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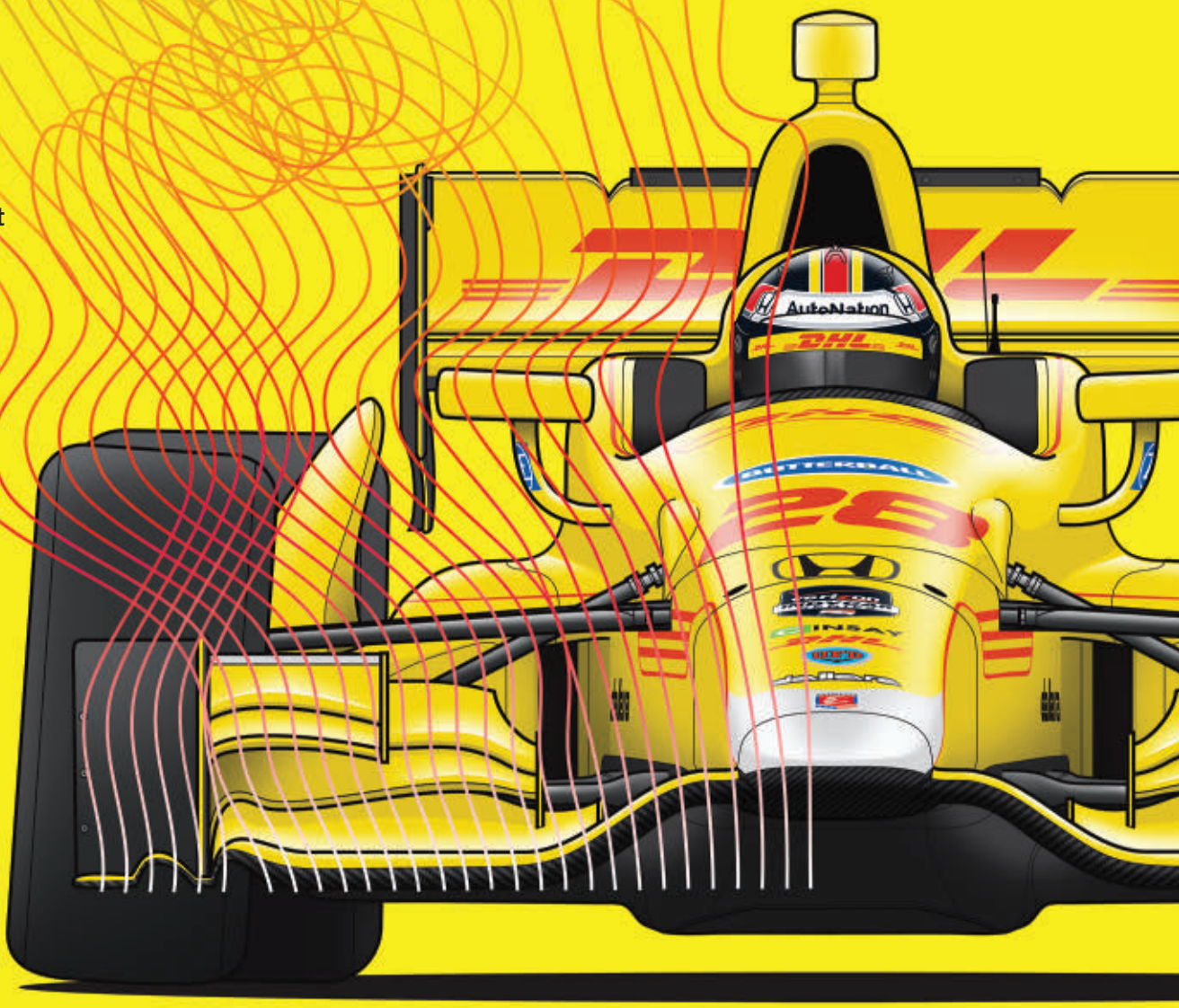
THE TECHNOLOGY ISSUE

INDYCAR 2015: FAST IS BACK!
New aero rules target speed records

FORMULA 1 ENGINE WARS
Why Mercedes dominated 2014

FUTURE RACECAR
Science fiction meets science fact



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THEIR SPIRIT LIVES ON

Innovation comes to the IndyCar Series once more as aero kits arrive for 2015. Here's our take on one...
Illustration: Paul Laguette

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Andrew Hone/LAT

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Michael Levitt/LAT

"I want to win Indy, I want to win the championship again, and then keep doing it, keep going for it"

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Jamo Schurgers/Red Bull

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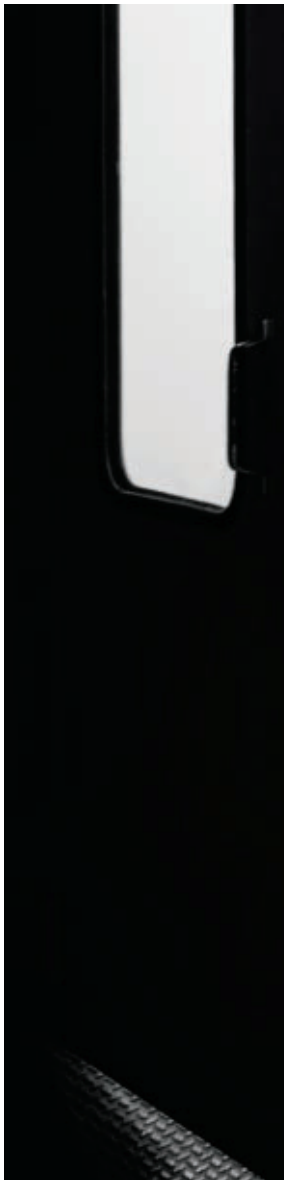

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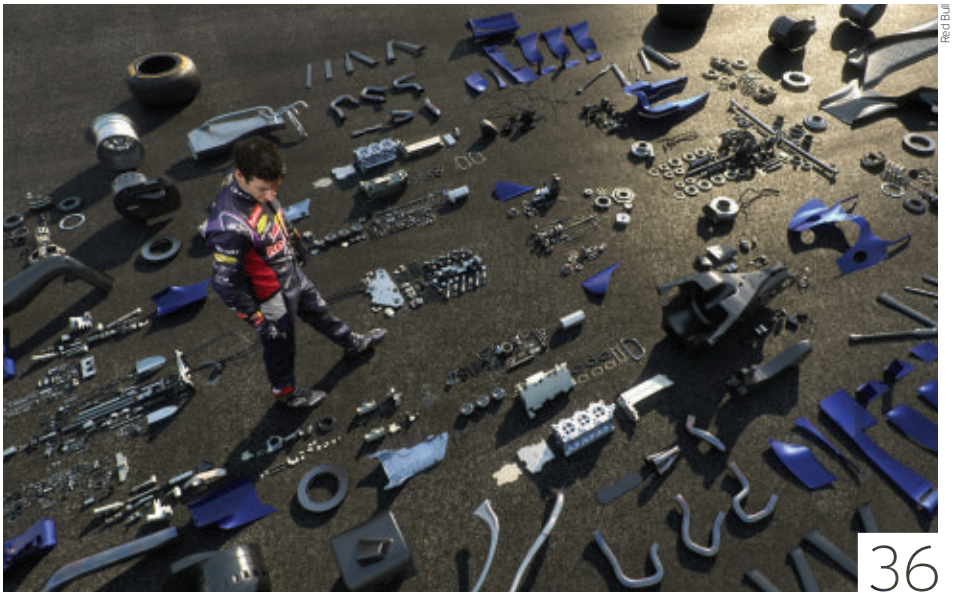
To freeze or not to freeze? That is the question for engine manufacturers in F1. (BELOW) Tech-lover's dream! (BELOW LEFT) Paul Tracy – the man, the legend and the huge talent.

Paul Laguette/LAT



Red Bull

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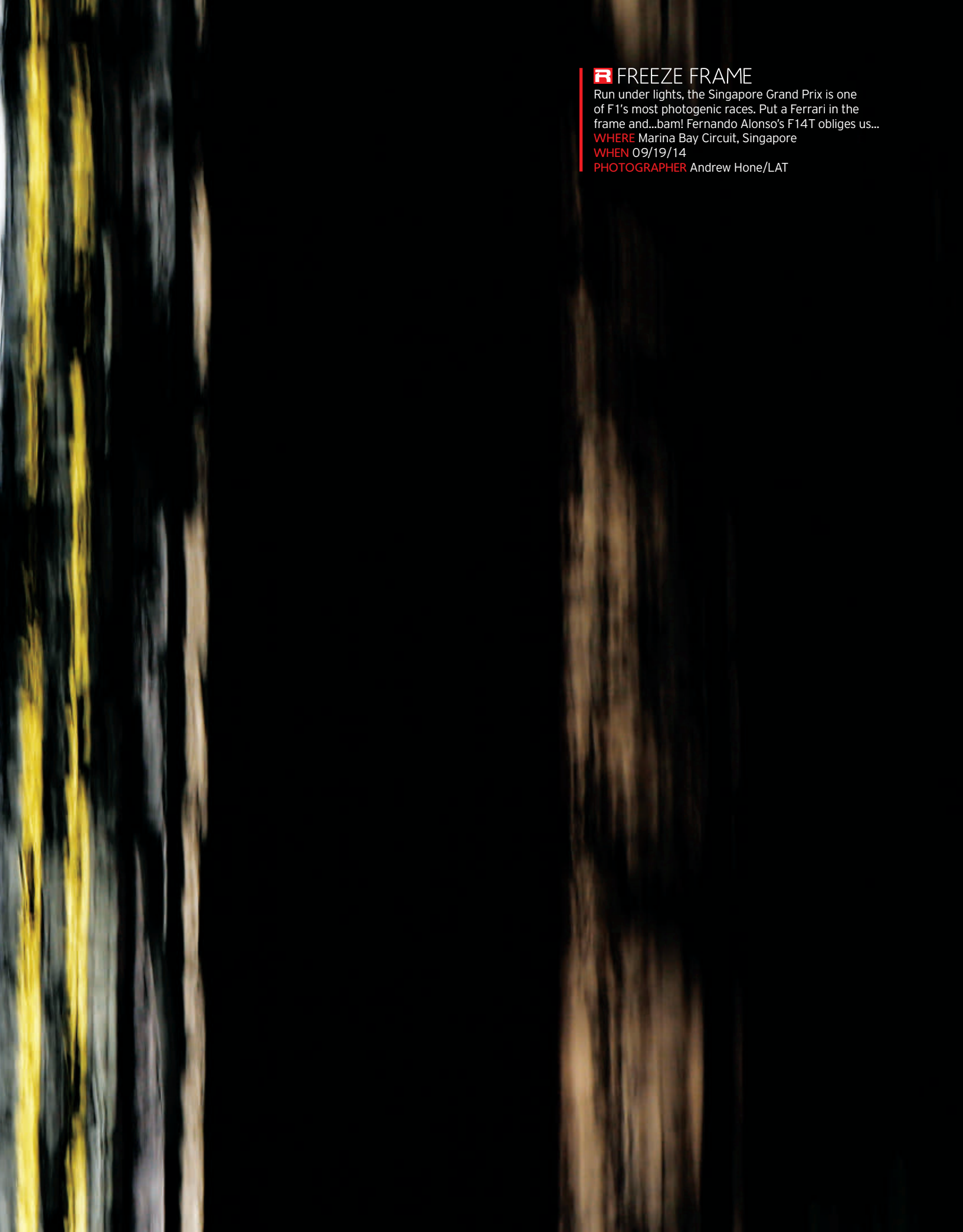

FREEZE FRAME

Run under lights, the Singapore Grand Prix is one of F1's most photogenic races. Put a Ferrari in the frame and...bam! Fernando Alonso's F14T obliges us...

WHERE Marina Bay Circuit, Singapore
WHEN 09/19/14
PHOTOGRAPHER Andrew Hone/LAT

FREEZE FRAME

Rain. Teams don't care for it, but photographers kind of dig it. Here, a rain-lashed pit lane and one of AF Corse's Ferrari 458 fleet add up to a great shot at CoTA's WEC counter.
WHERE Circuit of The Americas, Austin, Texas
WHEN 09/18/14
PHOTOGRAPHER John Rourke/AdrenalMedia.com

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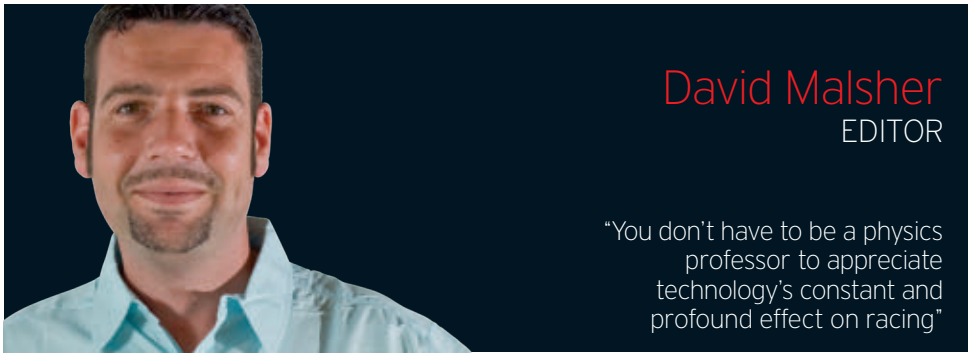

David Malsher
EDITOR

"You don't have to be a physics professor to appreciate technology's constant and profound effect on racing"

It's a strange paradox that while no sport embraces technology quite like racing, it's treated as a dirty word by some fans who associate it with spoiling the action, making life too easy for the drivers, or making it too complicated to comprehend.

Well, let's first of all point out that Miller Indy cars, Lotus F1 cars and Chaparral Can-Am cars incorporated cutting-edge technology, and yet we *cherish* rather than despise them for that. Secondly, you don't have to be a professor of physics to appreciate technology's constant and profound effect on racing. And that's what much of this *Technology Issue* is about.

The 2015 IndyCar aero kits (page 48) will be far more radical and distinctive than many expected, and ferociously efficient, too. However, they're no match for the amazing Dunlop Future Racecar which former Brabham and Benetton designer Sergio Rinland has penned (page 54). It uses tech that he insists will be mature enough to render aspects of his concept viable in as little as five years. There's some stunning blue-sky thinking in that story alone...

But if you're still trying to grasp the present, namely those new-for-2014 F1 power units, and how Ferrari and Renault (and Honda) can ever catch up with Mercedes, it's all explained starting page 36.

Michael Levitt/LAT

We're not slaves to technology, however; we appreciate the humans in the cockpits, too, which is why this issue contains an interview with Verizon IndyCar Series champ Will Power (ABOVE), a tribute to former Indy car ace Paul Tracy, and an analysis as to why Red Bull feels Max Verstappen is ready to race in F1 next year at the age of 17.

● We were saddened to learn of the death of Ben Blake, our NASCAR correspondent for almost 10 years. Ben was one of those rare talents who could write incredibly engaging and insightful feature stories, yet was also a great news-hound, one who cut through the baloney to find the facts and put them out there. The world of racing journalism is a poorer place without him. ■

editor@racer.com

CONTRIBUTOR

Selfie!

Two contrasting projects for Paul Laguette's skills in this issue: P.T. in a punk flyer style, and an exquisitely executed take on a 2015 IndyCar aero kit. Mr. Versatile!

STORYBOARD

Steve Shunck

Research for his homage to Paul Tracy in this issue caused Robin Miller to stumble across a self-created "media kit" by the "Crazy Canuck" from 1990. Robin felt obliged to share it with P.T.'s amused former teammate and rival, Dario Franchitti.

For racers only.

The ABS kit from Bosch

We, the Bosch Motorsport team, have developed an ABS kit for motorsports use, which can be individually tuned according to driver, car and racetrack requirements. This shortens your lap times and your way to the podium position. Find more information at **www.bosch-motorsport.com**

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Peter Fox/Getty Images

Vettel's surprising decision to leave Red Bull Racing was a winning ticket for Daniil Kvyat, who'll graduate from Toro Rosso to RBR for his sophomore F1 season. Does this mean Jean-Eric Vergne can stay at STR to partner rookie Max Verstappen? Apparently not.

PRE-EMPTIVE STRIKES

Vettel pulls the plug, Alonso takes the Fifth and McLaren leaves its drivers guessing...

> While the Mercedes team has made competition for race wins in F1 this year largely a battle between teammates, the competition for next year's seats – aka silly season – is hotter than ever.

The continued struggles of Ferrari (see chart, BELOW) steadily whittled away at the once-ironclad relationship between the Scuderia and Fernando Alonso, and reached an evident – if unconfirmed – breaking point in early October. But the two-time World Champion's status as F1's biggest free agent was thrown into doubt when four-time and defending champ Sebastian Vettel announced that he was leaving *his* team at the end of the year.

The abrupt end to one of F1's most successful partnerships followed the revelation earlier this year that design genius Adrian Newey was stepping back from a day-to-day role with Red Bull Racing. That, along with Renault's as yet unproven ability to bridge the large performance gap between its power units and those of Mercedes, were surely two of the main factors that lured Vettel toward the exit.

Seb did not reveal where his new F1 home would be, although Ferrari was the only obvious prospect. The blogosphere went into overdrive, with rumors of contract offers in the $80m range.

Alonso, too, seemed to enjoy leading the more excitable members of the press corps on wild goose chases about his future plans, although he admitted at the Russian GP that he was "unlikely to be driving a Mercedes-engined car." That put the smart money on his return to McLaren to help develop the all-new Honda power units. Who he'd replace – 2009 champion Jenson Button or highly promising rookie Kevin Magnussen – remained unclear as we went to press.

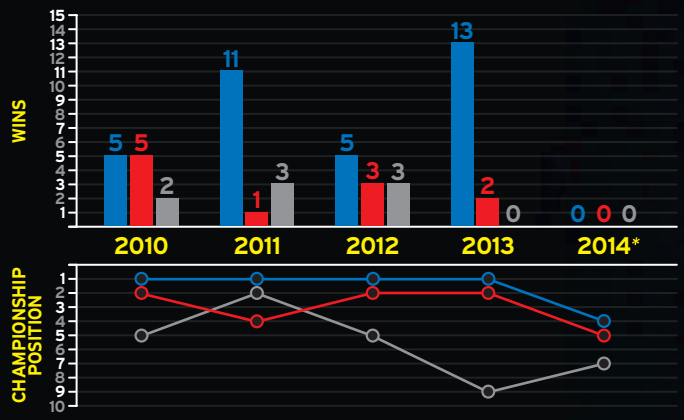
Lorenzo Bellanca/LAT

HELLO, I MUST BE GOING

Fernando Alonso and Ron Dennis fell out in a major way during the Spaniard's single season at McLaren in 2007, a year which ended in the McLaren/Ferrari "Spygate" debacle. Seven years on, Ron mischievously suggested he wouldn't be averse to Alonso *or* Lewis Hamilton returning to McLaren in 2015. Hmmm... Presumably not both, though. Once was enough, we suspect.

DIVERGING FORTUNES

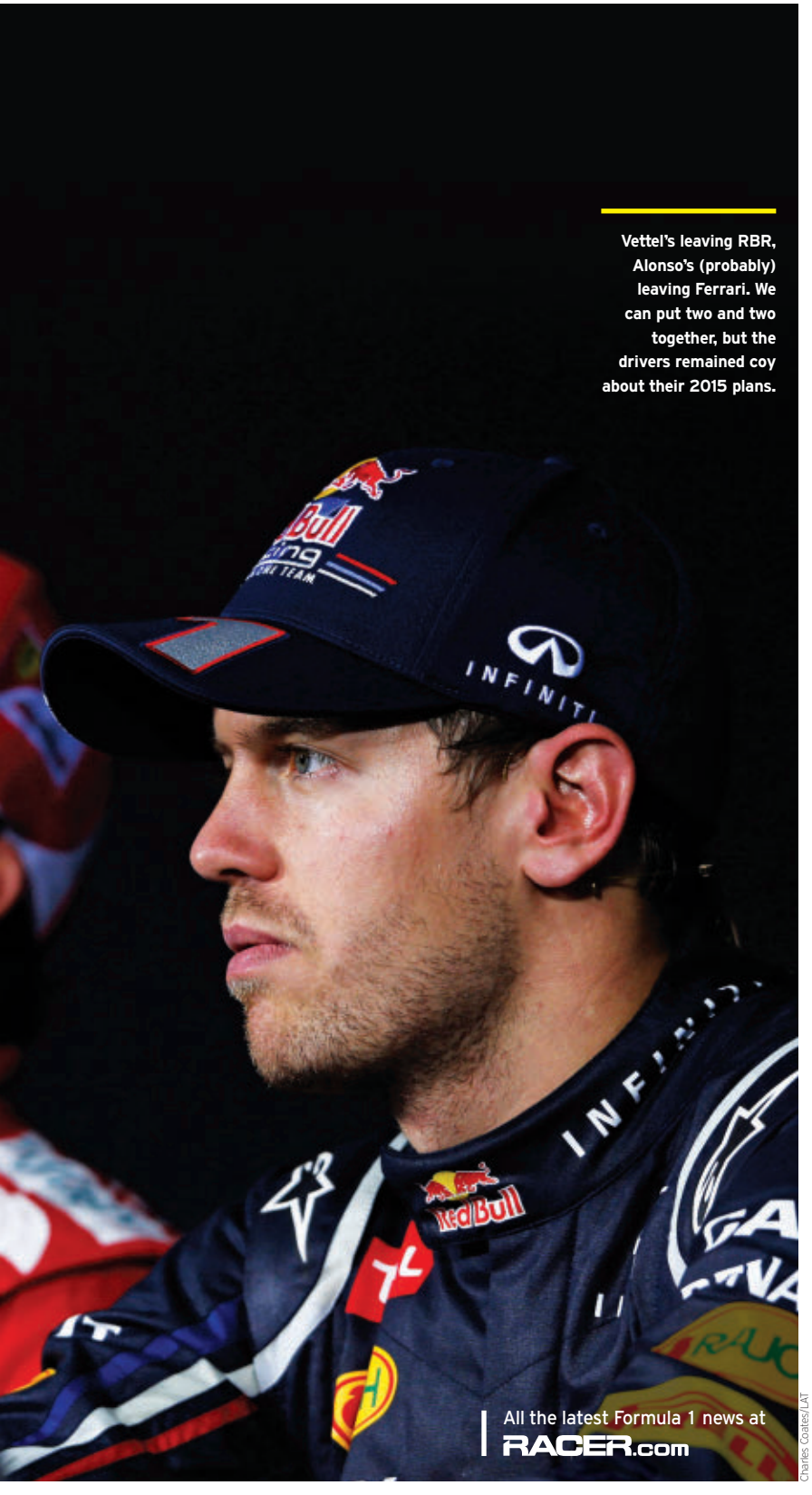
The three World Champions now vying (we think!) for seats had significantly varying results – until 2014: Vettel (blue), Alonso (red) and Button (gray).



** through 2014 Japanese GP (round 15 of 19)*

While F1 stars squabble over prime seats, F1 hopefuls are increasingly being squeezed by the financial challenges facing smaller teams. Simona De Silvestro is the latest victim, losing her Sauber test role as the Swiss team scrambles for a budget.

LAT

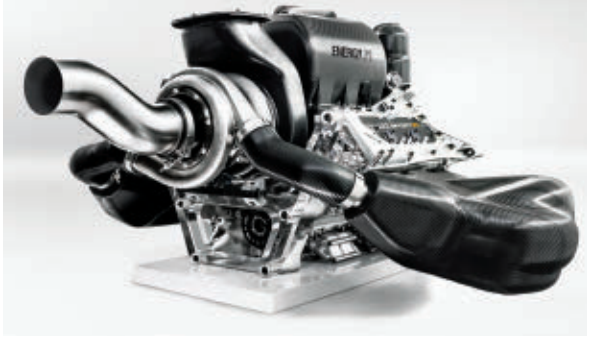


Vettel's leaving RBR, Alonso's (probably) leaving Ferrari. We can put two and two together, but the drivers remained coy about their 2015 plans.

Charles Coates/LAT

All the latest Formula 1 news at RACER.com

Limiting engine competition sounds like a good idea unless, like Renault, your piece turns out less equal than others.



Renault

COLD WAR OVER ENGINES

Would thawing development freeze help or hurt?

> Formula 1's engine development was "frozen" by mutual consent at the launch of the turbo V6 formula, but there are increasingly strident calls for that freeze to be thawed amid Mercedes' domination of the season. Naturally, the arguments of those in favor are countered by those of the currently dominating party.

"It is healthy for F1 that Ferrari, Honda and Renault should have the ability to close that gap," argued Red Bull's Christian Horner, "otherwise we are going to end up in a very stagnant position."

Mercedes' Toto Wolff warned that an "unfreeze" risked re-igniting F1's smoldering budget crisis.

"You don't want to have regulations changing three months before the start of the season," he said. "That translates into escalating costs, out-of-control costs. This is why there is a process in place and that it needs to be unanimous after a certain date."

Since lifting the freeze requires unanimous consent of all F1's teams, Mercedes appears to hold the winning hand in this contest, too.

Alastair Staley/LAT

FIESTA TO END SIESTA

After 23 years without one, Mexico again has a GP for 2015. And it figures to feature at least one Mexican driver, for the first time since Pedro Rodriguez in 1970 (ABOVE).

LAT archive


Paul Webb/LAT

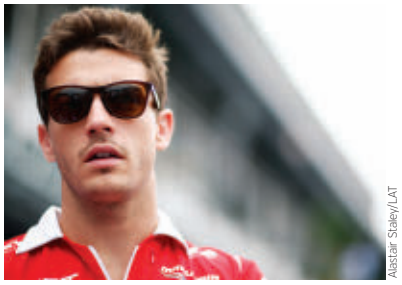
David Brabham (LEFT) has launched the crowd-funded Project Brabham to re-establish the illustrious marque with a 2015 FIA WEC LMP2 program. For more details, search for "Project Brabham" on your web browser.


Sam Bloxham/LAT

F1 drivers show their support for seriously injured rival Jules Bianchi before the start of the Russian GP at Sochi Autodrom.

SO MUCH PROMISE

Jules Bianchi was an F3 Euroseries champion and runner-up in both GP2 Asia and FRenault 3.5. He scored Marussia's first-ever points at Monaco this year and was in strong contention to replace Kimi Raikkonen at Ferrari at the end of 2015.


Alastair Staley/LAT

F1 TO ERR ON THE SIDE OF CAUTION?

Jules Bianchi's horrifying crash opens debate about full-course yellows and safety cars

> Formula 1 looked set to alter its yellow-flag rules following the huge accident at the Japanese Grand Prix that left Marussia driver Jules Bianchi with severe head injuries and still fighting for his life as this issue of *RACER* went to press.

The Frenchman, who is also one of Ferrari's junior drivers, aquaplaned off the rain-soaked Suzuka track on lap 43 and collided with a large tractor-crane recovery vehicle which was in the process of retrieving Adrian Sutil's spun Sauber. FIA race director Charlie Whiting revealed the Marussia left the track at 132mph, and amateur video showed it spear under the rear of the rescue crane. Bianchi was diagnosed with a diffuse axonal injury.

Whiting confirmed the marshals on the scene followed the correct flag procedure – double-yellows for Sutil's crash and a green flag afterward – and that Bianchi had slowed in compliance with the yellows, although to what extent was unclear.

In a meeting at the inaugural Russian GP that followed a week later, the FIA and teams discussed introducing a rule that forced drivers to slow down to a specific delta time through an affected area of a track. However, many racers and fans are still calling for F1 to follow the U.S. racing example of full-course cautions whenever any recovery vehicles and course workers are exposed trackside.

LAT archive

First career podium: third at Monaco in '82. It was a track where de Cesaris shone; he took fourth for Jordan there in his final year, 1994.

ANDREA DE CESARIS, 1959-2014

> Andrea de Cesaris, a Formula 1 stalwart from late 1980 until 1994, was killed in a motorcycle accident in Rome on Oct. 5. The Italian journeyman racer was just 55.

De Cesaris drove for McLaren in his first full F1 season in 1981, but was most famous for startling performances in Alfa Romeos in '82-'83. Although the cars were unreliable, they were fast, and de Cesaris took pole for the 1982 Toyota Grand Prix of Long Beach, the same year he scored his first podium finish at Monaco.


LAT archive

SPA HEARTACHE

Spa in '91 saw Andrea almost win for Jordan, as he closed on leader Ayrton Senna, who had gearbox issues. Sadly, AdC's engine let go.

The following season, he earned two runner-up finishes at Hockenheim and Kyalami, and was leading at Spa until hitting mechanical difficulties.

Spells at Ligier, Minardi, Brabham, Rial and Scuderia Italia yielded just a couple of podium finishes, but Andrea produced several fine performances in 1991 to help earn Jordan GP fifth in the Constructors' Championship in its debut season. He drove for the financially struggling Tyrrell team in '92, taking it to sixth in the final points.

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Nigel Kinrade/LAT

The DeltaWing had its most competitive run in the TUDOR Championship finale. The heavily revised DWC13, with front wing, dive planes and top wing, finished Petit Le Mans in fourth. Katherine Legge's fastest race lap was just 0.5sec off the best overall.


Nigel Kinrade/LAT

By reducing power *and* drag, NASCAR hopes to increase passing and prevent the field from getting too strung out on long runs.

PRODUCTIVE REDUCTIONS

Less power and less testing for NASCAR in 2015

> At the end of September, NASCAR delivered to teams the 2015 racing package for all three national series. Key among the changes in Sprint Cup are a 125hp cut in power (down to 725), a shorter rear spoiler and a driver-adjustable track bar, all to improve the racing.

The move to eliminate private testing is to encourage teams to test along with Goodyear and NASCAR.

"I'm a big fan (of not testing)," said Joe Gibbs Racing ace Matt Kenseth (INSET), "especially the 'no Daytona testing;' we really don't learn anything there."


Nigel Kinrade/LAT

Along with changes that include a move to automated pit road officiating, a new parts-approval process and an electronic rule book, the latest changes are intended to allow teams and drivers more adjustability, and to produce more passing for the fans.


John Harrelson/LAT

TONY STEWART IN THE CLEAR

No criminal charges after fatal sprint car accident

> A 23-member grand jury cleared Tony Stewart of any "aberrational driving" at Canandaigua Motorsports Park on the night his sprint car struck and killed Kevin Ward Jr., who approached Stewart's car on foot as the field was under caution. Ontario County D.A. Michael Tantillo also said toxicology reports showed Ward had a level of marijuana in his system high enough to impair judgment.

POIGNANT GLORY

Dodge prevails, then bails, after just two seasons

> While Action Express Racing was a shoo-in to win the inaugural TUDOR United SportsCar Championship Prototype crown at Petit Le Mans, such was Joao Barbosa and Christian Fittipaldi's lead heading into the Road Atlanta finale, the top GT Le Mans title contenders, Corvette and Viper, entered the race just six points apart.

But going on to clinch the Teams' and Drivers' titles wasn't enough to keep Dodge in the series for 2015. Less than 48 hours after achieving TUDOR Championship glory, Chrysler Group LLC confirmed the works Viper program had been axed.

"Our company has made a business


Michael Levitt/LAT

EXPRESS DELIVERY

Action Express Racing's Joao Barbosa and Christian Fittipaldi took their first sports car title with second at Petit Le Mans, following wins at Daytona, Indy and Elkhart Lake (ABOVE).

Nigel Kinrade/LAT

Paul Miller Racing gave the Audi R8 LMS its first win of the season in United SportsCar's GTD class when Bryce Miller, Matthew Bell and Christopher Haase held off a strong phalanx of Porsches to take the Petit Le Mans victory at Road Atlanta.

Nigel Kinrade/LAT

decision to discontinue the SRT Motorsports Dodge Viper GTS-R racing program," said Ralph Gilles, senior vp of product design, and the man behind the SRT brand. "We are very proud of the amazing achievements our fantastic teams, drivers and partners achieved on track the last few seasons."

And rightly so. Jonathan Bomarito and Kuno Wittmer entered Petit Le Mans six points ahead of Corvette Racing's Antonio Garcia in the Drivers' points and SRT switched Wittmer to the No. 91 car to double the chances of a Viper driver beating the 'Vette man. Wittmer duly edged it after Bomarito's No. 93 was delayed by gearbox issues. But the No. 93 earned the Teams' crown, defeating the No. 3 Corvette, while Dodge also beat Chevy in the Manufacturers' standings, albeit trailing Porsche.

In the GT Daytona category, it was Dane Cameron in Turner Motorsport's BMW Z4 (BELOW, leading Wittmer's Viper) who clinched the title. Cameron, partnered for most of the season by Markus Palttala, finished fourth in the finale, as none of the new class champions managed to add Petit Le Mans to their list of victories.

Wayne Taylor Racing won the race overall, with Jordan and Ricky Taylor and Max Angelelli on driving duty.

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Richard Prince/Cadillac Racing

In the Cadillac CTS-*V*'s final season in Pirelli World Challenge, veteran Johnny O'Connell gave it the perfect send off, winning the GT Drivers' title as he and Andy Pilgrim also earned Caddy the Manufacturers' crown.

Phillip Abbott/LAT

Trying to make these kinds of scenes a more regular occurrence is what has driven Simon Pagenaud to Penske.

Henry Busby/Verizon

FOUR THE FIRST TIME

There's not much Roger Penske hasn't done in Indy car racing, but running four cars full-time is one of them. Expect plenty of fireworks from Pagenaud, Montoya, Power and Castroneves in 2015…but plenty of wins, too.

SIMON'S SIMPLE CHOICE

When Roger Penske comes knocking, it's hard to say no, as Simon Pagenaud has proven

> The IndyCar off-season, which started on Aug. 31, hasn't seen quite as much upheaval at the top of the driver/team ranks as Formula 1 (see page 12), but there's been enough movement to trigger intrigue and speculation both before and after the switches were confirmed.

Few believed Simon Pagenaud would ever sever his ties with Honda, nor that Roger Penske would ever run four cars. Yet both have come to pass and come together, as the Frenchman, who this year finished fifth in the IndyCar Series with the Honda-powered Schmidt Peterson Motorsports team, will drive a Team Penske Dallara-Chevrolet in 2015.

BACK HOME

James Hinchcliffe is a known quantity at Schmidt Peterson, as Sam ran Hinch in Indy Lights back in 2009.

"Simon is a very talented, focused and determined driver," said team owner Roger Penske. "We know how tough he's been to compete with over the last few seasons and we feel we now have four drivers very capable of winning on any given weekend and four guys who are legitimate championship contenders."

Schmidt Peterson's prompt signing of James Hinchcliffe to replace Pagenaud made Andretti Autosport's situation less clear as the Canadian departed after three seasons and three wins with AA. But as we went to press, the third "giant" of the series, Chip Ganassi Racing, was set to confirm Sage Karam as replacement for Ryan Briscoe in CGR's four-strong lineup.

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The how, what and why on 2014's best of the best

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Our congratulations to Kuno Wittmer for bringing home the GTLM Driver Championship and to the SRT Motorsports Team for bringing home the GTLM Team Championship. These wins were fortified by hard work and an all-in effort from everyone including Riley Motorsports, our drivers: Jonathan Bomarito, Marc Goosens, Dominik Farnbacher, Ryan Hunter-Reay and Rob Bell — and of course our faithful fans. Thank you for believing in us, cheering with us and reminding us why we do what we do. We are proud of our collective achievement and grateful for the friends we've made and the experiences we've shared. Onto the next ... ***driveSRT.com***

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POWER & GLORY

IndyCar's three-time runner-up is finally a champion, but Will Power's contentment with the 2014 title after a hard battle is only temporary. The Penske ace wants more.

WORDS David Malsher | MAIN IMAGE Michael Levitt/LAT

Perry Nelson/LAT

In the end, the 2014 IndyCar Series title fight distilled to Power vs. Castroneves, each of whom had finished runner-up three times in previous years. Either way, The Captain, Roger Penske (BELOW), was going to be happy.

Spontaneity. That's been one of the keys for 2014-spec Will Power. The new Verizon IndyCar Series champion's acceptance speech at the end-of-season awards banquet went great while he was just riffing, then turned hilariously chaotic as he tried to follow the auto-cue. But it ultimately won hearts. That reflected his season, which was about tearing up the script, and instead thinking and acting on instinct. End result: winning the ultimate prize.

Sunday morning after his title-clinching drive in Fontana, Power is leaning back on a sofa in his hotel lobby, sipping on the first coffee he's allowed himself all year and looking genuinely content. And you may not believe this, but he's relaxed in a manner that looks like it could last for some time. It's a demeanor I haven't seen from him – or at least, not within a 20-mile radius of a race track – since an interview we did in Mexico City to discuss his Champ Car Rookie of the Year title, eight long seasons of glory and heartache ago. That intervening period is what amplifies exponentially his latest "mission accomplished" mood. That, and the pleasure of knowing he did it his way – playing the long game by focusing on the short game.

"Maybe people don't believe me, but most of this season I did what I said I would – not pay attention to the points," says Team Penske's first IndyCar champ since 2006. "I was trying to maximize each race weekend and each situation in that weekend...partly because that's what had brought me the best success last year. Once I didn't have a realistic shot at the 2013 title, I just went for it and we won three of the last five races. So I thought, 'Well, OK, that seemed to work, let's keep doing that.'"

Ernie Mastro/LAT

"If I made a mistake or strategy went against us, I accepted it. What's done is done...let's move on"

WILL POWER

Admittedly, living in the moment occasionally hurt Power's medium-term prospects this year, and also meant the adrenaline pumped harder, making him more transparently annoyed when things went wrong. Yet those internal storms blew themselves out much quicker, too.

"Yeah, because I wasn't constantly looking back and thinking about what might have been," he agrees. "Or not very often, anyway. With the schedule having so many back-to-back-to-back races, honestly, we didn't have time to dwell on crap. If I made a mistake or if strategy went against us because of when cautions fell, I accepted it. 'What's done is done, we can't change it, let's learn from it but move on.'"

There were a few of those moments for Power. Penalties for pit-lane speeding (Indy and Texas), driving over pit equipment (GP of Indy), blocking (Pocono) and avoidable contact (Detroit 1) could have driven him crazy with frustration in previous years. Not this time. He came back from each setback – self-induced or otherwise – as hard and fast as ever. When, finally, he considered the consequences of things going wrong, it didn't subdue him: it stoked the fire.

"When I hit the wall as we were coming to the green flag at Toronto Race 1, that was the first time I thought, 'This could be a big swing against us in points.' Luckily, the race wasn't started [spray from rain meant the drivers couldn't see on the fastest sections of the track]; they put me to the back the next day, but we limited the damage in the points and got a top 10. Helio [Castroneves, his Penske teammate and main title rival] was on the podium, but from that moment, I was so determined not to finish behind him ever again." >

PENSKE'S WAIT IS OVER AFTER EIGHT YEARS

The year Will Power won Champ Car's Rookie of the Year title, 2006, was also the last season Team Penske clinched an Indy car title. Sam Hornish (BELOW) prevailed in the IndyCar Series after a truly epic year-long, four-way fight between the two Penske drivers (Hornish and Helio Castroneves) and two Ganassi drivers (Dan Wheldon and Scott Dixon). In the end, Sam beat Dan, on the same points total, but with Hornish on four race victories to Wheldon's two. And Castroneves was only a further two points behind!

Michael Levitt/LAT

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FONTANA RELIEF

Immediate and extended family empathized with Will Power after the finale at Auto Club Speedway. Wife Elizabeth (LEFT) has shared his joys and heartaches...and tolerated his silliness (ABOVE) since 2006.

In the second race later that same day, Power's No. 12 Verizon Dallara-Chevrolet, its driver far more at ease in the wet conditions, filled the mirrors of the sister No. 3 until Helio finally cracked, making a small mistake in Turn 1. Will grabbed his opportunity, driving around the outside of his rival at Turn 3. He'd go on to finish third while Castroneves was down in 12th after more on-track strife, and so the Brazilian's championship lead had been slashed from 28 points to 13 in the space of just a few hours.

Yet, however much Power tried to take each race as it comes, eventually the championship's riptide dragged him off his island of relative serenity and into the deep waters of the title race. Over the previous four seasons as a full-time Penske driver, winning the championship had become too much of an obsession for him to remain oblivious now. Castroneves' electronics issue at the start of the Mid-Ohio race effectively neutralized Power's suspension failure in Houston and he returned to the top of the points table. "All" he needed to do now was keep beating one of the best in the business running with identical equipment to his own.

Power pulls a reluctant grimace, and admits, "Yeah, in the last three races, I thought about points...and I got sick of it, to be honest, but I had to. I *needed* this championship like you wouldn't believe.


Phillip Abbott/LAT

So did Roger [Penske], Tim [Cindric, team president and Power's strategist], Dave [Faustino, race engineer], Swede [Matt Jonsson, chief mechanic] – everyone who'd been through the downs with me in the last few years. At Milwaukee, I didn't sleep well before the race. After we took pole, I knew we'd done a decent job, we had a strong car and it was all about executing."

He did so with as emphatic a race win as we saw from anyone all season, and it's the race he cites as his most satisfying from 2014. On a day when most drivers moaned about the way their front or rear tires burned off, Power actually made one pit stop fewer than his main rivals, overcame a slight strategic miscue, and led 229 of the 250 laps on the way to his third and final win of the season. He also made a significant point while running wheel to wheel with feisty oval maestro, Chip Ganassi Racing's Tony Kanaan: being in the title race was not going to make him overly cautious.

"No, I wasn't making a point," says Power. "Honestly. I just didn't worry about Kanaan, because I trust him. TK's tough, won't give you an inch more than you need, but he's a real smart racer. Nah, I just knew we had a fast car and I needed to take full advantage of it."

Aside from being evacuated from his hotel in Sonoma at 3.30 a.m., when a 6.0 earthquake struck the area on the


Phillip Abbott/LAT


F. Peirce Williams/LAT


Phillip Abbott/LAT

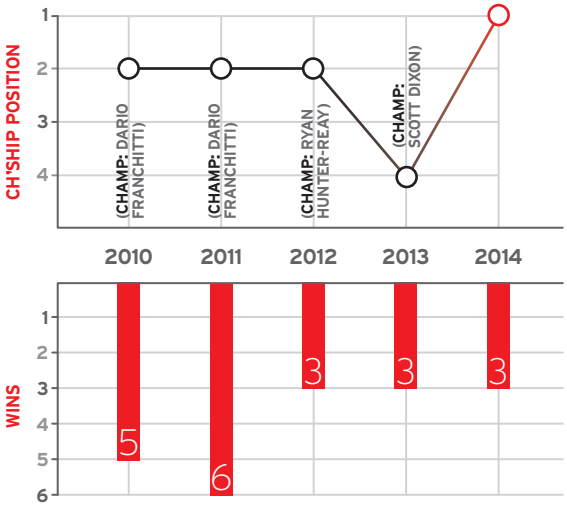
(LEFT) Failing to complete just one lap in the whole season was one key to Will's championship. Another was the fine strategic work done by Penske president Tim Cindric (BELOW LEFT). Third place in Toronto (BELOW) was the start of an almost error-free final third of the title race.

THE WILL TO WIN

"The days are gone of a driver winning more than four races in a season," said Power pre-season, but three wins, four poles, 11 races led and 623 laps led were all top-of-the-class figures.

POWER RANKINGS

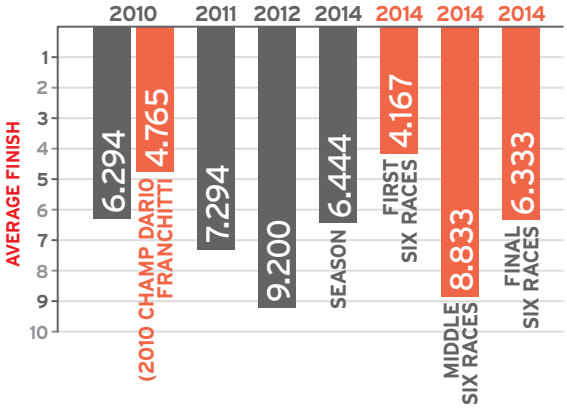
Three years of being runner-up taught Power to withstand disappointment, but 2013, when nothing went right for most of the season, taught him to forget points and just go racing.



GAME OF AVERAGES

Eleven wins in the last two seasons of the old Dallara IR-03 weren't enough for Power to overcome the almost unbelievable *average* finish of his old bête-noire, Ganassi's Dario Franchitti.


Dan Boyd/LAT



"The biggest change [this season] was being confident and strong in every discipline"

WILL POWER

morning of the race, the 33-year-old Aussie should have all-but clinched the title in NorCal. His pole was vintage Power and no one looked in the same league. But a mid-race spin on cold tires left the championship door ajar for Castroneves, despite the No. 3 getting caught up in a multi-car incident that left him eight places behind Power at the checkers.

The following Tuesday, Power asked what the points situation would have been heading into the double-points Fontana finale had he just finished an easy runner-up behind Scott Dixon at Sonoma. Before I could work it out, his new mindset kicked in. "Actually, don't tell me; can't think that way. We just know we've got to finish top six at Fontana if Helio wins...and I'll assume he'll win and get all the bonus points."

That was telling. So, too, was the fact that Power looked quite calm after qualifying on the back row at Fontana's Auto Club Speedway when a wayward slide on the opening lap of his run bled away the P1 potential he'd shown in practice.

"I was tense before the race because of the variables," he recalls. "If someone spun in front of us or we had a mechanical issue, we'd be in trouble. So I was very careful and methodical at picking my way to the front. When we got up to fourth for that restart, although our car was a long way from being brilliant, I knew if we took advantage of the new tires, we'd get an extra point for leading a lap, so I went for it. Psychologically it put pressure on Helio, too: at that point, he knew I was where I needed to be and he also knew he didn't have a car to win the race. Neither did I, but I had the car to win the title..."

Job done. Dream achieved. Title won. The obvious question is, what was different this time? Was it really just down to "taking each race as it comes?"

"No, I'd say the biggest change was being confident and strong in every discipline," he says, referring to the oval tracks. "I mean, it's not like we weren't in several winning positions on ovals even back in 2010 – but that had nothing to do with me; it was all car. Wide-open throttle racing had three problems: firstly, it was dangerous; secondly, it was about balls, not brains or talent, and thirdly, you didn't work on the car much over a race weekend because the hard work was done by the aero department way ahead of time. At the track, all we did was polish it.

"It's totally different now. This year – on all types of circuit – you had to nail the >

Michael Levitt/LAT

Michael Levitt/LAT


Paul Webb/LAT

(ABOVE) Fire and desire, even now. (LEFT) Long Beach is one of only three races where he thought in terms of points and just collected an easy runner-up finish.

"During the season, I kept thinking, 'Just one title would be fine.' But now we've done it, it's not enough..."

WILL POWER

philosophy on the weekend," he continues, alluding to that spontaneity that proved so crucial. "Apart from on ovals, not much that worked last year worked this year. If you were missing in one area, like aero balance, rollcenter, dampers, whatever, you were screwed. It's weird how different this season was from last and how different it was from track to track – no pattern *at all!*

"That sometimes caught us out; me and Dave would go too far in a certain direction and that's why there were a couple of street races where we started at the wrong end of the grid. Other times, our thinking worked. And then, *finally*, we made a bit of a breakthrough and found a setup philosophy that others had found earlier, and we were right up front again."

Power stretches his arms along the back of the couch and leans back, eyes heavenward. "Man, it was a tough year," he sighs. "I suppose I made it more difficult by pushing so hard and getting penalties. But everyone in IndyCar is a good driver, so you've always got to be on that edge. That's what makes it extra special to have the championship at last."

Then he snaps out of his reverie, sits upright, shoots a hard stare and delivers a slightly menacing smile that belies the quiet Australian drawl.

"You know, the funny thing is, during the season I kept thinking, 'Just one championship would be fine, something you've got for all time.' But now we've done it, it's not enough. I hate saying that, because I know there'll be people who read your interview and think, 'Man, is this guy *never* happy?!' But I want to win the Indy 500, I want to win the championship again, and keep doing it, keep going for it.

"With this parity in IndyCar, domination is probably impossible, to be honest. But we want to come closer to domination than the others, year after year. And – at last! – having this weight off my brain will help, I hope." ■

MEARS ON POWER

"I KNEW HE COULD DO IT"

Rick Mears, three-time Indy car champion and four-time Indy 500 winner, is as proud of Will Power's title as anyone in Team Penske. "He was perfect that night," he says, referring to the Fontana finale. "He earned his way to the front before the first yellow. Then he just went for it, took the lead, which just showed his self-conifidence.

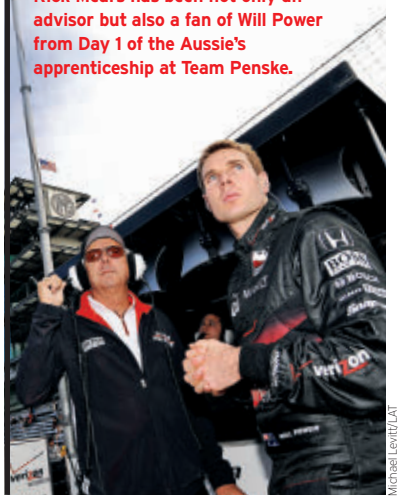
"To me, the big difference this year was Will's confidence on ovals," says Mears, "and I don't just mean from the 'going for it' point of view. I'm talking about the way he'd set up the car the way he liked, knowing that was the way to give him a strong car at the end of a stint. He just knew instinctively that doing this or doing that was the best way to go.

"When he got out of the car saying, 'I like these ovals more than I like road courses,' that shows how this car played into his hands. Listening to Will talk about how he loved drifting the car at 200mph at Texas was great!

"He's always had an acute feel for what a car's doing – I mean, something special you only encounter once every 20 years. But until this car [the DW12], he couldn't show that on ovals because the old car was just stuck to the track. This car allows Will to show what he's capable of and it's played to his strengths. He's not just guiding the car, but *driving* it.

"So although he's still intense behind the scenes, he has this self belief that means he knows what he wants in every circumstance. That's what earned him a championship."

Rick Mears has been not only an advisor but also a fan of Will Power from Day 1 of the Aussie's apprenticeship at Team Penske.



Michael Levitt/LAT

WILL POWER

Driver, #12 Verizon Team Penske
2014 Verizon IndyCar® Series Champion

CONGRATULATIONS ARE IN ORDER. The Verizon IndyCar Series saw 11 different drivers visit Victory Lane in the 2014 season. But in the end, Will Power and Team Penske battled to the final lap to take home the Astor Cup and the Championship. INDYCAR and the Verizon IndyCar Series would also like to thank all of our fans and partners for a spectacular season – your passion and dedication to the sport make it all possible. Be sure to follow us in the off-season to stay up-to-date on all the latest news about your favorite drivers, the cars, the 2015 schedule and much more!

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Verizon is a high-profile presence via track signage and its sponsorship of Team Penske (BELOW), but it goes a lot deeper.

Ernie Mastche/LAT

EXPLORING NEW VERIZONS

Verizon doesn't just sponsor the Indycar Series; the telecommunications giant leverages its existing and developing technologies to enhance the race experience for fans and competitors.

There was a time, back when record companies actually sold records and unleaded fuel was considered newfangled hippie juice, that motorsports sponsorships were fairly straightforward. A company wrote a check, put a big logo somewhere on the car, and then its execs hung out in hospitality all weekend.

To some extent, that can still happen. But the most effective commercial relationships have evolved well beyond the traditional sponsor/client model into genuine technical partnerships that deliver benefits on both sides. Case in point: Verizon and the IndyCar Series.

A long-time partner to Team Penske, Verizon's IndyCar presence ramped up dramatically in 2014 when it became the series' title sponsor. And the telecommunications giant has wasted little time in leveraging its technology to help reimagine the entire race weekend experience for fans and insiders alike.

The most widespread deployment of Verizon's know-how up to this point has been through its app: a standard version available on all carriers, and a tricked-up variant exclusive to Verizon Apple and Android customers. The elements that they have in common is their potential to enhance every aspect of a visit to an IndyCar event, from ticket-scanning upon arrival at the circuit, to following what's happening during the race.

"It's a holistic approach to bringing the entire fan experience up to the next level," says Verizon's David Samberg.

One of the keys to this is the Concierge

MULTI-FACETED PARTNERSHIP

(RIGHT) The Verizon Technology Pit was upgraded in 2014 to give VIP fans insider, high-tech access with exclusive camera views; one of Verizon's IndyCar missions is to constantly enhance and evolve the at-track fan experience; neat touches like cell phone charging stations all help to elevate the Verizon/IndyCar relationship beyond just sponsor/series.

Michael Levitt/LAT

Phillip Abbott/LAT

Nigel Kinrade/LAT

feature, which elevates the idea of the traditional printed fan guide by supplementing the weekend schedule with a GPS-enabled circuit map and real-time alerts in the event of changes to session times, such as this year's weather-affected Toronto race.

Other benefits can even be enjoyed by those who can't make the trip from, say, Arizona up to Mid-Ohio. Via the app, fans have the ability to watch the race live using customizable camera views, effectively making each user the producer of their own coverage. This extends to audio, with both pit-to-car transmissions and radio commentary available via the app.

"My son and I watch races from our kitchen table using the app," Samberg says. "At one race, we were watching Will Power's on-board camera and there was an accident, and we were able to see the whole thing from his viewpoint, from our kitchen. That was pretty amazing."

Aside from the app, one of the more visible manifestations of Verizon's technical savvy is the Verizon Technology Pit. A pitlane fixture throughout 2014, this provides VIP guests with an opportunity to enjoy additional features, including exclusive camera viewpoints and social media integration.

There has also been collaboration between Verizon and IndyCar to explore how all of this cleverness can benefit the series more broadly, and one area that's already undergoing a transformation is safety. A new system was tested during 2014 in which safety vehicles and the medical center will have access to additional cameras that will deliver a more comprehensive view of the circuit. The final version is scheduled for a roll-out next year, but a demonstration mode was in operation when Mikhail Aleshin had his enormous crash during practice at the Auto Club Speedway finale.

The Verizon/IndyCar partnership is the perfect example of how new thinking can help enhance practices that were previously taken for granted. And while a lot has been achieved in a short time, there is still more to come.

"We're always looking to add more," says Samberg. "With every sponsorship, and especially this one with IndyCar, we never stop looking at ways to evolve." ■

Michael Levitt/LAT

Michael Levitt/LAT

(TOP) Verizon is working with IndyCar's safety and medical teams to augment what they see around the race track. (ABOVE and LEFT) For teams and drivers, there's no such thing as too much information, and Verizon's new LTE Multicast technology ramps up their ability to analyze and react to what's happening on the track in real time.

Michael Levitt/LAT

LTE MULTICAST

ROLLING OUT THE NEW

Motorsport has long been a testing ground for technologies before they go mainstream, and Verizon is no different: IndyCar was the first real beneficiary of its LTE Multicast technology, which allows viewers to follow multiple camera angles simultaneously.

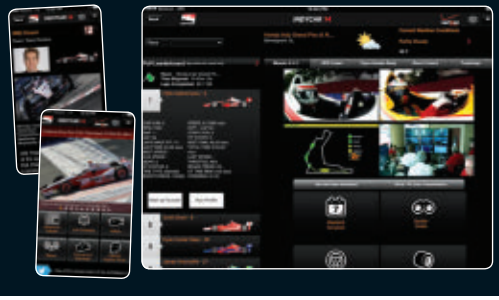
The LTE Multicast system was demoed for the first time at the Consumer Electronics Show in New York in 2013, and again for an event during Super Bowl week that same year. But the 2014 Indy 500, where it was available via a team app, marked the first time it was deployed on-site. It made an encore appearance at Sonoma.

"Down the road, it's technology that could be used in a lot of different ways," says Verizon's David Samberg. "IndyCar was a great place to start rolling it out. The first time we saw it being used in a real-world environment was at those two tracks, so IndyCar was a little ahead of the curve with that technology."

verizon INDYCAR SERIES

FUTURE EXPERIENCE

Innovations currently being worked on by Verizon to enhance the at-event experience for IndyCar fans include mobile ticketing and concession ordering and GPS directions around traffic hotspots.



BE AN INDYCAR INSIDER

Verizon's exclusive IndyCar app features for customers on Apple or Android devices includes live in-car cameras, real-time leaderboards, driver-pits radio, live race control and live race commentary.

TRADITION UPDATED

As much an icon of the Indianapolis Motor Speedway as the Yard of Bricks and pagoda, the newest version of the scoring pylon has received a high-tech, digital makeover.

It might seem counter-intuitive to spend a lot of money to make something look exactly like the object that it's replacing. But there are few sporting venues in the world with as keen a sense of their own heritage as Indianapolis Motor Speedway, so when the time came to replace the iconic scoring pylon on the start/finish straight, one of the main priorities was capturing the feel of its predecessor.

"When we started thinking through what we were going to do with the new pylon, the biggest thing for me was that it felt, at some level, like the old one," says IMS president Doug Boles.

"The new one is the third version of the pylon. They've all had a similar look and feel, and there is something about walking into the Indianapolis Motor Speedway on race day morning for the '500' and seeing one through 33 with the car numbers next to them. Once you can replicate what people are used to seeing, then you can look at how you can improve the fan experience."

So tradition lives on, but now as a digital feature that can be activated at the push of a button. Another button press later, and the all-LED pylon (LEFT), developed in conjunction with Panasonic, can change colors to reflect track conditions, display a flag for the national anthem, and seamlessly deliver other information to fans as needed.

"We knew what ribbon boards inside arenas could do, and we felt that this was like a vertical ribbon board," Boles says. "We wanted to make sure that we had a lot of flexibility built into it."

The pylon was lit up for the first time on the Tuesday before July's Brickyard 400 NASCAR Sprint Cup race, and saw active service during the race weekend.

During the coming year, video boards will be added around the track with the same digital capabilities.

IMS archive

THIRD-GEN PYLON

The original IMS scoring pylon (ABOVE) was erected in 1959. Its replacement served from 1994 until June 30, 2014.

Chris Owens/IMS Photo

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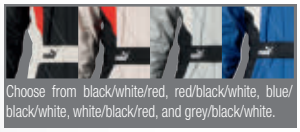

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GIL DE FERRAN

TWO-TIME CART INDY CAR CHAMPION
2003 INDIANAPOLIS 500 WINNER

I love Sunday mornings!

When I was racing, Sunday morning was the calm before the storm. The anticipation of what was about to come was simply awesome, and made me feel very alive.

Yet it's always been the case, and still is, that Sunday morning is my favorite time. Nowadays I can pig out on a very decadent breakfast, too, but the joy of gluttony aside, Sunday is still race morning! You see, most of my life I've lived on Eastern Standard Time (give or take a couple hours), meaning F1 races on TV are usually morning affairs.

As a kid, I'd sit with my dad, watching every minute in total fascination. Well, habits are hard to break, vices even worse, and I still do the same – when I'm home, that is...

I wake up, buy bread, eggs, bacon (you get the gist). But now, thanks to my DVR and F1 app, I sit there sipping my coffee *not* waiting patiently for the start! This is 2014, so I record the race at whatever ungodly hour it's on, then fast forward to the start. This, of course, causes domestic ructions...

I've read the news (Racer.com, obviously), done my research and I'm fully up to speed, so now I just want to see cars go around.

My wife, who's also a racing fan (lucky me), did none of this and wants to watch all the buildup, in stark contrast to yours truly. So, to maintain marital harmony, I go back to my other passion, the stove, while she's immersed in the "sensational" stories.

Then, finally, the time has come!

My own feeding frenzy taken care of, I ensure the lady is gastronomically served, too, and sink into the sofa to enjoy the next few hours beside my wife.

Start, exciting; first few laps, intriguing and exciting. I shout a little, swear some... Watching two screens simultaneously, I go into a pattern of explaining to everyone what's happening and what's about to happen, criticizing everyone's every move (obviously), analyzing lap times, driving styles – "This is why Lewis is using 2.3 percent less fuel than Nico" – and the progression of the race in minute detail. Yawning seems to be a common reaction by those around me...

My wife politely ignores me, and her attention drifts away until the very end, when it fully peaks again, the cars stopping, drivers getting out, podium, interviews, etc.

I, conversely, now take the opportunity to clear up breakfast, and start thinking and preparing for lunch! After all, what else is one to do on a lazy Sunday?

"I'm analyzing the progression of the race in minute detail. Yawning seems to be a common reaction by those around me..."

This pattern, with mild variations, has repeated itself in my household for decades and to me it gives you a glimpse into the enormous difficulty one has in deciphering how much technology is relevant in racing.

You're perhaps now wondering if I'm addicted to Irish coffee as a source of writing inspiration, and maybe overdosed on this occasion. So, let me expand...

If you look at my family – four of us, ranging from 1 7 to north of 40 – I'd say most of us are racing fans, but even among this fairly homogenous cultural sample, our reasons for liking racing and what grabs our attention are incredibly varied.

Charles Coates/LAT

STARTING POINT

Regardless of your level of interest in Formula 1, the start of a grand prix is exciting, right? But does it matter if the action is powered by hybrid-turbos or pushrod V8s? That's where the debate on relevance begins.

I LOVE SUNDAY MORNINGS

iStock photo

Sunday morning in the de Ferran household means a hearty breakfast, a comfy sofa and F1 on the TV – bliss. But Gil's long-held ritual did set him thinking about the relevance of technology in racing. No, really, it did...

A friend who said he couldn't understand the appeal of watching racing drove this home. He was interested while I was racing, but beyond this, saw no attraction in it at all.

Armed with so many contradicting observations (see above), I tried figuring out what role, if any, technology has in racing.

Clearly, it's a complex question, with potentially different answers for the different levels of our sport. So, let's first narrow down the range, then analyze the extremes within the chosen range.

OK, let's think of technology applied to the higher levels of the sport. Let's say F1, IndyCar, NASCAR and sports prototypes.

But even looking at this range, as should be obvious, the answer isn't immediately clear. So let's now think of some extremes.

Would fans really care if NASCAR Sprint Cup cars had highly-complex hybrid powertrains? I don't think they would.

Would fans really care if F1 cars had big displacement, pushrod V8s as propulsion? Me thinks it's likely to be yes.

Confusing? Well hold on and let's see if we can come to some sort of a conclusion.

I think that the level of technology applied to each series mostly depends on what that particular series stands for, the reasons for its existence, and what fans and competitors find appealing about it. In essence, what are its brand values?

For example, while I don't think the latest generation of F1 cars, with their complex and expensive power units, are any more appealing than the last, I do believe F1 must keep advancing to sustain its perceived value and brand to many fans and manufacturers.

A big danger in all of this – which, quite frankly, I'm very susceptible to – is to go down a road that we (the geeky insiders) think is *so* cool, but no one else, or at least the large majority, really cares.

If I had a remit to decide what technology should apply to any series, I'd be mindful of the series' brand (as mentioned), how the majority of its competitors would be able to cope (financially and operationally), and of the perception of current fans and competitors. But, perhaps more importantly, I'd be very mindful of potential new sectors of fans' likes, dislikes and desires. After all it's no secret that our beloved sport is struggling to attain growth.

I've already run out of space and we didn't even examine the question of technology very deeply! How about...

Are different technologies making the sport too perfect, clinical and, therefore, boring? Are we too good? Do we want to see more failures and errors, more humanity?

Should we regard technology in operations differently to tech in the cars?

Which technology is relevant? And to what and whom? And even if it *is* relevant, does it increase appeal? If so, to whom?

What is technology after all? Information technology? Materials? Engineering? And how can we forget what we already know will make us better? Is it right and effective to stop the application of such knowledge?

When my friends from *RACER* decide it's time for an incredibly boring, heavyweight dissertation on the subject, perhaps I can state my views on many of these questions.

In the mean time, Sunday mornings continue to be special.

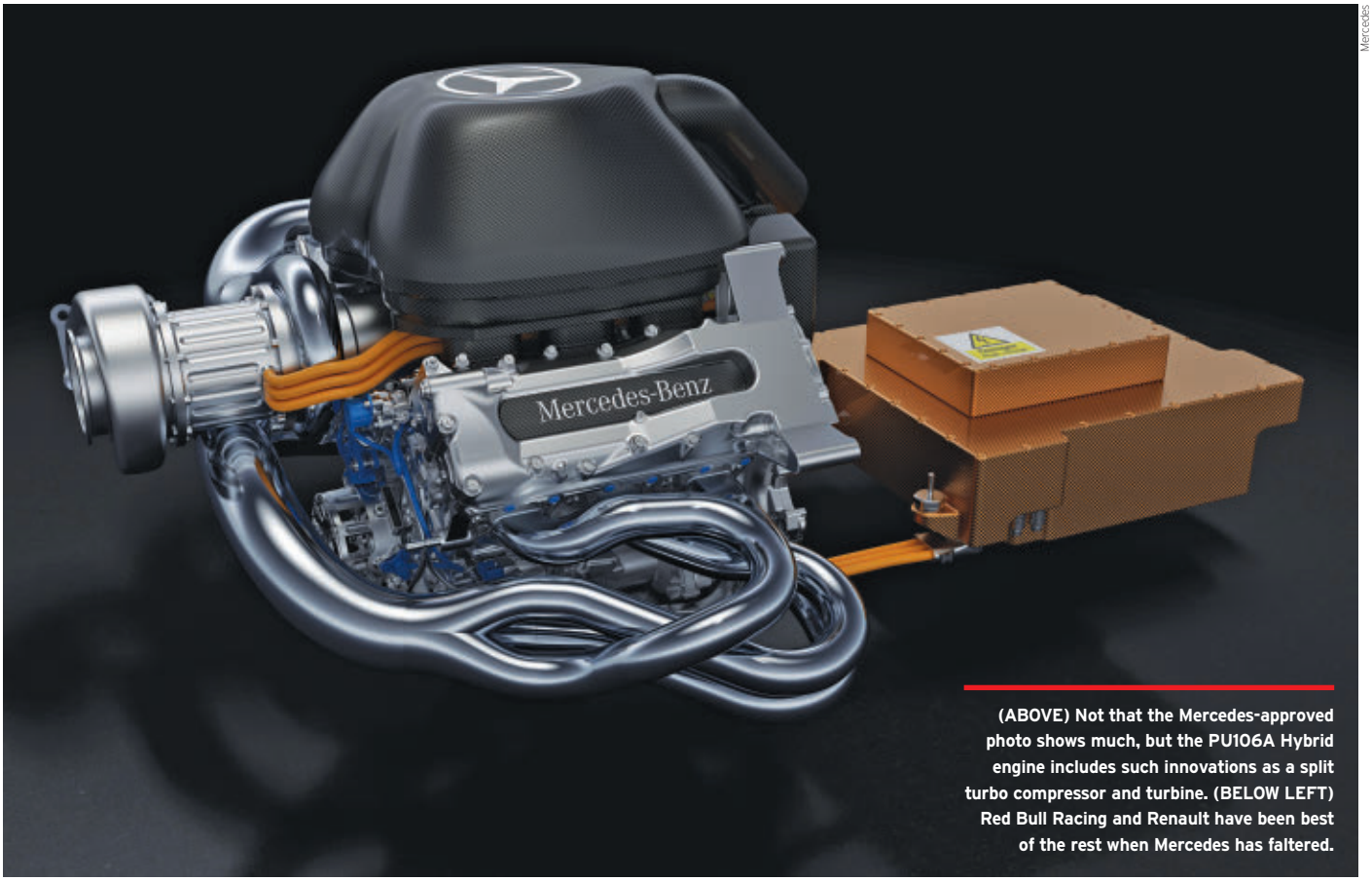
And now on to lunch! ■

WORDS Edd Straw
MAIN IMAGE Peter Clausen Film & TV/Red Bull

HYBRID HIERARCHY

Mercedes-Benz is top dog under Formula 1's new-for-2014 engine rules. So what did it do better than the rest, and how can it be caught?

Turbocharging made its F1 return in 2014, but that's only the start of it. Energy recovered from the engine exhaust and under braking provides a double hit of added power, too.



Mercedes

(ABOVE) Not that the Mercedes-approved photo shows much, but the PU106A Hybrid engine includes such innovations as a split turbo compressor and turbine. (BELOW LEFT) Red Bull Racing and Renault have been best of the rest when Mercedes has faltered.

An old war is being fought anew in Formula 1. For much of the first century of grand prix racing, engine performance was king. Then came the aerodynamic era, when the scramble for downforce was everything. But the introduction of the 1.6-liter, turbo-hybrid V6 power units in 2014 has brought it full circle. Once again, horsepower is the defining factor in F1's unforgiving meritocracy.

The new engines, which put out as much, if not more power than last year's engines when the full 160hp from the combined kinetic and heat energy recovery systems is being deployed (a figure of 800hp being a conservative estimate), but with way more torque, are currently frozen in specification. Yet performance has improved dramatically over the course of the season.

Mercedes' PU106A Hybrid engine has dominated, winning 13 of the first 16 races. with its rare defeats mostly self-inflicted. Racing in its shadow, the Renault Energy F1-2014 (three wins with Red Bull Racing) and Ferrari 059/3 (zero wins) power units have proven to be much of a muchness, with the French marque perhaps having the slight edge in the battle of the also-rans, particularly on the most power-hungry tracks.

Dean Mouhtaropoulos/Getty Images

"It's really about getting the maximum number of molecules into every kilogram of fuel"

ANDY HOLMES

The engine regulations are highly prescriptive. They must be 1.6-liter, single-turbo, 90-degree V6s, with a 15,000rpm maximum, an 80mm (3.15in) bore diameter, a race fuel limit of 100kg (220lb), a fuel flow limit of 100kg/hr (220lb/hr), and a 145kg (320lb) minimum weight, and that's just to name a few of the enforced similarities.

So, given such tight parameters, how can the Mercedes be so much better?

There are no magic bullets. Mercedes started earlier than the rest, so had the lead-time to make the most of its prodigious resources. Innovative ideas such as having the turbocharger's compressor and turbine at opposite ends of the engine and linked by a shaft through the vee, instead of packaged together, bring obvious advantages but take time to execute – time Mercedes gained by starting early. It's exaggerating to say this is the trick that has made all the difference, but it confers packaging and multiple performance benefits (notably, reduced turbo lag). Gains made in a multitude of areas, even marginal ones, can add up to a huge advantage.

And it's not just about the engine itself, it's also about the twin energy recovery systems making up the ERS. Mercedes also had an advantage here, with the project effectively expanding on the in-house work done on the previous generation KERS.

"There's three sources of energy," says Mercedes engine chief Andy Cowell. "One is the combustion of the internal combustion engine, then there's the exhaust energy, and then there's the kinetic energy, The second one is an integral part of it."

The design and operation of that Motor generator Unit-Heat (MGU-H), which harvests energy from a turbine spun by exhaust gases, and which can itself be >

Steve Etherington/LAT

ANDY COWELL

Like many UK-born Formula 1 engine specialists, Cowell honed his chops at Cosworth Racing, working on the CK engine that powered the 1999 Stewart-Ford, among other projects. He joined Mercedes-Benz (now Mercedes AMG) High Performance Engines in 2005, becoming managing director at its Brixworth, UK, base in 2013.

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Steve Etherington/LAT

(ABOVE) Mercedes has been the dominant force under the new-for-2014 rules. (BELOW) Ferrari's Fernando Alonso is poised to throw his lot in with McLaren and 2015 returnee Honda.

Andrew Hone/LAT

"A small, highly-turbocharged race engine with a big, single turbo is going to be horrible to drive"

ROB WHITE

powered to spin the turbo, is essential. And this is where Mercedes has excelled.

The other key area is fuel. Petronas has done a superb job optimizing the fuel to maximize power and detonation resistance – key in turbo engine performance – as well as delivering the required efficiency.

"Fuel economy is very important," explains Petronas director of research and technology Andy Holmes. "It's really about getting the maximum number of molecules into every kilogram of fuel. But it goes further than that. We have direct-injection engines and there are some components we'd like to use in terms of the molecules of the fuel that are more likely to create deposits in the injectors, which hinders efficiency. We have to balance it, molecule by molecule, to get the maximum density *and* the injector compatibility."

Then there is lubrication. Not only do you want to minimize the friction in the system, but Petronas has also produced an oil that, at high temperatures, expands to give more protection when the engine is under more extreme conditions.

The other key area of development is software. This touches every part of the engine and, in conjunction with ever-improving fuels, is what has allowed engine performance and, crucially, drivability to increase significantly over the season.

"A small, highly-turbocharged engine with a big, single turbo is going to be horrible to drive," explains Renault Sport F1's Rob White. "But when it all works correctly, the drivers feel these engines are good to drive because torque delivery is instant, and that's because the software concocts a method to deliver the torque that the driver needs.

"The next thing is optimizing around a lap. That comes down to operating the different sub-systems of the power unit in a way that allows the driver to get the most out of the car. So in the phases when we are power-limited, the task is to deploy the different elements of the power unit In a way that makes the elapsed time to cover that specific distance the smallest possible. The scheduling of the power and energy delivery during this phase is one of the things you can optimize."

Steven Tee/LAT

ROB WHITE

Another Cosworth Racing alumni, White initially worked on the company's CART program, before switching to F1 in 1997. He joined Renault F1 in 2003 as engine technical director, moving to its Viry-Chatillon base in 2005 to take over from Bernard Dudot as deputy managing director, engine operations.

On top of doing its design work better than the rest, Mercedes was also ahead of the game in terms of operation, partly down to investing in a state-of-the-art dynamic rig that allowed the engine to do more realistic dyno miles, while Renault and Ferrari used less complex setups.

But things will change in 2015. For over the winter, there is an opportunity to make big changes to each engine design.

The engine is split into 42 components. These range from the crankshaft, to oil scavenge systems, to pistons. All of these elements are frozen for the season, save for a regulation that allows manufacturers to apply for dispensation to make changes for reasons of reliability, safety or cost-saving. All three manufacturers have been given the FIA's permission to make such modifications this year.

Performance upgrades can only be made in the off-season, although there >

Unlike the ageing 2.4-liter V8s they replaced, the 1.6-liter V6 turbo-hybrids introduced into F1 can have real relevance to the street cars manufacturers such as Mercedes build.

MAKING F1 MATTER AGAIN

THE RELEVANCY QUESTION

The new breed of hybrid power units allow Formula 1 to be a vehicle for technology transfer once again.

For a major automotive manufacturer to sign off an engine project for Formula 1's latest regulations, requiring a spend of around $200 million per year for the early seasons, a serious return on investment is required. Marketing plays a big part in justifying this expenditure, but technology transfer is another way that it can pay its way, even if the engine isn't winning.

A major motivation for F1 abandoning the normally-aspirated 2.4-liter V8s used from 2006-'13 was to make it more road-car relevant. Without the potential for the transfer of technology, the fear was it would be increasingly difficult for those already in grand prix racing to continue to spend money on it. As for enticing new manufacturers? Forget it.

Only one engine supplier gets to power the champion, so there has to be more to it than "just" winning. But technology transfer and road relevance are vague phrases. You aren't going to be driving a street car powered by an engine taken out of the back of Lewis Hamilton's Mercedes any time soon. But tech transfer isn't really about that.

Yes, design concepts and engineering solutions can be ported over, but much of it is about sharing information, ideas, approaches, materials. Motorsport is a hothouse for new ideas with potential applications, and that applies to working practices and ways of thinking as much as hardware. There's no way to know the specific benefits an F1 project will have for an auto maker's road cars in the future, but there will be some, given the technology now being developed in F1.

"The heat recovery technology used in F1 can be transferred into street cars, for example," explains Honda F1 boss Yasuhisa Arai. "It's a technology that fascinates us and we want to challenge ourselves with."

This potential for technology transfer certainly played a key role in persuading Honda to return, and Mercedes and Renault to stay on. But the bigger picture can't be ignored. F1 *had* to be seen to be more road relevant simply because road cars are becoming more environmentally conscious.

Don't underestimate the totemic value of these energy-efficient power units. They won't change the world in and of themselves, but they have dragged F1 into the present, which is where it must be if it is to remain cutting-edge technologically and a worthwhile investment for auto makers.

Mercedes

GOING THE OTHER WAY...

Tech transfer is a two-way street. Mercedes applies the same Nanoslide low-friction coatings to its F1 engine (ABOVE) that it first developed for road cars, for example.

Mercedes


Charles Coates/LAT

"The trick is to work out which are the most profitable engine changes in terms of performance"

ROB WHITE

are discussions that might allow changes to be made in-season in the future with the same technical limits that govern the freeze. The number of changes permitted diminishes each year until 2019. A token system is used to regulate this. Each of the 42 components is awarded a weighting of between one and three, which equates to tokens. For 2015, changes worth 32 tokens are permitted.

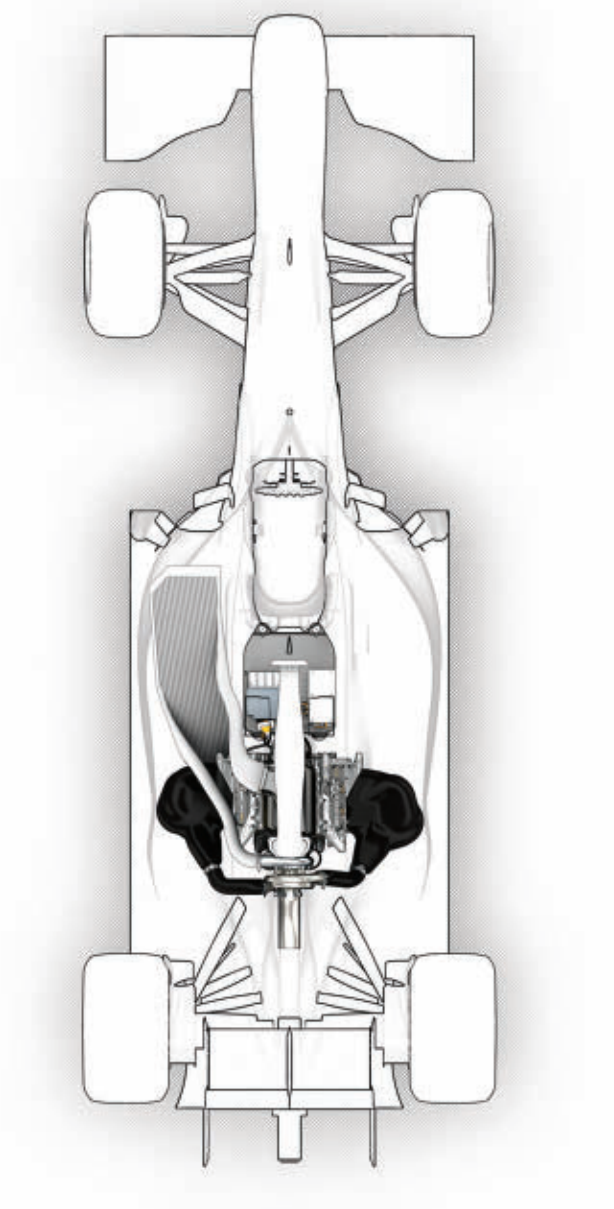
However, several components are already frozen permanently. These are (deep breath...) the upper/lower crankcase cylinder bore spacing, deck height, bank stagger, air valve system, crank throw, main bearing journal diameter and the rod bearing journal diameter of the crankshaft. Everything else, 92.5 percent of the engine, is *potentially* changeable, and 32 tokens equate to a total of 48 percent that can *actually* be changed this winter. It's up to each manufacturer as to which 48 percent that will be. So, if Renault or Ferrari want to emulate Mercedes in splitting the turbo compressor and turbine, they can – it'll just mean using some of those tokens.

"The trick is to work out which are the most profitable changes in terms of performance," says White. "It's a matter of ranking where the opportunities might lie, then starting work on the developments needed in order to decide whether to confirm or amend the plan. There's enough scope for substantial change."

In the coming years, a sliding scale gradually freezes more of the engine and allows fewer changes to the point where, in 2019 and '20, only the ERS wiring loom, engine-mounted electrical components and the pressure charging system from the exhaust flanges to turbine inlet are free. In effect, that's a total freeze. New manufacturers can join the process along the way, but are bound by identical constraints (see sidebar).

So Ferrari and Renault will both improve. But Mercedes is also making improvements, and its 2015 engine package is known to be more powerful. It's a fast-moving target, and one source close to Renault suggested that, even with all the changes, a realistic target is only to halve the gap to Mercedes this winter.

But these engines are only in year one. With the prodigious financial, technical and intellectual resources in F1, there is still a lot to come from them in the seasons ahead. ■



Renault (ABOVE) has some tough calls on which parts to change this winter. (TOP) With the technology still new, even Mercedes has its bad days...

ENGINE FREEZE PROGRESSION

For 2015, a manufacturer can change 48.5% of its '14 power unit. But only 92.5% of the parts are eligible to be changed. After that, both percentages fall each year.

YEAR	OPEN	CHANGEABLE
2015	92.5%	48.5%
2016	77%	38%
2017	77%	30%
2018	65%	23%
2019	5%	5%
2020	5%	5%


Charles Coates/LAT

2015: HONDA IS BACK

PLAYING CATCH-UP OR PLAYING IT COOL?

There's a difference between being late to the party and being fashionably tardy. But which one is Honda, which returns to F1 after a six-season absence next year for the *second* year of the new engine rules?

The Japanese auto maker, winner of a combined total of 11 constructors' and drivers' titles, returns to F1 with old ally McLaren to win. But even Yasuhisa Arai (ABOVE), who heads the project, admits that "we have both advantages and disadvantages" from the late start.

There's more time for research and development and the chance to study what Mercedes, Ferrari and Renault have been doing. But Honda cannot test in anything even vaguely resembling an F1 car before the end of this season and, given the timescale, there's a limit to how much of what it learned from watching the rest can be incorporated into its 2015 power unit.

Results will dictate whether Honda's approach is the right one. But, realistically, winning from the outset would be a sensational achievement. And the grapevine suggests Honda has some way to go. In just two-thirds of a season, the current manufacturers have made huge strides with software improvements. Dyno work can only substitute for some of that experience.

And if Honda does lag behind, only 77 percent of its power unit design isn't locked by the engine freeze for its second year in 2016, as opposed to just over 92 percent that the current engine makers are permitted to change in '15, meaning catching up will be harder.

But...never underestimate Honda.


Honda

Honda, which recently released an image of its 2015 V6 (ABOVE), has had a year to observe what its opposition has done so far.

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DRIVING THE NEW BREED

For the drivers, just like for the teams, adapting to the 2014 Formula 1 power units is a work in progress. But, as they point out, it's the same for everybody.

WORDS Edd Straw
MAIN IMAGE Andrew Hone/LAT

Driving the new breed of Formula 1 cars is not easy. While it might be less of a physical challenge than it once was, the combination of massively increased torque and reduced downforce means that 2014 cars are more tail happy than in recent years. Previously, it was possible to stamp on the throttle with the peaky, superseded 2.4-liter V8s, but drivers now need a more cultured right foot.

And for all the progress that's been made with making the engines more drivable, the power delivery less savage, that's a characteristic that's likely to be here to stay. Asking Fernando Alonso in Singapore whether the behavior of the Ferrari engine in 2014 is anything like it was the previous year elicits a laugh.

"No, it's very different," he explains. "We have a lot of torque this year, so whatever you can do to improve the delivery, you're moving in the right direction. But the torque is there and it will always be there.

"It's a little bit more complex going out of long-exit corners; they are more tricky compared to last year. The blowing exhaust effect was a big help for that, because we picked up a lot of downforce on the power. The cars are moving more, the tires are harder than last year, so it's more difficult and it's slower, too. But it's the same for everybody."

The power delivery is the most obvious change. But as well as the huge complexity of operating the power units, which requires drivers to make constant

changes to settings via the steering wheel, other factors have forced them to adapt their styles, too. Early in the season, the rear brake-by-wire system created significant problems for many teams. And even now, squads such as Lotus are still grappling with it.

The electronic, rather than mechanical link between the brake pedal and engine is necessitated by the impact of harvesting so much energy for the ERS under braking. The brake-by-wire technology makes millisecond-to-millisecond adjustments to brake bias, without which the car would be undrivable. Just as with a Formula E car, where engaging "re-gen" offers a clear braking effect, the ERS is now part of the braking system of an F1 car. And its impact is greater than that of conventional engine braking.


Steve Etherington/LAT

GENTLE ON THE THROTTLE

Based on FOM-supplied fuel consumption data, Lewis Hamilton appears to have the edge on conserving gas over his Mercedes teammate Nico Rosberg (ABOVE) – as much as 2-3 percent at some grands prix.

"In terms of overall feeling for the driver, there are cross-effects between a lot of the power unit elements," explains Red Bull Racing's Sebastian Vettel (LEFT). "It's not just where you are on power, but also when you hit the brakes that determines how the car behaves. The brake-by-wire system is new, so tuning it is obviously a lot of work."

For those drivers who have a well-sorted system, the feel isn't so different. Some have complained that the initial bite of the brake pedal isn't quite as positive as it once was, but ultimately what dictates braking performance is how well the software is set up. Clearly, to maximize the amount of energy harvested, the brake bias is wound back more than you'd normally expect. But the Motor Generator Unit-Kinetic (MGU-K) is only allowed to recover a maximum of 2mJ per lap, so the effect on braking is variable.

The other significant factor is the need to ensure that the full race distance is completed using only 100kg (220lbs) of fuel. Earlier in the season, there were complaints about drivers having to cruise to get to the end of the race, triggering the infamous "taxi driver" jibe from now ex-Ferrari supremo Luca di Montezemolo.

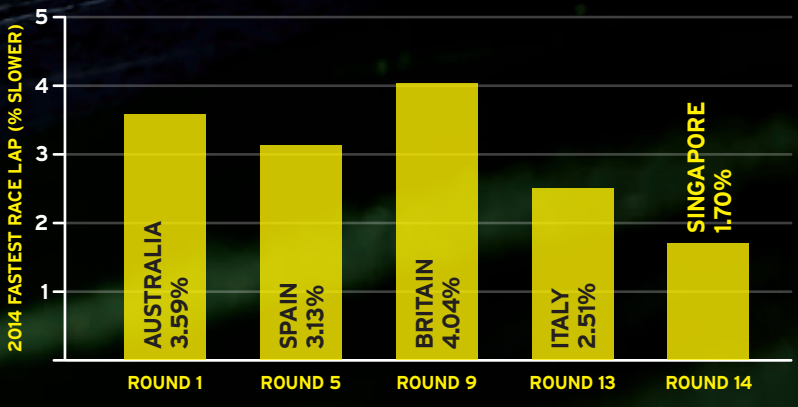
Mercedes, in particular, has made light of such concerns. As early as the second race of the season, in Malaysia, customer team Williams was able to start the race with less than 100kg to save weight without paying a serious price. Partly, this is down to the efficiency of the engine package, particularly the way that the Motor Generator Unit-Heat (MGU-H) power is used, but it's also because things aren't as critical as many feared.

"The fuel has had no significant impact on racing," says Mercedes driver Nico Rosberg. "It's straightforward and very similar to past years, where we always tried to start the race with less fuel because it's better for race performance."

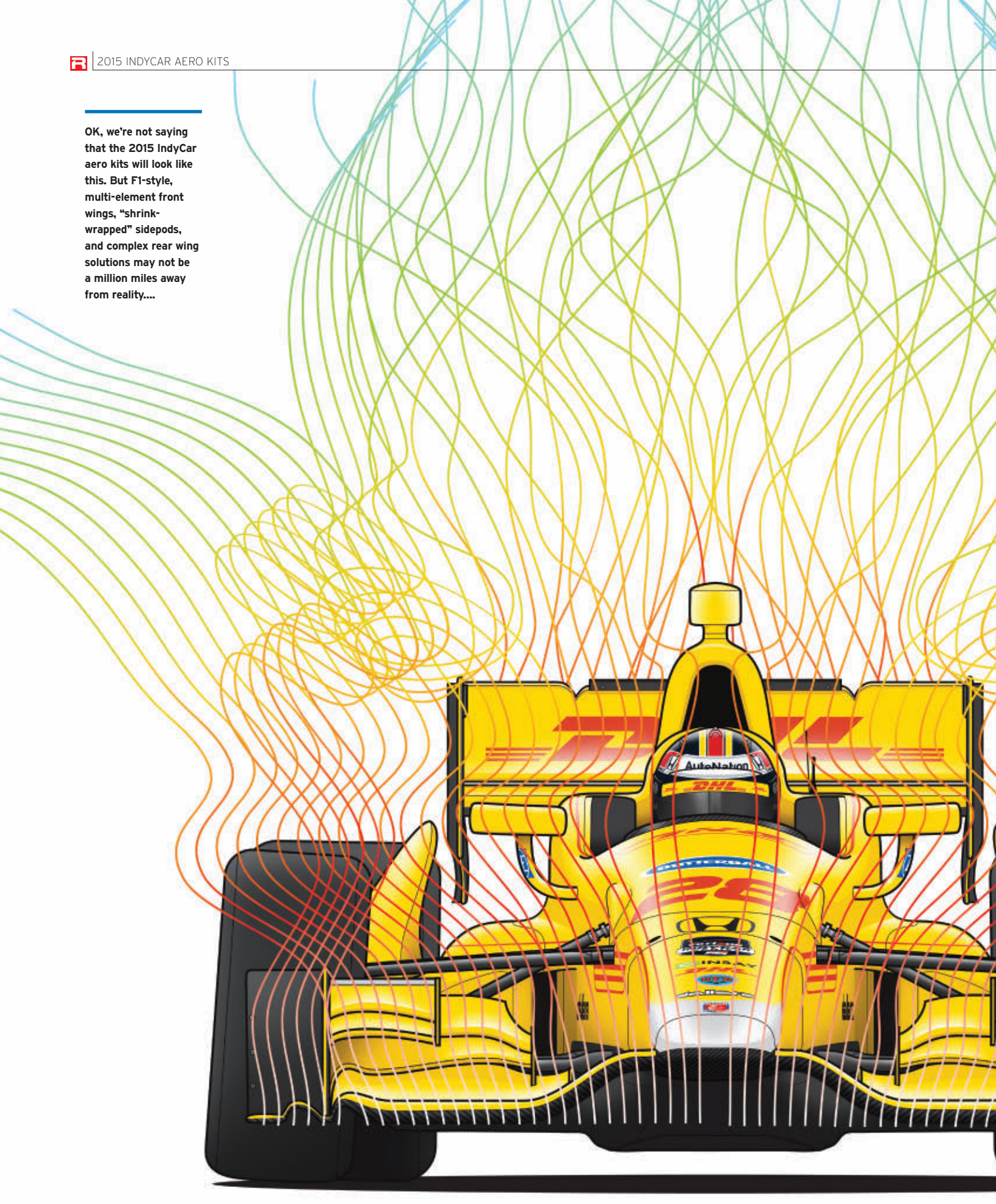
When the power units are running smoothly, thanks to the instant power delivery achievable through using the MGU-H to spin up the turbo to avoid lag, drivers find them responsive and good to drive. The complaints usually only begin when things start to go wrong... ■

SLOWER FOR NOW, BUT GETTING QUICKER...

As expected, the performance deficit of the 2014 power units relative to the old 2.4-liter V8s is reducing as the packages are honed. Comparing race fastest laps, a 3.59 percent deficit in Melbourne had reduced to 1.7 for the Singapore GP, two-thirds of the way through the season. Silverstone's British GP was an anomaly in the trend, but mostly down to winner Lewis Hamilton's ability to cruise after Mercedes teammate Nico Rosberg posted a DNF.



OK, we're not saying that the 2015 IndyCar aero kits will look like this. But F1-style, multi-element front wings, "shrink-wrapped" sidepods, and complex rear wing solutions may not be a million miles away from reality....



WORDS Marshall Pruett | ILLUSTRATION Paul Laguette

THINKING INSIDE THE BOX

It isn't quite "anything goes," but the freedom afforded to IndyCar's manufacturers in designing their 2015 aero kits should make for more distinctive – and *way* faster – racecars.

If you've been waiting with the patience of a saint for innovation to make its long-awaited return to IndyCar racing, your prayers could be answered next season. Even the most optimistic open-wheel fan would concede years of stagnant-spec designs have tainted a series that was once a beacon for ingenuity. Yet, with aero kits on the way in a matter of months, the Verizon IndyCar Series is finally ready to relegate its cookie-cutter reputation to the history books.

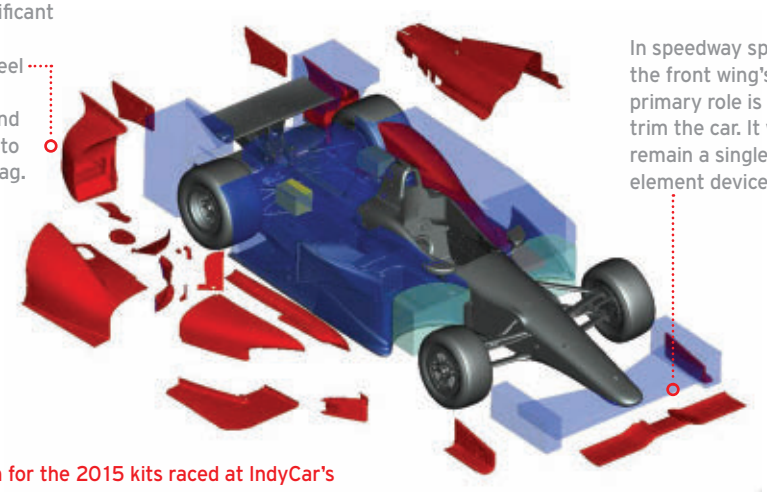
Initially proposed by the series in 2010, it took until last year's Indy 500 for aero kits to finally receive the green light for '15. But with current engine manufacturers Chevrolet and Honda fully committed to the radical aerodynamic redesigns of their choosing, IndyCar enthusiasts could see the greatest year-to-year visual change since wings first appeared at the Brickyard in 1969.

Based on the early concepts pitched by the series, the introduction of aero kits was initially more of a branding exercise than an outlet for aerodynamic creativity. Years of stop/start haggling over the topic saw the idea eventually morph into something closer to a purebred engineering challenge, and by the time Chevy and Honda began their CAD work, drag losses and downforce gains were all that mattered. Which is how it should be, surely?

The crux of the final aero kit rules involves open and closed regions defined on the existing Dallara DW12 chassis – a series of boxes with specific dimensions to work within – where manufacturers are allowed to let their inner Bernoullis and Jackson Pollocks run wild.

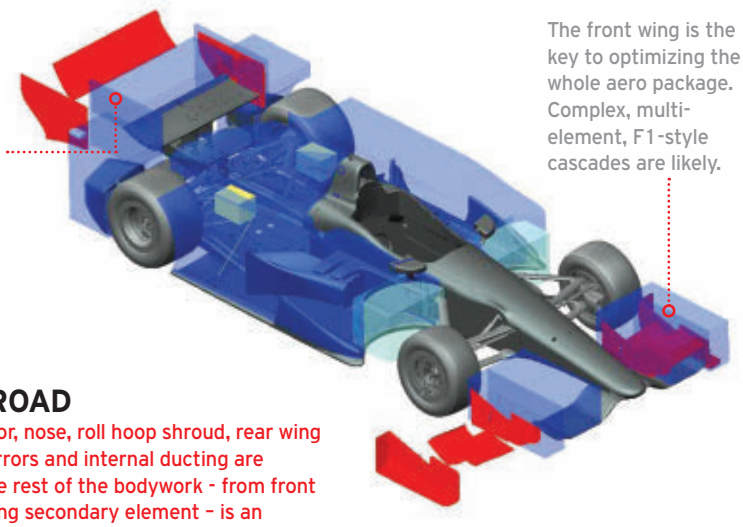
In lieu of using Dallara's "default" bodywork, engine manufacturers have exceptional freedom to go miles beyond the simple like-for-like panel replacement that the series intended back in 2010, when it first announced its gameplan for the next-gen IndyCar. Given the freedom afforded by the new, wide-open boxes, aero kit designers have been frenetically (and secretively) filling those various zones in a race to win the high-downforce war.

Formula 1-style cascade front wings, turning vanes, flow conditioners and an endless array of flicks and aero appendages should dominate the base Dallara from front to back on short ovals and road/street courses. The opposite is expected in speedway trim, where Chevy and Honda have been waiting for the opportunity to solve the limitations >



OVAL

A prime aim for the 2015 kits raced at IndyCar's big speedways will be drag reduction. The baseline Dallara DW12 is a "draggy" car, so expect to see "shrink-wrapped" bodywork and a reduced frontal area for the oval package.



STREET/ROAD

The DW12's floor, nose, roll hoop shroud, rear wing main plane, mirrors and internal ducting are unchanged. The rest of the bodywork - from front wing to rear wing secondary element – is an aerodynamicist's dream scenario, bound only by a series of imaginary boxes of fixed dimensions.

of the draggy DW12 package.

For the first time since the current car was introduced in 2012, there will be visual differences between the series' competing brands, and the motivations behind venturing down this costly rabbit hole have been universal.

"With how the rules were ultimately written, there's a big competitive advantage to creating an aero kit," says IndyCar president of competition Derrick Walker, "and, inversely, a disadvantage to not having one of your own. But the initial concept of an aero kit was to have individual shaped cars that added some branding possibilities for engine manufacturers. We've since moved beyond that basic idea. Along with their engines, those manufacturers have two big opportunities to influence performance."

"Along with their engines, those manufacturers have two big opportunities to influence performance"

DERRICK WALKER

Finding real-world relevance in any open-wheel series is a challenge, but aside from the PR value of draping an Indy car in bespoke bodywork, GM Racing Director Mark Kent says there's production-based benefits in the exercise, too.

"Frankly, we've already received a benefit from it," he says. "We've hired some talented people from Formula 1 – folks with advanced model-making experience, and people with design and simulation backgrounds from that paddock – and it has already filtered down to our Corvette Racing program. From there, that knowledge has made its way to making an impact on some of the things we're doing on the production side."

Most fans have a decent understanding of the effort and financial resources needed to create a brand-new IndyCar

CREEPING UP ON 237...

ON TARGET FOR THE INDY RECORD

IndyCar's competition and technical gurus, Derrick Walker and Will Phillips, outlined the series' intentions to increase speed and technology in the coming years during a presentation at Detroit in June of 2013. A little over a year later, based on the early targets, the project seems headed in the right direction.

The first benchmark cited by IndyCar was an increase of lap speeds at Indianapolis to 232mph by 2014, and Schmidt Peterson Motorsports' Mikhail Aleshin obliged, posting the fastest lap of the month at 232.917mph with a tow in his Dallara-Honda DW12.

The Detroit presentation came two weeks after Ed Carpenter earned the 2013 Indy 500 pole with a four-lap average of 228.762mph in his ECR Dallara-Chevy. And while he fell short of the 232mph mark on the way to the 2014 pole, averaging just 231.067, that did represent a 2.3mph year-on-year increase in single-car speed, thanks to the numerous off-season engine upgrades and re-homologated components permitted by IndyCar.


IMS archive

Arie Luyendyk's 237.498mph lap posted in qualifying for the 1996 Indy 500 remains the benchmark for IndyCar to aim for.

Aero kits are the primary item listed for Indy's projected speed increase for 2015, with laps of 235mph intended to come from significant drag reduction efforts by Chevy and Honda. Excessive drag has plagued the baseline DW12 at speedways since it began testing in 2011, forcing IndyCar to allow extra turbo boost to bring lap speeds up to levels achieved by the car's predecessor.

engine, but when it comes to something as nuanced and unfamiliar as aero kits, costs and value are hard to define.

And at a series-mandated purchase price of $75,000 per kit, it definitely won't be a profit-making endeavor for the manufacturers. "It ain't cheap," says Chevy's IndyCar program manager Chris Berube. "I won't say how much, but it's millions."

"It's not just, 'We'll put a Chevy or a Honda logo on the side of the car and we'll say it's an aero kit,'" adds Walker. "There is real engineering going on, and that's a considerable investment. It's thousands of hours of work just to create the final design. It's going back to when Indy cars were continually evolving. And once the first kits appear, there will be more development until they're homologated. It's a big undertaking."

The giant workload was spawned by IndyCar's thin aero-kit rulebook. The new-for-2015 floor from Dallara (which induces a 300lb downforce reduction), nose, shock cover, mirrors, roll hoop shroud, internal ducting and rear wing main plane are the only significant bodywork items that cannot be modified.

From the current car, it leaves everything that attaches to the nose, all that mounts to the primary rear-wing element, the sidepods, engine cover and rear wheel >

Chris Owens/IMS Photo

(BELOW) Detroit 2013: IndyCar's president of competition, Derrick Walker, lays out the framework for IndyCar's introduction of manufacturer-designed aero kits.

Using Carpenter's pole speed progression as a baseline, the next significant engine performance upgrade comes in 2016, meaning that aero kit manufacturers will need to find 3.9mph through efficiencies to meet IndyCar's desired goal for 2015.

The series wants to hit 237mph in 2017 through more power and tire development, and the process could start anew in 2018 when the successor for the DW12 is expected to be introduced.

Phillip Abbott/LAT

Ed Carpenter celebrates winning the 2014 Indy 500 pole. His average speed over four laps was 231.067mph.

Michael Levitt/LAT

SHARING THE LOAD

Chevrolet's 2015 IndyCar aero kits are being designed and developed in conjunction with its long-time racing technology partner, Pratt & Miller.

BEHIND CLOSED DOORS

NOT SHOWING THEIR HANDS

IndyCar has established a defined schedule for aero kit testing, homologation and introduction – although the manufacturers have been afforded an exceptional amount of leeway to keep their prized shapes hidden from the competition.

Where spy shots of their respective engines would tell only part of the tale, photos of the Chevrolet or Honda aero kit captured during pre-homologation testing would give both sides time to model and possibly steal ideas, leading to a virtual and real-world lockdown until the last possible moment.

"We're in no rush to let our work be seen," says Honda Performance Development VP Steve Eriksen.

Oct. 6 was the official opening day for on-track aero kit testing, and it came after thousands of miles completed by drivers secreted away on simulators. Manufacturers have until Jan. 17, 2015, to complete six days of their choosing with the aero kit prototypes, and must submit all parts for homologation by the 18th.

Benchmarking both aero kits will take place in the digital realm before IndyCar can gauge their relative performance on the race track.

"We've started with sims and await more numbers to be able to compare them; manufacturers are required to provide IndyCar with their performance estimates and IndyCar will attend the manufacturer tests and gather data," says IndyCar president of competition Derrick Walker. "Lastly, we may well do a full-size wind tunnel test to see for ourselves."

The question of when fans will get their first chance to see images of aero kits is still under negotiation between Chevy, Honda and the series.

"If it's agreed upon by the manufacturers, I've asked our media department to work with the manufacturers to try and facilitate something for the fans to see where we are heading," says Walker.

Pratt & Miller, makers of Chevy's aero kit, and Wirth Research, which leads Honda's project in collaboration with HPD, will have very little time to produce their wares with a March 1 delivery date. IndyCar's Spring Training will take place beginning March 16 at Barber Motorsports Park, where both kits will share the track for the first time. Two weeks later, the race debut for aero kits will be St. Pete, March 30.

Michael Levitt/LAT

WIRTH THE WAIT

Similar to recent collaborations on LMP1 and P2 sports car designs, HPD is working with Wirth Research on its 2015 IndyCar aero kits. Wirth's emphasis on virtual design seems well suited to the challenge.

Glenn Dunbar/LAT

The complex, multi-element front wing cascades on Fernando Alonso's Ferrari F14T Formula 1 car give a hint on the complexity of the aero solutions we may see in IndyCar in 2015.

guard (aka "Kardashians") open for new interpretations. With all that real estate manufacturers can now shape to their own ends, IndyCar's fielded some probing design questions from Chevy and Honda.

"We've had some interesting inquiries from both manufacturers about how they see certain things fitting into their boxes," Walker admits. "It's such a departure from what's currently done that the boundaries are being found by pushing against them and having us say where to stop."

Aero kits have become just as much of a packaging exercise, courtesy of low-line engine covers and form-fitting sidepods, as an experiment to see how many extra items can be created to assist performance. There's no telling how many widgets and winglets will be contained in each kit, but Walker expects manufacturers to stuff their virtual boxes until they are full.

"It's simpler for the fans to look at a current car and try to imagine which panels could change," he says, "but that's only half the job. In reality, whatever shape you want, it's just got to fit inside a space no bigger than this imaginary box with its set dimensions. Whatever creativity you can punch into this area, knock yourself out. I think it's the best approach."

A somewhat late decision to replace the standard DW12 floor with the lower downforce design for 2015 added more work for manufacturers, although its introduction wasn't wholly unexpected.

"We have no desire, unlike some other racing series, to get into the performance balancing business"

DERRICK WALKER

"They were made aware about a year and a half ago in Detroit, when we said we were going to try and reduce the surface area under the racecar," says Walker. "But once we went ahead with it, it did set them back somewhat. Compared to what we've had, there are changes to the center of pressure and there's less downforce, and the first thing they'll try to do is get as much of that back as possible. It's going back and remodelling and reworking things around the new floor."

Converting the cars between slick speedway configuration and the higher-downforce packages used elsewhere will be similar to current practice, with teams adding or removing the approved pieces for each type of track. And once aero kits debut in competition at St. Petersburg next year, teams and manufacturers can look forward to a continuation of IndyCar's hands-off approach to performance disparities.

"We have no desire, unlike some other racing series, to get into the performance balancing business," Walker exclaims. "That's a very alien thought in IndyCar. However, if there's a real mismatch and you've got one manufacturer completely out to lunch, we wouldn't stand by and watch half the field suffer. They might as well stay at home, so we'd have to see how to get them close without going too far."

Predicting the actual performance gains aero kits will offer from the streets of St. Pete to the 2-mile superspeedway at Auto Club Speedway is impossible at this point, but the defending Indy 500 winner has seen numbers from simulation programs that suggest records will fall. >

Reducing the size of the Dallara DW12's floor will bleed away around 300lbs of downforce. The reduction has been achieved by removing floor area either side of the driver (LEFT).

THE NEXT-GEN INDYCAR

THINKING AHEAD

If all goes to plan, a new IndyCar chassis will debut in 2018. Preliminary conceptualizing is already under way.

The road to creating the next Indy car has been defined by IndyCar's competition group, and with three seasons left to run on the Dallara DW12 chassis and 2.2-liter turbocharged V6 formula, Derrick Walker intends to spend a full year developing the concept with input from his paddock.

"When you back up from 2018, certainly within the next 12 months we have to be thinking and developing a plan that says, 'This is what we're going to do, this is where we're going with the sport,' and build it into the new car and engine," says Walker. "That's the timeframe for change.

"We introduced the concept to the owners so they can think about the future of their current cars, and how we should go about building the next car – call it the DW18 chassis, *per se* – what it will be and what new things we should consider."

By starting the process in 2014, Walker will have more than enough time to shape the DW18's performance, safety, powertrain options and possible areas of innovation.

"We proposed to the team owners – just food for thought because it wasn't an official proposal in any way – that we would take one year to actually evolve the options or ideas for them to consider," Walker explains "If they endorse it or wish to see it implemented in some form, then from there we'd start developing and eventually end up with a new car on track in '18."

Walker's reference to the new car as a DW18 isn't a nod to Dallara being the automatic choice to build it. But the shrinking base of constructors with previous Indy car experience would seem to put the Italian firm in pole position. Swift's motorsports interests have dwindled in recent years, leaving Multimatic, which took over Lola, as the only other firm that possibly fits the criteria.

The supply contract would need to be confirmed by late 2016 to have a prototype out and testing by the middle of '17, and while some adjustments to IndyCar's engine formula could be made, sweeping changes requiring brand-new motors might not fit the budget limitations faced by Chevy and Honda. However, augmenting the existing turbo V6s with hybrid ERS systems is a strong likelihood.

Scott LePage/LAT

SIX YEARS ON TRACK

After making its race debut in the 2012 IndyCar season-opener at St. Pete (ABOVE), the base Dallara DW12 chassis will have served six seasons by the time its planned replacement comes on stream in 2018.

For IndyCar president of competition Derrick Walker, the journey to a new racecar for 2018 starts right now.

Chris Jones

IMS Photo

IMS Photo

(ABOVE) Spec wing assemblies on the cars rolling off the haulers will be no more in 2015. Add in the engines, and Chevrolet (LEFT) and Honda get to battle on two fronts in IndyCar.

"Even the casual IndyCar fan will notice the visual differences between the cars, and they'll also see the speed increases," says Ryan Hunter-Reay. "We'll be breaking track records at just about every place we visit over the next few years. I'm not sure about [the 241mph all-time speed record] at Fontana, but we'll work towards breaking it at Indy." (See sidebar, page 46)

IndyCar's aero kits have evolved from a marketing ploy to a formidable engineering challenge for manufacturers to solve. Creating visual variety within a field of identical DW12s is icing on the proverbial cake, yet with wins and championships at stake, the primary objective for Chevy and Honda is clear.

"The kits will be much different than how the current car looks, but the manufacturers are only concerned about aerodynamic power and efficiency," Walker states. "Their whole mindset is driven by beating the other guy. I don't get the impression they're trying to design a pretty racecar. It's performance, performance, and more performance."

"There are interesting times ahead," adds Hunter-Reay, whose Andretti Autosport team is aligned with Honda. "These will be some of the biggest developments we've seen in quite a while. The best ideas usually win, and I hope Honda's on top. But, as you know, it's also down to the teams testing and refining those ideas.

"We'll be breaking track records at just about every place we visit over the next few years"

RYAN HUNTER-REAY

"We can make a big difference on our end, and I'm really excited that we get to develop new things and make the most out of something different – something that isn't the same old spec. Where we're headed reminds me a lot of my early days in Champ Car, and I've been waiting for this to return for a long time." ■

INDYCAR OVAL SAFETY

INVESTIGATING THE CANOPY QUESTION

IndyCar's multi-discipline racing is at the heart of what sets it apart from any other form of motorsports in the world. And in key instances – especially at the superspeedways – it also comes with an element of danger that surpasses anything found in Formula 1 or NASCAR.

In the buildup to the 2014 Auto Club Speedway finale, Schmidt Peterson Motorsports' Mikhail Aleshin was the latest IndyCar driver to be catapulted into the fence at more than 200mph. While the Russian rookie was fortunate to escape without any head injuries, Dan Wheldon's fatal accident at Las Vegas in 2011 was a tragic demonstration of the major flaw of open-cockpit racecars in such situations – namely, survivability is largely down to the angle and direction that the car impacts the fence.

The most obvious direction for IndyCar to go involves the use of canopies akin to something found on a fighter jet. The NHRA took the lead on this in 2012 by approving full canopies for its Top Fuel dragsters (BELOW), and they first appeared in '13 with units manufactured by Indianapolis-based composites firm Aerodine.

Phillip Abbott/LAT

IndyCar's Derrick Walker says canopies will be part of the next-gen Indy car, and will be investigated for use with the current Dallara DW12.

"It's been on my radar ever since I came to IndyCar," he reveals. "I've had discussions with Dallara about trying to design a partial canopy – not a fully-enclosed one, but a partial one that would serve as a deflector for any debris that comes at the driver. It's not a quick solution that's just around the corner, but we're asking Dallara to come up with options we can try in a simulator right now. And for the 2018 car, it's a given."

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The new, state-of-the-art Dallara IL-15 is coming in 2015 with a guaranteed three-race scholarship for the series champion, including the 2016 Indianapolis 500

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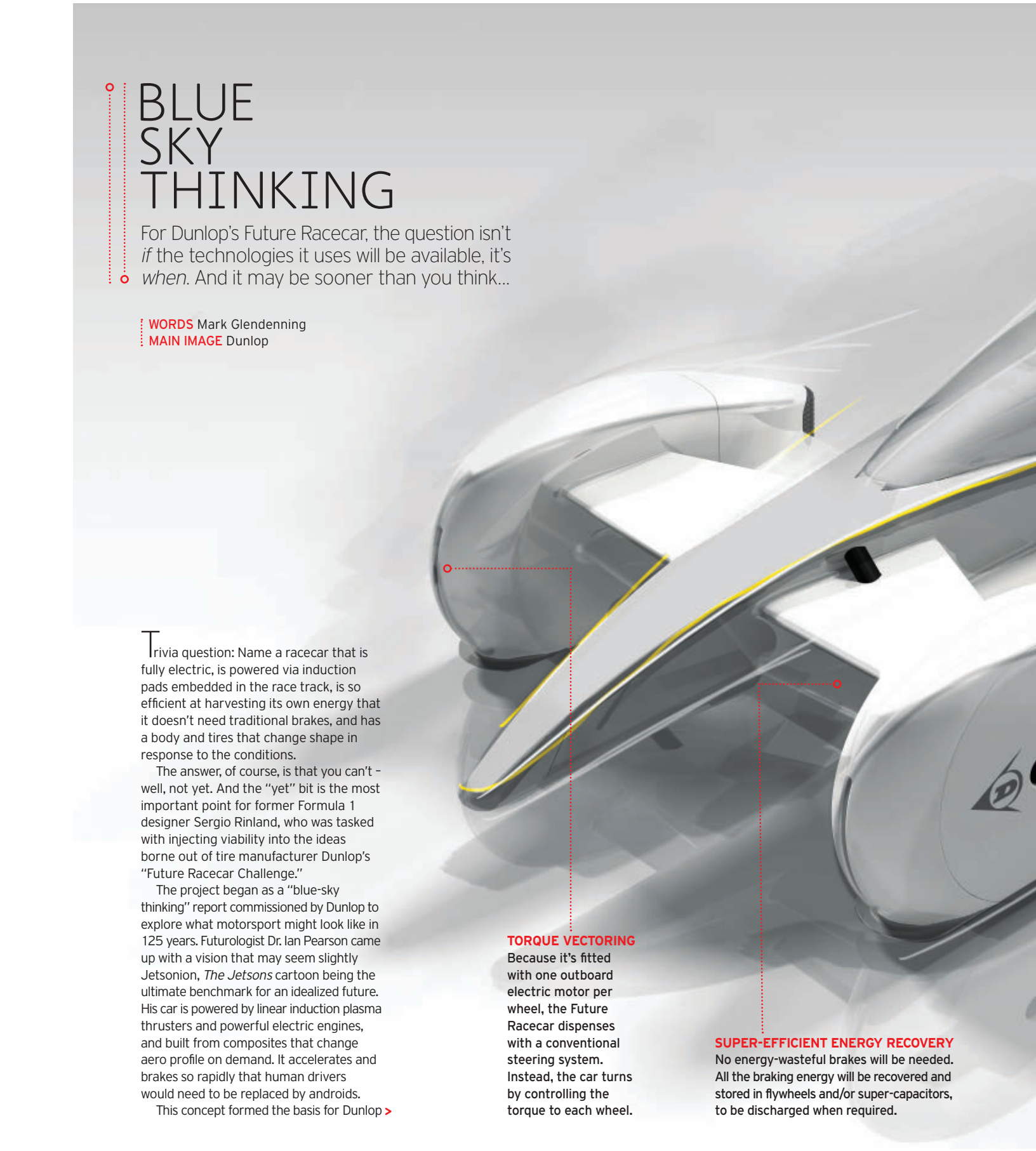
INDY LIGHTS PRESENTED BY COOPER TIRES

BLUE SKY THINKING

For Dunlop's Future Racecar, the question isn't *if* the technologies it uses will be available, it's *when*. And it may be sooner than you think...

WORDS Mark Glendenning
MAIN IMAGE Dunlop



Trivia question: Name a racecar that is fully electric, is powered via induction pads embedded in the race track, is so efficient at harvesting its own energy that it doesn't need traditional brakes, and has a body and tires that change shape in response to the conditions.

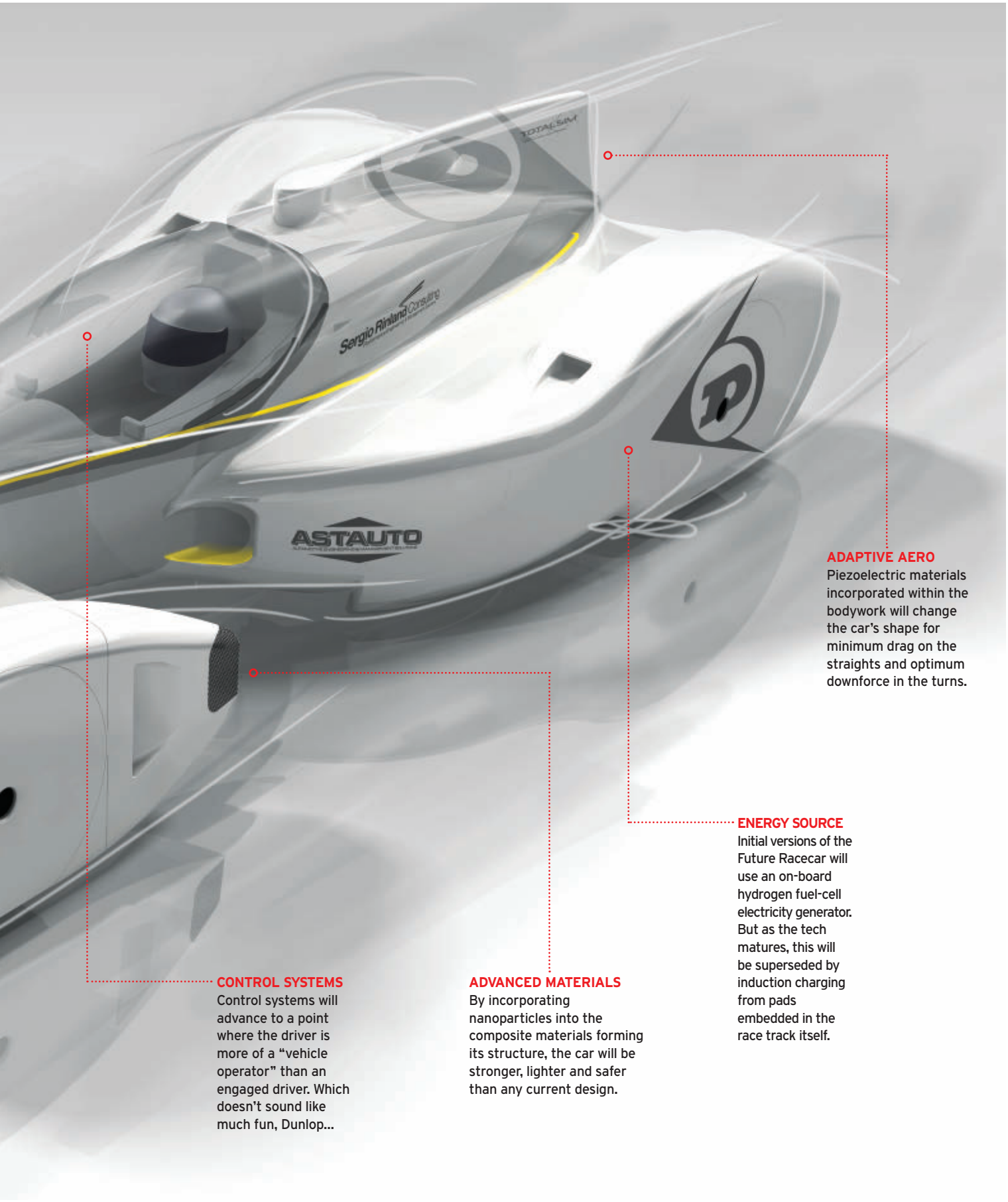
The answer, of course, is that you can't – well, not yet. And the "yet" bit is the most important point for former Formula 1 designer Sergio Rinland, who was tasked with injecting viability into the ideas borne out of tire manufacturer Dunlop's "Future Racecar Challenge."

The project began as a "blue-sky thinking" report commissioned by Dunlop to explore what motorsport might look like in 125 years. Futurologist Dr. Ian Pearson came up with a vision that may seem slightly Jetsonion, *The Jetsons* cartoon being the ultimate benchmark for an idealized future. His car is powered by linear induction plasma thrusters and powerful electric engines, and built from composites that change aero profile on demand. It accelerates and brakes so rapidly that human drivers would need to be replaced by androids.

This concept formed the basis for Dunlop >

TORQUE VECTORING
Because it's fitted with one outboard electric motor per wheel, the Future Racecar dispenses with a conventional steering system. Instead, the car turns by controlling the torque to each wheel.

SUPER-EFFICIENT ENERGY RECOVERY
No energy-wasteful brakes will be needed. All the braking energy will be recovered and stored in flywheels and/or super-capacitors, to be discharged when required.



ADAPTIVE AERO
Piezoelectric materials incorporated within the bodywork will change the car's shape for minimum drag on the straights and optimum downforce in the turns.

ENERGY SOURCE
Initial versions of the Future Racecar will use an on-board hydrogen fuel-cell electricity generator. But as the tech matures, this will be superseded by induction charging from pads embedded in the race track itself.

ADVANCED MATERIALS
By incorporating nanoparticles into the composite materials forming its structure, the car will be stronger, lighter and safer than any current design.

CONTROL SYSTEMS
Control systems will advance to a point where the driver is more of a "vehicle operator" than an engaged driver. Which doesn't sound like much fun, Dunlop...

Dunlop

INTELLIGENT TIRES

Use of embedded piezoelectric materials will allow the tires to change shape for a smaller contact patch on the straights to reduce rolling resistance; larger in the turns to increase grip. Sensors and smart materials will optimize pressure and temperature.

Hanna-Barbera/Turner Broadcasting

Set in the year 2062 (a century after its 1962 TV debut), *The Jetsons'* take on future living included aerocars, robot maids and two-hour work weeks. We'd be happy with just the latter...

inviting fans and industry insiders to submit their own ideas for technologies that could be incorporated into motorsport in the shorter term, with Rinland – whose F1 résumé includes stints with Williams, Brabham, Benetton and Arrows – tasked with hammering it all into some sort of reality. What Dunlop didn't know when it approached the UK-based Argentinean was that he already had a head start.

"When they first came to me, they didn't know that I'd actually designed a car already," he says. "It was supposed to be the Formula E car!

"The technologies that all the people proposed were very similar to the ideas that I'd been thinking should be in the car of the future, so I didn't have to dig deep into what they all meant."

What sets the Future Racecar apart from many similar projects is that it leans heavily on technology that already exists, albeit in an underdeveloped state. It starts with it being electrically powered.

"At the moment, battery technology is the limiting factor," says Rinland. "In the foreseeable future, the energy will be generated by hydrogen fuel cells. Right now, if you want to generate electricity within the car, you need an internal combustion engine.

"A lot of prototypes are being built around the world to use hydrogen fuel cell technology, but we're not yet at a point where we can say it's 'today's technology'. It's still at the research stage."

"This car is about where our ambition and imagination can take us with technology being developed today"

SERGIO RINLAND

The main problem electrical power faces in racing at the moment is that it's not in the same league as fuel in terms of energy density. Rinland believes that the increasing scarcity of fossil fuels will inevitably tilt the world – motorsport included – toward electric-powered cars.

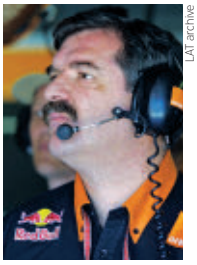
But he also recognizes an opportunity spun from racing's strong history as an incubator for technology.

"I've always believed that racing improves the breed faster than any other means, because in racing you simply have to do it," he says. "It's not like you've got a decade to develop lighter electric motors and if you save five kilos, you're good. In racing, you need to do it for next week.

"There will be electric cars. How you generate the electricity; that's what's being developed at the moment. Right now, the purely electric cars have a huge battery that you have to spend hours charging before they go 200, 300 miles. That's the technology that exists today, and that's what Formula E is, in terms of racing cars.

"But the future is developing energy generation within the car, and then later, hopefully, transferring energy from the race track to the car, but with a limitation on power because you can't have speeds that exceed the race track. So this car is all about where our ambition and imagination can take us with technology that's being developed today. We didn't describe any technology that isn't already being discussed or isn't under development."

Indeed, headway's already been made on the power-unit front: in a street car, an electric unit developing 150-170kW (200-225hp) currently weighs around 75kg (165lb), but a racing version exists that >



LAT archive

SERGIO RINLAND

Buenos Aires-born designer Rinland has worked in Formula 1, sports cars and DTM, and was an early adopter of simulation as a design tool. His consulting company, Astauto Ltd., is particularly focused on alternative energy systems for racing.

With 1,483hp on tap and massive downforce from its rear-mounted suction fan, the Red Bull X2010 concept has been shattering virtual lap records wherever it has run.

NEWEY LET LOOSE

ALTERNATIVE REALITY

The Red Bull X2010 concept was a no-holds-barred concept, yet all based on plausible and existing tech.

Kazunori Yamauchi has a lot of ideas. One of them, the massively successful *Gran Turismo* racing sim series for PlayStation, has earned him a lot of money. And another has led to one of the most extraordinary racecars you'll never see.

The Red Bull X2010 of, yes, 2010 was a dramatic answer to a simple question: if you were to throw all of the current regulations away, what would a racecar built purely for optimal performance look like?

Yamaucho took his idea to Red Bull Racing chief technology officer Adrian Newey. The car that they came up with has a 3-liter V6 engine that produces 1,483hp at 15,000rpm, has a top speed of 280mph, and will go from zero to 120mph in 2.8sec. Some of that performance is derived from a modern interpretation of the rear-mounted suction fan that distinguished the Chaparral 2J and Brabham BT46B.

"If we didn't have regulations, then the opportunity would exist to make a car that would be obscenely quick around a lap," said Newey at the time. "Although it would be pretty uncomfortable to drive, just because the G-forces would be so high."

Indeed, the limitations of the human body are the primary reason that the X2010 wasn't even faster – maximum forces under acceleration were estimated at around 8.75G, fighter-plane maneuver levels.

The downside? Outside of the virtual world and some concept mockups, it doesn't exist.

Charles Coates/LAT

IMAGINATION CONFINED

Adrian Newey, the brains behind the no-holds-barred Red Bull X2010 concept, is reducing his role in F1 partly due to the constrictive nature of the current rules.

But that hasn't stood in the way of ongoing development of the car: a new version, the X2014, was released this year. Nor has it affected its popularity. A run of 1:18 scale die-cast models sold out almost immediately.

Chances of the car taking on a more tangible form are limited by budget. In Newey's estimation it would cost "an order of millions" to actually build an X2010 and have it run a lap. And then, of course, you'd have a major problem finding a category that would permit you to race it.

But in a world where F1 teams like McLaren run their simulator in real time during grand prix weekends as a virtual third car, a concept doesn't necessarily need to take on a physical form to prove a point. And when Sebastian Vettel tested the X2010 on *Gran Turismo 5*'s Suzuka layout, he broke the simulated F1 track record by 20sec. For an encore, he backed that up with a 1m04s lap of the Nurbugring.

As much as it was an exercise in fun, the X2010 is also a glimpse of how racecars might look, had the rules evolved differently. That alternate reality is scary...and awesome.

Red Bull


GM media

As an excuse to show one of Harley Earl's stunning GM Firebird concepts (LEFT, the 1953 design is the first of three in the series), we're sounding a note of caution: the future doesn't always turn out looking the way the visionaries see it. In this case, that's a real shame. But this masterpiece does live on as the car on top of the Harley Earl Trophy presented to winners of the Daytona 500. (BELOW) Battery tech is the performance limiter in current electric racecars, notably Formula E.

KAAN: BLAST FROM THE (RECENT) PAST

In 2008, the LA Auto Show asked design houses from nine major auto makers to come up with a concept for a 2025 racecar.

The winner was Mazda's Kaan (BELOW), chosen for its unique styling and innovative use of technology.

Like the Dunlop Future Racecar, the Kaan derives its power from embedded induction pads in the road surface, and also electronically optimizes tire shape for low drag or high-grip running.


Mazda

weighs just 12kg (26lb) without its inverter.

Longer-term, the need for cars to carry vast amounts of energy on board could potentially be countered by racing on tracks that have induction pads built into their surface. Again, the technology is not yet at a point to make it viable, but there have been steps in that direction: Drayson Racing's B12/69EV, which was built around a Lola B1 chassis, is induction-charged. That car broke the electric vehicle speed record a couple of years ago, although its batteries can only hold 15 minutes worth of charge at a time, and it can only recharge while stationary in its pit.

Another intriguing aspect of the Future Racecar is its target of near-100 percent energy recovery, eliminating the need for conventional brake systems as the car's energy recovery systems do all of the stopping. The technology, Rinland believes, is relatively close.

"I'd say that at the moment we are at 20 percent [energy recovery], so to reach 100 percent, we are probably five to 10 years away from being able to say, 'OK, we don't need brakes anymore,'" he says.

"Although the next problem will be that we're relying on the electric motors working as generators, and the more power you add, the bigger they need to be – and then we have to store the energy."

Even the most radical element of the Race Car of the Future has its basis in existing technology. Rinland's design includes active aerodynamic surfaces – think of the flexi-wing saga in F1 a couple of years ago – but in this case, it also features intelligent tires that change profile based upon what the car is doing. The first step towards making intelligent surfaces a reality is composite road cars, and vehicles such as the BMW i3 represent early progress in that direction.


Formula E

"We are probably five to 10 years away from being able to say, 'OK, we don't need brakes any more'"

SERGIO RINLAND

Actually making the bodywork move is dependent upon piezoelectric technology that's only been declassified by the military in the past decade or two. Until now it's been utilized almost exclusively in the aerospace arena, but Rinland believes that, as the technology matures, costs will drop to within a range that makes it accessible for more mainstream use. The benefits of a car that can generate less drag in a straight line, and then add on downforce when it reaches a turn, are obvious. If one of the greatest limitations on electric vehicles is range, anything that reduces the amount of energy consumed for the same distance traveled is a win, and that includes punching a smaller hole through the air.

Giving the tires a talent for shapeshifting, too, would deliver a similar advantage. If the contact patch can be narrow on the straights, but then flatten out to provide more grip in the turns, rolling resistance will be reduced and less energy consumed.

"That was a teaser I threw to Dunlop, saying, 'put piezoelectric materials into the tires,'" Rinland says. "I'm pretty sure they're thinking about that now."

The (virtual) elephant in the room is that the Future Racecar would currently be ineligible for F1, Le Mans, or any other major championship. Rinland's guess is that as these sorts of technologies become more prevalent, motorsport itself is going to have to adapt accordingly in order to retain any relevance to the wider world.

"Formula 1, Le Mans and IndyCar are so regulated that this is not allowed at the moment," he says. "But I think the time will come. It *has* to come." ■

THE DRIVER'S VIEW

BACK TO THE FUTURE

Old school and new school thinking combine in Penske new recruit Simon Pagenaud's future vision.

The car of my dreams would have a minimum of 850hp, turbo or not, with engines ranging from four to 12 cylinders. No power steering, small wheels with wide tires, big wings with freedom of design, and I'd allow a skirt and venturi system, too.

"Ideally, I'd leave the engine free so that we can come up with new ways to propel the car"

SIMON PAGENAUD

When I wrote this down I thought, "This is just a Formula 1 car from the late 1970s or early '80s!" But then I thought about the controls. I'd like to see some way to make things easier to adjust from in the car, perhaps a touch system like an iPad. The button system is convenient, but it's quite old and it could be improved with a touch screen.

And what I'd like to see is more in-car adjustment. Right now, apart from the DRS [drag reduction system] in F1, a driver can't do anything with the wings. I'd like to see adjustable traction control, fully-adjustable brake migration, and fully-adjustable ride height. The only restriction I'd impose would be an H-pattern gearbox, just to put more emphasis back onto the driver.

Opening things up even more, I'd like to see all-wheel drive, and I'd like the car to have a diesel engine because of the torque. In the future I'd also like to see a water engine being added [where hydrogen and carbon dioxide are extracted from water and converted to fuel]. I know it exists, but there has been little development done on that.

In fact, ideally, I'd leave the engine free so that we can come up with new ways to propel the car. It doesn't have to be a combustion engine. I'm very much in favor of new technologies. My dream car is more of a dream idea about what the sport has to become, and the key thing is that the rules need to be free so that it can evolve. To me, racing needs to be relevant to daily life.

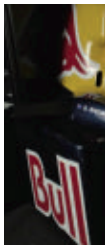
Steven Tee/LAT

MISSION CONTROLS

Just like NFL players memorizing their play book, F1 drivers must learn the function of every button and dial on their steering wheel.

Did you just say early '80s F1 cars, *Monsieur* Pagenaud? Well, here are two of France's finest: the Renault RE20 and Ligier JS11/15 of 1980. *Formidable!*

LAT archive



VIRTUAL REALITIES

With simulation techniques becoming ever more sophisticated and accurate, the digital design and testing of racecars is a burgeoning reality.

WORDS Marshall Pruett
MAIN IMAGE Red Bull

Winning any race at the pinnacle of motorsports, be it a Formula 1 grand prix or the 24 Hours of Le Mans, requires the best design of car, constant development of that car, and an ongoing ability to optimize it for any given set of circumstances.

That's always been a given, but how those goals are achieved has seen a fundamental shift in recent years, with a greater reliance on virtual development tools now absolutely essential.

In the rarefied strata of F1 and the World Endurance Championship's LMP1-H ranks, and to a lesser extent in other blue-chip series, the process of creating a car, building it and testing it at various tracks to quantify the product is antiquated. Instead, there's a massive reliance on digital packages and processes that have moved big chunks of learning and exploration to data churned out from server farms hidden from sight.

As technology marches on, races and titles are now won and lost by successful efforts in the digital realm before the first wheel is turned and throughout the season, as much as by anything accomplished at the track. This odd development – where driving, design and engineering talent alone is not enough to win – rewards those who embrace everything that computer-aided design (CAD), computational fluid dynamics (CFD), finite element analysis (FEA), simulation and driving simulators have to offer.

"They're amazing in simple terms," says Wirth Research founder Nick Wirth, whose company specializes in digital services. "They've had a huge role in our company since 2006, and they've been pivotal in development for our more important cars."

CAD, CFD and FEA have been regular tools for constructors and teams to use since the 1990s, followed by the spike in simulation use and, recently, the growth in multi-million-dollar driving simulators. Both forms of simulation – with and without drivers in the loop – represent the greatest areas of digital racecar advancement.

"The simulator is basically limited by


Red Bull


Red Bull

DRIVERS STILL MATTER

Although sim packages are able to model racecar dynamics with an incredible degree of accuracy, the nuances of a driver's steering, throttle and braking are yet to be fully mastered. Hence, driver-in-the-loop simulators such as those of Red Bull Racing (LEFT) and Honda Performance Development (BELOW) are still important.

Michael Levitt/LAT


McLaren


Red Bull

the quality of models it's running," Wirth explains. "It will be running models of the car, the suspension, the aerodynamics, tires, tracks, track conditions, etc., and it's only as good as the information you put in.

"Take a qualifying run simulation at Indianapolis as an example – very often you've got a head wind going into Turn 4 and a tail wind into Turn 2. Regardless of anything else in the simulator, if you don't have your environmental model right, the wind angle and speed in this case, you won't accurately predict the car's behavior and speed. It just won't be right. And aspiring to get every little detail like that right just goes on and on forever."

"The simulator is limited by the quality of models it's running. It's only as good as the information you put in"

NICK WIRTH

Jeff Bloxham/LAT

The constant advancements in these digital tools have transformed what most teams attempt during testing and practice sessions. With most of the guesswork removed by simulations prior to the car turning a lap, teams are often seeking confirmation of what the simulation said to expect, rather than sending out their driver without a clue on what they will find. As simulation tech gets better, the familiar term "testing" could soon be replaced by "verifying" once teams get to the track.

"If you make a change on a racecar – raise a spring, change a tire pressure, whatever – what we try to do in simulation is get all of those changes to affect the behavior of the car in as similar a way as possible to the real racecar," Wirth explains. "People are successful to varying levels. I can't go into exactly how successful we are with our simulation, but I'm satisfied with where we are; you could always do better, you can always learn more."

Wirth has also seen the cost benefits that come from computer-based R&D.

"It's way cheaper," he says. "You don't burn up fossil fuel; you don't use tires up; you don't have to put a ton of carbon in the air moving people around on flights, or put them up in hotels... It is far, far cheaper testing on even the most expensive simulator, particularly with the pinnacle racing series. It's way more efficient.

"And the other thing is, as a racecar designer, they are fantastic for conducting experiments which are otherwise very, >


Steve Etherington/LAT

(TOP) Every major F1 and WEC team possesses significant in-house simulator capacity. (ABOVE) Virtual design pioneer Nick Wirth. (LEFT) Thanks to simulation, Porsche WEC driver Brendon Hartley gets to "try it before you buy it" in virtual form.

Michael Levitt/LAT

DRIVER-INDY-LOOP

Coming on stream in Spring 2013, Honda Performance Development's Brownsburg, Ind.-based driver-in-the-loop simulator allows HPD and its teams in IndyCar and sports cars to develop chassis and aero setups and engine maps in a relatively low-cost environment. (LEFT) Ganassi's Scott Dixon approved...

very difficult to do at the track. It's extremely difficult to, say, successfully change the wheelbase of a car in real terms on a track and keep everything else the same. It takes time to change; the weather will change between runs; track conditions change, and you're unable to have a properly linear comparison. That's where a simulator really comes into its own, because you can have perfect control and perfect repeatability in terms of the environment."

In tandem with simulations, virtual testing can begin through driving simulators before a chassis is even completed.

"They've yet to come up with a simulation program that can replace a driver's feel and feedback"

BRENDON HARTLEY

"The simulators used in F1 or the WEC aren't so much for training drivers; they're a simulation tool to develop racecars, which I think is the most impressive part," says WEC Porsche 919 Hybrid driver and former Mercedes F1 tester Brendon Hartley.

On top of his real-world race performances, the Kiwi earned a reputation as an elite development driver using simulators. With Porsche starting from scratch in LMP1-H, the 24-year-old was a perfect fit.

Mercedes

"I've been lucky enough to work with quite a few teams, and even with the F1 teams, the drivers aren't in there training very much," says Hartley. "Instead, the teams are using simulators to develop their cars away from the track, and that works out well if you're in a series where track testing is heavily restricted. You can learn a lot about new parts, how they work, what kind of gains they'll give, and so on, just from trying them in the simulator. It's getting more realistic every day."

Hartley's last comment is revealing. Teams can now test the efficacy of a new part before it ever turns a lap in anger. And if it doesn't perform on the simulator, it won't reach the manufacturing stage.

"Whatever you can think of, whatever part you can come up with in your mind will be tested on a simulator first," he adds. "You can test it virtually before you ever manufacture the part, which saves a lot of money and is pretty incredible, really.

"As a driver, you'll work on setups using the simulator, too. They can run simulations without the driver that gives them a lot of information, but they've yet to come up with a program that can replace a driver's feel and feedback, so that's why driver-in-the-loop tests are vital."

Simulators also play a vital role in getting young drivers up to speed in a new chassis or at a track they've yet to race. But, according to Hartley, there's one educational aspect they can't replicate.

"The only thing that you don't have is the fear," he says. "Simulators are one of those development tools that will never stop improving and getting more real, but there's no way to incorporate the danger and how that makes a driver think and react." ■

(LEFT) Driver-in-the-loop (DIL) simulators aren't just the domain of racing. Daimler AG's driving simulator in Sindelfingen, Germany, opened in 2010 and can be used to simulate and research high-risk maneuvers, such as high-speed lane changing, with "everyday" drivers at the wheel, as well as more conventional DIL simulations.

The McLaren F1 team's at-track debriefs are conducted with factory-based engineers in on the loop, too.

REMOTE ENGINEERING

MEANWHILE, BACK AT BASE...

F1 teams don't operate in isolation at the track. Real-time links with their factories add to the engineering power.

The practice of transmitting real-time telemetry between factories and teams is reserved for series like Formula 1 and the WEC, where eight- and nine-figure budgets are flaunted and technological advancement is embraced. Teams and manufacturers extend their at-track capabilities by engaging a secondary workforce at their home bases, with additional engineers aiding in chassis setup decisions and test drivers working on simulators. It's a potent addition to the arsenal, but one that comes at a questionable cost, as racecar designer and former F1 entrant Nick Wirth notes.

"Frankly, it's mostly done in Formula 1 because that's the only series where there are the resources and infrastructure to support that type of activity," he says. "It's drivers working on problems, engineering crews working on it, and even mechanics if there's a technical issue. In most other series, that's not a financial reality."

Giant telemetry poles and satellite dishes can also be found beaming information skyward from the Audi and Porsche haulers in the LMP1-H portion of the WEC paddock.

"They're probably spending close to an F1 budget on their LMP1 programs, so it wouldn't surprise me if the top LMP1 factory had that kind of activity," says Wirth.

Cost aside, he concedes the merits of doubling data-driven work capacity are undeniable, noting: "If you have that possibility, it's fantastic because you'll be running in the session and you can have somebody else in another part of the world carrying on the same activity virtually. So, instead of sitting there waiting for another session to occur and wondering what to do next, it's pretty obvious that if you can do it, it would be an advantage."

THE SITUATION ROOM

Engineers manning the "war room" of McLaren's UK-based technology center see the same information, at the same time, as the team out at the track.

Depending on the task at hand, the factory-based support team can work in tandem with the track operation, or labor away overnight and return their findings for consideration the next morning.

"It depends on who is doing what, and how far the team gets through their test plan or if it has questions that require further investigation," Wirth notes. "It's things like how far off they think they are on the setup, and how close they are to where they want to be running.

"If they're way off, they may want to try more radical things back at base after the day's running is done, then make a call on whether they transfer any of this to the real cars. If they're relatively happy with the car on the track, they'll be less inclined to try some of the more adventurous suggestions that might come out of the simulator. The day's results drive this process."

Steven Tee/LAT

ANTILOCK UNLOCKED

ABS systems developed for motorsports increase overall brake performance, while retaining car stability. The bottom line is faster, more consistent lap times.

When antilock braking systems (ABS) were introduced on passenger cars to keep drivers from losing steering in a panic stop, the idea was generally dismissed as useless for racing purposes. Many racers and autocrossers quickly figured a way to pull fuses or find other ways to disable ABS to get the maximum performance in competition. No system, they said, was going to be better than an experienced driver's right (or left) foot.

Fast forward to the present, and not only are road ABS systems much more evolved and honed than the early ones, but there are also versions developed specifically for racing, such as Bosch Motorsport's ABS M4. Now, given the choice, racers don't want to compete without them.

"You can't go as fast without ABS," states six-time SCCA Club Racing National Champion Don Knowles. "Not over one lap, and certainly not over a race distance."

The accomplished racer, in addition to his multiple SCCA Runoffs victories, has numerous wins in professional racing series in production-based cars. He recently had a chance to test the Bosch Motorsport M4 ABS system in an Ariel Atom at Virginia International Raceway's Patriot Course. Lap times, he notes, are only one benefit (albeit a significant one – 1.5 to 3 percent faster over the course of a lap at VIR). Consistency, tire preservation, tunability and enhanced safety are the others.

Richard Prince/Cadillac Racing

RAIN OR SHINE

In the wet, as well as the dry, ABS allows a driver to be more consistent in maximizing the potential of a racecar for the specific conditions.

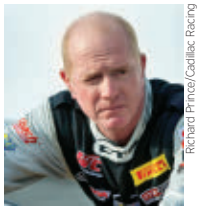
"ABS allows the racer to find the tractive point of the tire, so you can brake as deep and late as you have to and still maintain steerability," explains Jim Emerson, manager of Bosch Motorsports North America. "The good thing with this system that we've seen in some of our applications is the ability to tune it around a driver's preference. Take a GT class car with two different types of drivers; you have the ability to have a system that is adaptable to each of their driving styles. You're protecting and enhancing the performance of both drivers."

The fact that the M4 is developed specifically for motorsports, and designed with the higher grip limits of racing tires and harder bite of racing brake pads in mind, makes it more suitable for track use than road car-based systems.

Even as they admit it's faster, some skilled and professional racers would just as soon *not* race with ABS, saying it takes away an advantage a truly skilled driver has over the competition. But if anyone

CONSISTENTLY QUICKER

The ABS function is a compromise between drivability and brake effectiveness. For road car use, drivability is the primary focus. In a motorsports context, the compromise shifts toward braking performance, as experienced drivers can still control a slightly unstable vehicle. Fitting Bosch Motorsport's ABS M4 system (BELOW) to a track-spec Ariel Atom resulted in significant lap-time improvements for multiple SCCA champ Don Knowles at VIR (LEFT).



Richard Prince/Cadillac Racing

Pirelli World Challenge GT class champ Johnny O'Connell notes that ABS allows a racecar driver to "consistently get a little bit deeper" into the turns.

else is using it, you can bet they'll opt for it to make sure they're not at a disadvantage.

Johnny O'Connell, a three-time World Challenge GT champion with Cadillac, can understand that point of view. But, as he says, even though it may take away an advantage he has over other drivers, "that doesn't mean you don't love having ABS and maximizing the potential of the car in every turn. You can consistently get a little bit deeper. And if you do over-extend, you don't flat-spot or ruin a set of tires.

"In the wet, it's phenomenal," he adds. "Without ABS, you've got be very soft. Your driver skill and your touch is much more important, and the risk/reward equation is a lot more challenging. With ABS, in both wet and dry, you can be much more consistent, and much more consistently at peak performance."

The ability to choose different maps for different conditions plays a large part in that. There is, however, another aspect to it. Not only can changes to the system help maximize braking, they can also fine-tune certain handling characteristics, be it by enhancing or reducing those traits.

"If you can add a little more slip control, or take a way a little slip control, then there's a potential balance that translates into a tactical advantage," explains Knowles. "If your car has a little understeer or oversteer and you want to deaden it, you can add a little slip control to the front, which means that instead of having ABS kick in at, say, five percent slip, it kicks in at eight percent, so the tires slide a little bit before the ABS works, and that kind of deadens that end of the car. It slows down the way the car reacts to the driver's inputs."

Knowles cites a variety of conditions where ABS can be a tremendous asset – low-grip situations, bumpy or rolling tracks, and the increasing use of trail braking as opposed to doing all braking in a straight line. The chance that a driver may encounter any or all of those situations on any given lap makes ABS a powerful tool for the racer. ■

HOW ABS WORKS

MAINTAINING CONTROL

The basic premise of antilock brake systems is that they do exactly what the name implies – keep the brakes from fully stopping (locking) the wheel, which would cause the tire to slide, rather than roll, and thus lose both deceleration and steering ability.

"We give the driver the ability to brake to the point where they think they need to come to," says Jim Emerson, manager of Bosch Motorsports North America. "We look at the wheel speed sensor, find the optimum mu-slip curve of the race tire, and ask, 'Where is the steerability point? Where does the driver need to be to maintain this tire's level of performance?'

"From that, do we allow a pressure decrease in the system? Do we allow the driver to turn in more? To do that, the system processes a variety of measures from lateral and longitudinal acceleration, to slip values of the tires and brake pressure, to make sure the tires don't lock up.

"We optimize the pressure control and allow the system to take away pressure at the wheels and we let the driver maintain control."

BOSCH MOTORSPORT ABS M4

Developed for motorsports, ABS M4 is based on a series production ABS and is suitable for front-, rear- and all-wheel drive cars. A driver can select preferable control settings (maps) for the weather, the racetrack and their own driving style.

ABS MADE FOR RACERS

To learn more about the ABS M4 system from Bosch Motorsport, go to **www.bosch-motorsport.com**

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SUPER TOUR

Paul Tracy's version of the song would be more Sid Vicious than Frank Sinatra. So now he's switched from outraging to engaging the Indy car audience on TV, it's worth recalling his talent to explain why his words carry so much weight. The record shows he took the blows and did it his way...

WORDS Robin Miller | ILLUSTRATION Paul Laguette

It really wasn't fair. Considering all the joy, anger, amazement, disbelief and entertainment he provided us for 22 years, Paul Tracy just slipped away. No farewell tour, no announcements, no press conferences and no chance for us to salute one of the most daring, confounding, dazzling and polarizing race drivers to ever strap on an Indy car.

"The Thrill from West Hill" went away quietly, which was anything but his style during his 272 starts in CART, Champ Car and IndyCar.

Tracy's trilogy spanned two decades with three prominent teams (Team Penske from 1991-'97, Team Green from 1998-2002 and Player's Forsythe 2003-07) and countless memories of a mercurial talent who left people shaking their heads for his brilliance or pestilence.

"He was a fast driver and messed up a lot of equipment, but many of the great ones do that," says Roger Penske, who gave the young Canadian his big break in 1991.

"I call P.T. a Sunday guy because it didn't matter where he qualified or what was going on during the race, he was never out of it," says Jimmy Vasser, who began as one of Tracy's rivals and then co-owned his last ride at Indianapolis.

"Paul gave everything all the time, he was a grinder," recalls Barry Green, who won, lost, fought for and nearly *with* his tempestuous star. "That got him a lot of wins and it also got him into trouble."

"Let's face it, he liked to stand on the gas," smiles Rick Mears, who served as P.T.'s coach, psychologist and voice of reason during his days with Team Penske.

"With Paul, the fight was *never* over," states Sebastien Bourdais, Tracy's nemesis and sparring partner in their combative days in Champ Car.

Tommy Kendall one of Tracy's BFFs for 20 years describes Tracy as "one of the more fascinating personalities to ever exist and one of the biggest bundles of contradictions you'll ever see. He was brash and brave, but he was also shy, soft-spoken and intelligent."

"Paul was a fast driver and messed up a lot of equipment, but many of the great ones do that"

ROGER PENSKE

Dario Franchitti, who spent five years as Tracy's teammate and a dozen as his rival, ponders the question about his pal's lasting image on Indy car racing and sums it up quite well. "It was never boring with P.T. was it?" laughs the three-time Indy winner.

No it wasn't. Whether he was tangling with Michael Andretti, bouncing off Bourdais, dueling with Nigel Mansell, or leaving the paying customers cheering about one of those ambitious, rambunctious moves, Tracy always generated emotions. He clashed with car owners Penske, Green and Vasser, had to take Gerry Forsythe to court, and spent much of his CART career in chief steward Wally Dallenbach's doghouse.

He lost the 2002 Indianapolis 500 in kangaroo court, but won sympathy from all around the globe.

He scored 31 victories from all over the grid, threw away at least 10 more >

The evolution of Paul Tracy from firebrand racer to razor-sharp TV commentator was a riotous blend of glory and mayhem, on and off the track. There was no denying his genius, however.


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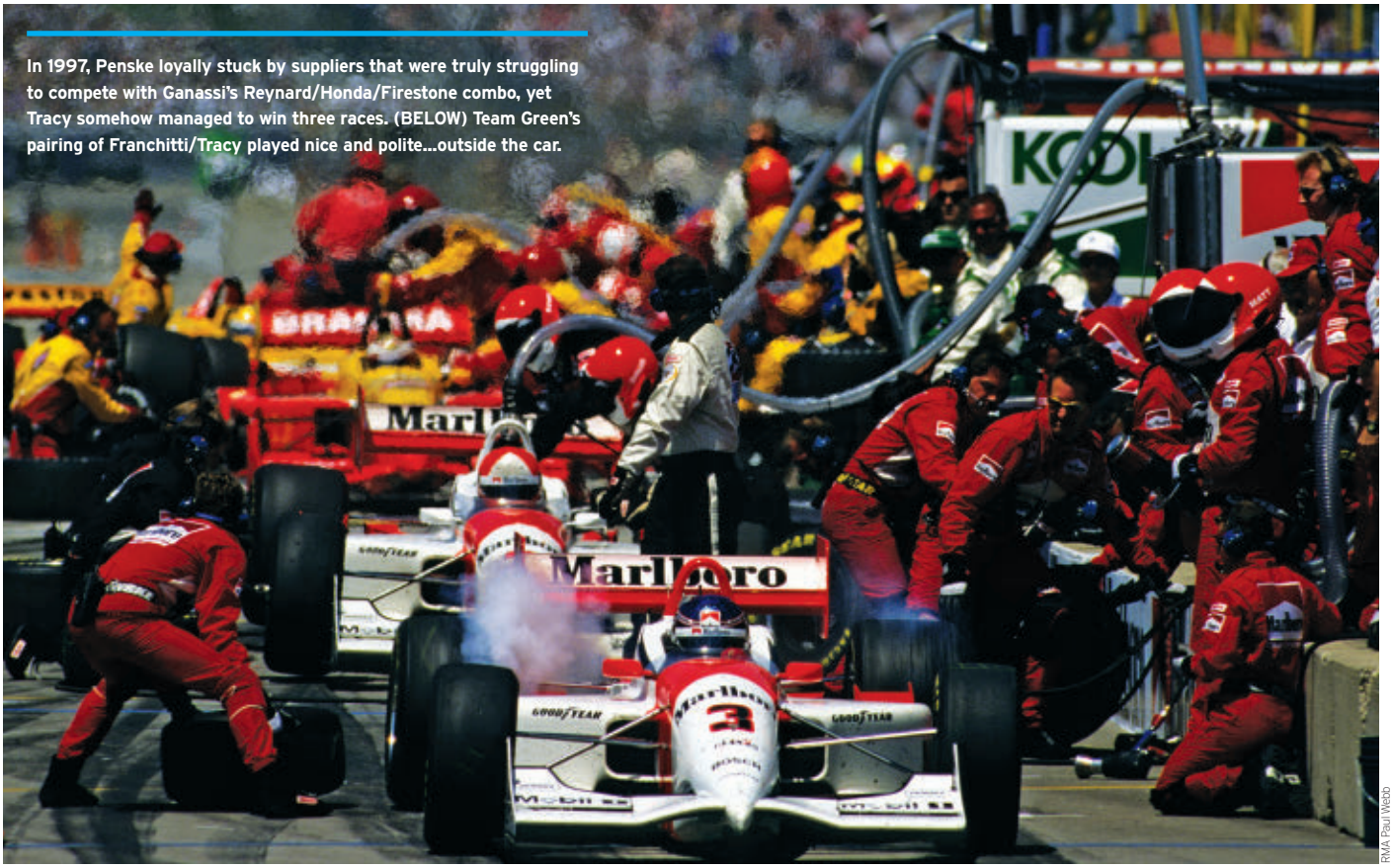
MY WAY



In 1997, Penske loyally stuck by suppliers that were truly struggling to compete with Ganassi's Reynard/Honda/Firestone combo, yet Tracy somehow managed to win three races. (BELOW) Team Green's pairing of Franchitti/Tracy played nice and polite...outside the car.

RMA Paul Webb

wins with some boneheaded moves, but finally harnessed his aggression in 2003 to capture the lone championship of his "big-car" career.

Sure, had he throttled back and gone for points on more occasions, Tracy's stats would be better and more indicative of his monstrous talent. But that wouldn't have been the driver we came to expect. Loathe him or love him, P.T. was always worth the price of admission and left an indelible mark on walls, fellow drivers and open-wheel racing.

"He was the hardest guy I ever raced against; you could never relax," muses Franchitti, who shared laughs, wins and a few memorable on-track tangles during their five seasons together at Team KOOL Green. "You knew going into the corner with him it was a 50/50 deal and that you were going to have to back off because he wasn't going to."

Vasser, who came into CART a year after Tracy and became part of the Target Ganassi ensemble that included Alex Zanardi, Juan Montoya and four straight titles, said racing P.T. was even tougher than trying to manage him.

"I rate Paul second to Zanardi as the hardest racer I ever went against," says the 1996 CART champ. "He was simply relentless. A hard racing mother#$^%@."

Michael Levitt/LAT

"You knew going into a corner 50/50 with P.T. you would have to back off because he wasn't going to"

DARIO FRANCHITTI

Adds Bourdais: "Most everyone you pass and move on. With Paul, you'd pass him, look in your mirrors and he was still there! Even though he was dead in the ashes."

Kendall thinks he knows why. "P.T. was fueled by rage in the car," he says. "He hated being passed and that was obvious."

After turning heads in Formula Fords, he migrated to Indy Lights and captured the 1990 title. That earned him a shot with Dale Coyne, whose Payton-Coyne team back in 1991 was a field-filler. So when P.T. qualified Dale's car 14th in his CART debut at Long Beach, it opened people's eyes. First and foremost of these was The Captain, who swooped down and scooped up P.T. like a seagull snaring a fish.

"My first memory is talking to his dad [Tony] about that young, bold kid from Canada and it was obvious Paul had a lot of talent and we wanted him," says Penske, who had Tracy in his car at Michigan three months after Long Beach.

Part-time with Penske was better than full-time with most everyone else and, by 1993, Tracy was a regular following the sudden retirement of Mears. In that first full season with Team Penske, P.T. showed everyone a preview of what was to come: tremendous talent offset by non-stop aggression and maddening inconsistency.

Nothing illustrated this better than Phoenix in the spring of '93, when Tracy was trampling the opposition. He'd led 151 of the 200 laps and owned a *two-lap* cushion over second-placed Emerson Fittipaldi when he crashed trying to lap Vasser.

At year's end, he owned as many wins (five) as champion Mansell and had led more laps than anyone, yet finished third in the points standings because he either won it or wore it.

"Part of what made it difficult for him was running so hard all of the time but he felt that's what he had to do to win," says >

LAT archive

FIRST IMPRESSION

Qualifying 14th on his Indy car debut in a one-off ride with Dale Coyne at Long Beach in '91 was eye-catching. When P.T. made his second start, it was with Team Penske.

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WORTH THE WAIT

Ten years after his first Indy car victory, P.T. finally won the CART title at Surfers Paradise (BELOW) in 2003, following his seventh win of the year in Mexico (RIGHT).

RMA Paul Webb

Mears, whose calculating style was the total opposite from his understudy's. "It was like qualifying on every lap and he had trouble feeling what the car was telling him so we could get him a better car.

"I think it was at Laguna Seca ['93] when Emerson beat him to pole position; Paul couldn't understand how the old man could have beat him. I explained Emerson had 'built a better mousetrap.'"

Green concurs with the four-time Indy winner. "Paul gave everything all the time," he says. "I guess his weakness was his inability to engineer a car. But that was also his strength, because he'd adjust his driving style to suit the car and make it go fast."

That was never more evident than his swansong season with The Captain. In '97, Reynard/Honda/Firestone was the package to have and Tracy was strapped with a Penske/Mercedes/Goodyear. Yet he tied Ganassi's champion Zanardi for laps led and managed three consecutive wins.

"And don't forget, 19 of Paul's wins were when he was usually spotting the field 70 pounds because there was no weight rule then," says Kendall...

Phillip Abbott/LAT

"Paul gave everything all the time... He'd adjust his driving style to suit the car and make it go fast"

BARRY GREEN

Despite eight wins in his first two full seasons in CART Indy Car, Tracy was too raw and uncut to be a Penske lifer so he moved to Newman/Haas in '95, returned to Penske for two years, and then in '98 joined Team Green, where he was paired with a Scottish kid who'd push his limits.

"When I was a rookie in '97, P.T. was a major star, but he'd always take time to answer my questions and ask how I was doing," recalls Franchitti. "So we were already friendly, but I think that first year together at Barry's team, I surprised Paul with how competitive I was.

"After that, we had some moments on the track, but we never had a cross word with each other. We did piss off Barry a few times though..."

Green watched his talented two-some tangle four times across 1998-'99 (Dario scores it 3-1 as P.T.'s fault!) and nearly came to blows with Tracy on one occasion.

"We were both intense and had some arguments, but we had a lot of laughs as well," remembers Green.

What wasn't funny was the 2002 Indy 500. Replays show Tracy ahead of Helio Castroneves when the yellow light flashed on for the final time, but he didn't get his face on the Borg-Warner Trophy following a protest that Tony George disallowed.

"That race, Paul hung in there all day,

Along with the 31 victories came losses and altercations that were part of Tracy's allure. Among them, he was robbed of victory in the 2002 Indy 500 (LEFT) and enjoyed an amusing altercation with nemesis Sebastien Bourdais at Denver in 2006 (RIGHT).

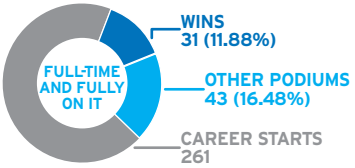
Dan Boyd/LAT

P.T. BY THE NUMBERS

Sometimes a racer's stats give a false impression, but Paul Tracy's convey exactly the type of driver he was: relentlessly fast on race day, but not always prone to finishing...

CART/CHAMP CAR HIT RATE

P.T. finished well over a quarter of his CART/Champ Car races in the top three, but he could have achieved even more.



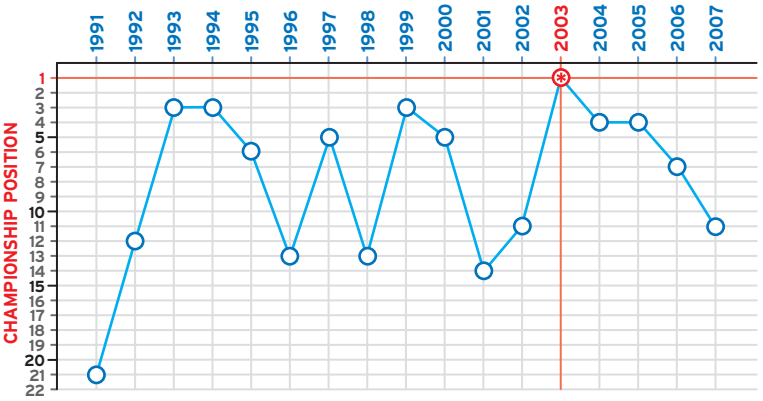
A LEADING LIGHT

17.36%

Tracy's irrepressibility, as noted by Bourdais, is clear in terms of laps led across his CART/Champ Car career. In comparison, Michael Andretti led 19.4 percent, while Al Unser Jr. was P1 for "just" 10.02 percent of his career.

BOOM AND BUST

If the stats above look impressive, they come despite – not because of – Paul's wildly varied season-long performances throughout his career. But while he let himself down on occasion, just as often he flattered the cars he was given. Two sides of the same coin.



Phillip Abbott/LAT

then started charging, and in my mind he'll always be the winner," states Green.

But the most heated rivalry of Tracy's career came after taking his elusive title in 2003. Driving for Forsythe, he banged wheels and heads with Bourdais as they traded insults and victories for four years.

"For three-fourths of my rookie season we raced each other hard but clean and I liked him," said the Frenchman, who captured four straight Champ Car crowns for Newman-Haas, '04-'07. "Then, at Miami, we were battling for fourth and he just put me in the tires and took us both out.

"After that it was game on and I didn't give a rat's ass, I wasn't backing down or giving him the corner. Then he would say something and I would react and I'd say something and he'd react. It got ugly at Denver when he just ran out of brains and hit me, but I guess a lot of people thought it made the series super-exciting."

By the time the Indy Racing League and Champ Car merged in 2008, Seabass was off to Formula 1 and Tracy still had some fight left in him, but not many miles. >


Michael Levitt/LAT

The final win of P.T.'s career was in 2007 at Cleveland (LEFT), when after surviving two collisions and two changes of nosecone, he came through to win. (BELOW LEFT) These days, Paul continues his policy of telling it as he sees it in the NBCSN booth, along with Leigh Diffey and Townsend Bell.

"I'm not surprised Paul is good on TV because he's smart, and if he observes something, it sticks"

TOMMY KENDALL

He charged from 15th to fourth at Edmonton in a one-off IndyCar start in '08 and then was a part-timer for KV Racing – he could have won Toronto in '09, but for a clash with Castroneves. His final Indy car race came in 2011.

Tracy's transition to the television booth for NBCSN has been well received as his candor, humor and racing savvy makes him almost as entertaining to listen to as he was to watch drive.

Says Kendall, "I'm not surprised he's good on TV because he's smart, and if he observes something, it sticks. He can also poke fun at himself and it's good that those who thought he was a knucklehead can now find out he's pretty switched on."

Informed that Tracy was singing his praises on NBCSN this season, Bourdais smiles and when asked how we should remember his rival, says: "Super strong on out laps and in tough conditions. He probably lost a lot of championships because he never ever compromised."

Franchitti concurs, saying: "Yeah, he gave away a lot of wins and probably a title or two, but he's well thought of because of who he was on the track. There was only one Paul. He was not a cookie cutter driver. And he was damn good."

Vasser's honest appraisal wraps up why P.T. will always be a treasure.

"He made some big mistakes, but that's part of P.T. because he drove way over the limit all the time...and his limit was a lot higher than anyone else's. That was Paul's style – balls out and going for it." ■

TRACY'S TREATS

THREE TO REMEMBER

Two come-from-behind wins and a fantastic duel that didn't end up in victory lane are Paul Tracy's favorite memories of his Indy car career.

"I guess my best win was at Elkhart Lake in 2000 [BELOW]," he says. "I was supposed to start seventh, but had an ECU issue, so my car stopped just as we got the green. I just sat there resetting the onboard computer and by the time I got going, I was last and around 50 seconds behind the leader.

"That race went green the whole way, so I had to catch and pass everyone and that's what I did. I ran out of fuel after taking the checkered flag and coasted to a stop in Turn 5 and the fans were going crazy. That was cool."

Even though he ranks storming from 17th to first at Long Beach that same season pretty high, he chose an oval win at Madison, Ill. in 1997 as No. 2.

"After my final pit stop I came out fifth and there were only 10-12 laps to go," he recalls. "I went from fifth to first and passed Patrick Carpentier on the last lap to take the win. It was my third victory in a row and my last one for Roger [Penske]."

What many rate as one of the greatest races in Indy car history came at Loudon, N.H. in 1993 and featured a donnybrook between Nigel Mansell (Newman/Haas), and the Penskes of Emerson Fittipaldi and Tracy.

"The last 40 laps we were running qualifying times and I think Nigel and I traded the lead four or five times in the final 10 laps," grins Tracy, who finished second to the reigning F1 champion by just a few car lengths. "I didn't win, but our battle through traffic was what racing is all about and it was a pleasure to run that hard and close with Nigel.

"Best second place I ever had."


Phil Abbott/LAT

Through the trees, through the field and on to Victory Lane. Road America 2000 is P.T.'s favorite of his 272 Indy car races.





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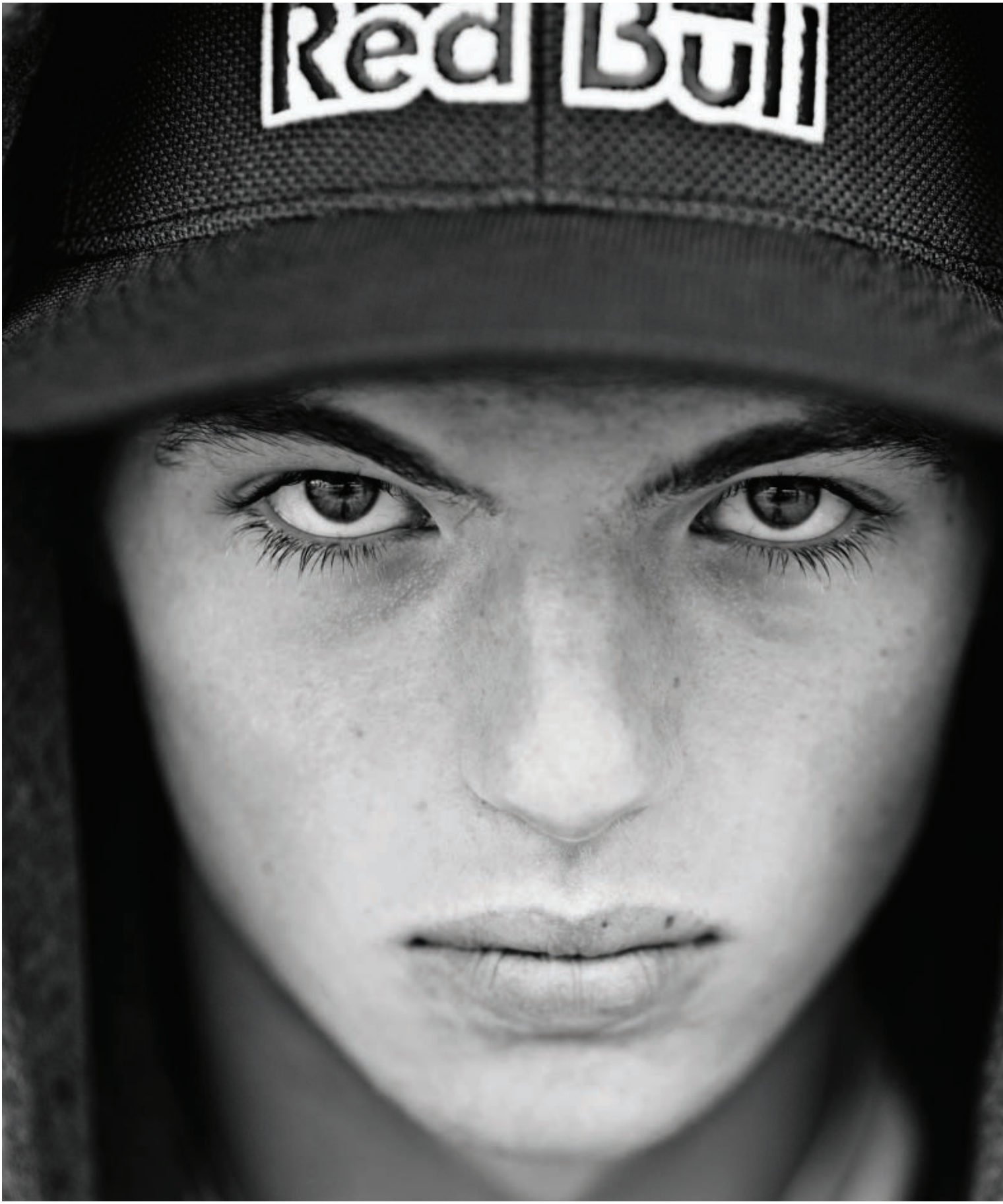
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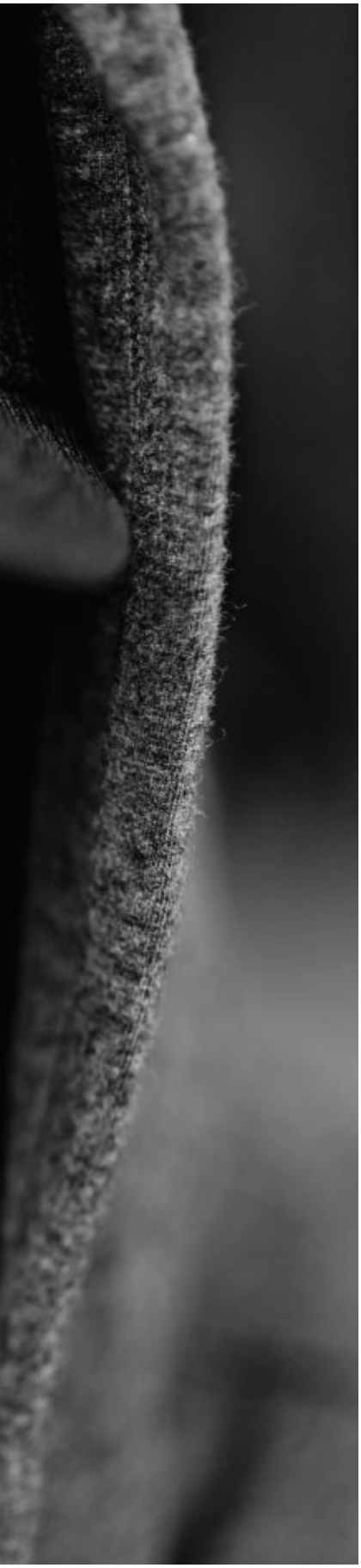


THE MAX FACTOR

Is 17-year-old Max Verstappen too young for Formula 1? Red Bull doesn't think so. And as the guy who nurtured Max's precocious talents for a decade, neither does his father, Jos.

WORDS Adam Cooper | **MAIN IMAGE** Philip Platzer/Red Bull

Red Bull's announcement, Aug. 18, that Max Verstappen will race for Scuderia Toro Rosso in the 2015 Formula 1 World Championship caused shock waves.

The Dutch-Belgian Formula 3 rookie was still 43 days shy of his 17th birthday when the energy-drinks giant dropped its bombshell (astutely timed to coincide with the build-up to his home grand prix at Spa-Francorchamps), and was still only 16 when he logged his first proper F1 test mileage in the frenzied weeks that followed.

When Verstappen makes his F1 race debut in Australia next March 15, he'll blitz the record for the youngest ever grand prix starter, currently held by former Red Bull protégé Jaime Alguersuari, at 19 years and 125 days (see page 78).

Meanwhile Red Bull's resident talent spotter, Helmut Marko, has piled on the pressure by comparing his new signing with Ayrton Senna, calling him "an exceptional talent that comes along only once in decades." This from the man who mentored Sebastian Vettel and Daniel Ricciardo...

The fast tracking of Verstappen has left many wondering if it's really wise for a 17-year-old kid to be racing in F1, whatever the obvious potential of the individual in question. Is someone of that age really ready for the pressures that he will inevitably face? Should a teenager not yet eligible to drive a road car in his native country be allowed to race an F1 car? And what about the ethical issues should the next 17-year-old phenom be signed up to race a Martini-liveried Williams, or a Johnnie Walker-backed McLaren – or even find themselves on a podium clutching the obligatory bottle of champagne?

And there's a bigger picture in terms of the wider public perception of the sport. Is F1 getting too easy if someone so young can be rushed straight into it, bypassing most of the accepted training series?

The response from the Red Bull camp, and from those who know and have worked with Verstappen, is that he's exceptionally mature for his age, and that he *is* ready. Just three days after his 17th birthday on Sept. 30, his first run in a current-spec F1 car seemed to confirm that. Driving in the first free practice for the Japanese GP (one of four planned FP1 outings this season), he ended the session just 0.443sec slower than Toro Rosso teammate Daniil Kvyat – as in, the guy tapped to replace four-time F1 champ Vettel at RBR in 2015.

One could also point to the fact that some of the greats of the sport – Senna >

REVEALED IN ROTTERDAM
Max Verstappen's first public duty as Toro Rosso's 2015 driver-in-waiting was to demonstrate a two-year-old F1 car on the streets of the Netherland's second city.

Red Bull Contentpool/Jarno Schurgers

himself, Nelson Piquet, Alain Prost and, in more recent times, Jenson Button – jumped straight into F1 from F3. Then there's Kimi Raikkonen, who made the extraordinary leap from Formula Renault 2.0 with Sauber in 2001, albeit at the age of 21.

So why is Verstappen seemingly so far ahead of the development curve?

Firstly, he's benefited from an extraordinarily focused program overseen by his father, ex-F1 driver Jos, who guided him through more than a decade of karting.

"The last five or six years, I was doing maybe 100,000km a year with my van, throughout Europe," says Jos. "I went to Italy, Spain, Portugal. Wherever we had a kart race, we went testing. I did everything I had to do for him to be successful."

They turned their attention to cars last summer: "The first time he drove a racing car was at the end of August at Pembrey [in Wales]. We were on our own, because I didn't want journalists there to put pressure on him. I gave him two days to get used to it, then we did about 24 days of Formula Renault 2.0 testing until mid December, going all around Europe."

Think about that for a minute – quite an impressive schedule by any standards. An F3 team boss then convinced Jos that Max

YOUTH MOVEMENT

With almost two years on the next youngest grand prix debutant, Max Verstappen has time on his side when it comes to resetting some other F1 records.

YOUNGEST F1 DEBUTANTS

	DRIVER	YEAR/RACE	AGE
1	**Max Verstappen***	2015 Australian GP	17 yrs 166 days
2	**Jaime Alguersuari**	2009 Hungarian GP	19 yrs 125 days
3	**Mike Thackwell**	1980 Canadian GP	19 yrs 179 days
4	**Ricardo Rodriguez**	1961 Italian GP	19 yrs 207 days
5	**Fernando Alonso**	2001 Australian GP	19 yrs 213 days
6=	**Chris Amon**	1963 Belgian GP	19 yrs 320 days
6=	**Daniil Kvyat**	2014 Australian GP	19 yrs 320 days

**Assuming that Verstappen starts the 2015 Australian Grand Prix, March 15*

MILESTONES

The youngest F1 point scorer is Daniil Kvyat (19 yrs 324 days). The youngest F1 World Champion is Sebastian Vettel (23 yrs 134 days), who also happens to be the youngest winner of a grand prix (Italy, 2008 BELOW) at a mere...

21yrs 73days

PERSPECTIVE...

Of the current field, Jenson Button's F1 career goes back the furthest. When he made his debut at the 2000 Australian GP, Verstappen was just...

2yrs 164days

GEPA/Dutch Photo Agency

Alastair Staley/LAT

Andy Hone/LAT

(Clockwise from ABOVE LEFT) Max Verstappen's rookie Euro F3 campaign triggered interest from multiple parties; first miles in a current F1 car came in Free Practice 1 at the Japanese GP – one of four planned 2014 at-event sessions with Scuderia Toro Rosso to build his experience; the role of Max's father, Jos, now switches to more of an observer than a tutor.

"The way that Max was passing other cars, you could see that his car control was incredible"

JOS VERSTAPPEN

should set his sights higher, and with his final kart commitments out of the way, the chance came on Dec. 18 in Valencia, Spain.

"In the beginning I thought maybe F3 was too high," recalls Jos. "I wanted him to concentrate on Formula Renault. But to be honest, after six or seven laps in an F3 car he was doing the same times as the others. He said the F3 car was a proper racing car, much more balanced, so he could brake harder and deeper into the corner. He just liked the feeling of it."

Meanwhile, in January, Max had his first racing experience in the Ferrari Academy series in Florida: "That was good," says Jos, "because that's where he really learned the first things he needed to go car racing. There were some good drivers, but immediately in the first race you could see that he was very motivated, and very fast."

Jos finally agreed that Max should forget Formula Renault 2.0 and leap straight into F3: "I didn't want to make a mistake with his career. A lot of thinking, a lot of talking with people, and then we made the decision to do European F3.

"At first I figured it would be a learning season for him, and definitely for the first two races it was a steep learning curve. But the speed was there. After the first race, I was thinking for sure he's going to win some races this year. He made some little mistakes, but the mistakes went away, and he was doing a fantastic job. The way he was passing other cars, you could see his car control was incredible, and I think that's what other people noticed as well."

They certainly did. Mercedes, well aware of Euro F3 from its position on the DTM touring car series' support bill, came calling. Previously, Jos had rejected overtures from Red Bull in karting, preferring to remain independent, but the Austrian-based beverage behemoth with a penchant for promoting youth had not given up.

"I think it was good to do it our way, and make our own decisions," says Jos. "We kept talking to them, but you know how it works: if you're fast, people come to you anyway. Everybody is watching drivers in the lower categories. I knew if Max did a good job, people would come.

"The first meeting Helmut Marko had with Max was half way through this year, >

LAT archive

JOS VERSTAPPEN'S F1 CAREER

WORK YOUR WAY DOWN...

Fernando Alonso and Mark Webber used Minardi as a stepping stone to greater things. But in his topsy-turvy Formula 1 career, Jos Verstappen did it the other way around – he started out in a World Championship-winning team and finished at the back of the grid with the financially strapped Italian outfit.

Verstappen first caught the attention when he won the 1993 German F3 title driving for Willi Weber, who was also Michael Schumacher's manager. Later that year, he made the headlines after what was supposedly his first F1 test for Footwork. Only later did it emerge that he'd quietly got a feel for F1 power by trying an outdated, but still quick enough Leyton House at Zandvoort...

He landed the reserve role at Benetton in 1994, but was thrown into the deep end when JJ Lehto was injured before the season began. It was a tough baptism and, inevitably, he was left trailing by teammate Schumacher. He never again landed a front-running seat but, helped by canny management, enjoyed spells at Simtek (1995), Arrows ('96), Tyrrell ('97), Stewart ('98) and Arrows (2000-'01), before his career fizzled out at Minardi in 2003.

"I made too many mistakes in the beginning," says Jos. "Is it unfinished business? No, it's part of life. I enjoyed it, but didn't get the results I wanted. I'm very happy that Max has the chance to come into F1, and hopefully he can learn from my experience as well."

LAT archive

Jos's F1 career began with championship caliber Benetton (TOP) in '94, but ended a decade later at minnows Minardi (ABOVE).

Red Bull Contentpool/Jarno Schurgers

THE PLAN COMES TOGETHER

After racing karts for almost three quarters of his life (a dozen years), then switching to F3 for 2014, Max Verstappen is already putting in the F1 testing miles in preparation for his 2015 grand prix debut with Toro Rosso.

and he wanted to speak with Max – only with Max, not with me! But Helmut knows that I'm not stupid about racing – he knows that Max being so far ahead for his age didn't happen by chance. What we were doing, we were doing right."

Red Bull announced Aug. 12 that Max was a Red Bull junior driver and then, just six days later, went a step further by confirming he'd have a seat at Toro Rosso.

The obvious question is, why the rush? Surely he can only get better by continuing his education in Renault 3.5 or GP2, with some F1 testing and simulator mileage thrown in? He'd still break all the records making his GP debut in 2016, aged 18.

Jos's view is simply that the opportunity to jump straight in was too good to miss – and Max may as well do his learning in F1.

"Say you made the wrong decision with a team in a feeder series, or there's a change of engineer or something, and then you have a bad year," he says. "Probably you'll never get a chance again to go to F1. You see how many people do GP2 for three or four years, and after that they never get out of it? That's one reason Helmut wanted to put him into F1. He has the momentum, and he can learn his craft in Toro Rosso.

"And Red Bull has so much belief in Max that they'll give him time. Yes, it's a learning curve, but he picks up things very quickly."

Mark Thompson/Getty Images

"I was hard on Max. If he can survive me, he can survive Formula 1! I always asked for more than 100 percent"

JOS VERSTAPPEN

Max was quickly absorbed into the Red Bull program, undertaking physical and mental preparation, and getting used to the controls of a 2012 Red Bull F1 car with some straightline running at Rockingham in England, prior to driving it a street demo in Rotterdam.

He then had his first proper test with a 2012 Toro Rosso at Adria, Italy, as part of the ongoing effort to get him the FIA super license that would allow him to run in those FP1 sessions in 2014. He wowed the team with his instant feel for the car.

Jos has no concerns about Max's extreme youth: "For sure he's only just 17, but some people pick it up easier than others. And also, with my experience, he went the right way immediately. And I tell you, I was not the easiest person. If he made mistakes, I was hard on him. And that's why mentally he's very strong, because he's survived me, and if he can survive me, he can survive F1! I always asked for more than 100 percent."

Given that Max does not yet have a road car driver licence, and won't be eligible to drive rental cars for years to come, Jos has a good reason to accompany his son on the F1 circuit next year. However, he insists that he won't become a difficult "racing dad."

"I'm stepping back already, it's not me they talk to, it's Max," he says. "Max is his own person, he has to do it his way, and I'm there because I like to see what he's doing. I just bring him to the track. I did my job, to make him as good as he could be. Now he's in F1, this is the time to step back, and he has to do it all himself now..." ■

(LEFT) Verstappen's composure and maturity isn't just confined to the racecar. His media savvy has been nurtured by his father and honed by the Red Bull PR machine.

GENES OR GRAFT?

NATURE? NURTURE? OR A LITTLE OF BOTH?

Max Verstappen isn't lacking in the racing genetics dept., but being around the sport was just as key.

The careers of sons of famous drivers provide interesting case studies for the "nature vs. nurture" debate. Did they succeed because talent was in the genes, or because their well connected dads gave them opportunities that others could only dream about?

One could argue that the likes of Damon Hill and Jacques Villeneuve made it despite not having a father around who planned every step of their careers. But in most cases – such as Nico Rosberg – it's a question of nature and nurture combining.

Max Verstappen is perhaps the most extreme example of both sides of the equation. Not only was father Jos a Formula1 driver, but his mother Sophie Kumpen hails from a famous Belgian racing family and was a talented karter who raced (and often beat) many future star names.

While many famous sons have had the advantage of being put in a kart at a young age, it's unlikely that anyone has been through the sort of intensive program that Max benefited from. Jos was totally hands-on in every step of his development.

"He was four-and-a-half years old when he started," says Jos. "We went to the track and I let him drive, and I was watching him, what he was doing. There was no pressure, and only on the way home I was talking – 'You did this, you did that' – just briefly telling him what he should do and things like that. He was very motivated to drive, but really you could see that even by six, compared to kids of his age, he was a lot further along.

"First of all it's important to have the talent. I can't tell how much it helps that his mother was racing before, but he had a feeling for driving at an early stage.

"When he was seven he was allowed to do his first kart races in Holland with a 50cc engine. I also brought him long to the big races, and he was always watching, so he learned a lot from that.

"We always prepared our own equipment, and when I was on the dyno he was always there to watch, always asking, 'What are you doing now?' The education he has compared to other people who raced karts is completely different, because he was always there. That's why I think Max is a lot further than the other people of his age."

XPB Images/LAT

F1'S SECOND WAVE

When Max "son of Jos" Verstappen (ABOVE) joins the circus in 2015, he'll be racing alongside Kevin "son of Jan" Magnussen (BELOW) as second-gen F1 drivers.

Steven Tee/LAT

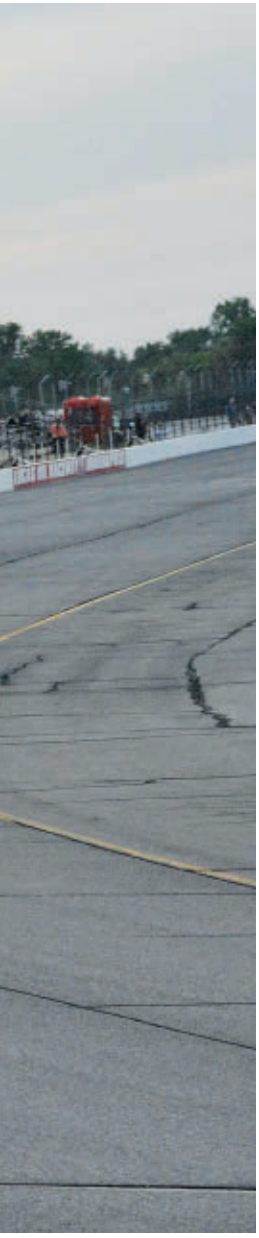
Glenn Dunbar/LAT

(BELOW) Although he's something of a hostage to fortune as McLaren struggles in 2014, rookie Kevin Magnussen has impressed enough to be (reasonably) confident of retaining his seat in '15.

SOME ENCHANTED EVENING

Pro Mazda (PICTURED) and USF2000 drivers get a taste of short-oval racing at Lucas Oil Raceway on the Saturday before the Indy 500. Their "bigger brothers," the Indy Lights cars, compete on the famed Speedway a day earlier in the Freedom 100.

WORDS David Malsher MAIN IMAGE Chris Owens/IMS Photo



THE *FAST* TRACK

Tougher than ever in 2015, the Mazda Road To Indy provides a clear route to IndyCar...but only for the best of the best.

Check your egos at the door, kids, because if you're embarking on the Mazda Road To Indy program, be aware that it's specifically configured as a meritocracy to highlight the best drivers in each series. From the moment you set foot in a Cooper Tires USF2000 Championship Powered by Mazda car, you're scrutinized by IndyCar team owners and talent scouts, all looking to find the driver most likely to become a future Verizon IndyCar Series champion.

"That's what's so good about the Mazda Road To Indy," says Spencer Pigot, who this year clinched the Pro Mazda Championship Presented by Cooper Tires, the second rung on the ladder to IndyCar. "It's structured in a way that a team owner can watch the racing, see the results and say, 'OK, let's keep an eye on this driver, because he's leading and we know these cars are equal.' It's the only open-wheel ladder system in the country, so they know they're watching the best drivers available and that's important to the people trying to assess your potential."

The proliferation of junior open-wheel series in Europe and around the world has diluted Formula 1's feeder system. How do F3 and GP3 drivers compare, for example? Is the next logical step FRenault 3.5 or GP2? If the best in each series don't encounter each other until they reach F1, could it be that there are only one or two true aces in each? By contrast, the Mazda Road To Indy is a beacon of clarity.

Pigot, who's completed two seasons at each level so far – 2011-'12 in USF2000, 2013-'14 in Pro Mazda – and never finished outside the top four in a championship, says: "Each step is a logical progression and each step challenges you. There isn't one thing the cars from the next series up do much better. They just become more demanding right across the board – more power, more downforce.

"Apex speeds between USF2000 and Pro Mazda are the same, but in Pro Mazda you arrive at a higher speed, yet able to brake later. More downforce and bigger tires also mean you go through high-speed turns faster, but your aero's more affected by running close to the car in front. Each series prepares you for the next step."

From Pro Mazda to Indy Lights Presented by Cooper Tires is a bigger leap, but one in a more focused direction from 2015 onward. The old Lights car, which turned obsolete at August's season finale, had a particular way about it, being an all-oval car adapted to run road and street courses. The new Dallara IL15 is designed for all types of track on the Lights calendar, >

"[At each step] the cars become more demanding across the board – more power, more downforce"

SPENCER PIGOT

UP TO SPEED ON THE FAST TRACK TO INDY

For the latest from the Mazda Road to Indy ladder, go to **indylights2014.com** for Indy Lights Presented by Cooper Tires, **promazdachampionship.com** for Pro Mazda Championship Presented by Cooper Tires and **usf2000.com** for the Cooper Tires USF2000 Championship Powered by Mazda.

Chris Owens/IMS Photo

Chris Owens/IMS Photo

(LEFT) Spencer Pigot made sure his second season in Pro Mazda was the money year, earning six wins on his way to the title. (FAR LEFT) Pigot with MRTI promoter, Dan Andersen.

USF2000 cars slipstream well, yet don't suffer too much aero wash in corners, and that allows cars to remain close. It gets trickier further up the Mazda Road to Indy...

Tim Hole

and to better prepare drivers for the raceability of the IndyCar Series' DW12.

"The IL15 has outperformed our wildest dreams," says Dan Andersen, promoter of all three steps on the Mazda Road To Indy. "Our partners – AER, Cooper Tires, Cosworth, Motegi, Performance Friction, etc. – contributed to this hugely, and I give great credit to Tony Cotman [project manager] and to Dallara."

If Andersen sounds enthusiastic, so he should. Tony George Jr.'s desire to have a logical, organized and well-promoted route to IndyCar was the reason why, in 2009, he approached Andersen, a team owner and a man who'd run USF2000 for a decade before it came under IndyCar's umbrella. Now Andersen has strong partnerships with Mazda and Cooper Tires, an understandable path of progression and a fast new car to lure teams and drivers from home and abroad.

"We'll have teams that have the wherewithal to support drivers who don't bring megabucks, just talent"

DAN ANDERSEN

It's a perpetual structure, too: the higher the median driver standard, the harder the competition, so teams will keep hiring top drivers in order to succeed, which in turn attracts top drivers the following year.

"Fierce competition is what racing is all about," says Andersen. "We'll have teams that have the wherewithal to support drivers who don't bring megabucks, just talent."

Chris Owens/IMS Photo

FANTASTIQUE!

Frenchman Florian Latorre won the 2014 Cooper Tires USF2000 Powered by Mazda title with a great blend of consistency and outright pace.

Equally, he hopes Indy Lights teams will expand to set up Pro Mazda and USF2000 squads, increasing the depth of talent in the cockpits and also the engineering rooms.

"We have a history of seeing mechanics and race engineers and data acquisition engineers move up the ranks from junior formulas into IndyCar," says Andersen, "and the tougher the competition, the better prepared they'll be for graduating to IndyCar where the margins are so tight."

Andersen admits that the Mazda Road To Indy's impending boost with the IL15 could not have been better timed.

"In Europe, drivers are frustrated that even if they win a series, they're not guaranteed to graduate. They wonder why they spend six- and seven-figure sums each year, but even if their potential is huge, they're not picked up by teams in the next level up. So a lot of drivers and teams are looking over here and thinking, 'There's a place where, if we do well, we'll graduate.'"

"One of the big attractions of IndyCar," adds Pigot, "is seeing the top Americans battling stars from Europe and around the world. Having that situation at the start of the Mazda Road To Indy will be a good thing because the tougher the competition, the tougher we all become."

In other words, a rising tide floats all boats...and that applies on a larger scale, too. The reinvigorated Indy Lights Presented by Cooper Tires series will surely prove beneficial to the whole Mazda Road To Indy program. ■

GIMME THREE STEPS

COOPER TIRES USF2000
POWERED BY MAZDA

Chris Jones/IndyCar/IMS Photo

- A slicks 'n' wings open-wheeler, with a 170hp, 2-liter engine. USF2000 is a notable step from 130hp treaded-tire Skip Barber Racing School cars.
- In 2014, all but one of the 14 rounds were in front of IndyCar teams.
- Gives many drivers their first taste of oval racing, at the 0.686-mile Lucas Oil Raceway on the eve of the Indy 500.

PRO MAZDA
PRESENTED BY COOPER TIRES

- Step up in power to 255hp, combined with more downforce. "Braking zones are shorter, so planning moves is vital," adds new champ Spencer Pigot.
- Similar to USF2000, all but one Pro Mazda race in 2014 was part of a Verizon IndyCar Series weekend.
- Adds Milwaukee to the oval roster, on top of a race at LOR.

INDY LIGHTS
PRESENTED BY COOPER TIRES

Chris Owens/IMS Photo

- Brand new Dallara IL15 designed to handle and deliver power in a way that prepares drivers for IndyCar's DW12.
- There's 450hp with 50hp push-to-pass boost from the AER-built 2-liter, which ensures it's a 200mph-plus car.
- 2015 champion is guaranteed three entries in the 2016 Verizon IndyCar Series, including the Indianapolis 500.

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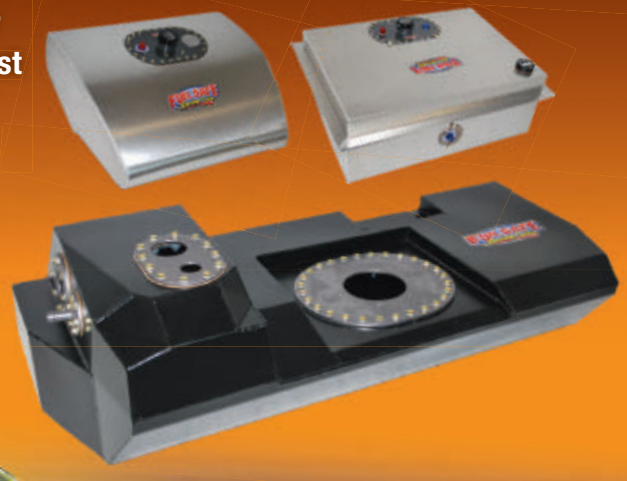

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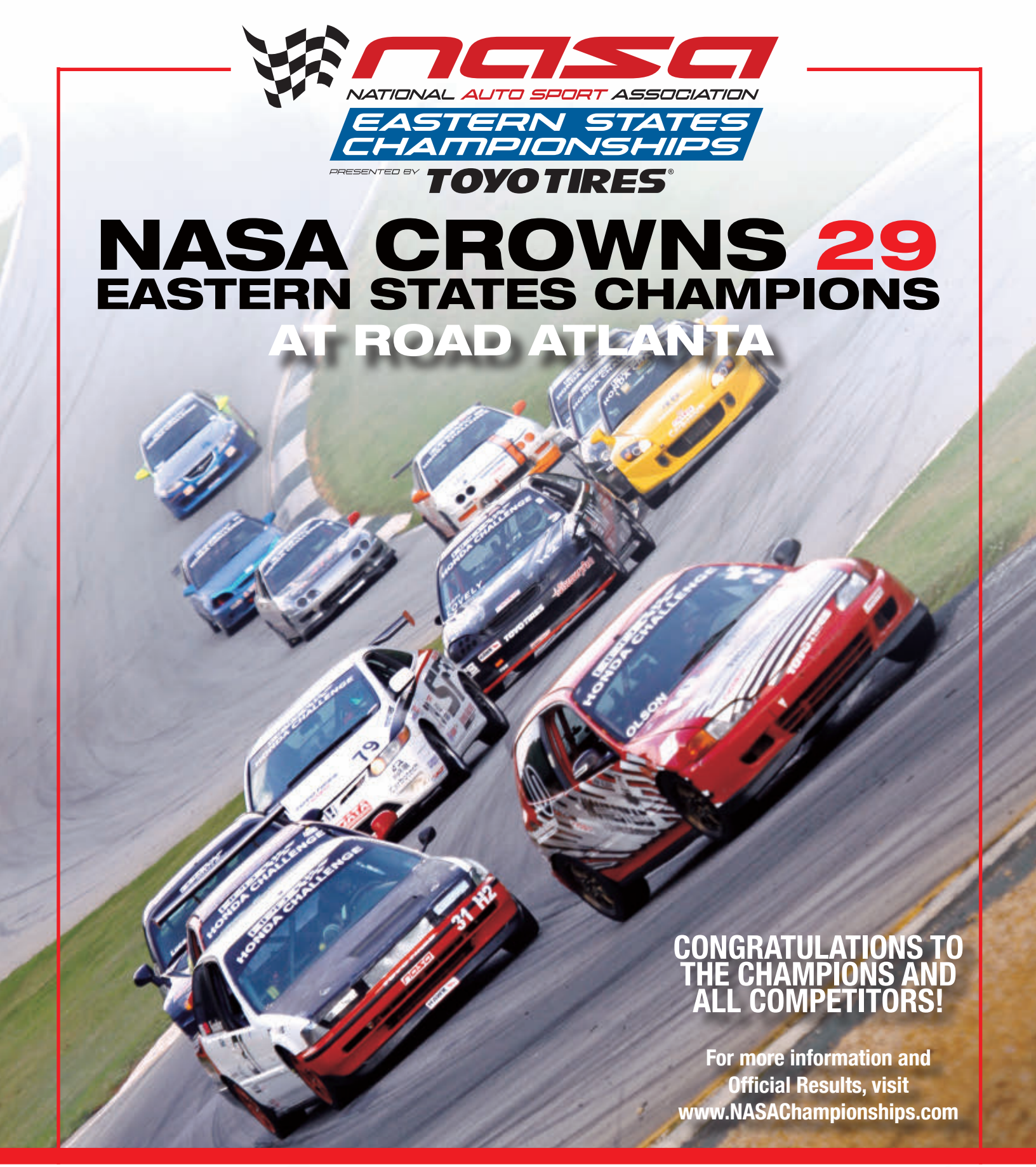

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2.	Terry Mathis	$750
3.	Michael Patterson	$500
4.	Patrick Wehmeyer	$400
5.	Dennis Ramsey	$300

SPEC MIATA

1.	Alex Bolanos	$4000
2.	Danny Steyn	$3000
3.	Matthew Pombo	$2000
4.	Jonathan Czarny	$1000
5.	James Drago	$750

SPEC IRON

1.	Corey Rueth	$1000
2.	Aaron McSpadden	$750
3.	Audrey Zavodsky	$500
4.	Olaaf Rossi	$400
5.	Cody Powell	$300

944 SPEC

1.	Daniel Williams	$2000
2.	Dan Piña	$1500
3.	Gary Barton	$1000
4.	Jason Stanley	$500
5.	Jason Walsh	$350

SPEC E30

1.	Sandro Espinosa	$4000
2.	Robert Gagliardo	$3000
3.	Eric Palacio	$2000
4.	Larry Fraser	$1000
5.	Ryan Whitinger	$750

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1.	Kris Popvic	$1000
2.	David Isbell	$750
3.	John Oldt	$500
4.	John Putnam	$400
5.	Brian Yorks	$300

HONDA CHALLENGE 2

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2.	Michael Maduske	$1500
3.	Jeremy Hopps	$1000
4.	Brian Casella	$500
5.	Jonathan Baker	$350

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1. Chris Griswold
2. Matthew Gaetano
3. Jimmy Bost

Camaro Mustang Challenge
1. Derek Wright
2. Kent Owens
3. Sammy McSpadden

Factory FIve Challenge
1. Paul Arnold
2. John George
3. Paul Kaiser

Super Touring 1
1. Benjamin Lesnak
2. Ray Sweers
3. Rene Molina Jr.

Super Touring 2
1. Matt Isbell
2. Chris Durbin
3. Mark West

Super Touring 3
1. David Ziegler
2. Kevin Harvey
3. Mike Rea

Super Unlimited
1. Mike Howard
2. Joseph Freda
3. Alan Palmer

Spec 3
1. Barry Battle
2. Jon McAvoy
3. Anders Skandsen

Performance Touring B
1. David Schotz
2. Jeremiah Fox
3. Robert Rutzky

Performance Touring E
1. Ben Anderson
2. Eric Powell
3. Jason Kohler

Performance Touring F
1. Ronald Nielsen
2. Matthew Denny

Spec Z
1. Jay Pellegrini III
2. Brian Kleeman
3. John Baldwin Jr.

German Touring Series 1
1. Tim Pruitt
2. Joey Sullivan
3. Larry Helm

German Touring Series 2
1. DJ Fitzpatrick
2. Jonathan Vasquez
3. Zach Hilmann

German Touring Series 3
1. Edgar Cabrera
2. Hugh Stewart
3. Drew Ewing

German Touring Series 4
1. Randy Mueller
2. John Graber
3. Edward Baus

TT1
1. Benjamin Lesnak
2. Edward White
3. A.R. Hoshmandy

TT2
1. Greg Vannucci
2. Reese Cox
3. Alan Cohen

TTU
1. Reese Cox
2. Chris Griswold
3. Ray Sweers

TTB
1. Jeremiah Fox
2. David Schotz
3. Allan Page

TTC
1. Chi Ho
2. Daniel Walters
3. Team Schotz Racing

TTD
1. Jon Kozlow
2. Marc Cantor
3. Harold Dunn

WORDS & IMAGES Richard S. James

ALL ABOUT THE BUGGIES

Chad George spent a couple of years lost in the woods before coming back to Lucas Oil Off Road Racing in Pro Buggy, a racing version of the vehicles he knows well.

"This team...myself and my team, have always had fairly good results along the way. But nothing like this year. This year has been outstanding, not only for myself, but the full team, myself and my cousin."

So says 2014 Lucas Oil Off Road Racing Series Pro Buggy champion-in-waiting Chad George. While he hadn't quite clinched the championship as *RACER* went to press, it was his for the taking – unless there was an unusually large turnout in the two remaining rounds, all he really needed to do was start one of them to seal the title. That was thanks to an impressive season that included five wins and 11 podiums out of 13 rounds. His cousin, Garrett George, accounted for another two victories.

Chad has three previous titles to his name, two in the Unlimited UTV class (2009 and '10) and one in SuperLite ('11). He then sat out a year after struggling in Pro Lite. Garrett had a reasonably strong Pro Buggy season in 2012, before spending most of last year sitting on the sidelines. But emerging with a pair of new Funco buggies in 2014, they've had a stellar season.

Much of that comes down to the fact that buggies are not just what the Georges drive; it's what they do. Funco is a family-owned builder of sand cars. It started in 1967, when Chad and Garrett's grandfather, Gil, discovered the joys of duning and changed his focus from drag racing to sand cars, building custom tube-framed sand cars when most of the dune riders were in homebuilt machines or modified Volkswagens.

It wasn't long before desert racers noticed what George was building, and started buying his cars for racing. Legends such as Ivan Stewart and Steve McQueen raced Funcos in the 1970s.

Back then it was more about the racecars. Now, the racecars are a sideline, and the recreational sand cars are the main focus of the business. Though they may be built for the dunes, these aren't exactly your typical dune buggy.

Just like sports cars, vehicles built for playing in the sand come in all shapes, sizes and specifications. As a Mazda MX-5, Porsche Boxster and Ferrari 458 Italia are all sports cars, so there is a big variety in sand cars. When you think of what Funco is building, think toward the upper end of that scale. The fact that 90 percent of Funco's customer base is in the United Arab Emirates and Qatar – a part of the world where there is a lot of sand and a lot of money – should tell you something.

"The cars we're building now are upward of 200 grand," says Chad. "You have something that's basically like a Bugatti for the sand, but it drives like a Pro 2."

Buggies play a big part in Chad George's life. (ABOVE) George and a part-built Funco sand buggy, and (RIGHT) giving it the gun in his Pro Buggy race machine.

These "luxo-buggies" include soft leather seats, iPads mounted in the dash for navigation and entertainment, and even headliners. Mechanically, they're not far removed from the Pro Buggies Chad and Garrett race. They have bulkier suspensions, because they're heavier and have a bit more travel. But where Pro Buggies are powered by normally aspirated, four-cylinder engines making a litle more than 200hp, Funco sand cars have LS-based V8s, usually super- or turbocharged.

"Our standard package is a 440 with a 4.0 Whipple blower," Chad explains. "I

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think the right number for these sand cars – and I've tested pretty much all of ours as of the last seven years – has to be around the 850-900hp range. That gives you the power to lift up the front end whenever you want, but you're not fighting it."

All the cars are hand built in Rialto, Calif., by the George family and a few workers. And then those same people, family and Funco employees, are all at the track on a race weekend supporting the race effort. Chad's father, Grant, takes care of the business side of Funco while Garrett's father, Greg, is laying his hands on every part that goes into the cars.

Chad and Garrett are not only the third-generation of Funco, they're also the third generation of racers. Gil raced desert, as did Grant. Greg took to the stadiums in the Mickey Thompson series. Now, the third generation is making its name on the track while continuing the Funco legacy in building great sand cars.

"It's a major undertaking; not something anyone can do unless you love it, and we love it," says Chad. "We love building the product and we love taking them out to the dunes and playing with them, tossing them. These cars, you could be doing 90 and just throw it sideways, drifting, >

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Attain Media

(ABOVE) For Chad and Garrett George, testing the family-built Funco buggies on the dunes of Glamis is part – a very enjoyable part – of their day job. But racing in the Lucas Series' ultra-competitive Pro Buggy class (ABOVE RIGHT) beats even that.

"Nothing beats head-to-head racing, or taking the checkered flag first and the bliss that follows"

CHAD GEORGE

wheelie out…the whole deal. It's insane."

As much as Chad loves playing in the dunes, he loves racing more. He was a Kawasaki factory driver in UTVs before he started heading up the truck ladder. When that didn't go exactly as planned, racing wasn't as much fun. But this season has renewed his competitive fire.

"Racing is a lot different than playing," he says. "The driving difference between the sand car and Pro Buggy is small. Getting into the Pro Buggy, you're just wishing you had the power of the sand car and that little bit more suspension. But nothing beats head-to-head racing. Nothing beats taking that checkered flag first and the bliss that follows. It just can't be matched out on the sand. I love both, but if I had to choose, I'd go racing because I'm a very competitive person. Luckily, here at Funco, we get to do both."

And that is very much the key to George's success this season. There are a lot of similarities between the sand car and the Pro Buggy, and in driving them.

"The sand dunes at Glamis, where we usually use a sand car, are nothing but a giant short course, but you get to choose a line," he explains. "The geometry is pretty similar. Take a sand car, shrink it down and you've got a Pro Buggy. They're really one and the same, on a smaller scale. Driving one of our sand cars next to driving my racecar, the skills and the operating translate really well."

Now, he's on the verge of claiming another championship in his "rookie" year in Pro Buggy, while his cousin is headed toward a top-five finish in the points. He notes that he has a hard time identifying himself as a rookie, because the buggies are what they do, day in and day out.

"When I stepped into it, it came easy to me, because I knew what to expect," he says. "I knew how hard I could go, and it was a self-built, Funco Motorsports-built car, so I knew I could trust it; I knew what it was going to do in a corner. That goes back to having confidence, not only in myself, but my team and the people behind me."

Sometimes, it seems, it pays to go with what you know... ■

RENEWED CONFIDENCE

CHAD GEORGE CAME BACK HARD AFTER A DIFFICULT SEASON IN PRO LITE AND A YEAR OFF.

Chad George seemed headed to the top of short course off-road racing. In the first years of the Lucas Oil Off Road Racing Series, he was dominating first UTV, then the spec SuperLite class, beating people like 2013 Pro Lite champ and current Pro Lite and Pro 2 competitor RJ Anderson, and Pro 4 racer Corry Weller. But then came a rough season in Pro Lite, where he never finished better than fifth and ended up 12th in the points.

"My truck wasn't up to par, so every time I went out on track, we'd change something trying to catch up," George says. "Come half-season, the truck was pretty good, but my confidence was shot. You can't win without confidence."

That's a large part of what has led to his resurgence this year. Strapping into a Pro Buggy, he knew exactly what to expect, for several reasons. One, the family company, Funco, builds fancy buggies. Two, his cousin had raced at the end of 2013 with a clone of the buggy in which he would compete, sorting it out.

"A truck is kind of out of our ballpark. But with a buggy, we knew exactly what was going to be the case. My cousin Garrett had run it in the last two races of 2013 and done some testing, so he'd worked out some bugs. By the time I got in the car, that allowed us to be competitive from the get-go."

Chad George was a two-time UTV champ in 2009 and (ABOVE) '10. He followed those successes with the 2011 SuperLite title.

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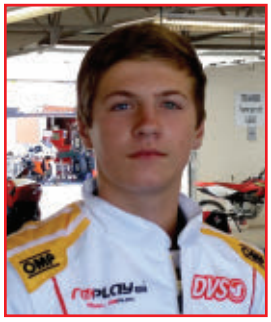
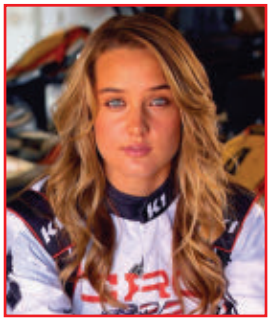
Verizon IndyCar Series driver James Hinchcliffe, Indy Lights Presented by Cooper Tires champion Gabby Chaves, US karting legend Alan Rudolph and three-time Rotax Grand Finals champion and four-time Euro MAX champion Ben Cooper comprised the panel of experts in the selection process.

OLIVER ASKEW
AGE 17 | TEQUESTA, FL



CHRISTIAN BROOKS
AGE 14 | SANTA CLARITA, CA



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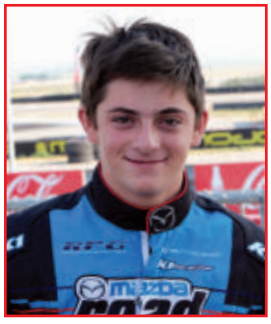
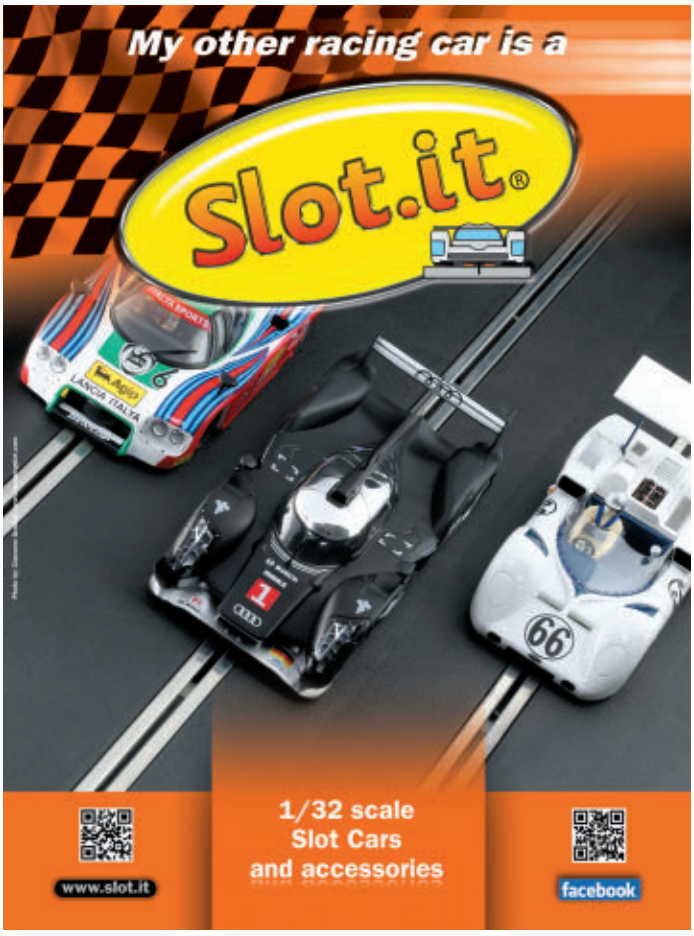
AGE 19 | GRAND JUNCTION, CO



AUSTIN VERSTEEG
AGE 15 | SANDY, UT

COOPER TIRES | andersen PROMOTIONS | mazda



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MAKING TRACKS

Skip Barber Racing School

Michai Stephens, with his father Mark (on right) and cousin Seth Bradley, impressed instructors at Skip Barber Racing School as well as Team USA Scholarship judges.

SKIPPY GRADS, TEAM USA SCHOLARS

Aaron Telitz and Michai Stephens have used Skip Barber Racing School as a launch pad

> Skip Barber Racing School is renowned for its success rate, with Michael Andretti, Helio Castroneves, Jeff Gordon and Ryan Hunter-Reay among its alumni. So when one of the School's most respected instructors endorses the latest winners of the Team USA Scholarship, it resonates.

The 2014 recipients of the Scholarship, which sends two young Americans to the Formula Ford Festival and Walter Hayes Trophy in the UK, are Aaron Telitz and Michai Stephens, who impressed judges with their pace around the road course at Auto Club Speedway and with their answers in interviews afterward. This comes as no surprise to Skip Barber's Bob Ziegel.

"They both show a lot of promise," says Ziegel. "Aaron came through karts and local stock car racing and was immersed in motorsports for most of his childhood. Michai decided he wanted to do this fairly recently, but he did a three-day Skip Barber course, was an outstanding student and, in 2012, got invited to the IndyCar Academy – a scheme of [*RACER* founder] Paul Pfanner's. He did well, finished fourth, then came back in 2013 and absolutely dominated.

"We have an observer on every corner and work hard on drivers' basic skills and understanding of the car"

BOB ZIEGEL, SBRS INSTRUCTOR

"As a result he won the scholarship to race in our series for a season and we think that's the best way for a driver to learn. We have an observer on every corner, and work hard on drivers' basic skills and understanding of the car. Aaron was a quick study because of his previous experience and because he's smart. Michai's also really focused, attentive and brilliantly talented.

"Michai's won about half the races he's ever entered, and in Aaron's first year in USF2000, he finished fourth in points. So we think they both have bright futures."

Ziegel is pleased that the Skip Barber Racing School has again been proven by two of its graduates shining as they move up.

"SBRS's identical cars make our jobs as coaches/instructors clearer," he says, "because we'll judge drivers on braking, mid-corner speed, and so on. We can usually tell exactly what they're doing right when they're fast, and what they're doing wrong when they're off the pace. It's a very precise and successful system." **David Malsher**

Aaron Telitz not only finished fourth in his USF2000 debut season, he was top of the rookies (which comprises most of the field, as you'd imagine) and even got a win, at Lucas Oil Raceway.

GAINING MOMENTUM

Michai Stephens got his first taste of slicks 'n' wings when he tried a USF2000 car on the IMS road course during the Chris Griffis Memorial Test, named for the late Sam Schmidt Motorsports Indy Lights team manager. Michai clocked a lap just 1.8sec off the fastest time. Like we said, he's a quick study...

Chris Jones/IndyCar/IMS Photo

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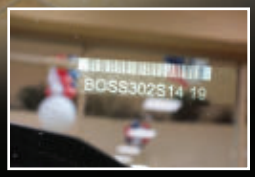

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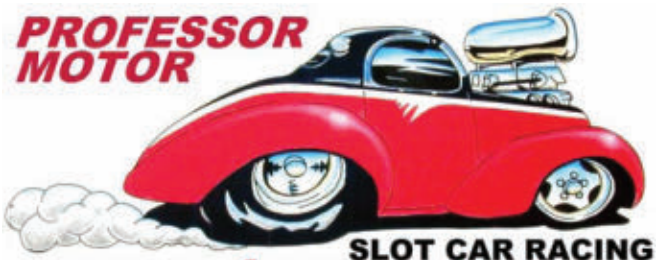

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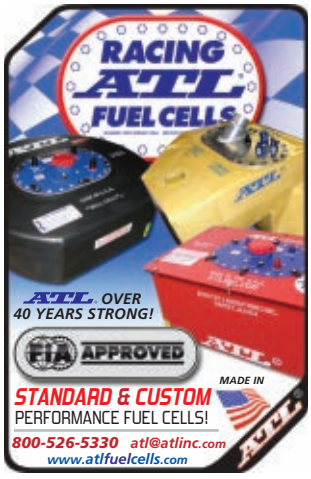

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Brembo brake calipers and rotors, dry sump oil system, full roll bar with side door bars (SCCA legal). Front and rear adjustable sway bars, rear suspension uprights lowering roll center 2-inches. 358 C.I. all aluminum 560hp Kroyer racing engine. Three complete sets of wheels and tires. Extra rear gears and limited slip. Sway bars and springs for any track setup. Currently powered by a 358 C.I. 827 horsepower NASCAR Roush/Yates Racing engine. Added features are as follows: Two Cobra carbon fiber seats. Full aluminum belly pan (in three pieces). Dual MSD ignition, switchable from inside cockpit. VARA - HSR vintage legal. Contact for further details and price. **Gregory ghgearhead@aol.com (949) 294-7849**. [25062-10]

2013 HONDA CIVIC SI ROLLER

Current IMSA CONTINENTAL TIRE ST / SCCA World Challenge TC/TCA / NASA PTTT / SCCA. 2013 body in white with roll cage and seam-welded chassis by Mark McMahan, Pro-tuned coilover AST shocks, HPD suspension front and rear including rear camber arms and ride height adjusters, HPD/Stop Tech 4-piston W/C front calipers and rotors with full HPD brake cooling tubes and carbon fiber air ducts, Recaro seat with slider brackets, safety belts and window net, MOTEC sport dash and Race Keeper W/C system, 10 Enkei wheels 8x17, stock fuel tank, flat black body wrap. Car is extremely light and only needs engine and transmission to race $29,500 or best reasonable offer. **Contact Joe (602) 618-6137 or joe@aandcproperties.com**. [25070-10]

VAN DIEMEN F2000 RF02

For sale. Race Ready, Prep by HP-TECH. **For more information: hptechmotorsport@gmail.com or (786) 525-1524**. [25075-10]

2004 BMW E46 M3

SCCA / BMW CLUB / NASA ST2/ST3. Full approved cage, new 3.2L blueprinted engine, CP high-compression pistons, Schrick cams, Euro header and 3-inch exhaust, VAC carbon fiber intake plenum, Dinan throttle bodies, Accusump oiling system, Turner Motorsports oil cooler, upgraded alum radiator and electric fan, Clutch Masters flywheel and clutch, Blanton 4:10 diff, TC Kline double-adjustable Koni shocks coilover in front and ride height adjustable in rear, all suspension bushings upgraded, front/rear roll bars by Ground Control, alum rear control arms, diff cooler installed in trunk, front splitter, rear wing and carbon fiber roof, race seat, slider and all belts updated, AIM dash, removable steering wheel, fiberglass doors, fiberglass trunk included, front carbon fiber bumper included, two sets of TR Motorsports wheels, Lexan rear window included, 4-piston Stop Tech front calipers and Stop Tech rears, miscellaneous spares, low hours on engine and drivetrain, Epic Motorsports tune, 343-365RWHP. $52,500 or best reasonable offer. **Contact Joe at (602) 618-6137 or joe@aandcproperties.com**. [25071-10]

2006 F2000 VAN DIEMEN

Prepared by James Lee. Quicksilver Ford Zetec, WRD Gearbox, Prince frame upgrade, Dynamic Shocks, AiM Data w/GPS. New Fuel cell. Entire spares package. 100th Series race-winning car. **Contact Kyle Connery. (772) 538-5048**. [25064-11]

Slot.it's exquisite range of 1:32 current and classic sports cars now includes the 1971 Targa Florio-winning Alfa Romeo T33/3 of Nino Vaccarella and Toine Hezemans.

SPARE NO EXPENSE

Slot Mods USA has taken slot-car tracks to a new level. But its $300,000 "Fantasy Track" will raise the bar again.

For 88 years, the Neiman Marcus Christmas Book, published by the fabled luxury retailer, has been the resource guide for the "one percent" when they're stumped for a stocking stuffer.

Gift ideas in previous editions have ranged from his and hers MiniSub Mark VII submarines for $18,000 in 1963, to a private concert with Elton John for $1.5 million in 2005. Included among the 2014 Christmas Book's high-ticket desirables happens to be...a slot-car track.

For $300,000.

As you'd imagine, it's not just any slot-car track. This one would require its own room because, coming in at 12ft by 30ft, it can't exactly be pushed back under the bed when you've finished racing for the evening.

Hand built to your exact desires by Slot Mods USA, this "Fantasy Track" can be a replica of an existing race track, a combination of different sections from several real race tracks, or your own crazy creation in 1:32 scale.

It comes complete with a camera system to record your races from multiple corners and angles while viewing it on custom mini screens, as well as an integrated timing system so that there'll be no argument on who's the fastest.

Six to eight months after the order is placed, Slot Mods USA founder and

1986 Indy 500 winner and IndyCar and sports car team owner Bobby Rahal (RIGHT) gives his competitive streak a run out at least once a month on his Slot Mods USA-built track at Autobahn Country Club.

TRACKSIDE WITH BOBBY RAHAL

Bobby Rahal is a slot head, and we mean that in the most affectionate terms. Along with his collection of racing memorabilia and racecars at Autobahn Country Club in Joliet, Ill., is a Slot Mods USA recreation of Road America, circa 1963.

Rahal had a Scalextric set as a boy which, along with accompanying his father to Road America, is among his early memories of a life in racing. Later, when real cars beckoned, the slot cars were put aside.

A few years ago, Rahal rediscovered slot cars through motorsport marketing impresario Zak Brown. After seeing Brown's track, Rahal got in touch with David Beattie to commission his own.

"It's definitely a conversation piece, and it's amazing to discover how many people are into slot cars," says Rahal. "It's definitely a way to bring back my youth, but it's also fun to develop a different skill around racing and, as always, to be really competitive."

For the record, son Graham currently holds the lap record at Bobby's track...

Fast cars need a fast, precise controller. Professor Motor's PMTR2131 Ninco Electronic Controller fits the bill for your 1:32 finest, and is remarkable value at just $56.95. Pre-order at **professormotor.com**. And there's free shipping on orders over $100.

A GLIMPSE OF SLOT-CAR TRACK NIRVANA

Slot Mods founder David Beattie recently appeared on NBC's *Today* show to talk about the $300,000 "Fantasy Track" available from the Neiman Marcus Christmas Book. His track shown here offers just a glimpse into what that price tag will deliver. At 6ft by 12ft, it includes a timing system but no cameras, and can be yours for "only" $75,000.

master builder David Beattie, who by that point will have spent a considerable amount of time in your home performing the final assembly, will return on a night of your choosing with friends and racing legends David Hobbs and Vic Elford.

Together, you'll christen the track with a party of your friends who you may just suddenly find are now totally addicted to slot-car racing. With a track like this, who could blame them?

EXPLORE

Learn more about Slot Mods USA's hand-crafted, museum-quality slot-car tracks at **slotmods.com**

ATTENTION TO DETAIL

When Bobby Rahal decided his dream slot-car track would be the Road America of his early 1960s childhood, he flooded Slot Mods USA founder David Beattie with many of his own images of the classic Wisconsin road course from that era to get the details just right.

Carrera's exclusive rights to make Ferrari and Red Bull Racing F1 cars in slot car form gives it unprecedented access to the real thing, resulting in works of art like Fernando Alonso's 2013 F138 rendered in 1:32 scale.

RECREATE FORMULA 1'S CLASSIC STAGES

If you've got the pieces, Carrera has the plans to make your own grand prix track.

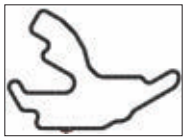
If a $300,000 slot-car track isn't in the budget just yet, but you still like the idea of Spa-Francorchamps or Suzuka pushing the daily driver out of the garage, Carrera can help.

The Austrian-based slot-car giant offers a huge selection of current and recent grand prix circuits, with a complete breakdown of the track pieces you'll need to complete a monster like Spa – an epic 96ft long, but needing a 30ft x 22ft footprint – or a more compact project such as Albert Park in Melbourne, the home of the Australian GP, which requires just 43ft of track and a 15.5ft x 10.5ft space in your garage or man cave.

Find out more, and check out Carrera's latest cars and 1:32 race party sets (trophies included), too, at **carrera-toys.com**.

GET BUILDING

Whether it's Suzuka (ABOVE, crossover included), Spa (BELOW) or another F1 fave, Carrera has the plans.



Scalextric's 1:32 stunning rendering of Bentley's Continental GT3 captures all the poise and presence of the luxo-racer. You can pre-order at an un-Bentley $54.99.

SCALEXTRIC: STILL THE BENCHMARK

You certainly can't accuse the 1:32 doyen of going with the obvious options...

It's the most venerable name in slot cars, the brand that kick-started a life-long addiction for so many of us, but 57-years-young Scalextric remains a benchmark for 1:32 scale racing.

Recent and upcoming releases in its excellent Legends range include Bruce McLaren's M7C from the 1969 German Grand Prix, Jochen Rindt's 1970 Dutch GP-winning Lotus 72C – the first of four consecutive wins for the Austrian, who died later that year at Monza, and Tony Trimmer's Melchester Racing McLaren M23 from the 1978 British GP meeting – a race he failed to qualify for. Eclectic choice, or what? Which is why we love Scalextric.

hornbyamerica.com

SHELBY'S 250F

Scalextric doesn't just go for the obvious in its Legends range. A limited-edition of Carroll Shelby's 1958 Maserati 250F is beautiful proof of that.

GIFT GUIDE

STUFF *WE'D* LIKE TO RECEIVE...

TSM-Models' 1:18 racecar replicas are among the finest out there, and its newly released Greenwood Corvette "Spirit of Le Mans" car is brash, colorful confirmation of that. **tsm-models.com**

Triumph Sports Chronograph Watch

MSRP $374.99

shop.triumphmotorcycles.com

Just in time for the holidays, the black, silver, and red Sports Chronograph Watch from Triumph Motorcycles comes water resistant to 5 ATM and features a 100 percent genuine leather strap, stepped chapter ring, Japanese chronograph movement and 45mm diameter case – plus some serious Triumph DNA.

RC Alfa Romeo 155 V6TI

MSRP $223

RC Renault Alpine A110

MSRP $252

tamiyausa.com

All-wheel drive DTM Alfa or rear-wheel drive rally Alpine? They're just two great RC cars from Tamiya's vast fleet.

International Motor Racing Research Center Prize Draw

One ticket for $40 or three for $100

Win a Fiat 500 Abarth *and* a trip to Italy! Purchase tickets today and support the work of the International Motor Racing Research Center at Watkins Glen, dedicated to preserving and sharing the history of motorsports – all race series, all tracks worldwide. Only 3,500 tickets will be sold: one for $40 or three for $100. The Center is a 501(c)(3) non-profit organization; the ticket price is tax-deductible. Drawing: Dec. 13, 2014. Need not be present to win.

Call (607) 535-9044

or contact research@racingarchives.org

HJC Motorsports' Si-12R helmet

MSRP $675.99

hjc-motorsports.com | (562) 407-2186

HJC's new SNELL SA2010-approved Si-12R features a Super Lite Composite Weave Shell, making it one of the lightest helmets in the industry. It has a fire resistant moisture-wicking comfort-carbon removable/washable interior and improved Advanced Channeling Ventilation System for optimum cooling.

CTEK MUS 4.3 Test and Charge battery charger

MSRP $119.99

ctek.com | (330) 963-0981

The CTEK MUS 4.3 Test and Charge is a unique battery charger designed to give consumers a complete picture of the health of their vehicle charging system. It combines an advanced microprocessor-controlled battery charger with a battery and alternator test function to provide the ultimate in battery testing, charging and maintenance.

Gurney Eagle-Weslake F1: Stance & Speed Monograph No. 5

$17.95 plus S&H

www.stanceandspeed.com

The most beautiful Formula 1 car ever (our readers said that, so it's true) photographed by *RACER* regular Peter Harholdt, with words by Bob Varsha and a foreword by Dan Gurney himself. Magic! Pre-order now to receive books before the Holidays.

Champion Racing: A Little Bit of Magic

$130 plus S&H

bullpublishing.com

David Bull Publishing's superb tome tells the story of Dave Maraj's Champion Racing team, including its victory in the 2005 24 Hours of Le Mans. Words are by *RACER* contributor David Tremayne.

2015 Scuderia Ferrari Calendar

$39.95 plus S&H

Not just any Ferrari calendar, this is the official one, and the stunning images reflect that lofty status.

Who wouldn't be stoked to receive tickets for the 2015 Indianapolis 500 or one of the other major events at the Indianapolis Motor Speedway? Reserve them now at **indianapolismotorspeedway.com**

1:18 1938 Alfa Romeo 8C 2900B Special Touring Coupe
MSRP $423.99
replicarz.com | (800) 639-1744
CMC Models comes up with another incredible 1:18 scale replica. This is the 1938 Alfa Romeo 8C 2900B Special Touring Coupe in high-luster burgundy. Over 1,800 individual pieces are hand assembled to produce a highly detailed and accurate die-cast model. The opening hood shows the detailed engine and opening doors reveal the authentic interior. The trunk also opens to show the spare tire. Replicarz stocks the entire range of models by CMC.

Alpinestars Tech 1-Z Shoe
MSRP $329.95
alpinestars.com | (310) 891-0222
The new 2015 Tech 1-Z is Alpinestars' premium race shoe, certified to meet FIA 8856/2000 homologation standards. Its streamlined profile incorporates advanced performance technologies and materials such as Nomex and supple kangaroo leather, making it extremely lightweight and durable. Extensive perforation zones provide excellent ventilation, while Alpinestars' exclusive thin rubber compound outsole, derived from its F1 program, provides superb levels of feel, grip and comfort on the pedals.

NASA TrackTime gift certificates
Starting at just $50
trackgift@DriveNASA.com
Ever wanted to become a racecar driver? Looking to turn a friend or family member into a more competent highway driver? NASA TrackTime makes the perfect gift for friends or family. Their street car, NASA's instructors, equals fun and great behind-the-wheel knowledge. Gift certificates start at just $50 for an introductory experience. Email **trackgift@DriveNASA.com** for your gift certificate.

RACER MAGAZINE SUBSCRIPTION

RACER magazine subscription
$39 for a one-year print subscription (8 issues, includes instant-access digital subscription); $9.99 for a one-year digital-only subscription
racer.com/intro
The gift that keeps on giving. Treat yourself, a loved one or a friend to a one-year subscription to America's finest motorsports magazine. Print issues are mailed in a protective polybag.

THE *RACER* STORE

racermerch.com
Introducing a new, one-stop shop for *RACER*-branded clothing and merchandise, back issues of your favorite magazine, and stunning motorsport art from some of the incredible photographers and illustrators who contribute to *RACER* magazine, including Ricardo Santos (TOP, Alain Prost's 1981 Renault RE30) and Rick Graves (LEFT, Joe Leonard's 1968 Lotus 56 Turbine).


Scott LePage/LAT

The final score was 9-2 in terms of wins for the Daytona Prototypes over P2 cars in IMSA's unified Prototype class. At Petit Le Mans, Wayne Taylor Racing completed a sweep of the three enduros for DPs.


Michael Levitt/LAT

STING IN THE TAIL FOR TUDOR GTLM CHAMPS

It was mission accomplished but also, poignantly, over and out for the young Dodge SRT Motorsport program in IMSA at Petit Le Mans in October. Kuno Wittmer won the TUDOR United SportsCar GTLM class Drivers' crown, while the two-car Viper GTS-R squad claimed the Teams' title. In only the car's second complete season of GT racing, those were truly great achievements. Two days later, Fiat Chrysler Automobiles announced that the program had been axed for 2015.

F1 WORLD CHAMPIONSHIP

March 16	Australia	Nico Rosberg
March 30	Malaysia	Lewis Hamilton
April 6	Bahrain	Lewis Hamilton
April 20	China	Lewis Hamilton
May 11	Spain	Lewis Hamilton
May 25	Monaco	Nico Rosberg
June 8	Canada	Daniel Ricciardo
June 22	Austria	Nico Rosberg
July 6	Britain	Lewis Hamilton
July 20	Germany	Nico Rosberg
July 27	Hungary	Daniel Ricciardo
Aug. 24	Belgium	Daniel Ricciardo
Sept. 7	Italy	Lewis Hamilton
Sept. 21	Singapore	Lewis Hamilton
Oct. 5	Japan	Lewis Hamilton
Oct. 12	Russia (Sochi)	
Nov. 2	United States (CoTA)	
Nov. 9	Brazil (Interlagos)	
Nov. 23	Abu Dhabi (Yas Marina)	

VERIZON INDYCAR SERIES

March 30	St. Petersburg	Will Power
April 13	Long Beach	Mike Conway
April 27	Barber	Ryan Hunter-Reay
May 10	Indy GP	Simon Pagenaud
May 25	Indy 500	Ryan Hunter-Reay
May 31	Detroit 1	Will Power
June 1	Detroit 2	Helio Castroneves
June 7	Texas	Ed Carpenter
June 28	Houston 1	Carlos Huertas
June 29	Houston 2	Simon Pagenaud
July 6	Pocono	Juan Montoya
July 12	Iowa	Ryan Hunter-Reay
July 20	Toronto 1	Sebastien Bourdais
July 20	Toronto 2	Mike Conway
Aug. 3	Mid-Ohio	Scott Dixon
Aug. 17	Milwaukee	Will Power
Aug. 24	Sonoma	Scott Dixon
Aug. 30	Fontana	Tony Kanaan

IMSA TUDOR UNITED SPORTSCAR CHAMPIONSHIP

Jan. 25-26	Daytona	S. Bourdais/ J. Barbosa/C. Fittipaldi
March 15	Sebring	Pruett/Rojas/Franchitti
April 12	Long Beach	S. Pruett/M. Rojas
May 4	Monterey	J.V. Overbeek/E. Brown
May 31	Detroit	J. Taylor/R. Taylor
June 7	Kansas (PC)	C. Braun/J. Bennett
June 29	Watkins Glen	M Valiante/ R. Westbrook
July 13	Mosport	G. Yacaman/O. Pla
July 25	Indianapolis	J. Barbosa/ C. Fittipaldi
Aug. 10	Elkhart Lake	J. Barbosa/ C. Fittipaldi
Aug. 24	VIR (GT)	G. Fisichella/P. Kaffer
Sept. 20	COTA	S. Pruett/M. Rojas
Oct. 4	Road Atlanta	J. Taylor/R. Taylor M. Angelelli

NASCAR SPRINT CUP SERIES

Feb. 23	Daytona 500	Dale Earnhardt Jr.
March 2	Phoenix	Kevin Harvick
March 9	Las Vegas	Brad Keselowski
March 16	Bristol	Carl Edwards
March 23	Fontana	Kyle Busch
March 30	Martinsville	Kurt Busch
April 7	Texas	Joey Logano
April 12	Darlington	Kevin Harvick
April 26	Richmond	Joey Logano
May 4	Talladega	Denny Hamlin
May 10	Kansas	Jeff Gordon
May 25	Charlotte	Jimmie Johnson
June 1	Dover	Jimmie Johnson
June 8	Pocono	Dale Earnhardt Jr.
June 15	Michigan	Jimmie Johnson
June 22	Sonoma	Carl Edwards
June 28	Kentucky	Brad Keselowski
July 6	Daytona	Aric Almirola
July 13	Loudon	Brad Keselowski
July 27	Indianapolis	Jeff Gordon
Aug. 3	Pocono	Dale Earnhardt Jr.
Aug. 10	Watkins Glen	AJ Allmendinger
Aug. 17	Michigan	Jeff Gordon
Aug. 23	Bristol	Joey Logano
Aug. 31	Atlanta	Kasey Kahne
Sept. 6	Richmond	Brad Keselowski
Sept. 14	Chicagoland	Brad Keselowski
Sept. 21	Loudon	Joey Logano
Sept. 28	Dover	Jeff Gordon
Oct. 5	Kansas	Joey Logano
Oct. 11	Charlotte, N.C.	
Oct. 19	Talladega, Ala.	
Oct. 26	Martinsville, Va.	
Nov. 2	Fort Worth, Texas	
Nov. 9	Phoenix, Ariz.	
Nov. 16	Homestead, Fla.	

FEATURE RACE

U.S. GRAND PRIX
WHEN Nov. 2
WHERE Austin, Texas

C'mon, this one's a no-brainer. Yes, it's a two-way title fight, but CoTA could be decisive.


Steven Tee/LAT

TICKET INFO

Order race tickets directly at **www.circuitoftheamericas.com**

WHERE & HOW

Nearby cosmopolitan Austin, CoTA has fine-tuned traffic flow for its big GP crowds.

KID ROCKS

Le Mans racer and Dyson Racing protege Matt McMurry, who doesn't turn 17 until November, added an exclamation point to his breakout year with victory in the final round of the Cooper Tires Prototype Lights season at Road Atlanta.


Scott LePage/LAT

"You play many times on the PlayStation and you can see the many buttons – they are all there – so you already have a first feel for it"

MAX VERSTAPPEN explains why his F1 debut at age 17 is no big deal


Charles Coates/LAT

Charles Coates/LAT

"I cannot provide a guarantee that we will be [in F1] until the end of the season or next year – but who *can* do this?" MANFREDI RAVETTO **admitted buying out Caterham was just the first hurdle**

Tony Schumacher edged closer to a possible eighth NHRA Top Fuel title by denying Brittany Force her first win in the final round at Reading – her fourth final round of the year.

NASCAR NATIONWIDE SERIES

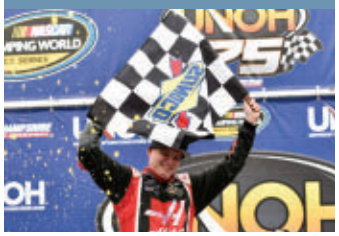
Feb. 22	Daytona	Regan Smith
March 1	Phoenix	Kyle Busch
March 8	Las Vegas	Brad Keselowski
March 15	Bristol	Kyle Busch
March 22	Fontana	Kyle Larson
April 4	Texas	Chase Elliott
April 11	Darlington	Chase Elliott
April 25	Richmond	Kevin Harvick
May 3	Talladega	Elliott Sadler
May 18	Iowa	Sam Hornish Jr.
May 24	Charlotte	Kyle Larson
May 31	Dover	Kyle Busch
June 14	Michigan	Paul Menard
June 21	Elkhart Lake	Brendan Gaughan
June 27	Kentucky	Kevin Harvick
July 4	Daytona	Kasey Kahne
July 12	Loudon	Brad Keselowski
July 19	Chicagoland	Chase Elliott
July 26	Indianapolis	Ty Dillon
Aug. 2	Iowa	Brad Keselowski
Aug. 9	Watkins Glen	Marcos Ambrose
Aug. 16	Mid-Ohio	Chris Buescher
Aug. 22	Bristol	Ryan Blaney
Aug. 30	Atlanta	Kevin Harvick
Sept. 5	Richmond	Kyle Busch
Sept. 13	Chicagoland	Kevin Harvick
Sept. 20	Kentucky	Brendan Gaughan
Sept. 27	Dover	Kyle Busch
Oct. 4	Kansas	Kyle Busch
Oct. 10	Charlotte, N.C.	
Nov. 1	Fort Worth, Texas	
Nov. 8	Phoenix, Ariz.	
Nov. 15	Homestead, Fla.	

NASCAR CAMPING WORLD TRUCK SERIES

Feb. 21	Daytona	Kyle Busch
March 29	Martinsville	Matt Crafton
May 9	Kansas	Kyle Busch
May 16	Charlotte	Kyle Busch
May 30	Dover	Kyle Busch
June 6	Texas	Matt Crafton
June 14	Madison	Darrell Wallace Jr.
June 26	Kentucky	Kyle Busch
July 11	Iowa	Erik Jones
July 23	Eldora	Darrell Wallace Jr.
Aug. 2	Pocono	Austin Dillon
Aug. 16	Michigan	Johnny Sauter
Aug. 21	Bristol	Brad Keselowski
Aug. 31	Mosport	Ryan Blaney
Sept. 12	Chicagoland	Kyle Busch
Sept. 20	Loudon	Cole Custer

CUSTER'S FAST STAND

With a name like Cole Custer, he was born to be a NASCAR ace... but *this* soon? At New Hampshire's Truck Series race, the Californian become the youngest winner in NASCAR national series history at 16 years, 7 months and 28 days.



Michael Levitt/LAT

FEATURE RACE

FORD ECOBOOST 400
WHEN Nov. 16
WHERE Homestead, Fla.
Yes the hype machine is in overdrive but the climax of the Chase for NASCAR's Sprint Cup always ensures real drama.

TICKET INFO

Order race tickets directly at **homesteadmiamispeedway.com**

WHERE & HOW

OK, it's in Homestead, not Miami, but it's a highway breeze to HMS. Also nearby: Biscayne National Park's epic offshore barrier reefs.

Sept. 27	Las Vegas	Erik Jones
Oct. 18	Talladega, Ala.	
Oct. 25	Martinsville, Va.	
Oct. 31	Fort Worth, Texas	
Nov. 7	Phoenix, Ariz.	
Nov. 14	Homestead, Fla.	

FIA WORLD ENDURANCE CHAMPIONSHIP

April 20	Silverstone	A. Davidson/ N. Lapierre/S. Buemi
May 3	Spa	A. Davidson/ N. Lapierre/S. Buemi
June 14-15	24 Hours of Le Mans	M. Fassler/ A. Lotterer/B. Treluyer
Sept. 20	CoTA	M. Fassler/ A. Lotterer/B. Treluyer
Oct. 12	Fuji, Japan	
Nov. 2	Shanghai, China	
Nov. 15	Sakhir, Bahrain	
Nov. 30	Sao Paulo, Brazil	

NHRA MELLO YELLO SERIES

Feb. 9	Pomona
Feb. 23	Phoenix
March 16	Gainesville
March 30	Las Vegas
April 13	Charlotte, N.C. (PSM)
April 27	Houston, Texas
May 18	Atlanta, Ga. (PSM)
May 25	Topeka, Kan.
June 1	Englishtown, N.J. (PSM)
June 15	Bristol, Tenn.
June 22	Epping, N.H. (PSM)
June 29	Chicago, Ill. (PSM)
July 6	Norwalk, Ohio (PSM)
July 20	Denver, Colo. (PSM)
July 27	Sonoma, Calif. (PSM)
Aug. 3	Seattle, Wash.
Aug. 17	Brainerd, Minn.
Sept. 1	Indianapolis, Ind. (PSM)
Sept. 14	Charlotte, N.C. (PSM)
Sept. 21	Dallas, Texas (PSM)
Sept. 28	Madison, Ill. (PSM)
Oct. 5	Reading, Pa. (PSM)
Nov. 2	Las Vegas, Nev. (PSM)
Nov. 16	Pomona, Calif. (PSM)

PIRELLI WORLD CHALLENGE

March 30	St. Petersburg, Fla. (GT)**
April 13	Long Beach, Calif. (GT)
April 27	Barber, Birmingham, Ala. (GT, TC)**
May 16	CTMP, Bowmanville, Ont. (TC)**
June 1	Detroit, Mich. (GT)**
June 1	Millville, N.J. (TC)**
June 21	Elkhart Lake, Wis. (GT, TC)**
July 20	Toronto, Ontario (GT)
Aug. 3	Mid-Ohio (GT, TC)**
Aug. 24	Sonoma, Calif. (GT)**
Aug. 31	Brainerd, Minn. (TC)**
Sept. 13	Miller Park, Tooele, Utah (GT, TC)**

** double-header event

OLD GOLD

Johnny O'Connell called on all his years of experience to eke out one more Pirelli World Challenge GT crown for Cadillac's CTS-*V* against newer GT3 cars. Next year Cadillac is expected to take on the world in PWC with a GT3-spec ATS.

Richard Dole/LAT

FIA WORLD RALLY CHAMPIONSHIP

Jan. 19	Monte Carlo	Sebastien Ogier
Feb. 9	Sweden	Jari-Matti Latvala
March 7-9	Mexico	Sebastien Ogier
April 4-6	Portugal	Sebastien Ogier
May 9-11	Argentina	Jari-Matti Latvala
June 1	Italy	Sebastien Ogier
June 27-29	Poland	Sebastien Ogier
Aug. 1-3	Finland	Jari-Matti Latvala
Aug. 22-24	Germany	Thierry Neuville
Sept. 12-14	Australia	Sebastien Ogier
Oct. 3-5	France	Jari-Matti Latvala
Oct. 24-26	Spain	
Nov. 14-16	Britain (Wales)	

COOPER TIRES INDY LIGHTS CHAMPIONSHIP

March 30	St. Petersburg	Z. Veach
April 13	Long Beach	G. Chaves
April 26	Barber 1	Z. Veach
April 27	Barber 2	G. Chaves
May 9	Indy GP 1	M. Brabham
May 10	Indy GP 2	L. Razia
May 23	Indianapolis	G. Chaves
July 6	Pocono	G. Chaves
July 20	Toronto	A. Baron
Aug. 2-3	Mid-Ohio 1&2	J. Harvey
Aug. 17	Milwaukee	Z. Veach
Aug. 23-24	Sonoma 1&2	J. Harvey

PRO MAZDA CHAMPIONSHIP

Mar. 29-30	St. Petersburg 1&2	S. Pigot
April 26-27	Barber 1&2	S. Pigot
May 9-10	Indianapolis 1&2	S. Hargrove
May 23	Indianapolis (oval)	G. Grist
June 28	Houston 1	S. Hargrove
June 29	Houston 2	S. Pigot
Aug. 2	Mid-Ohio 1	N. Costa
Aug. 3	Mid-Ohio 2	G. Grist
Aug. 17	Milwaukee	S. Pigot
Aug. 23	Sonoma 1	K. Kaiser
Aug. 24	Sonoma 2	J. Gutierrez

USF2000 CHAMPIONSHIP

Mar. 29	St. Petersburg 1	V. Franzoni
Mar. 30	St. Petersburg 2	RC Enerson
April 26-27	Barber Park 1&2	RC Enerson
May 9	Indianapolis 1	W. Owen
May 10	Indianapolis 2	A. Starrantino
May 24	Indianapolis (oval)	A. Telitz
July 19	Toronto 1	J. Eidson
July 20	Toronto 2	F. Latorre
Aug. 1	Mid-Ohio 1	RC Enerson
Aug. 2	Mid-Ohio 2	J. Eidson
Aug. 3	Mid-Ohio 3	F. Latorre
Aug. 23	Sonoma 1	RC Enerson
Aug. 24	Sonoma 2	F. Latorre

RACER.com

Robin Miller answers your questions on Racer.com. Write to **MillersMailbag@racer.com**

TV
FALL 2014


NHRA

The NHRA's Countdown clock reaches zero at Pomona on Nov. 16, with extensive live streamed coverage of all classes on ESPN3, and same-day TV coverage on ESPN2.

NOV. 23

DOUBLE PLEASURE?

Formula 1's Great Experiment – a double-points finale – plays out in the extravagant setting of Abu Dhabi. Whether or not it plays a decisive role in deciding who will wear this year's crown will probably not change your mind as to whether it's a useful drama-ensuring tool, or a cynical gimmick to keep the fan base locked in until the final gun. But at least it adds another element to an unusual F1 season that has been among the most stratified in form, yet provided consistently close-fought races.

The Yas Marina Circuit, located on an island off the eastern coast of the Arab Emirate, is a fairly typical modern-variety F1 track, although its sunset start adds a touch of gravitas to what figures to be a highly charged pre-race atmosphere.

DETAILS

8:00am NBCSN: F1's title showdown in the desert.

ALL TIMES ARE EASTERN (ET)

WEDNESDAY, OCTOBER 22

No racing scheduled at press time

THURSDAY, OCTOBER 23

No racing scheduled at press time

FRIDAY, OCTOBER 24

12:00pm FS1: NASCAR Sprint Cup practice, Martinsville, Va. (L)
1:30pm FS1: NASCAR Camping World Truck Series practice, Martinsville, Va. (L)
4:30pm FS1: NASCAR Sprint Cup qualifying, Martinsville, Va. (L)

SATURDAY, OCTOBER 25

9:00am FS1: NASCAR Sprint Cup practice, Martinsville, Va. (L)
10:00am FS1: NASCAR Camping World Truck Series qualifying, Martinsville, Va. (L)
12:00pm FS1: NASCAR Sprint Cup practice, Martinsville, Va. (L)
1:30pm FS1: NASCAR Camping World Truck Series, Martinsville, Va. (L)

SUNDAY, OCTOBER 26

3:00am FS1: MotoGP Championship, Malaysia (L)
1:30pm ESPN: NASCAR Sprint Cup Series, Martinsville, Va. (L)

MONDAY, OCTOBER 27

3:00am FS1 (Oct. 27)
FIA World Endurance, Fuji
FOX Sports 1 airs highlights of the WEC races in the early morning hours, so set the DVR.


Ebrey/LAT

7:00pm FS1: Red Bull Air Racing, Las Vegas, Nev. (D)

TUESDAY, OCTOBER 28

No racing scheduled at press time

WEDNESDAY, OCTOBER 29

No racing scheduled at press time

THURSDAY, OCTOBER 30

No racing scheduled at press time

FRIDAY, OCTOBER 31

TBA NBCSN: FIA Formula 1, USGP practice, Austin, Texas (L)
12:00pm FS1: NASCAR Nationwide Series practice, Fort Worth, Texas (L)
1:00pm FS1: NASCAR Sprint Cup Series practice, Fort Worth, Texas (L)
3:00pm FS1: NASCAR Camping World Truck Series qualifying, Fort Worth, Texas (L)
4:30pm ESPN2: NASCAR Nationwide Series practice, Fort Worth, Texas (L)
6:30pm ESPN2: NASCAR Sprint Cup qualifying, Fort Worth, Texas (L)
8:00pm FS1: NASCAR Camping World Truck Series, Fort Worth, Texas (L)

SATURDAY, NOVEMBER 1

11:00am FS1: NASCAR Sprint Cup Series practice, Fort Worth, Texas (L)
12:00pm ESPN2: NASCAR Nationwide Series qualifying, Fort Worth, Texas (L)
1:00pm NBCSN: FIA Formula 1, USGP qualifying, Circuit of The Americas, Austin, Texas (L)
2:00pm FS1: NASCAR Sprint Cup Series practice, Fort Worth, Texas (L)
3:30pm ESPN: NASCAR Nationwide Series, Fort Worth, Texas (L)

SUNDAY, NOVEMBER 2

2:30am ESPN2: NHRA Mello Yello Drag Racing qualifying, Las Vegas, Nev. (D)
2:00pm NBC: FIA Formula 1, USGP, Circuit of The Americas, Austin, Texas (L)
3:00pm ESPN: NASCAR Sprint Cup, Fort Worth, Texas (L)
6:00pm ESPN2: NHRA Mello Yello Drag Racing, Las Vegas, Nev. (SDD)

MONDAY, NOVEMBER 3

No racing scheduled at press time

TUESDAY, NOVEMBER 4

No racing scheduled at press time

WEDNESDAY, NOVEMBER 5

No racing scheduled at press time

THURSDAY, NOVEMBER 6

No racing scheduled at press time

FRIDAY, NOVEMBER 7

11:00am NBCSN: FIA Formula 1, Brazilian GP practice, Interlagos, Brazil (L)

Charles Coates/LAT

"I should have a contract until the end of the year – but Formula 1 sometimes doesn't work on contracts..."
KAMUI KOBAYASHI **facing a race-to-race F1 future with struggling Caterham**

Glenn Dunbar/LAT

Formula E will attempt to apply the lessons learned from its inaugural race in Beijing to Round 2, again on an all-new street circuit, in the exotic locale of Putrajaya, Malaysia.

Jeet Leicester/LAT

12:00pm	FS1: NASCAR Nationwide Series practice, Phoenix, Ariz. (L)
1:30pm	FS1: NASCAR Sprint Cup Series practice, Phoenix, Ariz. (L)
3:00pm	FS1: NASCAR Nationwide Series practice, Phoenix, Ariz. (L)
4:30pm	FS1: NASCAR Camping World Truck Series qualifying, Phoenix, Ariz. (L)
6:30pm	ESPN2: NASCAR Sprint Cup qualifying, Phoenix, Ariz. (L)
8:00pm	FS1: NASCAR Camping World Truck Series, Phoenix, Ariz. (L)

CHANNEL GUIDE

ABC	ESPN on ABC
CBS	CBS Broadcasting, Inc.
CNBC	NBC Business News
NBC	NBC Universal
NBCSN	NBC Sports Network
ESPN	ESPN networks
ESPN-N	ESPN News
FOX	FOX Broadcast Network
FS1	FOX Sports 1 (formerly SPEED)
FS2	FOX Sports 2 (formerly FUEL)
TNT	Turner Network Television
VELOCITY	Velocity Channel
L	Live Program
R	Repeat Program
TBD	Start time to be determined
D	Delayed from earlier day
SDD	Same day, delayed

All listings subject to change. Networks may broadcast programs at different times in different time zones. Check local listings.

SATURDAY, NOVEMBER 8

11:00am	NBCSN: FIA Formula 1, Brazilian GP qualifying, Interlagos, Brazil (L)
4:00pm	ESPN: NASCAR Nationwide Series, Phoenix, Ariz. (L)

SUNDAY, NOVEMBER 9

1:00pm	NBC: FIA Formula 1, Brazilian GP, Interlagos, Brazil (L)
3:00pm	ESPN2: NASCAR Sprint Cup, Phoenix, Ariz. (L)

MONDAY, NOVEMBER 10

7:00pm	FS1: Red Bull Air Racing, Spielberg, Austria

TUESDAY, NOVEMBER 11

No racing scheduled at press time

WEDNESDAY, NOVEMBER 12

No racing scheduled at press time

THURSDAY, NOVEMBER 13

No racing scheduled at press time

FRIDAY, NOVEMBER 14

11:30am	FS1: NASCAR Nationwide Series practice, Homestead, Fla. (L)
12:30pm	FS1: NASCAR Sprint Cup practice, Homestead, Fla. (L)
2:30pm	FS1: NASCAR Camping World Truck Series qualifying, Homestead, Fla. (L)
4:00pm	FS1: NASCAR Nationwide Series practice, Homestead, Fla. (L)
6:00pm	ESPN2: NASCAR Sprint Cup qualifying, Homestead, Fla. (L)
7:30pm	FS1: NASCAR Camping World Truck Series, Homestead, Fla. (L)

SATURDAY, NOVEMBER 15

12:00pm	FS1: NASCAR Sprint Cup practice, Homestead, Fla. (L)
1:00pm	FS1: NASCAR Nationwide Series qualifying, Homestead, Fla. (L)
6:00pm	ESPN2: NASCAR Nationwide Series, Homestead, Fla. (L)

SUNDAY, NOVEMBER 16

1:30pm NBC (Nov. 16)
Red Bull Global Rallycross
A year of significant growth for rallycross ends with a network telecast of the Las Vegas finale.

3:00pm	ESPN: NASCAR Sprint Cup, Homestead, Fla. (L)
3:00pm	ESPN2: NHRA Mello Yello Drag Racing qualifying, Pomona, Calif. (D)
7:30pm	ESPN2: NHRA Mello Yello Drag Racing, Pomona, Calif. (SDD)

MONDAY, NOVEMBER 17

3:00am	FS1: FIA World Endurance Championship, Shanghai, China (D)

TUESDAY, NOVEMBER 18

No racing scheduled at press time

WEDNESDAY, NOVEMBER 19

No racing scheduled at press time

THURSDAY, NOVEMBER 20

1:30am	NBCSN: Red Bull Global Rallycross, Las Vegas, Nev. (R)

FRIDAY, NOVEMBER 21

8:00am	NBCSN: FIA Formula 1, Abu Dhabi GP practice, Abu Dhabi (L)

SATURDAY, NOVEMBER 22

4:00am	FS1: FIA Formula E Championship, Putrajaya, Malaysia (L)
8:00am	CNBC: FIA Formula 1, Abu Dhabi GP qualifying, Abu Dhabi (L)

SUNDAY, NOVEMBER 23

8:00am	NBCSN: FIA Formula 1, Abu Dhabi GP, Abu Dhabi (L)
6:00pm	FS1: NASCAR Nationwide & Truck Series awards ceremony (D)

MONDAY, NOVEMBER 24

No racing scheduled at press time

TUESDAY, NOVEMBER 25

No racing scheduled at press time

WEDNESDAY, NOVEMBER 26

No racing scheduled at press time

THURSDAY, NOVEMBER 27

No racing scheduled at press time

FRIDAY, NOVEMBER 28

No racing scheduled at press time

SATURDAY, NOVEMBER 29

No racing scheduled at press time

SUNDAY, NOVEMBER 30

No racing scheduled at press time

MULTIMEDIA

ON YOUTUBE

"The Chase: McLaren 650S"

McLaren's media department are masters at evocative content even when, like here, they don't want to give much away. This "teaser" video for the company's new GT3 car will get your blood racing.

ON RACER.COM

***RACER* Presents: The Bentley Boys are back**

RACER was granted unique behind-the-scenes access by Bentley and Dyson Racing for this series of videos charting the progress of their Pirelli World Challenge GT team.

ON TWITTER

@Andre_Lotterer is informed, interesting and embraces many forms of racing. Follow Audi's three-time Le Mans winner as he guns for a second World Endurance Championship.

Charles Coates/LAT

RACER.com

As well as Robin Miller's Mailbag, RACER.com now features Marshall Pruett's answers to your tech questions. Write to PruettsTechMailbag@Racer.com

IndyCar team owner Bryan Herta's 14-year-old son Colton is already an open-wheel winner in Malaysia's AsiaCup and is aiming for a full season of USF2000 in 2015.

Alastair Staley/LAT

OUT TAKE

There wasn't a Ferrari driver on the Italian Grand Prix podium this year (well, not a current one...), but that didn't dampen the fervor of the massed *tifosi* at Monza.

Scott LePage/LAT

FIRSTS
JUSTIN WILSON

> FIRST RACING HERO Nigel Mansell. I was at Brands Hatch for the final two grands prix there (1985 and '86) and Nigel won both of them.
> FIRST STREET CAR A Peugeot 306 turbodiesel – a loan car. Not very glam.
> FIRST RACECAR Formula Vauxhall Junior. I did the Winter Series in 1994 and then the full season in '95.
> FIRST RACE In karts, that would have been at Wombwell in Yorkshire, UK. First car race, FVauxhall Jr., at Pembrey.
> FIRST VICTORY Same race!
> FIRST ACCIDENT At Brands Hatch in a Formula First. I was trapped for two hours, and the Fire Dept. had to free me with the Jaws of Life. I was lucky to have only broken an ankle and a wrist.
> FIRST PAYCHECK From the Jaguar Formula 1 team in 2003.

ANNIVERSARIES

NOVEMBER BIRTHDAYS

LAT Photographic

John Anderson, 11/1/45; Alan Jones, 11/2/46; Ben Bowlby, 11/2/66; Derek Daly, 11/3/53; Derrike Cope, 11/3/58; Jacques Villeneuve, 11/4/55; Tim Flock, 11/5/24; Jonathan Palmer, 11/7/56; Zak Brown, 11/7/72; **EDDIE IRVINE, 11/10/65**; Gil de Ferran, 11/11/67; Michael Valiante, 11/11/79; Nick Craw, 11/14/36; **BRETT LUNGER, 11/14/45**; Skip Barber, 11/16/36; Terry Labonte, 11/16/56; Roberto Guerrero, 11/16/58; Dr. Terry Trammell, 11/17/49; Eliseo Salazar, 11/18/55; Jimmy Vasser, 11/20/65; Jacques Lafitte, 11/21/43; Joe Gibbs, 11/25/40; Dale Jarrett, 11/26/56; Ashley Force Hood, 11/29/82; Shawna Robinson, 11/30/64; Mika Salo, 11/30/66.

LAT archive

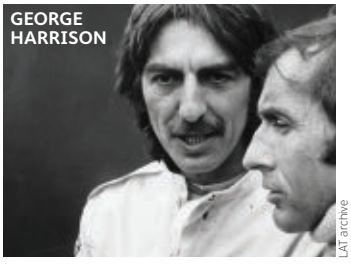
BRETT LUNGER
b. 11/14/45

Following the movie *RUSH*, American F1 veteran Lunger got fresh acclaim for his involvement in the rescue of Niki Lauda from his burning Ferrari. After retiring as a driver in 1979, Lunger worked briefly for CBS and served as a pilot for Angel Flight, flying severely ill patients for treatment.

LAT archive

WE REMEMBER

Gaston Chevrolet, 11/25/20; Eddie O'Donnell, 11/26/20; Rex Mays, 11/7/49; Joe James, 11/5/52; Jack McGrath, 11/7/55; Ricardo Rodriguez, 11/2/62; Don Branson, 11/12/66; **GRAHAM HILL**, Tony Brise, Ray Brimble, Andy Smallman, Terry Richards and Tony Alcock, 11/26/75; Masten Gregory, 11/8/85; Grant Adcox, 11/19/89; Stephane Proulx, 11/21/93; Elmo Langley, 11/21/96; Denis Jenkinson, 11/29/96; Bill Devin, 11/22/00; John Baldwin, 11/28/00; **GEORGE HARRISON, 11/29/01**; Jim Rathmann, 11/23/11.



LAT archive

IMS archive

REX MAYS
d. 11/7/49

Two-time AAA National Champion Mays was among the most respected, if unluckiest racers of Indy's roadster era, both before and after World War II interrupted the peak years of his career. A crash at Del Mar's fairgrounds claimed him at age 36.

WITHOUT COMPETITION...

SLOT MODS U.S.A. DETROIT, MICHIGAN

REAR VIEW
FALL 2014

WHAT **IndyCar Series drivers testing F1 cars**
WHERE **Europe**
WHEN **Whenever the opportunity arose**

Peter Spinney/LAT

The tusk-nosed FW26 was by no means a classic Williams, but Scott Dixon recalls driving a Formula 1 car as being an "amazing experience."

Scott Dixon still describes the Williams-BMW FW26 he tested in early 2004 as the greatest car he's ever driven. "It was exactly as you'd expect it to be; absolutely amazing in its responses, the way it turned in and reacted to every input," recalls the three-time IndyCar Series champion.

"Unfortunately, it rained on one of the days of the test, and I was learning the track, too [Paul Ricard in France], so I didn't have time to start setting it up the way I wanted. But I think I was only half a second off Marc Gene, who'd done loads of test miles for Williams."

Dixon had just completed a season in the all-oval Indy Racing League – and won the 2003 championship – so his road racing skills were perhaps not as honed as they might have been, but it probably didn't make as much of a difference as you'd assume. The real issue was the unique nature of an F1 car, far different even from the Champ Cars he'd raced on road/street courses in 2001-'02.

It's a difference that Alex Zanardi never got his head around in 1999, and it also didn't help Dario Franchitti in the summer of 2000, when he tested for Jaguar's ill-fated F1 team at Silverstone. But the main problem was that "it turned out to be a farce from start to finish...," Franchitti remarked recently. "After the first day, the car was swapped, and I don't know if I was running older-spec parts or what."

LAT archive

Franchitti was 1.4sec slower than Jaguar test driver Luciano Burti, but it's felt by all that he wasn't given a fair shake at setting a time.

Lorenzo Bellanca/LAT

Kanaan's reward for his 2004 IndyCar title with Honda was lapping Jerez in a BAR, but he had no intention of making a full-time switch.

While Dixon and Franchitti had been genuinely interested in switching to F1, Tony Kanaan's test of a BAR-Honda in 2005 was pretty much a pleasure trip, "a dream come true" for TK, who'd grown up idolizing Ayrton Senna. The 2004 IRL champ's test at Jerez went well, but he'd already committed to a new contract with Andretti Green Racing until the end of '08.

The new IndyCar champion, Will Power, had a try-out with Minardi in 2004, and given that he was only at F3 level at the time, his pace at Misano in his first F1 test was impressive and put him third fastest among the many (and more experienced) drivers trying out for Minardi at the time.

Sebastien Bourdais, of course, committed to an F1 race drive in 2008, and while partnering Red Bull favorite Sebastian Vettel was a daunting task, had he been allowed to set up the car as he saw fit, chances are he could have truly excelled. ■

FLIRTING WITH FLAVIO AND FORMULA 1

Paul Tracy's scorching speed for Penske in 1993 and '94 attracted Benetton F1 team manager Flavio Briatore, and in a test at Estoril (BELOW), PT got down to times matching those of team No. 2 Jos Verstappen. How he'd have dealt with Michael Schumacher is anyone's guess. When Briatore offered a three-year deal, but with no guarantee of races, Paul headed back across the Atlantic.

LAT archive

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– RANDY POBST, PIRELLI WORLD CHALLENGE CHAMPION

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