2013 FIA FORMULA ONE WORLD CHAMPIONSHIP

RENAULT SPORT F1 PRESS KIT

01

INTRODUCTION

Throughout its history, Renault has incorporated motorsport into its global marketing and technical development strategy. The sport has proven to be an effective testing ground for road car products, with innovative track solutions for downsizing, reliability and electric technology filtered through to the consumer ranges. With a powerful image and prestige value, motorsport, especially Formula 1, has also strengthened the brand in traditional markets while increasing visibility in emerging ones.

Renault Sport F1 is the sporting division created by Renault to represent its interests in the FIA Formula One World Championship and is tasked with designing and building optimised engines that can be fully integrated into a chassis package created by RSF1's carefully selected partner teams. Present in the sport since 1977, Renault has won 11 Constructors' World Titles and ten Drivers' World Titles in the championship, plus more than 200 pole positions and 150 wins.

The current power plant, the RS27, is a 750bhp V8 engine, in use since 2007. Identical units are supplied to four partner teams; triple world champions Red Bull Racing; Lotus F1 Team, double world champions in 2005 and 2006 when racing as the Renault F1 Team; Caterham F1 Team and Williams F1 Team. In 2012, this quartet scored nine wins and a total of 839 points, with Red Bull Racing securing the double of the Drivers' and Constructors' championship.

The main thrust of RSF1's work takes place at Viry-Châtillon, France, which has traditionally been the technical hub of Renault's F1 activities.

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RENAULT'S F1 HISTORY

Renault has competed in Grand Prix racing for over 35 years and has enjoyed success as both an engine supplier and constructor.

The journey started when Amédée Gordini, who had created Grand Prix cars under his own name, was recruited to design high performance cars for Renault.

The Dauphine Gordini appeared in 1957 and it was followed by further high performance cars including the R8 Gordini and the R12 and R17. Gordini also took the Renault name to Le Mans.

Gordini's facilities in Paris proved to be too small for the ambitious project, so a new building outside the city was sought. The ideal location was found at Viry-Châtillon, on the edge of the A6 motorway leading from Paris to the south of France. The Gordini facility was inaugurated on 6 February 1969 and it was to be the launch pad for motor sport success over the following decades.

The initial focus was on a new 2-litre V6 engine, which was officially launched in January 1973. The engine soon proved to be competitive in the prestigious European 2-litre sportscar series. That was followed by a move into the FIA World Sportscar Championship with a turbocharged version of the engine. Gerard Larrousse and Jean-Pierre Jabouille duly scored a historic first WSC win for the marque at Mugello in 1975.

Renault Sport was founded in 1976. That year saw the birth of a parallel single-seater programme with the V6 engine in European F2. Jean-Pierre Jabouille won the F2 title in 1976, and Rene Arnoux repeated the success the following year. Patrick Tambay and Didier Pironi also won races with the Renault engine.

In sportscars the turbocharged Renaults proved to be incredibly fast, securing a string of poles and fastest laps, but bad luck robbed the team of good results. The main goal was of course the Le Mans 24 Hours. Jabouille took pole in both 1976 and '77, but success eluded the works team, although a Renault-engined Mirage took second place in the latter year.

Everything came together in 1978 when Pironi and Jean-Pierre Jaussaud scored a historic victory, with another Renault coming home fourth. With Le Mans success finally secured, Renault could now focus on its other goal – Formula One.

The option to run a turbocharged engine had been in the rules for many years, but nobody had dared to pursue it until Renault. It had quietly begun track testing with a 1.5-litre version of the turbo engine in 1976, and a short programme of races was scheduled for the following year.

The RS01 made its debut in the 1977 British GP in the hands of Jabouille. Nicknamed the 'Yellow Teapot,' the car retired from its first race, but not before it had made a big impression. Four further outings at the end of the year provided more valuable experience.

The learning process continued through 1978, and at the US GP Jabouille earned the first points for Renault – and for any turbo engine – with fourth place.

With Le Mans won, Renault concentrated on F1 in 1979, adding a second car for Arnoux. Jabouille took the team's first pole in South Africa and then in July scored a memorable first victory on home soil in Dijon.

When Alain Prost joined in 1981 the Renault team developed into a regular pacesetter, and a World Championship contender. Indeed Prost only just missed out on the title in 1983. Renault also extended its involvement to that of engine supplier, forming partnerships with the Lotus, Ligier and Tyrrell teams. In Portugal in 1985 Ayrton Senna scored his first ever GP victory with Renault power, and the Brazilian proved to be one of the stars of the season.

The Renault management decided to close the works outfit at the end of 1985, and focus instead on supplying engines to other teams. Indeed in 1986 the Senna/Lotus/Renault combination proved to the fastest on the grid, as the Brazilian took eight poles – although frustration on race days meant that he scored only two wins.

At the end of 1986 Renault decided to stop its turbo F1 programme, but it was to prove to be a short sabbatical. Within months the engineers at Viry were working on a V10 for the new normally aspirated era, and in 1988 the ideal partner was found for the future programme in the form of Williams.

In its first year of competition in 1989 the new partnership won two

Grands Prix, and two further wins followed in 1990. During the later season Adrian Newey joined Williams as chief designer, and then Nigel Mansell – who had used Renault power at Lotus – rejoined the team.

It was the start of an incredible era. By the end of 1991 the combination was the one to beat, and in 1992 Mansell proved so dominant that he secured Renault's first World Championship by August.

Former works Renault driver Prost joined Williams in 1993, and he too won the title before retiring. Further championships followed for Damon Hill in 1996, and for Jacques Villeneuve in 1997. Williams-Renault also won the Constructors' title in 1992, 1993, 1994, 1996 and 1997.

Outside F1, Williams and Renault also collaborated on a touring car project that saw Renault Lagunas raced in the British Touring Car Championship. Success came quickly, and in 1997 Renault won the BTCC drivers', manufacturers' and teams' titles. The partnership also designed and built the iconic Renault Clio Williams, one of the most prized hot hatches of a generation.

In 1995 Renault expanded its involvement with a new collaboration with the Benetton team. Michael Schumacher won the championship in 1995, while Benetton won the Constructors' title – ensuring that with its two partners Renault scored six straight title successes between 1992 and 1997. Between 1995 and 1997 Renault engines won 74% of races.

Renault officially departed Formula One at the end of 1997. Williams, Benetton and later the new BAR team used Renault-based engines under the Supertec, Mecachrome and Playlife names, and work continued in a small development cell at Viry.

Again, Renault's official absence was to be a short one. In early 2001 it was announced that the company had bought the Benetton team, and was to return in a full works capacity. The Renault name returned as Benetton's engine supplier that season, and then in 2002 the team was reborn as Renault F1 Team, with the chassis department still based at Enstone, UK, while working closely with the engine division in Viry.

In 2003 Fernando Alonso gave the new team its first pole in Malaysia, and then the young Spaniard followed up with his and the team's first win in Hungary. The following year Jarno Trulli gave Renault victory in the most prestigious race of the year in Monaco.

In 2005 Alonso was the man to beat as he won the Drivers' title and Renault took the Constructors' version. Despite the huge change from V10 to V8 technology for 2006, the team was able to sustain its momentum as it again captured both titles.

Supplying other teams had long been a Renault policy, and in 2007 a new partnership was formed with Red Bull Racing.

The dark blue cars soon moved up the grid, and in 2009 Sebastian Vettel

gave RBR its first victory and earned the team runner-up spot in the Constructors' championship. In 2010 both drivers were title contenders from the start of the season. At the end of the year Vettel emerged triumphant as the youngest champion in the history of the sport, while Red Bull-Renault earned the Constructors' championship.

In 2010 Renault had begun the process of withdrawing from team ownership. The 2011 season marked the dawn of another chapter in the company's history as it returned to its core activity of engine supply, releasing its remaining shares in the Renault F1 Team. Under its new ownership, the team was now known as Lotus Renault GP, while Renault also supplied Team Lotus with engines.

Meanwhile Sebastian Vettel proved unstoppable in the World Championship, breaking all the records as he secured his second title with four races to go. Renault also powered Red Bull Racing to a second Constructors' title.

For 2012 Renault continued its successful partnership with Red Bull, with Vettel becoming the youngest-ever triple World Champion. The team also became triple Constructors' champions, joining an elite band of outfits to have sealed the title on three occasions. Lotus Renault GP was rebranded as Lotus F1 Team and duly returned to its winning ways with a superb win in Abu Dhabi, while Williams F1 Team returned to the Renault fold for the first time since 1997. It took just five races for the partnership to get back to its winning ways as Pastor Maldonado secured a win in the Spanish Grand Prix. Alongside the Caterham F1 Team, as Team Lotus became known, the four Renault engine teams finished in the top ten of the Constructors' championship with a total of 839 points and nine wins, Renault's most successful season to date.

YEAR	ACTIVITY	CHASSIS	ENGINE	DRIVER(S)
1977	Renault enters F1 for the first time with Jean-Pierre Jabouille as lead driver. The team makes its debut at the British Grand Prix. It enters a further three GPs that year.	Renault RS01	1.5l V6 turbo	Jean-Pierre Jabouille
1978	The team enters 14 GPs with Jabouille. It makes solid progress, qualifying third in Austria and finishing fourth in the USA GP.	Renault RS01	1.5l V6 turbo	Jean-Pierre Jabouille
1979	Jean-Pierre Jabouille and René Arnoux compete in the first full season for Renault. Reliability is better and the team secures its first pole in South Africa and first win at the French Grand Prix.	Renault RS01 / RS10	1.5l V6 turbo	Jean-Pierre Jabouille
1980	Jabouille and Arnoux secure wins in Brazil, South Africa and Austria, and earn four pole positions.	Renault RE20	1.5l V6 turbo	Jean-Pierre Jabouille René Arnoux
1981	Alain Prost joins Arnoux. Prost wins three GPs and finishes fourth in the championship, while Arnoux takes one win. Between them they secure six pole positions.	Renault RE20B	1.5l V6 turbo	Alain Prost René Arnoux
1982	Prost wins the first two races of the season and Arnoux adds two further successes. The speed of the car is obvious as the RE30B starts from pole in 10 of the 16 races.	Renault RE30B	1.5l V6 turbo	Alain Prost René Arnoux
1983	Renault's strongest season yet. The team finishes second in the championship, with Prost missing out on the title by just two points after winning four times.	Renault RE40	1.5l V6 turbo	Alain Prost Eddie Cheever
1984	Renault branches out into engine supply, teaming up with Team Lotus. Between Lotus and the works team the Renault engine starts from pole on three occasions but fails to win a race. De Angelis finishes the Drivers' championship in third and Lotus is third in the Constructors'.	Renault RE50 Lotus 95T	1.5l V6 turbo	Patrick Tambay (Renault) Derek Warwick (Renault) Philippe Streiff (Renault) Elio de Angelis (Lotus) Nigel Mansell (Lotus)
1985	In addition to Lotus, Renault also supplies engines to the Ligier team. Senna and de Angelis win three races to finish fourth and fifth in the championship. Ligier finishes sixth but the works' team concludes the year in seventh. It is announced that Renault will refocus activities on engine supply for the following year.	Renault RE60 / RE60B	1.5l V6 turbo	François Hesnault (Renault) Patrick Tambay (Renault) Derek Warwick (Renault) Elio de Angelis (Lotus) Ayrton Senna (Lotus) Andrea de Cesaris (Ligier) Jacques Laffite (Ligier)
1986	Renault supplies Lotus, Ligier and Tyrrell. Senna wins two races and starts from pole on eight occasions.	Lotus 98T Ligier JS27 Tyrrell 014	1.5l V6 turbo	Johnny Dumfries (Lotus) Ayrton Senna (Lotus) René Arnoux (Ligier) Jacques Laffite (Ligier) Philippe Alliot (Ligier) Martin Brundle (Tyrrell) Philippe Streiff (Tyrrell)
1987	No formal Renault engine activity.			
1988	In June a deal is signed with Williams for the 1989 season.			
1989	The Williams-Renault partnership hits the track. Thierry Boutsen wins wet races in Canada and Australia.	Williams FW12 / FW12B	3.5l V10	Thierry Boutsen Riccardo Patrese
1990	Two wins and a first pole position show that the Williams-Renault partnership has potential.	Williams FW13 / FW13B	3.5l V10	Thierry Boutsen Riccardo Patrese

1991	Mansell joins Patrese and the duo rack up seven wins and finish in second and third respectively in the Drivers' championship. Williams finishes second in the Constructors' table.	Williams FW14	3.5l V10	Nigel Mansell Riccardo Patrese
1992	Williams-Renault and Nigel Mansell emerge as the dominant force. Mansell wins the first five races and secures the title at the mid-season Hungarian Grand Prix. By the end of the season, the FW14B has won 10 of the 16 GPs.	Williams FW14B	3.5l V10	Nigel Mansell Riccardo Patrese
1993	Prost replaces Mansell and Williams remains the team to beat. The Frenchman wins seven races, with newcomer Damon Hill winning a further three. Williams-Renault secures 24 consecutive pole positions from 1992 to 1993.	Williams FW15C	3.5l V10	Alain Prost Damon Hill
1994	Williams-Renault secures the Constructors' title and Hill finishes a close runner-up in the drivers' race to Schumacher, but the year is marked by the death of Ayrton Senna at Imola. Mansell returns to lift morale and wins one race, while Hill takes six wins.	Williams FW16 / FW16B	3.5l V10	Damon Hill Ayrton Senna Nigel Mansell David Coulthard
1995	Renault supplies Benetton in addition to Williams and its engines win 16 of the 17 races and take 16 pole positions. Hill and Schumacher wrestle for the title, with the German emerging victorious. Benetton-Renault wins the Constructors' title at the first attempt.	Benetton B195 Williams FW17 Williams FW17B	3.5l V10	Damon Hill (Williams) David Coulthard (Williams) Michael Schumacher (Benetton) Johnny Herbert (Benetton)
1996	Williams returns to winning form and Hill finally takes the title with eight wins. Newcomer Jacques Villeneuve adds another four wins to the total, while Benetton finishes third in the Constructors' title with one win.	Williams FW18 Benetton B196	3.5l V10	Damon Hill (Williams) Jacques Villeneuve (Williams) Jean Alesi (Benetton) Gerhard Berger (Benetton) Alexander Wurz (Benetton)
1997	Villeneuve leads the Williams team following the departure of Hill and wins the championship in a dramatic finale at Jerez, having taken six victories. New team mate Frentzen scores his first win, while Gerhard Berger adds a single success for Benetton. Renault withdraws from official engine supply at the end of the year.	Williams FW19 Benetton B197	3.5l V10	Jacques Villeneuve (Williams) Heinz-Harald Frentzen (Williams) Jean Alesi (Benetton) Gerhard Berger (Benetton) Alexander Wurz (Benetton)
1998	Renault does not officially compete in the championship however Mecachrome and Playlife use the basic engine model to supply Williams and Benetton respectively.			
1999	The Mecachrome engine is rebadged as Supertec, and supply continues to Williams. Benetton uses Playlife for a second season.			
2000	Benetton continues to use the Playlife engine while Arrows picks up the Supertec deal following Williams' switch to BMW.			
2001	The Renault name returns to F1 following the conclusion of a deal to purchase the Benetton team, but initially the chassis name is unchanged.	Benetton B201	3.0l V10	Giancarlo Fisichella Jenson Button
2002	Benetton is reborn as the Renault F1 Team, and the outfit shows good progress as it finishes fourth in the championship.	Renault R202	3.0l V10	Jarno Trulli Jenson Button

2003	The team takes its first victory under the Renault name when Fernando Alonso wins from pole in Hungary. The Spaniard also takes pole in Malaysia as the team again finishes fourth in the championship.	Renault R23	3.0l V10	Jarno Trulli Fernando Alonso
2004	The team finishes third in the championship, with Trulli winning the prestigious Monaco Grand Prix.	Renault R24	3.0l V10	Jarno Trulli Jacques Villeneuve Fernando Alonso
2005	Alonso wins seven races and at the final race in Brazil he secures the World Championship. Fisichella also wins one race and helps Renault to its first Constructors' title.	Renault R25	3.0l V10	Fernando Alonso Giancarlo Fisichella
2006	Using the new Renault V8 engine Alonso wins seven races and takes his second championship. A win Fisichella helps Renault to successfully defend its Constructors' title.	Renault R26	2.4l V8	Fernando Alonso Giancarlo Fisichella
2007	Renault teams up with Red Bull Racing. Engine specifications are frozen, restricting developments and performance gains.	Renault R27 Red Bull RB3	2.4l V8	Heikki Kovalainen (Renault) Giancarlo Fisichella (Renault) Mark Webber (RBR) David Coulthard (RBR)
2008	Alonso returns to Renault, winning two races. The team finishes the year in fourth. The Red Bull partnership ends the year strongly.	Renault R28 Red Bull RB4	2.4l V8	Fernando Alonso (Renault) Nelson Piquet (Renault) Mark Webber (RBR) David Coulthard (RBR)
2009	Red Bull Racing-Renault scores its first win and pole at the Chinese Grand Prix and finishes the year in second following a further five wins. Alonso takes one pole position, but does not win a race.	Renault R29 Red Bull RB5	2.4l V8	Fernando Alonso (Renault) Nelson Piquet (Renault) Romain Grosjean (Renault) Mark Webber (RBR) Sebastian Vettel (RBR)
2010	Renault announces the partial sale of the team to Genii Capital but continues to compete under the Renault F1 Team banner. Red Bull emerges as the dominant team of the season, but the title goes down to the final race. Vettel is crowned champion and the team secures its first constructors' championship.	Renault R30 Red Bull RB6	2.4l V8	Robert Kubica (Renault) Vitaly Petrov (Renault) Mark Webber (RBR) Sebastian Vettel (RBR)
2011	Renault refocuses activities around engine supply and creates Renault Sport F1. Team Lotus joins the Renault fold. Red Bull Racing wins back to back titles and Vettel becomes the youngest-ever double world champion. The Renault team competes as Lotus Renault GP following the complete sale of the team and secures two podiums. Team Lotus finishes tenth.	Renault R31 Red Bull RB7 Lotus T128	2.4l V8	Vitaly Petrov (LRGP) Nick Heidfeld (LRGP) Bruno Senna (LRGP) Mark Webber (RBR) Sebastian Vettel (RBR) Heikki Kovalainen (Lotus) Jarno Trulli (Lotus) Karun Chandhok (Lotus)
2012	Williams becomes Renault's fourth team in the championship, reviving the historic partnership. Lotus is rebadged as Caterham while LRGP becomes Lotus F1 Team. Red Bull Racing wins the Drivers' and Constructors' titles, becoming triple double champions. Lotus and Williams both win one race apiece while Caterham finish tenth in the constructors' championship.	Lotus E20 Red Bull RB8 Caterham CT01 Williams FW34	2.4l V8	Kimi Raikkonen (Lotus) Romain Grosjean (Lotus) Mark Webber (RBR) Sebastian Vettel (RBR) Heikki Kovalainen (Caterham) Vitaly Petrov (Caterham) Pastor Maldonado (Williams) Bruno Senna (Williams)

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TITLES & STATISTICS

DRIVERS' TITLES

1992	Nigel Mansell
1993	Alain Prost
1995	Michael Schumacher
1996	Damon Hill
1997	Jacques Villeneuve
2005	Fernando Alonso
2006	Fernando Alonso
2010	Sebastian Vettel
2011	Sebastian Vettel
2012	Sebastian Vettel

CONSTRUCTORS' TITLES

1992	Williams Renault
1993	Williams Renault
1994	Williams Renault
1995	Benetton Renault
1996	Williams Renault
1997	Williams Renault
2005	Renault F1 Team
2006	Renault F1 Team
2010	Red Bull Racing Renault
2011	Red Bull Racing Renault
2012	Red Bull Racing Renault

RENAULT'S ENGINE STATISTICS

Races started	500
Wins	151
Pole positions	202
Fastest laps	151
Raced laps	86645
Raced km	416845
Races led	277
Led laps	10199
Led km	49178
Points (drivers)	5226.5

04

2013: THE FINAL CHALLENGE FOR THE V8

2013 will be the final season of competition for the V8, normally aspirated engines. Introduced across the board in 2006, the eight cylinder units are highly optimised and capable of producing well over 750bhp. Subject to a freeze in specification and performance gains since 2007, the engines will be 'retired' after the season-ending Brazilian Grand Prix to make way for a turbocharged V6 unit equipped with potent electrical recuperation systems and a greater emphasis on fuel economy.

RENAULT'S V8 STATISTICS

128 GPs entered
48 pole positions
46 wins
37 fastest laps
4 drivers' championships
4 constructors' championships

KEY V8 MOMENTS

Bahrain 2006:
First V8 win for Renault (Fernando Alonso)

Malaysia 2006:
First V8 pole for Renault (Giancarlo Fisichella)

Brazil 2006:
Renault wins the constructors' championship, the first V8 to have done so

China 2009:
First Red Bull Racing victory

Brazil 2010:
First Red Bull Racing Constructors' title

Italy 2011:
The Renault RS27 wins the Italian Grand Prix

Bahrain 2012:
The Renault RS27 secures a 1-2-3-4 result

Monaco 2012:
The Renault V8 wins three consecutive Monaco GP

USA 2012:
Red Bull Racing become triple world champions

Brazil 2012:
Vettel becomes the youngest-ever triple world champion

05

THE RS27 ENGINE

After nearly eight years of competition, the RS27 is a highly optimised V8 unit. As a result, the focus in 2013 is to deliver optimal reliability and flexibility in engine management.

"The V8s will make way for the V6 at the end of the year. After eight years, the engines, and indeed the engine regulations, are now very mature but there is a new optimum to be found each year," says Renault Sport F1 technical director, Rob White; "We work with our partners to be able to support them as they seek this level, for example on the Coanda effect exhausts we saw introduced last year, which will continue to have performance gains this year. Through a slightly different use of the engine we can get the final tenths and hundredths out of every single part."

"Obviously the working window to explore becomes smaller and smaller each year," expands head of track operations, Rémi Taffin. "There are a few remaining tweaks we can introduce on engine mapping that will improve fuel consumption even further, but with this being the end of the V8 era we will try to make the engine as neutral as possible. This requires relations between the team and engine partner to be even closer than ever before.

"Last year we felt we consolidated the operational side, with our procedures and structures allowing us flexibility to adapt to the culture of each team. We could ensure that the engine was correctly optimised in line with chassis developments, including the Coanda effect exhaust systems, which were progressively introduced across the year. Being responsive enough to incorporate and positively influence developments of these magnitudes is something we have worked hard at, and we want to continue this into 2013. This consistency in our procedures is something we will also lean on as we seek to improve across-the-board reliability. Last season proved that, yet again, every single kilometre needs to be completely on point to achieve 100% reliability."

Unlike in previous seasons where we have seen clarifications or tightening of engine rules, there aren't any major changes for this season, which is positive as it allows us to fully capitalise on previous years' experiences. Reliability is an area the Renault team continues to focus on, as Rob explains: "We are not making major changes, rather we have an action plan in place to counteract each problem we suffered in 2012 and we aim to fully satisfy the expectations of all our teams."

DESIGNATION:	RS27-2013
CONFIGURATION:	2.4L V8
NO OF CYLINDERS:	8
NO OF VALVES:	32
DISPLACEMENT:	2400cc
WEIGHT:	95kg
V ANGLE:	90°
RPM:	18.000
FUEL:	Total
OIL:	Total
POWER OUTPUT:	>750 bhp
SPARK PLUGS:	Semi surface discharge
IGNITION SYSTEM:	High energy inductive
PISTONS:	Aluminium alloy
ENGINE BLOCK:	Aluminium alloy
CRANKSHAFT:	Nitrided alloy steel with tungsten alloy counterweights
CONNECTING RODS:	Titanium alloy
THROTTLE SYSTEM:	8 butterflies

06

KEY ENGINE REGULATIONS

ENGINE USAGE

- Unless he drives for more than one team, each driver may use no more than eight engines during a Championship season.
- Should a driver use more than eight engines he will drop ten places on the starting grid at the first Event during which each additional engine is used. If two such additional engines are used during a single Event the driver concerned will drop ten places on the starting grid at that Event and at the following Event.
- An engine will be deemed to have been used once the car's timing transponder has shown that it has left the pit lane.
- The eight engines may be used at any race as required by the engine manufacturer.
- If an engine is changed in accordance with Article 34.1 the engine which was replaced may not be used during any future qualifying session or race with the exception of the last Event of the Championship.

ENGINE ARCHITECTURE

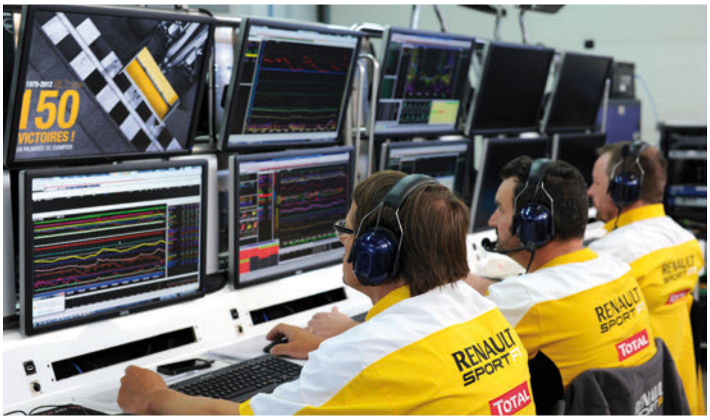
- Engines must be 4-stroke, 2.4-litre V8s, with a V-angle of 90˚.
- Crankshaft rotational speed must not exceed 18,000rpm.
- Engines must be normally aspirated. Supercharging is forbidden.
- Minimum weight of 95kg.
- Engines must have two inlet valves and two exhaust valves per cylinder.
- Cylinder bore diameter must not exceed 98.0mm.
- Variable-geometry inlet systems or exhaust systems are not permitted, nor are variable valve timing and variable valve-lift systems.
- With the exception of electric fuel pumps, engine auxiliaries must be mechanically driven direct from the engine with a fixed speed ratio to the crankshaft.
- Only one fuel injector per cylinder is permitted which must inject directly into the side or the top of the inlet port.

KERS AND ENERGY RECOVERY

- With the exception of one fully charged KERS, the total amount of recoverable energy stored on the car must not exceed 300kJ. Any which may be recovered at a rate greater than 2kW must not exceed 20kJ.
- The maximum power, in or out, of any KERS must not exceed 60kW and energy released from the KERS may not exceed 400kJ in any one lap.

TORQUE

- The only means by which the driver may control the engine torque is via a single chassis mounted foot (accelerator) pedal.
- The accelerator pedal shaping map in the ECU may only be linked to the type of the tyres fitted to the car: one map for use with dry-weather tyres and one map for use with intermediate or wet-weather tyres.
- Engine control must not be influenced by clutch position, movement or operation.
- The idle speed control target may not exceed 5,000rpm.



EXHAUSTS

- Engine exhaust systems may incorporate no more than two exits, both of which must be rearward facing tailpipes, through which all exhaust gases must pass.

IGNITION

- A supplementary device temporarily connected to the car may be used to start the engine both on the grid and in the pits.
- Ignition is only permitted by means of a single ignition coil and single spark plug per cylinder
- The car may have a stall prevention system to avoid the possibility of a car involved in an accident being left with the engine running. All such systems must be configured to stop the engine no more than ten seconds after activation.

FUEL & OIL SYSTEMS

- The fuel tank must be a single rubber bladder conforming to or exceeding the specifications of the FIA.
- All the fuel stored on board the car must be situated between the front face of the engine and the driver's back.
- No fuel intended for immediate use in a car may be more than ten degrees centigrade below ambient temperature.
- Competitors must ensure that a one litre sample of fuel may be taken

from the car at any time during the Event.
- All oil storage tanks must be situated between the front wheel axis and the rearmost gearbox casing longitudinally.

PARTS

- No 'exotic' materials or alloys are permitted in the manufacture of the parts.

CONTROL ELECTRONICS

- All components of the engine, gearbox, clutch, differential and KERS in addition to all associated actuators must be controlled by an Electronic Control Unit (ECU) which has been manufactured by an FIA designated supplier to a specification determined by the FIA.
- The ECU may only be used with FIA approved software and may only be connected to the control system wiring loom, sensors and actuators in a manner specified by the FIA.

ADDITIONAL REGULATIONS:

- Under regulations introduced at the end of 2006, the specification of engines used during the 2006 Japanese Grand Prix was frozen.
- No changes have been made to the fundamental engine specification since this point and no performance-enhancing modifications are permitted.
- Changes are however permitted to facilitate chassis installation between teams, for reliability reasons or for 'fair and equitable' reasons between engine manufacturers.

Q&A WITH ROB WHITE

Deputy managing director (technical)

"There is a new optimum to be found each year and we have to work with our partners as they seek this level."

With 2013 being the last year of the V8 engines, what remains to be optimised on the RS27?

2013 will be the last year of the V8 engines that, after eight years of service, will be retired at the end of the season to make way for the V6 in 2014. As a result, the engines, and indeed the engine regulations, are now so mature that changes are only permitted for reliability purposes or to make minor adjustments to take into account the new season's cars. There is however a new optimum to be found each year in the cars and we have to work with our partners to be able to support them as they seek this level. A good example of this is the Coanda effect exhausts we saw introduced last year; small performance gains can be made through a slightly different use of the engine. It is in these areas that we have worked hardest to get the final tenths and hundredths out of every single part. This is done very much in collaboration with our individual teams, which is why maintaining good relations is even more crucial this season.

Would you say therefore, at this stage, that greater gains can be made operationally rather than technically?

Absolutely. At this stage in the V8 lifecycle there is more to be won by optimising procedures and trackside operations completely, plus working with teams and suppliers in order to be completely prepared. We need to make sure all the I's are dotted and the T's are crossed well in advance of the season to cope with every eventuality. We have worked hard at mapping and calibration for new engines and we have also tried to eradicate our reliability gremlins from last year.

What changes have you put in place, if any?

We are not necessarily making major changes, rather we have an action plan in place to counteract each problem we suffered in 2012. Unlike in previous seasons where we have seen clarifications or tightening of engine rules, there aren't any major changes for this season, which is positive as it allows us to fully optimise our own performance.

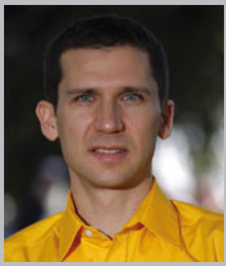
Are we likely to see the same sort of 'exhaust race' we have seen in previous seasons?

Not entirely as the four teams have adopted an approach that is conservative and aggressive at the same time. Fundamentally there is the same package, but they need to be aggressive to put through performance enhancements and stay ahead of the competition. Our job is to accompany each team in that direction.

With next year seeing the introduction of the V6 engine, how are you splitting resources between engine projects this year?

The V8 development is limited to preparing the individual GPs we go to and our housekeeping needs to be correct to guarantee the quality is there. Inevitably this is the year that the design and development of the new V6 engines will overtake the resources dedicated to the V8, so we need to ensure a turnkey service right until the Brazilian Grand Prix. The new V6s are the biggest change to hit the engine world in over ten years, perhaps ever, so we need piece of mind that everything is functioning seamlessly this season trackside.

Q&A WITH RÉMI TAFFIN



Head of Track Operations

"We want every team we supply to be a potential race-winning team"

Have you introduced any new trackside procedures this season based on your experiences in 2012?

What we will see in 2013 is actually an evolution of the structures put in place following the restructure as an engine supplier in 2011. Last year we felt we consolidated the operational side, with our procedures and structures allowing us flexibility to adapt to the culture of each team. We could ensure that the engine was correctly optimised in line with chassis developments, including the Coanda effect exhaust systems, which were progressively introduced across the year. Being responsive enough to incorporate and positively influence developments of these magnitudes is something we have worked hard at, and we want to continue this into 2013. This consistency in our procedures is something we will also lean on as we seek to improve across-the-board reliability. Last season proved that, yet again, every single kilometre needs to be completely on point to achieve 100% reliability.

With this being the last year of the V8, have you got any areas left to exploit trackside?

Obviously the working window to explore becomes smaller and smaller each year. Of course we continue to function within the rules, but to seek out every last area we can to improve the performance of the RS27 and our service to our clients. We need to be completely on top of every item and, unfortunately, one area we could do better in is reliability. We have looked long and hard at every single part and every single procedure to seek the last percentile from each.

In 2011 it was blown floors, in 2012 engine maps and Coanda effects – what do you expect to be an area of development this year?

We will see the Coanda effect again this season, although with a year of development under our belts the gains will become smaller. There are a few remaining tweaks we can introduce on engine mapping that will improve fuel consumption even further, but with this being the end of the V8 era we will try to make the engine as neutral as possible.

Are there any parts you have revisited to improve extra reliability this year?

Purely technically, we have worked solidly through the winter to sign off different fixes for our main 2012 reliability issues. It showed that, even in an engine freeze era, it's not that easy, even if you don't change a lot of parts. That is however the difference between dealing with maximum performance and changing specs every race and dealing with reliability and frozen specs – you need to look after consistency in manufacture and production quality, which are not at all the same issues.

With a potential 19 races this year, what impact will this have on engine management over the year?

If we have one less race this year we would actually have a bit more flexibility within the engine pool to deal with engine management. It's not a major advantage but it does give a bit more to play with if we need to.

After one year of partnership with Williams, what are the key points to work on this year?

We will definitely build on the strong links we recreated in 2012. Now every single procedure is in place and we must trust these to deliver. We will push on engine installation and engine usage for each customer though, not just Williams. It is important to remember that a key factor will be our ability to work on both 2013 and 2014 engines programmes in parallel, which is why it is crucial to have a turnkey service in place trackside.

How has the relationship with Caterham progressed after two complete seasons together?

We can now say that we work very efficiently with Caterham and it is difficult to see a big difference with the bigger teams, operationally speaking. Obviously the cars fielded by teams are always different but we trust Caterham to score their first points this year. All the signs are good as they are now settled in their new facilities, the workforce is larger and more experienced and the budgets are completely in line with what is needed to succeed. It's going to be a really good day when we score points together!

Red Bull is a demanding customer…what can you deliver to help keep them ahead of the field?

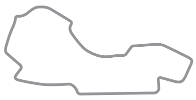
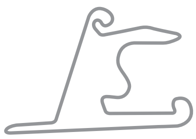
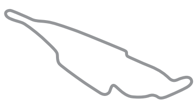
We share the same fighting spirit. We like them to push us and we are always proud to answer quickly and efficiently to their requests. It is even more rewarding when we are able to propose new solutions to make the car faster. Firstly we need to secure our reliability to get back to a normal situation and then we will be able to push the limits again. That is why we have worked so hard on reliability.

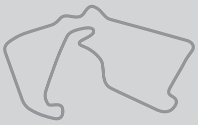
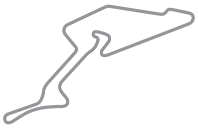
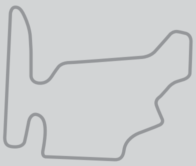
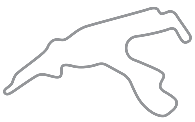
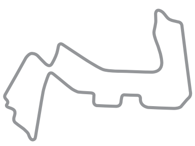
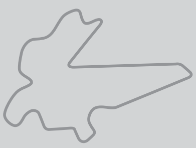
Lotus returned to winning ways – has this relationship settled down its current format?

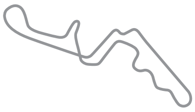
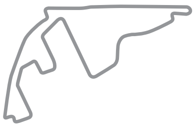
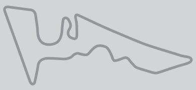
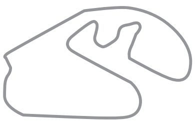
Rather than returning to winning ways, I think it is normal to see Lotus winning and we will keep on supporting them in the same way. In fact we didn't change our working pattern after Renault left the team to Genii. Obviously we still have a very close relationship with the Enstone-based team and we always welcome their new ideas and help them as much as we can: they are clearly involved in filling our dynos' schedule! More importantly however is the fighting spirit we have built up within the individual engine teams: we want every team we supply to be a potential race-winning team.

07

2013 CALENDAR

DATE	GRAND PRIX	SITUATION	DESCRIPTION
17 March	Australian Grand Prix 	Albert Park	With a combination of short straights and second and third gear chicanes, this 16 turn track requires medium to high downforce and good traction is essential. A driver needs the engine to be responsive on the throttle to maximise acceleration out of the slow corners and carry speed down the short straights, however the quick section at the back of the circuit also demands good top end speed. The resultant fuel consumption rate per lap will be one of the highest of the year due to the short, hard bursts of power.
24 March	Malaysian Grand Prix 	Sepang	Sepang presents a challenge for engines on account of the high ambient temperatures and humidity. The temperatures can reach over 40°C, so engine cooling becomes crucial. The high water content in the atmosphere also displaces air that could otherwise be combusted, and slows the combustion process. These both act to reduce power output, so RSF1 recreates the climatic conditions on its test cells back at Viry-Châtillon to ensure the engine is fully optimised.
14 April	Chinese Grand Prix 	Shanghai	Shanghai has a 1.3km straight between turns 13 and 14 where the RS27 will sit at full throttle for between 17 and 18 seconds. Combined with the 700m start finish straight and other short bursts of power, engines will be at full throttle for 53% of the lap. The rest of the circuit features 16 medium to low speed corners, including the radial turn from T1 through to T4, demanding responsiveness into and drive out of the corners.
21 April	Bahrain Grand Prix 	Sakhir	High ambient temperatures and low humidity are the main challenges for engines in Bahrain. The hot conditions mean that the bodywork may have to be slightly opened to aid the cooling configuration, while the aridity increases pressure within the cylinder chamber, which can cause a corresponding loss of power. The desert location also means sand may be ingested into the inlets and cause damage to the internals of the engine so Renault Sport F1 has developed a filter based on those used in desert rallies.
12 May	Spanish Grand Prix 	Catalunya	Barcelona is often used for winter testing as it has a variety of low and medium speed corners that give a very good 'average' of characteristics of other circuits on the calendar. It is around 60% full throttle with a 1km pit straight where the cars reach over 300kph. The track follows the contours of the hills, and therefore undulates over the course of the lap, meaning the cars will be subject to high lateral forces.
26 May	Monaco Grand Prix 	Monte Carlo	With low speed corners punctuating the lap, the average speed of Monaco is just 160kph. The challenge is therefore to deliver a highly responsive engine through the lower rev limits of the engine (around 15 – 17,000rpm) rather than the top end (16 – 18,000rpm) to give response on the entry and exit to the corners. With so little time spent at full throttle, the engine has little chance to breathe and cooling can become a real issue as the parts run very hot.
9 June	Canadian Grand Prix 	Montreal	A lap of the 4.361km track takes just 75 seconds on average, the quickest single lap time of the season. This is due in part to the relatively short length, but also to the long straights of the Circuit Gilles-Villeneuve. The straights are connected by tight hairpins where the cars brake down to a little under 60kph, so the RS27 must combine good top end power with effective engine braking and pick up on the entry and exits to the corners.

30 June	British Grand Prix 	Silverstone	Silverstone still tests the upper limits of the engine, even with the addition of the new slow loop. It counts as one of the power tracks of the season, with 66% of the lap spent at full throttle in qualifying and 61% in the race, plus an average speed of well over 200kph. The awesome Maggotts-Beckett-Chapel complex remains one of the biggest challenges on the calendar; a sweeping, high-speed complex of four connecting bends. Average speeds through this section are around 250kph and no lower than 190kph at any one point.
7 July	German Grand Prix 	Nürburgring	The Nürburgring is a medium speed track with an average of 191kph and a maximum speed of 305kph in qualifying. The average is balanced out by a mix of low speed corners, such as turns 1 and 7 where the cars will run between 75 and 95kph and the four long straights. As a result the engine has to be driveable through the lower revs but also offer responsiveness and top end power. In particular Renault Sport F1 will work carefully on the selection of the top gear ratios since seventh gear will be engaged four times a lap, a higher than average usage.
28 July	Hungarian Grand Prix 	Hungaroring	The twisty 4.381km circuit is often compared to a kart track, with one slow speed corner leading into another in very quick succession. This sinuous nature gives rise to the second lowest average speed over a lap (after Monaco). Power sensitivity and outright engine power is therefore not a major concern so engine engineers therefore work to deliver good low speed torque response and driveability.
25 August	Belgian Grand Prix 	Spa-Francorchamps	Over 70% of the track is taken at full throttle and over one lap the engine will have a total wide open throttle time of over 43secs, making it one of the toughest tests for the RS27. Outright power and top speed are crucial and any gains will be twice as effective in reducing lap time compared to Monaco. To compound the challenge, changes of altitude over the lap – and between corners – put the internals of the engine, particularly the lubricant systems, under considerable pressure.
8 September	Italian Grand Prix 	Monza	The Autodromo di Monza isn't called the Cathedral of Speed for nothing; over three quarters of the 5.793km lap is spent at full throttle and the maximum speed goes over 330kph up to four times per lap. F1 cars will be at the highest average speed of the year; very close to the 250kph mark, so Monza represents the ultimate test for an engine's outright performance and reliability.
22 September	Singapore Grand Prix 	Marina Bay	The 5.073km circuit has a huge 23 turns – more than any other track on the calendar, bar Valencia – 10 of which are taken in second or first, 7 in third and only 1 in fourth gear, which means that the engine is working at between 8,000rpm and 13,000rpm for the majority of the corner apexes and exits. The average speed is therefore correspondingly low, with cars circulating at just 170kph over the lap. The stop-start nature of the track and the short bursts of acceleration between the turns make Singapore one of the least fuel efficient of the season.
6 October	Korean Grand Prix 	Yeongam	Korea sits in the middle of the power-driveability ratio and engine requirements are similar to those of Australia: good driveability through the medium to low speed corners, responsiveness out of the slower chicanes and hairpins, with a good top end power for the long straights. There are three straights in the first sector so engine engineers work on providing good top speed and acceleration through correct gear ratios, particularly in seventh. Fuel consumption is very high over one lap due to the stop-start nature of the last sector.

13 October	Japanese Grand Prix 	Suzuka	The combination of corners, relentless flow through the high speed sections and radial turns, esses and hairpins makes Suzuka one of the toughest challenges of the year for F1 engines. A high-speed figure of eight track that features every possible corner, the engine needs to deliver across the entire power spectrum without sacrificing driveability and responsiveness. The high speed corners such as the Esses also subject the internals of the engine and lubricant systems to high lateral G-forces.
27 October	Indian Grand Prix 	New Delhi	The Buddh International Circuit is an interesting circuit, with a variety of corners and speeds throughout the lap. The first part of the circuit requires good top speed and power since 75% of this sector consists of straights. The second part of the track is twistier and requires a more driveable and responsive engine. Additionally, the circuit is very slippery with the dust, and any additional grip will be reflected in the lap time.
3 November	Abu Dhabi Grand Prix 	Yas Marina	The day to night schedule makes ambient conditions vary significantly and grip levels, tyre warm up and air pressure will change. The engine needs to respond to this new set of parameters, so careful engine management and flexibility is crucial.
17 November	United States Grand Prix 	Austin	With an average speed over one lap of 196kph during the race and just over 205kph during qualifying, the Circuit of the Americas is in a similar bracket to Valencia. Fuel consumption is one of the highest of the season over one lap as the lower temperatures of Austin offset its relatively high altitude and change of gradient, but low ambient humidity and the twisty first and last sectors where the driver is constantly on and off the throttle increase consumption. The starting fuel load is one of the heaviest of the year.
24 November	Brazilian Grand Prix 	Interlagos	Interlagos is all about altitude. The track is 800m above sea level and as the altitude increases the air pressure drops and the air is thinner with a lower oxygen content. With less oxygen available for the fuel to burn, power output drops. For every 100m the engine loses around 1% of its potential power output, meaning the RS27 will produce around 8% less power than at a sea-level race such as Korea. Over the course of the lap the track also undulates significantly, putting the oil and fuel systems under considerable pressure, particularly the last long left hand corner onto the pit straight.

	Length (km)	Average Speed (km/h)	Top Speed (km/h)	% of lap at full throttle	Fuel consumption (litres)	Fuel consumption (l/100km)
Australia	5.303	210	312	62	2.5	67
Malaysia	5.543	197	311	59	2.45	63
China	5.451	193	321	49	2.45	64
Bahrain	5.412	200	313	59	2.5	66
Spain	4.655	192	323	55	2.1	64
Monaco	3.34	153	279	34	1.5	64
Canada	4.361	199	317	57	2	66
Great Britain	5.891	217	309	61	2.55	62
Germany	5.148	193	289	53	2.45	68
Hungary	4.381	182	303	47	1.9	62
Belgium	7.004	226	313	70	3.15	64
Italy	5.793	236	331	72	2.5	62
Singapore	5.073	162	303	37	2.2	62
Korea	5.615	195	317	55	2.55	65
Japan	5.807	216	319	62	2.6	64
India	5.125	204	314	65	2.35	66
Abu Dhabi	5.554	188	312	58	2.5	64
USA	5.513	198	313	57	2.5	65
Brazil	4.309	200	310	62	1.75	58

08
OUR TEAMS

INFINITI RED BULL RACING

The Red Bull Racing-Renault collaboration started in 2007 and has since grown into one of the most successful engine-chassis partnerships in the history of the championship. By the end of 2012 Red Bull Racing and Renault had secured 34 wins and 46 pole positions, plus the crowning glory: the triple double championship wins in three consecutive seasons from 2010.

Red Bull Racing and Renault Sport F1 have since consolidated their partnership and will work together until at least the end of the 2016 season, with the establishment of a technical joint venture to collaborate on the 2014 engine regulations.

RB9 - TECHNICAL SPECIFICATION

Chassis: Composite monocoque structure, designed and built in-house, carrying the Renault V8 engine as fully stressed member

Transmission: Seven-speed gearbox, longitudinally mounted with hydraulic system for power shift and clutch operation. AP Racing clutch

Suspension:

Front: Aluminium alloy uprights, carbon-composite double wishbone with springs and anti-roll bar, Multimatic dampers

Rear: Aluminium alloy uprights, carbon-composite double wishbone with springs and anti-roll bar, Multimatic dampers

Brakes: Brembo calipers. Carbon discs and pads

Electronics: MESL standard control unit

Fuel: Total Group

Wheels: OZ Racing,
Front: 12.0in x 13in diam.
Rear: 13.7in x 13in diam.

Tyres: Pirelli

Brakes: Brembo calipers. Carbon discs and pads

DRIVERS

Sebastian Vettel (D)

Mark Webber (AUS)

CHRISTIAN HORNER, TEAM PRINCIPAL, INFINITI RED BULL RACING

It's important for Infiniti Red Bull Racing to work with a historically successful company such as Renault Sport F1. In Renault Sport F1, we have an engine partner which is dedicated to giving us exactly what we need. As a team we are demanding and Renault Sport F1 always does its best to deliver. They provide us with an engine and consistently focus on car integration to ensure we get the maximum benefit.

LOTUS F1 TEAM

Renault has a long and successful connection with the Enstone team, and the partnership is still bearing fruits in its current incarnation, with a total of 10 podiums and one win in 2012.
The relationship started in 1995 when Renault supplied engines to the then Benetton team, led at the time by Michael Schumacher. In the first year of the partnership Schumacher took the Drivers' crown and the team the Constructors' title. After withdrawing from official engine supply at the end of 1997, Renault returned to the fore at Enstone in 2002, taking control from Benetton and creating the Renault F1 Team. Enstone was the UK base for the chassis operations while Viry-Châtillon remained the hub for engine activities. Under the Renault banner, the team re-emerged as a dominant force, with Fernando Alonso taking back to back world titles in 2005 and 2006.
Renault's decision to re-centre F1 activities around engine supply led to a minority shareholding being sold to Genii Capital in 2009 before the Luxembourg-based group purchased 100% control at the end of 2010. Renault remained involved as engine partner, aiding the team to re-emerge as a front running team in recent season.

E21 - TECHNICAL SPECIFICATION

Chassis: Moulded carbon fibre and aluminium honeycomb composite monocoque, manufactured by Lotus F1 Team and designed for maximum strength with minimum weight. RS27-2013 V8 engine installed as a fully stressed member.

Front suspension: Carbon fibre top and bottom wishbones operate an inboard rocker via a pushrod system. This is connected to a torsion bar and damper units which are mounted inside the front of the monocoque. Aluminium uprights and OZ machined magnesium wheels.

Rear suspension: Carbon fibre top and bottom wishbones with pull rod operated torsion springs and transverse-mounted damper units mounted in the top of the gearbox casing. Aluminium uprights and OZ machined magnesium wheels.

Transmission: Seven-speed semi-automatic titanium gearbox with reverse gear. "Quickshift" system in operation to maximise speed of gearshifts.

Fuel system: Kevlar-reinforced rubber fuel cell by ATL.

Cooling system: Separate oil and water radiators located in the car's sidepods and cooled using airflow from the car's forward motion.

Electrical: MES-Microsoft Standard Electronic Control Unit.

Braking system: Carbon discs and pads. Calipers by AP Racing. Master cylinders by AP racing and Brembo.

Cockpit: Removable driver's seat made of anatomically formed carbon composite with six-point or eight-point harness seat belt. Steering wheel integrates gear change, clutch paddles, and rear wing adjuster.

KERS: Motor generator unit driving into front of engine with batteries as an energy store. Motor Generator supplied by Renault Sport F1. Electric control unit by Magneti Marelli

Front track: 1450mm
Rear track: 1400mm
Overall length: 5088mm
Overall height: 950mm
Overall width: 1800mm
Overall weight: 642kg with driver, camera and ballast

DRIVERS


Kimi Räikkönen (FIN)


Romain Grosjean (FR)

ERIC BOULLIER, TEAM PRINCIPAL, LOTUS F1 TEAM

Enstone has a long-standing relationship with Renault which has been highly effective in terms of results and rewarding in terms of the relationships we've built. The performance and reliability from Renault's powerplants over the years has been exemplary and the close links we share with Renault has enabled great things to happen. Even though the engine regulations have been fixed and many areas of engine development frozen for many seasons now, Renault have been exceedingly proactive and effective at developing the permitted areas to enable the very best performance for our car. Now we look forward to 2014 and the new engine rules where we are working very closely with Renault on development of the exciting V6 turbo engine.

WILLIAMS F1 TEAM

The iconic Williams-Renault partnership was reborn for 2012, and immediately recreated the winning formula seen in the 1990s. At the Spanish Grand Prix, just five races into the season, Pastor Maldonado gave the team its first win since 1997, dominating the race on pace and strategy. Seventy-six points placed the team eighth in the constructors' championship by the end its first year.

The duo originally teamed up in 1989, with success rapidly following. Nigel Mansell secured the partnership's first double title in dominant form in 1992, with Prost retaining the crowns in 1993. Damon Hill and Jacques Villeneuve secured drivers' titles in 1996 and 1997 respectively, while the constructors' championships were secured in 1994 and 1996 – 1997 before Renault's withdrawal from F1. Over the nine years of the partnership, the duo secured 63 wins, four drivers' titles and five constructors' wins.

FW35 - TECHNICAL SPECIFICATION

Chassis: Monocoque construction laminated from carbon epoxy and honeycomb surpassing FIA impact and strength requirements.

Front suspension: Double wishbone, push-rod activated springs and anti-roll bar.

Rear suspension: Double wishbone, pull-rod activated springs and anti-roll bar.

Transmission: Williams F1 seven speed seamless sequential semi-automatic shift plus reverse gear, gear selection electro-hydraulically actuated.

Clutch: Carbon multi-plate.

Dampers: Williams F1.

Wheels: RAYS forged magnesium.

Tyres: Pirelli, Fronts: 245/660-13, Rears: 325/660-13.

Brake system: AP 6 piston calipers all round, carbon discs and pads.

Steering: Williams F1 power assisted rack and pinion.

Fuel system: ATL Kevlar-reinforced rubber bladder.

Electronic systems: FIA SECU standard electronic control unit.

Cooling system: Aluminium Oil, Water, KERS, and gearbox radiators.

Cockpit: Six point driver safety harness with 75mm shoulder straps & HANS system, removable anatomically formed carbon fibre seat.

Engine: Renault RS27-2013 2.4L V8, 900 V angle, 32 valves, aluminium block and pistons, nitrided alloy steel crankshaft with tungsten alloy counterweights, titanium connecting rods, 8 butterfly throttle system, 18000 rpm maximum speed.

KERS: Williams F1 battery, MGU and electronics.

Dimensions & weight:
Weight: FIA Minimum
Overall length: 5000mm, overall height: 950mm, overall width: 1800mm

DRIVERS

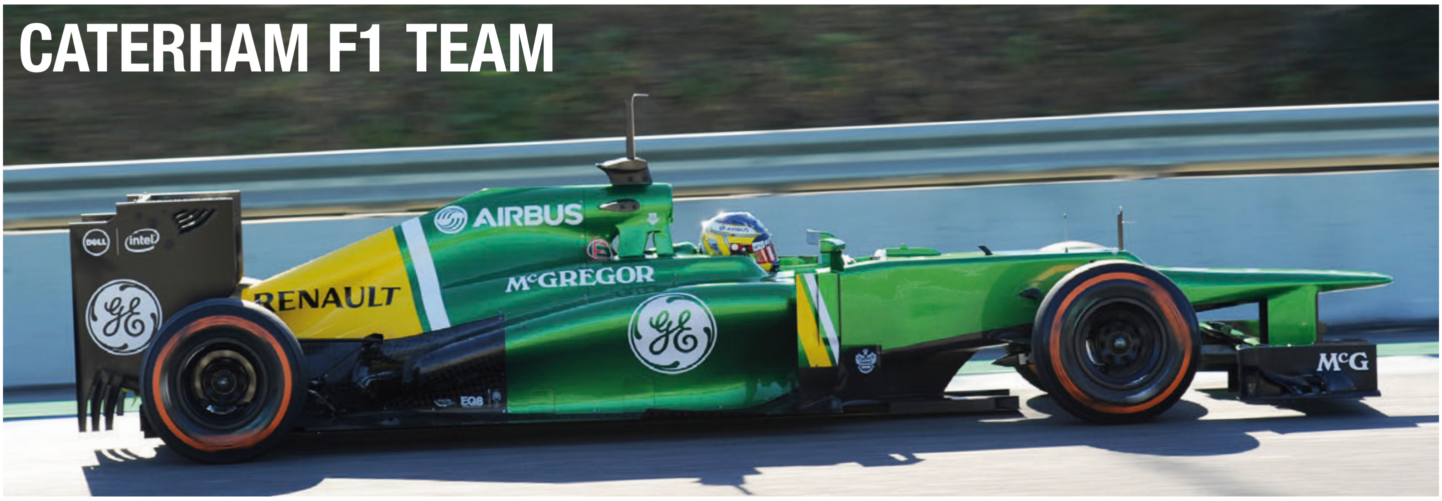
Pastor Maldonado (VEN)


Valtteri Bottas (FIN)

FRANK WILLIAMS, TEAM PRINCIPAL, WILLIAMS F1 TEAM

Renault has been a partner to Williams many times over the past few years. They are enjoyable people to work with and they always deliver what they promise. They have never let us down and we hope we can give them a good reward for the effort that they put into our partnership. I believe Renault have always understood how to make reliable, high performance engines and we are confident they will once again deliver a first class product. They are an outstanding partner for us.

CATERHAM F1 TEAM



Caterham F1 Team entered the championship in 2010 under the banner of Lotus Racing before becoming Team Lotus for 2011. The Anglo-Malaysian squad teamed up with Renault for its second season of competition, and over the course of the year went from strength to strength to become an established, and respected, outfit.

A rebirth as Caterham F1 Team in 2012 gave the team a new identity, although the team's depth in resources and drive to succeed remained. It secured tenth in the Constructors' championship for the third year running and now enters 2013 determined to improve on this result.

CT03 - TECHNICAL SPECIFICATION

Engine: Renault V8 RS27-2012

Chassis material: Carbon Fibre

Bodywork material: Carbon Fibre

Front Suspension: Carbon Fibre

Rear Suspension: Carbon Fibre

Dampers: Penske & Multimatic

Steering: Caterham F1 Team

Gearbox: Red Bull Technology

Clutch: AP

Discs: Carbone Industrie or Hitco

Calipers: AP

Pads: Carbone Industrie or Hitco

Cooling system (radiators, heat exchangers): Caterham F1 Team

Cockpit instrumentation: MES

Seat belts: Schroth

Steering wheel: Caterham F1 Team

Driver's seat: Caterham F1 Team

Extinguisher system: FEV

Wheels: BBS to Caterham F1 Team Specification

Fuel cell: ATL

Fuel provider: Total

Lubricants provider: Various

Wheel base: More than 3000mm

Overall Length: Approx 5 metres

Overall Height: 950mm

DRIVERS

Charles Pic (FR)

Giedo van der Garde (D)

CYRIL ABITEBOUL, TEAM PRINCIPAL, CATERHAM F1 TEAM

Whilst we are still in the early stages of the project, Caterham F1 Team is proud to play an integral role in the Renault / Caterham Cars partnership. It is a very exciting project that reinforces our position as one of the five car-makers on the 2013 F1 grid. Our input into the success of the partnership has already begun - through competing in the FIA Formula One World Championship we have taken on the responsibility of raising the awareness of the Caterham brand, something that will be a key success factor when the project moves to the commercialization stage.

Q&A WITH JEAN-MICHEL JALINIER

President and Managing Director

'Success also breeds expectation, which means we have a lot to live up to in 2013.'

What benefit has Renault so far gained from its F1 involvement?

First of all, we should talk of benefits in the plural rather than singular. Being involved in F1 works on many levels, both technical and commercial. The solutions and developments honed by our team of engineers at Viry are cutting edge and the expertise gained from these exercises is directly relayed through to our road car ranges; throughout the year we have a large team of engineers from production. This team of approximately 30 people – around 10% of the workforce of Viry – are fully integrated into the F1 engine programme and the knowledge of the processes and developments needed to succeed at the highest level of motorsport under extreme pressure goes with them when they return to the parent company. Naturally we also have the benefits of participating in F1 on a marketing level. Winning against tough, well-respected teams demonstrates the outstanding quality of the Renault technology and can be used within numerous campaigns throughout the Renault network, both internally and externally. On a basic level, having the Renault name involved in F1 allows us to reach people in markets that are hard to penetrate due to their size, such as China and India.

What are the key targets for 2013?

2012 was an incredibly successful year in terms of results across our four partners. Three of the four teams winning races – the first time since 1983 that an engine manufacturer has won with three different teams – with all four finishing in the top ten of the constructors' championship. There were also impressive milestones, including the triple double with Red Bull Racing, our 150th win and the 200th pole. Success also breeds expectation, which means we have a lot to live up to in 2013. We weren't trouble-free though so this has got to be the aim this year; the same, if not greater, success, with improved reliability.

How can it achieve even better results?

There were some reliability issues throughout the year so we have put in place procedures and measures to safeguard against this. We are very conscious that this year will be the final year of the V8 and we will progressively switch from these operations to the V6 as we get closer to the end of the season. Therefore we need to be completely on top of our game right from the start. This means providing absolutely optimum service to each of our partners, in reliability and also what they need us to do.

How will Renault manage the transition from the V8 to the V6 this year?

The introduction of the new regulations is the biggest challenge for an engine manufacturer in almost 10 years, perhaps ever so we have been preparing for this since the changes were finalised in 2011. The core team working on the V6 was put in place immediately and it has been steadily growing since this point as the designs have advanced. This will happen more throughout the year until the balance becomes greatly in favour of the V6 and only a core team remains for the track operations and reliability of the V8 in the second part of the year. This is why getting everything right from the start is so important.

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RENAULT SPORT F1'S FACILITIES

Renault Sport F1's HQ is situated at Viry-Châtillon, a suburb south of Paris. The 10,000m² facility is responsible for designing, testing and operating highly optimised engines for competition in the FIA Formula One World Championship. This year, the V6 1.5l Turbo will be designed and developed in parallel with the V8 normally-aspirated units.

The larger Renault Group has also taken advantage of its state of the art facilities to test road-going engines and technology.

A core staff of 250 people are based at the facility.

DESIGN OFFICE

The Renault Sport F1 design office houses several departments, including CFD, calculations (fluid dynamics, structural evaluation etc), test and race operations. Although each team has a direct function relating to one area of the engine, all work as a cohesive department, allowing Renault to design and develop competitive and reliable power units.

Each engine takes approximately 18 months to design, with the final six months of the process given to testing and optimisation in the dynos. Currently, a small team targets performance and reliability from the RS27 V8 engine, while a significant number of people have moved to optimise the V6 1.5l turbo engine that will be introduced in 2014 when the new engine regulations come into force.

ENGINE ASSEMBLY

The engine assembly department is where development engines are built. Working closely with the design office, a team of 30 technicians incorporate newly designed parts into one-off prototype engines that will then be run on the facility's dynos to test certain aspects of engine performance.

Once all the parts have been tested on the dynos and approved for competitive use, the team is then responsible for writing build specifications for the race engines, which are built off-site by Renault's partner supplier, Mecachrome.

Each mechanic is responsible for one particular part and build process, giving a consistency throughout the engine build process.

Building a prototype engine takes two people six days on average.

DYNOS

Viry has ten test beds or dynometers (shortened to dyno) that are used to test complete engines or certain engine components for performance and reliability.

There are four types of dyno to test different engine characteristics; component testing dynos that are used to test engine components without having to use a complete engine; steady-state dynos that test the full unit for power developments, and dynamic test beds, which are used to test engine reliability and engine maps ahead of Grands Prix. Additionally, one dyno is configured to test engines in conjunction with a gearbox to get a complete picture of how a power train works.

Each week's running is carefully planned and each dyno may be used for up to 4.5 days a week, 12 hours a day.

When preparing for a race weekend, tracks maps can be inputted into a dyno to simulate the conditions the engines will encounter under race conditions. In some dynos at Viry atmospheric conditions such as humidity and temperatures can also be recreated to give a greater understanding of performance. Engineers can then check the proposed engine map settings will perform as expected in largely representative conditions.

Prior to each race an endurance test is also conducted to check reliability. Each engine may be run up to 3,000km on this type of test. Generally a track that is hard for the engine, such as Spa or Monza, which see the engine running at full throttle for around 70% of the lap, are used for this type of test.

ELECTRONICS

Electronics develop the electrical systems associated with the engine, including the wiring looms and the integration of the engine with the ECU, which is now a common part between teams. Additionally the department has a simulator that allows a driver and/or engineer to check the parameters of an engine map on a virtual car.

RACE OPERATIONS

A core team of engineers and technicians, plus logistics staff, travels to each race on the calendar. An individual team of seven (one engineer per car, two technicians per car, two electronics' engineers and one KERS technician) service Red Bull Racing, Lotus F1 Team and Caterham F1 Team while Williams F1 Team receives six personnel, since it supplies its own KERS unit. Throughout the year the same team ensures the same quality of service and good relations between chassis and engine partner.

MARKETING, COMMUNICATIONS & ADMINISTRATION

A number of staff ensure Renault's involvement in F1 is run correctly, financed appropriately and exploited as necessary.

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RENAULT SPORT F1 KEY PERSONNEL

MANAGEMENT COMMITTEE

President and managing director:
Jean-Michel Jalinier

Deputy managing director (technical):
Rob White

Deputy managing director (business & administration):
Yves Arbeille

Director of Marketing & Communications:
Olivier Gillet

TRACKSIDE OPERATIONS

Head of track operations:
Rémi Taffin

Track support team leader (Red Bull):
Thierry Salvi

Track support team leader (Lotus):
Ricardo Penteado

Track support team leader (Williams):
Laurent Debout

Track support team leader (Caterham):
Cedrik Staudohar

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LOOKING TO THE FUTURE

2014 will welcome a revolution in F1 technical regulations as the long-serving V8 engines are replaced by V6 turbo power units with a greater emphasis on electrical technology and energy recovery systems.

For Renault, the next generation of V6 turbos sees its involvement in F1 come full circle.

V8 V V6: AN OVERVIEW

	V8	V6
Configuration	2.4L V8-90°, 98mm bore	1.6L V6-90°, 80 mm bore, standard fixings to chassis and gearbox
Number of cylinders	8	6
Displacement	2400cc	1600cc
Number of valves	32	24
Weight	95kg	155kg without energy store
Permitted Fuel quantity per race	Unlimited, but typically 160 kg	100 kg (-35%)
Maximum fuel flow	Unlimited, but typically 170 kg/h	100 kg/h (-40%)
Rev limit	18,000rpm	15,000rpm
Intake	Normally aspirated	Turbocharged, with single-stage compressor and single stage exhaust turbine
Exhausts	Two exhaust outlets	One single exhaust outlet (via engine cover)
Fuel	Indirect fuel injection	Direct fuel injection
Internal Combustion Engine Power output	>750 bhp	Approx 600 bhp
Energy recovery systems	Kinetic Energy Recovery System (KERS), capable of harvesting 400kJ for a max power of 60kW, equivalent of a boost of approx. 80bhp for 6-7secs per lap.	ERS-K (Kinetic Energy Recovery) and ERS-H (Exhaust heat recovery system by E-turbo) The maximum power used to propel or brake the car through the ERS-K must not exceed 120 kW (approx. 160 bhp), while Energy input from the MGUK to the ES may not exceed 2MJ in any one lap. Energy released from the ES to the ERS-K may not exceed 4MJ in any one lap (approx. 33secs per lap). No limit from and to ERS-H
Number of Power Units permitted per driver per year	8	5

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OUR PARTNERS

PREMIUM PARTNER

TOTAL
www.total.com

Total is one of the largest integrated oil and gas companies in the world, with activities in more than 130 countries. The Group is also a first rank player in chemicals. Its 93,000 employees put their expertise to work in every part of the industry - exploration and production of oil and natural gas, refining and marketing, new energies, trading, and chemicals. Total is working to help satisfy the global demand for energy, both today and tomorrow.

TECHNICAL PARTNERS

CD-ADAPCO
www.cd-adapco.com

As an official supplier of CFD and CAE technology to Renault Sport F1, CD-adapco products continue to play a critical role in the ever improving performances of the team by engaging in a four year partnership.
CD-adapco is the world's largest independent CFD focused CAE provider. Its core products are the technology-leading simulation packages, STAR-CCM+ and STAR-CD.
The scope of its activities, however, extends well beyond CFD software development to encompass a wide range of CAE engineering services in fluid dynamics, heat transfer and structural engineering. Its ongoing mission is to «inspire innovation and reduce costs through the application of engineering simulation software and services.»
A privately owned company, CD-adapco has maintained 17% organic year-on-year growth over the last 5 years. CD-adapco employs over 550 talented individuals, working at 21 different offices across the globe.

ELYSIUM
www.elysiuminc.com

Elysium Inc. develops interoperability solutions for digital design and PLM markets, with millions of files translated and thousands of customers worldwide. Founded in 1984, Elysium is headquartered in Hamamatsu, Japan, and has additional offices in Southfield, MI, and Huntington Beach, CA. Elysium currently supports data exchange among CADCEUS, CATIA V4/V5, DELMIA, ACIS/SAT, SIMULIA Abaqus, SolidWorks, 3D XML, Inventor, OneSpace Modeler, Pro/ENGINEER, Wildfire, NX I-DEAS, NX, JT, Parasolid, XVL and the IGES, STEP, and STL standards.
Elysium products—ASFALIS, CADdoctor, CADfeature, PDcubic, PDQ NP, and CADpdm—are the favored solutions of many leading companies for translating, repairing, and ensuring the product data quality of 3D CAD/CAM and CAE models.

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