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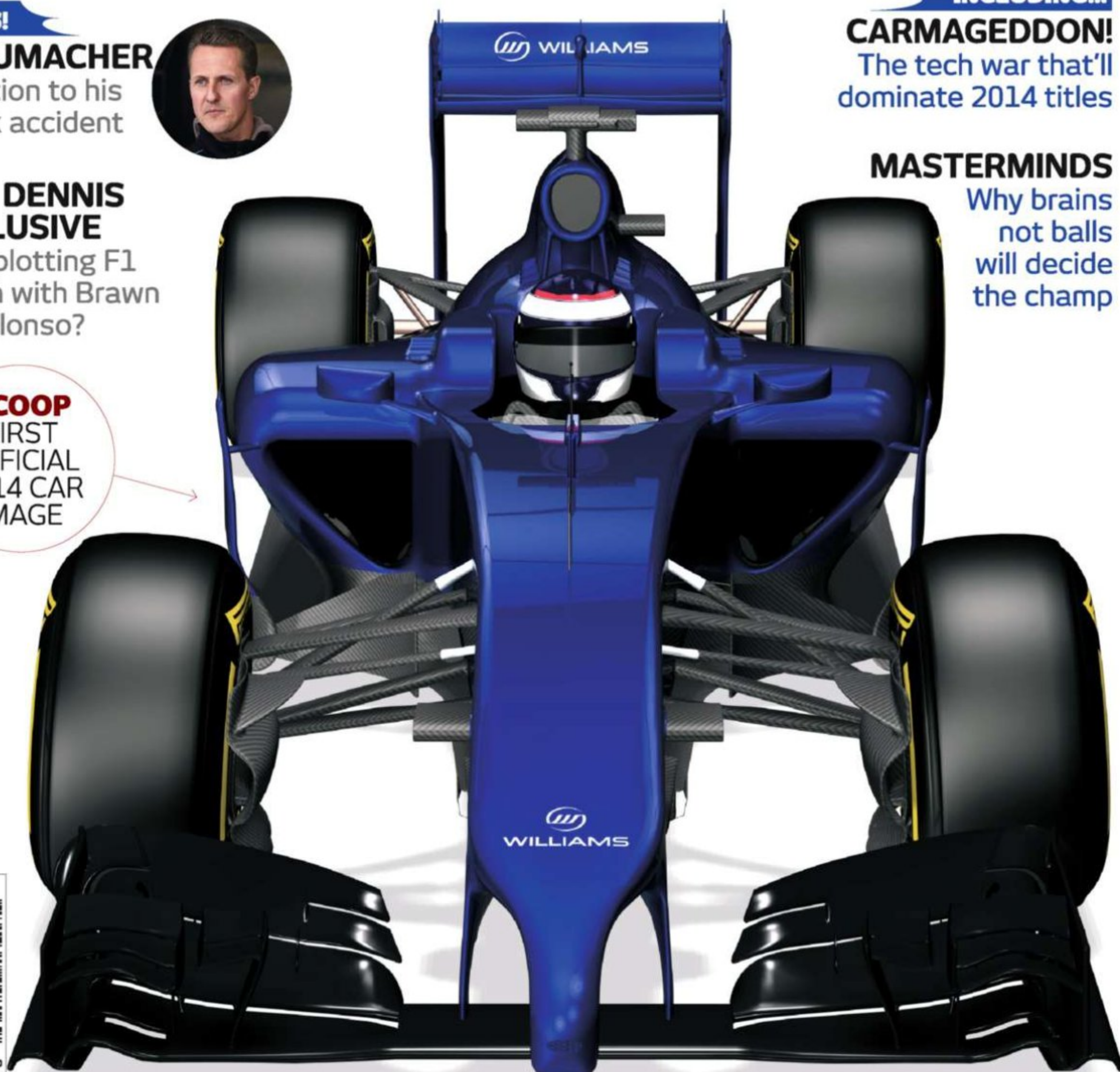
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A full report on Michael Schumacher's condition in the aftermath of his skiing accident





Ignition / Anthony Rowlinson / 02.14

So much has changed as the sport enters a new era

A million words have been written about Michael Schumacher; a million more will. Controversial, yes; brilliant, yes; as divisive of opinion as he was compelling to watch. All of these things and more, but this is no time to judge Michael Schumacher's contribution to Formula 1, nor his status in the annals of sporting greatness. Rather, it is a time to hope for his successful recovery from injury and respect his family's calls for privacy at a moment of unimaginable difficulty.

There is sadness, also, for the Button family, as news arrived shortly before we closed for press of the death of John Button, Jenson's dad. It's rare in Formula 1 to come across an individual truly without an enemy, but JB senior was one such. Ever present throughout Jenson's career, and his most loyal and enthusiastic supporter, John will be sorely missed in the paddock by all of us who've shared a natter, a joke and drop of red with him over the years. John, we raise a glass to you.

But however cheerless these recent events, the show must go on, and as teams adapt to F1's biggest ever rulebook shake-up, 2014 looks set to be a season to remember. So much has changed, indeed, that we've dedicated much of this issue to the most comprehensive run-down of the new rules and regs you'll find.

Where to begin? Perhaps with the all-new V6 hybrid power units that will provide the sound and the fury this year (page 46). They're nothing less than revolutionary: engineering masterpieces that have pushed their

creators' innovative powers to the limit. As a taster, how about turbochargers that spin to a peak of 125,000 revs? Or energy recovery systems with electro-thrust equivalent to approximately 160bhp? Gone are the days of 'KERS failure' being a mere irritation. If the ERS of a 2014 motor gives up, the performance drop-off of around nine seconds per lap will enforce retirement.

Despite the reduced capacity of the internal combustion engine, the overall output of these, ahem, electrifying units has increased – particularly at the grunty end. Lots of torque will be a defining characteristic, making them harder to control. They're also bound to be unreliable, at least in the early season, as there's simply so much new tech to optimise (ie to go wrong). One of Mercedes, Renault or Ferrari will have got it more right than their rivals, so expect teams with the most sorted engine to show strong early form.

How refreshing for F1 to have shifted the emphasis of performance from near-obsession with aerodynamic gain to become more motor-dependent – although don't doubt that the aero war will still be vigorously fought, as Mercedes' Geoff Willis confirms on page 54.

This degree of change will require a particular set of skills from drivers. Flat-out blitz stints are a thing of the past: cerebral speed is the key to 2014 success. And that's why I've stuck my neck out in tipping for success a man some might consider an unlikely candidate. Who's that? Turn to page 66 and you'll see...



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Contributors



Anthony Peacock
F1 Racing's master of languages

We've coveted an interview with Ferrari legend Mauro Forghieri for a long time now – all that was required was a polyglot scribe to vault the language barrier (p84)



Peter Windsor
Former Williams and Ferrari team manager

Having spent many years working at the sharp end, Peter has a keen eye for how style translates into speed. On p58 he analyses which drivers will thrive in 2014



Dominic Harlow
Ex-Force India and Williams chief engineer

To sort the meaningful changes to the 2014 rules from the less important ones, we asked Dominic – lately of Williams and Force India – to sum them up. See p40

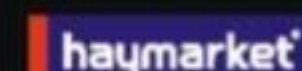


Thomas Butler
Roving lensman and cultural guru

Has camera, will travel. This month we dispatched Thomas to photograph one of F1's greatest engineers (p84) in a 17th century villa near Maranello.



Thanks to Nicola Armstrong, Matt Bishop, Thomas Butler, Sam Buxton, Tim Clark, Stephen James Cooper, Laura Coppin, Didier Coton, Russell Day, Sarah Dryhurst, Fiona Fallon, Lucy Genon, Ross Gregory, Joanne Grove, Bradley Lord, Chris Murray, Adrian Myers, Georg Nolte, Sophie Ogg, Vladimir Rys, Alexandra Schieren, Thomas Webb, Timothy Wright, Claire Williams **Special thanks to** Andrew Ferraro and Valter Bottas



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NEWS

Schumacher remains in critical condition

The seven-time world champion is still fighting for his life in a Grenoble hospital after suffering massive head injuries in a skiing accident in December

Michael Schumacher suffered life-threatening head injuries in a fall on a skiing holiday over Christmas. On 29 December, five days before his 45th birthday, the seven-time champion fell and hit his head on a rock. Even though he was wearing a helmet, the impact caused swelling and bleeding in his brain.

He was initially evacuated to a hospital in the Meribel resort, above which the accident happened, but his condition deteriorated rapidly. Schumacher lost consciousness and was taken to a more specialist unit in Grenoble.

Doctors operated on him that night, removing a haematoma from the right-hand side of his brain, and afterwards kept him in a medically induced coma at cool temperatures to reduce the risk of swelling. A second operation was conducted 24 hours later to remove a haematoma from the left-hand side of his brain and lower the pressure inside his skull.

Doctors said the operations were successful, but, at the time of writing, Schumacher's condition remained critical yet stable.

The team treating him confirmed other haematomas were spread through his brain, too deep to be operable, which made it impossible to predict an outcome. Doctors added that, if he survived, it could be weeks before any assessment could be made as to whether he had suffered permanent brain damage.

Former F1 doctor Gary Hartstein has been closely following news conferences held at the hospital and said: "Michael is grievously injured but from what's being said and not said, things are not getting worse."

There were mixed reports about the events leading up to Schumacher's injury. *The Times* claimed that because his helmet split open he must have been skiing at between 60-100km/h when he crashed – an observation apparently backed up by medics attending Schumacher, who described the impact as "very violent".

But Schumacher's manager, Sabine Kehm, who was not with him at the time, said: "That does not mean Michael was travelling at high speed. He was not too fast."

The incident happened on a stretch of untended snow – off piste – between two marked-out runs. Schumacher was with his son Mick and a small group of friends.

Kehm said: "Michael's group had been skiing on normal slopes. They went into an area between red and blue slopes. He helped a friend who had fallen, went into deep snow, hit a rock, was catapulted into the air and landed head down. It was bad luck, not because he was at speed."

Kehm urged reporters to respect Schumacher's privacy after a journalist dressed as a priest tried to gain access to his room.

News of his injury sent shockwaves through F1. Drivers and teams sent messages of support, many mentioning his fighting spirit.

A statement by his family said: "Following Michael's skiing accident, we would like to thank the people from all around the world who have expressed their sympathy and sent their best wishes for his recovery. They are giving us great support. We all know he is a fighter and will not give up. Thank you."



PHOTOS: MARK THOMPSON/GETTY IMAGES; ALEX GRIMM/BONGARTS/GETTY IMAGES; PETER MACDIARMID/GETTY IMAGES; SAUBER



Sabine Kehm: urged reporters to respect Michael's privacy



Michael's fans keep vigil outside the hospital in Grenoble



A message projected onto the side of the hospital on Michael's 45th birthday



MARUSSIA HOLD ON TO MAX CHILTON

Max Chilton will keep his seat with Marussia. This was announced on the *F1 Racing* stand at the 2014 Autosport International Show.



NEW TEAM SOUGHT

The FIA wants a new team to fill the vacant 12th slot on the grid for the 2015 or 2016. It's hoping F1's new turbo-engines will tempt car makers such as VW and Toyota into the sport.



The medical view

A professor of anaesthesia at Liège hospital and F1's medical delegate between 2005 and 2012, **Dr Gary Hartstein** gives his expert opinion on Michael Schumacher's injuries

"First of all, it's important to say that Michael is in very good hands. His head injury is life-threatening and the doctors looking after him deserve a lot of credit. But at the time of writing, it is still difficult to give any sort of long-term prognosis.

"From what I've heard, it sounds as if Michael's intracranial pressure was worryingly high early on. This is bad news because the swelling of the brain after an injury of this type compresses the blood vessels that are needed to nourish the brain.

"You try to optimise the flow of cerebrospinal fluid and blood return to the heart by nursing the patient 30° head up. The brain must be perfused with blood containing the right amounts of oxygen and glucose to maintain healthy cellular metabolism. If the pressure is too high, the patient is sedated to protect the brain by decreasing its metabolic requirements.

"We know that besides keeping Michael deeply asleep, they've also slightly lowered his body temperature. This is part of the strategy to optimise the brain's metabolic state.

"We've been told that Michael has bilateral lesions. This means the brain is wounded in both hemispheres, which shouldn't surprise us as it was a hard hit. We haven't been told what kind of lesions he suffered, but we can assume a mix of three types. First, the haematoma. This is collected blood that has coalesced enough to be evacuated. Two have been drained, and the rest will be left to resorb naturally.

"Next are contusions. These are bruises that result from blunt forces, and consist of areas of swelling and blood that's seeped out of the vessels into the tissues. In the brain, as elsewhere, that blood gets absorbed, and the damage heals. It's usually fine, but sometimes small cavities are left behind.

"The third type of lesion is microscopic. It consists of damage to the bundles of cables connecting brain cells. This type of damage isn't readily visible using standard imaging, but is often associated with poor neurological outcome.

"Michael will remain sedated while the swelling reduces and his brain is nourished with oxygen and glucose from blood flow. Recovery could take a long time and we will need to be patient."



Dr Gary Hartstein:
"We will need to be patient"



Despite his 25 per cent share in the team, as a non-executive chairman Ron Dennis has no say in the running of McLaren

EXCLUSIVE

McLaren boss Ron Dennis plots comeback

There's trouble at the top as non-executive chairman Dennis reveals he has spoken to Ross Brawn about joining McLaren and says he wouldn't be averse to re-hiring Fernando Alonso

All is not well at McLaren – and that is not just a reference to their dismal 2013 season on the track.

Behind the scenes, sources claim a power struggle is taking place that could lead to Ron Dennis regaining control of a team that, until recently, seemed to be slipping away from him.

Despite being a 25 per cent shareholder in McLaren Racing

– and a 16 per cent shareholder in McLaren Automotive, the road-car division – as a non-executive chairman, Dennis has no executive power on the board. Nor does he have any say in the running of the F1 team, from which he stepped down in 2009.

It is widely known in F1 that there is tension between Dennis and McLaren's other major

players: Mumtalakat, the Bahraini royal family's investment arm, which owns 50 per cent of the team; and Dennis's long-term partner Mansour Ojeh, who owns 25 per cent. And the relationship between Dennis and McLaren team principal Martin Whitmarsh has been strained for some time.

Three facts about Dennis have emerged in the media. One is that

he is sourcing Chinese finance to buy out Ojeh. The second is that he has sounded out Ross Brawn as to his future availability. And the third is that he says he would not object to Fernando Alonso returning to McLaren.

That last fact is perhaps the most astonishing. After all, Alonso fell out with Dennis to catastrophic effect, following a

stormy season together in 2007. McLaren were almost brought to their knees by Alonso's threat to reveal incriminating information about the 'Spygate' scandal to the FIA, which led indirectly to a \$100m fine and exclusion from the constructors' championship.

And yet, when asked whether he would have a problem with Alonso returning to the team, Dennis said: "I think one has to recognise that the first objective of any team is to win races and then whatever obstacles sit between a team wanting to win races and winning races, be it engineering, fiscal or human issues, you put it to the team to resolve them. You never say never."

Dennis also admits he has spoken to Brawn, now a free agent heading off for a fishing holiday after leaving Mercedes and insistent he won't enter any discussion about his future until the summer at the earliest.

"We were shooting together," said Dennis. "We were having a chat and we're mature motor-racing people, so of course you're going to talk about life. But beyond that, as you would expect, it's normal stuff: people probe around, the possible, the impossible. My understanding is he intends to take a year off."

But why would Dennis be sounding out Brawn when he is explicitly not meant to have any

role in McLaren's F1 operation. What could his intentions be?

"When you're chairman," he said, "you look at the other investments you have and you try to bring the vision as to what the future should hold. As a motor racing person it is completely understandable that you focus on motor racing, which is the core activity of McLaren, but it's a much bigger look that I take."

"Of course you want to win races and succeed. But this is sort of almost what that part of the company exists to do and it is of course vital to look at that and judge the team."

Sources say Dennis has no interest in sitting on a pitwall orchestrating McLaren as team principal. But that is not to say he is happy with how things are going at McLaren.

Does he want to use Chinese money to buy back Ojeda's shares and install Brawn at McLaren to make McLaren a winning force when paired with engine supplier Honda from 2015? Is he willing to have Alonso as a driver (assuming of course the Spaniard is prepared to work with Dennis again, which he has suggested he is not)?

"Clearly," Dennis says, "whatever strategy or intentions I have for my own involvement in the world, let alone McLaren, until I choose to make those public, you don't know."



Ron Dennis would not rule out Alonso's return to McLaren

WINNERS + SPINNERS

UPS AND DOWNS ON THE F1 ROLLER COASTER

GOOD
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Fans who want to have their say

Ferrari have confirmed that the designation type number of their 2014 title challenger will be decided by fans via an online vote. Perhaps it will end up as the F166 (after the new 1.6-litre V6 regs).

The kings of qualifying

The FIA have announced that the driver who scores the most pole positions in this year's Formula 1 world championship will receive a new trophy. But despite the double-points rule for the season finale, there will be no additional points awarded for pole.

Popcorn sales

Fans of the *Senna* and *Rush* movies can enjoy a new F1-flavoured big-screen offering: *1: Life on the Limit*, a documentary narrated by Michael Fassbender that charts safety improvements in the sport over the past 40 years. The film went on general release in the UK on 10 January.



Russian attendance on the grid

Remember Sauber announcing last summer that Russian youngster Sergey Sirotkin would get an F1 seat in 2014? Well they now seem to have backtracked on that plan and the inexperienced Sirotkin will spend another season driving in World Series by Renault for Fortec.

Staff retention

Mercedes have taken on two engineers from Red Bull. Head of vehicle dynamics Mark Ellis will become performance director at Mercedes, while chief simulation engineer Giles Wood now becomes chief engineer. Pierre Wache will fill the vacancy created by the departure of Ellis.

Flashy new car launches

Most teams are planning to roll out their new cars on the morning of the first Jerez test (28-31 January), putting an end to the era of lavish launches. Even McLaren are just limiting themselves to an online reveal.



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F1 Mastermind

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- 1 Can you name the Dutch driver who started 106 F1 grands prix?
- 2 Which Formula 1 team factory has the postcode OX29 9EF?
- 3 Which football team does Marussia sponsor?
- 4 Which former F1 circuit has a corner called 'Bolderberg haarspeldbocht'?
- 5 How many races did Nelson Piquet (left) win en route to the 1981 world championship?
- 6 Who did Michael Schumacher crash into on the installation lap of the 2005 Chinese GP?
- 7 Which team ran a car known as the CG911 in 1991?
- 8 Which engine manufacturer took the first 16 positions in the 1973 German GP?
- 9 In which city was Force India driver Sergio Pérez (right) born?
- 10 Where did Jan Magnussen score his only point in F1?



THIS BOY CAN DRIVE

Keeping an eye out for the stars of tomorrow



Alex Lynn Who is he?

An Essex-born British racer, who last month announced he will contest this year's GP3 Series with Carlin.

How good is he?

Lynn, 22, was the British Formula Renault champion in 2011. He made the transition to Formula 3 the following season, and on his first visit to Macau put his Fortec on pole position and finished third overall in the race.

At last year's Macau Grand Prix he took pole again – and this time followed it up with victory.

Anything else we need to know about him?

Lynn's tie-up with Carlin coincided with his appointment to the Red Bull Junior Programme for 2014. Carlin have run the likes of Sebastian Vettel, Daniel Ricciardo and Jean-Eric Vergne in the past – so Lynn will start the year as one of the favourites. He's managed by former F1 driver Alex Wurz.

F1 chances

F1's Red Bull Junior rookie Daniil Kvyat won the GP3 Series in 2013 and joins the F1 grid with Toro Rosso in 2014. If Lynn can repeat that feat, then watch this space...

NEWS

Di Resta may have been fast, but his attitude didn't help with F1's commercial pressures



Di Resta forced out of Formula 1

Force India driver most likely to return to DTM

Paul Di Resta's F1 career appears to be over, at least for the time being. The Scottish racer has not been offered an F1 drive for 2014.

The Scot has known for some time that he was on his way out; before the Abu Dhabi Grand Prix he told friends that he had accepted it as a reality. He was aware that without significant finance his chances of finding another seat were effectively zero, as all the teams that still had seats to fill at that stage were looking for drivers with funding. Force India have now confirmed a driver line-up of Sergio Pérez and Nico Hülkenberg. Pérez is sponsored by Mexican telecoms giant Telmex.

Di Resta has not helped himself, however. His tendency to speak harshly over the team radio when he encounters problems has been noted, as has his failure to grasp the realities of the commercial aspects of F1.

"Ultimately," says former driver and BBC co-commentator David Coulthard, who cycles with Di Resta and has tried to help him with his career, "his fate is a good example of the fact that being a fast racing driver is not enough."

"You have to make sure that you are a professional racing driver in the sense of understanding how to glad-hand the sponsors and the team."

"It is a constant PR exercise out of the car. It's tough and a lot of drivers don't get that."

Di Resta is now highly likely to return to Germany's DTM touring car championship, from which he graduated to Formula 1 in 2010 following a reasonable amount of success. His cousin Dario Franchitti earned fame and fortune in IndyCar before retiring after one too many serious accidents. Di Resta has therefore decided that IndyCar is just too dangerous.



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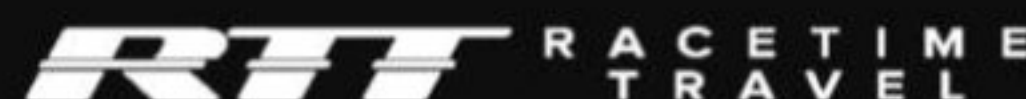
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PITPASS / Driver line-ups confirmed at Sauber and Force India



Sutil starts a new season for a team other than Force India – for the first time in his F1 career

PHOTO: SAM BLOXHAM/LAT, SAUBER

NEWS

Sutil joins Sauber; Pérez to Force India

Mid-field seats now filled as Nico Hülkenberg and Adrian Sutil swap places and McLaren refugee Pérez joins Force India

Adrian Sutil is starting his seventh season in Formula 1 (not including his year out in 2012), but 2014 will be the first time he has experienced a different team.

The German racer has always driven for Force India (including one year when the team competed under the name Spyker). But for 2014 he has been forced to find a new home. He has chosen to race for Sauber, in a swap deal with fellow German Nico Hülkenberg.

Sutil says he was looking for a move long before it became clear that there was no seat

for him at Force India: "I felt that it was time for a change and we worked hard for months to make it happen. It will be an interesting experience to see how another team does things."

Sutil appeared on the *F1 Racing* stage at the Autosport International Show in January and said he was

targeting podiums and looking forward to "the factory being an hour's drive from home".

Sauber have decided to stick with Esteban Gutiérrez as their second driver despite the Mexican's unconvincing debut in 2013. The continuation of sponsorship from Gutiérrez's home country was instrumental in the deal.

And after being dumped by McLaren, Sergio Pérez has a new home at Force India where he will race alongside Nico Hülkenberg (who has switched from Sauber). The Mexican has won admiration for the dignified manner in which he handled McLaren's decision to sign Kevin Magnussen, and hopes to use his new team as a springboard back to the top.

"I'm looking forward to proving myself in F1 again," he said. "I managed to get the attention of big teams in 2012 with Sauber, and I see no reason why I can't do the same next year."

He admits he has something to prove, following a 2013 in which he failed to convince McLaren he was championship material.



Pérez: hopes to use Force India to secure a return to the top

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NEWS

Bernie awaits court verdict

Long-running saga over Ecclestone's dealings with a German banker will soon conclude

Bernie Ecclestone is set to learn whether he has been found guilty in a £27m bribery trial that concluded in London's High Court in December 2013, with Mr Justice Newey reserving judgment until the new year.

Ecclestone had been accused of making a "corrupt bargain" with banker Gerhard Gribkowsky, and stands accused of paying him \$44m (£27m) in bribes to undervalue German bank BayernLB's stake in Formula 1 when the sport's commercial rights were sold to CVC Capital Partners.

German media company Constantin Medien say they lost out as a result of the alleged deal, claiming Ecclestone wanted to ensure CVC ended up as owners of F1 because they had guaranteed they would retain him as chief executive.

Ecclestone does not deny paying the money to Gribkowsky, but insists the payment was to prevent the banker from giving false information to the British tax authorities about Ecclestone's finances and triggering a lengthy and expensive inquiry.

Meanwhile, the UK's shadow attorney general Emily Thornberry has called for Ecclestone to be investigated by the Serious Fraud Office. She said: "We cannot just walk away from this case. It does seem to me that we have a duty to investigate this. What is the Serious Fraud Office for if not for investigating cases like this?"

Giving evidence in the High Court, CVC chairman Donald Mackenzie, said: "If it is proven that Mr Ecclestone has done anything criminally wrong, we would fire him."

The Constantin Medien case was a civil trial, so Ecclestone could retain his position whatever the outcome. But he is now waiting to hear if he will face trial in a criminal case in Germany. BayernLB, who are preparing their own £246m damages suit, have been granted access to the documents from the recent High Court trial.

Ecclestone recently indicated, for the first time, his preference for a successor, saying Red Bull team principal Christian Horner would be "ideal". *F1 Racing* now understands Ecclestone's remarks were a typical double-bluff. High-level sources say it was aimed at supporting Horner while he was suffering from internal pressure at Red Bull, rather than being a serious suggestion for the future management of F1.

REACTION

Uproar at double points for final race

Double points in Abu Dhabi, drivers to pick own numbers, and a budget cap are some of F1's more controversial new rules

Formula 1 has taken the controversial step of introducing double points for the final round of the world championship, amid a series of sporting changes for next season.

The FIA said the decision was made "to maximise focus on the championship until the end of the campaign," but reaction has been almost universally negative – not just from fans but also from the current and former drivers who have given their views.

Sebastian Vettel called it "absurd", claiming "drivers, fans and experts are horrified."

"I value the old traditions in Formula 1 and do not understand this rule," the four-time world champion added.

And former driver Martin Brundle described it as "an answer to a question no-one was asking".

Ferrari, too, have questioned the new rule, calling it "artificial" and suggesting it could be dropped before the start of the season.

The idea first came from Bernie Ecclestone, who wanted to find a way to prevent the fall-off in television viewing figures that occurs when a championship is decided early. A drop in people watching makes it harder for teams to generate sponsorship.

The irony that appears to have been lost on Ecclestone is that a ploy such as this may actually lead to a drop in viewing figures if

viewers object to the artificiality of the situation.

There have been other changes as well. Each driver will now be able to pick a car number for their entire career; a trophy will be awarded at the end of the year to the driver with most pole positions; and most importantly of all, the principle of a global cost cap has been adopted for 2015.

Whether a budget cap materialises remains to be seen. A figure has not yet been set, and given the teams have spent four years failing to agree over a resource-restriction agreement, many F1 insiders doubt they will be able to do so for a fixed-expenditure figure.



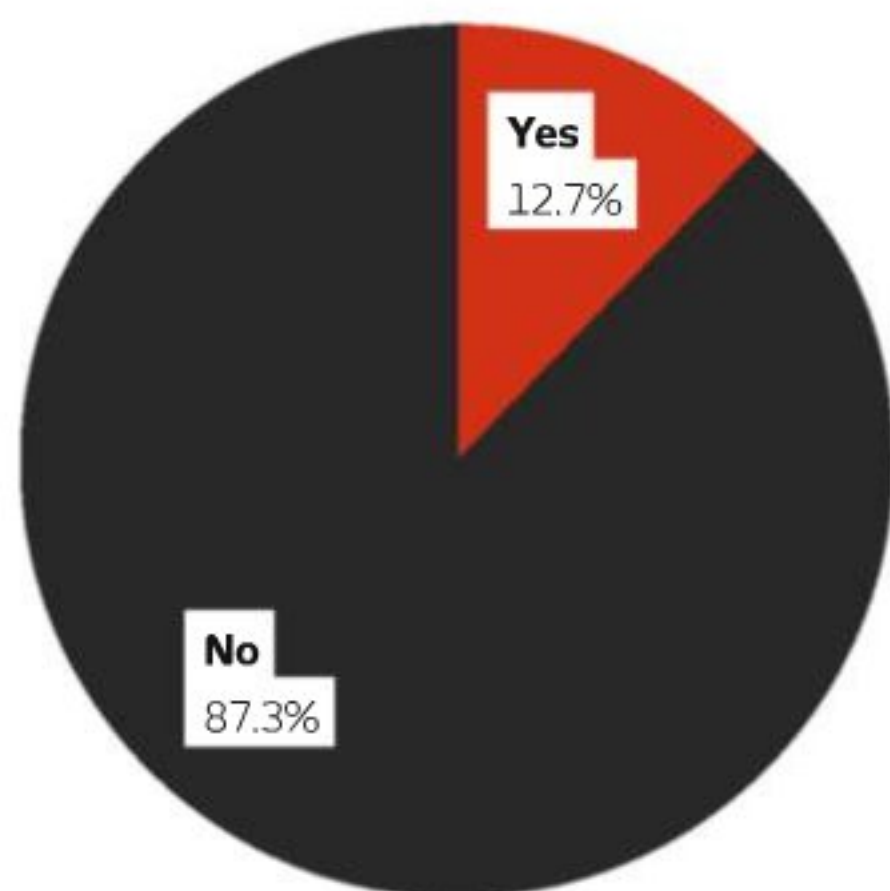
Yas Marina: double the excitement?

STATS

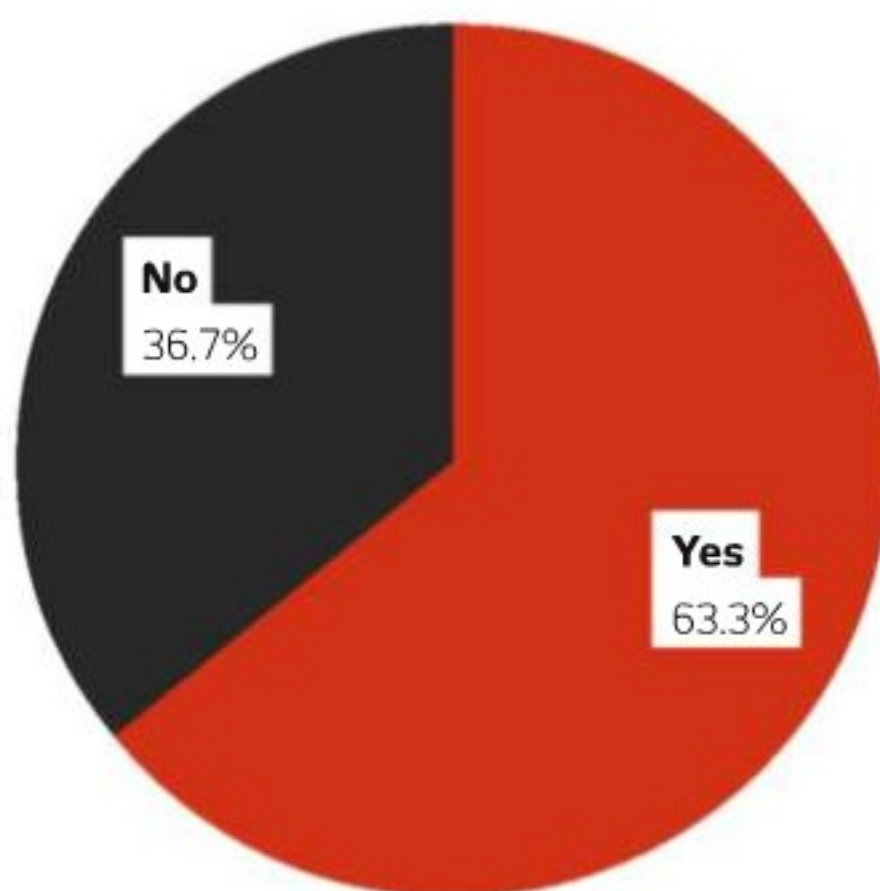
You say 'no' to double points

More than 7,000 *F1 Racing* readers gave us their views about F1 in 2014...

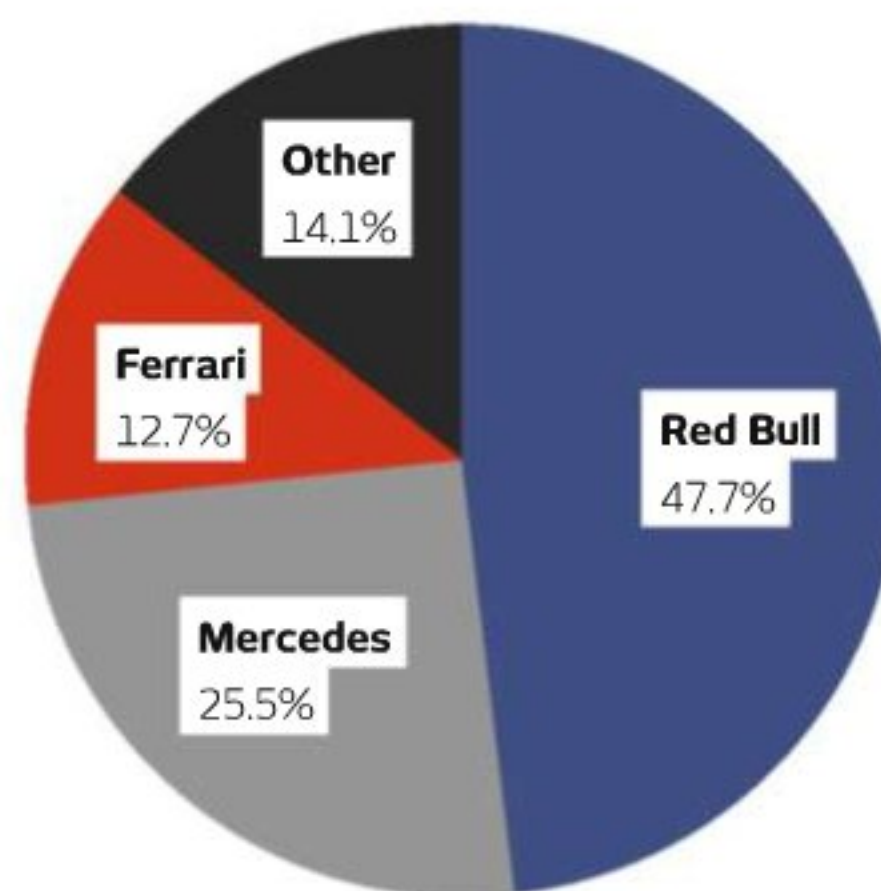
Do you agree with awarding double points at the season finale?



Do you agree with drivers choosing their own numbers?



Which team will be most competitive in 2014?



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NEWS

Rosberg suffers tyre failure in Pirelli test

High-speed spin while testing 'completely innovative' new compounds deepens rift between Pirelli and teams

A tyre failure at 200mph on Nico Rosberg's Mercedes at the pre-Christmas Pirelli test in Bahrain has reignited concerns among teams about the suitability of F1's tyre supplier.

Rosberg tweeted about the incident, saying: "Just spun at full speed 320km/h on Bahrain straight cause my tyre blew up without warning. Thanks to that need to get some toilet paper now." The tweet was deleted a few minutes later.



Four teams pushed to get Michelin into Formula 1 for 2014

Pirelli had requested the test to try out some 2014 tyres, because they are concerned about the torque demands of the new turbo engines. After

the incident, they issued a statement saying they had been trying out designs that were "completely innovative in terms of structure and compounds", adding that the failed tyre was a "prototype that had only been tested in the lab and which will not be proposed again".

Pirelli are not yet confirmed as F1's tyre supplier. Practicalities mean they will be, but the FIA have stated only that Pirelli "may" continue, subject to satisfying technical and safety standards. In the light of the issues in 2013, this recent failure will not increase confidence in Pirelli's ability to do that.

In 2013, four teams, one being McLaren, pushed to get Michelin into F1. Michelin were keen, as was FIA president Jean Todt. But Bernie Ecclestone persuaded three teams to sign new contracts with Pirelli (with

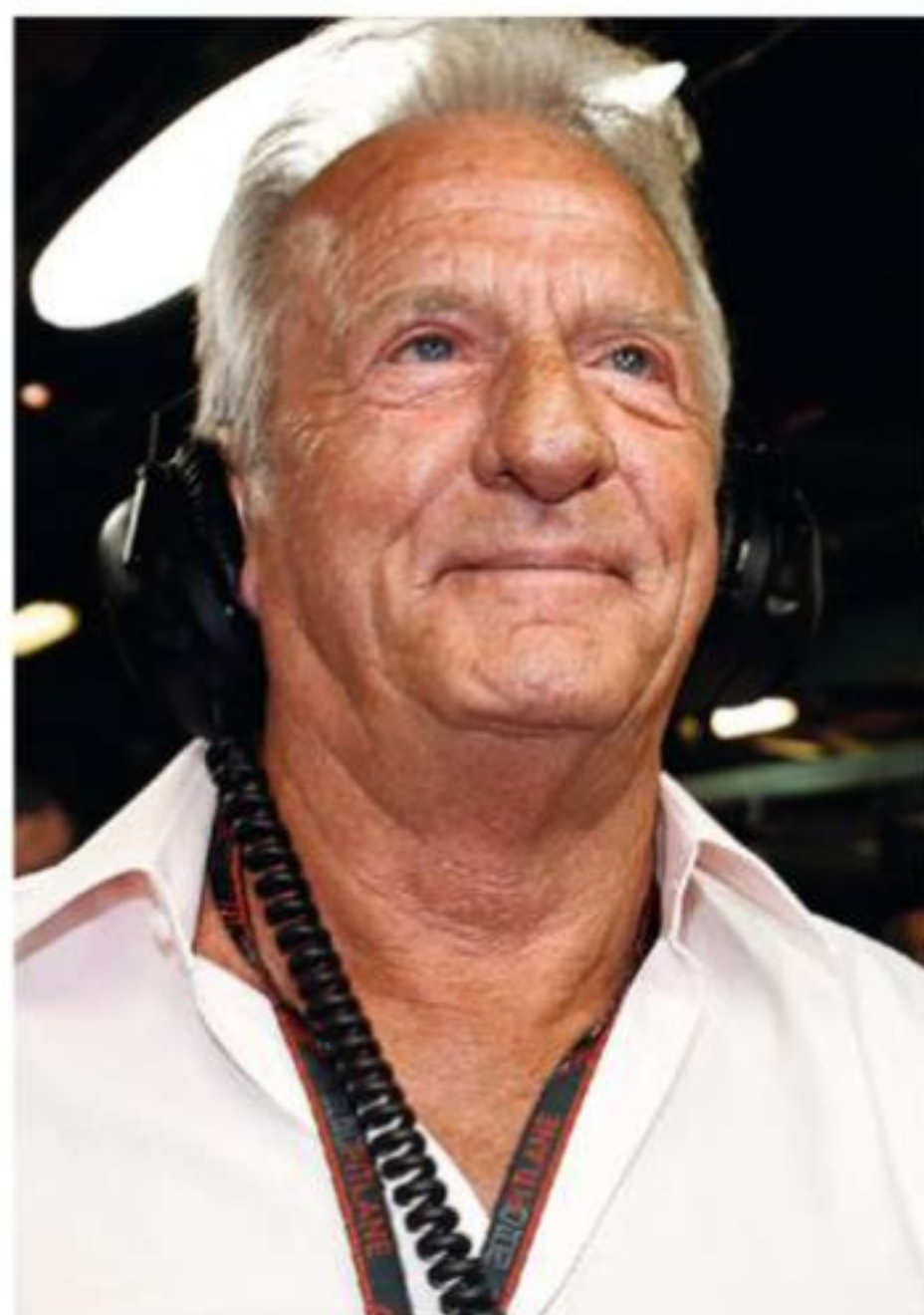


Rosberg spun at 200mph during Pirelli test in Bahrain

whom he has a trackside advertising deal), thus scuppering the Michelin plan. The FIA is supposed to hold a tender process for a new tyre supplier, but Todt was fighting for re-election as president and did not want Ecclestone to back an opponent.

Speaking to *F1 Racing* (p64), Pirelli boss Paul Hembery said: "I'm happy F1 chose to conduct pre-season testing in Bahrain this year, as it's an important track for getting to grips with temperature and traction."

OBITUARY



John Button 1943-2014

As a new season dawns, the F1 paddock has lost one of its most popular and ever-present figures. John Button, father of 2009 champion Jenson, has passed away, aged 70. He died of a suspected heart attack at his home in the south of France on Sunday 12 January.

John's life was dominated by motor racing. In his early days he raced a VW Beetle in rallycross and was runner-up in the 1976 British championship. His success took him to Europe where he continued to race, but his attention switched to his son when he gave Jenson, then aged eight, his first 60cc kart.

John started to take his son to karting circuits across the country. As Jenson's prowess behind the wheel grew, Button Sr

established a karting engine preparation business to help fund his son's racing career. And over the course of Jenson's F1 career, John missed only a handful of his races. Indeed he was on top form, as ever, in Brazil 2013, when he helped Jenson celebrate becoming F1's most experienced British driver (joint with David Coulthard on 246 starts).

"He was not only a great dad, but also a lovely man, and he'll be enormously missed by Jenson, of course, by all at McLaren, and indeed by the Formula 1 community at large," said McLaren boss Martin Whitmarsh.

F1 Racing passes on its condolences to the whole Button family and John's four children, Jenson, Natasha, Samantha and Tanya.



In 2013, the web-based motorsport TV show hosted by Peter Windsor clocked up some amazing statistics... and 2014 promises to be even bigger and better



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Pat Symonds

PITPASS TECH

Explaining the hidden brilliance that drives Formula 1 forward

THE SCIENCE BEHIND...

Weight saving

The subject of weight has been continually in the news with respect to the 2014 cars. Why is weight so important this season?

To be pedantic, it is actually mass that is important, as Isaac Newton pointed out in his second law of motion, which he published in 1687. In this, he stated that it is mass that resists acceleration. Believe it or not, a car with a notional weight of 650kg will actually weigh around 170g less in Interlagos than it will in Abu Dhabi, owing to the higher altitude of the circuit in São Paulo having an effect on the gravitational strength felt by the car. This change of weight occurs even though the mass of the car is unaltered.

Does this mean that a heavier car simply accelerates more slowly than a lighter car?

Yes it does, but not just in the context of the classical 0-to-60 time. A racing car is always accelerating in the sense that its velocity is always changing. By this, I mean that it is not just gaining speed along the straight that signifies a change in velocity. Changes in velocity also take place during braking and even when a car is going around a corner. In order to go around a corner, a car changes its velocity in a lateral sense and acceleration is defined as a change of velocity in any direction, whether it be lateral, longitudinal, vertical, or any combination of the three.

Can you quantify the effect in terms of lap time?

We use simulation to predict lap times under a variety of conditions, and from this we can predict the effect of mass on lap time. Of course the answer will be slightly different on each circuit, depending on the nature of the corners, but as a rule of thumb an extra 10kg of weight will slow the lap time by around 0.4 seconds.

But surely all cars are at the minimum weight limit, so weight doesn't matter?

In a sense this is true, and before the advent of KERS it was very easy to build an F1 car to the minimum weight. Since KERS with its heavy batteries was introduced, it has become slightly more difficult but certainly not impossible to accomplish. The reason it has become a topic of conversation recently is that the 2014 power units are considerably heavier





HOW IS THE MINIMUM WEIGHT DECIDED UPON, AND HOW IS IT BALANCED FRONT TO REAR?

It was introduced to remove the temptation to compromise safety through inappropriate construction. This was when analysis lacked the integrity it has today. Now it's more to do with cost.

In terms of weight distribution front to rear, this goes hand in hand with the tyre characteristics.

Tyre sizes in F1 are similar front to rear, so static loads on the front and rear axles are similar. More recently, the rules have limited distribution to within around 0.5 per cent of 46 per cent front. This has been done to stop expensive experiments with cars of wildly varying weight distribution.



Driver weight is now a bigger issue due to the greater weight of the new power units

than their 2013 counterparts, and suddenly it is no longer easy to achieve the minimum weight limit. This is why attention has now turned to driver weights, since they are counted as an integral part of the car weight.

If it was relatively easy to achieve the weight limit before, why was so much emphasis put on weight saving through complex and intricate designs?

It was because there is another factor that affects performance and that is the height of the centre of gravity. Its effect is not as profound as that of mass itself, but nevertheless a reduction of centre of gravity height of 10mm will improve lap time by around a tenth of a second. Now that may not sound much, but it can make a difference of several grid places in qualifying. The easiest way to reduce the centre of gravity height is to reduce the mass of the components on the car to achieve a basic design that is underweight and then to make up the weight with heavy ballast placed as low as possible on the chassis.



Ballast (usually made from tungsten-based alloys in F1) is added to a McLaren at the 2010 Turkish GP

So you spend a fortune to reduce weight just so you can add heavy parts to get the weight back up?

Yes. It sounds perverse but it really isn't, although the powertrain actually has a prescribed centre of gravity height just to eliminate this contrariness. There was also a time when we could set the ballast in different positions to alter the load on the front or rear tyres to improve their utilisation, but for the past few years even that freedom has been taken away from us through prescriptive regulation.

What do you use for ballast?

We used to use depleted uranium, but it seems to have become socially unacceptable these days... Now we tend to use tungsten-based alloys, which are more than 50 per cent more dense than lead, and therefore easier to package within the tight confines of the car.

How do you save weight then?

Well the best way is to eliminate parts. If they don't exist you can't make them any lighter.

This might be done by integrating the function of parts such that a bracket performs more than one purpose, for example.

If we are unable to eliminate a particular part, then a careful analysis of the loads and stresses that the component is subjected to will allow the designer to optimise the design for minimum weight. Modern analysis techniques have contributed greatly to this while actually improving reliability.

We also use some pretty exotic materials, such as carbon-fibre composites, which offer very high strength and stiffness-to-weight ratios. For metallic parts we will use the best alloys of steel, titanium and aluminium and then machine every last gram out of them – often at very high cost.

Have you ever gone to extremes for weight saving?

Well I do remember one particular car I worked on many years ago. The wires in the loom were so thin, I recall that when current was applied to the rear light, the wire glowed more brightly than the light itself. 🚫



Peter Windsor RACER'S EDGE

Authority, wit and intelligence from the voice of *F1 Racing*

WISHING MICHAEL A FULL AND SWIFT RECOVERY

We all reacted in our own ways to the news of Michael Schumacher's accident. In my case, as it became clear that Michael's condition was life-threatening, I thought back to March 1986, when Frank Williams' life was also hanging by a thread. Like Michael, Frank was in a coma and on a life-support machine. I don't think I've ever prayed more, or *wanted* anything more, than for Frank to survive that crisis. Confined to a wheelchair for the rest of his days? Unable to cope on his own? That would be *nothing*. All that mattered was his life. The gift of his life, if we were given it, would equate to a million Christmas Days.

I was always shocked by those F1 luminaries who at this crucial time advised Frank's wife, Virginia, to turn off the life-support machine.

"Frank wouldn't want to live like that," said someone I'd prefer not to name. Who can fathom this person's thoughts or motivation? Luckily, Ginny's response was short and to the point.

"Bollocks," she said in that way of hers. "So long as Frank can think and talk, he can run a racing team. Enough please. Doctors? Keep him going..."

Although Michael's condition, as I write, is thankfully stable, his crisis, for me, engendered the same feelings. It doesn't really matter what after-effects materialise so long as he's with us. To lose Michael in a freakish skiing accident, with his family around him, over the holiday period, a few days short of his birthday, would be almost too much to bear. Love him or loathe him, he is so much a part of modern F1 that it's as if he's created it. Certainly his approach to racing (specifically the positives) still permeates the F1 paddock – and particularly the

minds of most of the younger drivers you see out there today.

For me, his accident is also a reminder that I've been guilty of taking him for granted. It's so easy to think about Michael in terms of the dubious things he's done on track and his less-than-satisfactory three years with Mercedes, that we tend to forget all

the astonishing moments he gave us at both Benetton and Ferrari. There is no excuse for what he did at Adelaide 1994, or Jerez 1997 or Monaco 2006. But equally, there's no excuse for filing his seven world championships and 91 grand prix wins under the heading of 'boring'. And, while we're at it, let's not forget that it should have been eight titles: 1999 would have been his, too, but for that brake failure at Silverstone.

Anyway, thinking positively, what will be the effects of this accident? None of us know, but we can perhaps surmise: Sir John Whitmore, a very fast and versatile racing driver in the 1960s, was staggeringly successful in his retirement as an author and international speaker (750,000 books sold in 25 different languages). He also skied in his spare time. Skied hard and fast.

"John was a very, very good skier," recalls Paul-Henri Cahier, who in his own right was skilful enough to ski regularly with Bob Wollek, the former French ski champion who later won F2 and WEC races with great consistency.

In 2007, having just turned 70, Sir John had a big off-piste accident in Austria, smashing his head against a hard sheet of ice. Like Michael, he was wearing a helmet. Like Michael, he seemed more or less okay for the first 30 minutes or so.

Then he collapsed.

"Luckily, like Michael, I had excellent attention," he recalls. "I was skiing with some of the instructors I had employed, and they immediately arranged a quick evacuation by helicopter." Sir John believes that his head injuries were by a degree not as severe as Michael's; even so, he was placed in an induced coma for four weeks. I was interested to know how he felt when he came out of that coma and what after-effects he has today.

"You do lose some memory," he says, "although in my case I am of course much older than Michael. I'm at an age when you lose some memory anyway – or so my personal assistant tells me," he adds with a laugh. "What I *would* say is that the doctors, because they are always moving around and doing a million things, don't always understand the process of coma recovery. I was in a coma for about four weeks. It was induced because your brain works better if you're calm and quiet – and that's what a coma is: calm and quiet. When you come out of it you don't know what

Sir Frank Williams survived a car crash in March 1986 to continue as Williams team principal



Michael in his glorious Ferrari years, where he notched up five of his record-breaking seven titles



day it is, what time it is, what country you're in. You know nothing. Different people react in different ways to different types of coma.

"I have some small forgetfulness now – people's names and phone numbers etc, and I feel a little bit of loss of memory sometimes –

faces from long ago, for example – but then I am 76 now, as I say, and that could simply be part of the ageing process."

Whitmore also discovered one, fascinating result about which he speaks with enthusiasm and a smile.

"There's no excuse for filing Michael's seven world titles and 91 grand prix wins under the heading of 'boring'"

Sir John Whitmore survived a skiing accident in 2007. Like Michael, he was placed in an artificial coma to aid recovery



"I think more slowly, but that's intentional. I realised that my whole life was lived in a rush. I was in a rush when I was racing and when I stopped racing, I still kept rushing. I built up my coaching business to the point where I never stopped. One week I'd be in China, the next in the USA. It was endless.

"When I came out of the coma, I took the opportunity to slow down. And as a result I got less *quantity* but far greater *quality*. And that's beautiful, because the quality of my thinking now is higher than it's ever been. People even think I'm a nicer person!"

Right now, taking matters just one day at a time, the only issue is Michael's survival. And, God willing, we'll be saying 'hi' to him some day soon. Beyond that, and if Sir John Whitmore's personal experiences are any sort of guide to the situation, we may still be in for a laugh or two, yet.

PHOTOS: GLENN DUNBAR/LAT; STEVE ETHERINGTON/LAT; GARY HAWKINS/LAT

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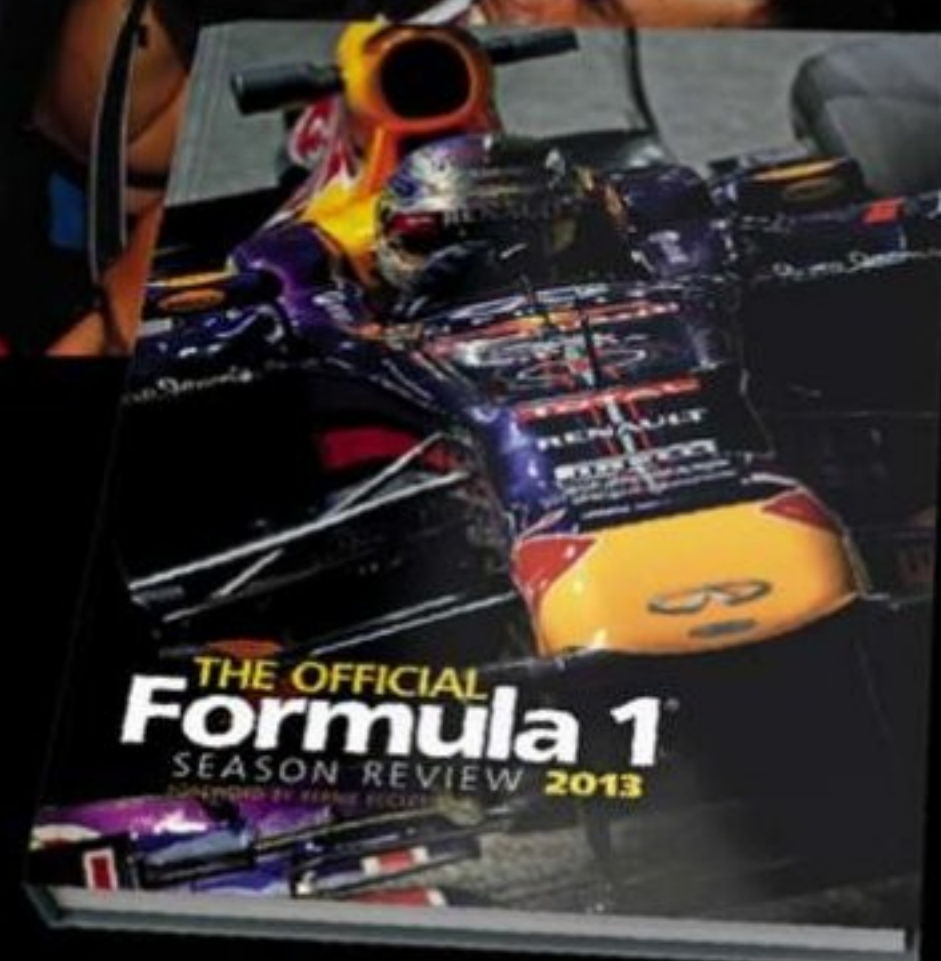
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Dieter Rencken

POWERPLAY

The stories F1's bigwigs would rather you didn't know...

WHEN COMMERCIAL NEEDS DRIVE UNPOPULAR RULES

Nothing in recent times has incurred such wrath from the fans, nor better conveyed the complexity of Formula 1's current governance, than the introduction of the 'double points' rule. This, ludicrously, awards twice the score for the final race of the year – the Abu Dhabi Grand Prix in 2014 – than for any other event.

So Abu Dhabi will obtain a slice of F1 history by hosting the first championship finale held under F1's new 'eco-friendly' regulations. Whether it will be a finale of note – a title showdown, perhaps made artificially so by the introduction of the double-points rule – remains to be seen.

The overriding question, though, is not whether Yas Marina (or any future occupant of the final slot) deserves such preferential treatment, but how such a Mickey Mouse regulation managed to slip past the sport's august but conservative ruler, the FIA's World Motor Sport Council – which can reject or ratify decisions, but not amend them. The answer lies in the manipulation of a revamped governance procedure, one that was put to its first test in December and found chronically wanting in most respects.

Following the expiry of the 2010-12 Concorde Agreement (the tripartite covenant that outlines the technical, sporting and commercial obligations of the FIA, FOM and the teams) and with no successor in place, the sport currently operates to a hybrid governance procedure. This draws on the old system, but can be overruled by revised procedures devised by FOM and headed by their embattled CEO, F1 tsar Bernie Ecclestone. According to sources, during the first sitting it was a matter of making it up as the procedure rolled along, with the outcome proving the folly of a system intended to streamline an often tortuous process.

However, in attempting to redress the unwieldiness of a procedure in which Sporting/Technical Working Groups (represented by all teams) devised regulations, then escalated them to the Formula 1 Commission (comprising the FIA, FOM, all team principals, technical supplier representatives, sponsors

and race promoters) for approval prior to rubber-stamping by the WMSC, the sport has flushed junior down the plughole along with the soap suds.

The Working Groups, which previously had the power to frame and vote on rule changes, have been relegated to advisory bodies. These 'feed' F1's Strategy Group, made up of the four 'Constructors' Championship Bonus Teams' (Red Bull, Ferrari, McLaren and Mercedes), Williams (on a heritage basis), and a best-placed 'other' team (currently Lotus).

The ad hoc nature of FOM's selection process is best illustrated by the inclusion of Mercedes, which have not a single constructors' title to their name – unless you factor in championships won as Tyrrell and Brawn. In which case Lotus should be a permanent member on account of their titles won as Benetton and Renault...

Where in the Working Groups the teams had one vote each and the FIA/FOM had none, the Strategy Group's 18 votes are equally split three ways. The FIA, FOM and the six team representatives have one each, with a simple majority carrying proposals. See how the teams' position has been seriously weakened?

It gets worse. Go up the regulatory ladder to the F1 Commission. Here they held 12 votes, plus the right to appoint two each of sponsor representatives and circuit promoters, in effect granting them 16 votes. Call it 18 if you include nominated representatives from engine and tyre manufacturers. In a 26-delegate body requiring a 70 per cent majority, this gave them a powerful voice. Not any more – with sponsor and circuit representatives now appointed by FOM, and after the demise of HRT, they are left with 11 votes.

Add in the two 'technical votes' and the teams may muster 13 votes (if they unite) out of 25 in a system that still operates on a 70 per cent majority. But Pirelli are commercially aligned, on account of big 'bridge and board' signage deals, while Renault are said to be cosy with FOM. Again, spot the difference? Where the teams previously held the whip hand, FOM holds sway.

In December the process became even more tangled. The Strategy Group and F1 Commission met *after* the final WMSC meeting of 2013, requiring any motions approved by the F1 Commission to be automatically ratified. Thus the double points idea – in effect a sporting matter driven by commercial requirements – has passed into the regulations. It could, though, have been worse: Pirelli had originally proposed to the Strategy Group that two pitstops be made mandatory.

The FIA, FOM and the teams currently operate to a hybrid governance procedure. This draws on the old system, but can be overruled by Bernie Ecclestone



PHOTO: ANDREW FERRARO/LAT



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VALTTERI BOTTAS ROOKIE YEAR

In his final column, the Williams racer looks forward to a new season

IT'S ALL CHANGE IN F1 FOR 2014 AS VALTTERI PREPARES FOR HIS SECOND SEASON

Testing for the new season starts next week, and I can't wait to get back behind the wheel. It has been a busy winter for everyone in F1 because of the number of regulation changes and the switch from 2.4-litre V8s to 1.6-litre V6 engines. I enjoyed my winter break at the end of my first year in F1, but now I'm looking forward to testing and starting another season.

I spent my Christmas holidays back home in Finland with my family, and in the New Year went up to Lapland with friends. It's a great place for winter sports such as cross-country skiing and Ski-Doo driving on the snow and ice, although there isn't much sunlight in northern Finland at that time of year. It's light for a few hours, then it's grey and then it gets dark again. The temperature ranges between -10°C and -35°C and despite what you might think, it's really good fun and keeps you fit.

I can't wait to test our 2014 car next week, although I'd already spent a lot of time on the simulator in January, so I am up to speed with how the new car will behave.

Many fans will be surprised when they see the cars for the first time as they are quite unconventional-looking but, to be honest, I've seen this car so many times in the windtunnel over the past few months that I'm used to it now. The first time I saw it though it was a bit of a surprise, and it will be interesting to see what the other teams have done. To me all F1 cars are beautiful, but if the Williams is fast then of course it will be the most beautiful car on the grid.

From a driving perspective, the main difference from last year is the engine power and, in particular,

the increase in the amount of torque the power units provide. It's so high that it's very easy to break traction and spin, especially exiting slow corners. So you need to be very precise with the throttle pedal and be careful to choose the correct gear – of which we'll have eight from this year.

Slow corners will be taken in a much higher gear than before because the engine has so much torque in the lower

revs. The extra torque is good, because it will benefit drivers who are more adept with their right foot.

The new aero restrictions also mean the cars slide a little bit more and in addition to the planned harder compound tyres, they will be more difficult to drive. Of course we will have to wait until we get to Jerez to see exactly how the tyres cope with the traction.

The 2014 rules are a big change: we are almost starting from zero again. I like that. There are so many drivers in the field who have a lot of experience, so I don't mind a bit of a reset, actually. I think it will be quite a different spectacle at the first race in Australia. There might be some problems with reliability because there are so many new things coming in on the engine side, plus there is fuel-saving to consider, too. There will be much more communication between the driver

"The 2014 rules are a big change: we are almost starting from zero again. I like that. Many drivers have a lot of experience, so I don't mind a bit of a reset, actually"

and engineer this year as they try to calculate the fuel loss during a race. It should be interesting.

I will continue to work with my engineer Jonathan Eddolls into 2014, but there are changes afoot in the team. We have new aerodynamicists joining us, new engineers and Felipe Massa from Ferrari. Plus a new engine supplier in Mercedes. I feel that Williams are stronger as a team now, stronger than we were at this point last year. Since Pat Symonds arrived there have been many changes for the better. If we keep working hard, hopefully that can be transferred to the track.

There are other changes planned for 2014, such as double points for the season finale in Abu Dhabi. Personally I like that idea. Yes, it will penalise a driver who has a mechanical problem in that race, but fighting for double points will be exciting for the teams and the fans. It might mean that teams keep pushing with developing their cars right up to the end of the season.

Finally, we pick our own numbers this year. Again I think it's a good thing. In many sports a player can keep the same number for their whole career. It helps the fans recognise us and it's good for the teams from a marketing perspective. I'm going for the 77 as it looks cool with my name and I think it will look great on the car. Let's get the hashtag #BO77AS trending this year...

"Since Pat Symonds arrived at Williams there have been many changes for the better"



PHOTO: GLENN DUNBAR/LAT

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ALL NEW F1 2014

Everything is changing.

Formula 1 is taking a massive
step into the unknown:

new, hybrid, turbocharged engines
that have been untested in competition;
new aerodynamics, fettled in ever fewer
working hours; and all rolling on new tyres.
It calls for new driving styles, new
strategies - indeed, the
only certainty is...
uncertainty

Welcome to F1 2014 →

ALL NEW F1 2014 THE CAR



Facing a massive regulatory shake-up, teams started designing 2014 cars back in 2012. Now, as finishing touches are made, *F1 Racing* presents an exclusive first glimpse of the new Williams FW36

WORDS ANTHONY ROWLINSON

PICTURES WILLIAMS





IT'S EARLY 2012 and the first tech meetings are being held in team buildings from Brackley to Faenza, to discuss the massive rulebook change lurking on the not-so-distant horizon. Even by the sport's own intense standards, these gatherings are unusually focused, for the 2014 season, with its ground-up revamp of the technical regulations, is looming ever larger. And if teams are to meet its challenge, design concepts will have to be conjured, then interrogated, *now* – two years ahead of time.

Among myriad changes on a growing 'to-do' list are: the installation of all-new turbocharged V6 power units incorporating twin electric motors; a narrower front wing; the loss of the rear beam wing; the loss of blown diffusers; no more Coandă-effect exhausts; and lower noses.

Engineers know that all these requirements will demand significantly different aerodynamic and cooling solutions from those currently familiar, and will shape cars very differently. The subtle year-on-year tweaks F1 has grown used to over recent seasons will be trumped by something far more radical. Almost certainly, therefore, the next generation of F1 cars will have a whole new look. But how...?

It's at moments like this that the sport's most enlightened technical minds reveal their true worth, by showing the way that others are then bound to follow. For a technical reboot on this scale forces design teams to stop in their tracks and dedicate resources to shaping a future understood only in broad-brush terms. After those early brainstorming sessions, intended to clarify understanding of what's ahead, the first detailed strokes have to be made. →

ALL NEW F1

2014 THE CAR

In decades past, a chief designer would most likely have turned to his drawing board to give two-dimensional form to concepts held only in grey matter. Now though, those first lines are sketched on engineers' Computer Aided Design (CAD) machines. For a smaller F1 team, maybe two or three of them would have set to work in late summer 2012 to make the first electronic outlines of their 2014 model; in a larger squad such as Mercedes or Red Bull, a group of 20 or more would have been assigned to the task.

Fine detail work would still be too-far distant at this stage, but fundamentals will all be addressed – the shape of the chassis; how it will integrate with the dimensions of the new engine; where the driver, batteries and radiators will be located; where the exhaust will exit.

This work is unglamorous yet essential – as vital to the performance of the finished vehicle as solid foundations are to any building. A team who fumble the basics will find, two years later, that they have a car fundamentally unbalanced and therefore unloved by its drivers (think, for example of the 2013 Williams FW35, which got better late season when stripped of some of its aerodynamic intricacy); or one, perhaps, with insufficient cooling and therefore prone to failure as hidden components overheat.

Mistakes of this kind happen more frequently than you might imagine, even for F1's grandee teams. McLaren's mythical MP4-18A of 2003 was an elegant and aerodynamically advanced design, yet despite extensive testing it never raced. The strength of its carbon-fibre monocoque chassis had been compromised at a conceptual stage by a decision to employ an unproven bonding method. So while the car's windtunnel figures pointed to a winner, come the track tests, McLaren found they had created a car prone to falling apart. The '18' also had trouble passing mandatory crash safety tests and suffered from inadequate cooling as its radiator

sidepods had been shrunk in a quest for greater aerodynamic performance. Only after ground-up redevelopment over subsequent seasons did the MP4-18A concept prove itself, in the form of the MP4-19B and MP4-20 – both GP winners.

More recently, Red Bull's 2006 RB2 was scuppered by an off-season switch from Cosworth motors to Ferrari, as heat-measurement data was interpreted differently by the two engine manufacturers. Result? Red Bull built a chassis with insufficient cooling for the Maranello V8 it housed, and from the first tests the RB2's aerodynamics were compromised by cooling holes cut into its bodywork.

The prospect of failure on this scale would have haunted teams in 2012 as they ploughed through 2014 R&D programmes, trying to remain undistracted by the immediate demands of competing in that year's world championship.

Since the start of 2013, however – more than a year from the first track tests of 2014 cars – the attention of designers would have been engaged more fully with the composition of the new car.

For some teams, how best to apply resources is a key factor dictating the new-car build process. If they're locked in a full-scale championship fight, as Red Bull, Mercedes, Lotus and Ferrari were last season, then inevitably resources (manpower, brainpower, windtunnel time and cash) are directed to the pressing goal of winning that year's battle – even at the expense of the following year's performance.

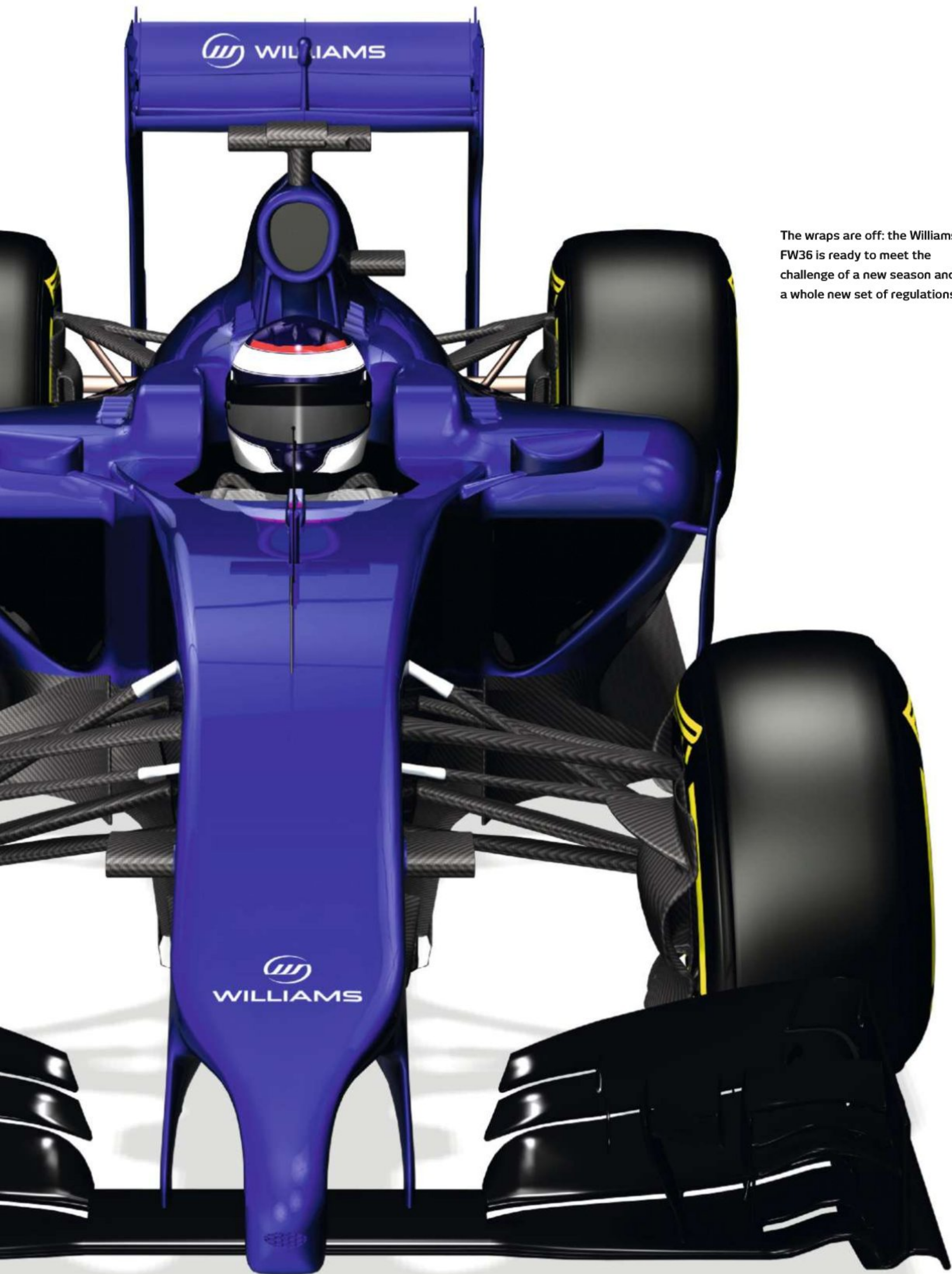
For teams not wrestling for honours, however, mid-2013 marked the cut-off point for expending energy on last year's car. McLaren made that decision with their woeful MP4-28, as team principal Martin Whitmarsh admitted over round nine in Germany: "We're pretty much fully focused on 2014 now," he told reporters, "with just one more upgrade coming this year."

Given the foot-to-the-floor intensity of F1 competition, McLaren felt it prudent to sacrifice

their 2013 title challenge for the betterment of their 2014 campaign. Thus unburdened, they've had more freedom, like their fellow non-title battlers, to focus on labour-intensive projects such as completing scale-models for windtunnel testing. These micro-F1 machines, accurate in every detail, yet built to a 50 per cent scale, are used to validate design ideas that previously existed only on CAD screens.

"This is when you really start to get into the nitty-gritty of the design work," says Pat Symonds, chief technical officer of Williams. "You find out, for example, that regulation changes like removal of the rear beam wing are a much bigger job than you'd imagined. And coupled with the narrower nose wing, you've suddenly got a very →

"For teams not wrestling for honours, mid-2013 marked the cut-off point for expending energy on last year's car"



The wraps are off: the Williams FW36 is ready to meet the challenge of a new season and a whole new set of regulations

ALL NEW F1 2014 THE CAR

different flow pattern over the car. This affects all your aerodynamic and cooling calculations.”

Increasingly, teams tackle some problems using computer simulation, although many persist in making dummy parts they can test ‘for real’. Management of these resources – how to spend money, which type of modelling is most efficient – is once again a key consideration.

The first major milestone in the build process comes with the so-called ‘aerodynamic release’ of ‘wetted’ surfaces – “those that are licked by airflow”, as Symonds describes them. At Williams, these were completed by June 2013, with work on the car’s cooling systems finished by the F1 August shutdown.

But as soon as team personnel returned to their factories, last September, workshops had to gear up for an onslaught of bespoke new

components that needed making (every F1 car is a prototype, don’t forget, unique for each season). The aim has been to have a monocoque ready for crash testing by December. “This might

slip into January, but you’re really pushing things if you do,” reckons Symonds.

Why so? Because by January 2014 all the teams will have been desperate to have their

sparkly new machines ready for the three tests coming thick and fast before the first fly-away races of the year.


In order to have a car prepped and running for these vital exploratory outings, teams have organised their staff into parallel workflows. That means dedicated sub-teams each working towards their own goal of ensuring their

components are ready and perfected to form a part of the whole. Transmission engineers will talk to suspension designers; they, in turn, will discuss with the monocoque guys how best to locate wishbone mounting points. The chassis crew will work hand-in-glove with the aero team to ensure the uniquely demanding rigours of the windtunnel can be serviced... and on it goes: teams within a team, each working to create a harmonious whole that’s better than anything produced by a rival. That’s the aim, at least.

Such a complex and time-pressured undertaking carries with it many opportunities for error, particularly in a year that embraces such sweeping technical change. “So you want a car that won’t give you too many headaches,” says Gary Anderson, ex-technical director of Jordan Grand Prix and Jaguar Racing.

And it’s vital, he reckons, to have a solid grasp of the challenges of this year’s regulatory re-set. “For 2014,” he says, “with such a big change to the power systems, there’s more to be gained by optimising engine and transmission performance, than by chasing tiny aerodynamic gains. But it’s easy to lose sight of the big picture when you’re head down in your own project.”

There’s little doubt that come March, 11 teams will present 22 immaculate and beautiful new F1 cars to contest the first race of the season. The talk will be of hurdles cleared, deadlines hit, compromises made and inspired solutions found. The media will dutifully recycle the information and millions of race fans, hungry for the new season, will lap up the news.

But only those behind the scenes, back at base, pulling all-nighters for two years, will truly know what it has taken to build a 2014 F1 car. 

“Every team’s aim was to have a monocoque ready for crash testing by December 2013”



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2014 Regulation changes: EVERYTHING YOU NEED TO KNOW

With major rule changes on the horizon for 2014, we asked former Force India chief engineer **Dominic Harlow** to summarise the key points

First tabled in 2010 for introduction in 2013, the new sporting and technical rules are so far-reaching that they present an enormous challenge. Thus, sensibly, they were pushed back a year in order to let Formula 1's engineers take stock and put the

appropriate structures in place. But even with an additional year in which to prepare, this is quite a leap – not quite into the unknown, but certainly into areas where previous certainties have been swept away. Here are the major changes for 2014...



TOP TEN TECHNICAL REGULATION CHANGES

FUEL FLOW

- 1 There is now a 100kg/hr fuel-flow limit, 'GDI' gasoline direct injection at up to 500bar, and one single-stage turbocharger replaces unrestricted port injection fuelling naturally aspirated induction. The engine's maximum power is reduced from around 750bhp to 600bhp.



ENERGY RECOVERY SYSTEM

- 2 An electrical motor generator (MGU-H... 'H' for 'heat') is coupled to the exhaust-driven turbine and compressor. The Energy Store (ES) releases energy back to the MGU-H and MGU-K ('K' for kinetic) based on driver torque demand. The car thus becomes a full hybrid.

BOOST



- 3 Four megajoules of energy per lap can be released from the ES via the MGU-K at up to 120kW (161bhp). Only 2MJ per lap can be harvested from the rear wheels, but energy in and out of the MGU-H is unrestricted, meaning changes in output between qualifying and the race. This is up from 400KJ in and out of KERS at 80bhp. At full output, KERS gave a contribution of 6.7secs, whereas ERS provides 33.3secs.

V6 ENGINES

- 4 V6 engines of no more than 1600cc, revving to a maximum 15,000rpm, with fixed mounting positions replace V8s of up to 2400cc, 18,000rpm and bespoke geometry. The new engines will be homologated from 2014 to 2020 inclusive. Changes will be permitted to their specification, subject to a table of modifications, slowly reducing the freedom allowed year by year.



GEARS

- 5 Eight forward gear ratios are mandatory (most teams used to use seven). Ratios are nominated for the year (with one 're-nomination' permitted in 2014 only), instead of 30 nominated choices in 2013.

SIDE IMPACT STRUCTURES

- 6 The design of the side impact structures has been standardised, a change to the previous regime where there was design freedom subject to various loading and impact tests. This imposes some conditions on bodywork in front of the sidepod area.

BRAKES



- 9 Anti-lock braking remains prohibited but brake-by-wire systems have now been permitted to control rear brake pressure.

NOSE AND FRONT WING

- 7 Noses have been lowered to reduce the possibility of 'launching' accidents caused by nose-to-rear-tyre contact, and to provide more compatible impact structures in T-bone shunts. The profile of the nose is defined by the maximum side-view height from the front bulkhead forwards, and the tip drops from 550mm above the ground to 185mm. The overall width of the front wing drops from 1800mm (the maximum width of the outermost parts of the wheels) to 1650mm. The FIA-prescribed section remains 500mm wide, so the effective width of the wing for downforce generation is reduced by 12 per cent.

WEIGHT

- 8 Minimum weight for car and driver has increased by 48kg to 690kg (subject to tyre weight) overall. This is one of the biggest step changes in F1 history. Minimum engine weight was 95kg, but is now 145kg for the entire power unit, including 20-25kg for the ES.



REAR WINGS

- 10 The main flap will have a shallower profile and the lower beam has been removed. This cuts rear downforce by at least as much as the changes to the front wing. To reduce blowing effects (which the turbo would do anyway), the exhaust is above the rear impact structure, clear of the bodywork and behind the rear-wheel centre-line. Inlet location is restricted, to prevent teams 'sucking' parts of the bodywork instead. →

ALL NEW F1 2014 REGS

SPOT THE DIFFERENCE

A number of significant changes mean a big difference between 2013 and 2014 specs

2013 spec

High nose

The tip of the front nose is 550mm above the ground

Front wing

The overall width of the front wing is 1,800mm

Weight

Minimum weight for chassis and driver is 642kg

2014 spec

Low nose

The nose is now 185mm high, down from 550mm

Front wing

Narrower wings, now measure 1,650mm

Weight

Minimum weight of car and driver increased to 690kg

Gearbox

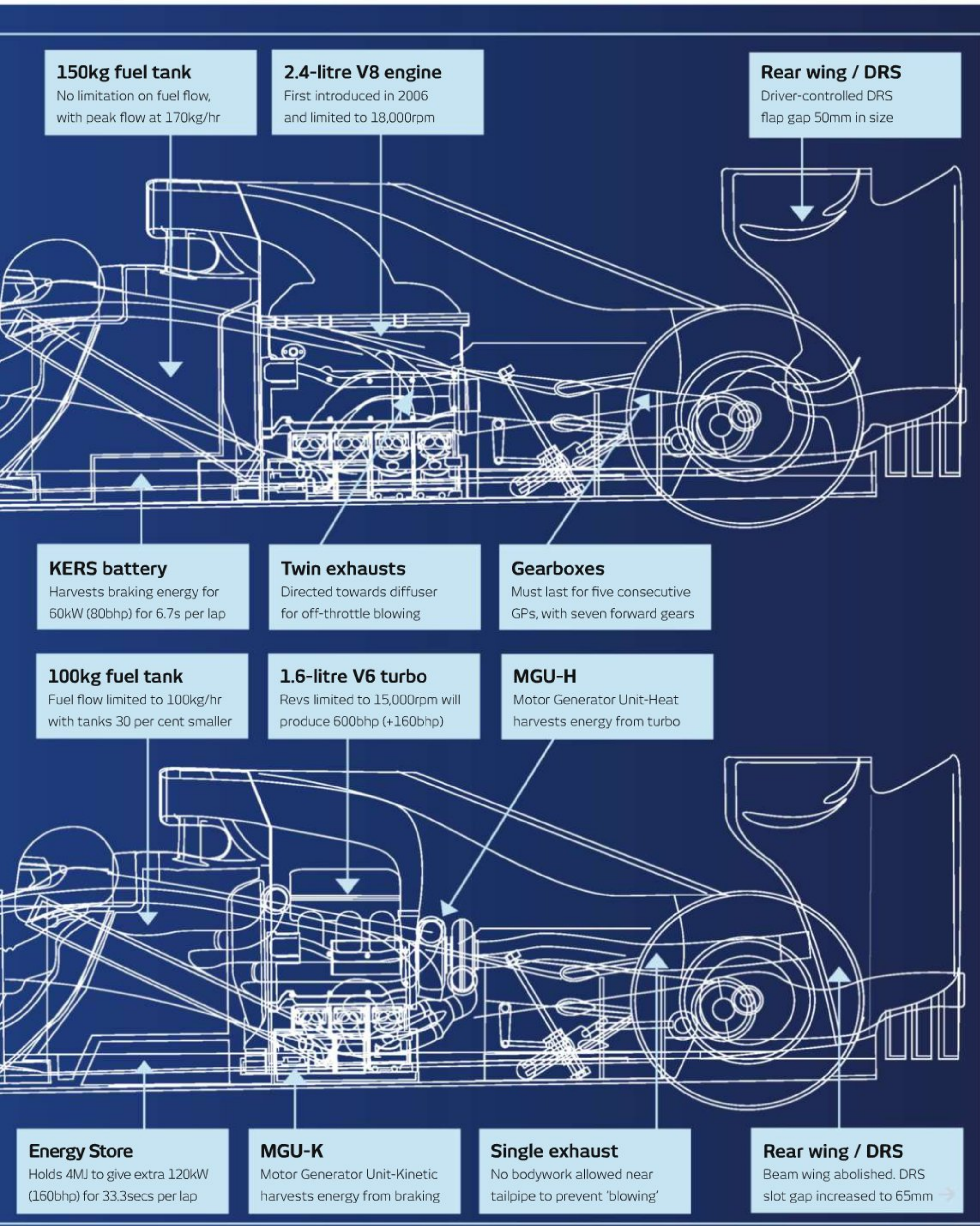
Ratios fixed for year (one joker) with eight forward gears. To last six GPs

Tyres

Pirelli will introduce harder more durable compounds

Sidepods

Additional cooling demands and new crash tests will widen sidepods



150kg fuel tank

No limitation on fuel flow, with peak flow at 170kg/hr

2.4-litre V8 engine

First introduced in 2006 and limited to 18,000rpm

Rear wing / DRS

Driver-controlled DRS flap gap 50mm in size

KERS battery

Harvests braking energy for 60kW (80bhp) for 6.7s per lap

Twin exhausts

Directed towards diffuser for off-throttle blowing

Gearboxes

Must last for five consecutive GPs, with seven forward gears

100kg fuel tank

Fuel flow limited to 100kg/hr with tanks 30 per cent smaller

1.6-litre V6 turbo

Revs limited to 15,000rpm will produce 600bhp (+160bhp)

MGU-H

Motor Generator Unit-Heat harvests energy from turbo

Energy Store

Holds 4MJ to give extra 120kW (160bhp) for 33.3secs per lap

MGU-K

Motor Generator Unit-Kinetic harvests energy from braking

Single exhaust

No bodywork allowed near tailpipe to prevent 'blowing'

Rear wing / DRS

Beam wing abolished. DRS slot gap increased to 65mm →

ILLUSTRATION: CRAIG SCARBOROUGH

ALL NEW F1 2014 REGS

TOP TEN SPORTING REGULATION CHANGES



TESTING

- 1 Winter tests start in January, two weeks earlier than in 2013, and will run until ten days before the first race as normal. In 2015 there will be no testing in January.
- 2 Multi-team testing will take place in-season on four occasions (there was one in-season test – for young drivers – in 2013), each test lasting two consecutive days and happening on the same circuit after an event.
- 3 The new Appendix 8 to the Sporting Regulations will reduce the amount of experimental time available to teams for aerodynamic development. This means no more full-size testing at dedicated aerodynamic test venues. Limitations on windtunnel testing and CFD resource are included in the Sporting Regulations for the first time, again in Appendix 8.

QUALIFYING

- 4 Positions from previous sessions will carry forward in the event that two cars elect not to complete a timed qualifying lap. This is to motivate teams to attempt to set a time (rather than save tyres) in qualifying.

ENGINE

- 5 Previously, drivers were limited to eight engines per year; now they are limited to just five power units comprising six separate entities: ICE (Internal Combustion Engine), TC (Turbocharger), CE (Control Electronics), ES (Energy Store), MGU-H and MGU-K. Using a sixth power unit or more of any one of its components is punishable by a ten- or five-place grid penalty.
- 6 The new V6 engines will be homologated from 2014-2020. Changes will be permitted to their specification, subject to a table of modifications slowly reducing the freedom allowed year by year.


FUEL

- 7 Cars are limited to 100kg of fuel to take them from the race start to across the finishing line. This replaces a free fuel load, which usually evened out as 140kg of fuel from lights to flag. This may or may not encourage 'economy drives', but it will provide a new tactical facet.

TYRES

- 8 An extra set of prime tyres will be made available each race weekend, making 12 sets in total (seven prime; five option). These can be used only in the first 30 minutes of FP1. This is intended to encourage running during FP1, and offer greater useful track time for less experienced drivers. The rules don't specify whether a driver must be back in the pits inside 30 minutes or leave the pits within the first 30 minutes to comply.

GEARBOX

- 9 Each gearbox must complete six consecutive events rather than five. A five-place grid-drop remains in place if this limit is breached.
- 10 Since ratios are set pre-season, the gearboxes are completely sealed – permitting changes only for damage or, in 2014, on five 'joker' occasions without a penalty. 

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- A. Michael Schumacher
- B. Fernando Alonso
- C. Kimi Raikkonen

ALL NEW F1 | | | |---|---| | 2 | 0 | | 1 | 4 | ENGINES

Forget scare stories about 2014 turbos being dull: they promise to be everything F1 should be: fast, furious and massively powerful, heralding...

F1'S RETURN TO **POWER!**

WORDS
MATT YOUSON
PICTURES
MERCEDES &
RENAULT

So, F1's new power units finally arrive and the dinosaur V8s are discreetly hauled off to the knacker's yard. All hail the revolution! But what does the future hold for F1's new power generation? Frankly, it's impossible to predict, but in the absence of anything solid, rumours and guesswork have filled the vacuum – much of it pejorative. "The engines will be too quiet," we hear. "They're too expensive," snarl team →





ALL NEW F1 2014 ENGINES



1 The MGU-H ('H' for 'heat') captures heat energy from exhaust gas, transferring it to either the MGU-K or the energy store

The turbocharger boosts power by increasing the density of the engine's air intake. It also drives the MGU-H



2 The energy store takes energy from the MGU-H and transfers it to the MGU-K when a power boost is needed

The MGU-K ('K' for 'kinetic') recovers energy under braking and boosts power using the MGU-H and energy store

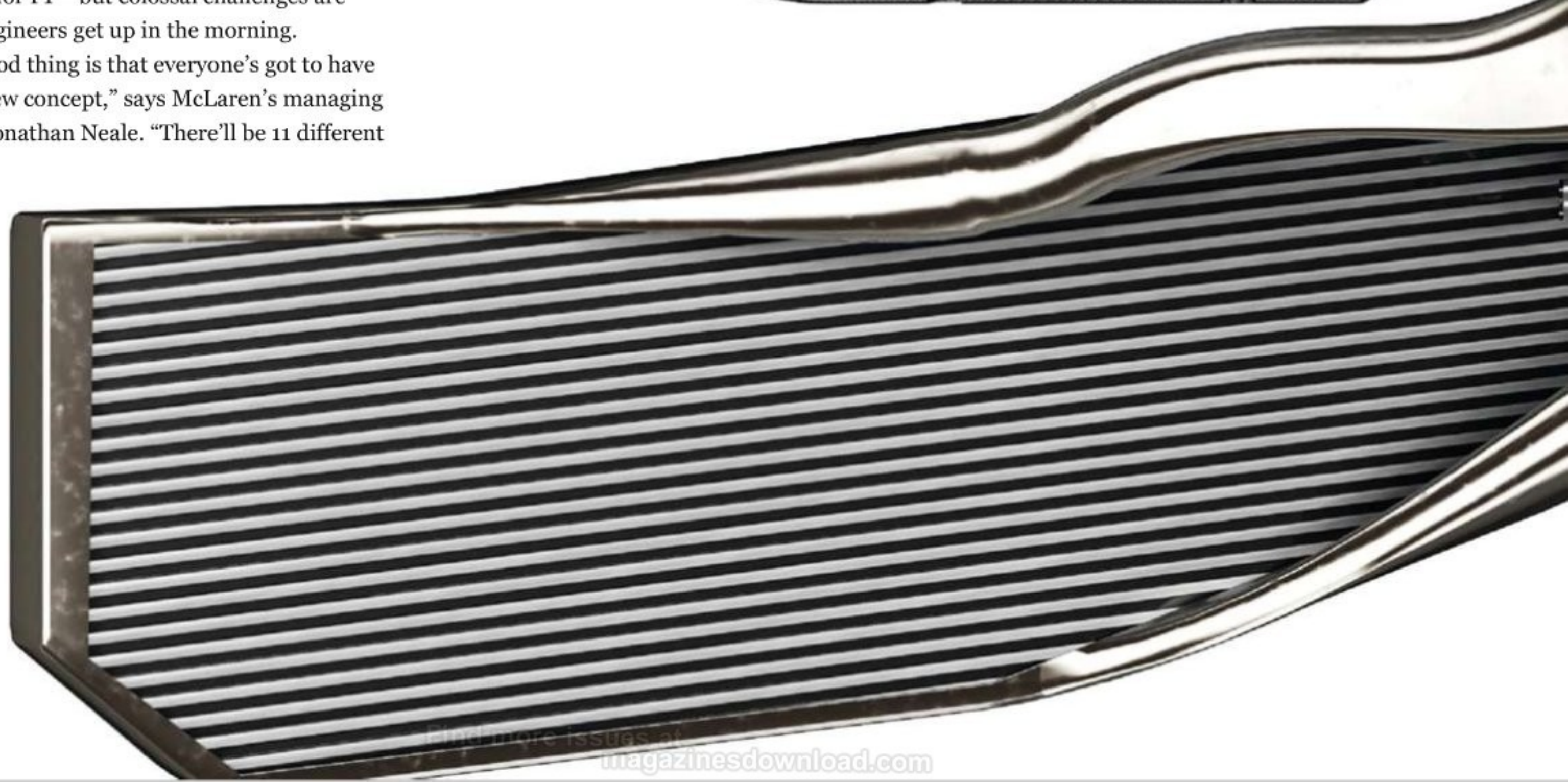
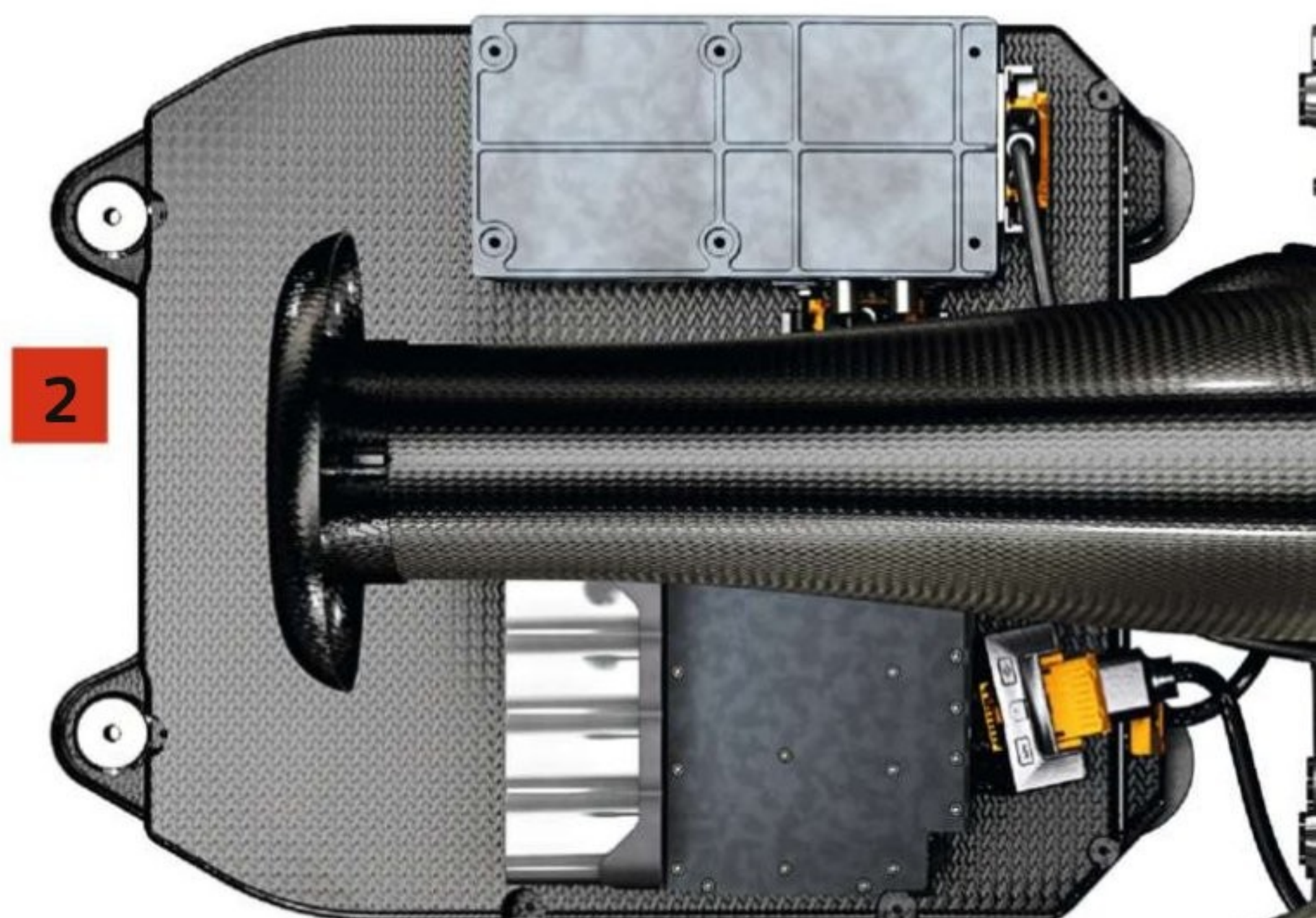


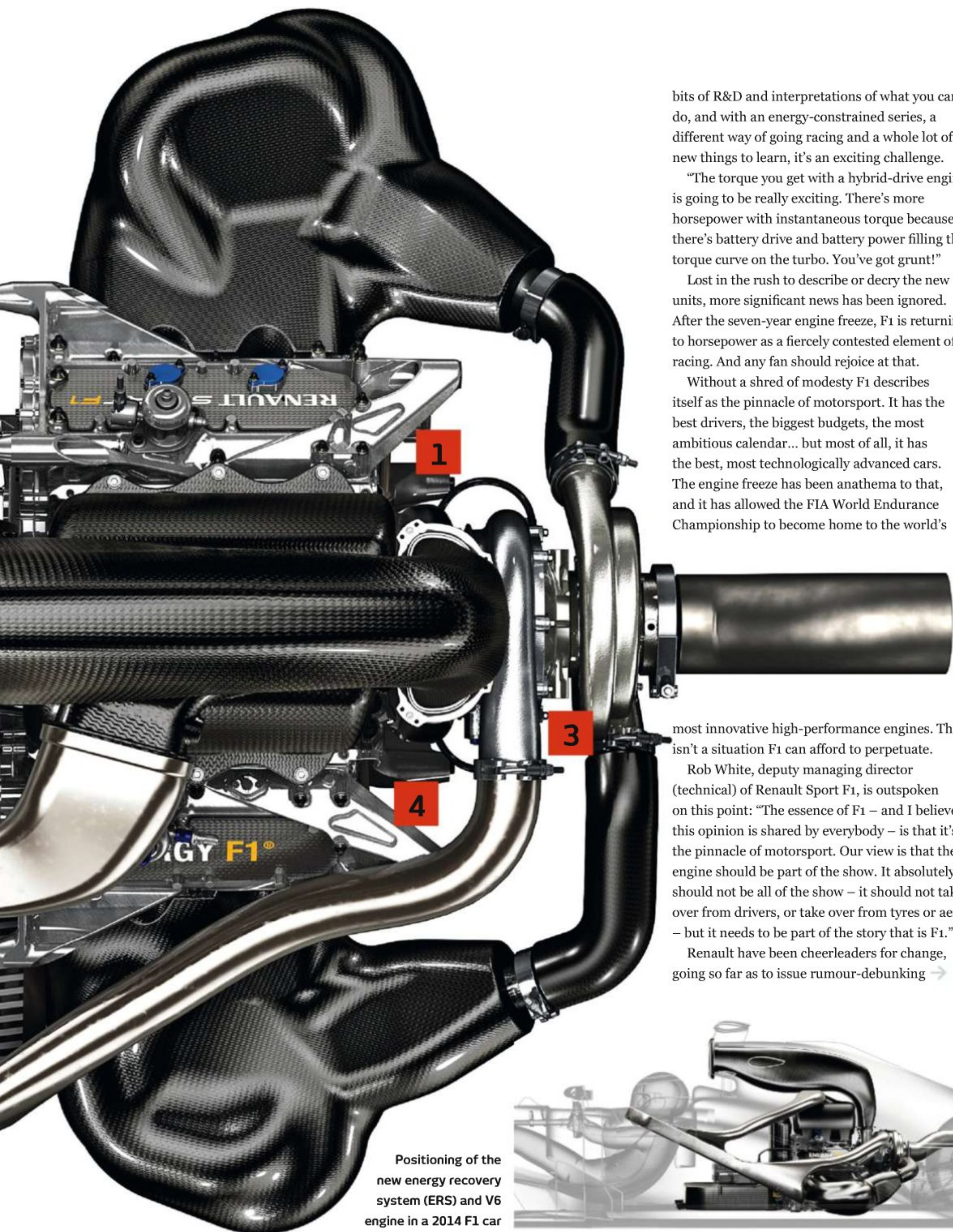
principals. "Reliability issues!" screech overworked engineers. "It's going to be a disaster, with cars running out of fuel or cruising around on efficiency runs," wail promoters, horrified by visions of empty grandstands.

If you believe the naysayers, indeed, F1 is going to hell in a hybrid handcart. So is this truly a self-destructive PR exercise destined to burn half-a-billion dollars and ruin F1? The voices of dissent think so, and it makes for lurid headlines. There is, however, a counterargument. Speaking more quietly, but perhaps with greater authority, backers of the switch argue that it could be good news for F1. In fact, it could be brilliant.

The teams themselves are optimistic. Yes, there are beleaguered designers with too much to do and too little time in which to do it, but among those able to catch a glimpse of the bigger picture, there's much to savour. This is a colossal challenge for F1 – but colossal challenges are why F1 engineers get up in the morning.

"The good thing is that everyone's got to have a brand new concept," says McLaren's managing director Jonathan Neale. "There'll be 11 different





Positioning of the new energy recovery system (ERS) and V6 engine in a 2014 F1 car

bits of R&D and interpretations of what you can do, and with an energy-constrained series, a different way of going racing and a whole lot of new things to learn, it's an exciting challenge.

"The torque you get with a hybrid-drive engine is going to be really exciting. There's more horsepower with instantaneous torque because there's battery drive and battery power filling the torque curve on the turbo. You've got grunt!"

Lost in the rush to describe or decry the new units, more significant news has been ignored. After the seven-year engine freeze, F1 is returning to horsepower as a fiercely contested element of racing. And any fan should rejoice at that.

Without a shred of modesty F1 describes itself as the pinnacle of motorsport. It has the best drivers, the biggest budgets, the most ambitious calendar... but most of all, it has the best, most technologically advanced cars. The engine freeze has been anathema to that, and it has allowed the FIA World Endurance Championship to become home to the world's

most innovative high-performance engines. That isn't a situation F1 can afford to perpetuate.

Rob White, deputy managing director (technical) of Renault Sport F1, is outspoken on this point: "The essence of F1 – and I believe this opinion is shared by everybody – is that it's the pinnacle of motorsport. Our view is that the engine should be part of the show. It absolutely should not be all of the show – it should not take over from drivers, or take over from tyres or aero – but it needs to be part of the story that is F1."

Renault have been cheerleaders for change, going so far as to issue rumour-debunking →



Strange brews

The hunt for performance continues deep inside the power units, where the right fuel and lubricants can boost performance and efficiency

So much has changed in the 'engine room' for 2014 – but the need for fuelling, cooling and lubricating has remained constant. The nuances, though, have given rise to huge challenges as scientists compete to create speciality brews to optimise the performance of the new hybrids.

The hybrids will need serious TLC, for despite losing one third of their capacity and operating with new fuel-flow and fuel-load restrictions (100kg/hr and 100kg respectively), their specific output per litre is expected to rise by at least 15 per cent.

This continues a trend of rising power densities, all while engine and transmission lifespans have increased in leaps and bounds. Where the 'old iron' 2,400cc V8s developed 760bhp (320bhp/litre), the V6 element of 2014's eco-friendly

units is estimated to pump 600bhp (375bhp/litre).

Factor in restrictions on engine usage (from eight units per entrant, to five), the likelihood of longer race seasons, static fuel regulations and greater thermal and mechanical loads generated by forced induction, and the guys in white coats have their work cut out. All the more so since bespoke oils, fuels, hydraulic fluids and lubricants cannot be developed through dedicated testing, yet must function perfectly from the opening pre-season test.

These demands have meant quite a few sleepless nights at ExxonMobil, technical partners to McLaren-Mercedes. Their tribologists (specialists in friction) and rheologists (flow rate) have been hard at work in Clinton, New Jersey, where blue-sky research is undertaken, while their counterparts in Paulsboro, New Jersey, research molecular structures with atomic force microscopes, before testing on dynamometers begins at McLaren's Woking HQ and Mercedes High Performance Engines in Brixworth.

"It works well," says Bruce Crawley, ExxonMobil's global motorsport technology manager. "The programmes are well integrated, so [the three parties]

work as a team to identify and exploit opportunities. On a day-to-day basis we work with Mercedes, but all parties are involved."

Their to-do lists include assessing component coatings, reducing friction and evaluating the effects of chemicals on seals and hoses. Whether it's the development of superbrews or lightweight lubricants, the objective is the same: optimising performance and reliability.

F1's fuels advisory group – comprising all oil companies in F1, plus wannabes – meets twice a year, and for 2014 it proposed the fuel specification be carried over, providing an element of road relevance, for petrol-powered road cars burn the same pump product, whether turbo-ed or not.

However, forced induction increases the danger of 'knock' (detonation), which in turbos is utterly destructive. Fuel flow and weight restrictions compound matters, as these will increase the tendency for lean fuel/air mixtures. Mitigation of detonation is a major priority in Paulsboro, where every one of the ten scientists on the F1 project has a PhD.

"The fuel is different [from that used in V8s]," says Eugene Choi, who is responsible for fuel

development, stressing that direct, high-pressure fuel injection brings further challenges. "It could run in the V8, but wouldn't be optimised. The vaporisation is different and turbocharging is a key difference, as the fuel needs to be knock-limited."

Another challenge is ERS cooling, as motor/generator output not only doubles to 160bhp, but energy released goes up five-fold, with motors spinning at 50,000rpm (previously 38,000). The turbo-driven generators are ultra-high-heat devices with specific lube and cooling demands. To save weight, engine oil cools the ERS electric motor hardware, placing more stress on the thermal resistance of molecules.

The chemical composition of the engine oil used to protect the V6 is an optimum mix of up to 20 synthesised constituents, many of which are also used in off-the-shelf Mobil 1. Lead-time for F1 lubricants is measured in months; in road-car products, it can take several years.

"Everyone has the same amount of fuel, so performance comes from having the most powerful engine for the amount of fuel available," summarises Crawley. "Getting the most performance out of the fuel available is key."

Dieter Rencken



The fuels created for the new V6 turbo are very different to those used for the old V8 engine

official statements on the sensitive issue of reduced engine noise. This isn't a trivial matter: the visceral pleasure derived from hearing a normally aspirated V8 is something that cannot be replicated on television. The sound and fury of grand prix cars has the capacity to put bums on seats, and without spectators F1 is in trouble. Fortunately these turbos are not the gutless, anaemic travesties people feared they would be.

"The engines are still high-revving, ultra-high-output competition units," says White. "Fundamentally, the engine noise will still be loud. It will wake you from sleep. Circuit neighbours will still complain.

"I am sure some people will be nostalgic for the sound of engines from previous eras, including the preceding V8, but the sound of the new generation power units is just different. It's like asking whether you prefer Motörhead or AC/DC. Ultimately it's a matter of personal taste. In concert, they're both pretty loud."

Andy Cowell, managing director of Mercedes AMG High Performance Powertrains has high hopes of the new engine: "The turbocharger is a single-stage turbine, with a single tailpipe coming out, so the noise from all six cylinders ends up in that one pipe. That makes frequency in the tailpipe higher on the new power unit compared with the V8 – and pleasant to the ear.

"We also have a maximum turbocharger speed of 125,000rpm, which actually makes a lovely noise. It's a reasonably large beast. Spinning at full speed with the mass flow of exhaust going through the hot side and air going through the cold side... if it were running on the table in front of me, we wouldn't be sitting around relaxing. We'd be putting our fingers in our ears."

Nobody says the new cars will be as loud as the V8, but the sound they produce will still exceed the pain threshold. Simulations suggest a drop in intensity from 145dB to 134dB. That's a sizeable reduction, but it's still louder than being in the front row of that AC/DC stadium gig, and

Power from the driver's perspective

Although designers are currently under the microscope, pretty soon the drivers will buckle in again. For the experienced competitors, the V8s had become a known quantity. The new hybrids, however, are a step into the unknown.

Jenson Button has been part of McLaren's design effort, piloting the driver-in-the-loop simulator in the latter half of 2013.

"The V8-powered cars are powerful, but they don't have any torque, so having torque is something new. For example, Turn 3 in Barcelona:

you go through there and it's very difficult to lose the rear end because of power, whereas next season if you apply the throttle a bit too quickly, because of the torque you are going to lose the rear end. It's a very different feeling. You've got to give the throttle pedal a lot more respect than any other year I've raced."

While the car itself may be a handful, the driver will at least have one fewer thing on his mind. To date, KERS has been a driver-operated system, but the button on the steering wheel disappears,

as KERS has been subsumed into an automated system. Management of power flows around the car is set to be one of the key battlegrounds in 2014, but it's one that will be fought in software. The driver will be free to concentrate on driving and let the car get on with managing power delivery.



the aural assault will still rattle fillings in the grandstands. Of course, that wonderful F1 howl owes something to quality as well as quantity. To assess that, we'll have to wait – but Fabrice Lom, FIA head of powertrain, gives the matter some context: "In 1988 V6 turbos in F1 were revving lower and had less capacity. Ayrton Senna and Alain Prost were not lacking in fans and the show, as far as we remember, was quite good."

Another fear is that with fuel limited to 100kg and fuel flow restricted to 100kg/hr, F1 could turn into an efficiency formula, with drivers performing to a delta rather than racing. Luca Badoer, head of Ferrari's engine department voiced precisely that fear. "Ferrari feel this could be a danger," he said. "We like F1 to consider efficiency, but we don't like it to be a sport where you cruise for 50 per cent of the laps."

Lom argues that the driver's conscious effort to conserve fuel will actually diminish: "It will

be a race for efficiency but not a 'drivers' race for consumption'," he says. "Unlike today, the management of the efficiency of the power unit will be done by electronic control. The driver won't have to save fuel or change his driving style. That will be done automatically. His only focus will be to go as fast as possible."

If 2014's power units sound and perform like F1 engines, it's hard to see how spectators could feel short-changed. For teams, however, the case is rather different. With engine costs for customer teams projected to double or triple, there's concern that small teams falling by the wayside will damage the show. No wonder three-car teams and customer cars have been mooted.

But it isn't necessarily the case that technical ambition makes the new power units more expensive. There is conjecture that any engine other than the frozen V8 – and perhaps even that – would have borne the same cost burden, albeit without the fringe benefits and sponsorship potential of the hybrids. The V8s were sold at a loss under a deal done way back when F1 had six major car firms supplying engines. The landscape has since changed considerably, with the remaining manufacturers taking up the slack created by their departing rivals and grumbling about great expense for no perceivable reward. The status quo was not going to hold.

"The power units are more expensive – but there are some notions that must be killed off," says Lom. "First, the V8s were no longer relevant to some of the big OEM car producers. There →



The new energy system (ERS) replaces and enhances KERS for 2014

Bright sparks

Multi-channel power delivery presents a massive challenge for 2014 engine-management systems

In 2008, the FIA mandated standard F1 ECUs. Made by McLaren Electronic Systems (MES), these 'black boxes' let the FIA check the use of banned gizmos such as driver aids, while simplifying management of differentials, engines and transmissions.

These units continued until the start of 2013, when they were replaced by upgraded ECUs, five times more powerful, to allow seamless migration and a learning year ahead of 2014.

The first-gen boxes were sealed units that required teams and/or engine suppliers to adapt their own software and hydraulics to the MES units, while enabling the FIA to 'plug in' during scrutineering.

The mark II ECUs provide three partitions: one for the FIA, one for FOM and one for the team. They also let teams develop in-house software to suit their specific requirements.

"Things are changing," says Peter Van Manen, MES managing director. "We have new and more complex powertrains, standard areas of software, plus software that will be developed and maintained by teams and engine makers."

The entire system has been made tamper-proof, using 'box locking' methods developed during MES's 15 years in F1. It can, though, be accessed by the FIA to ensure a car is legal.

"From an electronics perspective, the most significant change is that you need to protect against things like drivers executing changes,

while keeping it accessible," adds Van Manen.

The 2014 power units use the ERS-K, ERS-H and V6 as energy sources, but are restricted by fuel flow, fuel quantity and stored energy. Choosing a power source is therefore complex when measured against demand and, crucially, against race-distance requirements.

Rob White of Renault Sport F1 explains: "When the driver makes a torque demand, the engine provides some of it and the system then needs to decide whether the balance is provided by any of the energy options or whether to use stored energy to accelerate the turbo, to increase boost, to produce the torque required."

Freescall's Qorivva microprocessor provides the brainpower to the ECU, crunching 1,000 sums per second. Freescall supply most major motorsport series with ECUs, but a bigger prize is that

F1 is a test bed for technology transfer to road cars.

"The interesting thing is that you've got all this data, all these interfaces, so how do you collect it all and do something with it," says Freescall vice-president Steve Wainwright.

"There are two levels: one is machine-to-machine communication and the other is the overlay of intelligence that goes with it. So people make decisions based on data that's there, then activate something." Reliability and security of data transfer in F1 is paramount and the race track provides a perfect environment at which to test components at speed – crucial in the development of road-car safety systems and autonomous car technology.

So although the FIA has striven to keep cars fully under the control of drivers, their on-board technology provides a platform for driverless cars.

Dieter Rencken



McLaren Electronic Systems' Tag-400 ECU for Formula 1 will manage power supply from the ERS-K, ERS-H and the V6

is no doubt some of them would have left F1 were we to continue with the V8. Second, *any* change costs more than stability. The initial development costs of the new power units will impact the price in the early years – but this would be true even for a new standard V8.

"Third, the price of the current V8 does not cover the cost of the engines even though the initial and main development cost has been long since amortised. Those prices were imposed on the engine manufacturers in 2008 – but the current economic situation would not allow them to continue subsidising F1. That would be even more true were we to go forward with a product with no marketing value. Were the V8s to continue, their prices would increase a lot.


"Finally, costs and bills are not the same: what the teams will pay is not the cost of the power unit but a balance between the costs and the marketing value of the product. If it's relevant to

If hybrid technology isn't your cup of tea, don't worry: you can ignore it. Developing technology to get more from less is as traditional an F1 trait as there is

them, a manufacturer will sponsor a team to use their new engine. And the image of the units will also attract new sponsors.

"In summary: the bill for the teams will possibly be higher than in 2013, but this is not true to all teams and the difference will not be to the extent of that rumoured."

The driving force behind these new power units is the aspiration to make F1 more socially relevant. It's a desire that annoys some of the sport's stakeholders and a sizeable percentage of its fans, too. But if hybrid technology and energy recovery isn't your cup of tea, don't worry: you can ignore it. Developing technology to get more from less is as traditional an F1 trait as there is. Throwing money at a problem until the most elegantly high-tech solution presents itself is in keeping with the sport's history. The new power units – and feel free to call them 'engines' because eventually everybody will – signal F1's return to the cutting edge of performance, putting cars right on the limit and occasionally beyond it. And this surely is a good thing.

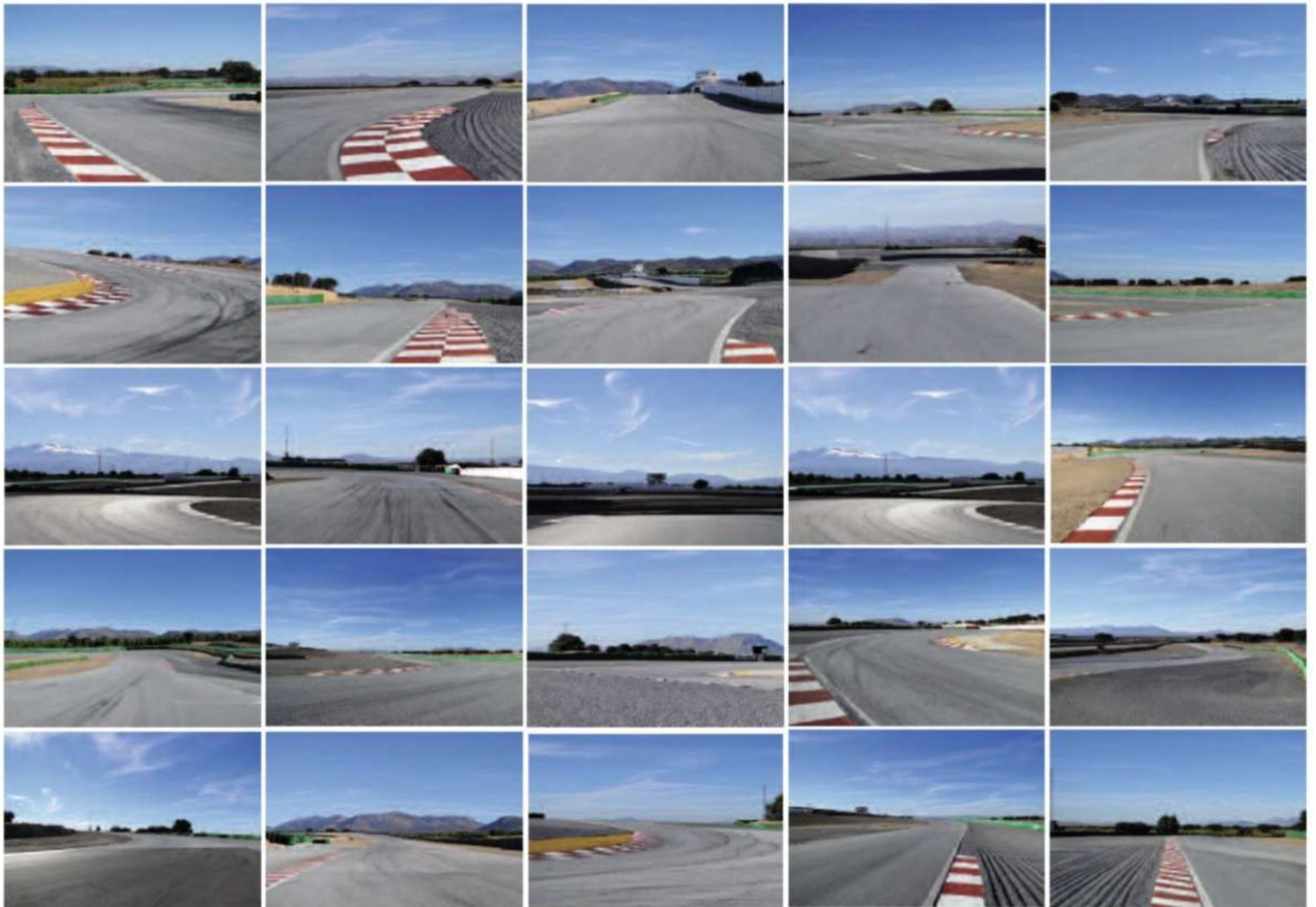
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ALL NEW F1 | | | |----|----| | 20 | 14 | |----|----| AERO





"W

e're naturally reticent... probably even more so before a big rule change."

With these words, Mercedes technology director Geoff Willis sums up the challenge in nailing down precisely what you can expect to see when the wraps come off the new generation of F1 cars over the coming days and weeks. This issue's cover image alone has been the subject of intense negotiations and no little secrecy.

So, as *F1 Racing* is ushered into an office overlooking the car park adjacent to Mercedes' windtunnel complex – one that turned out a title winner as recently as 2009 when the team were operating as Brawn GP – we're well aware of *les règles du jeu*. The actual changes to the aerodynamic regulations for this season are individually small, but, taken in combination with the packaging requirements of the new hybrid powertrains, they've had a profound effect on how the cars will look. We won't be getting a sneak preview of the W05, but we can pick the brains of one of the boffins behind it.

"You have to be careful because if you've been involved in setting the regulations, you can find yourself in the mindset that you know what the

The winds of change

Formula 1's new aerodynamic rules have grabbed fewer headlines than the new engines so far. But when the wraps come off, that will all change...

WORDS STUART CODLING
PICTURES MERCEDES

rules are," says Willis. "Whereas what you have to do is say, 'I'm not going to do what they *intend* me to do, I'm going to do what they *permit* me to do.' And that's what makes this time of year so exciting, because you have confidence in what you're doing mixed with some anxiety that there's something you may have missed."

Since 2009, the front wing has been 1,800mm wide – in effect, the same width as the car – but from this year on that has been reduced to 1,650mm. The FIA-regulated flat section of the wing in the centre remains at 500mm. In effect, this gives the teams 150mm less room in which to sculpt the various wing elements and endplates that both create downforce and set →



The main challenge for Formula 1 aerodynamicists for 2014 has been packaging the new power units

the tone for the car's aerodynamic 'envelope'. Since one of the front wing's other functions is to divert airflow around the two most significant aero blockages in that area – the front wheels – it's no surprise that this has had a big effect.

"Owing to the exact geometry of the front wing," says Willis, "it makes quite a big difference because the endplates are in an area where the flow structures that come off them interact with the front wheels and the contact patches where the airflow goes round the wheels. The two main flow features are the vortex that comes off the wing at the outboard end of the FIA section – the so-called Y250 vortex – and the endplate vortex structures. Both of those have now had a major influence to them changed, and that has an effect throughout the rest of the car."

"All the teams will be playing with these two things that they thought they understood well but for which the car must now be re-optimised."

And yet, at first glance, the narrower front wings of the 2014 cars will be less obvious than the nose treatments, which have been driven by a desire to reduce the likelihood of chassis penetration in a T-bone accident. The maximum height of the nosecone has been cut from 550mm to 185mm, which may perhaps call to mind the proportions of some great cars from the past. But the truth is somewhat uglier, owing

to aerodynamic consequences that were only discovered after the rules were fixed.

"The combination of that low nose and the remaining – fixed – FIA centre section of the front wing has had a bigger interaction than was first anticipated," says Willis. That much is clear from the nose solutions we've seen so far, which stick precisely to the letter of the law across the minimum width of the nose and in doing so look rather unfortunate. But form in F1 is necessarily subordinate to function.

At the rear of the car we bid farewell to the Coandă exhaust – there's a new FIA-mandated location for the single outlet, in a bid to minimise the opportunities for similar effects, though Willis remarks, enigmatically: "The exhaust always has an effect on a car's aerodynamics..."

There's also a new rear-wing setup, with the lower beam gone entirely and the higher one now occupying a smaller 'box' (so-called because it's tested in scrutineering by having the appropriate sized box placed over it as a measurement).

"The removal of the lower beam wing has been quite interesting," says Willis. "We know that the lower and upper beam wings and the diffuser all interact with each other a lot, so the removal of the lower wing, combined with the reduced 'box' you've got for the upper one, means the upper one is now closer to the limit. Keeping that

wing stable is now more of a challenge. There have also been small changes to the diffuser regulations, which have had a significant effect on the stability of the diffuser and its ride-height characteristics."

The absence of the lower beam wing also affects the trade-offs aerodynamicists look to make when dealing with engine cooling, which in itself is a less-known quantity this year due to the new power units. With turbocharging comes a different balance of oil and water cooling systems, and a bigger overall cooling requirement because the charge air from the compressor has to be cooled to an optimal temperature. This – along with the turbo itself and all the energy reclamation hardware – has to be packaged as tightly as possible.

"It's been an opportunity for us, with our close partnership with the engine group at HPP [Mercedes AMG High Performance Powertrains in Brixworth] to end up with a power unit developed for the race car and vice versa," says Willis. "It's been interesting to have that chance – for me, coming up to my 25th year in F1, and having seen V12s, V10s, V8s, it's the first time I've gone through a change of this magnitude."

"It's also an interesting time because much of the optimisation we've been doing has been based on simulation tools. The virtual car environment is now very sophisticated. So the biggest change to the powertrain in 25 years has turned up at just the right time for us to have the capacity to do all that work in the virtual world. Everything from energy management to combustion and cooling simulation, the power characteristics, the overall car CFD – had we tried to do this ten years ago we'd be a long way off optimum."

In spite of the increasing sophistication of the modelling tools, there are still limits. The FIA has sought to contain costs in recent years by clamping down on aerodynamic research, followed by a voluntary agreement among FOTA members to stick to a 60:40 formula, which defined windtunnel fan time in hours and the mean teraflops (trillions of floating point operations per second) in computing time for CFD per week. That has now been superseded by the so-called 30:30 agreement, which is enshrined in the Sporting Regulations. As well

as cutting fan time from 60 to 30 hours, the new rules call for no more than 80 'runs' per week and set an occupancy limit of 60 hours, which starts on the first run of the week. While this won't render windtunnel research less important, it will most likely tilt the balance further towards CFD.

"The biggest change to the powertrain in 25 years has turned up at just the right time for us to do all that work in the virtual world"



Since the simulation restrictions are now part of the rules rather than an opaque agreement between competing teams, the consequences of transgression will therefore be greater. But how are these limits going to be policed?

"We've got a process we've been using since the restrictions first came in," says Willis. "We maintain a log of every CFD and windtunnel run, how big it was and for what purpose. So we've got a lot of documentation and it is audited. You know your processes will be checked. That sort of policing has worked in the past.

"From our point of view, we've had a good look at potential efficiency improvements because every hour of windtunnel occupancy is going to be more precious than it was. We need to do more work to know what we're testing, why we're testing it – and at what point we abandon a test that isn't working as expected. We're pretty well-integrated between our windtunnel and CFD work, but there's more demand on that now to pre-filter what we feed into the tunnel. CFD has come of age as a design refinement tool."

In other words, the aero teams aren't going to do less work – they're going to try to do more in less time, because you can't, to employ a well-worn cliché, put the genie back in the bottle. You can't un-make all the powerful simulation tools that make F1 what it is, or force the sport's highly skilled and restlessly inventive engineers to un-learn what they have learned. And this process will intensify as the wraps come off each team's cars in the coming weeks, the spy photographers get to work, and rival engineers hunker down to take a good look at the other solutions out there.

In a stable rules environment it's very rare for one team to find a single advance that gives a decisive advantage. Performance increasingly comes through marginal gains working together (something which doesn't necessarily happen, it must be said, when you fit together separate elements that have all shown individual gains in simulation). Does the step change in the rules for 2014 mean that we may see bigger gains throughout the year? Willis takes a deep breath and exhales slowly before delivering his reply.

"The temptation when you're being beaten by somebody is to think that they must have some clever concept on their car – and occasionally there have been instances when people have found loopholes in the rules. But a lot of the time it's just that they've built a better car. You just have to keep pushing.

"As a business, we [F1 as a whole] are better at getting it right first time than we used to be. But when there's such a big change, you do hope that if there's a slap-your-head moment, it's others slapping their heads at what *we've* done..." 🏁

AERO CHANGES THROUGH THE AGES

No sooner had cars sprouted wings during the 1960s than the rule-makers got on the case...

1969

High wings are banned after accidents at the Spanish Grand Prix. Limits on size and location of wings are then enshrined in the technical regulations for the first time

1976

High airboxes are banned on 1 May (the second day of the Spanish GP weekend)

1978

The Brabham BT46B fan car is withdrawn in anticipation of being banned

1981

Sliding skirts are outlawed and a fixed minimum ride height is introduced to curb ground effect

1982

After teams use various means to circumvent the 1981 rules, skirts are 'unbanned', but have to be rigidly fixed to the cars

1983

Flat-bottomed cars become mandatory, largely removing ground effect

1985

New rear-wing limits are introduced to close a loophole teams were exploiting by adding winglets

1994

The underfloor plank is introduced, plus changes to diffuser and front-wing endplate dimensions, and front and rear wing height, as part of a number of speed-reduction measures following the deaths of Ayrton Senna and Roland Ratzenberger

1995

Smaller front and rear wings are mandated, along with a longitudinal step in the underbody

2004

Multi-element rear wings are banned

2005

The minimum height of the front wing is raised again, and maximum diffuser height is reduced

2009

Barge boards are banned except within a strictly mandated area; flow conditioners are banned entirely; rear wings are reduced in width by 25 per cent and raised by 150mm; front wings are widened from 1,400mm to 1,800mm and lowered from 150mm above the reference plane to 50mm; and the diffuser is made longer and higher

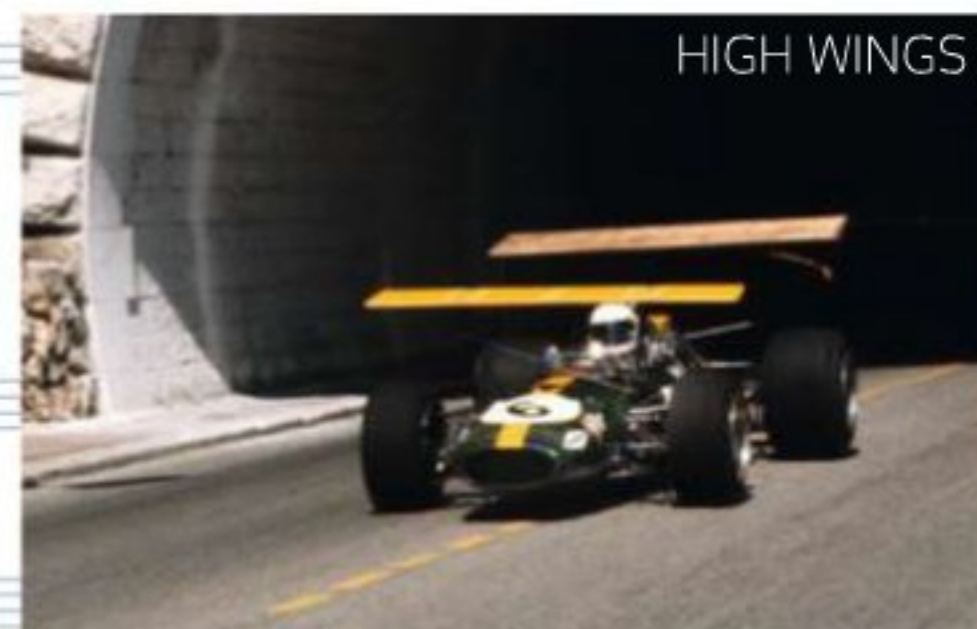
2011

The Drag Reduction System (DRS) is introduced and double diffusers are banned

2012

Noses are limited to 550mm above the reference plane for safety reasons and the exhaust-pipe-outlet location is more strictly controlled

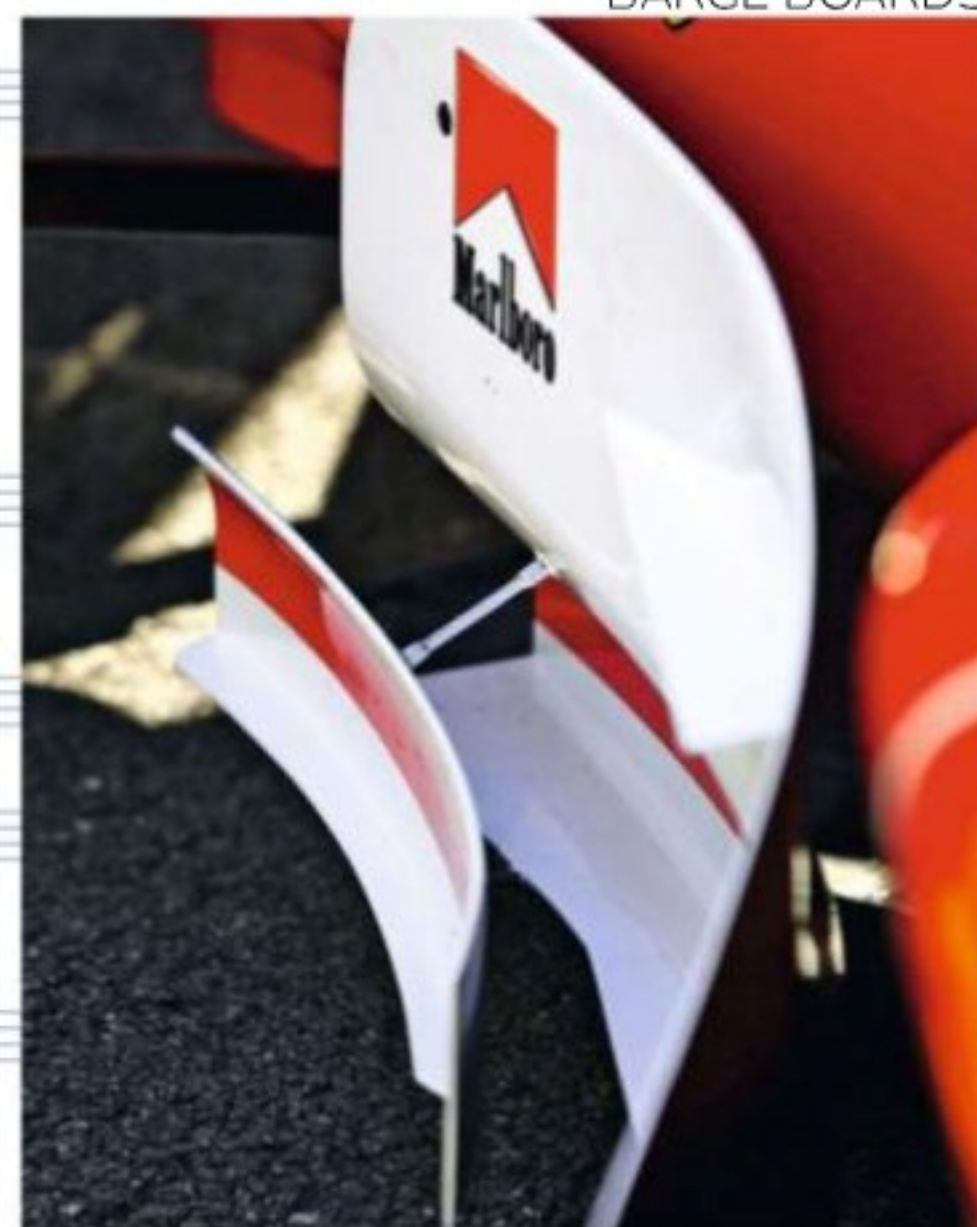
HIGH WINGS



SLIDING SKIRTS



BARGE BOARDS



DOUBLE DIFFUSERS



INSETS: STEVE ETHERINGTON/LAT; ANDREW FERRARO/LAT; SUTTON IMAGES; LAT ARCHIVE

ALL NEW F1

20
14

DRIVERS

WHO WILL BE F1'S SUPER SAVERS?

Formula 1's new 100kg fuel limit means drivers with the most precise touch on the steering and pedals will waste the least fuel, and have access to more power for longer. **Peter Windsor** examines this new challenge





Current drivers like Hamilton (left) face very different challenges compared to the likes of Senna (right) now fuel is limited to 100kg

Gill Research Ltd, Lymington, Hampshire, England. An excellent engineering company, whose products already supply the military, marine and motorsport industries with everything from fuel and oil sensors to ultrasonic flow sensors. You'll hear a lot more about Gill in 2014. For Gill have just been awarded a new deal: they are making the homologated F1 engine fuel-flow restrictors for the FIA (with calibration certified independently). Their part – their new, standard part, painstakingly replicated from one team to another within a tolerance that in theory will make things equal – is the new world upon which the right feet of our F1 stars will play.

No longer will the accelerator pedal of the car be *directly* related to the potential power of the engine over a race distance. On Sundays, certain drivers – those who use the pedals and steering well – will be able to spend more of the race with access to a higher power output.

Let's not get into the pros and cons of this new regulation (although personally I'm not a fan:



MAIN PHOTO: CLIVE MASON/GETTY IMAGES. INSET: LAT ARCHIVE

I'm a raw-speed guy – but that's another story) Let's look at the implications.

What this means is that a driver's use of fuel has never been more critical. It's not unusual these days to hear drivers being told from the pitwall to "watch the overlap", but in 2014 this particular sin could become a race-loser. And the scope of the problem will not end there. It goes right to the heart of how you drive the car.

The radio messages from engineers we heard in 2013 generally referred to their driver's use of the brake while still trailing the throttle into a corner, causing inefficient use of the fuel and the brakes. With most teams and drivers now eschewing foot rests on the left side of the footwell area, the left foot now rests on the brake pedal when the car is travelling in a straight line. If the driver is quite tall, or if the pedals haven't been correctly adjusted, overlap can occur even on the straights, under full power. This not only skews the engine-braking software for the next corner, but also wastes fuel. There was plenty of chat about fuel-saving in the last few years →

ALL NEW F1 2014 DRIVERS

of the V8 era, but ultimately a team always had the option to build in a fuel margin. Now, with the 100kg fuel limit and the 100kg/hr fuel-flow restriction, that option no longer exists.

None of this would be a problem if drivers still braked with their right foot. Today, though, no F1 constructor would contemplate building a car for a right-foot-brake setup. Every driver on the current grid is a left-foot braker. Always has been; always will be.

Why? Because of karting – and because of all the rungs on the junior single-seater ladder, which now cater for left-foot braking only. Show me a Formula Renault racer who knows how to heel-and-toe and I'll show you a 16-year-old who buys books from Waterstones.

Used to perfection, there is no doubt that left-foot braking is an advantage. Drivers with the foot co-ordination of Stirling Moss, Jim Clark, Jackie Stewart, Ayrton Senna or Nigel Mansell, would never be able to compete with the throttle-to-brake transfer time of, say, Jenson Button. Drivers also speak of *pressure* – of being able to plant their left foot on a big brake pedal and maximising stopping power in a way they could never do with the right foot on a smaller pedal.

Then there's the cornering thing, as pioneered by Michael Schumacher. Need more rear end to balance the understeer? Trail brake up to the rotation point, keeping the weight on the nose. Michael used to do this on the medium-speed left-hander down the hill at the Nürburgring. Mika Häkkinen was another who excelled. Turn 5 in Hungary was always a place to watch Mika.

For every Michael and Mika, however, there was a Jarno or a Ralf. Left-foot braking was the answer to virtually all their problems, for neither was particularly good at managing understeer. Front tyres beginning to grain? Trail-brake further into the corner. Keep the brakes squeezed until the front end bites. And they went slower, and slower and slower. "Understeer," they'd say later. "Undrivable..."

Yet the same issues were having less effect on drivers like Kimi Räikkönen. Glibly, observers from the pitwall (ie all of F1's power brokers) would explain the differences by Kimi being 'a racer', or 'super-quick', or not overlapping his trail-braking with the throttle.

What was actually happening was that your Ralfs and your Jarnos were categorising a new area of downside. Yes, they were tucking in the front end of the car. No, they were not saving time (even if they were, superficially, saving the tyres). Nor were they 'overlapping'. Actually, they were doing the opposite: much more than

'balancing' the car, they were, in reality, slowing it down enough to make the corner stick. Every car in the world handles well within its own limits: it's balancing the car's limit of comfort against its actual potential that is the problem.

So what was Kimi doing that Jarno was not? In my opinion, Kimi – and drivers like him – do their car-balancing more with the *throttle* (in conjunction with steering inputs) than the brake. The brake for them is a bolt-on, a fine-tuning device for certain types of corner – Turn 1A at Suzuka, for example – but it isn't the *main* thing. Use it as the *main* thing and you'll just... slow the car down or, at best, be guilty of overlap.

It's one thing not to overuse the brakes; it's another to use the throttle and steering correctly. No driver is perfect and every driver is different, that's a given. The basic physics, though, are undeniable: each straight has two ends. The first end determines your speed on the straight in front of you. The second end determines your speed on the next straight. The shorter the ends, the longer the straight – and we all know that the fastest way to travel is in a straight line. So how

"Kimi – and drivers like him – do their car-balancing more with the throttle than the brake. The brake for them is a fine-tuning device for certain types of corner"

"It's one thing not to overuse the brakes; it's another to use correctly the throttle and steering"

do you make the corners 'shorter'? And how do you avoid overusing the brakes? And how, come to that, do you maximise your use of the throttle?

At this point I defer to some notes I made when I was sitting in the back of a road car at Bruntingthorpe, not so long ago. Rob Wilson, the F3 winner and driver-coach, was in the passenger seat, and behind the wheel sat a current F1 driver. My notes went as follows:

"Gently apply the brakes for the briefest moment before applying real pressure. Brake to the slowest point of the corner, not the entry. This way you avoid surprising the car and it will stop in a shorter distance. Ease off the braking by a tenth in the last tenth of the

braking zone. Tease the steering wheel slightly so that the car can begin its turn. Then apply additional lock. Little turn, big turn. Apply more lock mid-corner. Sharpen the end of the turn so you can set yourself up to flatten the car and drive diagonally to the exit. To take an edge off the turn, it may be better to reduce the braking or apply a little throttle rather than suddenly reduce the lock. Making the corner 'shorter' is better than going for the highest minimum speed. The more available power, the sharper your mid-corner turn."

What this means for 2014 is that drivers who correctly use the steering, brake and accelerator pedals will have a greater advantage than →





Michael Schumacher was a pioneer of trail-braking up to the rotation point, keeping the weight on the nose to balance the understeer



Rise of the lightweights

"Agility, reaction speed, endurance, strength, VO2," says McLaren's driver performance manager, Simon Reynolds. "What I'm looking for is something similar to rugby players in terms of the spread of virtues."

Presumably he means a rugby player wearing the 9 or 10 shirt rather than a 1, 2 or 3, but I decide to keep this thought to myself as Reynolds continues to elucidate on the matter. His demeanour places him squarely in the 'drop and give me 20' school.

McLaren partner Lucozade Sport has invited *F1 Racing* to sample the brutal training regime that will enable Jenson Button and Kevin Magnussen to stay competitive. The facts are simple: Formula 1's new hybrid power units and their plumbing are much heavier than the outgoing V8 engines but, despite this, the minimum weight limit for car and driver has risen by less than 50kg [from 642kg to 690kg]. This is bad news for heavier drivers.

"I'm aiming for a weight of 65-72kg with body fat between 8-10 per cent," says Reynolds. Pity poor 78kg Nico Hülkenberg...

Lightness may be a desired outcome of the process, but it's not the only one. The drivers have to be strong enough to operate the car and retain the stamina to stay mentally focused. Reynolds demonstrates by squatting on the floor in a cockpit pose, arms outstretched as if grasping the steering wheel. "Lots of drivers migrate their shoulders to an anterior position rather than a posterior position [slouching], compressing their sternum and stopping them breathing properly."

Sample exercise: sitting on a flat medicine ball in an abdominal crunch position, feet off the ground, while rotating a pair of dumbbells held straight in front of you. This is, as you can imagine, hell – as is the arm test, where you pump a pair of dumbbells up and down, alternately, for 60 seconds. Reynolds tells me he expects '75-80 repetitions'. I grind to a halt after 42, every fibre of my arms burning.

"Come on!" he barks in my ear. "Twenty seconds left!" Jenson and Kevin, I feel your pain.

Stuart Codling

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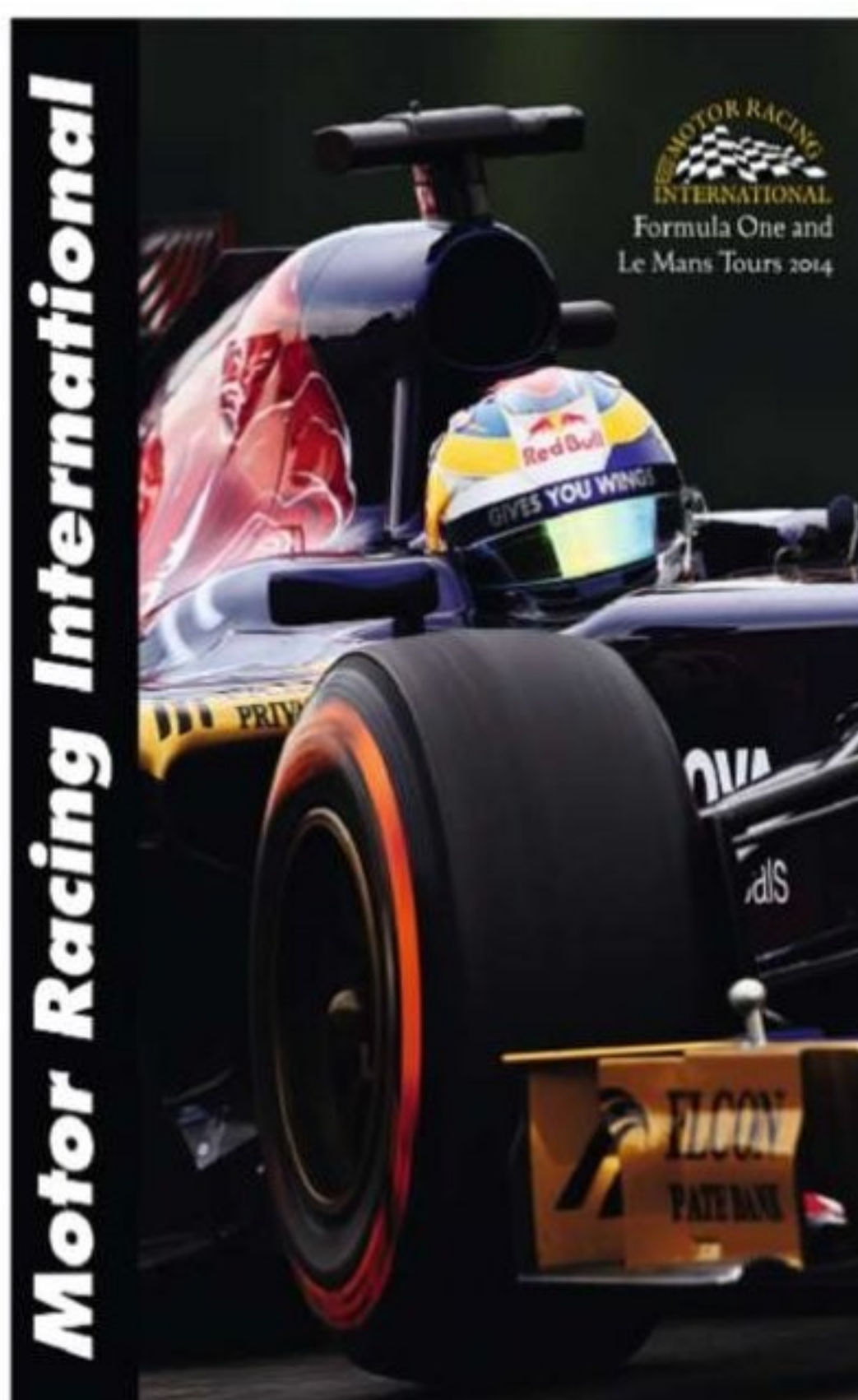
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ALL NEW F1 2014 DRIVERS



Clockwise: Mansell ("as good a turbo driver as we'll ever see"); Senna ("his mid-corner rotations were impeccable") and Prost ("he never looked quick")



we've seen at any stage in the two-pedal era. They will have a fuel advantage and this, in turn, will give them access to a power advantage; they'll be able to use the additional torque of the V6 turbos to manipulate a sharper turn mid-corner; and they will not be exposed to time- and fuel-wasting 'bobbles' from rotation point to exit.

Nigel Mansell was as good a turbo driver as we'll ever see. You rarely saw him out of line in a Williams-Honda, despite having up to 1,100bhp on tap, and he did just as I've described under braking, shortening the corner and using road on the inside that Nelson Piquet would never touch. He also had this mid-corner patience that often resulted in a millisecond of complete silence. Then, with perfect graduation, he would feed in the immense power, giving himself lots of room for the vagaries of turbo throttle-lag. A high minimum corner speed meant nothing to him – just as it meant nothing to Alain Prost.

You'd watch Alain on a qualifying lap in the Renault turbo and for the most part miss the action. He never *looked* quick. Ayrton, by contrast, continued to apply his natural 'on-off, on-off' throttle-blipping, mid-corner, throughout the turbo era. Those who had never heard him in Formula Ford 2000 or Formula 3 assumed it was how he worked with turbo throttle lag; that wasn't so. It was just how he drove. He got away with it because he used soft throttle return

"In 2014, with Gill fuel-flow meters in place, it will be about using the *perfect* amount of throttle for the correct lap time"


springs and because the 'blips' were tiny. It was a form of shadow-boxing. He didn't *need* to do it. His mid-corner rotations were impeccable.

No one in 2014 will be afforded such luxuries. In 2014, with Gill fuel-flow meters in place, it will be about using the *perfect* amount of throttle for the correct lap time – and that is only going to happen if the car is being driven – in my view – as per the above notes.

There will be other variables to consider. ERS. Engine reliability. Tyres. And the driver's ability to juggle these parameters in conjunction with

the pitwall. If I were Lewis Hamilton, I'd be thinking: 'Now what is Nico going to be working on in that supple brain of his? What systems operations will be important and which will be time-wasters?' In other words: I'd be worried.

Fuel usage – and, by extrapolation, how a driver uses the throttle in balance with the brakes and the steering – is what the 2014 regs are all about. It's almost as if the rule-makers sat round a table and said: "Okay, let's design a formula that rewards the touch and feel of drivers like Kimi, Seb and Lewis". By definition these rules should also suit the cerebral clarity of Nico Rosberg; and Fernando, as the world's greatest adapter, can't be counted out either. I'd also add Valtteri Bottas as a driver capable of using the throttle in the right way. The Grosjeans and the Hülkenbergs will find their way, but for them it won't be obvious out of the box.

Spare a thought, though, for the technicians at Gill, who are, as I write these words, preparing the devices that will change the face of F1 driving as we know it. For them, replication will be everything – and that's just the start of it. 



In 2014, a driver must balance the throttle with the brakes and the steering, and here it's Räikkönen, Vettel, Hamilton, Rosberg, Alonso and Bottas who will excel



In conversation with

Paul Hembery

After the *annus horribilis* that was 2013, we ask Pirelli's motorsport director what they learned from last season – and what the new regulations mean for 2014 tyres

INTERVIEW JAMES ROBERTS PORTRAIT ANDREW FERRARO/LAT

Last year was a bit of a disaster for Pirelli. First you faced disciplinary action from the FIA Tribunal for that mid-season tyre test with Mercedes, then came the catastrophic punctures at Silverstone. So what did you learn from 2013?

We learnt that we need to do more testing. The teams say they don't want to test, but they're not the ones making the tyres. We have to do a certain amount of testing to be able to do our job. F1 is a moving target. It isn't a single-chassis formula, so there are 11 different inputs on our tyres and we need to validate our tyre models, particularly in types of compounds. Having said that, we don't need to go to the other extreme where we do hundreds of thousands of miles of testing.

At the beginning of 2013, Red Bull were privately lobbying you to change the tyres. When they failed they criticised you in the press. How damaging was their public condemnation of Pirelli?

It was very disappointing that the media was used to try to influence change. While I understand a team wanting to do something from a sporting point of view, it's not the way you should operate. It's pointless to make statements like that now, however, as there is a new F1 Strategic Group who will listen to teams' views and act upon them accordingly.

Someone could have been hurt with the tyre failures at Silverstone. In the aftermath, how damaging was it for Pirelli?

It was damaging in the short term in the UK market because it was the British GP, but, in reality, it lasted about a week. People have short memories and yes, if it had gone on forever then it might have been a different matter.

We had to react quickly and we recognised there were problems and we put them right. We took our responsibilities seriously and we made changes. And we've learnt from it.

Did you consider tendering your own resignation at that time?

No. Certainly not. You do things based on the data that you have at the time. There was a huge frustration that, as a company, we weren't getting support from certain angles. And the FIA and Jean Todt were particularly helpful in getting the young drivers' test changed so we could run some tyres there. It's a hard sport to work in because there is a lot of paranoia. If in future another tyre maker come in, they'll look aghast at what goes on: a lot of them already think we're mad to work in a sport like this. Individually the teams are totally supportive. Collectively though, it all falls apart – and that's sometimes

CV

Date of birth 21 March 1966

Place of birth Yeovil, Somerset

Role Pirelli motorsport director



Sergio Pérez was one of six drivers to suffer a massive tyre failure at the 2013 British GP

difficult to deal with. We have our objectives, they have theirs. But because nobody is looking at the bigger picture, that gets lost.

Do you think F1's new Strategic Group will have the desired effect?

We're happy that there is one body that contains the teams, the FIA and FOM. I know some teams won't be happy as they're not included, but at least there is a platform for them, as last year people lost sight of what we were asked to do. In future there will be no point in complaining if we are not doing

something. Now everyone has a platform to represent the sport. We are a supplier, and if in 2014 the sport wants ten pitstops per race or just one pitstop – we will do it.


What are your concerns about the amount of torque that will be generated from the new engines? Is that why you are being much more conservative with tyre compounds in 2014?

Even if the regulations hadn't changed, we would have gone conservative. With such a big change, there are a lot of unknowns for everybody, and that includes the rate of development. Someone might gain an advantage that is more than anticipated and then you have to produce a tyre that caters for such a wide performance differential. There could be quite a disparity between the first car and the last car, which is something we have to take into account.

What changes are you making in line with the new regulations?

We're trying to improve the tear-resistance and mechanical strength of the compounds, partly to reduce wheelspin and partly to reduce the marbles: the latter at the drivers' request.

It's easy to say what you want, but when you try to marry together all the compromises it's less easy. To create a two- or three-stop race, there are two ways of doing it: either through wear or chemical degradation. In the first two years it was more chemical degradation and last year was a mix of both. Last year you could have done the whole race on one set if you hadn't been obliged by the regulations to change tyres.

I'm happy F1 decided to conduct pre-season testing in Bahrain this year, as it's an important track for getting to grips with temperature and traction. Now we'll know where we are before Melbourne, rather than three or four races in. 

INSET: STEVEN TEE/LAT





Balls in the AIR

Formula 1 2014-style will challenge drivers mentally as never before. A season, then, in which those with the sharpest minds, such as Mercedes' Nico Rosberg, could flourish

WORDS ANTHONY ROWLINSON **PORTRAITS** THOMAS BUTLER

Let's talk about a young, gifted, multilingual, fair-haired German, who drives for a British-based but foreign-funded F1 superteam, and who should have a pretty decent shot at winning the 2014 world championship.

No, not *that* one. *This* one. The one with the world-champion dad, Keke, and a handy knack for unsettling headline-grabbing team mates.

Yes, let's talk about Nico (no, not *that* one, *this* one), the one who can ride a unicycle while juggling. The one who has always seemed uncommonly bright, in an academic sense, for a racing driver. The one whose skill set might be just the ticket for success under a newly framed set of rules and regs that surely have been tailored to suit drivers capable of thinking their way through a race, interacting closely with their engineers and managing competing, non-complementary performance parameters in the dash to the chequer. One who can juggle. And *boy*, can he juggle. Nico's eyes positively light up when he sees the props *F1 Racing* has brought along for his photoshoot – namely a unicycle and a set of juggling balls.

He needs no prompting to strip out of the dinner suit in which he's arrived, on account of his later scheduled attendance at the Mercedes GP Christmas bash, and zip himself into his race suit, all the better to engage in a little physical activity.

Then it's balls first, by way of a warm up. "I used to practice this a lot when I was younger," says Nico in his distinct Euro-inflected fast-paced patter, broken today just a little by his need to concentrate on three mid-air flying objects. "It's great for eye-hand co-ordination and, y'know, it's fun."

He starts to show some skills: underarm, overarm, pitching one of the balls and catching it a split second from a disastrous descent to the floor. It's impressive to behold – all the more so as he has come at this cold. His easy virtuosity is a reminder of how casually gifted F1 drivers are in matters of physical fluency; how much sheer talent they have to spare.

"Can you do four?" we ask.

"Much harder."

"Five?"

"No way... it's impossible. No, not impossible, it just requires a *lot* of practice. Like, hours and hours."

We'll hear an echo of this applied competitiveness later when we come to talk race driving, but now, for his next trick... unicycling!

Yes, Nico Rosberg can not only speak five languages fluently (English, French, German, Spanish and Italian), drive an F1 car with aplomb *and* juggle, he can also zip around a large room on one wheel, at considerable speed, without ever seeming to be at risk of catastrophe. Had the F1 thing not worked out, a career as a circus performer surely beckoned.

Forgive, if you will, the light-hearted tone, for in asking Nico to drop his guard before the cameras, we're seeing some of the raw attributes that make drivers what they are: balance, suppleness, flexibility, competitiveness, resolve – all driven by a sharp, open mind capable of accepting new challenges and decoding them in pursuit of success.

He'll need all that and more to confront the looming spectre of 2014, but, no surprise, he's worked that out already.

"One of the biggest challenges is just getting used to, well, *everything*," he says. "There are so many new things in 2014 it's unbelievable, so this →

ALL NEW F1

2014 ROSBERG



Nico Rosberg CV

Born 27 June 1985,
Wiesbaden, Germany

Debut Bahrain 2006
Races started 147
First pole China 2012
First podium 3rd,
Australia 2008
First win China 2012

F1 career

2013	Mercedes	2009	Williams	Poles – 4
	171 points, 6th		34.5 points, 7th	Fastest laps – 4
2012	Mercedes	2008	Williams	Wins – 3
	93 points, 9th		17 points, 13th	Other podiums – 8
2011	Mercedes	2007	Williams	Races led – 13
	89 points, 7th		20 points, 9th	Laps led – 212
2010	Mercedes	2006	Williams	Total points – 570.5
	142 points, 7th		4 points, 17th	

winter is more complicated than usual. Just getting used to everything and getting everything the way you like it. For example, I was starting to set up my display, but there are infinite set-up possibilities. It's so complicated – everything you need, everything you want to put on the display... it's amazing. Even that is just so complicated."

If Nico seems a little wide-eyed at the prospect of almost infinite possibility, he is not, even for a moment, fazed by what lies ahead. Indeed, his enthusiasm for the new is manifest when he teases us: "You know, if you walked through that door *over there* [he points to the corner of the room], you'd see our 2014 car. You'd be able to walk right up to it and touch it. So you're just a few metres from all that new technology." Rosberg is laughing as he says this, enjoying his moment of being able to tease a journalist he knows would *love* to have a peep at what lies on the other side. Alas, a firm interjection from Mercedes' press attaché makes it abundantly clear that there will be no sneak previews on this day (or, like, *ever*). Hey-ho. That doesn't prevent Nico from telling us a little of what he already knows.

"It's not a huge difference, driving-wise," he relates. "The main change is in torque and driving out of low-speed corners. There'll be less downforce, because we don't have the coandă-effect exhausts, so that's where the biggest change will be, plus small details: engine consumption, the whole system, the whole brake balance... everything is different to last year."

F1 Racing readers won't have forgotten that Nico won last year in Monaco, in some style, from pole. He controlled the race from the head of the field, deftly managing his fragile and heat-critical Pirellis from lights

"Nico gets what he needs and he gets it proactively. He's the very opposite of lazy"
Tony Ross, race engineer

to flag. And while there were mutterings of discontent about the slow overall pace, a driver able to think his way through the laps, balancing tyre wear against fuel consumption, against energy recovery, as they will all have to this year, is one better placed to succeed.

"Fuel limitation will play a big role," Rosberg confirms, "and we'll have to manage that optimisation. It will be difficult with just 100 litres... very, very difficult, in fact."

A close relationship with the 'second brain', or race engineer as they're more commonly known, will, then, be vital this season. Rosberg's is Tony Ross, who has worked with him since his F1 debut, with Williams, in 2006. He needs no convincing that Rosberg's mental acuity could

be a trump card this year: "Nico is the cleverest driver I've worked with in terms of his educational side," says Ross, "and he's good at juggling a lot of balls. We see it all the time in the garage. If you take the language aspect as an example, a team like ours is multinational, but he's able to speak to, say, a German engineer or a Spanish engineer in their own language, which really helps him in building the right group of people around him."


Rosberg is open about having constructed a 'Team Nico' on one side of the Mercedes garage – as any top driver should – and Ross reckons Nico is particularly effective at communicating in a uniquely tricky tongue – that being the sometimes obscure tech-chat vernacular beloved of F1 boffins.

"He's very good at working with engineers to set up a car," Ross notes, "and he is almost conducting an orchestra in terms of drawing information from the people around him. Between his performance engineer, his controls engineer, his engine engineer and his tyre engineer, he gets what he needs. He doesn't sit back and wait for it to be given to him – or even for it to be channelled through me. He gets it proactively. That makes him a very interesting character to work with – he's the very opposite of lazy."

He is also, despite the lure of arrogance that might ensnare one of privileged upbringing and growing success, approachable and grounded, with a courteous touch some of his peers might benefit from adopting, particularly in a season when drivers must lean on their teams like never before. A cool head and an easy manner are key for this season – one that will test tempers and place strain on highly wrought individuals.

So how does he rate his chances of felling a Red Bull with a Silver Arrow? Could Nico and his technically ambitious, amply funded team be the ones to make the mighty Milton Keynes beast stumble in its pursuit of success? He's too smart to throw down an easy headline and proclaim himself a title contender, but he will admit he's in a great position: "If the car performance is there," Nico says, prefacing his comments with caution, "I'm sure I can do a fantastic job. Whether that's enough to win the title or not... there are so many other factors that come into it we will just have to wait and see. But I am confident I can do a good job, yes."

As for the particular goal of dethroning King Seb, he offers this: "He is not God, you know. Of course he is beatable. He's one of us; I see him as one competitor like the others. He has done a great job, but things change."

Everything, indeed, is changing for 2014 and if at season's end a Mercedes F1 driver has proved himself the most capable of juggling whatever's thrown at him, *F1 Racing* won't be at all surprised. No not *that* one. *This* one. 

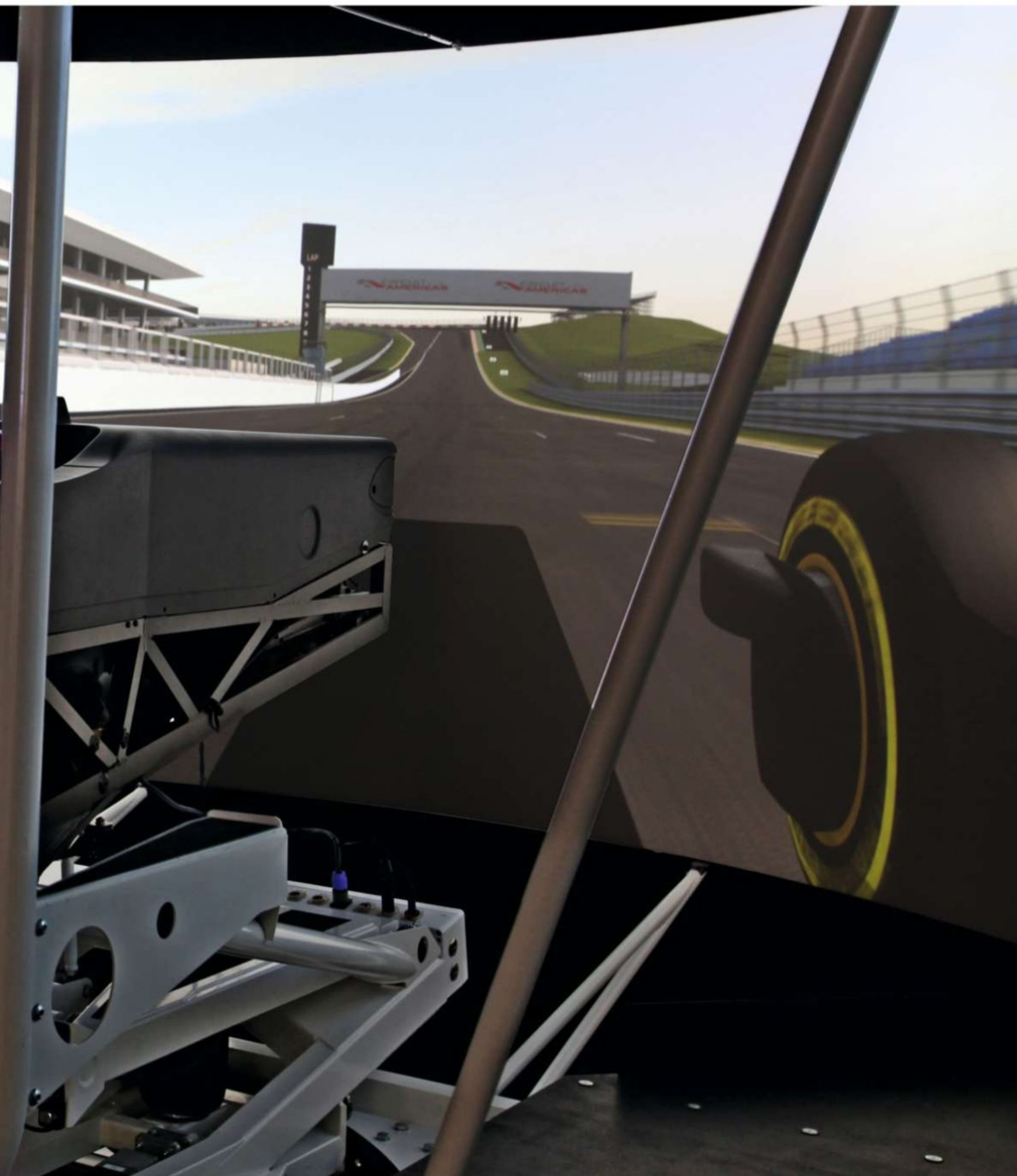


ALL NEW F1 | | |----| | 20 | | 14 | DRIVING

THE FIRST DRIVE OF 2014

In a small room in the middle of rural Oxfordshire, something very special is occurring. Caterham are running their new 2014 car in the simulator for the first time. *F1 Racing* joins them to witness those tentative first steps into the unknown...

WORDS JAMES ROBERTS PHOTOS SAM BLOXHAM/LAT



ALL NEW F1 **2014** DRIVING

Secret rooms are not meant to be found easily. After negotiating a series of single-track roads in the heart of the Cotswolds, *F1 Racing* finally reaches Caterham's F1 facility, tucked away in the damp English countryside. Once inside the confines of the building, we pass along corridors and around corners, through swipe-pass doors and past confidential design offices to one of the most prized possessions in F1: a 2014-spec simulator.

There's no glitz or glamour to be found here. No sun-kissed chic, no spectacle or drama. This is a side of F1 that's locked away. Despite the short winter days, the hours are long as engineers decipher bewildering amounts of data to create the 2014 Caterham F1 car. This is the computer generated model of the real thing that will hit the track in Jerez at the end of January.

In a dark corner of this room, the team's reserve driver, Alexander Rossi, is pounding around a simulation of his home track, the Circuit of The Americas, putting in the first laps with the new car. Elevated on a platform with six degrees of movement, he sits in a black monocoque facing a 180° wraparound screen with a representation of the circuit beamed in front of him via three overhead projectors.

Computer screens close to him relay his laps with real-time telemetry and his every input is recorded for analysis. With such a monumental change in the regulations over the winter, there is a lot of secrecy (and a lot of unknowns) about just how this season will pan out. But *F1 Racing* has been given exclusive access to watch a 2014 car (albeit simulated) being driven in anger for the very first time.

After Rossi has passed the iconic COTA observation tower and again driven the steep incline into Turn 1, the reset button is hit and he climbs out. Having driven the 2013 Caterham on the Friday morning of the grand prix in Austin last November, the 22-year-old is expertly placed to provide a back-to-back comparison between this and last year's car. He starts with the most obvious difference, the switch from normally aspirated 2.4-litre V8s to the new ERS-assisted 1.6-litre turbos.

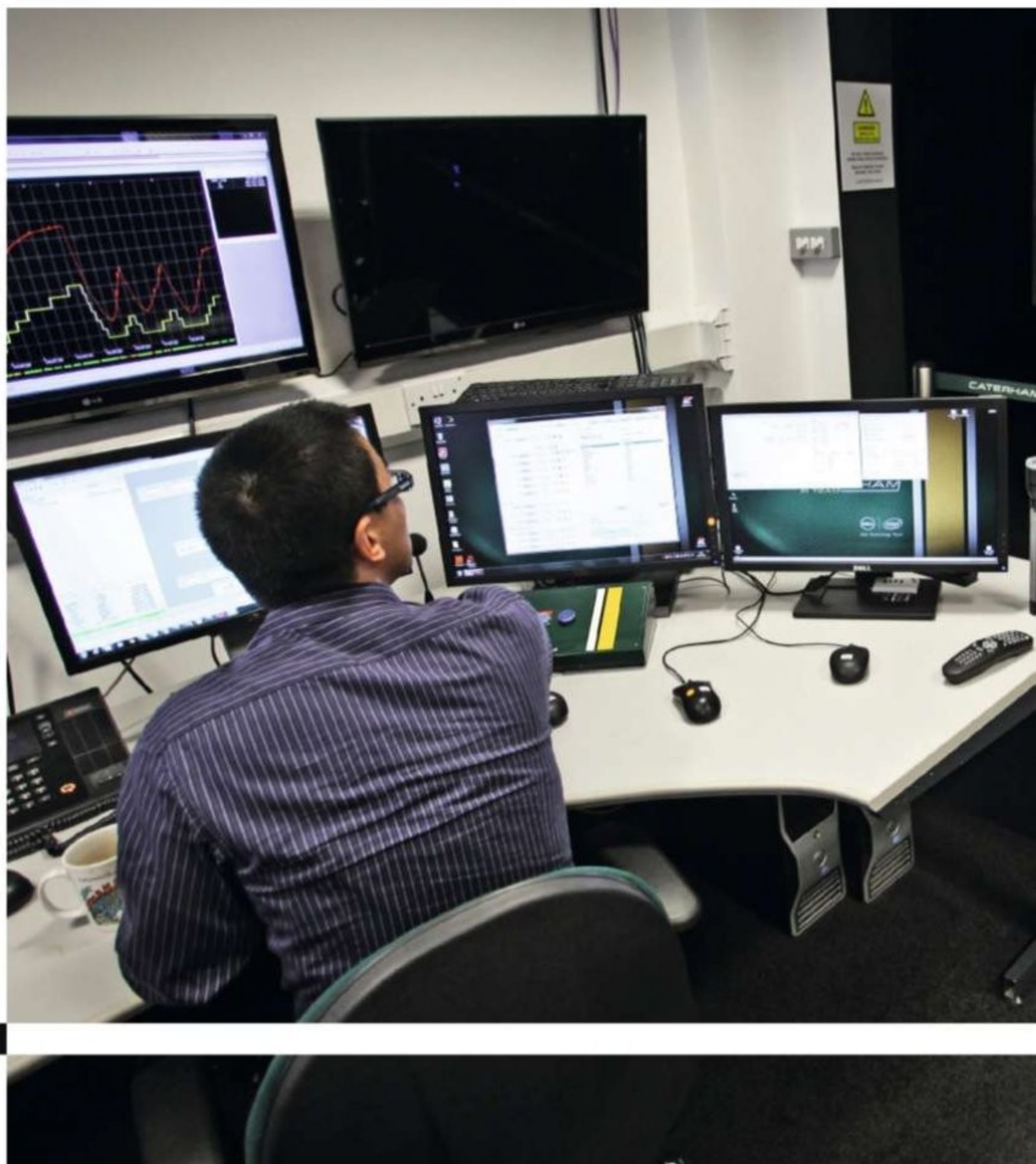
"On a normal engine, when you start to get wheelspin, you short-shift into the next gear to solve the problem. Well I've found that on these turbo-charged engines, short-shifting actually induces more torque – so it makes the problem worse," explains Rossi.

"The outcome is that as you go up through the gears, your foot is never quite on 100 per cent of the throttle. So that is something a bit different to what we've been used to before. I've been finding wheelspin all the way through to fourth gear. As with anything, in the beginning it's a bit of a shock, but the more you drive these 2014 cars, the more you can find tricks to optimise the speed."

The huge increase in torque (some figures are suggesting 150 per cent more torque at full power than in the V8 days) could benefit those drivers who tend to be more adept at controlling their right foot.

At the time Rossi was driving the simulator, Pirelli were flying to Bahrain to conduct a pre-Christmas tyre test. Because they were still finalising their tyre compounds for 2014, their proposed switch to a harder tyre (particularly at the rear) could exaggerate the problems created by the new powertrains.

"I've been finding wheelspin all the way through to fourth gear. As with anything, in the beginning it's a bit of a shock" Alexander Rossi



“If the tyres are harder, it will create more wheelspin... but then you’ll be able to get away with more wheelspin because the tyres will be more durable,” he explains. “It will have a massive effect on how the driver is able to get the power down. Changes might have to be made to the suspension to be able to deal with the torque, but that could sacrifice other aspects of the car.”

This is the first week that Rossi and Caterham have been working together on their 2014 simulator and so far they have been working using 2013 tyre modelling, since the powertrain is the priority. The next stage will be to feed in the aerodynamic restrictions on the chassis but, as ever, the figures coming out of the windtunnel are in a state of flux as designers and aerodynamicists find more ways to claw back downforce lost due to the new regulations. So the early iterations of the sim model are not going to reflect the actual chassis that will appear at the first race of 2014 in Melbourne. →



Rossi sits in the 2014 simulator, with images of the track beamed onto a 180° wraparound screen. Engineers collect and analyse the telemetry relayed to their computers

Cornering techniques: 2013/2014

At the end of Austin’s back straight is the 68mph, 90° Turn 12. Alexander Rossi explains how taking that corner in 2014 will differ to the approach in 2013

In a 2013 car...

“When you’re travelling at over 190mph there’s a big braking zone for this second-gear left-hander. As you approach the end of the straight, you look for the braking boards on the right and hit the brakes with maximum effort to do everything you can to scrub the speed off the car.

“As you turn in to the corner, you are trailing the brakes to keep the weight on the nose. Turn in, aim for the apex, and then from that point come off the brakes and apply the power. Then you accelerate through the gears at full throttle ready for the next corner. It’s pretty standard.”

In a 2014 car...

“You will be able to brake later because at the end of the straight the engine goes into recovery mode. So it will start taking off speed even when you’re at full throttle. The addition of engine deceleration will help you brake later for the corner. But you can’t trail the brakes into the corner like before, because the rear is so active with

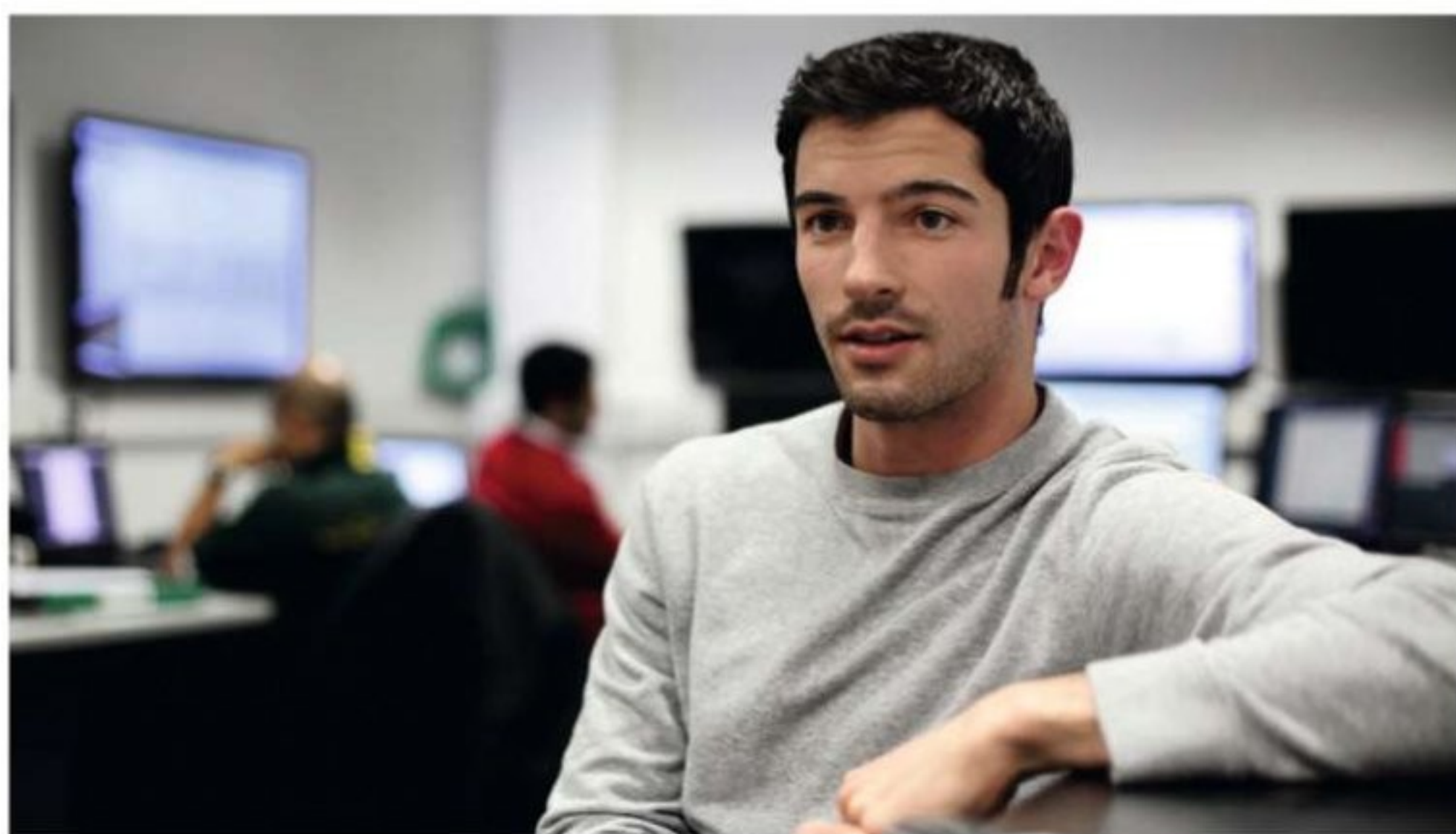
recovery that the brake bias moves to the front brake. That’s fine, but as downforce comes off the car with speed, if you turn in with similar brake pressure to what you’d apply in a 2013 car, you’ll lock the front tyre as you have more front-brake bias than before.

“As a result you need to get all the deceleration done before you turn in. Then there is a risk of understeer because you can’t keep the weight on the nose like you could with the 2013 car. There are the aero restrictions to think about, too.

“You pick up the power at the same point through the corner, but the point at which you reach full power is much further down the road than it was before. The difference is almost like driving in the wet, because even in fourth gear you can suffer wheelspin. All this means you need to be very progressive on the throttle.

“To be honest, although the change in style isn’t major, the concept is the same. The change in style won’t be as big as the jump from Bridgestones to Pirellis.”

US racer and Caterham test driver Alexander Rossi prepares to put the sim through its paces at his home circuit



“Building a model for 2014 requires all the different departments to feed the information in to us,” says David Chen, Caterham’s senior vehicle dynamicist.

“Data comes from Renault, Pirelli, our own tyre engineers and the aerodynamicists. We essentially have a vehicle model skeleton that we build all the various elements into, and then we are able to create a computer code that translates everything we know about the car onto this simulation model.”

It’s Rossi’s role to provide a driver’s perspective on all the inputs that have been added together to hone the 2014 model. It takes hours to correlate the data and refine the simulation, so it’s as representative as it can be. And once the model has been built, Caterham’s engineers can then move into the realms of increasing performance.

Despite the changes for 2014, Rossi doesn’t believe drivers will have any more to think about during a grand prix. The information with regards to fuel economy and engine management will be fed to them from the engineers.

“I think there will be less for a driver to do in 2014,” he says. “You are losing the KERS activation, that’s now automatic. And if there is a problem, the engineers will tell you what map to put the car in.

“Where the driver will have a big effect will be in the lead-up to the race. There will be such a big lap-time differential between qualifying and the race, because during the race, cars will be up to seven seconds slower as they will be saving fuel from the first lap onwards. But in qualifying they will run at full power, and the question will be how to set the car up for qualifying, knowing that due to parc fermé conditions, you won’t be able to change the car’s setup again for the race.”

It’s one of a number of unknowns that the drivers, teams and fans will face this season. Will strategy allow drivers to run at full power at different stages of the grand prix, or will they optimise their fuel economy and run to a delta time on every single lap?

And what about reliability? The problems with cooling the turbos have been well documented and blow-ups are expected. But it could be that




Another gaming console for Christmas?

Up to a dozen top-of-the-range PCs help power Caterham’s simulator

Between eight and 12 individual computers operate Caterham’s simulator. They include a number of dynamic-looking, top-of-the-range Dell Alienware Area-51 desktop PCs. Just one of those machines is as powerful as half a dozen Xboxes.

One computer sends the signals to the platform, which is capable of six degrees of motion: lateral, longitudinal, vertical, yaw, roll and pitch. That puts it in the same category as the top tier of other vehicle simulators – and also flight simulators. Another PC works with the vehicle dynamic calculations, then three are used to put the graphics onto the screen – these three are co-ordinated by another PC. A seventh PC runs all the standard ECU software you find on F1 cars. And three more analyse the data. Not a bad Christmas present, and you’ll still have change from your £1million to add on a few more circuits...

just the energy recovery systems fail. If that’s the case, the engines will lose 40 per cent of their power. That’s equivalent to eight or nine seconds per lap – can you see drivers continuing to race that far off the pace?

We won’t have these answers until on-track testing starts in earnest (just after *F1 Racing* goes to press in late January) and the racing commences in March. Until then, the simulators at least have one advantage over the real thing: they’re reliable and their running doesn’t get interrupted by someone else’s red flag. 

Swiss movement, English heart



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GO FIGURE

We celebrate the start of a new season with a selection of scintillating stats...

92

The **minimum number of nights you'd spend in hotels** if you travelled to every grand prix and the three pre-season tests, arriving the day before the action and leaving the day after

25,650,000

The **approximate revs a new V6 turbo engine** would make over 2014 if at full revs for an average time of 1h 30m per race



6,663 miles

The longest distance between any two consecutive races on the calendar, from Sochi to Austin



65

This season will be the 65th season of the Formula 1 World Championship

917

world championship **F1 grands prix** will have taken place by the end of 2014

The number of days from the season start, FP1 in **Melbourne**, to the end: the **Abu Dhabi GP**

254

1,146 The number of race laps on the 2014 calendar

49 hours

16 GP venues are a total of 63 hours ahead of GMT and the other three are a total of 14 hours behind. So, on aggregate, F1 is 49 hours ahead of GMT



LATITUDE

47.59619

LONGITUDE

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Want to be perfectly positioned for every GP in 2014? Move to **Schießlingalm-Riegel** in the middle of the Austrian Alps (latitude and longitude co-ordinates above) which guarantees the shortest distance to travel to each GP and back in 2014

72

Sochi in Russia

will be the 72nd venue to feature on the F1 world championship calendar

2020

The year the current contract for the Russian GP will run out

313

The total number of corners across the 19 circuits in 2014

1

new winner needed in 2014 to avoid a second consecutive season without a new winner, which has happened only four times before (**1983-84, 1987-88, 1990-91 and 2010-11**)

139

The number of miles between Spa and Hockenheim, the shortest between any two GPs

14-4

The **split of clockwise and anticlockwise circuits** in 2014. Suzuka goes both ways

5

world champions line up on the grid this season: **Alonso, Vettel, Hamilton, Räikkönen and Button**

YOU ASK THE QUESTIONS

Valtteri Bottas

He's relishing working with Massa; he doesn't even want to talk about working with Maldonado; and for some reason he fancies his chances in a drinking contest with fellow Finn Kimi Räikkönen...

WORDS JAMES ROBERTS **PORTRAITS** GLENN DUNBAR/LAT

Talk to any successful driver in F1 and they will underline the importance of maximising opportunities. When a young driver gets their chance to compete at motor racing's top table, they know they *must* seize the moment before it slips from their grasp. When Valtteri Bottas was presented with a full-time F1 drive with Williams last year, he knew it was his chance to shine.

The 24-year-old Finnish racer also appreciates that an on-the-limit flat-out lap that nets you 15th on the grid won't attract much attention. But continue that form in every session, in every race, and eventually the headline results will materialise. Take his P3 on the grid in Canada, or that eighth-place finish in Austin – both moments when he seized the chance to excel.

His strong form has led to a second season with Williams, where he's now paired with Felipe Massa. Here, Bottas discusses team-mates past and present, the challenges of the coming season and how he'd be keen to see a drinking contest between his fellow Finnish racers...

I've heard that you have compulsory military service in Finland. Were you in the military? Have you got any funny or scary memories?

Kamil Golab, Poland

Yes, I did military service for six months over the winter of 2008-09 and became Corporal Bottas! It was really good fun actually. I spent a number of nights in the forest shooting guns and practising being in a war. It was very interesting as I became part of a spy group.

When are you going to drop by to see your old friends in Live for Speed simulation and have a few races just for fun?

Milan Radonjic, Serbia

I used to do quite a lot of racing on the PC with the online Live For Speed simulation. I've got some friends online there, but for the last couple of years I haven't had the time to do it. All the simulation work I have done recently has been in the Williams simulator.

F1R: Did you win?

VB: Always.

Where did you go to relax over the winter and what did you do?

Severine Covens, UK

I went back home to Finland in mid-December and stayed there for about a month. I spent Christmas seeing family and friends and enjoyed a few winter sports. It was good fun and I really like Christmas in Finland, there is always a lot of snow. But since the new year I've been itching to get back into a racing car again.

I enjoyed your F1 Racing columns, especially the one about the surprise early-morning drugs test. What would have happened if you'd had a lie in?

Edward Hunter, UK

Yeah, that was an early wake-up call! I don't know what would have happened. Maybe a reprimand or something like that? If you miss →



YOU ASK THE QUESTIONS

one or two I think it's a reprimand and then a ban after that. Every single day you need to be available for one-hour time slots. So in the end I'm happy that I woke up and checked to see who was at the door.

What was the most valuable thing that you learnt in your first season of F1?

Roman Pacak, UK

I think it was to never give up. It was a difficult first season for us. We tried a number of different things with the car until finally in Abu Dhabi we found some speed. At the next race in Austin I finally got my first points. So I found 'never give up' was a good lesson.

The next time that German laps you, can you smash into him?

Angelo Lombardi, Australia

[Shakes head disbelievingly]

If Finland hosted a grand prix, where would be the best place to hold it?

Anthony Krawczyk, France

Hmm, the best place for a grand prix in Finland? You know, there are only 5.4 million people in Finland and most of them are based in the south of the country. Plus, in the summer it's quite warm and can be very pleasant there. I know they had a F3000 and DTM race on the streets of Helsinki. So in the south of Finland would be the best. But, for me, a race in my home town of Nastola would be amazing.

Why aren't you a member of the Grand Prix Drivers' Association?

Tony Barrett, UK

It's too expensive...

P3 in Montréal last year:
Valtteri's best grid slot to date



PHOTO: ANDY HONE/LAT

Have you ever beaten your girlfriend (Finnish Olympic swimmer Emilia Pikkarainen) in a swimming competition?

Chris Cassingham, USA

No! No chance. She's very quick.

The Finns are heavily associated with rallying. Is that something you've ever been interested in or paid attention to?

Luke Barry, UK

Yes. I tried rallying once actually. It was back in 2008 with [former Williams-turned-Mercedes boss] Toto Wolff. We did a rally in Austria with a Group A Mitsubishi Evo. It was a great day, I really enjoyed it and there was an Austrian rally driver who taught us how to rally on gravel. It's

very different but, if I'm honest, I like F1 more because you can race other drivers.

What's the fastest you've driven a road car?

Charlie Manning, UK

[Smiles] Actually I wouldn't say it was that much. Maybe 230kph or 240kph [140mph or 150mph]. And of course it was on the German roads on the *autobahn* where there are no speed limits...

Do you have any special pre-rituals you go through before a race?

Melissa Lim, Singapore

No. I don't believe in that stuff. I tried some when I was younger, but it never worked.

Could you describe Sir Frank Williams in one sentence?

Pawel Zielinski, Poland

A legend and a really good inspiration for the whole team and a true racer.

What was the hardest thing about coming into Formula 1 as a rookie?

Peter Johnson, UK

I think it was the lack of track time. If the team trust the driver, as they did with me, then they are going to give you the drive – but there was no testing available for young drivers. There was just the one young driver test or a little bit of Friday running, but that was it. And in that short window the team have to decide whether they believe in the driver or not. So it is what it is. →



"I had good qualifying and races in 2013, but no one could see the results of my hard work because it was all for 16th place or whatever"

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YOU ASK THE QUESTIONS

F1R: Are you concerned that some drivers coming into F1 don't have enough experience?

VB: I don't see there is a danger really. Every driver that gets close to Formula 1 will have been racing for many years in lower categories and will have gained experience there.

What did you make of the #BOTTAS Twitter craze?

Roger Smith, UK

It was pretty cool. I haven't seen it trending for a while – we need to keep pushing on with that! So when this is published, everyone needs to start using it again.

I really like your helmet design. It's simple and beautiful and reminds me of 'old school' racers. What inspired you to have such a design? Please don't change it – it makes you unique on the grid.

Zoltan Karpathy, UK

I really like the Williams car colours, and the blue on my helmet is Williams blue. It's more or less the same design I've always had. I've just changed the colours a bit. I like it and I just wanted to keep it quite simple.

How did it feel when your former team-mate Pastor Maldonado forced his way past you on the last corner of the 2013 Japanese Grand Prix? Did that harm your relationship?

Jack Jeffreys, UK

We were quite far off a points finish, so it wasn't risky from that point of view. But I never expected him to get inside. I was mostly thinking about our mechanics, because it would have been a lot of extra work and already in the flyaway races they work very hard. Luckily there was no damage, but to avoid having a crash I had to get off the track. I've learned from that. I won't leave a gap like that again in the last corner if somebody is as close as he was. We've had a few chats since then, but we never actually spoke to each other very much throughout last season.

Is there something in the water that makes Finland produce so many great drivers?

Jack Klinkert, Australia

It's a motorsport country: people love F1 and they love rallying. There are a lot of good karting tracks and a high level of competition. As soon as I started karting at the age of six it was competitive. If you wanted to be good, you had to push hard; so that made me better. Maybe it's also because the Finnish mentality is good for F1. We don't stress unlike some other drivers...

F1R: What gets you stressed?

VB: [long pause and a shrug] Nothing really.

How much are you looking forward to working with Felipe Massa this year?

Louise Franks, UK

Felipe will bring to Williams experience from his time at Ferrari. It'll be good to talk with him and see what he thinks about the new car. There are always different views that you can bring over from another team, so I think it will be interesting to work with him as the season develops. He has 12 years experience in Formula 1 so that will be really good for us. You can always learn something from another driver, especially one who is so experienced, so I will be watching him closely to see what he does and what I can take from him. He's a good guy, too.



INSET: GLENN DUNBAR/LAT

Will the 2014 cars be boring to drive?

Marcelo Gios, Brazil

I don't think so. It will be very interesting. There are new things for the drivers to learn, but I'm sure we'll see some great racing with these new engines. In the simulations so far we've seen a lot of torque from them, so they will be more difficult to drive and it will be hard to handle all that power. But shouldn't Formula 1 be all about who has the best skill with the right foot?

The Finns. You. Heikki. Kimi. Who would win a drinking contest?

Staffan Karlsson, Sweden

We need to have a contest! We've never had a drink together before, so we need to find out...


What was the most valuable thing you learnt in your first season of F1?

Roman Pacak, UK

It was quite tough when nothing seemed to work on the car. I was happy with my own performance because I had some good qualifying sessions and races, but no one could see the results of my hard work because it was all for 16th place or whatever. That was quite tough.

Did you learn anything from Pastor Maldonado when you were team-mates?

Simon Hutchings, UK

I'm not sure I want to answer that [Long pause]. I've learnt that to get points, you need to finish. You need to avoid incidents and keep the race clean, like in Austin. Then you get points. 

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A beautiful mind

He was responsible for designing some of the most iconic Formula 1 Ferraris of the 1960s, '70s and '80s – not only their chassis, but their engines as well. Yet he has never been interviewed by a British magazine. In a true world exclusive, *F1 Racing* brings you the story of **Mauro Forghieri**, who some would contend is the greatest Formula 1 designer of them all...

INTERVIEW ANTHONY PEACOCK

PORTRAITS THOMAS BUTLER

PHOTOS LAT ARCHIVE



e's been responsible for some of the most forward-thinking designs in Formula 1 and says that his biggest weakness lies in not looking sufficiently backwards. But Mauro Forghieri – Ferrari's technical director *par excellence* – is surrounded by history, every moment of every day. He lives in a 17th-century villa near Maranello (where else?) that is a picture of Palladian perfection, with frescos that take your breath away nestling among the gilded ceilings. Amid the cherubs and artwork, one thing you don't see is any reference to cars. They would look somewhat out of place among all this.

Step into his office though, and you're suddenly confronted with a personal museum even more astonishing than the centuries of Italian culture laid out in the other rooms: the testament to an extraordinary life's work.

Go back to the very beginning and it's not hard to find the source of the anarchistic streak always necessary for genius...

Mauro Forghieri: My father, Reclus, had a big problem politically because he was a liberal and a socialist [at a time when Italy was governed by Benito Mussolini and the fascist right]. But he was a great friend of Enzo Ferrari's. After the Second World War things were calmer and when my father came back to Italy after time in France and Britain, he actually allied himself to the British – Enzo Ferrari said he should come and work for him. So there was a friendship between Enzo and my family that I was always aware of.

F1 Racing: And that's what led you to a career in automotive design?

Mauro Forghieri: Not at all. When I was at university at Bologna I was interested in designing houses and furniture, but I also liked aircraft engines. One of the things that inspired me was something that I read: "A bumblebee knows nothing about the laws of aerodynamics, and yet he flies." I've never forgotten that.

In theory this is true, because the mass of a bumblebee compared to the surface area of its wings should make it technically incapable of flight. The French entomologist Antoine Magnan was the first person to hypothesise this, in the 1930s, but he failed to take into account the fact that a bumblebee simply flaps its wings harder than other insects (around 200 times a second), which increases lift. That's obviously not Forghieri's point, however. What he's saying is to ignore every preconceived principle of what should and shouldn't work, because the answer might just lie in a completely different direction. Look at the 312B that Forghieri introduced for the 1974 season: the first car that relied on bodywork, rather than only wings, to generate downforce. But more about that later...

F1R: So how did you end up working at Ferrari?

MF: I actually had a summer job there, working on chassis design. It was good fun, but I had no intention of going to work full-time at Ferrari after I graduated, even though I loved cars. My first proper job was as a teacher at a technical school near Bologna. The story with Ferrari started when Enzo said to my father: "Tell that mad son of yours to come and work here instead of wasting his time teaching... that way he might actually learn something." And he was right: I stayed for 28 years and learned a lot.

Forghieri's summer job from university was chassis design at Ferrari? Clearly, he knew the right people...

F1R: Something that made you different was the fact that you designed both the engine and chassis of Ferrari F1 cars; you saw design as a holistic concept. Was that your biggest strength?

MF: I considered engines to be my speciality, but I worked a lot on chassis too. Back then it was possible to do that: roles weren't pigeonholed in the way they are now. And I think that's the best way: a car is more than the sum of its parts. I learned from some very good people when I first joined Ferrari and I soon found myself being promoted, but by accident: one by one a number of engineers left as a result of various disagreements, mostly with Enzo Ferrari's wife – I'm not sure why and I didn't want to know as I don't like gossip – so at a certain point I found myself in charge of the gearbox and chassis, as well as the engine, plus the suspension. Then Enzo Ferrari called me and said: "Mauro, you're in charge of the *Gestione Sportiva*."

It was 1963 and I was 26 years old. I said to him: "With the greatest respect, are you mad?" He said he was serious and we made an agreement, which is how it happened. From time to time I was effectively called upon to be sporting director as well, and that's the only aspect I didn't like. I'm an engineer and purely an engineer; I never enjoyed the politics surrounding the sporting director role.

Ironically, that's exactly why Forghieri would have been a brilliant sporting director, too; he cared about people rather than politics. Forget his bumblebee: Ferrari at the time was a real hornets' nest.

F1R: But you had a special relationship with Enzo Ferrari. Would you call it a friendship?

MF: He knew I had devoted my life to his company, as my father had done. That's not →

"A bumblebee knows nothing about the laws of aerodynamics, and yet he flies."

I've never forgotten that."



Forghieri with Enzo Ferrari at the 1967 Italian GP: "I never called him [Enzo] 'Ingegnere' like some people did because I studied for years to get my engineering degree and his was an honorary one"





quite friendship; it's more a reciprocal respect. He knew my commitment, even though I resigned three times: from time to time things would annoy me. But it wasn't as simple as just working there, doing a job. Ferrari was something to which you gave yourself with body and soul. My family didn't know what it meant to have a Sunday with me; one year we were still working in South Africa on Christmas Eve. My colleagues were the same: they had married Ferrari so there was a real feeling of mutual respect and the absolute certainty that you could rely on everyone. It wasn't a normal relationship between employers and employees.

As for Enzo, he was a force of nature. Within his factory he had an intuition that was almost feminine – that was how he described it to me himself. He 'felt' things, whereas I calculated them. Sometimes we would watch him decide

on something with a 'yes' when all the information we had on the table before us should have led to a 'no'. I said to him: "But Commendatore," – I never called him 'Ingegnere' like some people did because I studied for years to get my engineering degree and his was an honorary one! – "why have you said yes to this?" And he used to tell me: "Because I feel it and you don't." About seven times out of ten he was right: it really was remarkable.

The Commendatore should have been more deferential to his technical chief, as Forghieri obtained some decorations from the Italian government for his engineering brilliance. It's typical of Forghieri that this is something he downplays. But deference was never the

The evolution of the Ferrari 312, under Forghieri, from the introduction of the rear wing in '68 to aero bodywork in '74

Commendatore's strong point and that's ultimately why so many people – including drivers – walked away from the Scuderia in a temper over the years.

It was also the reason, as he describes, for Forghieri's meteoric rise through the ranks.

Forghieri was the polar opposite

to the Commendatore: entirely devoid of ego. He worships at the altar of the great engineers of history and is an avid reader: there are two full libraries in his villa, which contain all the classic engineering texts and cover a massive variety of subjects. And it's from within those well-worn tomes that Forghieri draws his inspiration. He doesn't even describe his ideas as his own: he says they mainly belong to other people.

MF: It's true: most of them aren't mine. In my life I've had the good fortune to meet some remarkable people, and this is what led me to some successes. One of those people, for example, was Robert Eberan von Eberhorst, who designed the Auto Union. He was the first person to introduce modern aerodynamic thinking and roadholding into racing cars. I also used to go to a windtunnel at the University of Stuttgart that was run by an engineer called Potov. He was an incredible person: I think he was Czech, but he never told me.

He designed a unique windtunnel where the car was raised up in the air, which enabled him to better correlate the results seen on the road with results in the laboratory.

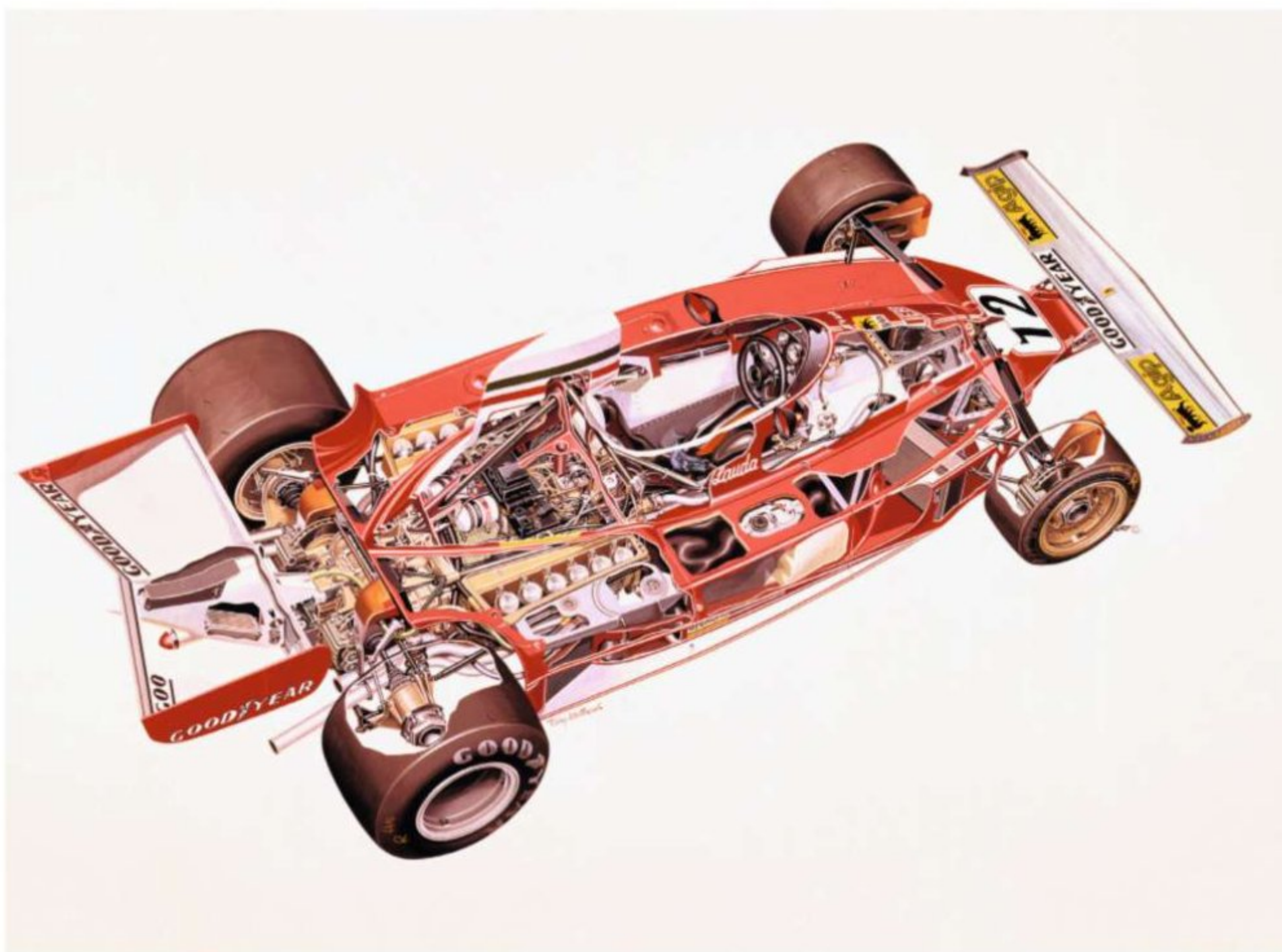
We introduced the rear wing in F1 after my work with Potov and following discussions with Michel May, a brilliant Swiss aerodynamicist. These are just some of the people I drew inspiration from. Things were so different then. You were exchanging ideas with other people all the time and going for dinner together even if they were from other organisations. There was a cross-flow of information that doesn't exist now.

Michel May told me he'd tried to do the Targa Florio in a Porsche with wings, but the organisers wouldn't let him. "But did you test it?" I asked him. "Of course," he said, "and look – I got some incredible results." So we tried that in Formula 1 in 1968 on the 312 and you know the rest.

Eberan von Eberhorst's book, 'Das Organische Automobil', is perhaps the best-thumbed in the Forghieri library. What's interesting is the diverse sources from which Forghieri drew his knowledge. Look carefully and you can see traces of those 1930s Auto Unions in the 1974 Ferrari 312B3 – in the way the bodywork wraps around the car's contours – while the



Forghieri's groundbreaking Ferrari 312T produced "downforce that not even the English teams could understand"



basic design of rear wing that appeared on the 1968 Ferrari was first seen on a pre-war land-speed-record car, which Forghieri carefully circled, in pencil, in Von Eberhorst's book – so many years ago that he can't remember. His mind is a treasure chest of painstakingly cultivated information.

F1R: Which was your favourite design?

MF: It was probably the Ferrari T: the car with transverse gearbox – the *trasversale*. It had a big

influence on the packaging of the whole car and the handling, and it was the first F1 car that had [aerodynamic] bodywork. There was pressure to bring it in as soon as possible, but I didn't want to introduce the T in 1974, as it needed proper work and development. So we introduced what we called the 312T in the 1975 season, which is when we were unbeatable. The car generated downforce that not even the English teams could understand – and that's the highest compliment I can pay, because I have a huge respect for →

"My favourite design was the Ferrari T: the car with the transverse gearbox... It was the first Formula 1 car that had [aero] bodywork"



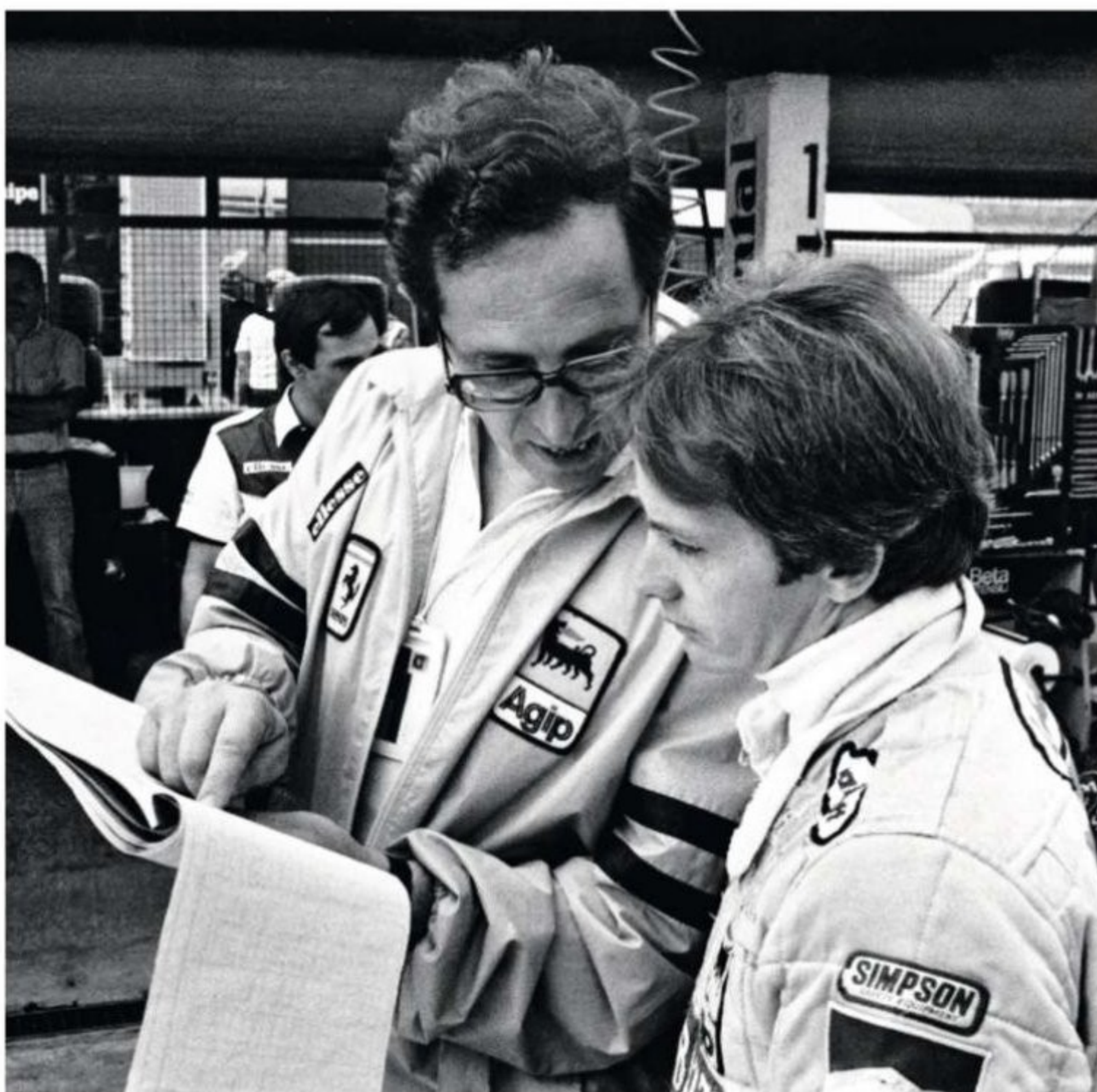
Forghieri points out the dedication on a drawing of an old Pininfarina-designed car:
"Forghieri. I believe your studio is the most deserving place for the careful conservation of this drawing." It's signed by Enzo Ferrari



the English teams. This came from what I had learned many years earlier, from Potov's windtunnel and Eberan Von Eberhorst, about how you can design bodywork to create downforce, which is exactly what we had been doing with sports prototypes like the P4 and the 312P a decade earlier. The 312T F1 car was a very nice, effective design, with the engine and chassis working well together.

But I also liked the 275 GTB road car: it wasn't actually a car I designed, but one that I worked on a lot – and one of the prettiest cars Ferrari ever made. Originally we copied an American design that put the transmission under the floor to free up cabin space. But we had forgotten some fundamental things: American cars used to rumble along at 4,000rpm and their power was restricted compared to European cars. Our car was fast and free revving: the transmission design basically worked, but we had horrendous vibrations – or torsional and flexional resonance, as we called it. So we redesigned it and introduced the transaxle linking the engine and gearbox, which was a first for Ferrari and something they still do today. This isn't something we invented: it's just

With Gilles Villeneuve at Hockenheim 1980:
"I told him so many times that he was driving beyond the limits of the car"





something we learned from our mistakes – which is what a lot of car design is actually about.

These are predictable answers: the 312T was the archetypal Forghieri F1 car, combining holistic brilliance within both engine and chassis, to serve Ferrari through the latter 1970s and, just, into the '80s. It won three drivers' titles (two for Niki Lauda in 1975 and '77, one for Jody Scheckter in '79) and four constructors' titles ('75, '76, '77 and '79) before being replaced by the turbocharged 126 in 1981. The 312T-series cars were powered by another Forghieri masterpiece: the 3.0-litre flat-12 engine (known as the 'boxer', even though it wasn't) designed to lower the car's centre of gravity. As for the 275 GTB, one recently sold at auction in the States for \$27.5 million – proof positive of the reverence in which it is held.

Dig deeper and Forghieri's answers become more surprising: one of his other favourite designs was Lamborghini's planned F1 car that he drew in the late 1980s. After a number of financial tribulations, it eventually saw the light of day as the ill-fated Modena in 1991. Chronically underfunded, the car had huge potential but was a design that was probably "a bit too far ahead of its time" according to its creator, who still has the original drawing hanging on his office wall. The one thing Forghieri would have liked to design, but never got round to, was a diesel engine for military use. We didn't see that one coming...

F1R: So after the T cars you built the 126...

MF: That got off to a complex start, as we had to design a new chassis around the new turbo engine. When I first started experimenting with forced induction, I first looked at Compres. This was a Swiss system that compressed the exhaust gases. The advantage of it was no lag, so we tested that alongside the KKK turbo

engine. The drivers said that they thought the Compres engine was much better; almost like a normally aspirated engine. But it had its disadvantages: there was a big steel mass on top of the engine that compromised the centre of gravity, and it chewed up belts. At Fiorano we got it to work, but when we tested it at Interlagos before the grand prix, the bumps meant that the belts were jumping off again. So in the end we had to race with the turbo engine. I think we could have got the Compres to work, but it would have meant a big investment that the *Commendatore* wasn't willing to finance.

When it came to the chassis, Harvey Postlethwaite taught us a lot about honeycomb aluminium. Ferrari brought him in because I knew nothing about that chassis technology. Our honeycomb chassis was very rigid but fragile. When Gilles Villeneuve had his fatal accident at Zolder in 1982, the car flew 25 metres into the air and when it came down everything shattered: chassis, seat belts, the lot. So we went through the car to try to strengthen what we could – and Gilles' team-mate Didier Pironi, who had an identical accident later that year at Hockenheim, was saved because we reinforced the area around the cockpit with carbon. The day after his accident, Pironi told me that as he was flying through the air, he saw the tops of the pine trees beneath him. Those trees were 40 metres high. One thing I am very proud of was that we never knowingly compromised driver safety. Not once.

On Forghieri's bookcase there's a steering wheel used by Villeneuve, and the paperweight on his desk is a small bronze sculpture of his helmet. Gilles. Where do we begin...?

MF: He was a special case. I told him so many times that he was driving beyond the limits of the car; there are so many stories that are easy to tell but hard to appreciate. Gilles became great friends with Jody Scheckter when Jody joined us for 1979, but you couldn't have found two people who were more different. Jody was always on time or normally early for testing. Gilles was always arriving at the last minute and you knew when he had got there because he used to pitch up and do donuts with his Ferrari road car. And of course we had to change the tyres on it every time before he left. It got to the point where the *Commendatore* said to me: "Tell him that if he keeps on doing that, we won't change the tyres for him any more..."

I think the next time he arrived at Fiorano it was in his helicopter, in fog so thick you couldn't see in front of you. Young Jacques was with him, too. I said to him: "Gilles – are you completely mad?" And he was his usual: "*Mais, il n'y a pas de probleme...*"

Anyway I told him that we wouldn't be testing because it was too foggy. So he just jumped into the helicopter and left again for the mountains. That was Gilles.

F1R: How much did Gilles appreciate the technical intricacies of his car?

MF: He wasn't a great test driver. Jody was better – and even Jody wasn't one of the best test drivers in the world, but he was very positive and disciplined. Above all, Gilles was an innocent and that's why the Imola incident with Pironi in 1982 hit him so hard: he would never have believed that a friend and team-mate could betray him.

Villeneuve never spoke to Pironi again after the 1982 San Marino Grand Prix, which he believed he was destined to win from the Frenchman after Ferrari held out a 'slow' sign, indicating that their drivers should hold station in one-two formation, which Forghieri confirms was indeed the intention. Pironi saw it differently and passed Villeneuve to win: think 'Multi 21', but 32 years ago. Two weeks later, Villeneuve died in Belgium.

F1R: Who was your favourite driver to work with?

MF: Probably Niki Lauda. Niki never tried to be *simpatico*, but he was a real team player. I knew that if we gave Niki a competitive car, he would always win if there was any chance of winning. Unfortunately, after his accident, he tried to come back too soon. Not physically but psychologically. If Lauda had come back as the driver he was before, he certainly wouldn't have stopped in Japan. When he stopped at Fuji he said to me: "Mauro, I don't want to carry on." →

"I also liked the 275 GTB road car: it wasn't actually a car I designed, but one that I worked on a lot – and one of the prettiest cars Ferrari ever made"





The most treasured of the engineering tomes in Forghieri's library, is Eberan von Eberhorst's *Das Organische Automobil*



With champion Niki Lauda in 1974: "Niki never tried to be *simpatico*. But he was a real team player"

I said to him: "Okay, let's just say we had some problems" – and that would have been true because we did have problems with the electrics in the

rain. But Niki wouldn't have it. He said: "No, it's my decision. You have to say this."

After that race I went back to the airport with Niki and Marlene: a terrible, sombre journey. We were all in a Rolls Royce, as our dealers in Japan also sold Rolls Royces at the time. I think Niki somehow still believed he was going to be champion until we were driving out of the circuit and we heard on the loudspeakers that James Hunt had become world champion by a point – not that even Hunt knew it. He was furious with his team management because he hadn't realised he'd passed the three cars necessary to make sure he would become champion. But that's just how it was in Formula 1 then: it was normal.

F1R: That's quite a noble act: to publicly sacrifice the reputation of your car to protect a driver?

MF: But you have to try to see it in a human context. With what happened to Niki, you had to try to make it easier for him somehow. It was our duty. Maybe a defect of mine is that I care too much about people.

This is something that plays a lot on Forghieri's mind: duty, loyalty. Concepts that in his view have long since vanished from modern Formula 1, although he takes part of the responsibility for the aerodynamic arms race the sport became, ever since he put that wing on the 312 in 1968. What he misses most of all, he tells us, is the camaraderie, which is probably best exemplified by one of his inventions that had nothing to do with engineering – at least not in the conventional F1 sense...

MF: In the 1960s, Formula 1 was a tough life because there were no proper pit garages or motorhomes. At one British Grand Prix, our mechanics had to get by during the day with sandwiches and pies, then in the evenings we were out late looking for restaurants. Afterwards we could be working on the cars until 4am. One day, I said: "To save time, why don't we prepare some food ourselves?" So we sent one of the

mechanics to buy a big aluminium pan and made a cooker out of a welding torch. And we boiled some water and made *spaghetti al pomodoro*. The Lotus mechanics next door seemed pretty interested in what we were doing, so we fed them, too. When we got home, Enzo Ferrari, who used to sign off the expenses personally, looked at what we had spent and said to me: "You've spent less this time – how come?" So I told him that we'd cooked at the circuit rather than eating at a restaurant. And he was angry: "That's shameful!" he said. "Did people see you do it?" I replied to him that they did – and with a huge amount of success, as they wanted some, too...

I suggested that if next year he allowed us to take a caravan to races, we could cook and eat in that – not to save money, but to save time. And he saw the sense in that and the caravan was purchased. So while we invented many things with the cars during my time at Ferrari – I must have done 24 or 25 cars – we also invented on-track catering and something approaching the first motorhome.

The thing about engineers is that they love thinking: inventing processes as much as machines. One of Forghieri's other lasting non-mechanical innovations was to restructure the garage into two distinct crews for the 1974 season: with separate engineers and mechanics for Niki Lauda and Clay Regazzoni.

MF: It solved the problem of getting drivers to agree about everything – which was one of the biggest problems – and it also encouraged a bit of intra-team rivalry, which raised the whole level. I was very happy with that idea and it's what the teams still do today.

That is Forghieri's perfect epitaph, because although he rubbishes claims that he is one of the great engineers of Formula 1 – "With the exception of people like Chapman, the truly great engineers don't come from motorsport" – so much of his thinking was ahead of its time. In 1987, he designed a Ferrari prototype road car (known as the 408 4RM), the company's first four-wheel drive car, making use of fresh thinking such as a glued aluminium chassis. His inspiration was beautiful: "The way that kids make little houses by folding cardboard."

But it was only in 2011, nearly 25 years later, that Ferrari presented the all-aluminium four-wheel drive FF – which has its roots in Forghieri's creation.

Now aged 78, he's still actively involved in the engineering consultancy he set up in 1994. But that's not a hardship, as true artists never really retire. They just think of even bigger, better, more fantastical and bold concepts.

"My favourite driver was Niki Lauda. I knew that if we gave Niki a competitive car, he would always win if there was any chance of winning"



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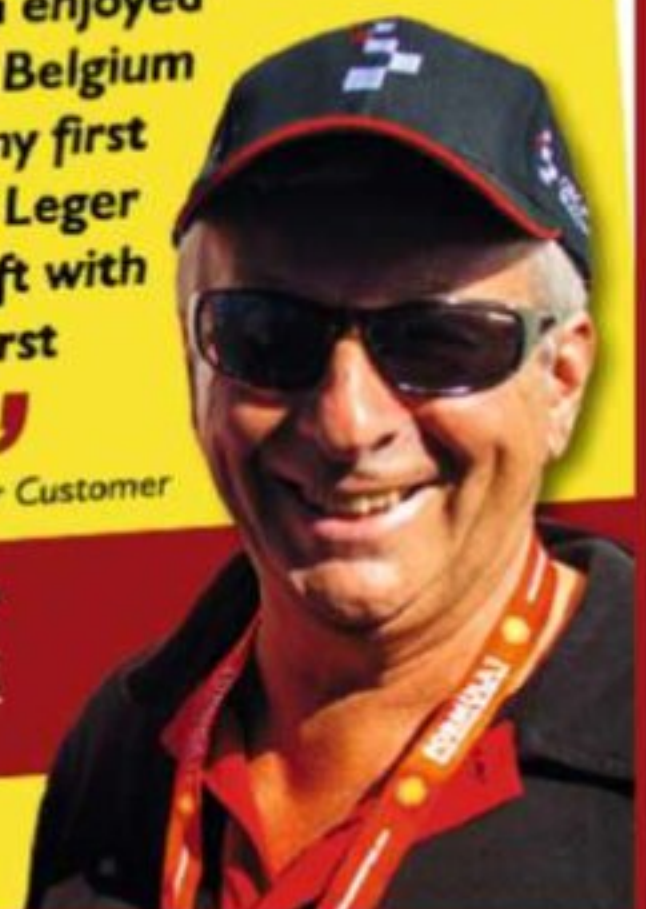
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“THE FIRST TIME driving a Formula 1 car is special, very emotional,” says Kevin Magnussen. “The second time you can concentrate more on the job...”

If McLaren’s great hope for this season is at all nervous about the task ahead, he doesn’t show it. He’s been quietly groomed for stardom as part of McLaren’s driver development programme for some time – and, while Woking’s in-house young driver scheme is more low-key and less up-or-out than its Red Bull equivalent, failure to hit the benchmarks is still a career-limiting manoeuvre. Just ask Oliver Rowland.

From the Ron Dennis era onwards, McLaren, as a rule, don’t take risks on unproven drivers in Formula 1; at the most recent end of the scale you have Lewis Hamilton in 2007 (a hit); at the other you have Andrea de Cesaris in 1981 (a miss). In between you have not very much, apart from a one-off outing for a young F3 star called Jan Magnussen, on whom they ultimately passed when contract time rolled round.

Now Jan’s son is on the scene, and while there’s a familial resemblance between the two – Kevin is perhaps a few inches taller – there the similarity ends. Jan was (*is* – last year he won the GT2 championship in the American Le Mans Series) a gifted and supremely brave racing driver, although he lacked application to the kind of on-track details that make the difference between the great and the merely quite good in F1, while off-track his rebellious streak didn’t endear him to employers such as Jackie Stewart, who hired him then swiftly fired him from a full-time seat. Kevin is clean-cut, focused, professional and calculatedly corporate – and, while Jan is undoubtedly a proud dad, he hasn’t had *that* much influence on his son’s career.

“He’s never been that big a part of my racing,” says Kevin. “Obviously my interest in motorsport probably came because my dad is a racing driver, but my uncle – his brother – has been more involved in helping and supporting my career, along with my whole family. More recently my manager and McLaren – and some great sponsors – have supported me incredibly well.”

This may come as news to some elements of the commentariat who, inevitably, view the younger Magnussen’s F1 opportunity through the prism of the politics of envy. When *F1 Racing* announced on Twitter that he would take over from Sérgio Perez in 2014, we were greeted with howls of protest from those who saw it as confirmation that a cosy network of privileged chums operates behind the scenes at the top level of motor racing, manipulating the driver market to deny talented-but-skint youngsters a chance.

“Well, I don’t have a rich dad,” says Kevin. “My dad is a racing driver as well, and he also has to fight to maintain his drives every year. I’m

M a g n u s s e n

Ready for the BIG

Some are born great, some achieve greatness and some have greatness thrust upon them. McLaren are taking a gamble by employing rookie **Kevin Magnussen** to replace Sergio Pérez. So will it pay off, as it did with Lewis Hamilton?

WORDS STUART CODLING
PORTRAITS MALCOLM GRIFFITHS/LAT

not the guy who’s always had the budget. I’ve had some really good people around me to help find sponsors so that I can race – but every year it’s been a challenge. I think it’s good that you don’t just get it like that, that you have to fight like I did – you have to know that at the end of every year it can just slip away.

“It pushes you a bit more and then when you sign a new contract, you feel so good. It makes you push to give everything you can.”

The conspiracy theory also discounts the fact that Kevin’s father didn’t exactly build up much brand equity during his brief tenure in F1; we’re not quite in the same ballpark as Brand Rosberg. Kevin has had to do the running himself, and in 2012 – racing in World Series by Renault after

TIME

finishing the runner-up in British Formula 3 – he stumbled, winning one race and taking two podium finishes but not seeing the chequered flag at seven others.

“Yeah, I was fast but there were too many incidents,” he says. “Things had to change.”

At the end of the year he showed an impressive turn of speed in an MP4-27 at the Abu Dhabi F1 young driver test, then had another tilt at World Series in 2013 – albeit with a different team, swapping from Carlin to DAMS. It says much about the difficulty of scaling the career ladder in motor racing that two roughly equivalent series – World Series and GP2 – provide a gateway to F1, but in any given year it’s tough to calculate which one offers the better platform. After all, Felipe Nasr, the man who beat Magnussen to the 2011 British F3 title, had an unproductive 2012 in GP2 with DAMS (finishing 10th) and then just scraped fourth in the same series in 2013. At the time of writing his 2014 plans are unknown – in spite of sharing a manager with Kimi Räikkönen.

“You have to prove yourself against the best and we thought World Series was a more competitive category than GP2,” says Kevin. “It changes; in some years GP2 is better, in others World Series – but lately World Series has generally been the better choice. Also, track →



"I've arrived in the team I always dreamed of. Ever since I decided to try to be a racing driver my goal has been to be the world champion, and my dream was to drive for McLaren."



And now I'm here..."

time is very important and in World Series you get a lot of track time, whereas in GP2 you get half an hour practice, half an hour qualifying and then two races. In World Series you sometimes get two-and-a-half hours of practice, then two qualifying sessions and two races. But the most important thing is to prove yourself against the best *drivers* and I think I've done that.

"How do you judge which championship is going to be the better one before the season starts? You have to guess. I think we made the right choice. GP2 was strong in 2013 but in World Series the level was just a little bit higher."

Being embedded in the McLaren organisation since 2010 has conferred many advantages upon Kevin. He's benefitted from a tough physical programme overseen by driver performance manager Simon Reynolds and spent time in the McLaren simulator ("It won't make you a more talented or skilful driver. It's a brilliant tool for preparing yourself, but it won't make a bad driver good"). But even so, he's had to tick the boxes along the way; over at Red Bull, witness the fall from grace of highly rated António Félix da Costa after an underwhelming 2013 World Series campaign, leapfrogged by Daniil Kvyat.

"I don't know if I could pick a *biggest* challenge because there have been so many," says Kevin. "Lots of things have to go right. Timing as well; you have to be the best, but you also have to be in the right place at the right time. For me, to get this seat with McLaren, everything has had to fall into place. Now it's a different job – the focus has to be on doing well – winning championships! – in F1. Since I was a little kid, getting to F1 has been my life. It's been a dream, something that seemed so far away for so long, and now suddenly it's here, yeah."

"I've arrived in F1 in the perfect way, I think. I've arrived in the team I always dreamed of. It's funny, but ever since I decided to try to be a racing driver my goal has been to be the world champion, and my dream was to drive for McLaren. And now I'm here..."

In F1, drivers play for higher stakes. Success is key to survival and prosperity, through commercial deals and the annual allocation of the prize 'pot' to the top ten teams. There is greater scrutiny. The promoters of World Series cover the travel expenses of key media outlets in order to attract journalists to races and thereby obtain a certain volume of coverage. F1 is different in that there are dozens of publications, websites and TV channels fighting for access and having to justify their presence with a continuous flow of what we must now call 'content'. So there is no such thing as a low-key debut for a rookie in a leading team. What's remarkable about Kevin is that he's so unruffled by the attention, so composed under pressure.

"It's not a big deal. It's part of the job, isn't it? There are a lot of other things you have to do, apart from driving. It's not a problem."

"It starts slowly. World Series prepares you – it's not the same but it gives you a taste of how it will be. Then you get into F1 and it's all... *bigger*."

"The new rules will be a bit of a leveller. The experience other drivers have with the previous generation of cars will not be as valuable. And, since the car is the main tool for what we do, now that's completely changed it has brought everyone back to zero. Obviously I'd prefer to have that experience – but I have a good teammate in Jenson and I'll learn a lot from him because he's got so much experience – not just with the driving but in working with the team."

I'll be sitting next to him, listening to him, and watching how he does it. I can learn from that."

As Sebastian Vettel revealed at last December's Autosport Awards, even as a four-time champion he still has to cope with flak from Red Bull's 'motorsport adviser' Helmut Marko if he fluffs a single sector in qualifying. Has Kevin sat down with McLaren team principal Martin Whitmarsh to agree what benchmarks he has to hit?

"I know what Martin expects! It's important to sit down with the people in the engineering team to make sure we all agree on what I should focus on over the winter. You're not going to get to a point where you think, 'Now I know everything. Now I'm 100 per cent ready.' You'll always feel you could learn more. We don't have that much time and I have to prioritise a little bit. It's important to set some goals – to identify where I'm going to focus, what I'll try to learn."

A year ago Sergio Pérez made his McLaren debut, having shown promise in the feeder formulae and during two seasons in F1 with Sauber. The intervening months have been an ongoing saga of disappointment, ending with the termination of his contract, even though McLaren's MP4-28 was rightly considered a stinker. Kevin is guardedly confident that things will be better this year – as indeed they must, even if it is to be an interim season before Honda power arrives in 2015. Is he ready for it? You bet.

"You don't really know until you get it on the track. I'm going to do *my* best – work hard on the elements I have control of – because if we have a car that's capable of winning, I need to do everything I can to make sure we win. That's not easy. We're competing against the best."

"I'll have to learn a lot and work hard – but I'm ready to do that." 🏁



Pictures of the year

They shot, they scored! Throughout 2013, the visual artists of **LAT Photographic**, *F1 Racing's* picture agency, were trackside at every grand prix, capturing a host of memorable images of the world's most photogenic sport. And here, lovingly selected for your delectation, is the cream of the crop...

POOL POSITION

Steven Tee hung out between the Swimming Pool and Rascasse corners at Monaco to capture this dramatic image: "I like this spot because it accentuates the proximity of the cars to the walls, and Maldonado obliged by coming through slightly out of control, leaving a trail of fresh rubber."

Image details: Canon EOS-1DX, 600mm lens, 1/1250th at F6.3 →





PICTURES OF THE YEAR

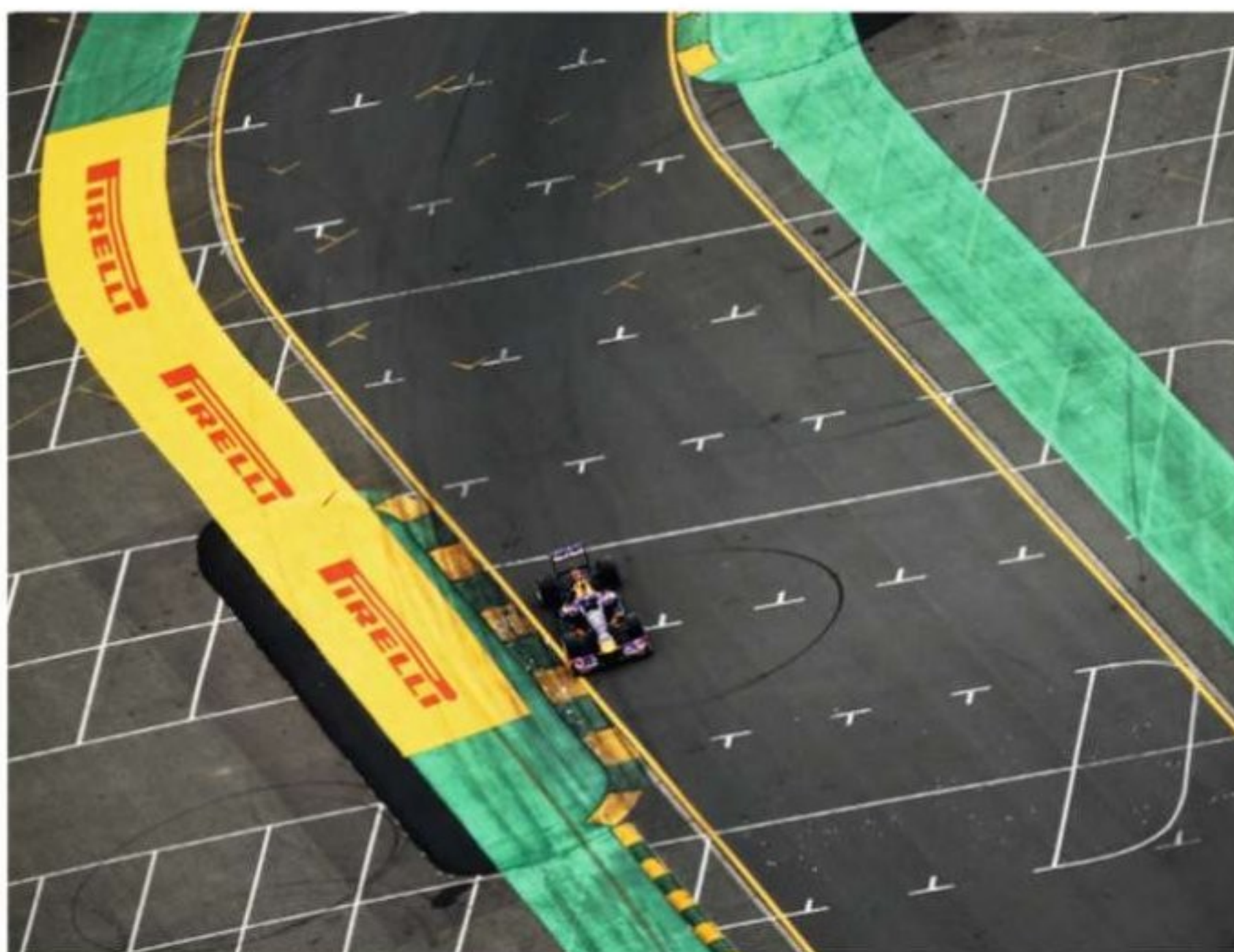


Steven Tee/LAT

"IT WAS GREAT TO EXPLORE THE CIRCUIT OF THE AMERICAS A BIT MORE THIS YEAR AND DISCOVER SOME NEW ANGLES"



Download the free
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app to view more
of Steven's work



A WALK IN THE PARK

"This bit of Melbourne's Albert Park track is obviously a car park when it's not being used as part of the racing circuit, and the lines give a series of pleasing shapes when viewed from above. I shot this from a helicopter – this is one of the more photogenic tracks, and you tend to get a different picture out of it every year."

Image details:

Canon EOS-1DX, 300mm lens with 1.4x converter, 1/1600th at F4.0



FLASH CORDON

"Most photographers line up outside the cordon for these 'victory shots', but with Vettel on a winning streak I wanted something different. This is taken from the balcony in front of the Suzuka media centre. The light comes from a remote flashgun held by Will, our digital technician."

Image details: Canon EOS-1DX, 50mm lens, 1/250th at F9



HE'S A FAN

"There's a little spot I like to go to at Singapore because of the way the light falls on the cars. Then these people arrived, so I thought I'd capture some silhouettes of them with blurry cars in the background. I love the reaction of the little kid in this shot as Sergio Pérez goes by in his McLaren."

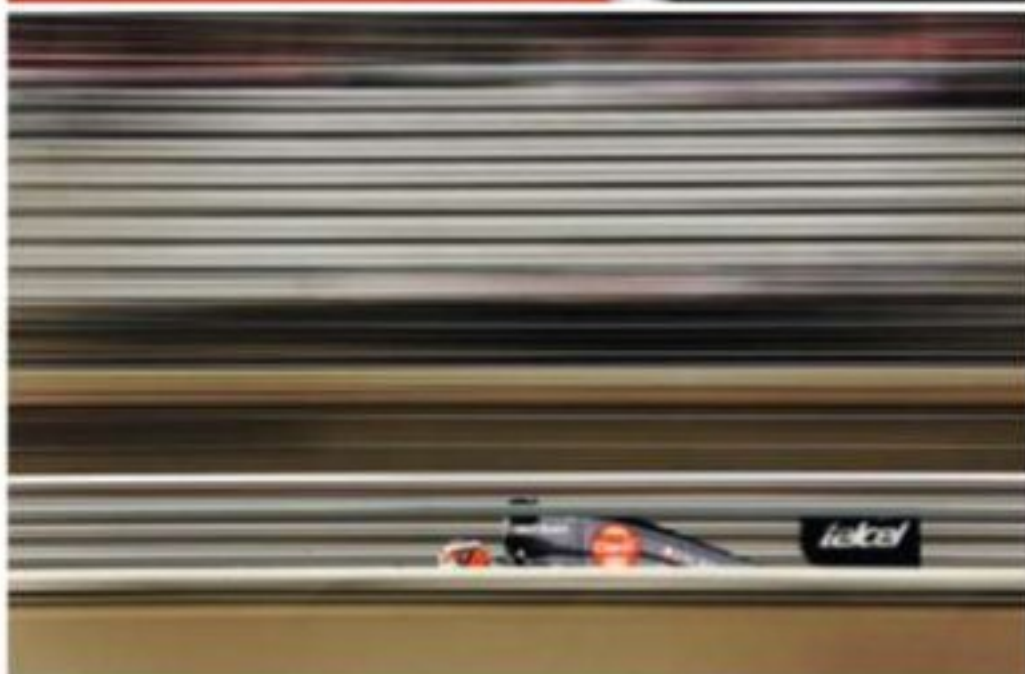
Image details: Canon EOS-1DX, 70-210mm lens, 1/50th at F6.3



See these photos and more on the *F1 Racing Parade* app for iPad

"This is the run down from the first corner at Austin. The pattern of the kerbing really brings out the hill's gradient"

"I shot this one of Hülkenberg from the pitlane at Austin. The wall in the foreground and the blurred grandstand seats give a set of nice, streaky lines"



"To me, this kind of sums up Alonso's year. He knows it hasn't been great"

"The lighting in Singapore isn't as even as it seems on television, so you get these pools of light. It picks out Kimi's tyre smoke nicely"

"Sometimes you're lucky on the grid and you find a driver on their own, with none of the usual hangers-on, just quietly preparing for the race" →





PICTURES OF THE YEAR



Andrew Ferraro/LAT

"WE SAW A BRILLIANT DRIVER ACHIEVE TRUE GREATNESS, THOUGH THE CHAMPIONSHIP WAS OVER EARLY"



SINGAPORE SPARKLE

"This is the run to Singapore's Turn 5. There's a little spot where in previous years the cars have sparked a lot, and with a slow shutter speed you can get a dramatic and interesting shot. In 2013 it was mainly just the Marussias that were kicking up sparks!"

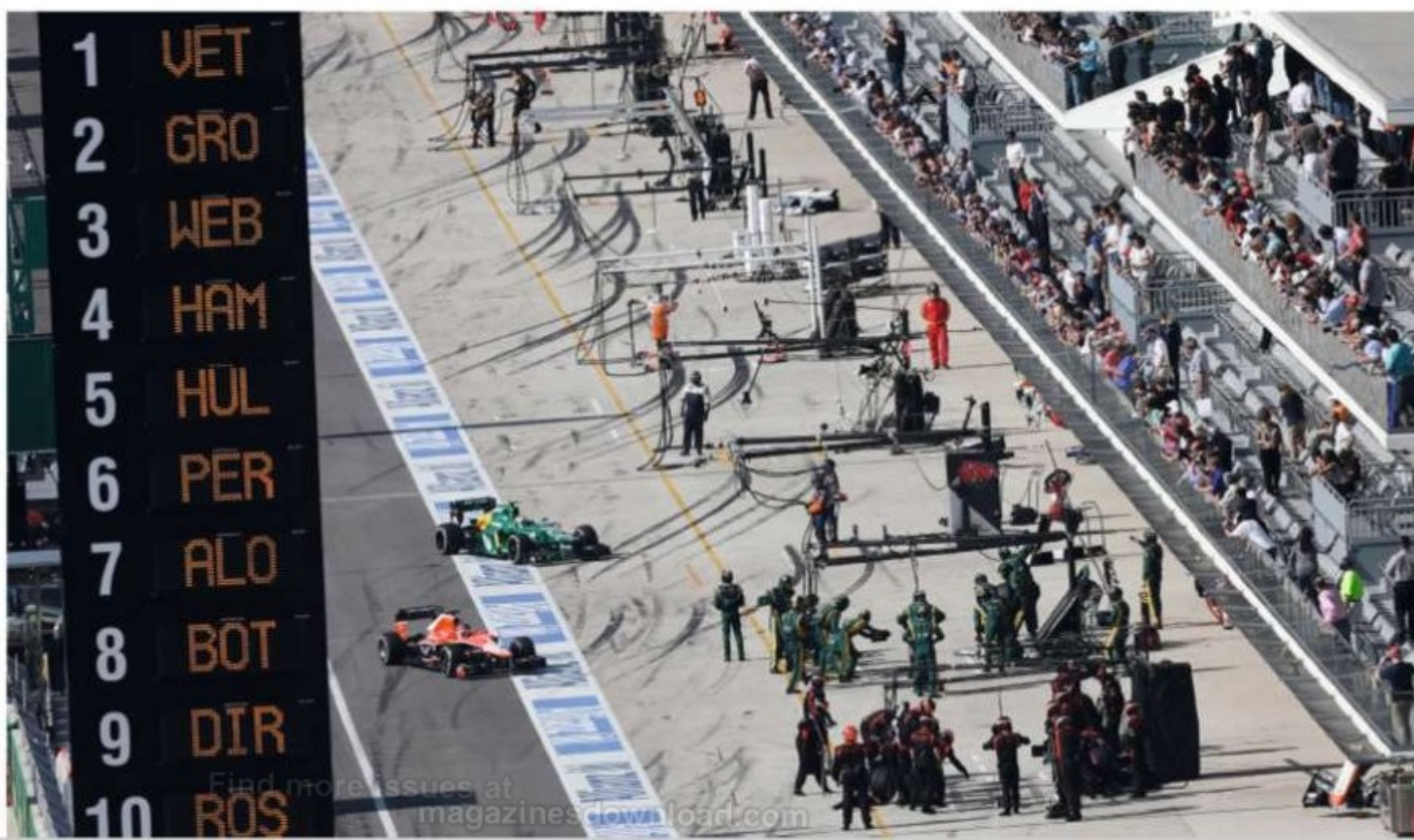
Image details: Canon EOS-1D Mk IV, 300mm lens, 1/5th at F13



TEXAS RANGING

"Restricted access to the pitlane, in the aftermath of a cameraman being struck by a flying tyre in Germany, meant we had to be more creative. The hill at the Circuit of The Americas gives a great perspective on some of the battles that go on in the pits – here Caterham and Marussia fight it out for tenth in the constructors' championship."

Image details: Canon EOS-1D Mk IV, 600mm lens, 1/800th at F5.6





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FINN IN A SPIN

"Kimi hasn't gone off-track very often since making his comeback, but he lost it during FP2 at Suzuka. I like the afternoon light here. When I arrived, *F1 Racing*'s deputy editor was poking around the car after it had been pushed clear!"

Image details: Canon EOS-1D Mk IV, 600mm lens, 1/400th at F5.6



DO I, DONUT I?

"You have to claim your spot by parc fermé early to get a good shot of the winner – and if you move you lose it. Going over to shoot this in India was a gamble – if Vettel had done just one donut then come in, I'd have been in trouble."

Image details: Canon EOS-1D Mk IV, 35mm lens, 1/500th at F3.2



Download the free *F1 Racing Parade* app to view more of Andrew's work



PANNING FOR GOLD

"This is a classic panning shot, but what makes it special for me is the lighting. It's taken at quite a dark part of the Singapore track – between Turns 5 and 6 – so you just get the little highlights on the car. What lifts this particular shot above similar ones is the sparks coming off the skid plate underneath."

Image details: Canon EOS-1D Mk IV, 70-210mm lens, 1/60th at F2.8 →





PICTURES
OF THE YEAR



"NOT A VINTAGE
YEAR FOR DIFFERENT
WINNERS, BUT THE
LIGHT HAS USUALLY
BEEN EXCELLENT"

Glenn Dunbar/LAT



THE LIGHT FANTASTIC

"Suzuka is a wonderful track for photographers as well as for drivers. This shot was taken from high up at the hairpin, late on in the race. The late-afternoon light is low, but it has a lovely and distinctive edge to it – you don't get this at any other circuit. It was a very simple shot to execute, and produced a great result."

Image details: Canon EOS-1DX, 600mm lens, 1/1000th at F9



See these pics and more on the F1 Racing Parade app for iPad



Download the free F1 Racing Parade app to view more of Glenn's work

"It's fair to say that Vettel and Webber have a pretty strained relationship, but in this shot – taken at Abu Dhabi – you can see the mutual respect"



"This is my shot of the year! I was waiting to do a 'walking in' photo when Valtteri came jogging into the corridor, saw me and did this little jump"



"In Germany, after qualifying, all the cars were nicely lined up before going into the scrutineering bay. With the sun on them, it made a colourful shot"



"I love this angle of the Spanish GP podium. You just need the driver to come forwards, and luckily for me, Alonso did"



JUST HANGIN'

"I've started to hang out in the pitlane before the drivers get into their cars to go onto the grid. It's a great opportunity to get close to them because there aren't any barriers, so you can stand right in front of the garage. Here at the Nürburgring, Lewis was practically posing with his car."

Image details: Canon EOS-1D Mk IV, 50mm lens, 1/400th at F1.4 →





PICTURES OF THE YEAR



Charles Coates/LAT

"IT WOULD HAVE BEEN NICE TO HAVE A FEW MORE WET RACES TO ADD SOME VARIETY TO THE IMAGERY"



AIR TIME

"Mirabeau is a great place to photograph F1 cars at the Monaco Grand Prix. If it's sunny, the light and shadows are dramatic. The camber of the road is interesting, you often see tyre smoke, and there's a bump that bounces the front wheel in the air – as Hülkenberg demonstrates here."

Image details: Canon EOS-1DX, 600mm lens, 1/1000th at F8



HIS PRAYERS ANSWERED

"The dream team of Adrian Newey and Sebastian Vettel ensured that Christian Horner's prayers were answered for another season – or perhaps he's just ruminating about how he's going to run things differently when he takes over from Bernie Ecclestone...?"

Image details: Canon EOS-1DX, 600mm lens, 1/320th at F4.5





GIVE US A SWIRL

"Occasionally you see vortices coming off the rear wings in Brazil because of the moisture in the air, but to see them swirling around the front wing and wheels like this was exceptional. This is Fernando Alonso coming over the brow at high speed onto the start/finish straight in the final laps at Interlagos."

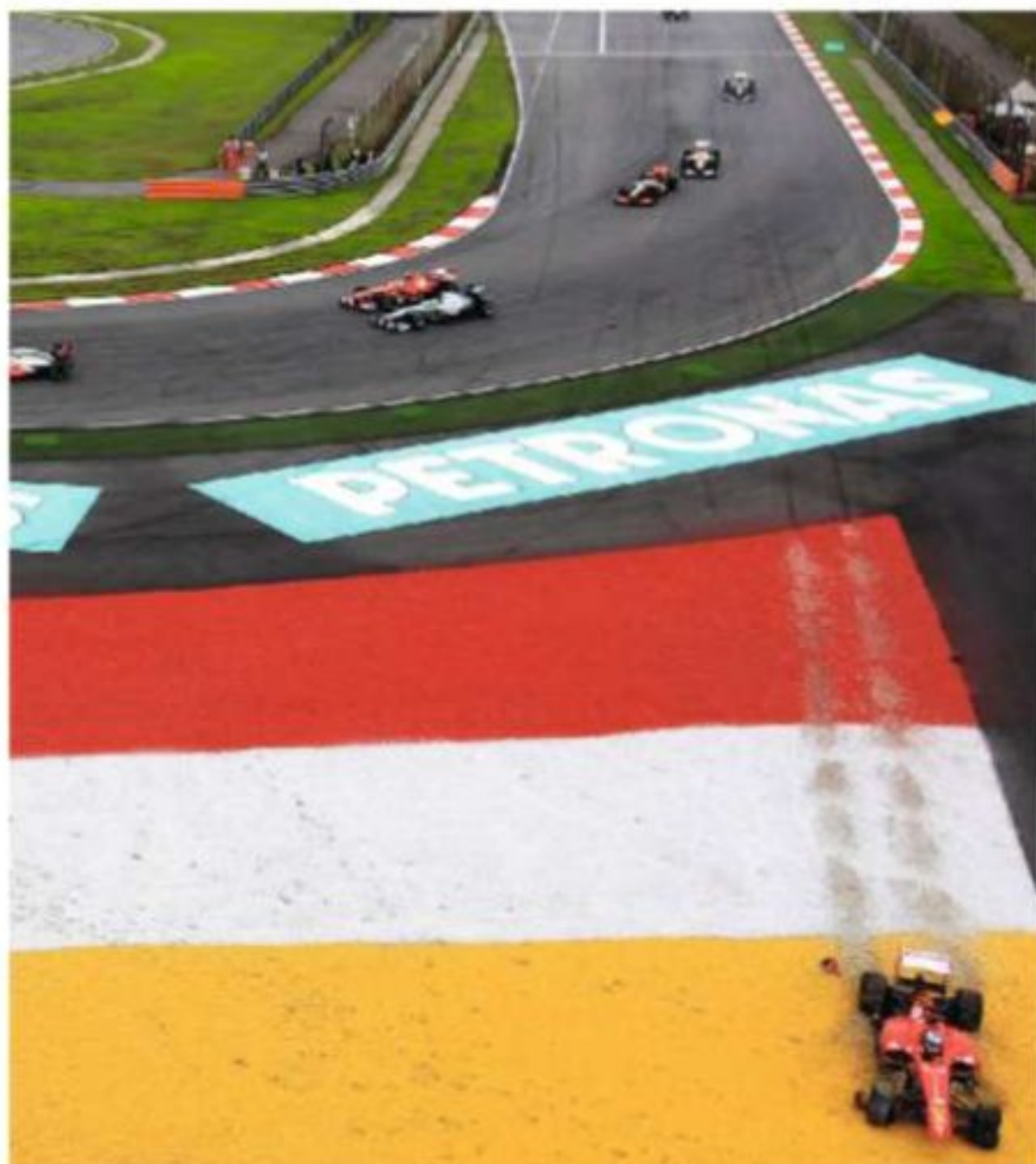
Image details: Canon EOS-1DX, 125mm lens, 1/200th at F4.5



AN UNORTHODOX LINE

"Alonso is an individual and often ploughs his own, lonely furrow. While the rest of the cars take a more orthodox line around Turn 1 at Sepang, I like the tell-tale trail through the gravel, which indicates that this particular furrow led to retirement."

Image details: Canon EOS-1D Mk IV, 16-35mm lens, 1/800th at F4.9



Download the free *F1 Racing Parade* app to view more of Charles's work

"One of the reasons I like this shot is that nobody else got it! The crowd at Silverstone went crazy for Jenson, who always responds well"



"The power and violence of an F1 car is never felt more vividly than at the exit of Monaco's Casino Square. It's a sensational spot"



"The picture of the smiling mouth in the background so obviously belongs to the smiling Daniel Ricciardo in the foreground. This picture really sums him up" →





PICTURES OF THE YEAR



Alastair Staley/LAT

"IT WAS AN EXCITING AND BUSY YEAR, COVERING SOME FORMULA 1 RACES AS WELL AS MY REGULAR GP2 WORK"



Download the free F1 Racing Parade app to view more of Alastair's work



"The colour of the Ferrari and the kerbs work well together here, shooting at 1/6th of a second to give a sense of speed"



"This is my top shot of the Indian GP weekend. It was my first championship snappers' scrum and I got Vettel with a tear (or champagne) in his eye..."



"With a slow shutter speed, the light shining through the grandstand at the Indian GP creates an arrow effect in the direction of travel"



SMOKESCREEN

"I was pretty much the only photographer on the scene here in Abu Dhabi because everyone else had gone off to shoot the podium. I was just walking back from my corner after the race when Vettel stopped right in front of me."

Image details:


Canon EOS-1DX, 600mm lens, 1/250th at F4.9



SWEET SUCCESS

"The light works well in this shot because it really highlights Lewis Hamilton's beaming smile and the spray of the champagne – you never really know what you're going to get when they uncork the bottle!"

Image details:

Canon EOS-1D Mk IV, 300mm lens, 1/500th at F4.4 



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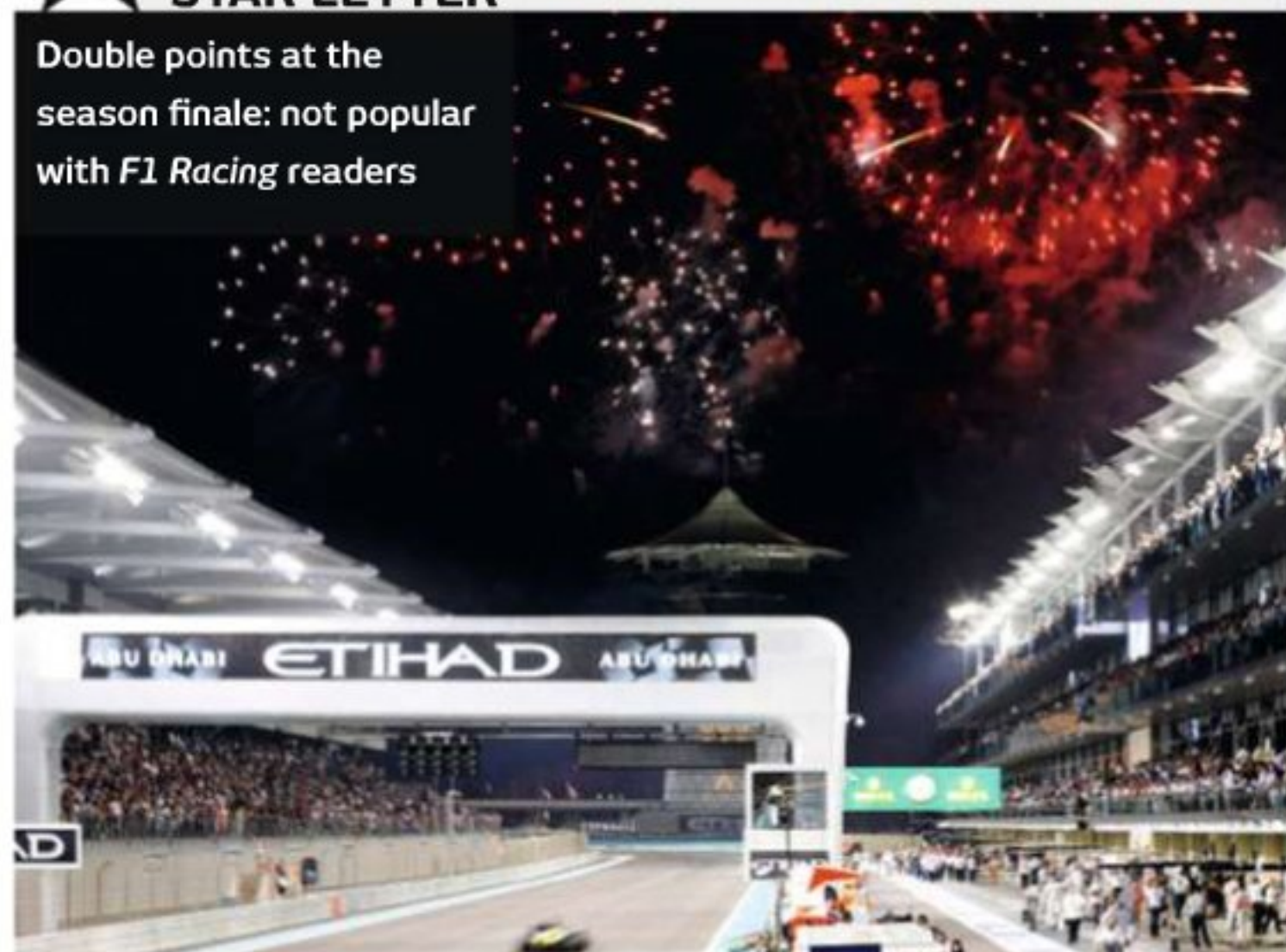
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★ STAR LETTER

Double points at the season finale: not popular with F1 Racing readers



Double points? Double drat...

Awarding double points for the final race of the Formula 1 world championship is the sort of meddling not seen in motorsport since Dick Dastardly and Muttley tried to win *Wacky Races* by painting a picture of a tunnel onto a brick wall.

Rather than setting up a possible 'winner takes all' finale, double points serve only to trivialise drivers' achievements in earlier races. It is patently obvious that this idea has come about as a result of Sebastian Vettel's recent domination of the sport. But Vettel winning the championship with races to spare is not a problem that needs addressing in a way that will disadvantage future championship leaders.

F1 should think more broadly and where the championship is won before the end of the season provide incentives for the rest of the field to finish further up the leaderboard. Otherwise, where is the meddling going to stop?

Trevor Starbuck
 By email



★ STAR PRIZE

Trevor Starbuck wins a pair of three-day general admission tickets to the 2014 Formula 1 Santander British Grand Prix. For more details, visit www.silverstone.co.uk/events. Hotline number: 0844 375 0740



The old way was better

Most people seem to think that double points for the last race is a gimmick – and I agree. If the FIA want it to be closer at the end of the season, why did they bring in the current scoring system? Surely it would be better to bring back 10, 8, 6, 5, 4, 3, 2, 1, than do something that could go against the person or team who has put in the best performances over the year?

Sarah Hart
 York, UK

A game of skill – or luck?

So it's been decided that F1 will award double points in the final round to keep championship battles open longer.

Overcoming the vagaries of mechanical failures, strategy decisions and the odd dumb move all contribute to making a season exciting. Alonso lost two titles because of a bad team day and a crash he had nothing to do with. Even he says it: "That's racing."

Having double points makes the F1 title little more than a lottery.

Gary Michaels
 Vermont, USA

Renting vs buying

The rather miserable experience of Caterham and Marussia prove that F1 is no longer a sport for small independent teams. Perhaps the time is ripe for teams outside the big four or five to become 'franchise teams'. Instead of a would-be owner buying a team outright, they could buy a three-year franchise: it would give the team the resources needed to compete and preserve the workforce, and attract investors and competitors who might otherwise be deterred by prohibitive costs.

Daniel Stafford
 Oxford, UK

NEXT MONTH...



OUR SPECIAL 2014 SEASON PREVIEW ISSUE

With weeks to go before F1 fires into action, we rate every team, driver and circuit. Plus...

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MURRAY WALKER



UNLESS I'M VERY MUCH MISTAKEN...

"I've got mixed feelings about 2014. Part of me is excited, but the other is apprehensive..."

I yield to nobody in my respect and admiration for Red Bull and Sebastian Vettel. Winning the constructors' and drivers' championships for four successive years is a truly monumental achievement. But variety is the spice of life and much as I applaud their well-deserved success, I desperately hope that one or more of their rivals are going to be able to exploit the new technical regulations, get their act together and give the Masters of Milton Keynes a run for their money.

Is that likely to happen, though? Well, until we see some track action, your guess is as good as mine. But I suspect it is not. Red Bull may or may not be marginally weaker as a result of personnel changes and the replacement of Mark Webber with Daniel Ricciardo, but they are still going to be awesomely strong. With sky-high

morale, the continued leadership of Christian Horner and Adrian Newey, Renault power and such a competent, experienced and successful workforce, they will take some beating.

In terms of the prestigious and lucrative constructors' championship, I see Ferrari, with Fernando Alonso, Kimi Räikkönen and a strengthened technical team, being Red Bull's main opposition because their three other main rivals all have potential weaknesses.

Mercedes will have new management, as a result of the enforced departure of Ross Brawn in spite of his brilliant masterminding of the team. They are perfectly entitled to their point of view that the days of a single team principal are over, but Ross's departure has truly appalled me and I hope for their sake that their new structure is up to the job.

McLaren not only have to catch up after a dreadful 2013, but will have to do so while getting new-to-F1 Kevin Magnussen up to speed in what is going to be their last season with Mercedes power, while preparing for their switch to Honda in 2015. That's a very big ask. Which just leaves Lotus, and there, even if they have overcome their financial problems, will moneybags Pastor Maldonado be an adequate replacement for Kimi Räikkönen? I think not.

That is the exciting bit, but sadly there's also a lot of potential doom and gloom to face up to in 2014 – starting at the top. As I sit here typing, the future of Bernie Ecclestone, the man who, praise him or vilify him, has made F1 what it is, is clouded to say the least. If the various court cases in which he is involved go against him, and Donald Mackenzie, his boss at CVC, does what he says he'll do and fires him, Formula 1 will be looking for a new head man and all will be chaos.

For what it is worth, I think Bernie has done a stunning job in making Formula 1 the global sporting extravaganza that it is. With the teams seemingly incapable of pulling together for the common good, F1 needs a dictator who knows what makes it tick, and although no one in this world is irreplaceable Bernie comes close.

I was going to say that F1 would be poorer without him, but many would say that it is poorer *with* him, on account of the fact that, in their opinion, the teams do not get nearly enough of the massive income that F1 generates. At least four of its 11 constructors have severe financial problems – to such an extent that there have been rumours of some of them having to merge to stay alive. Sadly, too, money talks louder than ability on the driver front. The fact that Nico Hülkenberg has been denied a top seat this season is a crying shame.

So Formula 1 is a bit of a curate's egg in 2014. There are intriguing prospects of an all-new look as teams and drivers grapple with very different, fuel-limited cars with very different power characteristics and all-too-familiar tyre-life problems. But overshadowing it all is the spectre of the need to reduce costs – a problem that no one seems to have the power to overcome.

An ancient Chinese curse is: 'May you live in interesting times.' Which is just what we're doing. Fingers crossed! 🍀



"For what it is worth, I think Bernie has done a stunning job in making Formula 1 the global sporting extravaganza that it is"



PHOTO: STEVEN TEE/LAT

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