

# Lifeblood

Scientists are using fuels and lubricants technology to gain every possible advantage in Formula 1

WORDS BY ADAM GAVINE



➔ Restrictions imposed on Formula 1 technology, such as the half-decade halt on engine development, have resulted in teams seeking the smallest of permitted advances to get an edge on the competition. One of the biggest areas of attention has been the very lifeblood of a race car: fuels and lubricants.

“Motor racing, especially Formula 1, generates the greatest technical progression in the development of fuels,” says Rogério Gonçalves, technical coordinator for Formula 1 gasoline at Petrobras, which supplies Williams. “Participating in the world’s most technically challenging and competitive motor racing category is a great opportunity for an energy company, and requires the development of products that comply with the highest demands.” Petrobras recently celebrated a decade working with Formula 1 fuels, and also develops fuels for categories such as Brazilian Stock Car, Mini Baja, and the Dakar Rally.

“Formula 1 fuel differs from other motorsport and pump fuels because it is designed for that specific engine, with the aim of getting the best engine power output and fuel economy in an engine running at 19,000rpm. It is different to any other engine,” continues Gonçalves.

“The FIA limitations on engine development put huge pressure on the oil companies. Improving fuels and lubricants is a way to increase the engine power with only minor changes in the engine. The chemical composition as well as the physical and chemical properties are FIA-controlled and you cannot add any product not found in commercial gasolines around the world.”

Such restrictions limit the ability of the chemists to apply the fruits of their research into F1 fuel. “There is one article in the FIA fuel regulation which states that 30% of the fuel must be composed of a maximum of 5% hydrocarbons,” he explains. “Without this limitation, we would have more flexibility to use a little more of some components that we have discovered.”

ExxonMobil has an active F1 fuel development program with McLaren and Toyota. Unlike some of its competitors, the company likes to keep a low profile when it comes to its F1 fuel, explains global motorsports technology manager, Bruce Crawley: “We’re not like Shell, which uses Formula 1 to promote its V-Power [retail] products. We are very keen to develop fuel for McLaren and Toyota to ensure they have



ExxonMobil has a fuel development program with Toyota F1, and supplies the team under the Esso brand name

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**Rogério Gonçalves, Petrobras**

a competitive advantage, but we don’t use that in any way for marketing.

“We have a slightly different approach to other fuel companies in terms of the amount of fuel we produce for Formula 1 programs, with only around 2,000 liters sent to a Formula 1 weekend. All our fuel and lubricant research is done under one roof at our research center in New Jersey, USA. But other than saying our fuel gives teams better lap times, we can’t discuss the fuel.”

Although specific formulations are kept well under wraps, it is no secret that biofuel is now an important ingredient.

Gonçalves explains, “For 2008, with the mandatory use of biofuels [following the FIA’s regulation that Formula 1 teams must use 5.75% biofuel in their fuel formulations], new demands were created that needed a quick response. Late last year, Petrobras was the first oil company to successfully debut biofuels for Formula 1 application, with a special demonstration with the AT&T Williams team in Buenos Aires. We are now working on new bio-oxygenates to be used in the fuel composition, additives, and products with high flame speed to comply with the requirements of a modern Formula 1 engine. So the main innovations are the discovery of new raw materials from our refineries, and new biofuels. Indeed, we have just created a new company solely to look after biofuels.”

Further north in the USA, ExxonMobil is undertaking similar work. “In motorsport, we are going on a bit of bio-mission,” says Crawley. “We are quite interested in the energy side. I wouldn’t really say the regulations have put pressure on us; I think it’s more of a question of the direction in which race series are going.”



One of Shell’s trackside analysts concentrates specifically on lubricants



### The Shell/Ferrari partnership



According to Lisa Lilley, Shell technology manager for Ferrari, the engine freeze has offered Shell the opportunity to push the development

of new lubricants: “We believe we can give Ferrari a competitive edge through products like Shell Helix engine oil and Shell Spirax gearbox oil. We have more opportunity for testing new base and additive technologies, as and when they come through. The protection of the engine and gearbox is fundamental, and the challenge is to build in as much performance as we can.”

“The lubricant has evolved over the past few years to help the engine and gearbox last for the number of races required by the FIA. The trick to designing the lubricant is to optimize both performance and protection – a difficult task since performance and protection are usually inversely related.” Lilley says that getting this balance right will continue to be the focus for the foreseeable future.

A key element of the partnership is the dedicated mobile laboratory and team of analysts that Shell takes to every race. “We monitor the fuels and the lubricants in the lab throughout the race weekend,” explains Lilley. “What we predominantly

look for are metal particles that wear away from the engine and gearbox and end up in the oil. By monitoring around 15 metals and elements that are present in the oil, we can help Ferrari understand the condition of the engine and gearbox.”

In the highly secretive world of Formula 1, there is plenty of information that is proprietary when it comes to specifics. “We are evaluating a whole range of different additives and base technologies. We have an ongoing R&D program, where up to 50 Shell technical staff work closely with the Ferrari engineers with the aim of improving the performance of our products,” explains Lilley. “We start the development process of new technologies with modeling and in-house screener tests. We would then send the most promising candidates to Ferrari where they would bench-test and finally track-test them to evaluate both for performance and protection over the complete life-span of an engine or gearbox.”

“We treat the engine lubricant as an engine component. If the engines needed to last longer, we would work with Ferrari to come up with the ideal lubricant. It would be one of a number of factors that would need to be changed to extend life of the engine, and one that plays a huge factor in protection and performance.”

WORDS BY JOHN CHALLEN

## The boys from Brazil



Petrobras has a dedicated team of 50 people working on its Formula 1 fuels, including engineers responsible for selecting raw materials

and managing the complex biochemical refinement process, and technicians who test and deliver the finished product to the track. Petrobras's Formula 1 fuel is developed in Brazil, at the company's research center at Cenpes and at its Downstream area. The 200,000 liters produced each season, including 20 different formulae approved by the FIA, are prepared at the Engine Refining Laboratory in Canoasin, and stored in 200-liter barrels and 20,000-liter tanks in Hamburg, Germany. Most of the fuel is sent from there to tests or races. "For the flyaway races, however, we send the fuels direct from Brazil by sea or air freight, depending on the time available," says Petrobras's Rogério Gonçalves (above).



where the engine has been modified to get maximum potential out of the oil. This is unusual in the commercial arena and we find it exciting because, with a blank piece of paper, we can find out the potential of our oil technologies.

"Using a bespoke oil is generally worthwhile, depending on the improvement you're looking for," he explains. "It will make a difference where competition is really tight, through improved power, reduced friction, etc. It all depends on the application and the baseline. We're not talking about a 10% benefit – it will be a single-digit percentage – but obviously that can be enough in close racing to put you on the front row of the grid instead of the second or third row. Also, in



Tony Hartlow in the mobile Mobil 1 laboratory. Housed in a McLaren truck, it goes to every F1 GP, as does Hartlow



"You may need to make some hardware

changes to exploit the full potential for a lubricant, so there is a design element to it as well"

**Bruce Crawley, ExxonMobil**

endurance racing you can gain some fuel efficiency. There are a number of different ways you can tune the dial, so to speak."

At the 2008 British Grand Prix, ExxonMobil introduced its Mobil 1 'NewTechnology' lubricant, a revised formulation that had been so successfully fine-tuned that it became euphemistically known within McLaren's racing team's engineering department as 'lap time in a can'.

The oil possesses a unique formulation that allows it to be less viscous, while still maintaining the high levels of lubrication required to efficiently coat a Formula 1 V8. The reduced viscosity speeds up the engine's internal processes because key components

are no longer required to pump their way through a thick coating of oil.

"A racing car really wants to run as little oil as possible in the sump," explains McLaren Racing's managing director, Jonathan Neale. "We want to use the minimum amount of oil needed to maintain a film in the most essential areas – such as the engine, gearbox and wheel bearings – but, by using a less viscous formulation, we can improve performance, while still maintaining the same levels of safety and efficiency we previously enjoyed."

Looking to the future, steady progress in fuels and lubricants is predicted rather than big changes. "In my personal opinion," says Gonçalves, "Formula 1 fuel will remain as it is today for the next few years, using the same limitations as for commercial fuels, and new figures imposed for pump fuels. We will probably have an increase in the amount of renewable materials, though, from today's minimum of 5.75%."

Crawley is similarly reserved about future developments: "We will see continued improvements, creating better friction performance through smarter engineering and engine designs. I see steady progression, just small steps. It's an ongoing exercise. The only thing I can predict making a step change is future coatings and super finishing. There are a few interesting things opening up there, but they are some time away from practical application." ❖