the change to each parameter as a result of the configuration adjustments, relative to the previous set up.

Increasing the overall rear wing from its minimum to the maximum available angle achieved almost exactly half of the required total balance shift to the rear. And, although drag increased with each rear wing increment, downforce increased sufficiently for the car's efficiency (-L/D) to improve. However, notice that the first wing angle increase was considerably more efficient, generating a greater -L/D increase, and also more effective, generating a bigger downforce gain for less additional drag than the second adjustment, even though the angle increments were the same. This suggested that the rear wing was edging towards the upper end of its operating range.

Next, the lower rear wing angle was increased, and this produced the results shown in table 3.

Although the lower rear wing is just a single-element device, the angular adjustment made was similar to the upper rear wing increments, and so it was slightly surprising that the effects of increasing its angle were relatively modest, though it is operating in a less favourable environment, and is also of narrower span than the upper wing. Nevertheless, a further small shift of downforce to the rear was obtained.

The rear wing angle was increased overall, shifting balance significantly

Increasing the lower rear wing angle made a minor difference

Reducing front wing flap angle had a significant effect, not just at the front

ATTENTION FRONT

Having maximised the available rear wing angle settings, attention shifted to the front end, and specifically to the front flap settings. The effects of decreasing the front flap angle from the maximum (hole four) to hole two, and then to hole one (minimum) are shown in table 4.

As expected, this offered a very powerful method of altering both downforce and balance, and the front percentage soon overshot the 36 per cent target figure, dropping to 32.48 per cent front with the front flap on its minimum setting. Before moving onto the final adjustments to attain the target balance though, let's just pause and look at table 4 more closely, because two things in particular stand out here. Firstly, drag went up slightly with decreasing front flap angle. Secondly, rear downforce increased by more than might be expected with reducing front flap angle, certainly in comparison with the front downforce shifts that resulted from the rear wing angle alterations shown in table 2. Both these observations are explainable if dropping the front flap angle increased the flow to the rear wing and enabled it to produce more downforce, which in turn would generate increased induce drag.

Returning to the quest for an aerodynamic balance, because the front flap increments were apparently a little coarse to dial straight to the 34-36 per cent front required, two adjustments were made simultaneously – the front flap was raised by one hole, and a 12.5mm Gurney was added to the rear wing flap (actually to the outer sections of the rear flap). The changes, shown in table 5, produced an efficient gain in overall downforce, along with the requisite balance shift to the front (the balanced numbers are shown compared to the starting numbers in table 6).

As with the Arachnid last month, balancing the Force was achieved with almost no change in overall efficiency. But whereas downforce had to be reduced to balance the Arachnid, the Force benefited from a 17.4 per cent increase in total downforce as it was balanced.

Thanks to CTR Developments, Force Racing Cars, Graham Wynn

Table 4: the effects of decreasing front wing flap angle

	ΔCD	Δ-CL	Δ-CLfront	Δ-CLrear	Δ% front	Δ-L/D
Front flap from max. to hole 2	+9.0	-53.5	-127.5	+73.5	-7.315	-94.0
Front flap from hole 2 to min.	+4.0	-59.0	-111.0	+52.5	-6.535	-87.5

Table 5: the effects of increasing the front flap by one hole and adding a rear Gurney

	ΔCD	Δ-CL	Δ-CLfront	Δ-CLrear	Δ% front	Δ-L/D
Front flap up 1 hole + Rear wing Gurney	+36.0	+137.0	+76.5	+60.0	+2.155	+92.5

Table 6: the baseline and the 'balanced' numbers, with the changes in counts

	CD	-CL	-CLfront	-CLrear	% front	-L/D
Baseline	0.676	1.263	0.725	0.539	57.40%	1.868
Balanced	0.796	1.483	0.514	0.969	34.65%	1.864
Change, counts	+120	+220	-211	+430	-22.75	-4

Simulation in action

Danny Nowlan takes a look at the ACO's latest entry-level LMP formula

BY DANNY NOWLAN

For the last couple of years I have been writing on many matters related to racecar vehicle dynamics and simulation. One of the recurring themes I have tried to make clear is that racecar simulation isn't hard. It's just different, and when you go about it properly it all falls into place. The other point I have tried to stress is that if racecar simulation is going to be of any use to you, you have to do the modelling yourself. There are no shortcuts. But now I think it's time we considered an actual case to ram home the point, so this month I'm going to discuss the PR1 Motorsports' Le Mans Prototype Challenge (LMPC) campaign in the American Le Mans Series (ALMS). The LMPC category is effectively a spec LMP2 racecar and, in Europe, is known as Formula Le Mans.

This year PR1 Motorsports has won two races (Road America and Petit LeMans). The team has also gone toe-to-toe with far better resourced and funded competition, and ChassisSim has been a critical part of its testing programme, making for the perfect case study of just how effective racecar simulation can be when used correctly. I should add at this point that I've had very little to do with the creation and running of this vehicle model.

Let me also state from the outset that, because this is a car that is currently being used, I am unable to give you model or car specifics, so I am not in a position to give you hard-won tyre characteristics, aero properties and other car-specific insights.

However, I am able to tell you *how* they did it, because once you understand the process, it will fundamentally change the way you go racing. There's an old saying, 'Give a man a fish, you feed him for a day. Teach him how to fish, you feed him for a lifetime.' So let us explore the process PR1 Motorsports went through.

The subject of our case study – PR1 Motorsports' LMPC entry

The first step in the process was to read the racecar manual, and use this information to modify a car model that most closely resembled the LMPC car. Even to state this is bordering on the obvious, but it just goes to show you don't need to over complicate things. The biggest mistake I see in people starting racecar simulation is to get too complex too soon. When you're starting out, keep it simple and basic, and just modify an existing model. This way it's easy to see where you go wrong if you make a mistake. What was extracted from the manual was the following:

- **Tracks, wheelbase and masses**
- **Geometry information and pick-up points**
- **Motion ratios**

This is the primary information you want from your racecar manual for setting up a simulation. It is nice if you are given aero information and bar rates too, but these always needs to be double checked with real-time data. What we have here is good enough for a start.

INSUFFICIENT INFORMATION

Before we move on to the next step in the process, let me outline how you fill in the blanks when you have insufficient information. If you don't know what a parameter is, you just fill it in from an equivalent car. This is why it is important to start from a base model that is as close to your target car as possible. There is no point being a hero and starting from scratch. Trust me, you'll get no brownie points for it. While this approach isn't perfect, it is a start and, if you're going to be successful with this, you have to get going.

The next step in the process was to construct the aeromap of the car. Given the aeromap wasn't supplied, there was only one option – run an aero test, and this was incorporated into the course of normal testing (no coast-down tests, just simple in and out laps). Fortunately, there was a decent engine map, so there wasn't too much guessing required on the engine side. While I won't go into specifics, this was the basic testing procedure: see **table 1.**

The baseline rear wing was the rear wing setting as specified in the starting set up, and the ChassisSim aero toolbox was used to construct the results.

The goal of runs 1-6 was to establish the necessary data to establish the ride height sensitivity map, the idea being to populate as much of the front and rear ride height envelope as possible. When you are done, you should have something that looks like as shown in **figure 2**.

The thing to note in figure 2 is the spread of the results. In a perfect world, what you are

"There is no point being a hero and starting from scratch"

Table 1	
Run no	**Set up**
1	frh0 and rrh0 + baseline rear wing
2	frh0 and rrh0 + d_rrh + baseline rear wing
3	frh0 and rrh0 + 2*d_rrh + baseline rear wing
4	frh0 and rrh0 + 3*d_rrh + baseline rear wing
5	frh0 - d_rrh and rrh0 + baseline rear wing
6	frh0 + d_rrh and rrh0 + baseline rear wing
7	frh0 and rrh0 + baseline rear wing
7	frh0 and rrh0 + baseline rear wing + two holes
8	frh0 and rrh0 + baseline rear wing + three holes
Just to clarify the nomenclature, frh0 = baseline front ride height as specified in the starting set up rrh0 = baseline rear ride height as specified in the starting set up d_rrh = delta rear ride height d_frh = delta front ride height	

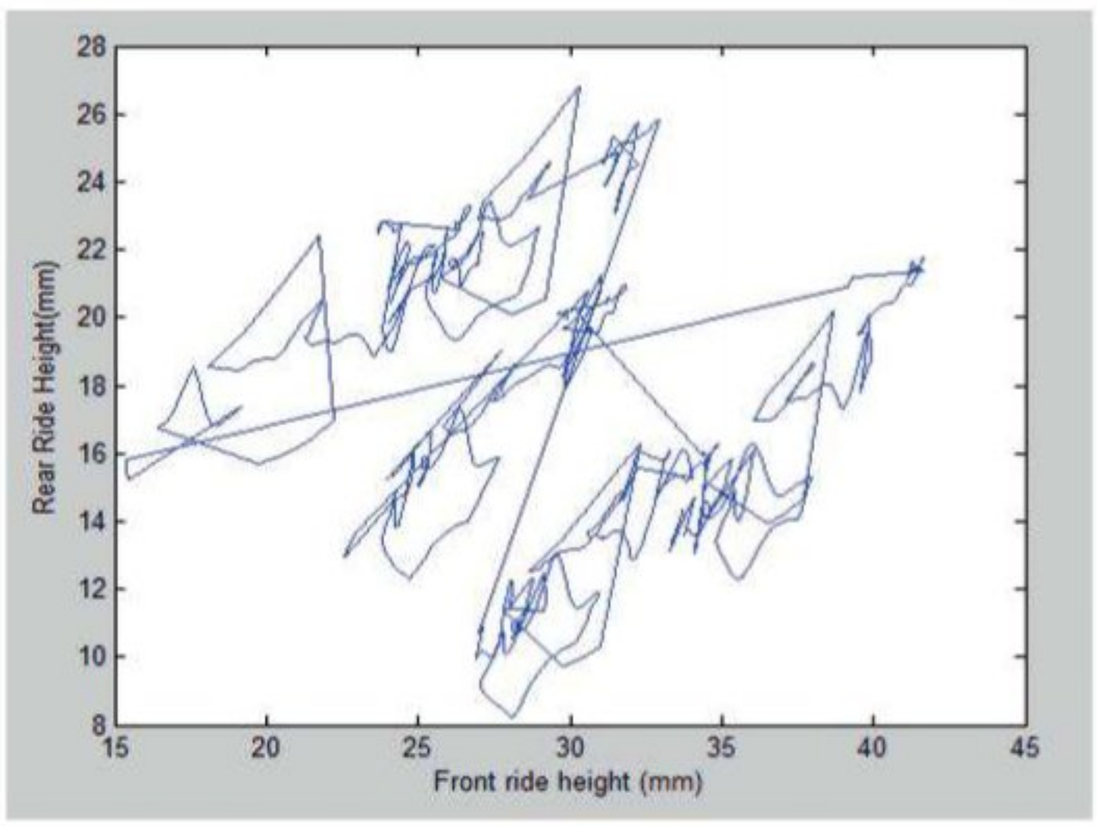


Figure 2: plot of front ride height and rear ride height sweep

Table 2			
Configuration	**CLA relative**	**CDA relative**	**Aero balance offset**
Baseline	1	1	0
+ two holes of rear wing	1.02	1.03	-0.02
+ four holes of rear wing	1.04	1.05	-0.04

after is something that looks like a square. The more results you have and the more widespread they are, the better the aeromap is going to be, and the LMPC car was a case in point. In terms of the steps in creating this aeromap, the following procedure was adopted:

- **The ChassisSim aero toolbox was run separately from runs 1-6**
- **The individual files where saved and re-named**
- **They where combined into a single file**
- **The aeromap curve fitting algorithms in ChassisSim were used to generate the aeromaps**

I should add here that because this is track-generated data, the aeromap was a work that did need to be refined. This is just due to the nature of what you are dealing with. But, because this foundation had been established, this proved to be a very cost-effective way of understanding the car's aero characteristics.

Once the ride height sweep was done, the ride heights where re-set and the rear wing was swept, to enable its effect to be quantified. The idea was to compare the rear wing back to the baseline configuration so it could be used to adjust the values in the ride height sensitivity map. This was done by running the ChassisSim aero modelling toolbox and looking at the average results. These were then scaled, relative to the baseline, the results of which should look something like what is shown in **table 2.**

While these aren't the actual values, what this table tells you is that for, say, + two holes of rear wing, we take the ride height sensitivity maps from our baseline, multiply the downforce map by a factor of 1.02, multiply the drag map by 1.03 and the aero balance offset is shifted back by two per cent. Again, not perfect, but still an effective method of quantifying what the rear wing was going to do.

The aeromap made its presence felt immediately, because the next race following this was a notoriously bumpy street circuit. Consequently, bump rubbers and bump rubber gaps are absolutely critical, and this aeromap proved helpful in determining the appropriate package to run.

"When you're starting out, keep it simple and basic"

TOOLBOX OF THE TRADE

The next step in the process was to determine the tyre model, and this is where the ChassisSim tyre force modelling toolbox came into play. This was specifically created to reverse engineer the tyre model from race data, and where it really comes into play is when you have no data from tyre manufacturers to work with. All that was done with the LMPC car was, once the aero model was validated, a monster file was created from track data and imported. All the check boxes were then ticked and the tyre force determination was run.

Once this was completed, the results were imported into the tyre model.

While this was an iterative process for the LMPC car, once it was done the tyre model would give both aero and mechanical set up direction for the car. The reason it is an iterative process is that you are using actual data to construct the model, so it is going to take a couple of goes to get it right.

Once the aero and tyre model was in place, the model was slowly refined at each subsequent race meeting, by comparing simulation data run before the event with actual data from the event. This allowed the simulated trends to be validated and the model improved. Once the model is at this point, we are not talking about huge changes, just minor tweaks here and there. While this might come across as fudging, it actually isn't. You are using the simulator as a highly capable calculator, to help really understand what the car is doing. This is the pay off for using racecar simulation, and why it is so critical to do the modelling yourself.

The result of all this in the PR1 Motorsports' case wasn't just very good correlation, but also a very fast racecar, which produced four pole positions and two wins in the 2010 season with only one series test. In fact, the pole position at Petit Le Mans was secured without the team even being present for pre-event testing.

The important thing to note here is there was no black magic involved; everything came down to simple attention to detail – looking at data, doing things in an orderly manner and, above all, using common sense. It also neatly illustrates how, if you use racecar simulation properly, it can tell you so much more about the car you are running, which is why it is such a vitally important tool for the serious racecar engineer.

4 speed ahead

Japanese Formula 4 offers an exciting insight into the impossible – a spec series that, well, isn't...

"F4 was always intended to have open regulations and technical freedom"

Japan's motorsport engineers had become frustrated. All of its premier open-wheel series had become spec, with Formula Nippon and Formula Challenge tightly controlled, one-make classes. The antidote, dreamt up by the Japanese Motorsport Industry Association (JMIA) was called F20. The rules were liberal, all cars would use an off-the-shelf monocoque and all of the engines had to breathe through a 20mm restrictor (hence F20). Beyond that, rules barely existed. Four prototype cars were built, but the concept was dropped

BY SAM COLLINS

when the long-established Formula 4 series decided to allow in the JMIA-spec cars.

'Most of the main race series in Japan, like Formula Nippon, use a one-make chassis, but over the years, at tracks like Suzuka, a number of small constructors have grown up, and they have been left with nothing to do. The mentality of the Japanese car companies is to outsource cars overseas – Honda built its F1 cars in England, Toyota in Germany,' explains Minoru Hayashi, the founder and chairman of the JMIA. 'F4 was established over 30 years ago and was always intended to have open regulations and technical freedom. There was a move to introduce carbon chassis cars into F4, but some of the small constructors were worried that they could not afford to do this.'

DIFFERENT TECHNOLOGY

As a result, the challenge that faced the JMIA was to create a competitive, composite-chassis car for around the same price as the established aluminium-chassis cars, such as the Myst, already racing in F4. Hayashi's firm, Dome, as Japan's leading motorsport composites firm, was tasked with designing and producing the chassis.

'Because of the constraints, we had to employ some different technology when making this chassis. It has no honeycomb core at all, so that reduces the manufacturing complexity and the cost,' Hayashi reveals. 'The life of the chassis is longer than a normal composite tub too, because you do not have to worry about delamination with no honeycomb. Our worry now is that the life is too long!'

The tub, named UOVA 4, was

The B-Max RK01, features include Öhlins dampers and a Honda engine

The Mooncraft MC090

The Zap F108, designed as a styling exercise by Dome founder, Minoru Hayashi. Dome produces the monocoque but the car is built by Zapspeed

The Tokyo R&D RD10W, developed by Osamu Watanabe under the guidance of Masao Ono (the focus of our Designers feature this month)

The Uova 4 carbon tub was designed all along to be versatile, enabling it to be used in series outside of Formula 4. Advanced aviation technology was used in its construction so it is as smooth on the inside as it is on the outside

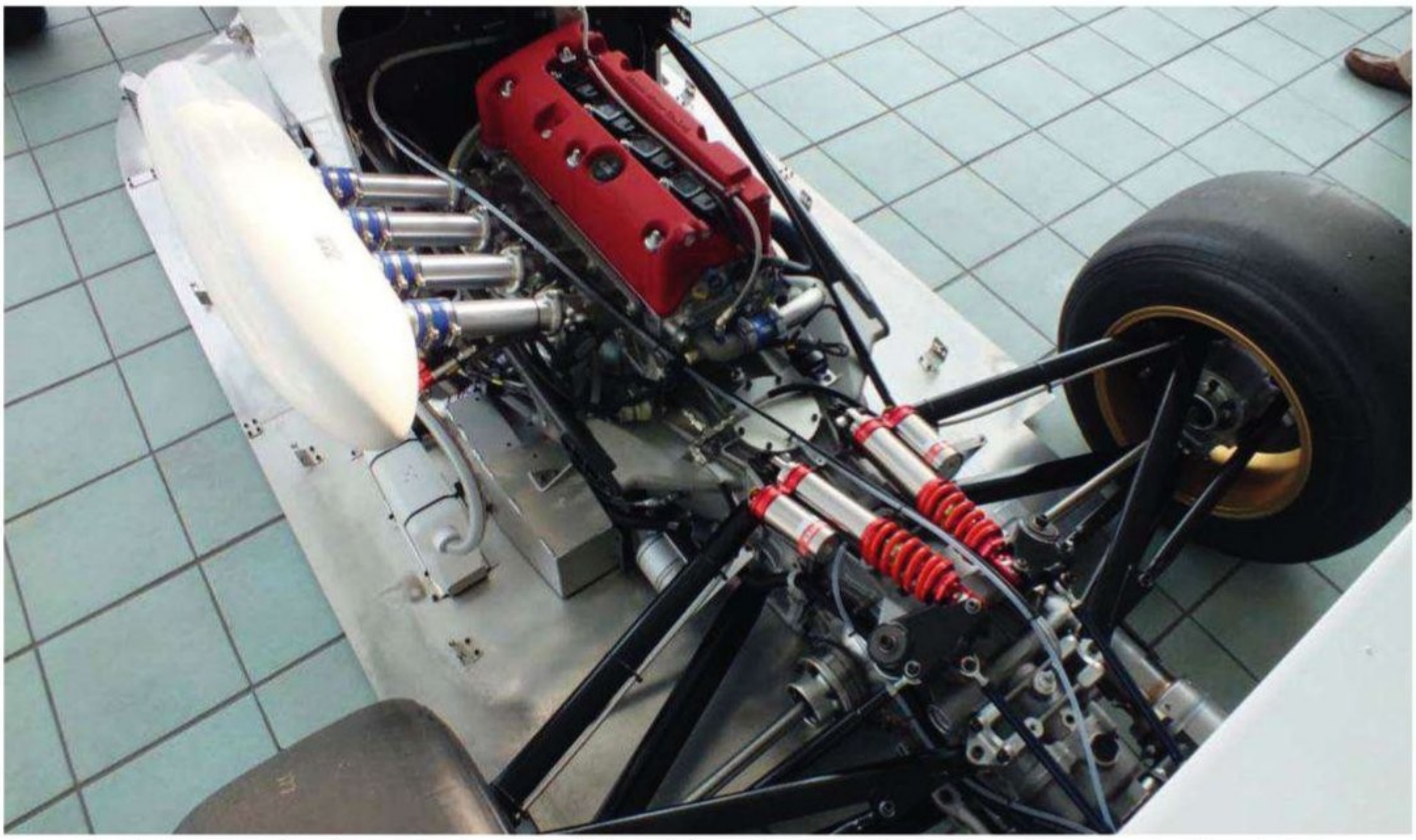
deliberately made to be highly versatile, as the JMIA has the intention of being able to sell it to a wider market. To increase the stiffness of the tub, the thickness of the carbon fibre can easily be increased. 'We have used this concept on a few projects for OEMs, and we think it would be possible to use on larger cars, too.'

AVIATION APPLICATION

What is surprising is when you look inside the UOVA 4 tub, for it is as smooth as the external surface, and looks exactly as you would expect from a car using conventional external tooling. 'One of the reasons we can do this and other manufacturers have not quite achieved it yet is that we developed this technology on an aviation project. In that application, the outside had to be as smooth as the tooling side as it was an engine nacelle, and it would be in the airflow on both sides.'

"no limit in the number of changes that can be made to the body once the season is underway"

CAD illustration showing the main components of the F4 concept. Note the front crash structure. Wing profiles are free but must be rectangular in plan view



Rear end detail of a Japanese Formula 4 car, showing the popular four-cylinder Honda engine (other 2.0-litre engines are permissable), Toda Racing Fightex dampers and Toda Racing sequential gearbox. The dampers, and the spec Yokohama tyres, are specially developed for the series

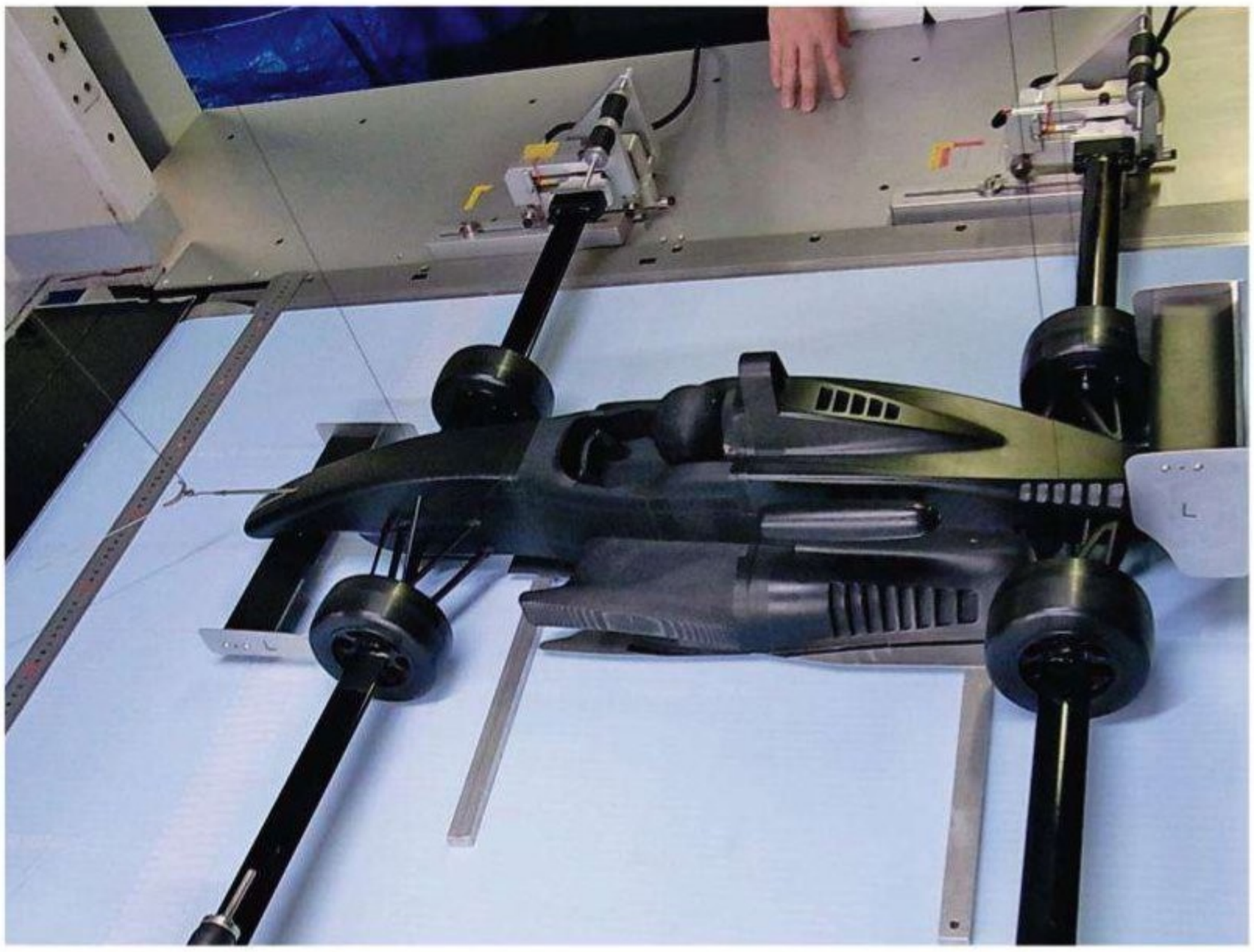
CRASH STRUCTURES

Safety was one of the main reasons F4 decided to adopt the JMIA's new chassis concept, and it features a rudimentary tubular steel structure that helps in side impacts, whilst a front crash box serves the same role in head-on shunts. This is aluminum as standard, but a composite unit is an optional extra. 'During one of the opening race meetings with the new formula cars, one car had a very heavy crash and it totally flattened the aluminium crash box,' reveals Osamu Watanabe, the F4 project leader at Tokyo R&D. 'The accident raised a number of questions about the safety of the standard crash structure, and there are those who insist that all cars should now be fitted with composite crash structure.'

Despite the innovative technology, Dome could not quite achieve the target of the composite chassis costing only as much as an aluminium chassis – well, at least not yet. 'We found it really hard to achieve the same cost as the older cars as the UOVA 4 is manufactured in Japan. If we were to get some more volume and move it to our facility in Thailand, then we could probably bring the cost right down. I believe that most of the small series around the world will end up eventually using monocoque like this, and a racing concept like it,' says Hayashi enthusiastically. The older cars cost around ¥5 million (£40,950 / $64,655), whereas the new cars will set owners back between ¥6.5 million and ¥7.3 million (£53,225-£59,775 / $84,050-$94,400), where a cost cap comes into effect. Crucially, this upper limit prevents the bigger manufacturers like Mooncraft, Tokyo R&D and Dome indulging in a wind tunnel-fuelled race.

AERO REGULATIONS

This is important as the aerodynamic regulations are incredibly loose, as Watanabe explains. 'With the wings, the rules only state the plan view of the wing, and that must be rectangular. The section is free, but it must be single element. The end plates must be flat, but the shape is free. Some of the safety equipment causes us limits – for example, the nose must cover the crash box and, in the sidepods, the side impact structures should be covered, but as long as they are the shape is free and you can place and shape the radiators however you want. The floor of the car must be flat, from the rear face of the front tyres all the way to the centreline of the rear axle. Behind that no panels are allowed, so no diffusers!' To further add to this,



Three out of the four cars were developed in the Mooncraft quarter-scale wind tunnel. This is the Tokyo R&D car

TECH SPEC

Chassis: Uova 4

Weight: 46kg

Length: 1758mm

width: 585mm

Height: 962mm

Skin thickness: 6.7mm

Fuel tank capacity: 35-40 litres

Height: 4200mm

Width: 1700mm

Height: 990mm

Track: 1422mm (F), 1388mm (R)

Weight: 483kg

Suspension: double wishbone with pushrod-actuated dampers

Fuel cell: ATL

Seat Belts: Takata

Transmission: five-speed sequential

there is no limit in the number of changes that can be made to the exterior body once the season is underway.

Some of the fixed mechanical components give the new-specification F4 cars a slight advantage in aerodynamic terms, as Watanabe explains. 'Compared to the old cars, these have a longer wheelbase so are better for us are dynamically, with more services to work with. It also gives advantages in weight distribution. The extra length comes from a long bellhousing and a long transmission.'

Suspension mounting points on a chassis that has no honeycomb core require metal load bearing plates to be added on the inside of the tub. Note the pushrod-actuated Toda Racing dampers. Upright design is also free

COMPONENT CHOICE

Some other critical parts of the new car are fixed: the suspension, bellhousing and the sequential transmission are all off-the-shelf components. But, in other areas, teams have total freedom. 'In the suspension, some people use dampers from Toda Racing, but Öhlins are also used. With the brakes, Alcon and Nissin are most common, but some people run Performance Friction, Brembo and AP Racing, too,' explains Watanabe.

The engine can be either a Toyota 3ZR tuned by Tachi Oiwa Motor Sports (better known as TOM'S), or a Honda K20A tuned by Toda Racing, but it is likely that if someone turned up with another 2.0-litre unit it would be able to compete. Currently, the two engines are fairly evenly matched, the Toyota being around 10kg lighter but the Honda producing slightly more power. A spec ECU from Japanese electronics firm R & Sports must be used, and this goes some way to maintaining the balance of performance.

"no one design has proven dominant"

But with everyone using the same base chassis, and limited choice of major components, is this not just another spec series? 'Selling a complete car is something the European constructors do, so why would we want to do that?' questions Hayashi. Indeed, though the chassis may be spec, Formula 4 concept has a large number of important technical freedoms and, with two seasons of the new look formula so far completed, no one design has proven dominant, though the carbon chassis cars are clearly more competitive than the older aluminium cars. With such aerodynamic freedom, it is also an exciting series to watch, and for engineers to work in, so have the F4 rule makers have cracked the problem that faces IndyCar with its aero kit concept?

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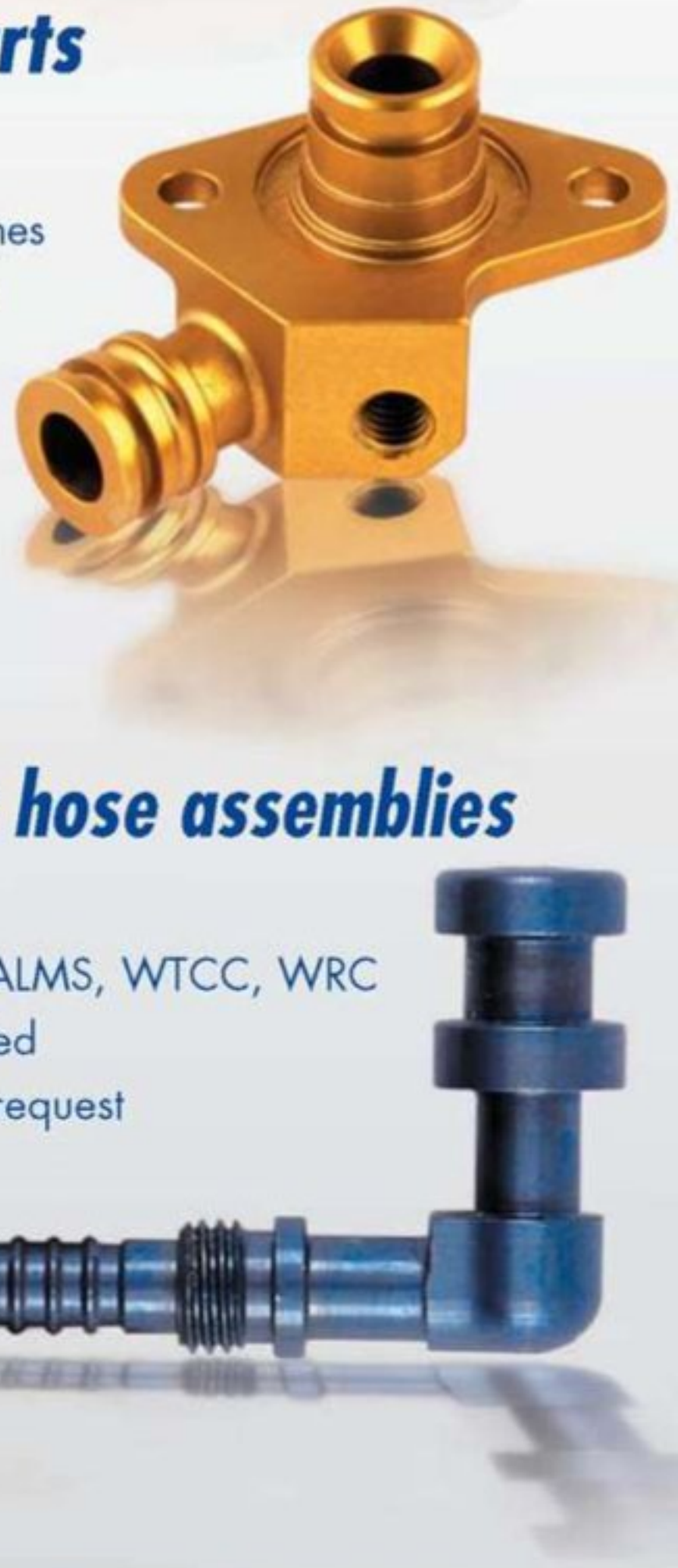

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Grand designs?

Though the FIA approved the concept of production GT cars contesting world rallies in January, almost a year down the line the Lotus Exige is the first to be homologated

BY MARTIN SHARP

What is Group RGT? The September 2010 FIA World Motor Sport Council put it like this: 'A specialist group representing interested parties will review the possibility of introducing GT cars to WRC events.' The relevant Appendix J 'RGT' category rules were subsequently published in January 2011, with a '(11-12)' revision in September covering modifications applicable on 1 January 2012. The answer is the RGT class is essentially a 'Group N' for GT cars, the technical regulations defining two-wheel drive cars only.

At the time of going to press, no GT model had been homologated to compete in international rallies, and indeed, public perception of the group has remained low.

Until, that is, Claudio Berro, Lotus' ex-Ferrari competition director, announced at this year's Frankfurt Motor Show that the Exige will be homologated into RGT for 2012, specifying Monte-Carlo, Corsica and San Remo as the targeted events. Before that announcement, Exiges had already been seen testing on Spanish tarmac special stages.

Among national series, GT cars currently contest rallies in France, Belgium, Spain and elsewhere. Cars such as Porsche 996s and 997s (GT3s), Nissan 350Zs, a few Lotuses and the Aston Martin V8 Vantage-based Rally GT have been catching the imagination of rally fans for years. That the FIA has now provided a regulated framework for such types of car to rally internationally – including on World Rally Championship (WRC) events – is encouraging, yet it is intriguing that no manufacturer has, prior to Lotus' announcement, taken the initiative.

GENTLEMAN DRIVERS

The Aston, developed to rally-ready form by Prodrive in the UK some seven years ago, was designed to meet the needs of 'gentlemen drivers' who want to go rallying in GT cars. At the time, the FIA seemingly did not wish for such cars to contest WRCs, but then Jean Todt became president, and the RGT regulations were announced. While perhaps a little large and unwieldy for tight and twisty special stages, the Aston Martin Rally GT placed second in the French Series GT class on its debut at the 2006 Lyon-Charbonnier.

Today, Prodrive develops and runs the Mini John Cooper Works WRC in the World Rally Championship, but its boss, David Richards, did investigate the feasibility of homologating the Aston into RGT: 'The FIA looked at the existing Aston Rally GT,' he explains, 'It found the existing rollcage would not be eligible for the WRC. To bring the 'cage to the necessary spec would

GT rally cars have always been popular, both with competitors and spectators, and the R-GT category could bring them onto the World Championship stage

have required a lot of work, so I decided not to do it.'

In an earlier incarnation, Prodrive was David Richards Autosport, which developed and ran rally cars for Rothmans Rallying, predominantly Porsche 911s. So would Richards consider running Porsches in RGT? 'No, we'll not go back to Porsches. We've already got a lot on with the Mini programme,' stated the Prodrive boss.

Nevertheless, perhaps the most obvious RGT contender could be a derivative from the Stuttgart stable. Porsche already has a long and successful history in rallying, and today, privateer 996s and 997 GT3s tend to take GT category victories and even occasional outright wins in national rallies. To add further perspective, the Rallye Alsace Grand National this September / October was run on the same stages as the WRC Rallye de France. It was won by a Subaru Impreza WRC S12B, while second was a Porsche 996 Cup car.

But if the Lotus Exige is indeed to contest Monte-Carlo next year, and if the Lotus is homologated for international rallying, it would then be reasonable to assume that other GT manufacturers would want a slice of the action / publicity, too.

While it is fair to assume high-profile manufacturers compete in motorsport to win outright, success in an accessible category such as a Group N formula for GT cars run on world-level rallies must surely be an attractive proposition to a manufacturer.

If so, why are there no RGT-homologated cars yet? Focussing on Porsche again, UK-based Tuthill Porsche is renowned for its historic specification rally 911s. Aware of the new RGT regulations, Richard Tuthill entered a 996 for the WRC Rally Sweden in February this year. The entry was, of course, welcomed with open arms by the organisers, but there was a snag. Tuthill: 'It was nothing but a good idea, and I fancied doing Sweden this year, so I put an entry in because there was a 996 - which actually made it a bit undesirable - already homologated in Group NGT. RGT is a step up from NGT [as used in France and Belgium]. Well, close, but they're just doing it at a national level, it's not FIA.'

To compete in Sweden, the Porsche needed FIA RGT homologation, which requires the manufacturer to submit the homologation and then, once approved, teams to build the cars, similarly to Group N: 'We need the manufacturer to be involved to make a safe, good, strong car,'" explained current FIA technical chief, Jacques Berger.

The technical boss exhibited his genuine passion for motorsport when asked if he felt that once one RGT car is homologated, other manufactures will join: 'I hope, I hope. It's like everything - I think everybody was waiting to have the first car, then perhaps everybody will follow.'

So what are the distinguishing parameters of a production car eligible for RGT homologation? Would a 'sports car', for example, be eligible? The unique challenges of rallying mean two-wheel drive production cars designed for swift tarmac driving would have little chance of success on gravel stages against purpose-designed, four-wheel drive opposition. But World Rally Cars and S2000 cars are not in opposition to RGT, it is a category on its own, one that specifically bans four-wheel drive cars. Perhaps then, the Lotus announcement will encourage other 'GT' car manufacturers to contest 2012 WRC stages?

"I think everybody was waiting to have the first car, then perhaps everybody will follow - I hope"

- Jacques Berger, FIA technical chief

The Lotus Exige RGT has already been seen testing on Spanish tarmac special stages and will be homologated for RGT 2012 competition

RGT REGULATIONS, IN ESSENCE

- Two-wheel drive series production GT cars with a minimum weight of 1200kg (2646lb) for those with engines over 3.1-litres, 1050kg (2315lb) for those below; ballast allowed
- Cooling systems free, though the oil cooler must be standard or an homologated variant option
- A mechanically activated throttle linkage can be homologated
- Wiring looms free, but with no additional input sensors or actuators allowed. Only water temperature, oil temperature, oil pressure and engine speed sensors are allowed and each may be linked to one or several visual display units (with data recording capability) by a loom independent of any other loom

Production car data logger only allowed, unmodified

- The injection ECU is free, but sensors must remain standard. Injectors and injector rails can be modified or replaced, provided threaded connectors are still used for fuel lines and pressure regulators. Injection components downstream of the airflow sensor controlling quantity of fuel entering combustion chambers can be modified but not replaced, provided they have no influence over the quantity of air admitted
- No electronics in the drivetrain or electronically, pneumatically or hydraulically-controlled differentials. Final drive ratio and differential are free, but the ratio must be homologated
- Gearbox must be in the same place and orientation as the production car, but its design is free, providing its linkage is direct and only mechanical, although steering wheel paddle shifts can be homologated and may be pneumatic. A gear cut is allowed
- Suspension parts may be reinforced, but not wishbones and anti-roll bars, and wishbones must be original or homologated. Damper design is free, providing their number, type and attachment points are not changed. Linear bearings are prohibited
- Wheels are free, within the homologated maximum diameter. Spare wheel is compulsory and a modified installation may be homologated in variant option
- An hydraulic handbrake may be homologated, providing its lever is positioned as per RGT homologation
- Lateral collision protection foam must be fitted
- FT3, FT3.5 or FT5 fuel tank is mandatory
- The safety 'cage must be to WRC or S2000 rules

Formula Pacific?

Already the fastest race series in Asia, Formula Nippon is preparing for a major revamp that could see it putting other, more high-profile western series to shame

BY SAM COLLINS

Around Motegi's 4.8km road course IndyCar was shown up by another spec series. Then, in free practice at the Japanese Grand Prix, two of the Formula 1 teams also fell foul of Asia's fastest racing category.

Formula Nippon grew out of the Japanese F3000 series in 1996, and has steadily grown in popularity over the years. It attracts many top European drivers and the cream of the domestic talent. Currently, the series runs a single spec chassis - the Swift FN09 - with two car manufacturers, Toyota and Honda, supplying engines. But the series is once again about to change, according to Hiroshi Shirai, president of Japan Race Promotion Inc, the series' organisers.

'I want to expand the series to the whole Asia Pacific region, he says enthusiastically. 'The Formula has a long history in Japan and the level of the series is high, and I want it to be the highest level series in Asia, too, from India to Japan. Right now, the economy is a little tough, but things will approve. We are investigating changing the name to Formula Pacific for next year and that shows our intent.'

New technology, led by Honda and Toyota, is a key part of Shirai's strategy to grow the championship: 'I want to introduce new technologies like hybrid powertrains and DRS, which will make the racing more relevant and exciting. With KERS, the plan is to have a single spec motor and inverter package, but open competition on the batteries as there are many suppliers in Japan.'

Both Honda and Toyota have test cars in action fitted with a Zytek energy recovery system and a development project is already underway. However, it is behind schedule for reasons beyond anyone's control. Shirai explains: 'They intended to start testing the hybrid system in May, but the earthquake postponed that, and stopped everything. Now they have only just started testing. The plan was for that to be introduced in 2012 but it can't happen yet.'

The Swift FN09 was not designed to accommodate an energy recovery system, especially with the requirements for housing energy storage mediums safely, and that, amongst other factors, means that an all-new car will be required, too.

'At the same time we were

"I want to expand the series to the whole Asia Pacific region"

planning to change the car to an all-new version, but the earthquake delayed that, too. The supplier is not decided but we will speak to companies like Dome and Lola in March or April next year.

'But the economy is still important. The teams have to spend a lot of money to change cars and they are very poor at the moment, so we have to wait. I want to see the new car in perhaps 2013 or 2014.'

The looks of the Swift FN09 drew many admiring glances in Europe and North America, but it was not universally popular in Japan. However, the new cars could look different for each car manufacturer, or even each team, as Shirai introduces more open technology to the series.

'I'm not sure about the current styling, I inherited that. I would like a fully open series, but that creates performance gaps and it is always a problem so I have to use a one-make chassis. But I would like to give engineering freedom in areas of the car as it's good for engineers and drivers. More testing time is important, too. Tyres will become free, so other things will also do the same, but Bridgestone must commit to it first. If they come, Michelin and Yokohama will come too I hope as they want to beat them, or at least try to. But if there is not competition it is meaningless. As for the other components, we will take things step by step.'

The new car and new regulations should bring new names to the series, too. Shirai openly says that he also hopes a Chinese car manufacturer will join the championship as an engine supplier in future, and possibly a Malaysian one, too. 'If some Asian company wants to supply an engine then it is fine for us, but keeping the playing field level is an issue.

'The engine regulations are only in the planning and concept stage at the moment,' continues Shirai. 'I wanted to go the same way as Formula 1 had originally intended to, with a small, turbocharged, four cylinder, as that may also attract Nissan. I think there is a possibility there, but that could just be me hoping.'

With new high-tech cars on the horizon, Formula Nippon or, as it may soon be known, Formula Pacific, could well be in a position to show up the new breed of IndyCars, and even more of the back-of-the-grid Formula 1 teams.

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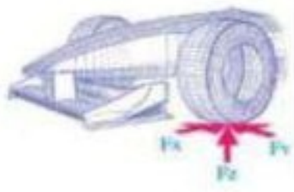

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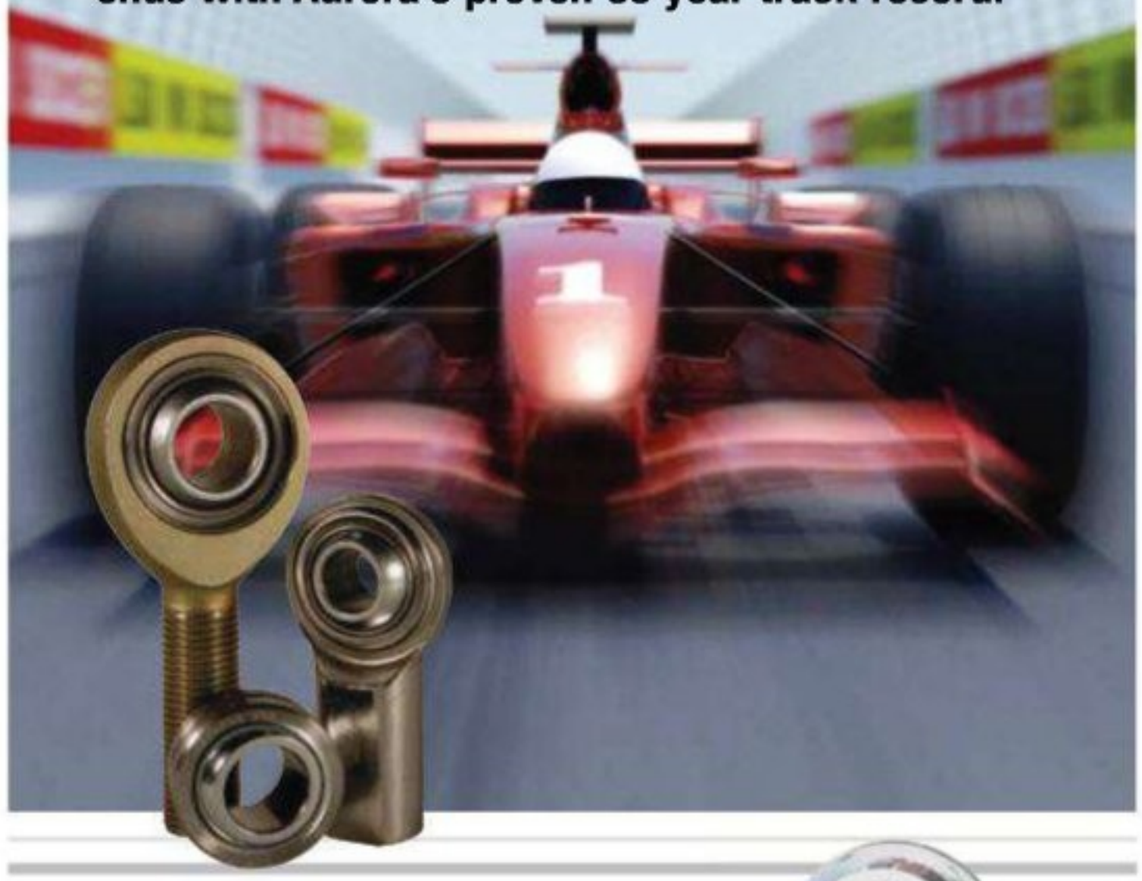

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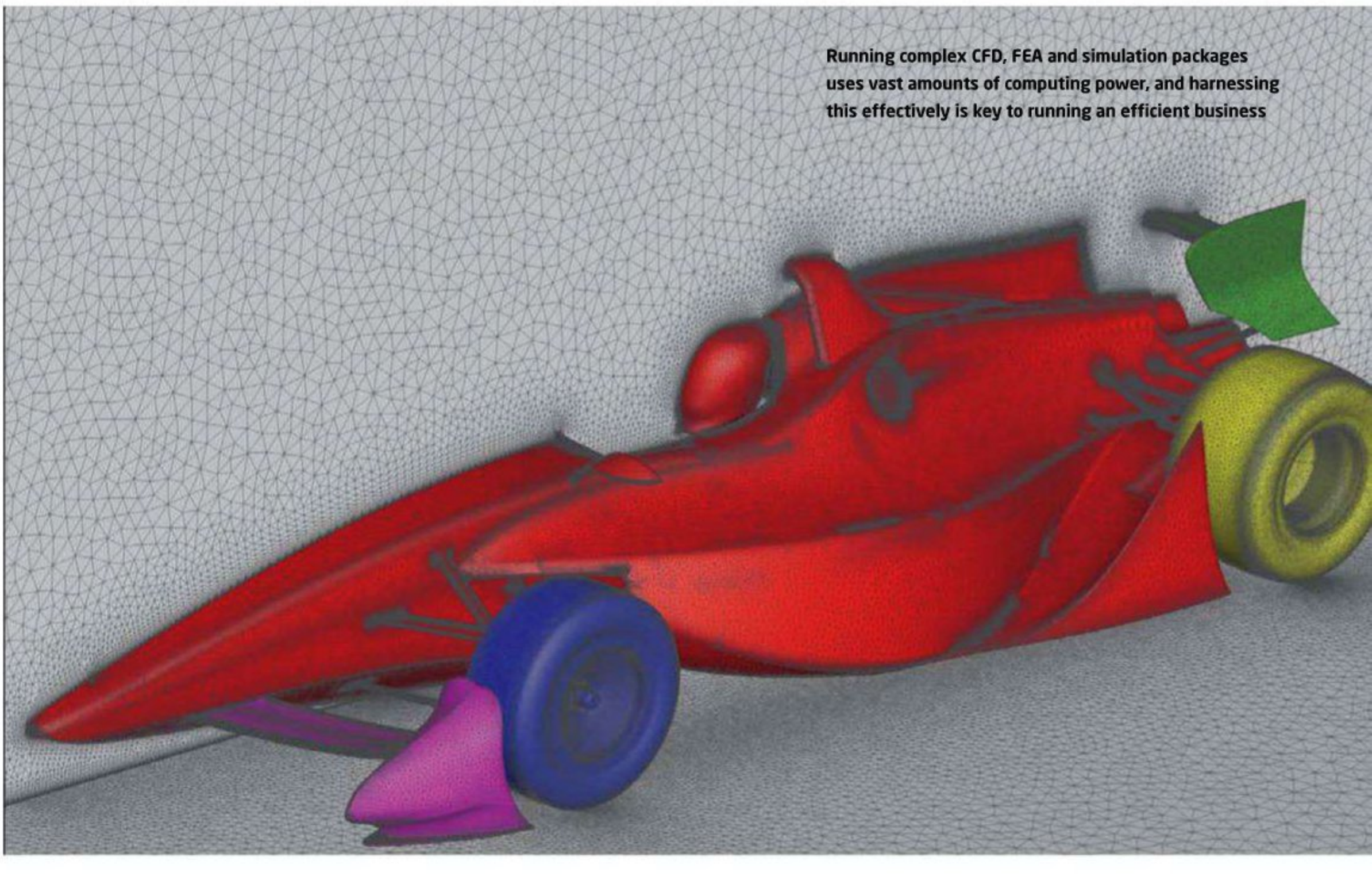


Running complex CFD, FEA and simulation packages uses vast amounts of computing power, and harnessing this effectively is key to running an efficient business

BY SAM COLLINS

The rise of powerful simulation tools like Finite Element Analysis and Computational Fluid Dynamics has seen many motorsport organisations increase their capabilities in recent years, but this rapid growth has led to inevitable issues with compatibility and workflow management.

Japanese-owned, California-based racecar constructor, Swift Engineering, is, by its own admission, a relatively small company, but it has found a way to stretch its limited resources and make the most of these new technologies. 'In 2001, when we were first getting into CFD, we tried to install our own high-powered computing (HPC) solution, and we learned a lot of lessons,' explains Swift's chief aerodynamicist, Dr John Winkler. 'We had a guy who was meant to be doing the CFD but he ended up doing the cluster management. We had no support from any partners as we were trying to run an off-the-shelf component. We wanted to use it as a tool but we never got what we wanted from it as we couldn't troubleshoot. It was very frustrating.'

That first 16-node cluster was replaced by two linked workstations in 2006, when the firm was engaged on a private jet project. This upgrade doubled the computing power. But by 2008 it was clear that the solution the firm was using simply was not up to the job in hand. 'We needed an HPC solution – something where we spent more time solving complex problems than we did administering the system.

We did not want a large IT staff simply dedicated to maintaining and operating our computer infrastructure and keeping the cluster up and running. We needed a system and software package that meant we could keep our head count down, one that would give us more users of the machine rather than more maintainers of the machine,' Winkler continues.

TURNKEY SOLUTION

Swift turned to Canadian firm, Platform Computing, as well as well known supercomputer firm, Cray, to implement a turnkey HPC solution.

Cray's CX1 and CX1000 hardware was combined with Platform HPC (foundation for Cray Cluster Manager), creating a compact computing cluster using Intel Xeon processors. 'It's pretty much an off-the-shelf package, but it is highly configurable. We are not IT experts, we are aero people. If we have to learn the IT stuff we have to come off the stuff we are working on. And Platform is there to help and support us. If we are not sure how to do something, they get it sorted out and set up.'

With this new-found capability, Swift is moving down the 'developing in the digital domain' approach, pioneered by British engineer, Nick Wirth. As part of this new move, Swift decommissioned its wind tunnel earlier this year.

"We needed a system... that would give us more users of the machine rather than more maintainers of the machine"

The Platform set up has been designed to aid useability, with Swift now able to schedule larger computations so engineers are not waiting overnight for results. Now, jobs started in the morning give results in the afternoon. Additionally, analyses can be run in parallel, further increasing the amount of work that can be done in a single day.

Currently, 100 per cent of the Platform HPC work at Swift is focussed on CFD, which means the firm can maximise its R and D resources. 'We do not spend time maintaining the system. In bigger firms you have people fully dedicated to doing that, but this has allowed us not to have the extra person in IT, and also allows our aero guys to spend 90 per cent of their time in CFD now. It basically means we can develop something faster using the same amount of resource.

'Now, if we want to bring someone in, they can work on design elements rather than IT maintenance, and that really helps us focus on designing cars and UAVs,' enthuses Winkler, who also claims Swift's engineers can now evaluate concepts within hours instead of the days it took before, and make design changes in real time.

Whilst Swift is currently active in spec racing with Formula Nippon and in various defence projects, it is clear that the Platform Computing concept it has implemented could have crucial advantages to teams limited on head count and working under resource restriction agreements, such as those currently in place in Formula 1. Swift is now planning to roll out the Platform HPC to its simulation and FEA, as well as more complex CFD, including multiple vehicle programmes.

Toyota returns to Le Mans with petrol hybrid LMP1

Return a boost to WEC, but new regs come under fire

The Toyota LMP1 programme will receive operational support from French team ORECA, which won the Sebring 12 hours in March, 2011

Toyota is to return to Le Mans next year, citing the opportunity to showcase and develop its hybrid technology as one of the main reasons it has decided to have another shot at the endurance racing classic.

The Japanese car giant will take part in selected rounds of the 2012 FIA World Endurance Championship (WEC) races, including the Le Mans 24 Hours. This will be the first ndurance racing programme since 1999, although it has supplied LMP1 engines to Rebellion Racing in 2011.

Toyota says its new car, a coupé, will be built by Toyota Motorsport Group (TMG) in Cologne, Germany, and will receive track operational support from the ORECA team which has run privateer Peugeots for the past two years. The powerplant, a gasoline engine, will be the work of the parent company in Japan. The car should be ready by the end of this year, and will begin testing in 2012. The company has yet to decide whether the car will be badged as a Lexus or Toyota.

Tadashi Yamashina, Toyota Motor Corporation senior managing officer and TMG chairman, said: 'Toyota Motor Corporation has entered Le Mans before, but by using our hybrid technology this time will be a completely new challenge. We want to write a new page in the history of the Le Mans 24 hours, as well as in the FIA World Endurance Championship, through our use of hybrid technology.'

"We want to write a new page in the history of the Le Mans 24 Hours"

Yamashina added that Toyota hopes the programme will have a direct impact on road car technology, too: 'In addition, we aim to learn from the experience of competing in such a challenging motorsport environment to enhance our production car technology.'

However, while Toyota's return has been welcomed, some current teams are said to be unhappy with the technical regulations announced by the ACO for the 2012 WEC, particularly the reductions in the diameter of the air restrictors, the boost pressures and the tank capacity of diesel vehicles.

Audi Sport's technical director, Dr Martin Mühlmeier, has been especially critical of the air restrictor and boost restrictions, saying: 'As far as we are concerned, these changes don't make sense. Gasoline and diesel engines were already rated fairly, as demonstrated by various measurements.'

Mühlmeier has also questioned the underlying philosophy behind the 2012 regulation changes: 'The ACO has systematically turned the 24 Hours of Le Mans into a forward-looking laboratory, has often played a pioneering role, and has, together with the automobile manufacturers, made some major contributions, not just to motorsport, but to automotive developments in general. But it is now trying to strike a balance by putting the performance of relatively old vehicles and engines on a par with cutting-edge developments. And, as far as we are concerned, this does nothing to promote technological progress.'

Spectre of unlimited spending as Formula 1's RRA row rumbles on

F1 could be heading for an all-out spending war as the Formula One Teams' Association's commitment to the Resource Restriction Agreement (RRA) remains in the balance. Teams still unable to come to an agreement over how to police it, and what its scope should be.

Controversy over the RRA came to the surface after a study by Dutch consultants, Capgemini, led to reports that Red Bull had breached the agreement – which limits a team's personnel and spending – although the 2011 championship-winning team has denied this is the case.

Since then there has been ongoing discussions within FOTA over the RRA, but no consensus has been reached, and there are now concerns that F1 could be plunged into a spending war should the RRA fall apart because teams are not in agreement.

Mercedes GP boss, Ross Brawn, who has himself been under fire for his interpretation of the RRA after the high profile hiring of Aldo Costa and Geoff Willis, is one of the men calling for changes in the agreement: 'I think for us, we're respecting the RRA, but I think it's at a crossroads because it's now starting to bite those three or four teams who have to control their resource to comply.

'I think there are seven or eight teams for whom RRA means nothing because they're always going to be below the limit. Now we're at a stage where the targets that were set are starting to bite into the [top] three or four teams and this is where it starts to get contentious, and we haven't structured it well enough yet to have the controls and checks and reassurances in place that gives everybody comfort and [that] leads to the innuendo and accusations that get thrown around.'

The fear is that if the teams cannot reach an agreement the RRA will simply disappear, but Virgin boss, John Booth, says that F1 must avoid a free-spending environment in which only the top teams can thrive: 'The RRA is very, very important to us. Remember we gave up a lot, together with the other new teams, to enter the sport... we gave up the price cap and bought into the RRA wholeheartedly, and it's very, very important to us that it continues and we work towards the agreement. I think a spending formula where three or maybe four teams could thrive is not what people want, and we must work hard to avoid that.'

The teams are set to meet again at Abu Dhabi in mid-November to discuss the RRA. The sticking point seems to be finding a way to make sure teams can operate without the suspicion that they are breaking the agreement. However, FOTA chairman and McLaren team principal, Martin Whitmarsh, says it's unlikely there would ever be an absence of suspicion: 'I think we have got to improve it. We have got to work together to enhance trust and mutual respect in the process. Will we ever reach a stage where everyone is very comfortable, has no concern, no accusation? I doubt [it], just as there isn't with technical regulations in my experience. But I think it has been the right thing for the sport and I think we have got to continue to persevere with it.'

With top teams reaching the limit of the 2011 RRA, will there ever be a time when everyone is above suspicion?

BRIEFLY

Shank to Indy

Former Grand-Am and Atlantic team, Michael Shank Racing, is to enter the IndyCar Series next year. The outfit will run a single car and will be one of up to five teams that will use the new Judd-developed Lotus V6 powerplant.

The MSR Indy team is a partnership between Michael Shank, businessman Brian Bailey and NASCAR driver AJ Allmendinger, who drives for Shank in GrandAm. However, Allmendinger says he will not race the team's IndyCar.

Safety moves

The ACO and FIA have announced plans to improve Endurance racing safety in the wake of the huge accidents at this year's Le Mans 24 Hours. The new regulations include a move to make the shark fin-style rear bodywork mandatory on all prototypes – LMP1, LMP2 and FLM – while there will also be a requirement for openings in the bodywork above the front and rear wheels. Also, the size of rear view mirrors will be increased on all cars except LMP1s, while a rear camera system will be mandatory on GTE cars.

Superleague sick?

There are worries for the future of the football-based Superleague Formula after its two final rounds, in China and South Korea, were cancelled. This follows the cancellation of rounds in Russia, Brazil and New Zealand earlier this year. Superleague denies the championship is in major trouble, despite it running just two rounds this year, and insists it will return next year. The football link – where each car carries the brand and colours of a major soccer team – is to go, however, to be replaced by a 'Nations Cup' approach, similar to the defunct A1GP. Grasping at straws anyone?

Sahara's $100m Force India buy in

Sahara India Pariwar, one of India's biggest and most well-known businesses, has acquired a 42.5 per cent share of the Force India Formula 1 team.

As a result of the deal, which is said to be worth $100m, the team will now be known as Sahara Force India. The rest of the team's ownership will be split between team boss, Vijay Mallya (also with 42.5 per cent), and the Mol family (15 per cent), who became involved in the outfit when it was known as Spyker. The total number of shares in the team has been increased as part of the deal.

Sahara India Pariwar is a major player in Indian business, active in finance, housing, media and entertainment, commodity sales, consumer products, manufacturing and information technology. It is also well known for its sports involvement, particularly its sponsorship of the Indian cricket team. The group claims to have a market value of a staggering $23bn.

The investment means the team can go ahead with its plans to expand its secondary base, which is in Brackley, but there will not be a move from its long-time base at Silverstone – its home since the days when it was known as Jordan.

Subrata Roy Sahara, 'managing worker' and chairman at Sahara India Pariwar, and incoming chairman of the team, said of the tie up: 'India is reaching new heights in all spheres, including sports. Formula 1 car racing has always remained a bastion of the western world. The advent of India in this exciting sport has remained a matter of pride for all our countrymen. I feel doubly proud that Sahara is the co-owner of India's only F1 team and I am sure that through the Sahara Force India F1 Team, we will together bring pride and laurels to our beloved nation.'

Rising force: with Sahara's financial and logistical backing, Force India F1 Team will be determined to go from strength to strength

Vijay Mallya, team principal and managing director of Force India, said: 'I am delighted to welcome Saharasri Subrata Roy Sahara as chairman of Sahara Force India. It has indeed been a matter of pride for me to put India on the F1 map with Force India and raise the performance of the team to its current levels. The Sahara Group has played a very important role in the development of sport in the country and is an ideal partner to take the Force India F1 Team to greater success in the F1 World Championship.'

Vodafone McLaren Mercedes renews Mazak contract

McLaren has negotiated an extension to its relationship with Mazak to continue in its role as the sole official supplier of the CNC machine tools to the team, a contract that has been ongoing since 1999.

A total of 19 Mazak machines are now installed at the McLaren Technology Centre in Woking, UK, including multi-tasking and multi-axis machines such as the Integrex, Vortex and Variaxis, as well as Quick Turn Nexus lathes and FJV machining centres, which are used to manufacture key parts for the team's transmission, suspension and aerodynamic assemblies.

Jonathan Neale, managing director of McLaren Racing, commented: 'We are delighted to have extended our relationship with Mazak. The partnership gives us access to the entire range of machine tools with a common point of contact and excellent support. Time is a critical element to us, so it's vital that we have high performance machines and high availability every day of the week. Our partnership has been a key contributor to the success of Vodafone McLaren Mercedes.'

Meanwhile, the McLaren Group recently welcomed a group of local teachers and students to the McLaren Technology Centre for a rare, behind-the-scenes glimpse of life as a McLaren engineer. The tour was organised in conjunction with the Department for Business, Innovation and Skills, as part of the UK Government's 'See Inside Manufacturing' campaign – an initiative aimed at encouraging young people to see engineering as a viable career choice. Both government and industry agree that changing negative perceptions of manufacturing amongst young people is essential if the UK is to re-balance its economy, foster the next generation of engineers and generate economic growth through high-value exports.

Ron Dennis, executive chairman of McLaren Group and McLaren Automotive, agrees: 'We've seen a worrying decline in our industrial base over the past two decades and this alarming trend must be reversed if we're to create a more stable and prosperous future for our country.'

Additional support for low carbon vehicles

The UK business secretary, Vince Cable, has announced that the British government plans to invest at least a further £15 million in projects to accelerate the commercialisation of low-carbon vehicles.

Speaking at the Innovate11 conference and exhibition in London, Cable said that the research and development projects funded by the investment will focus on reducing costs in the supply base and making progress in areas such as energy storage and management, and lightweight vehicle and powertrain structures.The investment will be delivered through a funding competition managed by the Technology Strategy Board, working in concert with the Office for Low Emission Vehicles. Details of the competition are to be finalised and will be announced by the Technology Strategy Board.

RACE MOVES

Aston Martin Racing team principal, **George Howard-Chappell**, has resigned from his post, and from Prodrive. The Englishman has been with Aston Martin Racing and Prodrive for 13 years,

LAT

Howard-Chappell

and oversaw the Ford BTCC programme, the development of the Ferrari 550 Maranello, the Aston Martin DBR9 and the Aston Martin AMR-One LMP1 programme. 'It was not an easy decision to make, but for a number of reasons I decided it was time for a change,' said Howard-Chappell. 'I have a long notice period so have plenty of time to think about what to do next.' With Toyota and Porsche having just announced LMP1 programmes, and more manufacturers expected to commit soon, Howard-Chappell could well remain in the endurance arena.

Alan Permane has been promoted to the role of track operations director at the Renault F1 team, taking on some of the responsibilities of departing sporting director, **Steve Nielsen,** who resigned from the post earlier this year. Permane has previously worked as chief race engineer at the team.

Former Ferrari technical director, **Aldo Costa**, is to join the Mercedes GP team at the beginning of December, filling the position of engineering director and working alongside **Ross Brawn**. Costa left Ferrari earlier this year after a disappointing start to the season.

NASCAR outfit, Red Bull Racing, is to lay-off 152 people when it closes its doors in mid-December. Red Bull Racing has run two cars in the Sprint Cup since 2007, the team both sponsored and owned by the Austrian energy drink firm from which it takes its name. Red Bull has also made it clear there will be no going back on the decision to close the team.

Doug Fritz is the new chief executive of Iowa Speedway. Fritz, who was formerly president of Richmond International Raceway, will look after the circuit's long-term strategic initiatives, events and facilities development and capital reinvestments. He will work alongside Iowa track president, **Stan Clement.**

Geoff Willis is the new technical director at the Mercedes GP team, where he will work alongside **Aldo Costa** (see above). Willis left the HRT squad earlier this year, reportedly because it was unable to satisfy him.

LAT

Geoff Willis

Willis has previously worked for Williams, Leyton House, BAR, Honda and Red Bull in a long and varied F1 career. **John Probst** is the new technical director at NASCAR outfit, Earnhardt Ganassi Racing, with Felix Sabates. Probst formerly worked at Red Bull in NASCAR, and before that was with Ford in its motorsport division.

Michael McLaughlin, a crew member on the no 23 NASCAR Camping World Truck racer, has been indefinitely suspended from all NASCAR competition for violating the governing body's strict substance abuse policy.

The mighty Bosch

Robert Bosch, founder of the eponymously-named manufacturing company, once said, 'I would rather lose money than trust.' It is a sentiment still maintained by the electronics giant as the company celebrates its 125th year of trading this year.

Bosch was born on 23 September 1861, in Albeck, near Ulm in southern Germany. Following an apprenticeship as a precision mechanic and stints at a number of other businesses, he opened his 'Workshop for Precision Mechanics and Electrical Engineering' in Stuttgart on 15 November 1886. Much of the company's growth was due to constant product innovation and meticulous quality control, but it was the high voltage magneto ignition system launched in 1902 that was its making.

In addition to being an effective businessman, Bosch was a socially-minded entrepreneur, acknowledging that 'employer and employee are equally dependent on the fate of their company.' Consequently, in 1906, he became one of the first employers to introduce an eight-hour working day, and dual shift patterns.

In 1913, he set up his own apprenticeship department with a training workshop, and associate training and qualification still command an important position at Bosch to this day.

Since the end of the WW2, Robert Bosch's legacy paved the way for his company's renewed rise to a global supplier of technology and services. In 2011, it is expected that the company's roughly 300,000 associates will generate sales of more than 50 billion euros.

Super B tie up with Interex

Battery manufacturer, Super B, has has announced that Interex Motorsport will become an official distributor for its products from October 2011. Interex Motorsport is a global distributor in the motorsport industry, with particular expertise and experience in Eastern European and the Middle and Far Eastern markets. 'This is a fantastic opportunity for Super B to reach new markets,' said Steven Bradshaw, Super B's European sales manager. 'Super B lithium batteries are a relatively new company in the motor racing industry, having only established in 2007, but in that short time we have developed an excellent reputation for performance and reliability.'

Chevrolet first out of the box with DP G3 set to test in December

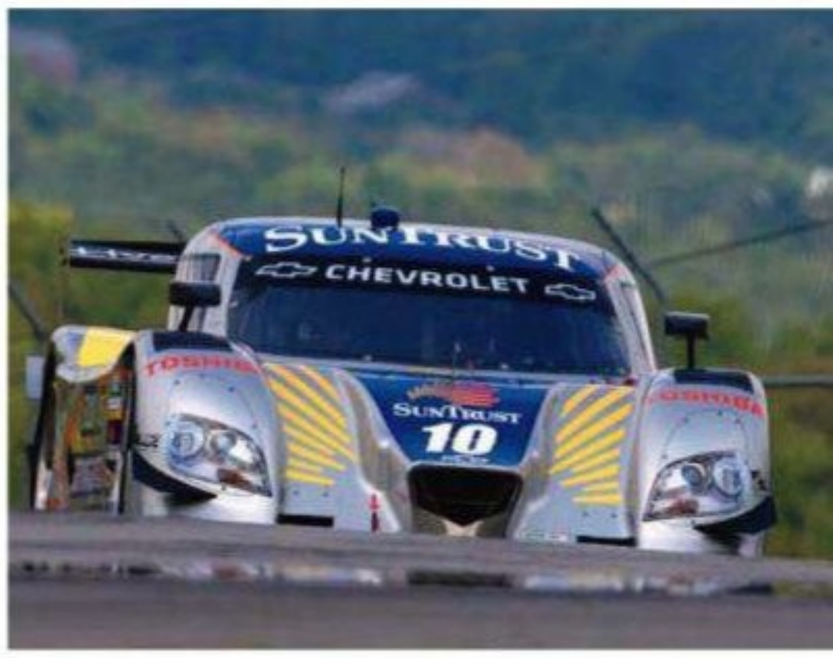
Corvette is likely to be the first manufacturer to homologate a DP G3 under new Grand Am regulations and driver Max Angelelli says the the car should begin testing in December ahead of the Daytona 24 hours in January.

'We will show up at the Daytona test in December with our Corvette DP G3 and we will be doing both days in a full race mode,' says the Italian. 'Pratt and Miller fitted the Corvette body on our Dallara chassis right on time as they usually are, and we will be making the final components fit before the end of November in preparation for testing.'

Angelelli was also worried that there will be few of the new generation prototypes on the grid next year. 'In this weak economy, Grand Am is taking a risk in asking all of us to change and invest more money when money is very difficult to find. We all appreciated General Motors in supporting the idea and invest in the series. Grand Am is really strong in their GT class. We, as DPs, are suffering a small field in quantity, but not in quality.

'We will see a mixture of 2011 and 2012 cars taking part in the races, and at the moment it's impossible to predict what the outcome will be. I will be racing with a Dallara chassis again, but it will feature aerodynamic elements designed by General Motors.'

Only Riley Technologies has released a rendering of the 2012-spec car so far.



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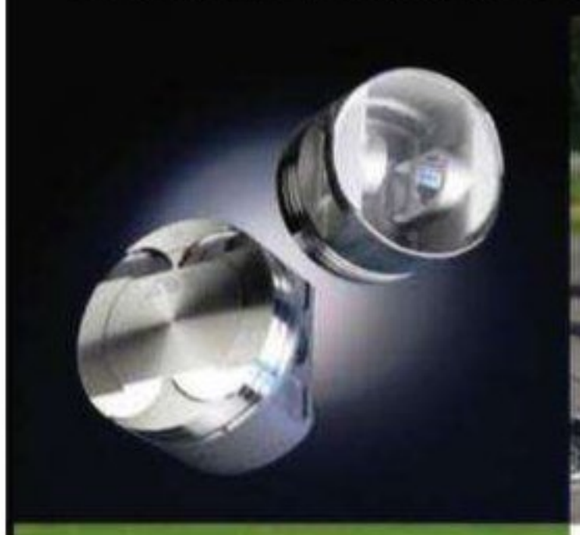

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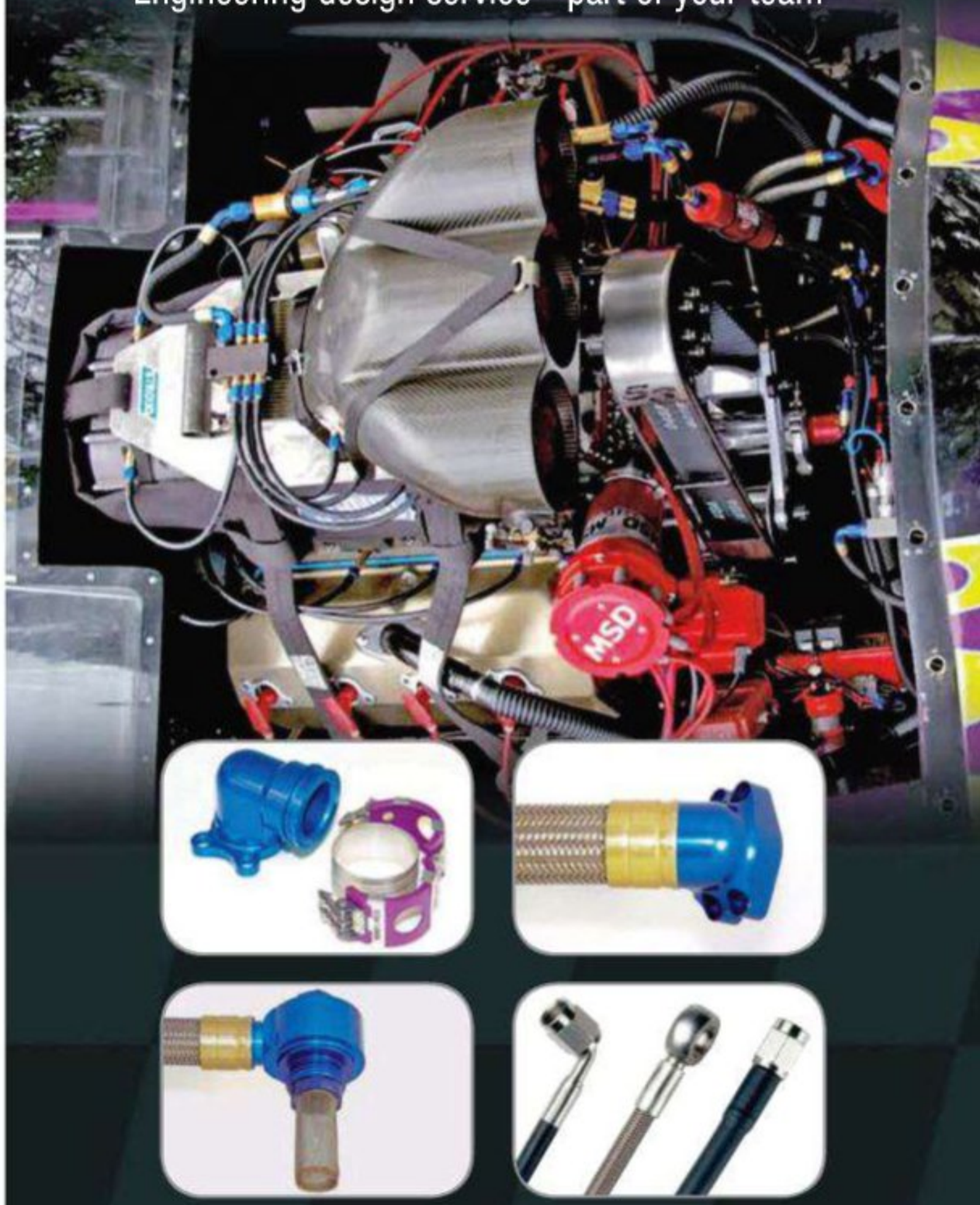

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RACE MOVES

Two-time Indianapolis 500 winner, **Al Unser jr**, has been suspended from his role as an IndyCar race official after he was charged with drink driving offences. The 49-year old, who has struggled with alcohol problems in the past, was said to have caught with a blood / alcohol reading twice the US legal limit.

Former BTCC race winner, **Paul Radisich**, has been appointed CEO of the new V8SuperTourers series in New Zealand – a rival to the New Zealand V8 Championship. At least 17 of

Paul Radisich LAT

the new monocoque-chassis cars are expected to turn out for the first race, which is to be held at Hampton Downs in mid-February.

NASCAR has announced the addition of six newcomers to its Integrated Marketing Communications (IMC) department. They are: **Estefania Acosta-Rubio**, **Jayme Christianson**, **Nick Kelly**, **Jennie Long**, **Matt Nordby** and **Becky Williams**.

AP Racing has appointed **Antonio Saorin** as research and development engineer. Saorin has previously worked for Ford Motor Company as a component chassis engineer, responsible for helping with the development of chassis for road cars. Prior to this, he completed a Masters in motorsport engineering at Epsilon Euskadi Racing Team and Mondragon University.

James Small has left the Kelly Racing V8 Supercars team, where he's been engineering the Holden Commodore driven by **David Reynolds** since the beginning of the season. Meanwhile, **Paul Forgie** has parted company with the Stone Brothers Aussie V8 team, where he was engineering Shane van Gisbergen's car.

Steve Hallam is to move from NASCAR to Australian V8 Supercars in 2012 after accepting the position of managing director of Walkinshaw Racing. Hallam, who is currently president of competition at Michael Waltrip Racing, will now oversee both the Toll Holden Racing Team and the Bundaberg Racing Team in Australia's premier

Steve Hallam LAT

motorsport series. Before moving to NASCAR, Hallam was head of race operations at the McLaren F1 team.

Long-time NASCAR executive, **Ed Bennett**, has been named chief executive of Grand-Am. Bennett will continue as a NASCAR official, serving as a vice president and chief administrative officer. **Tom Bledsoe** will continue as president of Grand-Am with primary responsibility for day-to-day operations of the organisation. Bennett will also be the primary conduit between Grand-Am and NASCAR on marketing, sales and communications efforts.

Moving to a great new job in motorsport and want the world to know about it? Or has your motorsport company recently taken on an exciting new prospect? Then send an email with all the relevant information to Mike Breslin at bresmedia@hotmail.com

NGTC set for numerical dominance in 2012

British Touring Car Championship boss, Alan Gow, reckons over half of the grid for next year's championship will be made up of Next Generation Touring Cars (NGTC), while the latest new car to conform to the new rules – a Vauxhall Insignia – has now been revealed.

Just four teams fielded NGTC cars in 2011, but the factory Honda Racing Team, plus leading privateers, Triple 8 Race Engineering and Eurotech Racing, have all announced they will run NGTCs for 2012, while others are also thought to be considering switching.

Alan Gow, the BTCC's series director and administrator, said: 'I would guess that around half the grid next year will be NGTC cars – and that's not only an impressive validation of the new regulations, but also a ringing endorsement of the BTCC itself, and the commitment teams are making to the championship. Just look at our grid numbers, our TV audiences and our spectator numbers – all of them are reaching fantastic new highs. We must be doing something right.'

Meanwhile, Frank Wrathall, who has run a Toyota Avensis NGTC under his Dynojet team banner this year, had this to say: 'The NGTC concept has helped us, for sure, coming in as a new team. It's definitely the future for the BTCC. We couldn't have afforded to build our own S2000 car, and NGTC gives you the

The latest NGTC to break cover, the Thorney Motorsport Vauxhall Insignia

opportunity to build a car to a reasonable cost. The fact that we've got two Toyotas, two Audis, a Proton on the grid shows it's working.'

Elsewhere, Thorney Motorsport unveiled its own NGTC-spec Vauxhall Insignia. The car, which was demonstrated on track at the 2011 final round at Silverstone, is currently powered by the Swindon-built TOCA turbocharged engine, but the team plans to switch to a self-developed Vauxhall unit for 2012, having ended its association with Neil Brown Engineering.

Thorney has also started production of two more NGTC Insignias, which it hopes it will be able to supply to customers next season.

More live online WRC coverage coming our way in 2012

The World Rally Championship's trial of live internet streaming from Rallye de France Alsace in October proved such a hit that it could pave the way for further similar coverage in 2012.

Fourteen hours of live action, captured by two helicopters and on-board cameras, plus service park footage and interviews, was available to view free of charge on the championship's official website, as part of a pilot project to investigate future digital opportunities. The exercise was the first test of a new partnership between WRC promoter, North One Sport, and end-to-end streaming specialists, Streamworks. The pilot proved popular with fans and WRC teams, leading Ford principal, Malcom Wilson, to comment: 'It's been fantastic and the quality has been superb. For a first attempt it's been very good and will take rallying to a different level.'

After a technical review and an analysis of feedback from wrc.com users and industry stakeholders, North One Sport CEO, Simon Long, said he hoped to offer more live coverage in the future: 'The aim of the trial was to determine the technical feasibility of live WRC streaming and to gauge demand from fans. The results in both areas are extremely encouraging.'

HARDWARE

High performance hoses

Italian brake specialist, Tar•Ox, has announced a new range of high performance brake hoses. The company has invested substantially in the latest technology to allow it to create a bespoke range of race-quality brake lines for a wide range of applications. By providing an optimum rate of fluid transfer from pedal to pad, the new hoses improve pedal feel and braking efficiency, enhancing the driver's 'feel' and confidence. The Tar•Ox range draws heavily from over 30 years of engineering experience and these new hoses pack an impressive specification. The lines themselves are Teflon-lined braided stainless steel, with custom-machined stainless end fittings. The outer finish is created by a hard-wearing 95PVC grade outer sleeve to protect against dirt and water ingress. Custom and bespoke builds can easily be accommodated to encompass any possible vehicle fitment.
For more information see www.tarox.com

DATA LOGGING

GPS lap timer

New from data logging specialist, AIM, is the SOLO – an automatic lap timer based on GPS technology. The system does not require a trackside beacon and records lap time information automatically. The GPS data, combined with the built-in accelerometers, can also record speed, braking points, acceleration and a variety of other variable. The SOLO display offers a breadth of information, including speed and position, lap comparison, predictive lap times and *g* force. If more data is needed, the SOLO DL model provides full data logging capability through a CAN connection to the vehicle's ECU, enabling it to record further information, such as rpm and temperatures.
For more information see www.aim-sportline.com

SET-UP EQUIPMENT

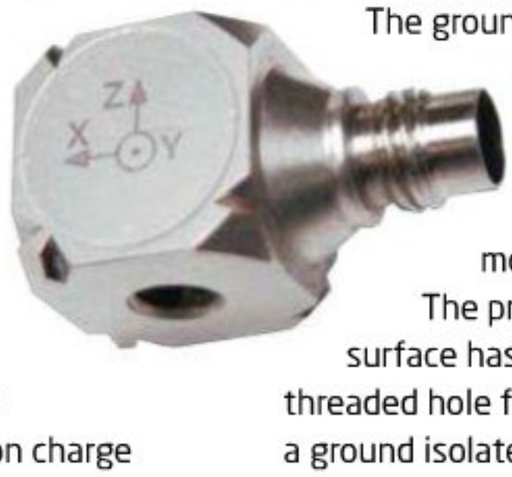
Coil spring tester

Racecar set up specialist, Intercomp, has introduced its next generation coilover spring tester and compressor. With a digitally measured travel of 10.5in (267mm) and the ability to compress coilover assemblies for service, the new design allows users to obtain test data over a greater travel range, saving valuable testing time. The new machine can test coil springs, coilover assemblies (including fifth coils), rod pressure, bump stops and coil bind to a load capacity of 5000lb (2260kg), making it a truly multi-purpose tool. Additional new features include removable shock mount pins with integrated centre reference marks. These pins are designed to double as rotational stops, allowing spring pre-load adjustments with spanner wrenches. Pre-load may also be adjusted by compressing the coilover assembly and turning the ride height adjustment nut freely.
For more information see www.intercompracing.com

SENSORS

Triaxial accelerometer

New from instrumentation specialist Kistler is the 8688A series triaxial accelerometers. These instrument grade sensors are ideal for use in a multitude of R and D and OEM applications where high-precision, low-frequency measurements and high-durability packaging are absolute requirements.



The low mass, hermetically-sealed (IP68) titanium cube measures just 12.5mm and combines Kistler's PiezoBeam technology with an integrated PiezoTron charge converter to produce a triaxial accelerometer that has an exceptional sensitivity to size ratio. Available in 5, 10 and 50*g* versions, the 8688A series accelerometers combine a 0.5-5000Hz frequency range with excellent phase accuracy and shock survivability – a specification suited to a wide variety of applications, ranging from aerospace ground vibration testing and flight testing to structural dynamics and vibration assessments to automotive laboratory testing and vehicle ride assessments.

The ground isolated mounting clip can be used in three sensor orientations for mounting flexibility. The primary mounting surface has a 10/32 UNF threaded hole for use with a ground isolated screw-on, adhesive or magnetic mounting base. The accelerometers can also be supplied with optional TEDS (Transducer Electronic Data Sheets) IEEE1451.4 capability.
For more information see www.kistler.com

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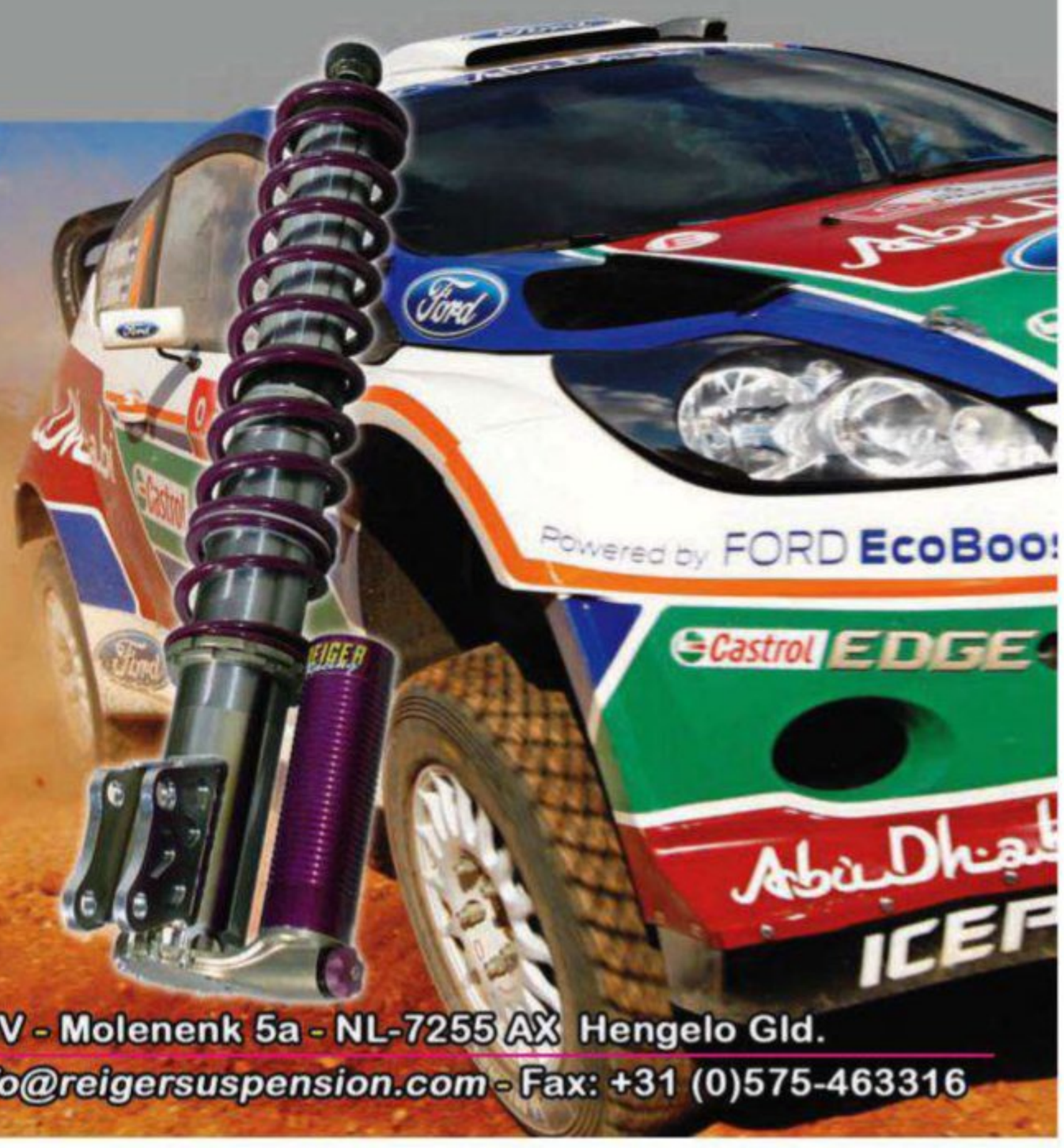

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A different way of thinking: Tony Fernandes

"The products we're talking about have now come to fruition, there's clarity on our brand [and] everything is coming together quite nicely"

Tony Fernandes is a charismatic figure in the Formula 1 paddock, first arriving as a sponsor then graduating to team ownership when, with Mike Gascoyne, he launched Lotus Racing, re-named Team Lotus in 2011. It started a series of events that saw him tussle and win with Group Lotus in the high court, launch an energy drink and buy the Caterham sports car company. At the same time, he continued to run his other Tune Group brands, which includes Queens Park Rangers (a London-based Premier League football team), Air Asia, mobile 'phones, hotels and a music promotion business. As a result of these diverse interests, his cars in Formula 1 and GP2 (via Team Air Asia) serve as a mobile billboard for his brands.

'In a competitive world of those businesses, standing out is hard, especially if you are from a small country like Malaysia,' says Fernandes. 'Formula 1 is a fantastic platform to promote yourself as a company.

'I'm a big believer in sports and the audience you get here is different than it is in football. Formula 1 appeals to a different market, so that's why I do it, but you can't do Formula 1 by itself in my opinion, and you can't do football by itself either,' explains the Malaysian.

'Doing Formula 1 does not necessarily sell more tickets, but I think many people forget that the power of Formula 1 is not just advertising. When I am looking for financing to purchase a fleet of new aircraft, or if I'm looking for a better supply of oil, the amount of meetings I've had and networking I've had via Formula 1 is incredible. In motor racing you have three days to meet lots of people, football is 90 minutes, of which you have 15 minutes maybe before the game, 15 minutes at half time and at the end of the game, where everyone's probably rushing off. In Formula 1, you have time to do business.

'Formula 1 has always been seen as just putting stickers on a car, but there's much more of a business-to-business angle that people do not see. If we can provide business for our sponsors, on top of giving them branding, you're onto a winner. Look at Total – they are our partner in Team Lotus and they supply product to Air Asia.'

With Fernandes now owning a car manufacturer, an engineering group and an F1 team, all the pieces are in place. But will it all come together in 2012?

The acquisition of Caterham Cars surprised many in the motorsport industry, and it looks likely that Team Lotus will be re-branded Caterham for the 2012 season. 'The products we're talking about have now come to fruition, there's clarity on our brand, we have a car company, everything is coming together quite nicely,' Fernandes hints, clearly unwilling to make a definitive statement yet. He is certainly keen to roll out a range of new Caterham models, all of which will undoubtedly find their way to the race track. And some of the composites work for the Caterham cars, be they in Formula 1 or in other, lesser series, will be carried out at Hingham in Norfolk.

"The amount of meetings I've had and networking I've had via Formula 1 is incredible"

To look after operations in the Team Lotus and Caterham Cars factories in England Fernandes promoted long-time collaborator, Riad Asmat, to group CEO. 'I focus on having the right people and delegating, but I am the gel for all the businesses. That's the strength of my role and the strength of what Team Lotus is. Riad will focus on this, Phil Beale will focus on football, but I pull them all together, that's my role. We've built over the last six months a very good car group, the engineering group and the F1 team, that has allowed us to build a pretty good division that wouldn't have happened without me sticking all these pieces together. I don't think I've taken any real step back, but I've always said my job is AirAsia. I'm really a chairman here, like at QPR and Tune, and my other businesses. Rehad is a CEO, we're kind of like a joint team principal in many ways. We combine effort, but the team needs a full-time person, and I cannot do that. I'm really here for the strategy and, since I'm writing the cheques, I've kind of given more direction, but I've not stepped back.'

But one of the things that makes Fernandes a popular figure is the informality of his organisation. Staff are encouraged to feel comfortable whilst at work, something that he believes increases productivity and innovation.

'If someone is dressed the way they want to be, they feel good, they are their own person. If I force them to wear a suit, they would not be themselves. I hate hierarchy. If I dress up in an expensive suit, I put a distance between myself and the staff, but if I'm one of them, I look worse than them.

'Innovation comes from creating an environment for innovation, and I think having a flat structure and an easy-going system, no one is afraid of giving ideas and I think that's much better than living in a world where there's hierarchy and fear. That's why I banned ties from Team Lotus. If we need to wear ties for certain events then we will. If sponsors want us to do it then we do it but I'd rather people be happy.'

Despite the rapid growth of Fernandes' interests, he is showing no signs of slowing down. 'It has been two or three years of a lot of development but basically, I now have to deliver a lot of what we said. AirAsia is mature, but now I really want to build this car group up... buying things and putting things together on paper is easy. Making them work is harder, and I'd rather deliver what we've got now.'

Clearly, future growth for his brands is Fernandes' goal. 'Look at what McLaren has done. They built a watch company from TAG, they have the Technology Centre and they build cars now, so we would be akin to McLaren, and maybe a little bit deeper than McLaren. I'm not talking Tony Fernandes-branded products because no one will buy them, but things associated with our brands.'

The long-term concept is that someone could fly on an Air Asia jet to an exotic destination where they stay in a Tune hotel and then drive a Caterham sports car to the track where they watch the racing team in action. It could be a very attractive way to leverage the brands of sponsors, says Fernandes: 'We are providing a lifestyle, and I mean now with sponsors – they have an interesting option – they can reach two markets, they've got football, with QPR, they have Formula 1 and I have a basketball league in Malaysia, so there are lots of things there they can do.' Perhaps the first of these is BRM watches, which can be purchased on Air Asia flights and the formula is likely to be repeated.

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ANGLO-AMERICAN OIL COMPANY TO SUPPLY INDYCAR

As the motorsport industry continues to feel the pressure to be more environmentally friendly, IndyCar has chosen to use Sunoco E85-R as their official fuel, making them one of the first major series to run a renewable fuel source. Made from sustainable ethanol and petroleum alkylate, E85 is one of the cleanest forms of fuel available, and now Anglo American Oil Company is carrying stock.

Blended in the Marcus Hook Racing fuel refinery, it is designed to maximise power within the E85 specification. Unlike pump-quality E85, the Sunoco E85-R contains a consistent 85 per cent volume of ethanol, which is made from corn, while the rest of the components comprise of pure chemicals to ensure consistency and clean burning.

The fuel burns at a cooler temperature to generate less heat, while its high octane properties will boost power in high compression and turbocharged engines. It is also fortified with a special additive to reduce the natural corrosiveness of ethanol and to increase lubrication of the entire fuel system, including injectors, carburettors, valve seats and cylinder bores.

Anglo American Oil Company will be exhibiting at Autosport International in Hall 9 on Stand 6565, where information on the new Sunoco E85-R will be available.

'We started our business mid-1999 and have exhibited at Autosport International every year since 2000,' said Anders Hildebrand, Anglo American Oil Company's managing director. 'The show has proven to be a great platform to not only develop new customer contacts, but also look after our existing customers and strengthen relationships. It also keeps us up to date with the latest news within the motorsport industry and is a great place to launch new products.'

Anglo American Oil Company Ltd
www.aaoil.co.uk
Hall 9, Stand 6565

ASNU EXPANDS UK FACILITY

Regular Autosport International exhibitor and leading fuel injection specialist, ASNU, is currently expanding its UK facility as a result of increased business. The Hertfordshire-based warehouse will be doubling in size as its clientele grows.

'People have realised that fuel consumption wins races, and that has driven people to us,' said Philip Ellison, ASNU's managing director. 'We assist in the better atomisation of fuel, which leads to better combustion and therefore better performance.'

And it's not just the motorsport industry whose attention has turned to ASNU. The marine sector, particularly in the USA, has also shown interest in its products and is now a major part of the company's clientele.

ASNU will again be exhibiting at Autosport International in January, where it will launch a new range of high-performance injectors.

'We were at the first show in 1991 and have been returning since,' added Ellison. 'The quality of the attendees at Autosport International really is amazing, and for us that is so much more important than quantity. The show offers a platform to speak to serious players in the industry. But if we were looking to expand into retail, we know that staying not only for the trade days but also for the weekend would put us in front of the right people.'

ASNU (UK) Ltd.
www.asnu.com
Hall 9, Stand E327

A PROFESSIONAL IMAGE, BOTH INSIDE AND OUT

System Store Solutions Ltd will be displaying its high quality workshop and industrial storage solutions at the NEC in January. Its bespoke systems have been utilised in some of the top facilities within the motorsport industry, including the Red Bull and Team Lotus Formula 1 factories.

From the initial design and layout to installation, System Store Solutions provides multi-functional products that are practical and versatile, without compromising on a clean and professional design, which can of course affect how potential partners view a team, whether it is workshop-based or trackside.

'Each year Autosport International provides System Store Solutions with a number of great opportunities to showcase the work we do with the various teams and manufactures in the sport, for both their workshops and transporters,' said director, David Price. 'We have also found year on year that those who visit The Performance Car Show also want us to outfit their garages and supply them with equipment, so the show is not exclusively trade-orientated for us anymore.'

System Store Solutions Ltd
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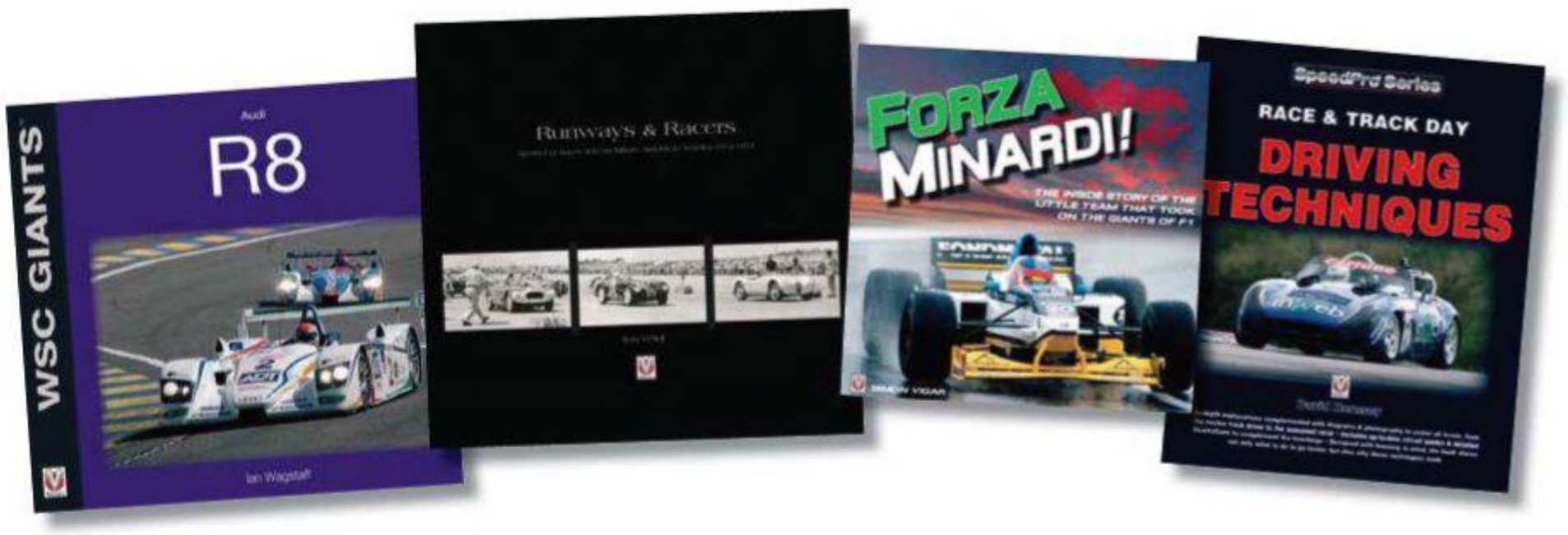

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Out of the frying pan...

Vincent Beaumesnil, the ACO's sporting director, was spotted last April having a romantic dinner with his wife in a street-side café in Le Mans. The couple were blissfully unaware of a bunch of journalists sitting nearby, and it is fair to say Vincent was mortified when we made our presence known.

It is hard, at this point, to imagine that he could be enjoying such carefree evenings with the arguments around the balancing of different technologies. Sure, at the time he had Audi and Peugeot on one side of the fence with their factory budgets and diesel engines and, on the other, he had the likes of Pescarolo's customer team and Aston Martin, which had a GT1 engine in a customer chassis.

Audi and Peugeot secretly feared that a manufacturer, particularly one of Japanese origin, would turn up with a dedicated team, a petrol engine and, with the balancing that had gone on, would beat them into next week.

Beaumesnil sat in the middle of all of this, and now that it has all shaken out, he still has Audi and Peugeot, while Henri and Aston Martin consider their futures. However, now that Toyota and Porsche have announced that they are coming with hybrids, and with Peugeot pushing its diesel hybrid, the ACO suddenly has a new fight to fight, and there are no soft options.

Porsche's decision was expected, and announced at the end of June, and it seems certain the German manufacturer will come with a petrol hybrid, using the knowledge gained from the development of its 918 supercar. 'You have Porsche RS Spyder engineers working on the 918 and, when we have reached a certain stage, they will go across to the LMP1 project,' says 918 project leader, Frank-Steffen Walliser. 'We are located once again in the motorsport department.'

Toyota's involvement was expected too, but the timing was a surprise. Despite its problems in the US, and the *tsunami* that brought the country temporarily to its knees in March, it has been quietly working on a global racing programme to replace its defunct Formula 1 project, and will also come with a petrol hybrid.

The problem Beaumesnil faces is that defeat for any manufacturer is going to cost more than just bragging rights. Defeat is going to show that one technology is somehow inferior to another. To allow the technologies to compete on an equal footing is therefore paramount, yet Peugeot says that one technology must have precedence over another to justify the huge investment that is needed to win. The regulations are going to have to tightly control budgets, but at the same time encourage technical innovation. Immediately, the problems have surfaced.

Toyota has been involved in negotiating the rule changes, alongside Audi and Peugeot, for 2012 and, in October, the ACO released its balance of performance measures for next season: the refuelling rigs will have the same flow rate, unlike this year; the diesels would be pegged back by seven per cent on the air restrictor and supercharger pressure; and the release of energy from a hybrid system will only be permitted above 120km/h, effectively wiping out the advantage of being able to deliver power to the front wheels mid-corner.

"the changes are no longer based on sound science"

Audi bit back immediately. 'It is all too easy for the general public to overlook the fact that the teams that currently use vehicles run on gasoline are nowhere near reaching the full potential of gasoline engines and vehicles, as laid down in the regulations,' commented Audi Sport's technical director, Dr Martin Mühlmeier. 'Until now, the ACO had a good idea of what this potential was. But now a different point of view has taken precedence.'

He then went on to criticise the further reduction in fuel tank size for diesels, and more again for hybrids. 'The changes made to the fuel tank volumes are no longer based on sound science,' he said.

With manufacturers calling for the rules to be finalised before the end of January, there is a long way to go, a lot to pack in, and clearly some arguments to be had. That street-side café, even with an audience, is going to seem a safe haven for M. Beaumesnil.

EDITOR
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