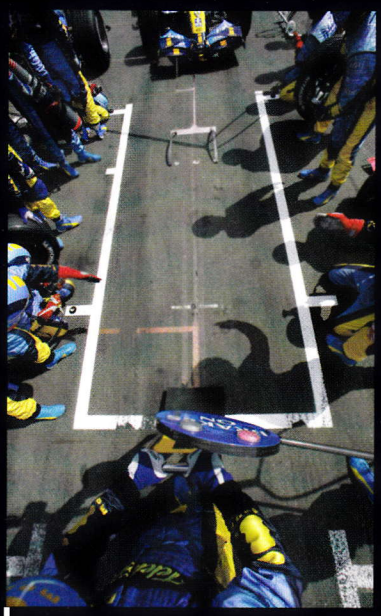
THE MOST EXCITING 8 SECONDS IN SPORT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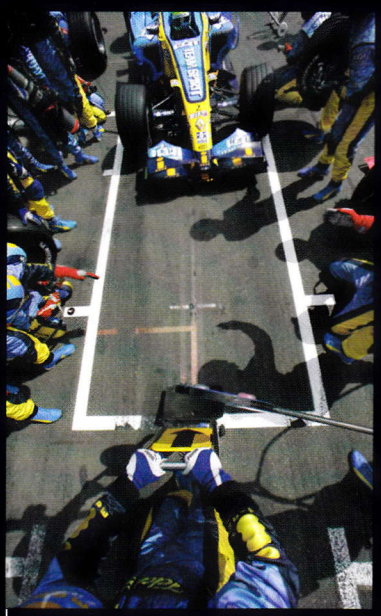
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Twenty-four people, 60 litres of fuel, four new tyres, 70 rehearsals a race. It is in the explosive precision of the pit stop that Formula One races are won and lost

WORDS BY PHILIP WATSON | PHOTOGRAPHS BY ADAM HINTON

THERE'S A SHUNT DURING THE OPENING LAP, AND JENSON BUTTON SPINS INTO GRAVEL AND OUT OF THE RACE ON LAP NINE, BUT OTHER THAN THAT, THE SILVERSTONE GRAND PRIX HAS BEEN SHORT ON GENUINE WHEEL-TO-WHEEL DRAMA. Starting from pole position, current world champion Fernando Alonso has inexorably extended his lead to a comfortable three seconds, and watching the young Spanish driver's progress on television monitors high up on the pit gantry, the 24 members of Renault's pit crew seem casual and composed. Dressed in fireproof suits, boots, gloves and balaclavas, and wearing helmets, goggles and face protectors, they look a little like Ninja Turtles on a pizza break.

Then suddenly, on lap 21, there is an eruption of activity. The crew jump up from their chairs and dart out to the pit box. Towering over them is the imposing figure of chief mechanic Gavin Hudson, brandishing a supersized "lollipop". From where I'm located, at the back of the garage, they look more like a disbanded rugby scrum than a tight and skilfully practised squad.

On Renault's internal radio system, I can hear race engineer Alan Permane issuing instructions to Alonso's team-mate, Giancarlo Fisichella. "OK, pit now, please, Giancarlo... 30 seconds, 30 seconds," he warns, then urges the crew to deliver "the same pace as Monaco".

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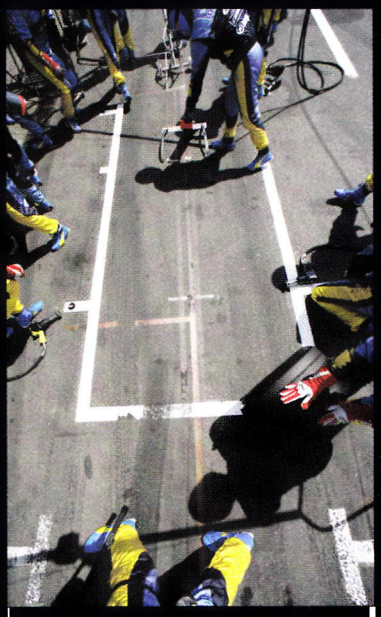

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The controlled explosion of precise, split-second movements that follow the car's speedy stop in the pit box is formidable to observe. Like a boxer's lightning jab or a tennis player's high-speed ace, it's almost over before you know it. After the wheels have been changed, Fisichella shifts the car into first gear, revs the engine a little, and waits for the final signal from the chief mechanic: the raising of the lollipop that tells him the pit stop has been completed and that the pit lane is clear. (Michael Schumacher, in a typical act of control-freakery, has a mechanic hold an extra mirror so that he can also see the fuel hose behind him.)

The whole process has taken less than eight seconds, although Permane continues to coach the Italian driver as he pulls away, reminding him to depress the limiter button that closes the fuel flap and prevents the driver breaking the 100kph speed limit in the pit lane.

"OK, well done, guys, brilliant job... we got Massa." The news that Fisichella has rejoined the race in front of Ferrari's Brazilian driver is greeted with cheers and high-fives by the Renault crew. Apart from a Renault car winning the race, this is the pinnacle of the pit crew's weekend: the speed and efficiency of their pit stop has enabled Fisichella to overtake a competitor. >

Training day: Fernando Alonso with his race engineer (centre) and pit team during practice for the British Grand Prix

OVERTAKING IN THE PITS IS NOW A REGULAR AND CRUCIAL FEATURE OF MODERN FORMULA ONE RACING; later in the same race, Michael Schumacher steals second position from Kimi Raikkonen in a similar fashion. With overtaking becoming increasingly difficult, and races often processional, some critics even contend that pit-stop efficiency is taking precedence over old-fashioned, seat-of-the-pants racing. For the drivers, though, the pit stop is as much a test of their capabilities as cornering.

"You might think that a pit stop is a chance for a break, but actually you have to stay extremely focused," says Giancarlo Fisichella, after finishing the race in fourth place. "There is a lot of adrenaline in my body as I enter the pit lane and it's very easy to break too late and overshoot the pit box, or to be too eager to get away. Both can cost you many seconds. Being stationary for eight seconds during a race can also seem like a very long time and you have to maintain self-control."

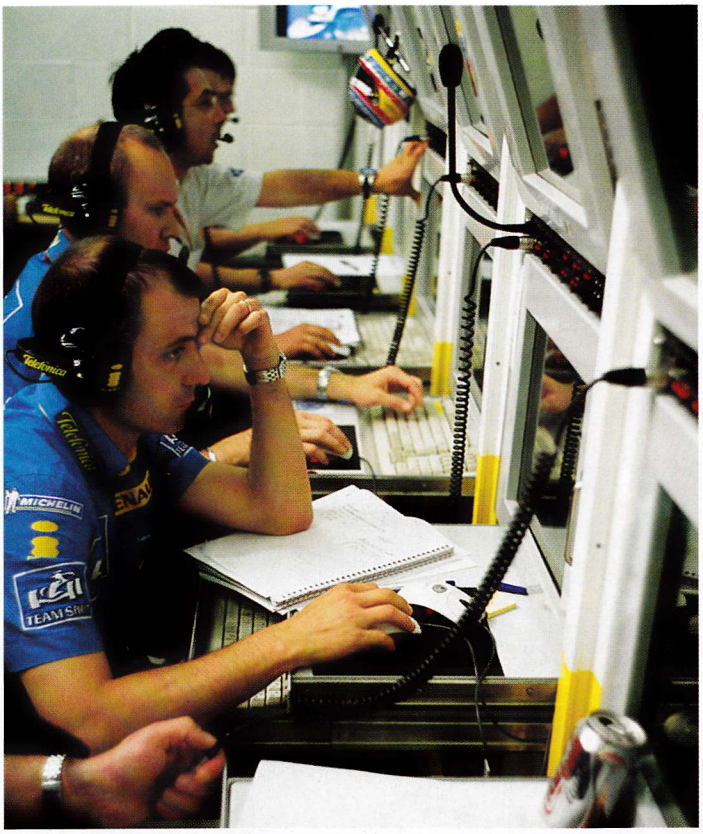
Former driver and ITV Formula One commentator Martin Brundle agrees: "A pit stop feels like suspended animation. It's quite surreal because there's all this movement and intense activity around you, but you're bolted into the car hard and fast. There's no compliance at all in a modern Formula One car, and all the frenzy of the refuelling and tyre changes are transmitted to the driver – it can be quite a physical experience."

The Renault crew are, naturally enough, in favour of pit stops, not least because it's an opportunity for them to contribute to the race. "From the factory making the parts for the car, to the designers, test teams, engineers, mechanic and the drivers, Formula One is a massive team effort that all comes together in a pit stop," says Gavin Hudson. "The buck stops with our pit crew and we have to perform on the day, but without the backing of everybody else in the team, we can't do it. Although it obviously helps if you have a really great driver, no single individual, however good, can make a Formula One team win."

> **"A pit stop feels like suspended animation. There's all this frenzied movement and you're bolted hard and fast into the car"**

Renault's flamboyant managing director, Flavio Briatore, compares the pit crew and his team to a watch. "While a pit stop can make you win or lose a race, and all the parts – the driver, the mechanics, the equipment – must be working perfectly if you want to have the right time, it is only the result of the 800 people who do their individual jobs – but all work together in the team."

The Renault crew even has the words "Team Spirit" emblazoned across their blue and yellow uniforms, and I get direct experience of that camaraderie during a pit-stop practice early on the Friday morning of the Silverstone weekend. While no fuel is used, the crew do not wear protective fireproof clothing, and the car is simply wheeled in with the engine switched off and a mechanic in the cockpit, the sessions are overseen and



Backroom boys: *above*, engine technicians analyse data which is beamed back from the car in real time. *Left*, the gearbox mechanic changes the car's oil

timed by Renault's sporting manager Steve Nielsen, and they are taken seriously. Basic tyre and fuel stops are run through, but the crew also practise such contingencies as changing the front nose or steering wheel, restarting the car if it stalls, and adjusting the front and rear wings. "Before the race the crew have done between 50 and 70 rehearsals, and by the time we get to the end of the season we've performed well over a thousand," says Steve Nielsen. I'm given the challenge of being gunman on the front left wheel. The wheel guns are heavy (around 4.2kg), clumsy, and attached to airlines that help rotate the magnetic heads at 8,000rpm. Squeeze the trigger and it makes a violent scream like the engine of a high-performance sportscar being turned over at maximum revs.

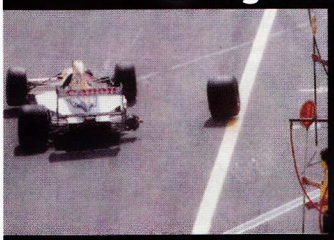
My task is to thrust the wheel gun onto the wheel nut, undo the nut, remove the gun with the nut attached, make way for two crew members to change the wheels, change the direction of the gun's rotation by clicking a switch (much like a domestic drill), replace and fasten the nut, pull out a small pin that locks the wheel in place, then raise my hand to signal that I've finished. The rest of the team and assorted onlookers will be watching. It's only a simulation, but the vehicle we're practising on is real enough. Its race tyres and magnesium wheels cost £2,200 each; the wheel nut costs £450.

"Stay calm and try to do it slowly," says Steve Nielsen. "Rush it and it will take a lot longer."

Amazingly, I record a time of 6.1 seconds on my first attempt, and there is a modest cheer from the pit crew. "You could be out of a job there, mate," says one of the crew to the mechanic who'd normally do the job. On my >

Five pits from hell

1 Estoril, 1991



Nigel Mansell is comfortably leading the Portuguese Grand Prix, but loses his right rear wheel as he exits the pit lane, after a nut is not fully fitted. The wheel overtakes his car, bounces through the Tyrrell pit area, and hits two mechanics. He rejoins in 17th place. It costs him the championship as Mansell finishes second to Ayrton Senna.

2 Hockenheim, 1994

Benetton's young Dutch driver **Jos Verstappen** and his pit crew are engulfed in flames when a petrol spillage ignites after hitting a hot exhaust. The fire is extinguished after a few seconds and the crew miraculously escape without serious injury, although five mechanics are taken to hospital and Verstappen suffers minor burns.

3 Jerez, 1997

Coming in for his second pit stop, **Heinz-Harald Frentzen** makes a rather fundamental error: he chooses the wrong pit box. Twice. The confused Williams' driver first enters the McLaren pit area sending wheel guns flying and ripping down air-lines, then proceeds through the Benetton box, before finally coming to rest in his own pit area.

4 Barcelona, 2000

Race leader **Michael Schumacher** is given the signal to exit – before the fuel hose has been disconnected. As he pulls away, he knocks over his chief mechanic, Nigel Stepney, breaking his ankle. At his second stop, Stepney's replacement fails to operate the fuel rig correctly and he finishes fifth.

5 Imola, 2006

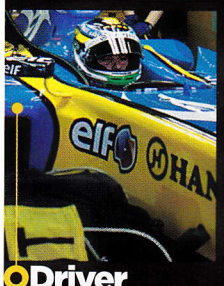
Jenson Button looks a certainty for the podium in San Marino, when Honda chief mechanic, Alistair Gibson, lifts his lollipop too early. Two mechanics are bowled over, one drenched in petrol. "Only egos were bruised," said Nick Fry, the Honda team principal.

Breakdown of a pit crew

Judgement day: pit practice at Silverstone. Two sessions of 30-40 rehearsals each help prepare the crew for every eventuality. *Right*, the hard work pays off as Alonso comes in first

Lollipop man

Chief mechanic Gavin Hudson guides the car in to the pits, oversees the work of the crew, issues instructions to the driver via his "lollipop", and ensures the car's safe return.



Driver

The driver puts the car into neutral and keeps his foot gently on the brake to stop the wheels turning. After the car has been jacked down, he shifts into first gear. He also takes this opportunity to peel a plastic strip from his visor. Cloths with wet and dry sides were used, but often they made the driver's visibility worse.

Jacks

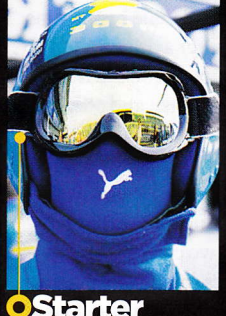
Two mechanics hold jacks that lift up the car. After the wheels have been changed, each of the four gun-men raises a hand to signal that his task is complete; when all four are raised the car is jacked back down to the ground.

Fuel men

Three men are in charge of the fuel rig (all the teams use identical refuelling units that put a regulation 12.1 litres of fuel into the car per second). One guides the hose's nozzle into the car's fuel filler, another stands behind him to help take the weight (a full fuel hose can weigh 40 kilos) and ensure the correct angle of entry; a third presses home a dead man's handle that cuts the fuel flow in an emergency.

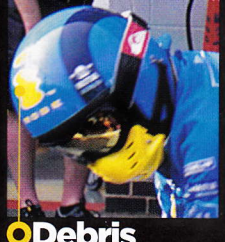
Spare rig

Two men stand by with a spare fuel rig that can be wheeled forward should the race rig fail.



Starter

A mechanic who will race into action with a long starter pole should the car stall.



Debris

Mechanics clear debris picked up from rival cars and the track from the side pods.

Fireman

Fireman carrying a 25kg fire extinguisher

Wheel men

One mechanic uses the wheel gun to remove and replace the wheel nut, two others make the change. The crucial importance of this procedure emerged at the Hungarian Grand Prix. During Fernando Alonso's second pit stop, the safety pin on his right rear wheel failed to disengage, the thread of the nut was damaged, the new wheel didn't attach properly and, two turns later, Alonso's race was over. The error was mechanical rather than human, but it cost Alonso vital points.

"Mechanics used to heave cans of slopping fuel over the head of the driver, who was invariably having a quick smoke"

second run, though, I fail to engage the gun correctly, and send the wheel nut flying over my shoulder, hitting a mechanic in the chest.

Each gunman keeps a spare nut on the ground between his knees, but by the time I've attached mine to the gun and fixed the new wheel in place, almost 24 seconds have passed. This time the reception that greets my meekly raised hand is more sarcastic. Rival teams would have changed wheels, refuelled and possibly even redesigned the chassis in less time.

DESIGN AND TECHNOLOGICAL PROGRESS HAS ALWAYS DRIVEN MOTORSPORT, and the pit stop has been always been integral to Grand Prix racing. A century ago, Renault won the prestigious 12-hour, 770-mile, two-day Grand Prix of the Automobile Club de France with the help of radical new detachable wheel rims. Previously, the driver and his mechanic had to slash off tyres with knives and lever on and inflate new rubber. If the steel wheel rims needed attention, pit stops could last 15 minutes. The new detachable rims, complete with inflated tyre, cut times to just 75 seconds, a major advantage at races where tyre damage was key.

In the decades before the first Formula One world championship race in 1950, the pit stop was a mark of all that was swashbuckling and insouciant about Grand Prix drivers. "The first time I saw a pit stop was as a 12-year-old boy at Brooklands (the legendary racetrack near Weybridge in Surrey) in 1935 and I remember being struck by how heroic it all seemed," says former F1 commentator Murray Walker, now an ambassador for the Honda team. "A driver would come charging into the pits, a mechanic would slam a funnel into the tank with a chamois on top to filter the fuel, and a huge, slopping fuel can would then be heaved up above the head of the driver, who was probably having a quick smoke."

Although symbolic of a certain maverick, indomitable derring-do, the pit stop was almost phased out during the Sixties, when a move to tiny 1.5-litre engines meant refuelling was mostly unnecessary. That changed in 1982, though it had more to do with tactics than the restraints of technology. In that year, Gordon Murray, a South African designer with the Brabham team, worked out that his drivers would be more competitive, and paradoxically save time, if they ran the race with lighter fuel loads on soft compound tyres, stopping once during the race to refuel the team's thirsty turbo-charged cars. All the F1 teams followed, and the era of continually balancing the twin demands of fuel load and tyre degradation was born.

Two years later, the sports governing body, the FIA, banned refuelling on the grounds that it had become too dangerous. The Brabham refuelling system could put 57 litres of fuel into the car per second (more than five times the current limit); fuel also flowed at a volatile 65 pounds per square inch. One team boss, Ken Tyrrell, described the fuel rigs as "bombs waiting to go off".

Refuelling returned 10 years later in 1994, in an attempt to add variety and a change of pace to the sport. That same season, Benetton's Dutch driver Jos Verstappen and his pit crew were engulfed in flames when a petrol spillage ignited after it hit a hot exhaust. It was the same year that Ayrton Senna and Roland Ratzenberger were to die at Imola. Pit stops from that moment on, like the sport in general, were about putting safety first, and changes and innovations, such as a failsafe dead man's handle on the fuel rig and pit-lane speed limits, were quickly introduced.

While today pit stops remain emblematic of Formula One's pre-eminent position as the world's greatest team sport, embodying the competitive ethos, edge and efforts of each member, critics often argue that they have become symptomatic of all that is tragically wrong with F1. Audience figures, especially in the UK, have declined in recent years, and there are those who despair at how nose-to-tail battles can be curtailed by a fuel break.

"At the moment, Formula One is too much about the technology and the strategy, whereas what I've always believed in – and never forget – is that it's about racing," says Flavio Briatore. "I'm fighting all the time to make the racing more dramatic."

Pit stops have, after all, only taken on this greater significance as a result of the reduction in overtaking on the track. Such factors as aerodynamic advances, increased tyre grip, traction control, and short breaking distances at the circuits now render overtaking, especially between the leading drivers, extremely difficult. The modern emphasis on pit stops is perhaps indicative of a wider malaise rather than being an ailment in itself.

"People love Formula One for the soap opera and razzmatazz, the glitz and the glamour, the speed and the high finance, but they'd like it a hell of a lot better if there was more wheel-to-wheel racing," says Martin Brundle. "A pit stop can be interesting strategically, but it's never going to compete with seeing two cars being driven flat out side-by-side down the pit straight, and one driver taking the lead by skilfully out-breaking. Pit stops are radio; on-track racing is television."

Pit-stops: a blueprint for life

The unrivalled efficiency of a Formula One pit stop has impressed leaders in many other fields. Business CEOs have used the pit stop as the acme of team organisation, while the British military were able to cut the time it took to rearm and refuel Apache helicopters by 50 per cent after consulting with F1 teams.

A more surprising application of pit stop technique is in cardiac surgery at Great Ormond Street children's hospital. After studying pit-stop practices at test circuits and races, two of its leading surgeons, Dr Allan Goldman and Professor Martin Elliott, modified theatre procedures.

Firstly, they introduced measures that ensured surgeons kept the Intensive Care Unit (ICU) team abreast of a patient's exact requirements. "It's like the guys on the pit wall giving information to the crew about when a car is coming in," says Dr Goldman. Other innovations included better task allocation, so staff knew exactly what was their responsibility.

The pair now hope to open a new £35m high-tech "F1 operating theatre and ICU" at Great Ormond Street, with plans for Formula One teams to sponsor beds and deck them out in team colours.

"It's dreamland, I know," says Dr Goldman, "but F1 teaches you that anything is possible."