

FROM THE EDITORS OF MOTOR SPORT MAGAZINE

BRITISH

SPECIAL COLLECTORS' EDITION STARRING

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JAGUAR

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ASTON

MARTIN

McLAREN

BLUEBIRD

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Since the very conception of this sport, Britain has been at the forefront in some form. Whether it was providing the engineering or design nous to find and exploit an advantage, constructing a machine to push parameters further than ever before, or simply providing the talented men and especially in the early days, women, behind the wheel, Britain excels on the world motoring stage.

There's a reason that six of the current 10 Formula 1 teams call the UK home - seven if you count that Haas has a technical base here - and it's because Britain still has some of the finest minds, machinery and technical networking anywhere on Earth. Around 75% of the research and development of the entire global motorsport market takes place in the UK. Motorsport Valley - the area around the Thames Valley in Oxfordshire and the West

Read more about Britain's incredible contribution to motor

Midlands that hosts the bulk of companies - is worth billions in trade and export each year. But even beyond the numbers, UK racing projects have both made and re-written history, established benchmarks and then shattered them in turn with every technological and generational advancement.

such as Stirling Moss' heroics on the Mille Miglia, Jackie Stewart's triumphs with underdog Tyrrell and later quest to improve safety, Nigel Mansell's rough and ready world title, Lewis Hamilton's record-shattering grand prix exploits. We've shied away from these headline acts, and raided our archives to find more varied stories of British success. This special issue pays tribute to some of the brilliant brains, talents, engineering and iconic moments when Britain shone.

Many of the stories are long-since told,

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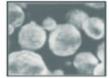
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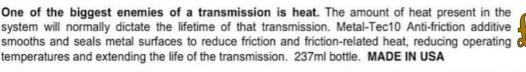
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& WOMEN)

The great machines of our sport would be nothing without the hearts and souls behind them. Here we celebrate a collection of characters who helped push British motor sport to the farthest frontiers





'YOU SEE? IT DESIGNS ITSELF...'

These were the favourite words of Anthony Colin Bruce Chapman and showed just how easily car design came to him. Then again, explains *Gordon Cruickshank*, the man was a bona fide genius

TAKEN FROM MOTOR SPORT, APRIL 1998



o story on Colin Chapman could omit the word 'innovation'. But his remarkable talent lay not so much in inventing devices as solving problems, and, more crucially, in identifying that problem first. What set him apart was his ability to look at the whole picture, ignoring the constraints of accepted knowledge while looking for a way to reduce weight, drag or complexity. If nothing existed to suit, he was too practical to set it aside and wait for technology to catch up; he would

Often the latest clever idea became blindingly obvious – but it took Chapman to see it first. Hugh Haskell, a Lotus engineer in the Sixties, relates in his book *Colin Chapman – Lotus Engineering* how Chapman would guide a junior through the needs and constraints of the current problem until his pupil reached the key to it. Then he'd say "you see, it designs itself!" and walk away.

dismantle the problem and find answers to

each of its constituent parts.

Although he took an engineering degree, his speciality was structural, not mechanical, engineering and this may well have helped his unusual ability to see the wide view. Structural engineering is yet more concerned than mechanical with economy of materials. A long-span beam, for example, has to cope with its own weight as well as applied loads. As you approach strength/span limits, the returns diminish: the thicker you make it, the less its strength increases. Generally this factor is less critical in automotive applications, but it is a crucial discipline for the structural engineer.

There are no long spans in a car, but Chapman's perennial drive for fineness and lightness surely reflects this early indoctrination, and it is possible to surmise his ability to look laterally at problems also thrived in this field. Instead of focusing purely on designing a strong bridge, for example, the civil engineer might also consider a causeway. Chapman's genius was that he could stand still further back and ask 'do we need to cross the river at all?'

His first car, a trials special built in 1948 from an Austin Seven, addressed the notorious whippiness of the A7 chassis by using plywood side panels bonded to alloy sheet – extra rigidity for no extra weight, by stressing panels which would otherwise do no more than keep the wind out. At a time when the vintage idea of keeping the chassis flexible still existed, he identified that predictable handling required a stiff frame with pliant suspension.

By the time he began his Lotus MkII, Chapman had researched every A7 part and selected the best, collectively extracting more than anyone from more or less standard parts. The car proved a successful all-rounder in trials, sprints and rallies and, in 1950, brought Chapman his first track win. From then on racing became his focus, and he designed Lotus MkIII carefully around 750MC regulations. Not specifically 'within' those regulations: forced to retain the A7 chassis, he bolted tubular bracing to it - not the last twin chassis of his career. Similarly, he side-stepped the drawback of its siamesed intake ports by devising an inlet manifold with a divider which poked tongue-like into the port, effectively splitting it. His car ran rings around the opposition, and the inlet was banned the next year. Lateral thinking, clever solution from existing technology, regulations exploited but not broken, official disapproval – he was setting his pattern.

"The next clever idea became obvious, but it took Chapman to see it first"

The MkIII's achievements brought a couple of commissions to build cars, and allowed Chapman to work on his first chassis design. To finance a car for himself, he had to sell a run of this new MkVI, and again he stretched the rules, avoiding Purchase Tax by offering a kit for self-assembly. Though using off-the-shelf parts for cheapness, Chapman's machine was a serious competition car featuring a triangulated tubular frame at a time when even Grand Prix cars had ladder chassis. It also had adjustable suspension, a key to his mastery of making optimum use of tyres.

The MkVI was the right car at the right time, and continuous demand, plus the race successes of its buyers, made Chapman a manufacturer. But it was racing which fired him, and allowed him to measure his achievements directly against others working under the same constraints. He loved to make parts redundant: using a fixed-length driveshaft as the upper suspension link, putting

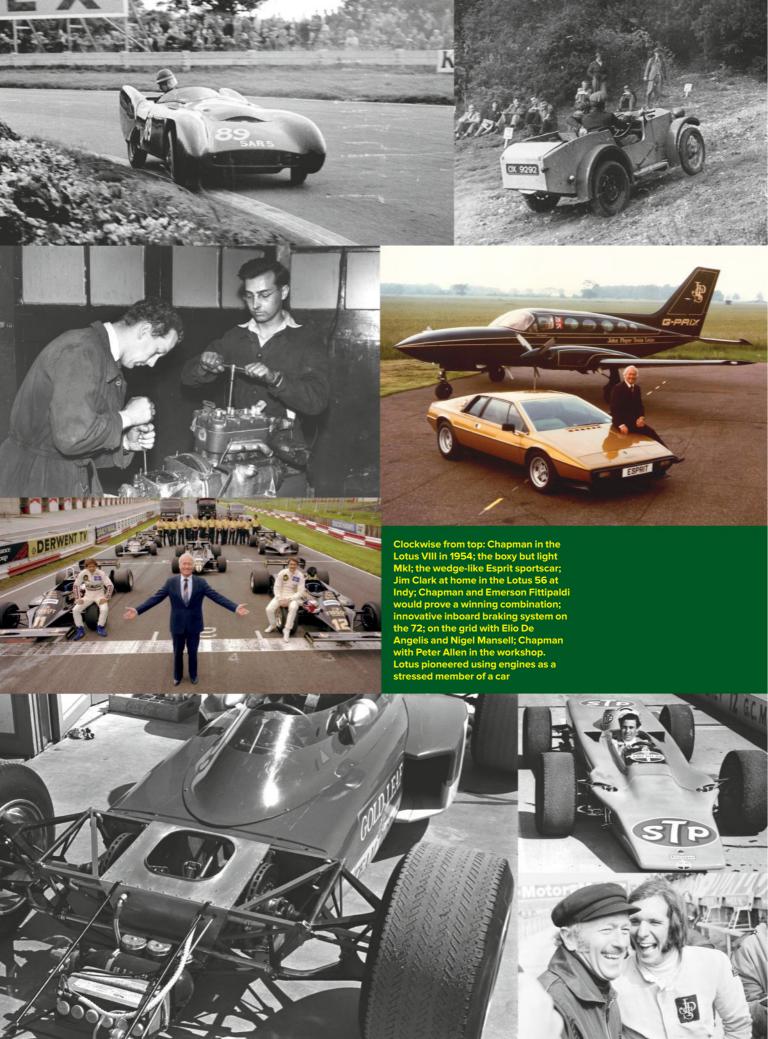
fluids through chassis tubes, using a moulded tongue on the Elan bonnet to obviate hinges, and throwing away several feet of metal on the Lotus 49 by using the Cosworth DFV engine as the rear of the chassis and bolting the suspension to it.

Very early on he focused on airflow, loving the fact that lowering drag is a something for nothing deal. With smooth bodies designed by Frank Costin, the VIII, IX and Eleven (Chapman now dropped the Roman numerals) sportscars looked like nothing else, and offered 130mph on only 80bhp. There were no exotic elements: they kept the split-beam front suspension of the VI, had unsophisticated running-gear and no costly lightweight materials. Yet they were light, simply because Chapman had distributed the minimum material efficiently, into a rigid tubular frame. At this time he was the only designer to have shown a knowledge of pure three-dimensional structures, and it led to his being asked to take a look at the Vanwall Grand Prix car. His advice on a space-frame chassis, a de Dion axle, and employing Frank Costin to shape the body turned Vanwall into a Formula 1 winner – before he had even built his first single-seater.

Not all his ideas worked. His sequential 'queerbox' closed up all the gears in the 'box by removing the selectors from in between them, and engaged gears by pins projecting from the hollow shaft. To this day it remains a fine concept, but no-one has yet made it work effectively.

qually, what seemed the brilliant stroke of using the anti-roll bar to locate the Eleven's wheel upright, and making a suspension arm redundant, brought adjustment difficulties, so for his first rear-engined design, the 18, Chapman adopted simple double wishbones. Slightly heavier, but easier to setup, and therefore a net improvement. He was not one to cling too long to a principle: if the perfect part was hard to manufacture or repair, and the advantage it offered small, he was quite happy to abandon it for something plainer if it meant an overall benefit.

This was the opposite position to BRM, which tended to pursue an idea beyond the sensible cut-off point, and spend thousands on the best possible quality even when it wasn't making the car faster. But after seeing what this 'new boy' had done for Vanwall, BRM also asked his advice, and allowed Chapman to change entirely the car's suspension, transforming its handling. It •



was all good PR for the arrival of the Lotus type 12, the F2 car which, in 1956, began the long train of Lotus single-seaters.

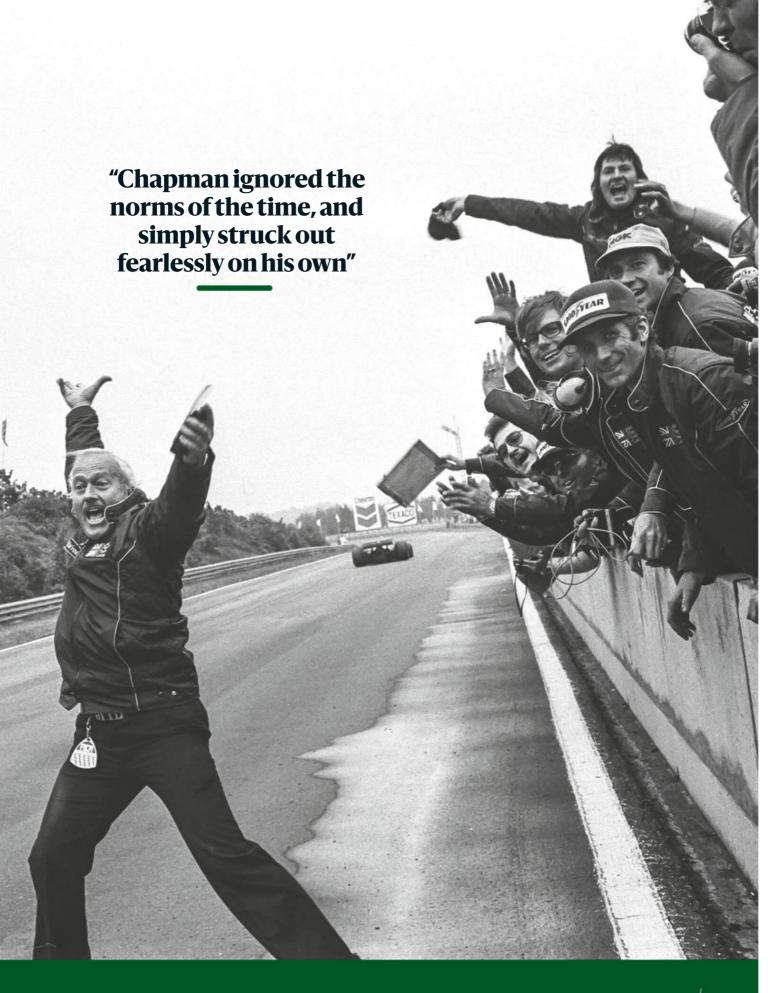
Though Chapman did not immediately follow the Cooper rear-engined route, he quickly became the one the others followed. The pencil-slim 20's cigar shape became the single-seater racing norm until 1968 when the radiatorless Lotus 56 Indianapolis turbine car introduced the wedge profile and shovel nose, trying to burrow under the airstream. The most admired of this series, the 72, is remembered for what Rindt, Peterson and Fittipaldi did with it, but Kenneth Sears, now Head of Technical Strategy and Research at Lotus, thinks its real importance was in its layout. It was, he says, the car which established the 'architecture' of all F1 cars from then until now. Side radiators, fuel behind the driver, a nose which has only aerodynamic functions; not a fashion, but a logical optimum which still applies.

Though racing had first priority, it had to be supported by a turnover of road cars, and while the VI and the following VII appealed to the hardened enthusiasts and many weekend racers, Chapman's next concept took Lotus in a direction, which has continued ever since glass-fibre. He wanted to build a comfortable road car; but instead of investing in heavy presses, or being restricted by individual hand-building, he ignored the norms of the time, read everything written about the subject (always a Chapman feature) and simply struck out fearlessly on his own.

s always he exploited the material to its limits, realising that since it was easy to make complex shapes, he could make one major moulding which did several jobs. Thus the 1957 Elite boasted the first glass-fibre monocoque shell, and confounded sceptics by boasting superb rigidity and delightful handling. It had suspension derived from the race cars, with the tall Chapman strut placed behind the seats, and front wishbones of wide-based shape to reduce the point loadings on the shell like an egg, a pure monocoque has a thin skin which needs reinforcing to cope with local pressure. But it was expensive and troublesome to build, so it did not change the industry.

Having proved his technological point, Chapman remained quite open-minded when designing the Elan that followed. Unlike the Elite, the Elan was intended to be an open car, and the lack of roof makes it far harder to retain rigidity. But when





Chapman saw the simple folded steel backbone his engineers had contrived to test the running gear without the body, he had no hesitation in adapting the idea for production. Bolted to the GRP 'tub', it produced a stiff, and watertight, structure with what was effectively one huge reinforcing plate to cope with all the point-loads.

It worked well for the small-engined Elan, but in the constant cross-feed of ideas from the road to the racing side, it proved not to be so appropriate elsewhere. In the rear-engined 30 sportscar of 1964, Chapman reversed the frame, putting the Ford V8 of the Type 34 Indy racer in the fork and using the hollow spine for fuel. It was sensationally low and beautiful (another of Chapman's assets was his eye for an elegant shape), but under the V8's torque it flexed dreadfully. They never made it work properly. Though the Elite had successfully demonstrated the monocoque principle.

Chapman's racers did not follow until 1962. From the elegant 16, last of the front engines, low drag came first and after the chunky 18 their shapes were pared down and down, with the driver lying down flatter each time. With the 20, the bottom of the driver's seat was as low as it could go; yet for the 22 Chapman sank the driver a little more by using his "Theory of the Compressibility of Bums" and slicing the seatbase off flat. However, as the chassis became slimmer, they lost the third dimension of height which brought rigidity. The answer came in 1962 with the 25, whose folded steel monocoque was a simpler but stiffer structure than a multi-tube. The new 'tub' was effectively a single structural member with the driver inside, made practicable by the availability of aircraft bag tanks for fuel, which could be inserted within the hollow sections. Chapman's eye always roved over other technologies for useful advances.

The 25 also marked the end of one innovation and the arrival of another. Chapman's 'wobbly web' cast wheel had cleverly used a folded shape to make a rigid unit in the same way as paper becomes strong when corrugated. But as tyre widths soared, cast spokes became more efficient, and the 25 was the last Lotus to use them. Also, as the driver became more reclined, the windscreen became more of an obstruction. Chapman devised the venturi screen, where air was squeezed up through a slot to form an air-curtain – the same principle as on Renault's recent Spider. He even used 'structural air' in 1958, when Le Mans regulations banned rigid tonneau covers; his cars had a cover like an inflatable cushion. Almost as good as metal, and quite legal...

hapman knew from the start that drag was power thrown away, and even the VIII and IX had carefully crafted aerodynamics inside the engine bay as well as underneath. Through the Sixties, racing car aerodynamics were all about air penetration, until Jim Hall equipped his Chaparral with its wing. After the banning of 1969's high wings, which acted directly on the wheel uprights, designers seemed stuck with nose and tail wings to push the body down on its suspension, requiring very hard springs which not only battered the car but were also desperately uncomfortable for the driver. It took Chapman some time •



finally got going after a push and spent a dismal race in the middle of the pack... unable to think much save that Boxing Day was a crazy day to go motor racing."

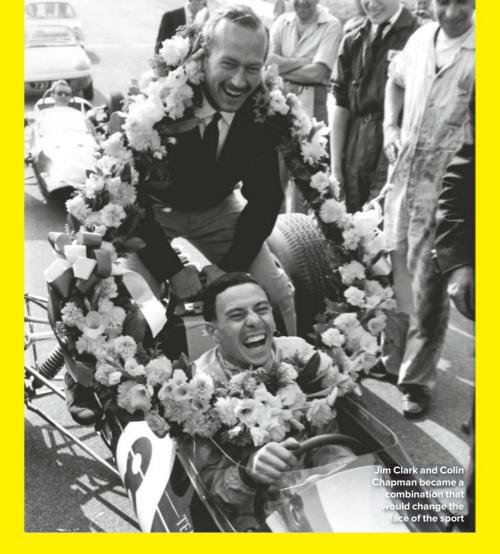
Fair to say Jim Clark didn't enjoy his single-seater debut. No doubt it was coloured by what had happened earlier. Having decided to settle for second behind the sister Lotus Elite of Graham Warner in the Production Sports Car race, he lost concentration – some say a rear hub broke – and spun backwards into a bank. It was his first crash. And his last outing in a car owned by friend and mentor lan Scott Watson.

This meeting was in every sense a turning point for Clark — and for the sport. He had for two seasons wrestled his conscience: the steady but heavy demands of the family and its farm versus the exotic, quickening lure of motorsport.

Notoriously bad at making decisions, he allowed himself to be talked round by racing friends after "frightening myself silly" in a Jaguar D-type at Spa in 1958. Those same people would have to pick him up after his disastrous Boxing Day Brands Hatch of 1959.

Warner kept the faith. Looking to expand his West London business, The Chequered Flag, he'd invited Clark to race a Formula Junior. The Gemini MkII was based on the Moorland MkI constructed in nearby Southall by Les Redmond, from a scheme by freelance designer Len Terry. Warner bought the rights and employed Redmond. A neat front-engine machine with a spaceframe chassis, Clark's was powered by a Speedwelltuned BMC A-Series 'four'.

Oddly, given his pencil-slim Lotus recliners to come, Clark complained about its cramped cockpit. His mood only darkened when the Gemini's battery died on the grid. Alongside him was Alan Stacey



How Clark drew Chapman's attention

Paul Fearnley looks at a how a damp day in Kent shaped a legend

in the unpainted prototype
Lotus 18 – Colin Chapman's
first rear-engined racing car: "A
cigar tube with four wheels,"
reckoned Clark. Others called it
"a biscuit tin". It was fitted with
a bitsa Ford 105E engine
cobbled by Cosworth from its
original standard unit and the
remains of the tuned item that
had locked solid due to a loose
flywheel and caused Warner to
crash his Gemini in practice.

The unsorted Lotus handled badly in the wet though its suspension was sufficiently soft for it to ground over bumps — and Clark reckoned it an accident-inwaiting. His prediction almost came true when Stacey spun and nudged the bank.

The works Elva of Peter Arundell won despite its Mitter-tuned DKW two-stroke appearing to tighten near the finish. This allowed the brand-new works Lola of Peter Ashdown to close within 0.4sec after prevailing in a dice with Arundell's team-mate Chris Threlfall. Clark finished a despondent eighth behind Mike McKee's Cooper, another brand-new model – Britain was finally discovering its Junior mojo – the Elva-BMCs of Chris Lawrence and pole-sitter Bill de

Selincourt, who spun on the first lap, and another Cooper. It could have been worse – but not by much: Stacey was 10th after his moment.

Matters had run late but more smoothly 12 months previously. Having received a Christmas Eve phone call from Chapman that his preproduction Elite was ready, Scott Watson rounded up Clark and they boarded the overnight express to London.

Having spent a sober Christmas Day night sleeping fitfully on the train, they collected the car from outside Green Park Hotel, drove it to Brands Hatch, taped its headlights and went racing.

Clark's prior experience of the Kent circuit was a Lotus F2 test. He did reasonably well during two runs but decided against purchase after it shed a wheel, rolled and flung Graham Hill from its cockpit.

Clark was happier in sports racers and GTs and delighted in the nimble Elite that he sampled that same day.

Chapman was already impressed by the shy Scot but had no inkling of what was to come at Boxing Day Brands.

Their dice in the 10-lap up-to-1500cc GT race was epic, Clark's progress being more agricultural than usual. *Motor Sport*'s report by Bill Boddy noted J Clark's "enormous verve" and remarked: "There are no stupid 'no wheels off the road' rules at Brands."

One story goes that Clark was incensed having heard Chapman and Mike Costin chatting in the gents' lav about how they would carve up the race in their works Elites.

"If I had known what I know now," he wrote in his 1964 book *Jim Clark at the Wheel*, "I wouldn't have done half of the things I did in that race. I have photographs of us going side by side round Paddock Bend, both with cars sideways on."

His white car was leading and pulling away with a few laps left when he was baulked by a backmarker. This delay allowed the opportunistic and determined Chapman to nip though on the inside at Druids and win by 1.6sec.

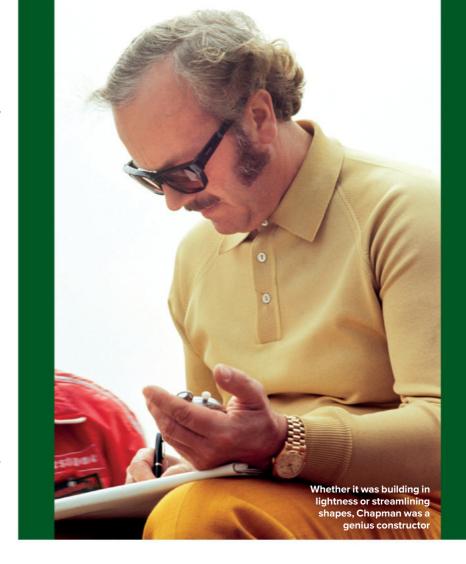
Chapman, who had a high regard for his own driving prowess, was convinced now that Clark's was a special talent. Within three months the combination of Chapman, Clark and Cosworth, plus a muchimproved Junior Lotus 18, would begin rewriting the single-seater canon. Christmas came early in 1960: on March 19, at Goodwood.Clark never settled for second again.

What the regulations said was that downforce had to be applied through the suspension. His approach effectively enlarged the old illegal high wings, joined them into one huge super-wing and dropped this down to bear on the suspension through light springs. Within this new structure, the traditional monocoque still rode on its own springs as if the outer shell were not there, the driver bobbing up and down slightly through the opening in the upper surface. Because the secondary springs were so light, they squashed flat with the downforce, applying it directly to the tyres. It was perfectly brilliant, and perfectly legal, but as we know it was 'clarified' by the rule-makers into the parc fermé of those ideas which would catapult one outfit into a clear lead.

hile brewing the twin-chassis idea, Chapman had filled in with his most far-reaching concept of recent years: it was first seen on the 1977 Lotus 78 wing-car, in which he turned much of the body into an upside-down aerofoil and then contrived the idea of sideskirts to stop the air flooding in from the sides and undoing much of the benefit. The subsequent 'ground-effect' era, though inspired by Chapman, was ironically a lean time for Team Lotus after the 79's allconquering '78 season. The 88 would have leap-frogged the team back on form, and its banning affected Chapman greatly.

It was at this point that Chapman focused on the design of a microlight aircraft. Having recently wound up his motor-cruiser companies (where he had achieved new levels of lightness for GRP hull structures) the emerging microlight field seemed to offer design opportunities not much fettered by rules, unlike the way racing was going. Says Ken Sears: "He was always finding ways of winning through innovation, so when racing began to be tightened up to make a better spectacle, he lost the thrill of the big bold step. He'd probably be bored today, with small steady refinements".

Typically, he assembled everything written on microlights and learned to fly one. As most microlights were tube and fabric affairs then, the rules were basic too. Chapman, a life-long aero-enthusiast and pilot, envisaged an enclosed and superlight composite two-seater, a practical tourer which would still qualify as a microlight



"He set people targets beyond what they thought they could achieve"

something the authorities had not foreseen. It would have significantly undercut the Cessna market. Tony Rudd designed an elegant little four-stroke engine, and the striking canard shape was developed by Rutan in the USA. The prototype was ready to fly on the day Chapman died in December 1982; like all the non-motoring projects, including the Lotus furniture designs, it was soon dropped.

From early days, of course, Chapman employed many designers to carry out his intentions, and the personal contributions of Mike Costin, Len Terry, Tony Rudd, Peter Wright and many others were all vital. But one of Chapman's talents was extracting from others what he himself could envision, and his hand steered every project. Sears: "Chapman could set people targets beyond what they thought they could achieve. His whole approach was one

of innovation and competition; winning races or being first to the airport, it mattered to be one up."

The creative atmosphere has always pervaded Lotus, and still does. The Norfolk company is a world-leader in composite moulding and a pioneer of active suspension. Sears thinks that the latter was possibly the first major innovation suggested to, instead of by Chapman, and proved it was possible to separate and resolve factors such as response and travel previously thought incompatible. Similarly the Olympic medalwinning Lotus bicycle, which incorporates some 'bad' engineering (the single-sided fork) for aerodynamic gain. And while the Elise's bonded aluminium chassis is rightly praised, it uses technologies which already existed. Someone just had to be bright enough to put them together in a new way - a lesson learned from the man who created Lotus. •









477 **PARTS** **SCALE**

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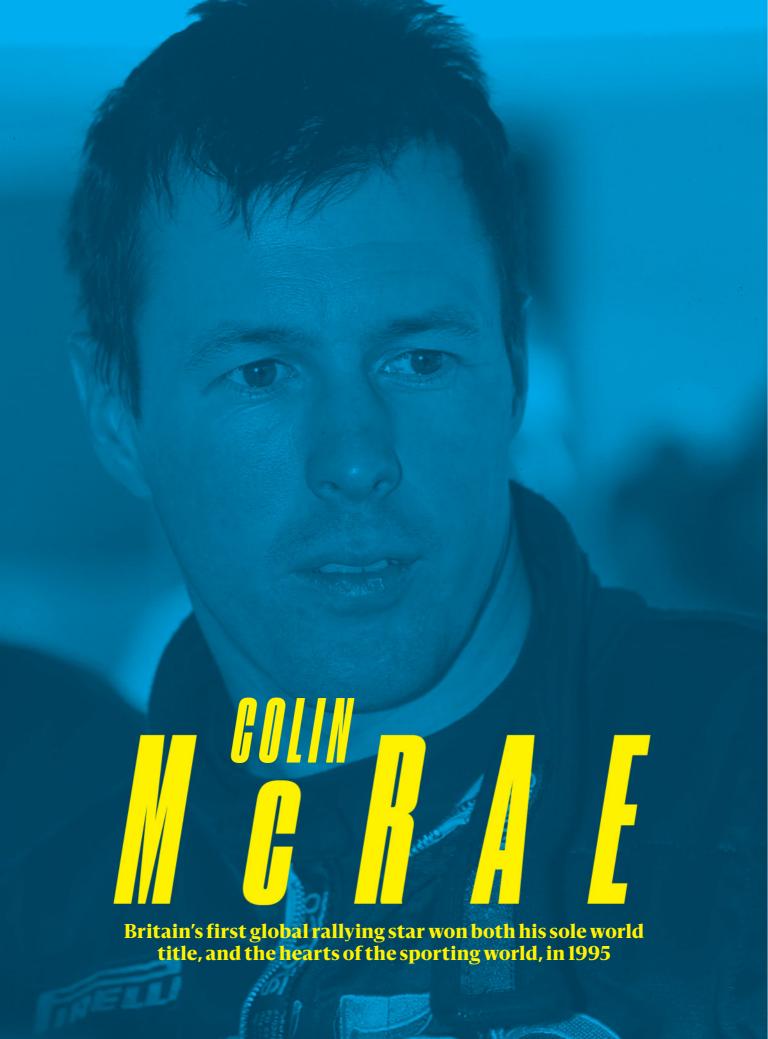


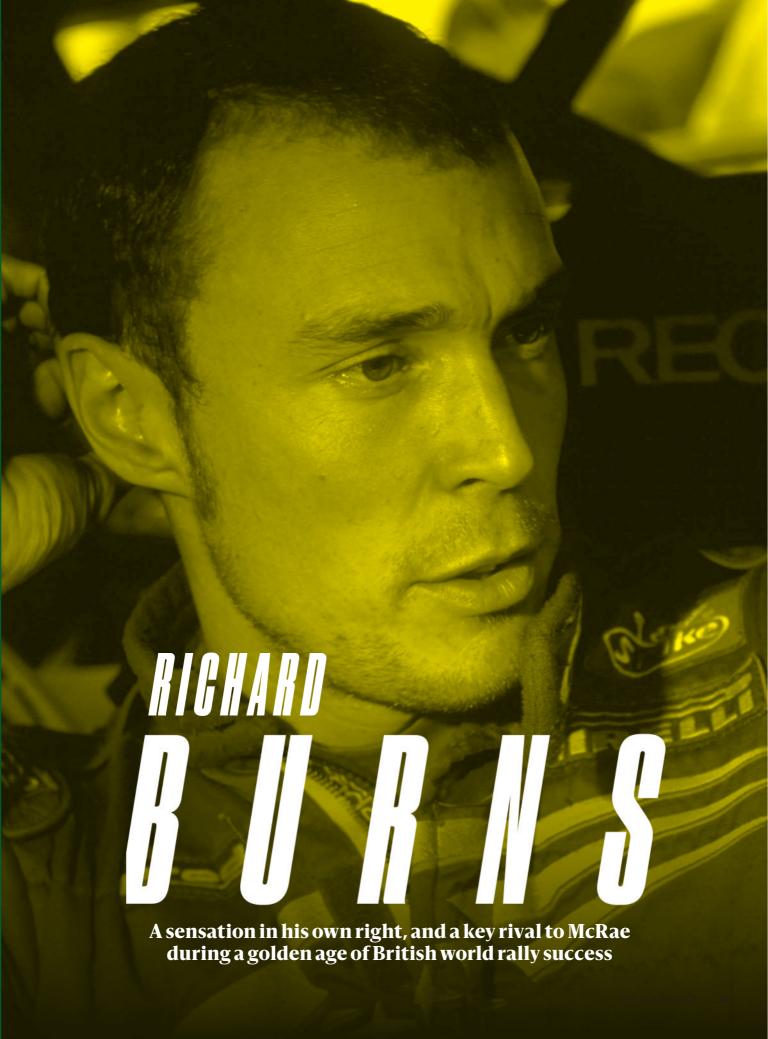
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FIND OUT MORE









WHEN GOLIN MCRAE WONTHE 1995 WORLD RALLY TITLE

Anthony Peacock recalls the Scotsman's brilliant Rally GB win, a drive worthy of a true champion

TAKEN FROM MOTOR SPORT ONLINE, OCTOBER 2016

n terms of Rally Great Britain's special moments, it doesn't get much more special than Colin McRae winning the 1995 world title, becoming the youngest-ever World Rally champion, (aged 27) and the first-ever British world rally champion to boot.

As he drove his Subaru Impreza onto the finish ramp he was preceded by a bagpiper, who would go on to accompany him on many other rallies all around the world in the future, forming perhaps the most unusual item ever seen on any packing checklist: Passport? Tick. Money? Tick. Bagpiper..? Tick.

Even now, a rally friend comments that he can't listen to the sound of bagpipes without thinking of Colin and that extraordinary day in Chester, on November 22, 1995, to be precise.

From his debut in the World Rally Championship two years earlier it was clear that Colin was a very special talent but undoubtedly a raw one, which quickly earned him the nickname of 'McCrash'.

With time, the inconsistencies were ironed out and McRae became simply the most exciting rally driver in the world. To a

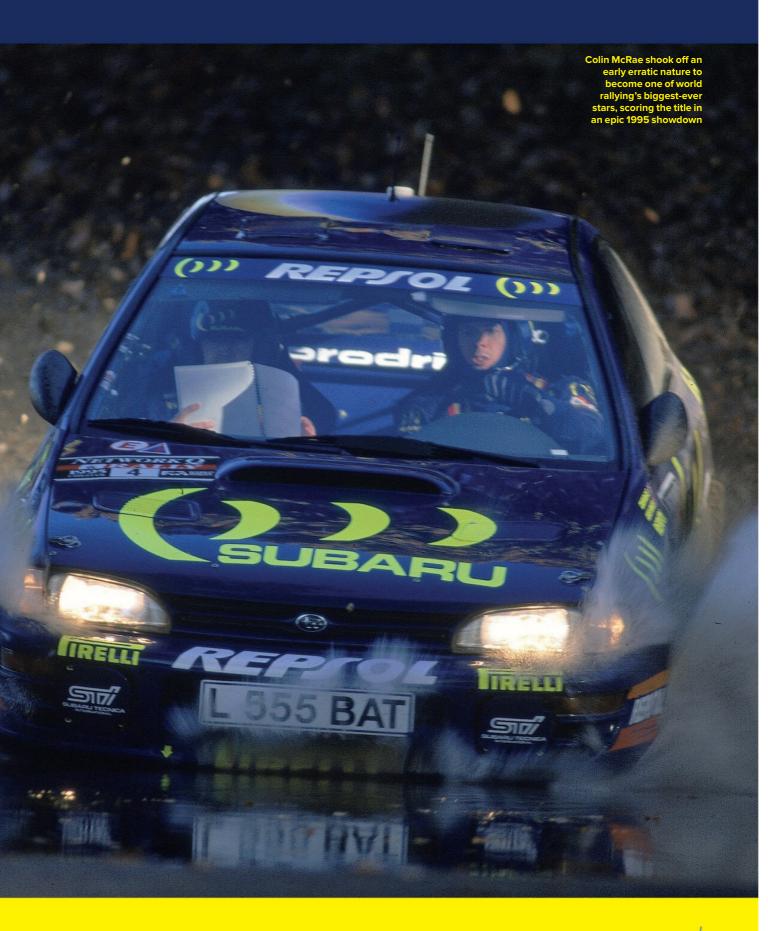
generation of people, the archetypal rally driver, thanks to his success and the fame of the *Colin McRae Rally* computer game.

But back in 1995, that was years away. Colin arrived at his home rally that season to the backdrop of a bitter feud with his team-mate Carlos Sainz. This had culminated in Subaru's management stepping into the road in front of McRae on the previous round in Spain in an attempt to make him slow down and let his team-mate win, as had been previously agreed (according to Sainz and the management, at least).

So Colin was still at the red end of the Richter scale when the cars drove off the start ramp for the Network Q Rally GB in Chester. By forcing the issue in Spain - because McRae ultimately agreed to take a time penalty after winning the rally on the road - Sainz may have inadvertently sounded the death knell on his championship hopes.

The Catalunya Rally - in Sainz's back yard - would have been only McRae's second win of the season (although he had amassed a solid run of podiums) and it could have given him a 10-point advantage heading into the final round.





Instead the Subaru team-mates started the rally equal on points, so it was winner takes all: just as the Japanese management (and headline-writers) had wanted. Sainz had already won Rally Great Britain twice though, McRae once - so experience should have been just on the Spaniard's side.

McRae set off only just on the right side of crazy: he was straight into the lead, but on the Monday morning (the second day of the four-day event) he picked up a puncture in the 36-mile Pundershaw stage and dropped a minute to Sainz.

The time lost seemed almost insurmountable, but over the next three days there was no stopping the flying Scot - who truly had a date with destiny.

Later on, in the infamous Kielder Forest, he picked up another puncture and bent a front-right suspension arm on a rock. He still emerged from the stage faster than Sainz. On the road section, the fans lifted the car like a human jack so that McRae and co-driver Derek Ringer could bend the offending item back into shape Fred Flintstone-style, using a log - the Impreza now pointing straight again. Another bullet dodged. But it took him until SS21, Sweet Lamb, to regain the lead.

Wednesday, 22 November was McRae's finest hour. On that day in particular he was imperious: smashing stage record after stage record, in the sort of quasi-spiritual zone that Ayrton Senna had spoken about only a few

"McRae entered a spiritual zone like Ayrton Senna had spoken of"

years earlier in Monaco. Quite simply, nothing could stop him. His progress was not merely mesmerising it was something that had never been seen before. Through the dank forests the blue and yellow Impreza was a dazzling beacon of fluidly imperious brilliance.

The final obstacle was simply surviving the last stage of the rally - the 11 miles of Clocaenog in North Wales - the end of an odyssey that would lead to McRae's place in history. The iconic blue and yellow Impreza won the stage to cross the finish line 36 seconds ahead of Sainz in total, after more than five hours of flat-out competition, with McRae claiming 18 of the 28 stages.

From there McRae headed to Chester racecourse for the finish, eventually preceded onto the ramp by his piper. A lot of that final road section was spent on the wrong side of the road; such was the amount of traffic that had built up as spectators rushed to the racecourse to see their hero crowned. McRae was the peoples' champion, which was at

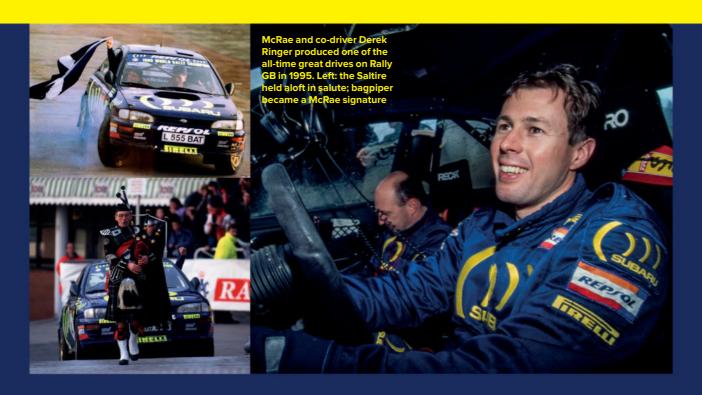
the heart of his appeal. Among the most vocal of his supporters that day in Chester was not just the army of his supporters, but a bunch of ordinary Scottish people from Lanark: his friends. McRae's friends weren't playboys or superstars, but normal working people.

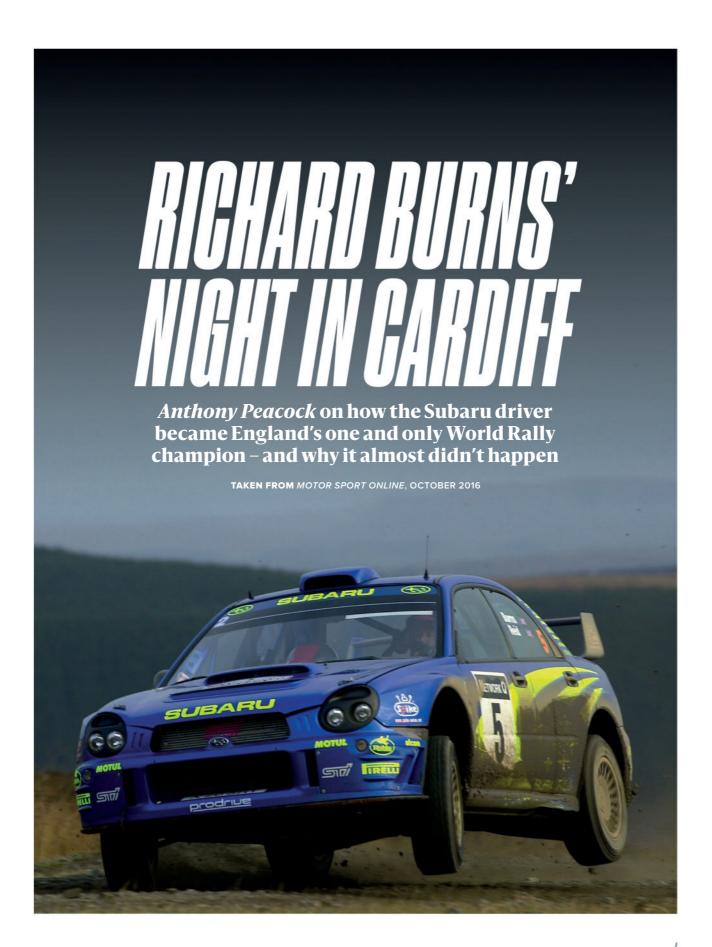
And then of course there was his family: five-time British champion Jimmy, wife Margaret and his brother Alister.

"That day in Chester is still one of the highlights of our lives," Jim McRae said. "It really doesn't seem that long ago that Margaret and I were at the finish celebrating. It was such a proud moment for us all. What could possibly be better than Colin winning the World Championship on home soil?"

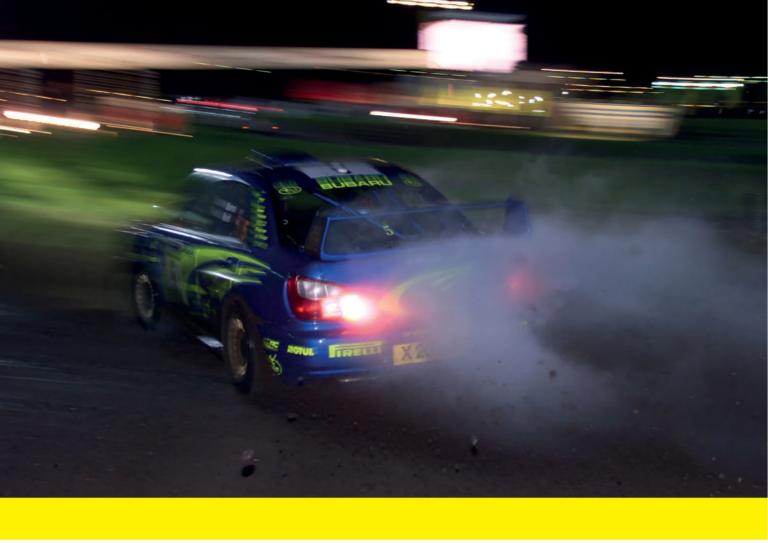
Colin, tragically, is gone but the iconic memories of that day remain, as does L555 BAT, the Impreza with which McRae sealed the title. In a poignant re-evocation of one of the most special memories in rallying Jimmy McRae drove it out onto the concrete apron of Chester racecourse in 2015, the very same place where McRae had performed those doughnuts exactly 20 years earlier, saltire held proudly aloft.

There's a certain magic to Britain's round of the World Rally Championship that ensures it will always been known for a number of unforgettable instances. But it will never get better than the moment when the thrilling, personable, sorely missed hero who is Colin McRae became world champion. •









he rain fell hard over the finish line at Margam Park, but that couldn't dampen the joy etched into the face of Alex Burns, the father of Richard Burns, and Richard's girlfriend Zoe Scott. They were waiting at the end of the final stage of the 2001 Rally GB, with other close friends who formed a vital part of the support network on which Richard so heavily relied. The result, by Richard's standards, was nothing special: third overall. But what it meant was colossal, it was the culmination of a life's work in fact.

The road that led to this special moment - when he became England's first and only World Rally Champion - was one that started just outside the city of Reading, which is about as well known for rallying as Bucharest is for foie gras. Richard's passion for driving first manifested itself when his age was still in single figures and he offered to park cars for visitors to his family home. From there it was on to the Under 17 Car Club and after that to Jan Churchill's renowned rally school in Wales. He entered the Peugeot Challenge in 1990, and winning this was what earned Richard his very first factory drive on Rally GB.

In short, he worked for it, all by himself. There were no favours or handouts, he did it the hard and painful way - sometimes quite literally. Take the cluttered workshop in the garden of the family home. Returning to it after many years, his world champion co-driver Robert Reid reflected on the worn workbenches and walls covered in fading rally stickers from national events, on which Richard faithfully chronicled their finishing positions in felt tip pen.

"Ah yes," nodded Robert sagely. "I'll always associate this room with Stanley knives and blood..."

One aspect of Richard's perfectionism was his insistence on cutting out his own mud flaps from plastic on the workbench. Often, the aftermath looked a bit like the set of a slasher movie. In which case it would be more Elastoplast, then straight back to work.

The point being that few people were as uncompromisingly single-minded as Richard in achieving their ambition. It all led to Sunday November 25, 2001, a day that should have been about unfettered happiness but - while the celebrations were real - it actually came at the end of a fraught event to the

backdrop of an intense contractual feud. While the world in general was privy to the usual vicissitudes of rallying that Richard and Robert faced on the championship decider, there were at least a couple of potential rallyending incidents behind the scenes.

The first was when Robert's map light disastrously failed before one of the many long night stages. Without seeing the pace notes properly they would lose time in the best case scenario, and end up in a ditch in the worst. In the end, Robert improvised a solution by tying a mini-Maglite torch to his thumb using cable ties - but it was hardly ideal. Even more seriously, the car refused to fire up coming out of parc fermé on the final day, which meant that Richard and Robert had to push it out and then try and sort it themselves by the side of the road before heading to the stage, with no mechanical assistance allowed.

On top of all that, Richard had already signed for Peugeot the following year - but Subaru was claiming that he had no right to do so, invoking a performance clause that would allow the Japanese brand to keep him. "So everyone for some reason remembers



that Rally GB was a reasonably straightforward event for us, but that wasn't the case at all," said Robert. "It was a very strange few days with lots of little problems, far from straightforward actually. Then there was this surreal situation in that we were celebrating together on Sunday and seeing each other in court on Monday."

Such was the uncertainty surrounding Richard's future employment that when he went to secretly test the Peugeot 206 WRC he took his close friend and photographer Colin McMaster with him in order to at least have a few photographic souvenirs "in case I never drove it again."

So when Richard famously grabbed Robert's arm and shouted: "You're the best in the world!" as they negotiated the final downhill section of Margam in 2001, it was the over-boiling of months of bottled up tension endured by the pair.

Unfortunately, we can't ask Richard himself what it meant to him. He passed away exactly four years to the day after he won the title, the tragic result of a brain tumour. But Zoe Scott, who was there at the finish in Margam, knew just how significant the achievement was.

"Richard always wanted to be champion and nobody knew what was happening with his contract situation," she said. "So I think winning the title came as a huge relief for him. He knew that whatever happened in the future, at least nobody could ever take that away from him. I was so happy for him because he deserved it so much."

"We were celebrating together on Sunday, and seeing each other in court on Monday. It was surreal"

The evening of November 25, 2001 in Cardiff then became considerably messier. Richard and Zoe headed out on the town, which is lively in the ordinary course of events, let alone when a new British world champion has just been crowned. It wasn't long before Richard was assaulted by his championship rivals with marker pens, including Petter Solberg and Colin McRae, who preceded to inventively decorate his grey T-shirt. That T-shirt became one of Richard's most precious possessions and is one of the centrepieces of the Richard Burns Collection - a display of memorabilia that is occasionally shown to celebrate the life of the 2001 World Rally champion. Unfortunately, it can only be decently displayed on one side, due to McRae's choice of vocabulary in his 'tribute' to the new champion...

For both joyful and tragic reasons, November 25 will be a date forever associated with Richard Burns. In the churchyard, a short walk from the family home where the plastic mud flaps were cut and the journey started, is where it ended. On Richard's memorial stone is written: "Always and forever, a gentle man and a brave champion."

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LUNCH WITH...

Almost unbelievably, this year marks the 47th consecutive season that Frank Williams has fielded a Formula 1 team. The first grand prix with a Williams entry on the grid was in Barcelona on May 4 1969. Ferrari and McLaren, as marques, can claim a longer history: but no single man has run his own F1 outfit for so long. Along the way his cars have racked up seven world championships for drivers and nine for constructors. Having received the CBE in 1987, Frank was knighted in 1999, made a member of the *Motor Sport* Hall of Fame in 2011 and is also a member of the French Légion d'Honneur.

For any man, this would add up to an extraordinarily full and successful life. But in Frank's case it is something far Given his place in F1's hall of fame, it's hard to believe he once ran his grand prix team from a phone box...

WORDS SIMON TAYLOR
TAKEN FROM MOTOR SPORT, MAY 2015

greater. It has been achieved despite a cataclysmic road accident in 1986 that left him almost totally paralysed, and confined him to a wheelchair for the rest of his life. In the ensuing 29 years he has continued to run his team, continued to win grands prix, continued to earn world championships. He will say this is because he has been fortunate to have around him a superbly talented and highly motivated team: but none of it could have happened without his inspiring leadership. In fact, if you spend any time with Frank Williams, inspiring is the word that leaps to mind. He is an inspiration, not just within the selfobsessed, inward-looking world of F1, but to all of us in a wider world. •





WILLIAMSRACING RACE SET



Williams FW45 - Albon V Williams FW45 - Sargeant













ORDER NOW

I got to know Frank even before his first impoverished steps into F1, during his early ramshackle days as a Formula 3 privateer. By 1968 he was running a Formula 2 Brabham for his friend Piers Courage, and the two of them were always good for a gossip in the paddock: Piers elegant, laidback, already brilliantly quick in the cockpit; Frank razor-sharp, always on the look-out for a deal, always wanting to pick a journalist's brains to learn who was doing what and to whom. Both of them were hugely entertaining, their schoolboy humour and sense of fun barely below the surface even when things weren't going well. Yet both were serious, professional racers, and both possessed an indomitable will to win. And, strapped for cash though they were, that BT23C was invariably the most immaculately turned-out car on the grid.

It was run out of a lock-up that also had to house the second-hand racing car parts that Frank was buying and selling to keep body and soul together. Even his powerful ambition could surely not have foreseen that the lock-up would become the massive sprawling complex of buildings that makes up the Grove headquarters of Williams Grand Prix Engineering, housing a staff of more than 650 people. This is where I'm seeing Frank today and, although much has changed in the 50 years since we first met, his sense of humour has not. His voice is weaker now: sometimes speaking for long periods is an effort. But his eyes twinkle and his enthusiasm for racing bubbles out, as it always has. Soon we are laughing over his memories of F1 then, and his take on F1 now.

rank's first steps in motor sport have been oft documented. Aged 20 he was racing an Austin A35, which he destroyed comprehensively at Gerard's Bend at Mallory Park. A couple of laps earlier the unrelated Jonathan Williams had done the same in his Mini. "I crawled out of the rear window of the wreck and heard a voice above me say, 'I thought I'd meet you sooner or later'. That was my first meeting with Jonathan. He gave me a hand up onto the bank and we watched the rest of the race." Back in the paddock Jonathan introduced Frank to a tall Old Etonian friend who'd come along to give him a hand: his name was Piers Courage.

The A35's running gear was built into an A40 bodyshell, and Jonathan also bought an A40, so they raced against each other during 1962. Meanwhile Piers built up a Lotus 7 out of a kit and went racing in that. CAREER IN BRIEF

Sir Frank Williams

Born 16/04/1942, South Shields, England 1962 Began racing in an Austin A35 1963 Formula Junior mechanic for Piers Courage

1966 Established Frank Williams Racing Cars
1969 Team makes F1 debut
1976 Leaves his own team, after selling controlling stake to Walter Wolf
1977 Williams GP Engineering formed, with

Patrick Head

1979 First GP win (Clay Regazzoni,
Silverstone)

1980 First F1 title (Alan Jones)
114 GP wins, 16 world titles

In 1963 Jonathan decided to move up to single-seaters with a Formula Junior Merlyn, and Frank threw in his job as a Yorkshire rep for Campbell's Soup to become his acting unpaid mechanic, living a gypsy existence around the lesser European circuits. Somehow, by 1965, Frank had scraped together the funds to borrow an old F3 Brabham and race it himself. He slept on a sofa in that notorious flat in Pinner Road, Harrow, whose shifting population included fellow racers Charlie Crichton-Stuart, Charles Lucas, Piers, Jonathan, 'Bubbles' Horsley and, on occasion, Innes Ireland. A long book could be filled with stories about the itinerant friends struggling from race to race across Europe with increasingly battered F3 cars: at one stage, desperate to get to the next race for the starting money, Piers stood the bent chassis frame of his badly shunted Brabham against a wall and reversed his tow-car into it to get it a bit straighter.

But Frank had higher ambitions. He managed to buy a second-hand Cooper of his own, and then a new Brabham, funding it by buying and selling bits and pieces among his fellow F3 racers. Then he graduated into dealing in single-seaters, calling himself Frank Williams (Racing Cars) Ltd. Piers had developed into by far the most talented driver of their crowd, and Frank decided to set aside his own efforts as a racing driver to go halves with Piers on a new F2 Brabham for 1968. Their budget was tight and there were retirements and accidents, but Piers invariably showed great speed. Then Frank found enough sponsors to buy one of the ex-works Brabham F1 cars and a couple of 2.5-litre Cosworth engines to do the Tasman Series. Against works Lotuses and Ferraris, Piers won the Teretonga International in New Zealand, and finished third in the series behind Chris Amon and Jochen Rindt.

Now Frank was determined to go grand prix racing, somehow. "I wanted a current Brabham BT26 chassis, the same as the works cars. Ron Tauranac wouldn't sell me one, of course, but I found he'd flogged one to a British club racer called David Bridges, on the understanding that it would be converted to F5000. I got myself up to Lancashire and persuaded him to sell it to me. Ron was absolutely livid, because I now had a chassis that was the same as the works cars." Despite a desperate lack of funds BT26/1 was immaculately prepared, and Piers was immediately quick. In their second grand prix, Monaco, he finished runner-up to the Lotus of reigning world champion Graham Hill, only 17sec behind after 80 laps: an extraordinary performance from a little privateer team.

"Formula 1 was very different then, in those pre-Bernie days. Seven of us went to Monaco: me, three mechanics, the truckie, Piers and his wife Sally. Sally did the timekeeping. I was paid £900 to turn up with one car, and £900 didn't go very far in Monte Carlo, even then. I had to borrow money from Piers to pay the hotel bill." But that second place meant that the F1 establishment now had to take Frank and Piers seriously: even more so when Piers repeated it at Watkins Glen.

For the 1970 season Frank was approached by Alejandro de Tomaso, who wanted to move into F1 with a car designed by the talented Giampaolo Dallara. De Tomaso provided three chassis, but Frank had to come up with funds to pay for the engines and the running of the team. Meanwhile Piers, having been one of the sensations of 1969, was offered a well-paid works drive by none other than Ferrari. Unhesitatingly Piers said, "Thanks, but no thanks." He wanted to stay with his good friend Frank. The first De Tomaso chassis was badly overweight, but the second chassis was lighter, and Piers worked intelligently with Dallara to improve the car.

Typically Frank and Piers referred to the car (which was turned out in Italian racing red) as 'the Tomato', and Frank still does. "The Tomato could have been very good. Dallara was clever, and Alejandro was married to an American named Isabelle Haskell, who was related to the Ford family. He was trying to get Ford in Detroit interested in F1, and if that had happened •

a lot of money would have come our way to go into the programme."

In the Dutch Grand Prix at Zandvoort Piers was running strongly, and had worked up to seventh place by quarter-distance, when he got off-line in the 140mph sweeps at the back of the circuit. The Tomato hit the bank, overturned and at once became an inferno. The primitive fire facilities meant Piers couldn't be reached, but he was almost certainly killed instantly, for his crash helmet had been torn off during the accident.

"After that everything collapsed, and de Tomaso walked away. I adored Piers. We had a very close friendship, and when he died it was hurtful in many ways. I was 28 years old, and I wasn't used to something like that blowing up in my face. So to keep going after that was hard work. But it never occurred to me to stop. We missed the next grand prix out of respect, and then we plugged on with our remaining chassis. Brian Redman drove for us, and then Tim Schenken. It was a terrible year with Bruce [McLaren, killed in testing at Goodwood], and then Jochen [Rindt, killed at Monza]. I was very close to Jochen, ever since our F3 days. I first met him at Wunstorf, one of those airfield races with straw bales forming the layout. In practice I watched this guy in a year-old Cooper and I thought, 'I have never seen car control like that.' He was just spectacular. Then when he came to England to do F2 races we'd travel around together. I became his biggest fan."

The next few seasons were very tough for Frank, endlessly searching for supporters and sponsors to add a little to the pot in return for a sticker on the cars. In 1971 and '72 he ran Marches: in F1 for Carlos Pace and for Henri Pescarolo, who brought Motul money, and in F2 for Pescarolo, Derek Bell and others. He first became a constructor in his own right in 1973, with a car designed by Len Bailey and engineered by a freelancing Ron Tauranac. Sponsorship came first from Politoys and then from Marlboro and the Italian Iso Rivolta company, the cars now being called Iso-Marlboros. From 1974 the chassis were given type numbers FW01, FW02 and so on. Drivers included Howden Ganley, Nanni Galli, Arturo Merzario and Jacques Laffite.

Always financial disaster was kept barely at arm's length. A story that did the rounds at the time was that Frank had to carry on his business from a public call box, because the phone at the factory had been cut off. Frank ruefully admits that this was true for a while. But, ever inventive, he usually managed to find some way of robbing Peter to pay Paul and keep one step ahead of the bailiffs.

By early 1975 things were desperate. That was when Giampaolo Dallara introduced Frank to the brash, ebullient oil millionaire Walter Wolf, who gradually fed money into the team. As Walter told me recently: "I agreed to buy him an engine, and by the end of that season I had bought him II engines." He went on to buy 60 per cent of the team, in return for paying off all the debts, and he also took over the Hesketh assets, so that the Hesketh 308C became the FWO5. "I was financially exhausted when Walter turned up. He was a tough businessman, but now there was enough for us to pay the bills as we went along."

But while Frank remains grateful to Walter, he did not enjoy being essentially an employee - especially when Peter Warr

"When Piers died, I was 28, and not used to things like that blowing up in my face"

was hired as team manager. At the beginning of 1977 he decided he had to leave and start afresh. He sold his remaining shares in the team to Wolf, and on the proceeds Williams Grand Prix Engineering was born. And, in a move that was to prove the best deal of his life, he persuaded a young engineer he'd hired before the Wolf takeover to come with him. That young engineer was Patrick Head.

"Now things began to be different. Before we'd just been bumbling from one technical crisis to the next, because I'd never managed to find a decent engineer. In those days there didn't seem to be many fully qualified university graduate youngsters around. Patrick was part of a new wave, and whatever he did was driven by engineering logic. We went on to benefit from that logic, and from his dedication and his design flair, time and time again."

Their partnership was to endure for 35 years, and a succession of seminal and winning F1 cars flowed from Patrick's drawing board. Even when he left Williams Grand Prix in 2012, it was to devote his energies to a subsidiary company, Williams

Hybrid Power. Frank is quick to acknowledge Patrick's massive contribution to the team's success: "The two of us were complementary. We had separate tasks, and we got on well. He pushed himself very hard, but he was a bit bossy. I'm never bossy, I'll always give a bit. He is a strong character, and he's a great bloke. I'm still full of admiration for him."

That 1977 season was a stop-gap year, with Frank running a March for Patrick Neve while Patrick designed the FW06. In another smart move Frank signed as his singleton driver the talented young Australian Alan Jones, who had already won the Austrian Grand Prix for Shadow.

"Alan was a tremendous asset to the team. They don't make them like that any more, sadly. He and Patrick understood each other, they needed each other to get the best out of themselves. There was a lot of mutual respect there." Now there was decent sponsorship from Saudia Airlines, and the neat, light FW06 was strong straight out of the box, invariably qualifying well. In 1978 niggling problems meant there was only one podium, second at Watkins Glen, but for 1979 Clay Regazzoni joined to bring Williams up to a full two-car team, and the FW07 was supremely competitive. "Thanks to Patrick we found ourselves with a very superior car, and we pretty much blitzed everybody." Jones won four out of the last six grands prix of 1979, with Regazzoni taking the first victory at Silverstone after Jones was stopped by water pump failure, and the team was second to Ferrari in the constructors' championship. In 1980 Jones won five rounds, Regazzoni's replacement Carlos Reutemann won one. Jones was world champion, Williams was champion constructor. And it was barely five years since Frank had been running his team from a public phone box, with the bailiffs hammering on the door.

he season-by-season story of Williams Grand Prix from then on is familiar, and in my conversation with Frank his memories are of people rather than individual races. "We won the constructors' championship again in 1981, although Nelson Piquet, who was at Brabham then, beat Carlos to the drivers' title by one point. In 1982 Keke Rosberg won the championship for us. Keke always had massive self-confidence, he came at you with a swagger, a bit pompous. But what Patrick and I liked about him was that he told it to you straight, even if that sometimes meant a bit of aggro. And he was obviously very quick."





Bernie Ecclestone, then owner of the Brabham team, had formed the Formula 1 Constructors' Association in 1974 with Colin Chapman of Lotus, Teddy Mayer of McLaren, Max Mosley of March, Ken Tyrrell and Frank. Eventually he sold Brabham to concentrate on his FOCA role. Frank has nothing but good to say about Bernie. "Until he arrived, F1 was just another European motoring activity, but he was the one who realised that it was seriously under-developed commercially. He saw the opportunity. The team bosses never thought Bernie was getting too big for his boots, because his brilliant negotiating powers were able to secure very good deals for us for each and every grand prix. He is hugely clever, which everybody knows, but people on the outside don't realise that he also has a fantastic sense of humour. Bernie came down from heaven: you can quote me.

"By 1982 the turbos were turning up, and we had a time in the wilderness, but by the end of 1983 we had our first turbo from Honda. The relationship with Honda wasn't always easy. It was their engine, and they seemed to think they were superior to us, it was as though they were stooping to help us. Patrick and I resented that. Later when we were with Renault it was very different, chalk and cheese. But the Honda V6 turbo was superb in its day. Honda was ferocious about winning, and loved Formula 1 as much as we did. So in a way we were fellow travellers." The Williams-Honda wins did not start to come regularly until 1985, but for 1986, with the engine/chassis relationship fully sorted and Mansell and Nelson Piquet as drivers, it looked as though Williams was on its way back to the top.

On Saturday March 8 1986, after a quick flight down to the Paul Ricard circuit to watch the final pre-season test for the new Williams-Honda FW11, Frank was driving a Ford Sierra hire car back to the airport in Marseilles when he went off the road. His passenger Peter Windsor, an F1 journalist but at the time sponsorship manager for the team, was only slightly hurt, but Frank sustained dreadful spinal injuries. In the Marseilles hospital the doctors asked Frank's wife Ginny to give her permission for the life support machine to be switched off. Of course she refused: knowing Frank as she did, she believed that if his brain was uninjured, and if he could still communicate, whatever his physical condition he could still run his racing team. She was right.

Frank was flown back to England, and in the ensuing weeks at the London Hospital, as his condition fluctuated, he came close to death on several occasions. Only his indomitable determination, and the fact that he had been ferociously fit and a seriously competitive daily runner, saved his life. Twelve weeks after the accident he went home, and six weeks after that Bernie arranged for Frank, with Ginny and a nurse, to be flown to Brands Hatch for the first day of practice for the British Grand Prix. When the crowd saw his wheelchair appear in the pits they gave him a standing ovation.

Sitting 29 years later in Frank's office at Grove, his accident is not mentioned. Frank doesn't think it's a topic worthy of discussion: he lived the first 45 years of his life one way, and since then he has lived it another. And his accident did not compromise the success of the team: during that 1986 season Nigel and Nelson won nine grands prix between them. Williams was the dominating constructors' champion once more, even if the rivalry between its two drivers split the points almost equally between them, allowing Alain Prost to win the drivers' title for McLaren by two points from Nigel. In 1987 it was a similar story, nine victories again, but although six of them were Nigel's, Nelson's better reliability earned him the title. Of their in-fighting Frank merely says: "Of course there was rivalry between them. If you don't like your team-mate, if you're a bit tetchy with each other, a little bit of needle can be helpful, and spur you on to greater things. It's when it affects things out of the cockpit that it can get out of hand.

"Nigel raced for us for six seasons, with a two-year gap in the middle when he went to Ferrari. In all he won 29 grands prix for us. He was runner-up in the drivers' championship twice in the Honda period and once when we were with Renault, and then of course in 1992 he dominated everything." Without that dramatic tyre blow-out in the final round of the 1986 season in Adelaide, Mansell would surely have been champion that year also.

"Having Nigel in the team was hard work to an extent, because he complained quite

"Bernie Ecclestone came down from heaven. And you can quote me" a lot. But he was magic when he was in the cockpit. It all began to happen when he was in the car, and it was well worth the arguments when he was out it. He did a wonderful job for the team, and I have all the time in the world for him. In 1992 he'd already clinched the championship by August, but by then Carl Haas had been softsoaping him, trying to nick him for Indycar for 1993. On the morning of the Italian Grand Prix he went into the press room and announced to all the journalists that he was walking away from F1. We'd been negotiating for a long time. In a weak moment I thought, I don't need this aggro any more, and he was gone. But it was arguably a good move for him, because he earned a lot of fame and money for himself in America.

o for 1993 we had Alain [Prost] and Damon [Hill], and we won both championships again. Out of 16 races, Alain won seven, Damon won three, and we were on pole 15 times. Alain was *very* gifted. I remember his season with us with great fondness, because politically he wasn't any trouble. Nigel was much harder work. And Alain was so smooth. It was extraordinary. When you watched him in qualifying it didn't look quick at all, and then: Bloody hell, look at those lap times.

"As for Damon, the thing about him was that he was shy. As the son of a very strong character and a world champion, Damon had to make his own way, and look how well he did it." Hill spent four years with Williams, and as Prost's team-mate in his first proper F1 season he won three grands prix on the trot and beat Prost to pole twice. In the dreadfully tragic 1994 season, during which his new team leader Ayrton Senna died at Imola, he rose brilliantly to the occasion. His fight with Michael Schumacher for the next three years was enthralling, culminating in his world championship title in 1996.

In 1990 Patrick Head had noticed that the little Leyton House F1 team was achieving much better results than could reasonably be expected, so he hired its technical director Adrian Newey. Newey's genius was to play a major role in Williams' success over the next six seasons until he left for McLaren in 1996. It was Williams' most successful period, with more than 50 grand prix victories and seven championship titles. "Adrian is incredibly clever, but what is so charming about him is that with all the success he has had, with us and then with McLaren and Red Bull after us, he has remained entirely unaffected and unassuming. He's nice enough to be an

Senna arrived for the 1994 season after six years and three championships with McLaren. It was only his third race for Williams when the team was hit by his tragic death at Imola on May 1 1994. "It's so sad that we never got a real chance to work together. Ayrton was happy to be in the team, he recognised in Patrick that here was a man that he could win with.

"When you were with Ayrton you began to realise that you were dealing with an extraordinary individual, a man of very remarkable mental capacity. When he was asking me a question I'd say to myself, 'Be careful, Frank, think before you answer.' I'd be telling him what I thought we should do about something, or what we'd done about it last time, and he'd be looking at me. You could see his mind racing all the time: 'Is Frank giving me the bulls**t, does he know what he's talking about?' There was always a bit of wanting to protect his back, being wary of people around him: he was slightly paranoid. But that was his natural business. He was very, very clever, very astute. I've always thought that, given his name and fame, and his intelligence as well, he could easily have become President of Brazil if he'd so wished. Bernie gravitated towards him. People who are exceptionally gifted, or exceptionally good at what they do, tend to recognise those qualities in others."

illiams won back-to-back drivers' and constructors' titles in 1996/7, because after Damon's title came Jacques Villeneuve's. "We got some good results out of Jacques - our seventh drivers' title and our ninth constructors' championship - but he was very definitely his own man. He always thought he knew best. He'd come into the pits and say, 'A bit too much oversteer, I need more grip at the back.' So Patrick would say, 'Right, let's try one softer on the springs, adjust the dampers accordingly.' And Jacques would say, 'No, that's not what I want.' He was a quick boy, and we certainly didn't waste our time having him in the team, but to say he had a different attitude to life is an understatement. He had interests outside F1: what appealed to him was different from the average racer."

Williams was strong during its 2000-04 BMW-engined period, and over five seasons it was twice second in the constructors' championship and twice third, with six wins for Ralf Schumacher and four for Juan Pablo Montoya. Thereafter, with Toyota, Renault and Cosworth engines, Williams suffered a long bleak period, apart from Pastor Maldonado's joyful win in Spain in 2012. But from 2014 there was a new seven-year engine relationship with Mercedes. With the FW36 proudly wearing Martini colours and with other significant changes within the team personnel, there was renewed optimism and focus. During that season Valtteri Bottas and Felipe Massa between them were on the podium nine times, and the whole team was enormously uplifted by their speed and consistency. Williams ended the season third in the constructors' championship behind Mercedes and Red Bull.

Frank apportions a big slice of the responsibility for this turnaround to Pat Symonds, who brought more than 30 years of F1 experience with him when he joined Williams in the summer of 2013. "Pat is quiet, softly spoken, never raises his voice. He tries to pretend he's a background man, but in fact he's ubiquitous. On the technical side of the team he is across everything that is happening. He never shouts, but he's always there to help things get better. Everyone has a lot of respect for him. What has brought us back to the top, or much nearer the top than we have been for 10 years, is the Mercedes engine, and Pat. The other ingredients were already here: the facilities, the people, the ability to make good racing cars."

The other key player in the team's renaissance is Frank's daughter Claire Williams. Two years ago she was appointed deputy team principal, while retaining responsibility for the commercial and marketing sides of the business. "Claire does a brilliant job. She is extremely well organised - when I was doing what she does now I was all over the bloody place. She is very, very industrious, and very efficient. She is passionate about motor sport, and she loves what she does. We think the same way, we talk the same language. It's in the genes, I hope." To underline this, when the team finished third in the 2014 championship, Claire said: "Frank keeps saying, 'Why is everybody celebrating P3? We're here to win'. That's exactly how I feel."

"The CEO is Mike O'Driscoll. It's his job to oversee the structure here at Grove, see that the right people are in the right places, that they're satisfied with their work and are appropriately paid." On the racing team under Pat, another key hiring has been former Ferrari engineer Rob Smedley, recruited as Head of Vehicle Performance. Pat sees this as focusing not on the race-by-race detail but on the cars' overall performance, on the bottom-line results.

Of his drivers, Frank's view is upbeat. "Valtteri [Bottas] is very popular here. He is very, very quick, and I hope he will be with us for a long time to come. He is quiet, but I reckon that's a Finnish characteristic: if you're from a country that is 35,000 square miles bigger than Great Britain, but with only 5.5 million people, I suppose it's difficult to find anyone to talk to - although Keke seemed to manage.

"Felipe [Massa] loves the team, and he's totally dedicated. At Ferrari Fernando Alonso generally got the better of him, but in qualifying Massa was sometimes quicker, and if he was slower it was only a matter of a tenth or two. If he's in the afternoon of his F1 career, it's certainly the very early afternoon. He's quick.

here's so much more technology now than when I started out. The driver is still a crucial part of the mix: the driver can't work without a good car, the car can't work without a good driver. That's how it's always been. But nowadays which engine you have is so important. In the early days of Williams everyone except Ferrari was using the Cosworth DFV, and the racing was very open. To start with the average DFV horsepower was 450bhp; maybe it ended up with 510bhp or something. But even with less power the racing was just as good. Maybe there was more jockeying for position. In those days, before wings, before skirts, before active ride, people never tapped the chassis for performance. If we maybe changed the roll bar twice in a season, that was all.

"Everybody who has worked at Williams has played his or her part in making it successful. And we've all had a great party as we've gone along. It's all more professional now, but I still go to all the debriefs and I pay attention. Other team owners have got to a stage when they have decided to sell, and have put a lot of money in the bank. That has never occurred to me. It has never crossed my mind. I did sell out some of my shares, but I still own 50.1 per cent of the team, so I still have the controlling interest. I come to work every day. The team is my life - absolutely my life."

Yes, Sir Frank Williams is an inspiration. He may not dictate the race-by-race strategy at each grand prix as he used to, but he continues to inspire every single one of those 650-plus employees at Grove. The team still has his name over the door, and that's how it will stay.

Sir Frank Williams died on November 28, 2021 at the age of 79.





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en years ago, in 2011, Leena Gade became the first female race engineer to win the Le Mans 24 Hours when she ran an Audi R18 driven by André Lotterer, Benoît Tréluyer and Marcel Fässler to victory - then did it again in 2012 and for a third time with the same trio in 2014. Such success and the fact she happens to be a woman pushed her into a spotlight not usually reserved for race engineers. Gade, like the majority who have worked with her over the years, just sees herself as a motor sport professional. Gender is an irrelevance to her, although as she has come to grudgingly accept, it might not be to the young girls and women with similar ambitions who have taken inspiration from her example.

Educated in a West London all-girls' school, Leena and her younger sister Teena have enjoyed rich, varied careers, having grown up with no discernible link to motor sport. Today, Teena is contracting for an autonomous car company having spent time at Prodrive, Skoda and in Formula 1 with Force India and AlphaTauri, while Leena heads up a UK-based vehicle dynamics centre for the Canadian Multimatic firm and continues to race engineer the team's IMSA DPi contender in the US. Here, we focus on her Audi years and her love affair with Le Mans, the race she remains most associated with.

Motor Sport You had your first taste of motor racing while at Jaguar - Formula Vee...

Leena Gade "Awesome racing! Jaguar was a really good experience for someone who had never really done anything with cars, but it was apparent really quickly that my time in general automotive was going to be limited. I had this interest in motor sport and met a chap called Alan Harding [of AHS Motorsport, based in Lutterworth]. He was great. He had a small out-building on a farm which had no heating, was packed with Formula Vee cars and had one mechanic. Alan would buy engines from the Brazilian VW factories and tune them on his own dyno. I told him I wanted to learn about race cars and how you put them together, and he said, 'Can you do some work experience? See if you like it. I can't pay you.'



Gade sisters Leena and Teena both became race engineers; Teena went into rallying

"I took two weeks off work. I supported them building up their cars pre-season, went to every race event and ended up doing it for two years while I was at Jaguar, then dovetailed it with data work for a Formula BMW team."

How were you drawn to Le Mans and sports car racing?

"I took voluntary redundancy from Jaguar in 2003 and while working full-time at MIRA did a handful of AIGP races where I met people who were in sports car racing and ended up at Chamberlain-Synergy in 2006. I went with them to Le Mans, which was the first time I really understood what it was. That was the first year Audi won with the diesel engine. We were running a Lola and I remember seeing the impressive team construction at the back of the pits. 'It would be good to work with those guys one day,' I thought. The following September some of the Chamberlain-Synergy mechanics were talking to [engineer] Howden Haynes about running a GT3 car, a Jaguar XK8. I knew the road car inside out because of my time at Jaguar. I was called a couple of days later and invited down, but when I got there 'H' pulled out the handbook for the Audi R10. I'd heard of that... He explained he was race engineering for them out in the US: 'I don't work for them full-time, but I do need an assistant and someone I can talk to when I'm back in the UK. Have you done anything



AUDI AG, NEWSPRESS

Audi Sport Team Joest

In 2011, Gade became the first female race engineer to win at Le Mans and by 2014 had completed a hat-trick



like this?' I'd only worked with Chamberlain-Synergy and Team Modena, who were running an Aston Martin GT1. 'Do you think you could do it?' I said I'd give it a go...

"The first race I did was St Petersburg with Champion Racing [which was running Audi Sport North America's entry in the

American Le Mans Series in 2007]. I don't know what Audi thought. I think H said he had an assistant, then had to tell Joest and Audi it was this person who basically turned up on his doorstep. They had a load of people, but he said he didn't want them, he wanted me."

"Nobody else knew how to run the race without the computer"

He showed incredible faith in you. How did it go at St Pete?

"It was a real baptism of fire because I'd never even seen an ALMS race. But towards the end we were trying to work out what fuel we needed to take on for the final stop and H said, 'I've worked out we need this amount, do you agree?' I said, 'I'll work it out,' and just did a hand calculation. I could see him watching me thinking, 'This is a new one.' I said what I'd worked out: this number of minutes left equals this number of laps, so you need this amount of fuel. He said, 'Okay, well that's a few seconds off what I've got, we'll go with my number.' We happened to win that one, but I didn't know how it had gone for me, in

fact I thought I'd blown it.

"Then a couple of days later he phoned and said, 'We have to prepare for the next race.' I did the rest of the season and the year after I also did the European-based Le Mans Series with H and that's when I got to know the Audi people."

Your manual fuel calculation must have impressed Haynes.

"When he asked about the fuel we needed I thought, 'Is he testing me?' Even now I still do a manual calculation. It's really important to have another method other than your computer to work these things out. At Spa in 2010 the pitlane lost power. Nobody had any computers working, all the servers went down

and we had no telemetry, but the race still carried on for another 20 minutes. Nobody on the other pitstands knew how to run the race minus the computer. You need a piece of paper, a pen and a stopwatch."

You were H's assistant on the winning R10 at Le Mans in 2008, one of the great races of the modern era. A landmark for you?

"Yes, H and I were contracted by Joest as freelancers. I'd say 2008 was my first proper Le Mans. There was an expectation of winning and the enemy, Peugeot, was at the other end of the pitlane. It was also the first year I got to work with Tom [Kristensen]. Up to that point and in 2007 I'd only ever worked with Allan [McNish] and Dindo [Capello]. We knew the Peugeot was faster than us and I remember at one of the pre-race meetings H made a comment: 'They're really quick. Like, three seconds a lap quicker.' Sure enough, at the start they were three seconds a lap quicker, then the gap was six seconds, then 10.

"In the *Truth in 24* documentary there's a comment from Allan on how fast the Peugeots are, and H says, 'Get used to it.' That was a learning experience: how are we





going to fix this? Then as the race evolved, I learnt from H what it meant to never give up. He was instrumental in that race in so many ways."

How did you step up to full race engineer?

"At the end of 2008 everything got curtailed. We did a handful of races in 2009. Coming back from Le Mans that year we were discussing what had happened, because Audi had an atrocious race. So we

made a huge list of things that had gone wrong. H said to me, 'I was talking to Ralf [Jüttner]. We were looking at the differences in the crews, and one thing that's apparent is the way you and I work is different to how everyone else works. We need to make it all the same. Would you be interested in engineering a car?' I remember looking at him and saying, 'Are you crazy?' But he said, 'Are you?' I said, 'I don't know whether I'd be good at it.' 'That's not the question: yes or no?' Again, I said I'd give it a go.

"They gave me quite a few tests to see what it was like. I'd always been in the shadows with H, but I'd learnt from him how to talk on the radio, how to approach problems, how to approach mechanics. I learnt everything I know from that man. So at the tests they were looking at that dynamic: how does she work with the drivers, the other engineers? It's easy to want to be a race engineer. It's a different job when you get there. Your personality has a huge bearing, the ability to be a leader and then hold your hand up when you make a mistake. Own it. You have to know where your car crew is at. Are they in a place where everything is calm, collected and organised? All of that stuff is a personality thing. It's all well and good doing simulations, but if you can't talk to a team you have zero chance of being a race engineer."

When was your first race running a car?

"Silverstone in 2010 with Dindo and Timo Bernhard. Allan and Tom were in the other car engineered by H. We did three races that year after Le Mans for what was then the ILMC [Intercontinental Le Mans Cup, the forerunner to the FIA World Endurance Championship]: Silverstone, Petit Le Mans and Zhuhai, and I had three different sets of drivers each time. With Dindo and Timo at Silverstone we finished third; the car was really bad, it was understeering everywhere. They had quite different driving styles. It was so bad Timo

gave me his trophy and said, 'This is to remind you how you shouldn't run a car.' Thanks!"

How did you find it, calling the shots?

"There were doubts. I wouldn't say it was plain sailing. I certainly felt I had a huge amount left to learn. As we were heading into Christmas they hadn't decided on the car crews for the year after and there was no guarantee I'd be engineering a car. When they'd asked me I turned it around and said, 'Do you think I can?' They said, 'Yes, you're good enough to do it.'

"What I didn't know, at some point during 2010 they had asked the drivers what they thought of the engineering teams and who they wanted for the next year. Out of the three crews, two of them said if they had a choice they'd want me and one of the data engineers."

In 2011 you formed a bond with Lotterer, Tréluyer and Fässler.

"We'd done the odd test but we hadn't done much together and didn't know each other very well. There was a big difference in the way they approached stuff and as the third car that year they were realistic about their chances at Le Mans. The expectation of winning was still there but it wasn't as high as for the regular guys. Their approach was 'control the things we can control'. Ben in particular was very good at compartmentalising feedback and the other two started to do the same. They recognised the level of inexperience in me, but they knew there was an entire team behind us that could help.

"They supported me with everything I was doing and speaking very honestly and openly was something we did for the remainder of our time together. All the way through to the end in 2016 and my final race with them at Le Mans, there was never any point when I felt uncomfortable in

saying to them we need to change the way we are working. We did have some heated team debriefs but at the end of them we all knew it wasn't personal and it had been done for a reason. I'm very close to them and still keep in touch."

What are your memories of that first Le Mans win together in 2011?

"That was another one of those times where you have to learn very quickly. When Allan went out [McNish crashed heavily at the Esses early in the race after colliding with a backmarker], H was on the pitstand to the left



of me and went very pale. Then we saw him get out and we knew he was okay. Rocky's was the one that was really scary [Mike Rockenfeller also collided with a backmarker, this time in the dark in the eighth hour, flat out on the Mulsanne]. All we could see was a Meccano toy kit left on the track. [Remarkably, Rockenfeller walked away.]

"Then it became one Audi against four

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it meant to

never give up"

Peugeots, and they were very quick. All we could do was try and win the race. One stop decided it at the end. We had a slow puncture, but fortunately we had Michelin with us. After two major accidents the last thing I wanted was to have another one and for something to happen to a driver, but they assured me that keeping the tyre

on for another four or five laps wasn't going to be a problem. We told André, 'You have a puncture,' and he'd already spotted it on the dash. We told him just to keep going. There was a lot of debate about whether to change just one tyre or all four at that last stop. Tom [Kristensen] was instrumental in saying just give him four new tyres because they are not expecting it down there. You've got the gap, just do it. That caught them by surprise. On the live feed you could see the Peugeot garage giggling because I think they thought they'd done it, but all of a sudden we changed tyres and left the pits with a gap of five, six or seven

seconds on fresh rubber. They glanced back on the live feed to the Peugeot garage and you could see their faces - and then the gap started to increase. Then the Peugeot guys started crying - and I giggled. Really immature.

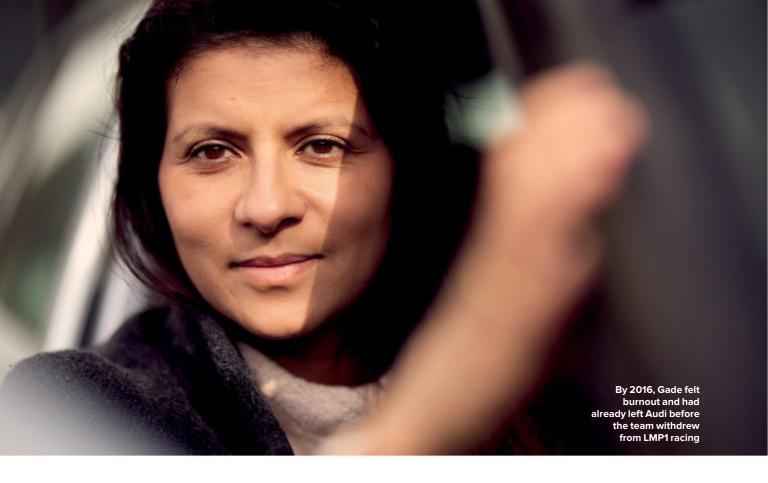
"When the car crossed the finish line I turned around and everyone else in the pit was crying and I couldn't understand why. In my head I understood what was going on and we were going to make it to the finish line, whereas everybody else was saying, 'Oh my God, that was so close.' Well, 13 seconds is still quite a lot, guys, even after 24 hours."

The victory put you and the drivers firmly on the map. Then you won again in 2012.

"That was a little bit different to the previous years. From December 2011, I started spending much more time at Audi Sport in Germany. They wanted to have a second test engineer to support the full-time test engineer they had, but the person needed to be based in Germany. Ralf asked me and said they could fly me back every weekend, and I asked, 'Can I not just live out in Germany?'

"They had to make a decision how many cars were going to race in what was now the WEC and the first year of running the hybrid. We had a glut of 12 drivers, like Marc Gené, who had been at Peugeot until they pulled out. Audi could decide how many hybrid and non-hybrid cars they could take. The hybrid system then wasn't powerful and you could still run the car with the hybrid turned off." •





What was it like adjusting to running the hybrid systems?

"In January 2012, I asked for my entire race crew for testing and it was a tall ask. I knew to be competitive in 2012 we needed to know everything about that car and one of the problems with a team that's not all based in one location - Joest was never a part of Audi Sport - is you very quickly rely on third-party reports or conversations to find out what's been going on. So I asked my race team to do every single test and most of them saw the benefit, although I don't know whether they ever forgave me. The testing was intense in 2012. In the run-up to Sebring it was quite a handful to deal with the flywheel system. Because we were on endurance duty you always had to keep going. If we were targeting 6000km it didn't matter what broke, you had to replace it, start again and keep going, to the point where it was soul-destroying."

What do you recall about the 2012 race?

"I'm not sure Audi will appreciate me saying this, but our hybrid only went one hour into the race and yet we still won. Some of the other competitors knew about it. The system was tough to work with and there were all sorts of issues. There was one safety car, which worked in our favour because Marcel had a spin at Porsche Curves and said he felt a hit on the back of the car, so I pitted him immediately. It was at a point where André wasn't ready to get

in the car. He was still upstairs in the driver room. When the car came in, Marcel got out. There was no driver to get in. I repeatedly told the crew to look at the back end of the car and they couldn't see any damage. In all the melee the tyres had been called out but they never got confirmation to be put on and we'd done four stints without changing by this stage.

"So André eventually jumped in and off he went, then the car stopper came to me and said, 'Hey Leena, you know we never

"Just to let

you know,

weforgot

to change

vour tyres"

changed the tyres.' I looked at him and said, 'Why didn't you?' 'Because you never told us to...' Oh s**t. I said to André, 'Just to let you know, your tyres are four stints old, we forgot to change them at the stop.' I could hear everybody on the intercom going, 'What the hell?' He said, 'They feel fine, we should keep them on.'

I said, 'No we shouldn't!' Then the safety car came out and Allan was right behind him. They must have known what happened. But André beat the safety car when it came out of the pits, and Allan didn't. That win meant a lot because I didn't want us to be the one-hit wonder."

Your car won the inaugural WEC title that year too. What was it like inside the team? "There was lots of politics through that year.

After Le Mans we started out having one hybrid and one non-hybrid car to finish off the rest of the season, but that became two hybrids. Politically, if the hybrid is supposed to be faster why did we decide that it was sensible to impede the other car by not giving it the system? I wouldn't say we dominated in terms of speed, but we had a good base from the start, from 2011 with the car crew being organised in a certain way, and with this open mentality where we could discuss

anything. Me and my number one mechanic, we used to have some amazing arguments, but it was never personal. We took the championship in Shanghai, so it went down to the final race and it was a nice way to finish the season. But I did think we've won the world championship, we've won Le

Mans twice - what else is there left to do? I started questioning whether it was time to stop, which was silly because I'd only just started properly race engineering."

But you did keep going and won Le Mans with the same drivers for a third time in 2014. What changed during that hybrid era? "We went from the flywheel system to having

"We went from the flywheel system to having a battery system. My least favourite car was the last one, the 2016 R18 - I hated it so much. It's the only one I don't have a model of because so much stuff used to go wrong on it."

Hybrid technology changed the way you went racing. Was it more challenging?

"In 2012 and 2013 we didn't have energy management to worry about. It was only in 2014 when new rules came in, we had smaller tyres and so on, that energy management became a factor. And the competition stepped up because there were now three manufacturers and one of them happened to be Porsche, the sister company to Audi.

"I remember when the Equivalence of Technology formula was being discussed, Chris Reinke, who was the head of the project, came to me one evening saying he had a series of questions from a journalist who wanted our take on EoT and how it affected driving style. Does energy management make the racing more relevant to road car customers? Ridiculous, it absolutely doesn't. Who lifts and coasts on the road, so why were we doing it? Slowly over time from 2014, we tried lots of different ways of handling energy management. In 2014 it started off with drivers doing it manually until we realised that was a mistake. They had light indicators in the car that told them if it was working or not working, but a bit later on we made it more automated.

"The six-hour races were fun, but we were hampered compared to Porsche and Toyota because they had bigger hybrid systems and at the shorter tracks that made a difference. And the EoT never really reflected that. Every stint we did was one or two laps shorter than the others and we were never given extra fuel to make it closer. But at Le Mans we were relatively even, which is what mattered most."

You must have learnt a lot from that period.

"When I look back, yes. Towards the end with the aero package on the Audi, that was quite something. Managing all of that was a good learning experience and having now seen a bit of GT3 with Bentley and how Balance of Performance is managed there, and having done IMSA into my third year with Multimatic's Mazda programme and how the DPis are brought together, I can see how strategy works in a different series. The WEC was fun, but it could have been even better racing. BoP will never be perfect but those complex cars we had and the driving styles they had to adopt in some instances, we took away a lot of the natural feeling they had from the tyres because there were so many other systems in the background. Now a lot more is in the drivers' control. If they run out of fuel because they didn't hit a target that's down to them, not us."

How did you feel when Audi pulled the plug on LMP1 at the end of 2016?

"I'd already escaped. I'd left in June after Le Mans. I'd made the decision at the end of 2015 that I wanted to stop and do something different. There weren't any other avenues inside Audi Sport and it was a chance to get away from it all and stop race engineering. At the time I was completely convinced I didn't want to be a race engineer. I was tired, worn out, quite depleted of the energy it takes. I went to Bentley. We had no idea the pull-out was coming, there was never any mention when I was there. I was quite surprised. I guess Dieselgate [the emissions scandal that rocked VW in 2015] was always going to catch up with us. It had already started when Porsche came in because the perspective of VW having two manufacturers fighting each other yet being part of the same group... We were allowed to race, we had a diesel, they had a petrol - at some point it was going to have to stop, and there was always a feeling that it would be Audi that would pay the price."

You've now reluctantly accepted your role-model status. How did you come to terms with it?

"I've just had the same question from one of my oldest friends for her podcast. We were talking about what we were like at school. She became a journalist, which was what she always wanted to do. She said to me, 'When we were kids we were brought up in the west side of London, the school we went to was a girls' school and there was a large proportion of girls from ethnic minorities.' She's Indian as well. She said, 'My only role model on TV was Moira Stuart. There was only one female black news presenter. Did you have any?' I

said there weren't any. 'So do you understand how that's important?' That was a cunning way of making me realise it is.

"I only noticed it for the first time in 2011 when Audi kept getting interview requests with me. At a meet-the-team session no other engineer was invited, except me. I didn't understand it. There was more after Le Mans. Audi was perceptive enough to say 'you have a choice on this, you don't have to do interviews if you don't want to. We can say no, but it's beneficial to you and to us. It's something unique that nobody else has'. I said, 'Okay, as long as it doesn't get out of hand.' I did an advert for the US market which was shown during the Super Bowl. There's not many race engineers who can say that."

Do you roll your eyes when people ask 'the question' about you being a female in motor sport?

"I never embraced it at first. Hey, I was given a job and was told to go and win a race and that's what I did. But it is different because there aren't other women doing it on a daily basis. If there were we wouldn't be talking about it. It's been 10 years since my first Le Mans win and there hasn't been anyone else, which begs the question why? Although I noticed at Daytona this year the paddock had more female mechanics and engineers around and my data engineer is female. 'Did you notice?' she said. Yes, and I think it's mega. IMSA are probably not aware it's on their doorstep - and we're not going to tell them either. In a way, change like that is a gradual process and if you force it sometimes it doesn't happen. I'm much more comfortable with it now - even if I still cringe about the whole thing sometimes."



ookie drivers have always been one of the most intriguing parts of the start of a new Formula 1 campaign. As the increasingly bland, and increasingly carbon-fibre bare car reveals proliferate, the speculation surrounding how the new blood will bed into the grid is guaranteed to intrigue.

Seeing how the rookies adapt and what level of promise they show is always one of the most fascinating elements of a new season. The 2019 crop of Alex Albon, Lando Norris and George Russell was a particularly good one. So let's take a look at one of the most notable grand prix debuts in F1 history, that of a then rookie but soon to be titan of the sport, Stirling Moss.

Moss's world championship-status grand prix debut came in the opening race of the 1951 championship, the Swiss Grand Prix, albeit at the wheel of an F2 car. Using F2 cars as grid fillers was quite a common practice by F1 race organisers in these early post-war years as F1 struggled to get re-established. Not only in championship-status grands prix, but also in the scattering of non-championship events. So by the time of Moss' official first appearance in the world championship, he was already quite familiar with racing his F2 car in a field that included grand prix machines, often from factory entrants including Alfa Romeo, Ferrari and Maserati.

Moss had been enlisted to the F2 team of HWM in 1950. The partners in that team - George Abecassis and John Heath (both of whom also raced the cars) - had signed him in 1950 as his 'Boy Wonder' reputation was burgeoning from his F3 performances. HWM was the specialist racing team formed from the Hersham & Walton Motors high-performance garage Abecassis and Heath had formed. Heath was the engineer who designed the HWM racer, using a twin-cam 2-litre engine from Alta, another specialist British engineering concern.

Racing in continental Europe paid good start and prize money and HWM even found it could make a profit from its very tightly-budgeted operation by shrewdly targeting the races in which to compete. Especially with someone of Moss' already-obvious speed to pedal them along. So Moss' first experience of what could loosely be termed 'F1 races' came in 1950 nonchampionship events. At Goodwood on Easter Monday the cars were not in top form but Moss made a sensational impression in the later Rome Grand Prix around the Caracalla circuit. He was running third behind the dominant supercharged F1 Ferraris until a hub broke and a wheel parted company with the car. He followed this up with a fantastic third place at the Bari Grand Prix, having briefly taken the lead as the F1 Alfa Romeo 'Alfettas' made their refuelling stops. Reigning world champion Giuseppe Farina was intent on

HINTS OF FUTURE GLORY

Sir Stirling Moss made his world championship grand prix debut in Berne for the 1951 Swiss Grand Prix. Mark Hughes looks back at the start of a glorious career

TAKEN FROM MOTOR SPORT ONLINE,APRIL 2020



Clockwise from top: Moss aboard his F2 HWM at the Swiss GP, 1951, his F1 debut; Moss in full flow at Goodwood that year; John Heath of HWM was instrumental in promoting Moss to grand prix racing







OGRAPHY ALAMY, GELLY IMAGES

putting the upstart in his place as he quickly caught the F2 car back up and went to pass. "I think Farina was annoyed," recalled Moss. "After all I was this new boy and he was a very important figure. In any case, he came alongside me going into a corner and just stayed there. He shut the gate on me. He gave me the alternative of slowing down or going into a wall. But I slowed right down, got on his tail and then, because what he'd done had put him on the wrong line, I got back ahead of him coming out. He then repassed again quite easily in a big fury and following through was Fangio in the other Alfa - and he was laughing his head off at what had just happened. Fangio endeared himself to me from that moment."

For 1951 HWM made a lighter, more powerful version of its F2 car. It was in this that he made his official debut in the F1 championship, by contesting the Swiss Grand Prix around the 4.5mile Bremgarten circuit, which wound its way around parkland north of the city of Berne. Moss had raced here when it had been an F2 event the previous year but this time he would be reacquainted with the formidable Alfettas which, with twin-stage supercharging, were now producing in excess of 400bhp from their 1.5-litre straight-8s, compared to the 130bhp of Moss' F2 car. Backing up Fangio and Farina in the Alfas were Consalvo Sanesi and the local, aristocratic racer Toulo de Graffenried. Ferrari was there with its 4.5-litre unsupercharged 375 model for Alberto Ascari, Luigi Villoresi and Piero Taruffi. They were backed up by three privately-entered 1950spec supercharged Ferraris. Other F1 entries came from the Talbot Lago team.

Fangio set pole ahead of Farina and the Ferrari of Villoresi. Moss qualified convincingly quickest of the half-dozen F2 cars, at 14th overall in between the F1 Talbot Lagos of Froilán González and Yves Giraud-Cabantous. At 107 per cent of Fangio's pole time, in an F2 car, this was more than respectable.

The race took place under conditions of heavy rain and was won in brilliant fashion by Fangio who, after leading from the start, suffered a pit stop delay that allowed team-mate Farina to be 5sec ahead after they'd both rejoined. He caught, passed and pulled away from his team mate and rival, this the foundation for Fangio's successful world title campaign that year. Taruffi drove an inspired race for Ferrari. Taking over the later-spec Ferrari of Ascari, who was in pain from burns inflicted in an earlier race, Taruffi came through the field - and passed Farina's Alfa on the last lap.

This time Moss was not close enough to get mixed up in their battle, but took an incident-free eighth place, two laps down but winner of the F2 class. So the future legend's official grand prix career was underway. There would be unimagined glories to come. •





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British engineering has produced more worldbeaters than any other, and still thrives today with seven of the 10 F1 teams based in the UK. Here, we look at some of the works of genius created to win, both on home soil and far beyond





Nobody's done it better

The writing was on the wall during 1992 when Williams forged ahead with active technology. But its 1993 FW15C took things to a whole new level, arguably one the sport has never again reached.

Adam Cooper talks to those who helped create it

STUDIO PHOTOGRAPHY JONATHAN BUSHELL / TAKEN FROM MOTOR SPORT, NOVEMBER 2023





Thirty years after Alain Prost won the 1993 Formula 1 World Championship the Williams FW15C remains the most advanced F1 car ever to race, perhaps challenged only by the McLaren MP4/8 that was its main rival that season.

The title was Prost's fourth, lifting him clear of archrival Ayrton Senna's three and one behind Juan Manuel Fangio's five. Such was his dominance, Prost secured the title early, in September, and in the wake of the sabbatical he'd been forced to take after leaving Ferrari under a cloud. Perhaps he had a point to prove in 1993.

As for Williams, the team was in the middle of its greatest, most dominant era. But the FW15C stands apart, even from Nigel Mansell's FW14B, because it was the high point of the technological development that was carrying F1 into unchartered territory - exciting or detrimental to the sport,

depending on your perspective. Viewed from today, Prost's Williams - from his only year with the team - can be considered a key touchpoint for the soaring evolution that has led F1 to the high sophistication of today. Yes, its technology was largely banned at the end of its title-winning season, but its influence would prove lasting.

Consider that by the latter part of the 1993 season the Williams had active ride, power steering, traction control, launch control, ABS and power-assisted brakes, and an early form of push-to-pass that was something akin to modern DRS. And in the background the team was developing a constantly variable transmission.

Given that most of that technology had to be binned when the FIA banned driver aids for the following season no subsequent F1 car has matched what the 1993 models were able to do in terms of optimising performance. And it was all achieved with a small engineering team and the relatively simple computing technology that was available at the time.

"The car was very sophisticated in its concept and the systems that it used to make it work," says Prost's team-mate Damon Hill





of FW15C. "But it was quite limited in terms of processing power and memory. By comparison, today's cars are massively complicated and more sophisticated, but they're restricted in so many different things that they can do. We definitely had a good selection of toys to play with."

"If you ignore the power unit side of things, then you can easily argue that it was the most technologically advanced F1 car there's been," says then Williams chief designer Adrian Newey. "It was effectively the last of an era, and that always makes a car special. To win with that car was fantastic. I look back on that year with fond memories. And working with Alain for that one season, and then seeing Damon's progress through the year, was a highlight."

The 1993 season was one of change for Williams. Prost's arrival had triggered Nigel Mansell's messy departure for the US, and with veteran Riccardo Patrese committed to a move to Benetton Frank Williams had to look elsewhere. He eventually opted to promote erstwhile test driver Hill, who had run a part-season for Brabham in 1992.

FW15C was a step on from the car with which Mansell had dominated the 1992 •

championship. It was regarded internally as the definitive 'active' car, because its predecessor had been originally designed for standard suspension, which inevitably created some compromises.

"FW15 was conceived through 1991 as being a proper installation of active suspension with the aerodynamics more tailored around active," recalls Newey. "Obviously 14B was an existing car that we then put active onto. And in that there were some compromises on the installation of the suspension. And effectively the aerodynamics didn't maximise the advantage of the much finer ride height platform window that it offered.

"So the research into 15A was really aimed at those two points, properly integrating the hydraulic actuators, etc, into the design of the tub and the gearbox. And then re-optimising the aerodynamics around the smaller ride height window that active offered, which is kind of analogous to a peaky engine versus an engine with a very broad torque curve."

he original FW15 was supposed to race in the latter part of the 1992 season, but FW14B was so dominant - Mansell would clinch the title in Hungary in mid-August - that it was put on hold. The team was also mindful of the early reliability issues that had cost Mansell a shot at the 1991 title, and thus preferred to stick with the proven model.

"The 14B was proving reliable and quick enough to do the job," recalls technical director Patrick Head. "So we didn't see that it was necessary to bring in the 15. On the active 14B there were a couple of bulges at the front that had hydraulic cylinders, and on the 15 they were sort of pulled inside and tidied up. The back end was a lot tidier on the 15. And it was a dedicated active car, whereas the 14 obviously was a passive car converted for the active ride."

The team had to adapt to a package of rule changes for 1993, including simpler front endplates plus narrower wheels and an overall narrower track. Hence the transition that winter via a B-spec interim test car to the C-spec that would eventually race.

A string of gizmos that Williams had been developing would feature on FW15C, with some introduced during the season. "I suppose they all came together in that car," says Head. "You've got to remember that McLaren were winning pretty much everything with the Honda engine, and obviously had quite good cars. And in that period I suppose Frank and I said, 'Look, •









It's hard to pick a single area where the Williams FW15C excelled as the design was the sum of ingenuity all round. Take a tour of the technology encapsulated within this groundbreaking grand prix car with our pinpoint guide

ILLUSTRATION TONY MATTHEWS

TYRES AND TRACKING

Tweaked regulations meant narrower rear Goodyears and a reduced tracking for F1 cars to 1.8m (down from 2m). A new minimum height above the ground was also given for front-wing endplates. These changes were designed to slow the cars, but the FW15C was said to have a 12% improvement in its lift/drag ratio over the 1992 FW14B and proved significantly faster.

ACTIVE SUSPENSION

Actuators fitted to each wheel expanded and shortened in length via hydraulic pressure, responding directly to the loads being put upon the car that were read by computer software. Thus the car could maintain an optimum aerodynamic efficiency at all times, which was a huge aid to set-up and ironing out the usual pitch, dives and rolls of conventional suspension. Lotus had pioneered active suspension in the 1980s, but it was Williams that harnessed its power best, in alliance with AP.

RIDE HEIGHT

The driver had control of this in FW14B via a knob in the cockpit to tailor the car corner to corner. But the knob became redundant for FW15C. The software could be programmed to continually change the set-up, leaving the driver free of such distraction.

POWER STEERING

Nigel Mansell hadn't needed it in FW14B, but power steering – still a novelty in F1 at this time – made sense for Alain Prost and Damon Hill, especially with heightened downforce and braking capabilities.

Active suspension could be realised thanks to developments in electronic digital control, which also led to the evolution and integration of ABS braking. Ahead of the front bulkhead, four Moog electrovalves, packaged with sensors, hydraulic connectors and

the brake-fluid cylinder, activated

the Williams system.

ABS

GEARBOX

The Williams allowed its drivers to benefit from fully automatic gear changes, but only if they wanted them. A flick of the paddles behind the steering wheel would allow them to revert to manual mode.

AERODYNAMICS

Honing a narrower range of ride heights and rake angles through active suspension created other benefits for chief designer Adrian Newey. His aerodynamic surfaces, such as the front wing and diffuser, could be designed to be more 'peaky' and aggressive because the active ride reduced the requirement for consistent downforce over a wide range of attitudes.

DIFFUSER

Along with a more aggressive design, the diffuser could also be stalled from the cockpit via a button. This clever device allowed the driver to reduce drag considerably and also, through the software, offered an extra 300rpm from the engine. It was effectively a 'push-to-pass' button long before such devices became common.

"We may have been the first to use the new technology in anger"

PADDY LOWE

ENGINE

Bernard Dudot and Renault's latest RS5 67-degree 3.5-litre V10 featured new con rods and revised inlet and combustion chambers, giving the engine an extra 30bhp over the 1992 version and taking it up to 780bhp. The V10 outpowered Ford's V8 and was lighter and less thirsty than Ferrari's V12. It remained the F1 benchmark.



we've got to beat McLaren.' The Renault engine was good, but no way was it as powerful as the Honda. It was lighter, but it wasn't as powerful. And we sat down and said, 'So, how are we going to beat them?' And the answer was technology. We were already working on a number of things. And we said, 'Well, let's bring all these things along in parallel.' And I suppose they all came together with the 15."

Even Williams was a small team in 1993, and much of the trick electronic stuff was developed by just two engineers, Paddy Lowe and Steve Wise. "What enabled traction control is a very common architecture on cars now called CAN, or Controller Area Network," says Lowe. "On a road car you've got loads of boxes all over the car, one to control the seat, one for the windscreen wipers, and they all talk to each other on a CAN network. So it's like an automotive version of Ethernet.

"The chip for that had literally just been invented by Intel, and we may well have been the first people to use that chip in anger on the ECU that we built for the 14B. And that allowed us to send the message to the engine that said, 'Please cut three cylinders right now.'"

The active system that proved so successful in 1992 was at the heart of the FW15C, suitably tweaked and refined. Its main benefit was to provide a stable platform to optimise Newey's cutting-edge •



aerodynamics. "The active ride was a sort of responsive system," says Head. "In that if you had load transfer, like when you hit the brakes, the nose would dip and the back would go up. Then the system would say, 'I don't really want this,' and would correct it. And when you turned into a corner, the car would initially begin to roll. And then the system would say, 'I don't like this - this is not what I'm programmed to do,' and it would correct it."

Lowe was the key player on the active programme before he left for rival McLaren early in the 1993 season. "You could run the car at very efficient aerodynamic attitudes that you couldn't do with passive suspension," says Lowe. "Most particularly the car was much lower

in ride height at low-speed. The second point was the tunability. You could tune all of that according to conditions, you could tune it even corner by corner, you could tune it according to balance. If the car was developing understeer, you had great ability to tune it out.

"We were growing different features particularly around how you tuned the suspension to different driver inputs, because with that suspension it could react to inputs from the steering, acceleration, brakes, throttle. The car also was just very much more responsive, because it effectively didn't roll, and especially at turn-in it was right there with you. During a classic turn-in the car pitches over. That effect just didn't exist.

"It always had four wheels properly on the ground bearing their proper weight distribution that you'd intended by design. So this gave you enormous traction, on top of the low ride height that you have in that low-speed exit. And of course we had traction control as well. So from the corner exit you're driving away from everybody, and that carries you down the straight."

here were other benefits to be gained from active, as Lowe recalls: "In those days floors were blown with exhausts in a really big-time way, massively more than anything we ever did in the later blown diffuser days. This was properly blown. And the difference in downforce at the rear could be up to 40%, coming on or off throttle. Imagine how big that is, and also how disruptive it is to balance.

"One of the big things that this active car could do was mitigate that disruption and allow you to get all the benefit of that extra exhaust downforce, because you could control the balance through that switch of on or off-throttle. That was a massive point."

"That night my head was almost in my soup due to the gforces"



DAVID COULTHARD

Williams' design included huge tech advances, and was its first true 'active car'. Right: Prost at Magny-Cours where he'd take his fifth win of '93



Once Prost understood how to work with the car's systems he and his race engineer David Brown were able to make the most of them. "With the active car I never ran out of tools," says Brown. "If the driver had a problem with the car, there was always something that you could do about it. And it became increasingly more interesting in '93 when we had distance-based offsets.

"For example, Alain did not like oversteer at all, and wouldn't drive a car that was loose. He'd go through Bridge Corner at Silverstone, the car was just a little bit too nervous for him, and he didn't like it. We said we will lift the front ride height up, Alain, as you go into the corner, and we'll drop it back down before you get to the left-hander after it. We did that, and it was fine. And it was purely distance based."

Active also allowed the team to run a form of push-to-pass that was discovered by chance. "We noticed in the wind tunnel that if we lowered the rear as far as we could without damaging the floor, which was probably around 10mm, then we could stall the floor," says Newey. "And that gave a significant drag reduction. •



Prost's final fling

Having spent 1992 on the sidelines after his departure from Ferrari, Alain joined Williams seeking redemption



ith Nigel Mansell gone and new

team-mate Damon Hill finding his feet, the path was clear for Alain Prost to make the most of the opportunity to drive the best car on the grid.

"Alain was very good to work with, very precise," recalls Adrian Newey. "But also frustrating at times. Pre-season in '93, we were at Estoril or Barcelona, and our lap times weren't looking good. And we all started to get a bit twitchy have we actually been overtaken here? And Damon of course was still getting himself up to speed with things.

"Basically, Alain had been playing around. He was doing the old thing of doing a few corners, but never worrying about stringing a lap together. So then finally, he said, 'OK I'm going to put a lap together,' and he went a second quicker or something! It was quite confusing to start with. When Nigel was in the car you knew what it was capable of."

Paddy Lowe agrees: "Alain would put the lap

together in his head, and not really deliver it all at once. He saved all his delivery for actual qualifying. So you couldn't say whether something was good from the stopwatch. Nigel was diametrically opposite – Nigel didn't know the meaning of going slowly."

Prost soon formed a good relationship with his race engineer David Brown.

"I really liked working with him," Brown recalls. "He was meticulous and hard-working. He was quite different: his McLaren upbringing brought a lot of fresh ideas. And he liked numbers attached to things, and so do I. He was really into looking at data. Most of that in those days came via Renault. And he would spend a lot of time with the Renault people."

Prost won the season opener in South Africa, but that was followed by an off in Brazil on a damp track after a



miscommunication with Brown over tyres, and then a tortuous path to third at a soaking Donington on a day when Ayrton Senna dominated. It took him time to come to terms with the complex FW15C and get the most out of its many systems.

"Alain struggled a lot with understanding how to get the car to his liking," says Patrick Head. "He would spend hours going through the set-up with David Brown, biting his nails until they bled. I wouldn't say we ever got to know him. Early in the season he seemed to be incredibly nervous; he was always stalling the car.

"But then he really got his act together and won six races from seven. It was as if he thought, 'Oh s**t, this isn't going the way I wanted,' and he put his head down and just bang, pulled away enormously."

In total, Prost won seven of the opening 10 races and although he wouldn't win again towards the year's tail end, that streak was enough to set him on the way to the fourth title he craved.



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So that's what the push-to-pass did. The first version of it, which was a bit silly really, was a latching toggle. And Alain did once do a lap having forgotten to turn it to de-latch at the end of the straight, and scared himself. After that we swapped it to a push and hold button..."

"It would drop the rear down and stall the floor, and you'd pick up top speed," says test driver David Coulthard. "So at places like Tamburello at Imola it was like, 'Am I going to keep the button on?' You would always end up lifting, getting the downforce."

In 1992 Mansell had got more out of the FW14B than his team-mate Patrese, in part because he had greater confidence in the active systems, but also because he could cope better with the heavy steering loads due to his natural strength. Power steering, introduced for the 1993 car, was of obvious benefit to Prost.

"That was a big thing for the drivers," says Newey. "We were generating pretty big levels of downforce. The layout of the car, with the chassis coming over the top of the steering wheel, did force quite a small diameter steering wheel. Which for Nigel, with his huge upper body strength, wasn't too much of a problem. But clearly for Alain that would have been quite a challenge."

lso new for 1993 were power-assisted brakes and subsequently ABS, with the latter raced for the first time at the French GP. "It was a four-channel anti-lock braking system," says Head. "The driver could just hit the brake pedal as hard as he liked without worrying. And it was interesting because it dealt with each wheel individually. So it could be releasing the line pressure on one calliper while still keeping high pressure on the other three. The driver could probably brake 10 or 15m later than he would have been able to without it.

"I can't say to you the ABS brought 0.3 seconds a lap or something. But we wouldn't have had an extra complication on the car unless it was a benefit."

"I remember the Imola test," says Coulthard. "And that night I was having dinner, I was eating soup. And my head was almost in my soup because of the level of forces in the car!"

All of this added up to a sensationally fast racing car. Prost was dominant in the early part of the season, winning seven races in total on his way to the title, while Hill learned quickly and became a strong force, logging the first three wins of his career in consecutive races.

"Eventually they went to as many different automated processes as you could think of," Damon recalls. "It was automatic upshift, automatic downshift. And then we had power-assisted braking, then ABS. The whole thing just went down that road. It was starting to get a bit insane. I think we had an active diff at one point.

"The power-assisted braking just meant you could press much harder. You could •

"It was very sophisticated. We had a good selection of toys to play with"

DAMON HILL

"It was one of our truly outstanding F1 cars, no doubt about it"



PATRICK HEAD

apply much more power to the brake pedal. The ABS was most impressive in Adelaide. I remember braking for the corner at the end of the back straight and just thinking, 'This is incredible, how I can brake with this thing. It was amazing. You could just nail it."

By that final race of 1993, Prost's last GP start and Ayrton Senna's farewell outing with McLaren before joining Williams, everyone knew that it was the end of an era in other ways. The FIA had banned all driver aids for the following season, and separately CVT - in which Williams had invested heavily and intended to run in 1994 - was also banished before it had even been raced.

"It was a highly-charged political year," says Newey. "And we got caught out on the technical side, as so often, in the overall politics of what was going on between the FIA and the teams."

"You can't spend too much time saying, 'Oh, it's not fair,' or anything like that," says Head of the clampdown. "You just get on

with it. And once all that was banned, we had a big challenge in 1994. We'd been running active ride for three years or so, so we had to understand how to run a car with springs and dampers and things. You just get on with whatever problem is right in front of you.

"So yes, it was a bit annoying losing all these toys, but we weren't thinking backwards. We were thinking, 'How are we going to deal with these challenges?"

Having been locked into active for several years, that winter the team had to take a massive step backwards, initially with the FW15D test car, while the definitive FW16 was developed for Senna and Hill to race in 1994.

"FW15D was actually just the toys removed and springs and dampers kind of bodged onto it," says Newey. "It wasn't a very nice car. I think what really caught us out in '94 - it certainly caught me out and I take responsibility for it - was that we'd had two

years of development trying to aerodynamically exploit this very narrow ride height window that active offered. Re-learning how to make a car work both aerodynamically and mechanically over a broad ride height window is something that we didn't do a good job of at the start of 1994."

"We knew we had to have a much more, ride-height tolerant, much more benign platform," says ex-Williams aerodynamicist Geoff Willis. "We said it's got to be half as sensitive or something like that. And it turned out actually we needed to make it 25% or 20% of the sensitivity. So the first few races that Ayrton drove the FW16 the car was a pig, because it was just too rideheight sensitive. And by Imola we'd already made huge progress on that."

FW15C has perhaps been overshadowed by the 1992 car with its Mansell associations, but Head still has fond memories of the model. "It was one of our outstanding cars, no doubt about it," he says. "At the end of the season I actually drove it, 10 seconds off the pace, at Paul Ricard, because I just thought this is never going to happen again, I'd like to see what it feels like.

"They had to take the seat out to get me to fit. So I had lots of sponge around me! I think Bernard Dudot drove it, and Adrian drove it. You didn't really know that it had all these devices on it. But it was a very good car, no doubt about it."



Back when Hill had a mountain to climb

Promising yet unproven, Damon Hill was the surprise candidate for a Williams seat in 1993. Yet the British driver proved doubters wrong in the finest fashion



amon Hill emerged as a candidate

Williams race seat in late-1992 after Nigel Mansell opted for the US and Riccardo Patrese left for Benetton.

Hill had been the team's test driver for a couple of years, and had impressed the likes of Patrick Head, Adrian Newey and Paddy Lowe, all of whom supported his candidature. A partial '92 season with Brabham, which gave him two race starts before the struggling team collapsed, also helped.

Eventually a somewhat reluctant Frank Williams

gave him the nod, calling Hill to the Didcot factory on a wintry Friday night to make the offer.

"We had to work quite hard on Frank to accept Damon as a driver," Head recalls of the situation.

Hill thus found himself thrust into the limelight alongside new signing Alain Prost.



"The big interest was around Alain, and how would he acquaint himself with this strange car that had a computerised control platform," Hill recalls of winter testing. "And it wasn't like anything he'd driven before. Nigel had got the hang of it. But he'd gone, and Riccardo had left as well.

"So I was the only person who had the continuity. I had to act as a kind of bridge to the new guy, Alain, about what to expect from this car. But I hadn't done much running in the passive car, so I didn't

have anything else to compare it to."

Hill's season got off to the worst possible start when he spun on the first lap at Kyalami: "All I had to do was a half-decent job. Still to this day I have no idea what happened, but in the race I just went round Turn 1 and suddenly I was backwards. It was a horrible first race."

From there things started to improve, and he scored a landmark pole position in France.

"It was all because I missed my brake pedal when I was going into the chicane on the last lap on my qualifying run," Hill recalls. "So I literally braked later by accident! I was starting to find my feet a bit by then."

The first victory came a few weeks later in Hungary: "Alain had a problem at the start, so I was on my own, and there was no competition. I think Patrese was second and I could see him in front of me. That's how far ahead we were!"

and Senna.

"I was very happy with it," he says of his first year.

"It was a good-ish performance. But I think there was always the question whether or not

Wins at Spa and Monza

followed, and Hill ended

the season in third place

in the points behind Prost

I was of the Nigel calibre, or the Alain calibre... or whoever. And that's a fair point to make. But I was getting better, definitely."

He'd also continued to impress the right people: "In South Africa he certainly did look very lost; he had some silly spins in practice," says Adrian Newey. "It looked as if it got to him a bit. He sorted himself out and kind of got on with it, and his rate of progress through the first half of the season was really great to watch."





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THE GREATEST RACING ENGINE EVER MADE

Cosworth's DFV engine dominated Formula I for more than a decade, also finding success at Le Mans and in IndyCar. Lawrence Butcher examines what made it unbeatable

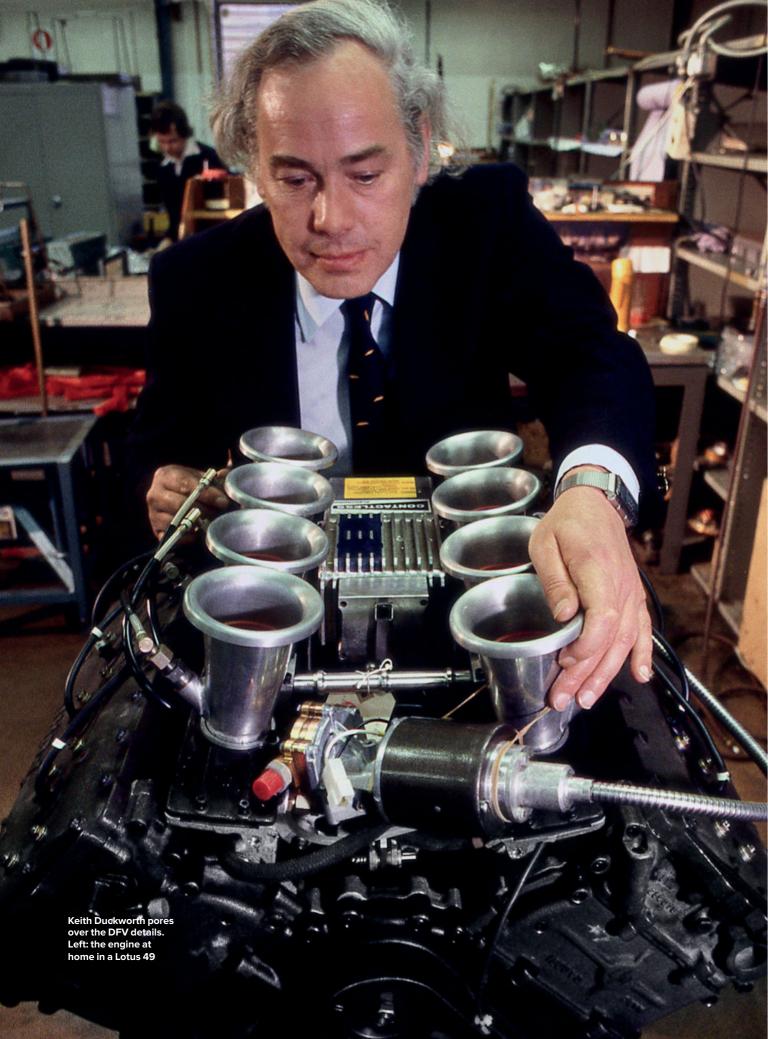
TAKEN FROM MOTOR SPORT ONLINE, JANUARY 2022

ust as the Coventry Climax racing effort was fading in the mid-1960s, a new contender was waiting in the wings, which would seal its place in racing folklore: Cosworth. The company name was a combination of engineers Mike Costin and Keith Duckworth's, both of whom worked together at Lotus and shared a background in aviation. Their most famous creation, the DFV 3.0-litre V8 engine, would form one part of an iconic motor racing combination in 1967, when paired with the Lotus 49 and Jim Clark. It would go on to be the engine of choice in grand prix racing for over a decade.

Much like Miller and Offenhauser before them, Costin and Duckworth were both quite different in their approaches to engineering. Duckworth was a first principles type, capable of thinking his way around problems, while Costin was more the hands-on type; between them they would make an almost unstoppable combination. There were, however, at least two other key players in the DFV story, Colin Chapman and the Ford Motor Company, via Walter Hayes, without whom, it is unlikely the young Cosworth company would have secured funding to build its 3-litre Formula 1 engine.

Having employed both Costin and Duckworth, Chapman was well aware of their talents and when the pair set up on their own in the late '50s (when Costin was in fact still Lotus technical director), a continued relationship with Lotus was logical. As the 1960s rolled around, Cosworth busied itself building engines for Formula Juniors, Formula 3 and Formula 2. This would prompt Duckworth to start to refine his thinking around cylinder head design, later put to good use in the DFV, with the development of the SCA Formula 2 engine. That engine used the Ford Anglia 105E engine as a basis, retrofitted with an overhead cam head and gear drive on the front of the block. He focused on upping the volumetric efficiency of the engine, adopting steeply angled ports to reduce shrouding of the valves. By the mid '60s the SCA was the engine to beat, but Cosworth had bigger plans and Duckworth was working on a design for a four-valve engine, in anticipation of new Formula 2 rules due in 1967 which upped capacity to 1600cc (from 1.0-litre).

The arrival of the 3.0-litre Formula 1 rules took the various British manufacturers somewhat by surprise. With big-banger sports cars making rather a mockery of •



Left to right:
the design and
development
team of the Ford
Cosworth V8
engine in 1967; Bill
Brown, Keith
Duckworth, Mike
Costin and
Ben Rood on
February 20, 1970
at Cosworth
Engineering in
Northampton



"Chapman needed a bespoke engine. Cosworth would build it. The issues were time and money"

F1's 1.5-litre minnows, there was a desire from both organisers and teams to make the class faster. The British outfits hoped for a 2.0-litre formula, which would allow for the use of enlarged versions of the engines they already had. However, at a meeting with the FIA in 1963, which sought the opinion of teams before rules for 1966 were agreed, the British contingent - led by Chapman - opened the bidding at 3-litres; the FIA promptly agreed. Cue a dash to find new engines and with Coventry Climax soon to be out of the picture, there were not too many obvious options.

Ferrari and Maserati dusted off V12 designs from the 1950s, BRM decided it could take its 1.5-litre V8, stack two on top of each other having flattened the vee out and make an H16, Harry Weslake readied a V12 for Dan Gurney's Eagles and so on. Never one for compromise, Chapman knew

he needed a bespoke engine built to the formula and Cosworth would be the ones to build it. There were just two problems: time, and money.

Developing an all-new engine has never been a cheap endeavour and Chapman went off to try and raise funds, but pleas for government backing fell on deaf ears while Ford did not wish to enter F1, despite its existing ties to Lotus. As a stopgap, Chapman made a deal with BRM to use its H16 while he continued the search for cash. Enter Walter Hayes, then head of public affairs at Ford of Britain, who knew Chapman well. He would bring Ford back into the game, convincing the UK operation to stump up the £100,000 needed at the end of 1965. The deal was that Cosworth would build a 3-litre F1 V8 and the 4-cylinder F2 motor. Duckworth and Costin had not been idle and by mid-'65 work was already underway on the latter,

called the FVA, which would enter competition in 1966. However, creating the DFV would not simply be a case of doubling up the FVA, which was still based around a production block. Duckworth had never developed an entire engine before and the DFV would require a bottom-up design; the result was not bad for a first try.

The engine would act as a stressed chassis member, so Duckworth had to account for the rear suspension loads in its structure, and the crankcase, cylinder heads and rocker covers were all designed to carry the forces through to the main monocoque. He opted for a 90-degree V-angle, keeping the engine narrow enough to not protrude beyond the monocoque sides of the car it was destined to power, the Lotus 49, and it was also impressively short. The use of a flat plane crank, which gave an even firing order, greatly simplified the exhaust layout. •

Throughout 1966, Duckworth worked on the myriad of detail engineering problems, chivvied along by Costin when his machinations took too long. Freed from the constraints of a production cylinder block, such as a fixed bore spacing, he was able to take some of his earlier ideas to a new level. For example, the cylinder heads, while based on the FVA, had an included angle of 32 degrees (compared to the 4-cylinder's 40 degrees). These worked in conjunction with a refined combustion chamber with a pent-roof rather than pure hemispherical design, Duckworth pursuing an idea of creating 'swirl' within mixture entering the chamber. This would better mix the air and fuel, improving combustion and thus power. The results proved Chapman's faith in Cosworth, during initial dyno running, the engine produced 408bhp and its low weight and compact form perfectly suited the Lotus 49, which had been designed specifically to accept it.

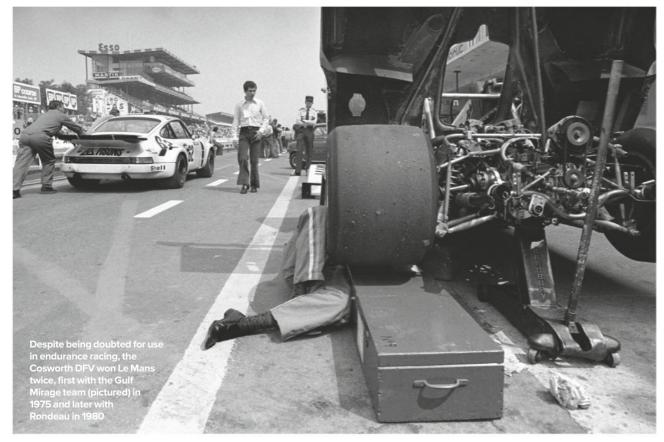
When the DFV was unveiled to Ford and the media, it was not quite the finished product. There were a few teething issues. The engine made its competition debut at Zandvoort in 1967, Graham Hill put the 49 on pole, but during the race, an issue – already known to Cosworth – reared its head and two teeth on the cam drive gears sheared, seizing the engine. Clark came through to take the win, but reliability issues would dog the engine through that first season. Clark secured three wins, but only wound up third in the championship.

Cosworth would have to wait until 1968 before it could truly stretch the DFV's legs, by which point, Ford had decreed that Lotus no longer had exclusive use of the engine. It would be a season tinged with tragedy, Hill took the driver's championship but

teammate Clark was killed early in the year driving an F2 Lotus at Hockenheim. Out of a total of 12 world championship rounds, Ford Cosworth-powered entries won all but one, shared between Lotus, McLaren and Matra; with only Jacky Ickx salvaging some small honour for Ferrari with a win at the French Grand Prix.

It would not be until 1975 that a non-DFV-powered car would win another championship and only the arrival of turbo power in the early '80s ended its dominance. The design's success was not limited to F1, despite reservations about its suitability for endurance racing, it powered two Le Mans winners and in smaller capacity, turbo DFX form, it netted 10 Indy 500 wins. No engine before or since has shown such domination across as wide a breadth of racing series and for that, the DFV has a strong case as the greatest racing engine ever. •

"No engine before or since has shown such domination across a breadth of racing series"



On a wing and a prayer

The chance to drive a revolutionary ground-effect Lotus 79 doesn't come around every day. So you take it, whatever the weather...

WRITER ANDREW FRANKEL / TAKEN FROM MOTOR SPORT, MARCH 2010



e all remember our first grand prix. You can watch it for years on the television but until you actually go and watch a gridful of Formula 1 cars come past, feel your insides churn and your ears itch, you will only have seen it. You will never have experienced it.

Mine was at Brands Hatch on a sunny summer's day in 1978. I don't believe in love at first sight, but in the case of the Lotus 79 I am prepared to make an exception. I can remember looking at Mario Andretti and Ronnie Peterson streaking away from the rest of the field in their now usual 1-2 formation and my 12-year-old mind knew

exactly why. Everything else on the grid that day, the Ferraris, McLarens, Renaults, Brabhams and Tyrrells, looked obsolete.

The Lotus 78 had been a pretty impressive piece of work, but the following 79 was something else: the lowest, sleekest racing car there had ever been. I recall perfectly poring over its lines and concluding it would be impossible to design anything to look more modern than this: any wider and it would break the rules, any lower and... well it was already on the ground. Truly I believed everyone else should just give up because it was not conceivable that anyone could do any better than this.

And I wasn't entirely wrong, though cause and effect had become somewhat muddled. Its speed was not a symptom of its looks, but the other way around. True, both Colin Chapman and Peter Wright had an eye for the aesthetics, but the reason it looked so different to any other car out there was simply because it was.

"We called it the unfair advantage," says Clive Chapman, son of Colin, boss of Classic Team Lotus and custodian of this Lotus 79 since it stopped racing. "The 78 was our first attempt at a ground-effect car, but the 79 was the first Formula 1 car to really exploit its potential. Straight out of the box it was two seconds a lap faster than the 78 •





everywhere, more at some tracks. We had to do some serious sandbagging." The reason the advantage was so wonderfully unfair for Lotus was that the main opposition came from Ferrari, which had just completed a hat-trick of constructors' titles; but its wide and low flat-12 engine made designing a true ground-effect car with proper venturi tunnels impossible. "Not only did we have something they did not, rather more importantly, they couldn't go out and get it."

Bizarrely, both the 79s failed that day at Brands and it was Carlos Reutemann's Ferrari that pulled a devastating move on Niki Lauda's Brabham to claim victory. But I only had eyes for one car, becoming mesmerised by Mario's inch-perfect lines, lap after lap while it lasted. If you'd told me then that one day I'd drive not only a 79, but that 79, I'd have probably passed out.

But that car is this car: Lotus 79/3, Mario's main weapon in his title year. The 79 didn't even make its championship debut until round six at Zolder in late May, which Mario won in 79/2, before going on to win at Jarama, Anderstorp and Hockenheim in 79/3, with his fifth win of the season coming at Zandvoort in 79/4. The 79's other win of the year was Ronnie's last victory, at the Osterreichring driving 79/2. Two races later he would crash his 79 in practice for the Italian Grand Prix and, with the spare set up for the considerably shorter Andretti, started his last race in a 78.

Of the two other 79s, 79/1 was the development car and raced just once in 1978 (with Jean-Pierre Jarier to no great effect at Watkins Glen) before being sold to privateer Hector Rebaque for the 1979 season. The last car, 79/5, was built for the '79 season, almost as if Colin Chapman knew he needed a long-stop in the event of the radical Lotus 80 failing to realise its potential.

oday, the 79 has another beauty, one conveyed on it by history. It seems scarcely believable now, but when it won Mario his championship, the era of the slicks-and-wings F1 car had not yet seen its 10th birthday. All we knew then was that, of those seen so far, it was the most beautiful of all. But now more than 30 further years have passed and I still cannot think of another that comes closer to visual perfection from more angles. If a spaceman fell to earth pondering the meaning of the phrase 'if it looks right, it usually is right', you could do no better than point him in the direction of this 79.

But there's an added magic of this particular 79. Unraced since 1979, it's not a



"With this weather, you won't get heat into any of the tyres we could put on it"

recreation clinging to a chassis plate as some kind of identity - it's all real. The tub, bodywork and even the engine and gearbox you see here belonged to this car in period. Clive is usually very relaxed about his cars being raced, but just a few are regarded as simply too important to risk compromising, and 79/3 is one of them. Gently restored to fully-functioning condition about 10 years ago, it goes to shows, has run up the Goodwood Hill and has attended other demonstrations, but that's it. It is fabulously original.

Today, its task is to carry me around the same Hethel test track upon which it would have been shaken down all those years ago. Sadly conditions are terrible - the air is a single degree above freezing, track conditions vary from quite damp to properly wet, and fog limits visibility to around 100 metres - not much for a car capable of making a Bugatti Veyron's acceleration look very ordinary indeed.

Frankly, I'd been expecting a call to reschedule, but Classic Team Lotus - still staffed by ex-Team Lotus engineers - is made

of sterner stuff. Chris Dinnage used to be Ayrton Senna's chief mechanic but today he has the somewhat less edifying task of looking after me. Conditions are right on the cusp between slicks and wets, but the slicks stay on because they'll look better in the shots. As Chris says, "in this weather you won't get any heat whatever we put on".

Before climbing aboard, there's time to soak up a few last details. The front of the car represents standard F1 thinking of the era, but as your eyes pan back past the cockpit with its effective little wind deflector, things change. There's no fuel in those long sidepods because, unlike the 78 that had three different fuel cells, all the 79's petrol goes directly behind the driver, freeing up space for the venturi tunnels that would change the face of F1 racing. It still wears its skirts, too, but on a bumpy track like Hethel, they're stowed in the pods. Simply dropping them to the floor doubles downforce.

Likewise at the back, everything has been moved out of the way of the airflow under the car: brakes and springs are inboard and years of traditional suspension design was abandoned because longitudinal radius arms would have got in the way. In their place came wide-based wishbones. Indeed when work began on the 79, ground effect was the dominant principle around which the rest of the car was designed and, where needed, compromised. Even the air intakes that wrapped around the roll-hoop of a 78 were abandoned as they interfered too much with the flow of air to the rear wing.

Needless to say, power is of the Cosworth DFV variety. The 79/3 runs a standard long-stroke engine to period specification which means around 480bhp at 10,600rpm, perhaps 80 more than the earliest DFVs, but at least 60 less than the maddest short-strokers have shown. As expected, it directs its power through a Hewland H-pattern gearbox, the Getrag sequential shift Chapman had intended proving insufficiently robust for racing.

It's time to go. Thanking Peterson's lanky frame for the fact that I can get in the 79 at all, I'm struck by how traditional the driving environment is... how backward, even, compared to its cutting-edge exterior. In terms of its dynamic abilities, it's probably closer to modern F1 than an early '60s machine, but the cockpit design appears to have evolved hardly at all. You still have to peer at tiny Smiths instruments with spidery numerals to read your revs, pressures and temperatures, which must have been irksome in a car of such retina-detaching performance. There's a brake balance bar

and separate controls for the front and rear rollbars (Dinnage says Ronnie could never remember which way to move them until Mario chipped in with 'hard in, soft out', after which he never forgot again), but that's it. Compared to the jet-fighter interior of a modern F1 car, the 79 seems nearer 50 than 30 years old.

But it also makes it gratifyingly simple to drive. Just flick on the fuel and ignition, wait for the external starter to spin the engine, catch it on the throttle and settle down to an even 3000rpm idle. There is an exquisite nastiness to close encounters with DFVs, like eating raw chillies or downing neat bourbon, and you'll put up with all the discomfitures just to feel the power. The clutch is sufficiently kind to avoid red-faced getaways and this particular Hewland 'box is as light, precise and easy as you could wish. But how would this irreplaceable slice of British racing heritage react to such terrible conditions?

t first it was unexpectedly accommodating. The motor would pull from as little as 4000rpm and felt quite strong at 6000rpm. The steering is light, the brakes meaty but responsive. I wasn't stupid enough to risk full throttle in the lower gears, but once up into fourth, I felt I could risk stretching its legs. But I was wrong. In that instant the car jinked right, and the revs and my heart-rate leapt as one. Wheelspin at 8000rpm in fourth gear. I'd bet plenty it would have done it in fifth too. Gerhard Berger once told me that a car could only be said to have enough power if it could spin its wheels at any given point on a race track. That day at Hethel, the 79 was that car.

Now treating it with even greater circumspection, I learned after several more laps where it could and could not be pushed, and as long as you trod ever so gently, full throttle could eventually be reached but not for sufficiently long in the fog to feel full thrust for more than an instant or two. It was mesmerising, tantalising and really rather frustrating.

Still, I think the 79 inspired as much confidence as you could expect from a bewinged F1 car on stone-cold, soaking wet slicks. I'd anticipated next to no grip in slow corners, for its springs have to be stiff enough to maintain ride height at maximum speed and downforce, but lateral adhesion was actually good enough not to make you fear going straight on every time the wheel was turned. It understeered, but mildly and predictably. The only frightening deficiency





"I felt I could risk it. But the car jinked right... the revs and my heart leapt as one"

was traction, which was fairly forgivable under the circumstances. As for the quicker stuff, it would have been insanity to try. Even in that weather, it was quick enough through Hethel's infamous Windsock curve to make driving little more than blind. Certainly had something unexpected appeared out of the gloom there would have been no chance to stop, leaving high-speed evasion the only option. And I didn't much fancy that.

So on the last lap I cruised, surreally driving a Lotus 79 like it was a road car. Not

only was it a lot less frightening, it allowed time to look around and savour what I was actually doing, a prohibitively dangerous luxury at any higher-effort level. Mario's wheel was in my hand, Cosworth's DFV at my back and Chapman's incomparable design all around me.

I can't say I consummated my 32-yearold love affair with the 79 that freezing, foggy day in Norfolk - to be honest it wasn't much more than a fumble round the back of the bike sheds - but when you operate from the position of someone who never even expected to sit in one, even that fleeting glimpse into its world is precious beyond words. Statistically the 79 was far from the best grand prix car in the world: it was competitive for just one season compare that to the 72 which won races in five consecutive years - and chalked up just six wins to its name. But it did change racing and stands today as one of the most iconic cars of its or any other era. And as we move into a new era of Lotus F1 cars, it's worth bearing in mind too that it was the last to win a world championship. And that is an act that will take some following. O



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omewhere in a parallel universe tractor maker Ferguson is held in the same esteem as those other tractor constructors Lamborghini and Porsche. And maybe in that world another tractor builder, Aston Martin owner David Brown, is a Formula 1 champion with a luckless Le Mans squad. Because in our universe it seems like F1 simply doesn't want tractor makers to succeed.

Their goods were surely good enough: the Ferguson P99 and Aston Martin DBR4 are a pair of F1 racing's great British whatmight-have-beens. But motor sport could never be accused of being fair.

There are various mitigating circumstances surrounding both cars' unfulfilled potential, though the P99 did claim a non-championship grand prix win at Oulton Park. The DBR4 has to settle for

being known simply as one of the prettiest of the 1950s F1 cars.

With the sun threatening to break through a damp morning, it upholds those standards as caretaker Martin Greaves of Classic Performance Engineering busily coaxes it noisily and carefully into life. The P99, so happy in the wet, needed less persuading to fire. It could hardly look further apart from the DBR4 - so low and so squat, like a stretched-out 500cc F3 machine.

Their respective visual differences are both cues of, and representative of, an era of grand prix racing that was moving at a frantic pace. Breakthroughs in downforce via wings were still years away, and the engine was just beginning to push rather than drag the car along - although the Cooper T43 preceded the P99 of 1961 by four years and, had the Aston not been mothballed, would have been a contemporary rival for the DBR4. Both cars were persevering last pillars of the front-

"Their visual differences are cues of an era of racing that was moving at a frantic pace"





engine formula - though for differing reasons. The pioneering four-wheel drive of the Ferguson dictated its engine-first set-up and was able to overcome any subsequent deficiency with the inherent improvement in grip, whereas the conventional Aston was simply late. Not only to the rear-engined light-bulb moment but into daylight at all.

Two expensive Aston Martin racing programmes, sports cars and single-seaters, into one flailing manufacturer simply didn't go, so management plumped for sports cars and was rewarded eventually with a Le Mans victory. Sound reasoning for a sports car marque. Had Aston gone with the F1 plan for 1958 with the DBR4, itself derived from the Le Mans car and developed from a DB3S, it would have launched into the thick of it. Instead it sat hidden away at the works while a different homegrown, front-engined British Racing Green machine - Vanwall ruled grands prix, and when finally

unleashed it spent 1959 in the shadow of the car that had blocked its exit a year earlier: the DBR1. That came good in June and won Aston Martin Le Mans and later the sports car world championship, although a month earlier the single-seater had threatened to steal its thunder by taking second place at Silverstone's non-championship International Trophy.

Sports car duo Carroll Shelby and Roy Salvadori shared driving duties, and the latter set a new lap record on the way to that second place behind eventual champion Jack Brabham's Cooper. From there the DBR4 floundered, non-starts, non-finishes and pointless outings largely the order of the day.

Just four cars were built, and ours here was created in the 1980s from leftover factory parts. Geoffrey Marsh, who owned DBR4/1, decided to make use of the various factory parts he had in reserve to recreate DBR4/2 which had been scrapped in period, and

when complete it even joined its lead car on some event outings, once with Salvadori and Shelby reunited in the two DBR4s.

The Aston and the Ferguson, both cars cared for by CPE, are linked by more than unrealised potential, and tractors.

After all, a man who was there when Aston Martin claimed its first major post-war international race win was also a leading figure in the rise of the all-wheel-drive Ferguson. Tony Rolt drove the sister car when Feltham won the Spa 24 Hours in 1948 and that same year was working with Harry Ferguson on an all-wheel-drive racer, 'The Crab', with Freddie Dixon. Claude Hill, designer of the Aston Martin Le Mans that won at Spa, joined them.

Twelve years and nine iterations of the 4WD system later came P99, a high-profile billboard for the technology Ferguson believed would save lives when it eventually reached road cars.



Another Aston Martin man, Jack Fairman, gave the P99 its public debut at Silverstone for the British Empire Trophy, but it was Stirling Moss who showed the car's potential at Aintree in July. Dipping into the ankle-high cockpit of the Rob Walker-entered car, he lapped three seconds quicker than his 1959 Nürburgring 1000Kms-winning DBR1 team-mate in practice. Out of the race in his Lotus, Moss took over for the final 20-odd laps and put rivals on notice - only to be disqualified for an earlier supposed indiscretion. "It was rather obvious that there are certain teams who do not want the Ferguson to succeed..." reckoned Bill Boddy in Motor Sport, "...and the Ferguson was wheeled away, completely healthy and showing great promise".

Into autumn the Ferguson made history at Oulton Park for the Gold Cup: "Its unique transmission meant it could out-brake every other car on the circuit and was quite immune from trouble," reckoned Boddy as rainmaster Moss and the ultimate damptrack F1 car coasted clear, initial first-gear start problems a distant memory. "There should be plenty of wealthy enthusiasts anxious to buy the production Ferguson [road car] when it appears, perhaps in 1963," WB signed off.

Alas. Harry Ferguson had died 12 months prior, and the project all but concluded after a few more frustrating outings. The Ferguson drifted into the shadows but never out of the family: the 4WD machine showed its pace at Indianapolis, won a British hillclimb title and events in Europe; then Harry's descendants left it with the Donington Collection until it was recommissioned to go racing – often with Barrie 'Whizzo' Williams at the helm.

For the time being, until it finds a new custodian via Duncan Hamilton ROFGO, it remains in the Ferguson extended family because its keeper is Tony Rolt's son, Stuart. "It was pretty important that I was able to buy it while my father was alive," he says. "It was a very important car to my dad. He worked for the great Harry Ferguson, a keen motor sport enthusiast, and Harry was persuaded by my dad that the way to demonstrate the advantages of the four-wheel-drive system, which included ABS when there was no ABS, was on a racing car.

"It was, for him, a big moment winning the Gold Cup - as important to him as winning Le Mans in 1953. They were up against top people like Graham Hill, John Surtees, Jimmy Clark. But my father was quite unsentimental, so when I went to go to buy it I remember him saying to me: 'What are you doing that for? It's going to cost you a lot of money!'"

For Stuart it brings back remarkable memories, but he has added his own history to the car, too. His children drove the P99 •





a day each during the Rob Walker tribute at Goodwood and his son Freddie drove it up the Ollon-Villars hillclimb in Switzerland in 2013 - in the process going one better than young Stuart five decades earlier. "When it won there in 1963, driven by Jo Bonnier, I went with my dad to the prize giving. It was about 15km up, and then of course we had to get down again. I remember sitting in the back of my dad's estate car behind Jo Bonnier driving the P99 down the hill on a public road, no lights. That is a rather fantastic memory."

Jack Brabham and Jo Siffert were there that day in 1963, too, but the Ferguson's permanent grip gave it the edge and won Bonnier over entirely. He smashed his own hill record, and reckoned he could have gone quicker still. So it clearly had pace on its day.

"Had they continued to run and if the conditions had been right," Rolt says, "I think they could have won grands prix. Who knows what might have happened? At Silverstone in 1961 there was something in the transmission that failed on the startline, and Stirling drove it very quickly at Aintree. It was nice to think that [Ferrari] were so worried that they got the car disqualified. There's an irony there: in 1954 when my dad was second in the D-type with Duncan

[Hamilton], they could have won it had Jaguar protested what was going on in the Ferrari pit when they almost certainly had more mechanics than they were allowed working on the car to get it started. All those years later Ferrari protested the Ferguson.

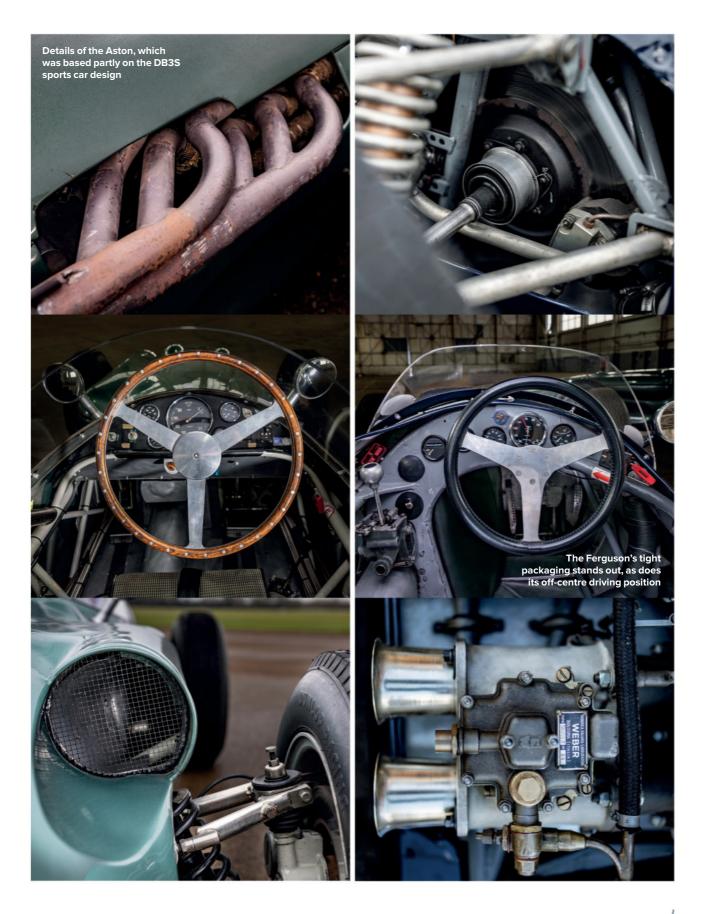
"In the Tasman Series, driven by Innes [Ireland] and Graham [Hill], it was on the mark but it was never clearly faster than everyone else. It was the start of the signs that the additional weight and complication required the right circumstances.

"When the 3-litre formula came in [for 1966] nearly everyone tried all-wheel drive. The disappointment from my father's point of view, I guess, was that against aerodynamics and big, fat tyres, which didn't exist during the P99's time, the advantage of adhesion and grip was being outweighed by the weight and complication of the parts."

If the Ferguson had needed the right circumstances, the only circumstances the Aston needed would have been any race track in 1958, if John Wyer is to be believed. Current historic racing is ferocious and fraught, and doesn't provide a fair test 60 years on, either, because originality comes second to speed. And these are both very original. Whether the P99 races again is uncertain and will •

"I remember Jo Bonnier driving the P99 down the hill on a public road, no lights"







depend on who takes it on. Rolt has been winding down its outings to only demo runs on the right occasions. "It's very precious and the world of historic racing is so competitive that I worry every time I see it on track," he admits. "The problem with the Ferguson is there's only one."

Greaves has certainly been kept busier by the Ferguson than the Aston. "All of the P99 drawings have been lost," he says. "There's plenty of history out there, but not technical information so a good deal of it is reverse engineering and starting from scratch. Over the years we've manufactured all of the safety-critical stuff: wheels, driveshafts, [inboard] brakes, hubs, gearbox and diff internals. We've only done a little on the chassis and the suspension - they're crack-tested and inspected, but they're the originals. You have to take a sensible view. We've had driveline failures because it just finds the next weakest spot. It is an absolute

jewel, beautifully engineered and packaged so well. But it was all done to a weight and size; they got a lot of components into a very small car and they are all working hard.

"The Aston is more traditional. The engine had some issues in period, but it's a bit more bulletproof. It effectively is a 2½-litre DB3S."

He is also best placed to compare and contrast the two from the cockpit. Neither is traditional when it comes to the seating position, and from the outside looking in the Ferguson seems as though it would take the most getting used to. To accommodate the transmission and its satisfying-looking gate, the driver is shuffled to the right rather than staring straight down its nose.

"You don't actually notice the driving position," reckons Greaves. "If anything the Aston is more unusual because you're on the propshaft and have a leg either side of the gearbox tunnel. That feels odd initially, but once you squeeze the loud pedal you forget about that! The Aston is much heavier and clunkier on the gearchange. It's a transaxle, so there is a big David Brown unit behind, and it sounds like it's going to break into a million pieces - until it gets warm. Then it starts working better.

"The Ferguson has a quick change, nice and light. Years ago we put a new clutch in and so I had to go up to the test track here at Bicester to make sure it was functioning correctly and the thing is just unbelievable. You can hardly get it to wheelspin - it just grips and goes. It's something else. And when you sit in the Ferguson, the history just exudes from every chassis tube."

It's a shame that history can't tell us exactly how far the P99 would have gone, and just how good the Aston Martin might have been. Both might have proved world beaters but for 'shoulda, woulda, coulda'. They were out of time. •





Kieft's anti-Climax

Going against the tide, this is another unique car

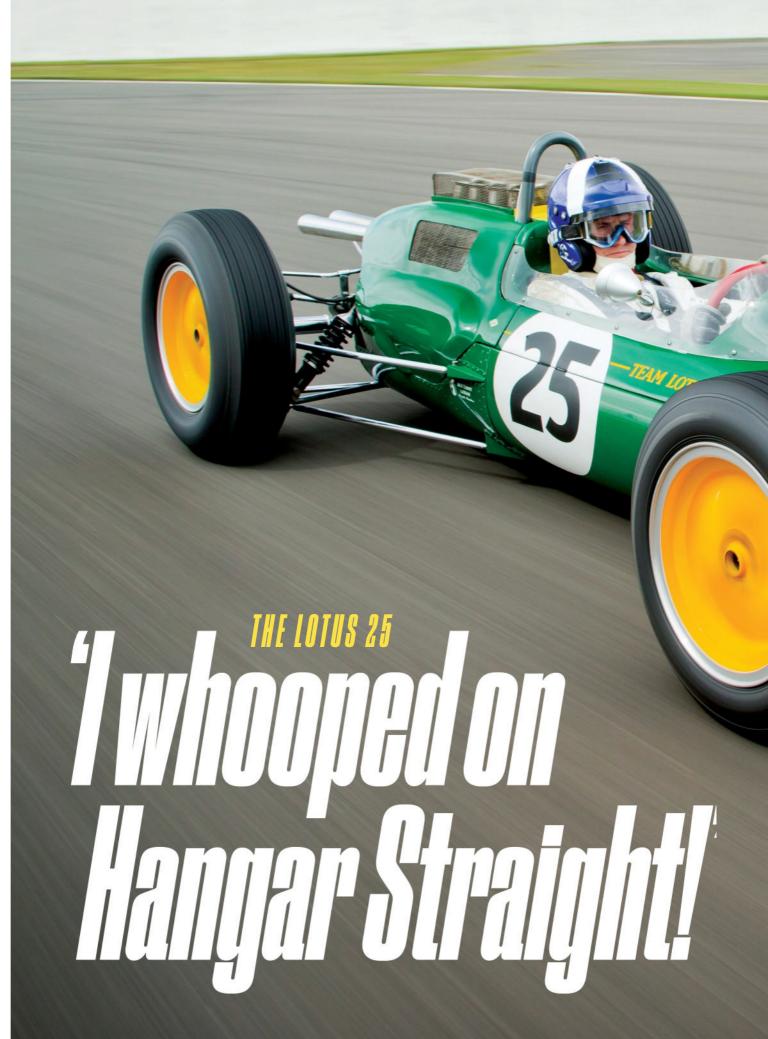
Until recently, the pretty Classic Performance Engineering stable housed a third example of Britain's pioneers that circumstances conspired against: the Kieft-Climax.

Like the Aston Martin it wasn't external but internal forces that kept it off race tracks in the 1950s. Like the Ferguson, it was pushing the envelope. The special 'Godiva' quad-cam V8 was created by the great Harry Mundy and 'Wally' Hassan when Climax owner Leonard Lee caved to pressure from British race car manufacturers lacking a suitably competitive engine. Climax had the engineers, but not the confidence. Ready to race, Lee pulled the plug fearing the Italians would blow them away. In fact the Godiva had the horses to more than compete.

Whether the carmakers, the likes of Cooper and HWM, would have tamed the power to keep up with Ferrari and Maserati in 1954 is another question left to history. Only in 2002 did a Godiva power a Kieft on track: "It is believed to be the only Godiva engine running in the world," says Martin Greaves. "It took a lot to get running well." More so, it seems, in period.



POLSON MOTOR CO





One grand prix winner encounters another: David Coulthard got to grips with the Lotus 25, a car synonymous with his compatriot Jim Clark. Within but a few laps of Silverstone, he was completely smitten...





avid Coulthard cuts the ignition, wiggles the red leather steering wheel and folds his arms. "Well, if you'd just like to put me in the back of the truck I'll stay in here. Tell the wife and kids I love them, but I might not be home." It's a nice soundbite from the professional broadcaster; maybe he composed it on the run down the pitlane, aware cameras were waiting, that the BBC crew has him miked up in the car. But it becomes plain later that the enthusiasm is real, the pleasure unfeigned. One Scottish driver who took the chequered flag here at Silverstone connecting with another Scotsman who did the same 50 years ago, one brick in an overarching year that made him champion. This is Jim Clark's Lotus 25, a revolution in design that fulfils a well-used phrase. It really did make all other racers obsolete overnight.

This is an appropriate place for DC, retired Formula 1 driver and popular BBC commentator, to experience his countryman's view over that minimal screen: Coulthard twice won the British GP here, in 1999 and 2000; Clark did so three times - '63, '65 and '67. But if a Chapman Mk9 time machine (that restless innovator would have got around to one eventually) dropped Jim here today he'd not know where he was, blanked off by barriers, constrained by concrete. Yet he'd learn the updated track in a couple of laps, and similarly DC soon has the feel of the gearchange, the light steering, the airy ride of a car that, aerodynamically, performs worse rather than better as speed soars.

What Jim would recognise instantly is his car. Yes, like all racing cars it had an afterlife, especially when Chapman wouldn't sell new 25s to his faithful customers, lumbered unknowingly with its spaceframe sibling, the 24. Customers like Parnell, which got its hands on this only once Chapman and Len Terry had already schemed the similar but uprated 33, and then modified it trying to keep up. But Jim Clark drove this car first, and in his delicate hands it was a grand prix winner. Now returned to 25 spec, this is the car you've seen Andy Middlehurst race at all the big meets for owner John Bowers. It's prepared and maintained by Classic Team Lotus, which means that the guys who built it in 1962 still look after it; not just the firm, the same people. In our quiet corner of the Wing pits – although this is Media Day for the Silverstone Classic the crowd hasn't yet twigged DC's presence - Bob Dance is preparing the car. 0



JAGUAR HEROES

The latest Motor Sport special edition is available to buy now

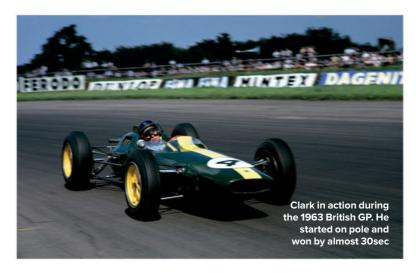


Once again, we've delved into the *Motor Sport* archive to bring you *Jaguar Heroes*, our latest special edition. Get your feline fix with race reports, track tests, features and interviews going back to the early

From the 1950s Bob was one of the bolts holding the Lotus race team together, and he literally knows this thing from the inside out. We're sharing this drive with the BBC, and while Bob is busy, DC is doing pieces to camera, supermodel-slim in his white overalls. Bob props a hair drier on the Climax FVMW, making a tent of his Lotus jacket over the intakes, to warm up the fuel metering unit. It's practically the entire Team Lotus crew here: Derek Wild, Willy Cowe and Cedric Selzer, Clark's mechanic for many years. Jim would know them all.

ask Cedric about constructing the 25's ground-breaking monocoque. Chapman already had experience with the eggshell principle through the Elite, but as he squeezed his single-seaters from slabby 18 to smooth 21 to slim, low 24, the chassis, driver and fuel tanks all battled for the same space across the cockpit. Sheet alloy and structural fuel tankage, plus the fact than you can squeeze drivers' bodies as he'd proven with his 'compressibility of bums' theory over the 22's flat-bottom seat, would resolve this. Lighter and stiffer than steel tubes, the riveted aluminium structure slides the driver way down between two large D-shaped tubes containing bag tanks, connected by welded bulkheads and a stressed floor. Two deep sponsons carry engine and rear suspension, and a wedge of tank puts a few more gallons behind the seat. Did Chapman explain it to the team? "Not much," says Cedric "He just did a GA [general arrangement] drawing – he was a marvellous draughtsman - and we expanded from that and some vague sketches. It was trial and error. The big problem was fitting in enough fuel: Dick Scammell and Ted Woodley had riveting experience – at that time we couldn't weld that hard alloy - and made the tanks bigger and bigger and the cockpit smaller and smaller, with Jim trying it each time. We really didn't know if it was a leap forward until I did the torsion tests, when it was obvious it was far more rigid than the 24."

"Mind you," adds Bob as he checks panel fastenings, "the drivers said the 25 was better



on corners but the 24 was more forgiving." DC strides past to change into sponsor's overalls for another task and pauses to introduce himself to me, not the other way around. "Let's talk after the drive."

There are earlier contenders for the first racing monocoque, but this is the car that in one unveiling moment sent every other designer to his drawing board, and Colin Chapman to the front row of the design grid. No, it didn't win first time out, and spaceframe BRMs, Coopers and Porsches still scored victories in 1962, but this was a balance-tipper: if you didn't follow you were going to be left in the wilderness. By 1964, four of the six constructors would be running monocoques.

"Everyone at Lotus knew about the secret car," recalls Cedric, "but there were no leaks. We took it straight to Zandvoort in 1962 without even a test run. And Dan Gurney said, 'With a car like this we could win Indy'." Among the dunes Jim's clutch failed and Trevor Taylor's 24 followed Hill's BRM to the flag, but in the revolutionary machine Clark would score another three championship wins at Spa, Aintree and Watkins Glen, almost enough for the title as he led at East London in South Africa – until the oil escaped from the Climax and a season-long tussle fell to Graham Hill. For 1963 there would be no doubt at all. On smaller, fatter 13in wheels and with improved suspension geometry, this slim panatella of a car would in the shy Scotsman's hands reel in pole after pole, seven grand prix wins and five non-title victories and make Clark champion for the first time. The greatest driver of the era (pace the injured Moss) had squeezed into the cleverest car and no one could stay with them.

oulthard is back for a seat fitting, now in white overalls once more. It's hard work, being famous. Abandoning the seat padding he wriggles down between those tanks, asking Bob if this is how Clark sat, click-clacks the gear lever, practises heel and toe. "Have to think myself back to the 1980s," he grins, arms and broad shoulders spilling over the car until Bob and Derek cap him off with the bodywork. Everyone decides this will work, the body comes off and he clambers out. "I can almost get my hands on the ground!" he exclaims, used to being ears-deep in carbon fibre. He has questions: he's been reading up about the 25, asks about fuel capacities, seat position, whether drivers complained about heat from the front radiator. He's never sat behind one in a racing car - a hotshoe who's never had hot shoes. "They just put up with it," shrugs Bob. Film crew collars him again; Bob removes the hair drier, climbs in (pretty spry for 77), flicks on pumps, checks for neutral, hits the starter. Everyone except Bob jumps as the V8 bark echoes round the pit. DC looks over and smiles.

While the Climax warms, Cedric has produced a photo album and the Lotus boys, plus team photographer Peter Darley, still snapping 50 years later, trade stories about all-nighters, relentless lorry drives to Italy, practical jokes shared with the F1 stars in their hotels. The thread to the current Lotus F1 race team may be long since broken, but if team spirit continues it's among the lads who are still part of CTL.

"Chapman did a drawing and we expanded from that and some sketches. It was all trial and error"

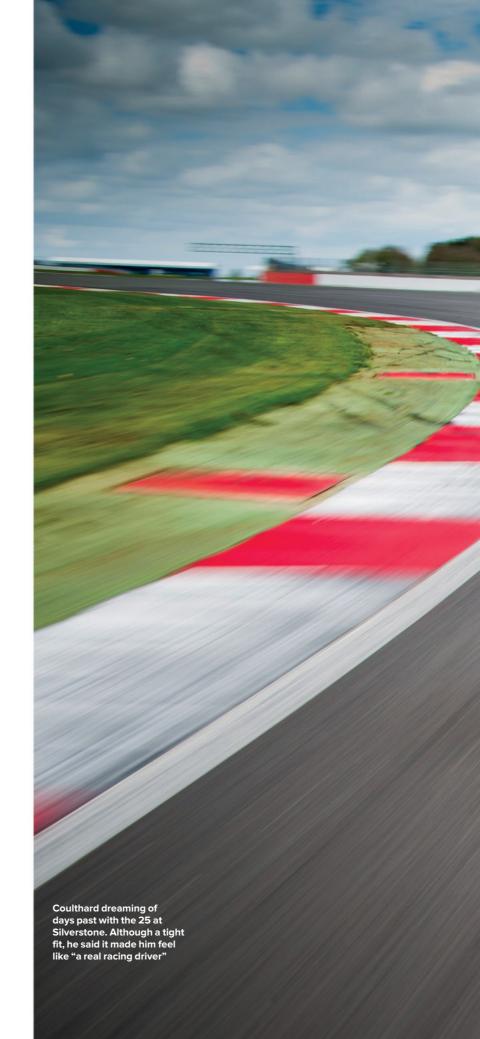
Ten minutes later the temperatures are up. Bob cuts the engine, the car is pushed to the pit door and DC gets out goggles and helmet – not the one we know, but an openfacer painted with the Scottish saltire especially for today. "I couldn't drive Jim's car in a full-face job," he smiles. Belt buckles lock him down and he looks up at Dance. Suddenly a man you'd pass in a crowd and a man who creates a crowd have swapped authority: Coulthard is the tyro, Dance the expert. He's strapped in a hundred drivers before; this is just another F1 winner. He nods, the V8 barks and DC propels the green and yellow machine down the pitlane.

gentle lap, a firmer one, then open throttles as he explores how a car moves on tyres with large slip angles, how it dances on those soft springs. When he returns for a check there's a big crowd. Helmet off, he lets every lens catch a smile, ever the pro, before Bob checks everything and he goes again, some laps for the BBC, some for our photographer, some for himself.

"That was brilliant! Really cool! Never thought I'd be so excited. I feel completely at home. For a moment I almost felt like Jim Clark - then I woke up." The car is back, engine ticking as it cools, shutters clicking as DC extricates his lengthy frame, pulls off the crash hat, tidies his hair in the mirror. "Got another wig somewhere. Oh no, it's Eddie's." All laugh, and the public performance is over; the roller shutter lowers and car and star are secluded for our debrief and photo shoot. Photographer Matt Howell wants to catch DC inspecting the Lotus; that's no effort as he's already asking Cedric and Bob about damper placement, sliding-spline driveshafts, the ducted air screen. Maybe it's for his BBC piece, but then he gets out his phone and takes his own pictures. Later I ask Cedric if Clark was au fait mechanically. "I wouldn't say he had trouble holding a screwdriver, but..."

The BBC steals David back, an unspoken tug of war between us. The cameras are insatiable; a tense director orders DC to walk around the car looking pensive, then the other way, to redo his lines describing that first-lap moment at soaking Spa in '63 when Jim Clark surged from eighth to first to eternal legend, first victory for the 25 that steam-roller season. DC is patient until he makes the same fluff four times and bad words erupt. Maybe he prefers working live, quizzing his peers on the grid, no lines to learn.

My turn again, asking about sitting in such a slim car. "You have great visibility •





but I did feel exposed," DC says. "You feel that at Monaco you could almost reach out and touch the barriers. I was very aware of the tanks wrapped around me, and the hot air blowing up from the cooling system."

"Everything was packed tight inside," adds Cedric. "With the 1.5-litre engine Colin wanted the smallest frontal area so everything came inboard, including the dampers."

"Now I see how drivers from that period drove with straight arms," DC continues. "There's not a lot of load in the steering. A huge amount of lock, but not much load. In a modern F1 car there's so much load and feedback it self-centres; this doesn't, or at least not with the same force, so you have to centre it yourself and be delicate. Hence the straight arms. Made me feel like a real racing driver. Haven't felt like that before..."

A bit of a squeeze? "It was, like the Leyton House I drove – ridiculously small cockpit but once you're doing your thing you don't think about it. It was difficult for me to get to fifth – I had to do a reverse-hand upshift. That would have cost me in a race."

Did he reach for a shift paddle? "Ha, ha! Not once. Thankfully I'm long enough out of F1 that that's no longer my default setting. But the first F1 car I drove, the McLaren in '91, had a manual shift. That V8 – it's not a young engine, but it's smooth. They said I could go to 9000 – I only went to 8.5 but that was useable rpm. For the grip it had it could handle more power; that's just under 200bhp and it would comfortably handle 50 more. But that's what they had."

So he didn't get it sliding... "Nope. Generally it pushes a little at the front. I almost had it drifting at Stowe where it's fast, but I didn't want to find out I'd got that wrong! I'm used to downforce pushing the car into the ground, but without that it moves around so much more. You can feel air under the car. Presumably it generates lift at speed?" he asks Bob.

"If you go fast enough."

"The idea of the high ride was to get the air passing underneath," explains Cedric.

"And it's softly sprung," adds Bob. "The Old Man used to say 'there's no substitute for wheel movement'."

"It certainly moved laterally in a straight line, more affected by the wind than I expected, almost as if it's floating on a current of air. It made me feel a bit uncomfortable in Turn 2, the long, fast left-hander. I'm sure in a classic expert's hands it would be flat, but I didn't want a high-speed rotation. But you'd get used to it; that would be your reality. In the low-speed corners I was starting to play a little with



the brakes and the downshift, feeling really pleased to be behind the wheel."

So it was a pleasure?

"Yes – it's a racing car! Any road car on the track, even the DTMs I've been racing, is still a compromise. This is designed from the start as a racing car, designed to win grands prix. There may be less road feedback, but it delivers both low- and highspeed grip in proportion. A modern GP car develops grip in an out-of-proportion way - at low speed there is relatively little because there's no downforce, but at high speed the level of grip is difficult to comprehend. So a normal person jumping into this could quickly get the feeling of the low-, medium- and high-speed grip. It would still take one of the greats like Jim Clark to balance the lateral forces against the extremes of tyre adhesion, though."

'm conscious he has a plane to catch, but as we talk he never looks at the enormous watch under the sleeve of his fourth clothes change so far.

"What stands out here," he resumes, "is the drivability of that little V8. A modern F1 engine is peaky – you have to rev it constantly and it's annoying. This has only five speeds but you get a journey through the gears that is 100% more pleasurable. You feel the dog going in and you think 'I've just rounded the corners of the dog a little bit and I've got two hours to go...' I know when Jim won here it was 2hrs 14min, where most of my races were 90 minutes."

Clearly he's been doing his research. "I wanted to learn the 25 story because I didn't

know it in detail. My racing history is pretty good from the '70s on when I was watching with my dad, who was a fan of Jim and got his autograph. But I don't have anything from that period in my own museum, not like Dario [Franchitti]. I rang him to boast about this because he's a big, big Clark fan. But the legend is there for good reason. It was a remarkable period in the development of motor sport; the genius of Colin Chapman and the great driving qualities of Clark."

What about some historic racing?

"This was brilliant, but with my lifestyle, all the GPs, not seeing enough of the family, I'm not tempted. But beyond my current career? Why not? I'm a racer. We're sitting at a track in the nice comfortable Silverstone Wing, but if we were sitting on plastic chairs trackside we'd still feel comfortable because racing people go to racetracks. I've been going since I was a kid and I hope to be doing it as an old man."

DC and JC both took the chequered flag here. Did he feel the connection?

"Very much. I actually whooped on Hangar Straight! I've never done that before in a car. It's just how I felt. Pleased and honoured, connected with a piece of history that guided the path of Jim Clark and many British drivers. I'm proud to have done it."

It's airport time. DC punctiliously shakes hands with everyone and strides off towards Spain. Bob and Greg then strap down a priceless element of British racing history in the lorry and head for Norfolk, three hours away. Getting up at 5am is nothing new for the Lotus lads – even if they've been doing it for six decades.

W RENAULD











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Not surprisingly, Renauld's timeless and streamlined looks were quickly adopted by the motor racing elite of the 1960's. Both Jim Clark and Sir John Whitmore favoured the wind-cheating, wrap-around style of Renauld.

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FOREVER

The idea was typically blunt: build a car to blow away the foreign competition.



E N G L A N D

Doug Nye tells the story of the BRM brute that captured the heart of a nation

TAKEN FROM MOTOR SPORT, FEBRUARY 2021



his is far more than just another Grand Prix car. Back in period, 'The BRM' was as much part of British national awareness as today's news of a Covid vaccine. Through the later 1940s, even my mum had heard of 'The BRM' - the 'British Racing Motor'. The relentless publicity promoting it made millions motor racing conscious. It was tipped to win Grands Prix for Britain, smash Johnny Foreigner's racing stranglehold and build national prestige worldwide...

In fact the British Motor Racing Research Trust's public relations office was probably the most effective department of the entire industrial co-operative building the BRM through 1948-51. Seldom have such an inflated reputation and naive expectations been publicly promoted for an as-yet-unbuilt Grand Prix car... But such massive PR backfired badly upon the organisation striving to become a British Mercedes-Benz *Rennabteilung*.

The project budgets adopted in 1945-46 were far outstripped by post-war inflation. Project creator Raymond Mays persuaded the British motor industry's finest to contribute parts for his sensational dream Grand Prix car. But through the cheerless late-1940s, against the backdrop which triggered George Orwell's dystopian fiction Nineteen Eighty-Four, government was exhorting industry to 'export or die'. Toolroom capacity for BRM work was scarce. Delays stretched as inflation burned funding. Target dates were missed and entries cancelled. After the car's launch in December 1949 it proved almost beyond its creators' development capability.

Expectations for this great hope near evaporated upon its 1950 race debut. Failure after so much hype sparked savage denunciation. Newspaper headlines bellowed Blooming Rotten Motor. Such backers as Alfred Owen of the Owen Organisation, Bernard Scott of Lucas, Sir John Black of Standard and 'Tony' Vandervell of Vandervell Products were big fish in their own ponds. Within the supposedly co-operative BMRR Trust, funding and supplying BRM at Bourne, Lincolnshire, consensus was rare. Owen - devout Christian and lay preacher - was the most conciliatory. Only he kept faith in the project's eventual success, and he would nurse BRM to it, but not for 12 more agonising years' struggle.

In fact Owen was a godsend to initiator Mays. 'RM' was responsible for the BRM project's flair, zest and fire - and for some of its early so-public failure. He had, with engineer friend Peter Berthon, co-created the pre-war ERA project with backing from wealthy Humphrey Cook, in 1934.

The 'English Racing Automobile' was effectively the first British production racing car for customer sale. After ERA collapsed in 1939, Mays developed his vision of a new all-British GP car, conceived by Berthon and constructed with British industry money and material. Ray was always dramatic. He certainly loved cutting *la bella figura*. The BRM Project 15 was perhaps Mays/Berthon's greatest stroke of automotive theatre.

Its stunningly complex 135-degree V16 engine, with Rolls-Royce-developed aviation-style two-stage centrifugal supercharging offering higher boost than ever previously applied to a road-racing unit, made it perhaps the most sensational GP car ever. It certainly made a spine-tinglingly sensational noise. The V16 could hit an unprecedented 10,000-

"It had plenty of torque... more than you could put on the road"

II,000rpm, belting out more horsepower per litre than any other racing engine until late '70s turbocharged F1. Long after the 1.5-litre supercharged Formula 1 to which it had been built evaporated, early 1952, the BRM V16's output peaked at over 585bhp - 390bhp per litre. At the time of its design, its best rivals - like the Italian Alfetta - hit 300bhp per litre. Yet Berthon had targeted 500. But it's extraordinary that this pursuit of peak power paid little regard to driveability. Delivering up to 70lbs psi boost the supercharging system made the BRM V16 a wheel-spinning terror.

Where a conventional supercharger has a falling torque curve beyond peak revs, the centrifugal compressor's curve just soared on up until the engine's mechanical limits were exceeded. If wheelspin in a Roots-supercharged car developed at 6,000rpm on an indirect gear, a driver would find that as engine speed rose so blower efficiency would drop, torque moderate and wheelspin diminish. But with the BRM V16, engine speed rising from 7,000rpm to 9,000rpm actually increased torque by a shattering 45 per cent. The more revs, the more boost - runaway

wheelspin, until the shaken *pilote* backed off, or the engine (or the tyres) disintegrated.

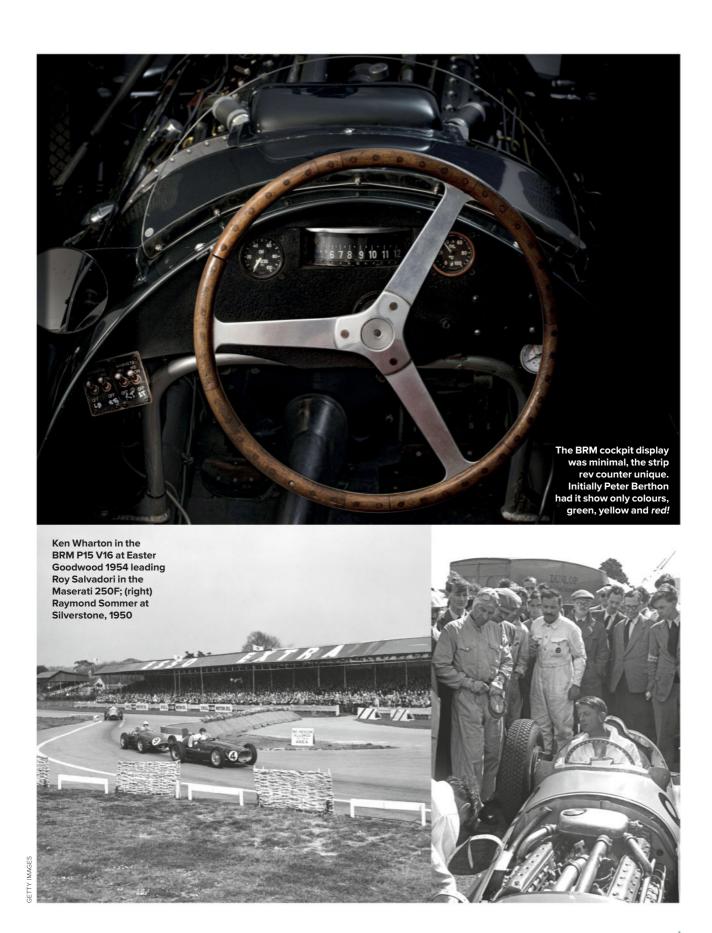
So the BRM's intrepid drivers found it only controllable within a restricted rev range. To be competitive they had to be in the right gear at the right revs, so they were continuously stirring the gearbox. Such stars as Juan Manuel Fangio, José Froilán González, Reg Parnell, Peter Walker and Ken Wharton might have the edge in power, but how much to unleash?

Tony Rudd, in charge of ultimate V16 development, once told me how "the basic problem was that we had an engine as powerful as a modern non-turbo Formula 1 trying to put its power down through a pair of tyres the same size as a Formula Ford... Tyres lived in a world of spin so the compound had to be relatively hard to cope with the high temperatures generated by spin. This led to the engine gaining an undeserved reputation for having no midrange torque due to its centrifugal supercharger. It had plenty of torque... everywhere... more than you could put on the road." Tony knew that from experience as he did much of the V16's testing.

he complex engine itself was effectively two 750cc V8s in tandem, with drive taken from a midship crankshaft gear stepping down to a separate output shaft. Bore and stroke were 49.53x48.26mm, displacing 1,488cc. Each domed piston was twee coffee-cup size. The Rolls-Royce blower drew mixture through two huge SU carburettors. Ultimately, BRM could more or less rely upon 150-200 miles of trouble-free running, up to 585bhp at over 11,500rpm, and deafened adulation from British crowds. Most memorably, these BRM V16s - especially in stub exhaust trim generated decibels on the threshold of pain.

The engine was angled to pass the propshaft left of the driver's seat into a transaxle cribbed from the 1939 Mercedes-Benz W165's. A brake servo pump boosted the four-wheel disc brakes, which BRM pioneered in GP racing. Suspension springing and damping was by ultra-lightweight Lockheed oleo-pneumatic struts. Front suspension featured Porsche-type trailing links; the rear a de Dion arrangement.

On May 13, 1950, the BRM V16 made its public demonstration debut driven by Raymond Mays at the British GP, Silverstone. The smooth-bodied car was sensationally low-built, its original pale-green unlouvred body very handsome. After further testing failures, under Trustee pressure, one car



The motor sport world had seen nothing like the V16 BRM P15 when it was unveiled at Silverstone in 1950. Incredibly powerful and wonderfully raucous, it was an elaborate feat of engineering despite ultimately failing to live up to the PR

ILLUSTRATION TONY MATTHEWS

Thin steel Girling disc brakes.

derived from aviation use,

surface and six circular

servo pump.

with chrome-plated working

friction pads, three clasping each side. Fluid system boosted by engine-driven

DISC BRAKES

SUPERCHARGER

Rolls-Royce two-stage centrifugal supercharger ran at up to 45,500rpm on engine-drive ratio of 3.25:1. Overall package would nearly fit into just a 10in cube, but proposed 'vortex throttling' system with nine swivel vanes within supercharger intake remained a concept only.

CHASSIS FRAME

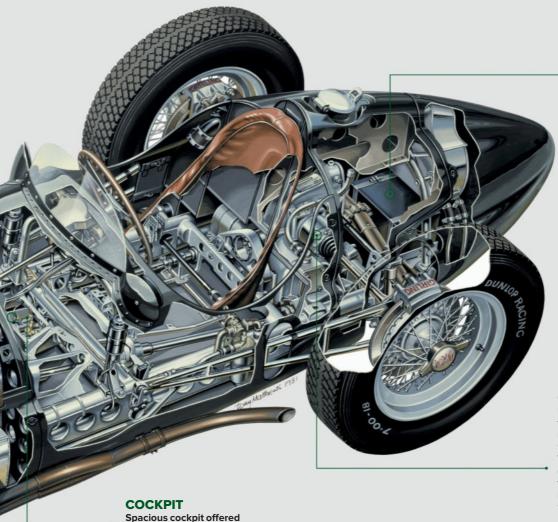
Made by Rubery Owen at Darlaston, West Midlands; 2½in round-section chromemolybdenum main tubes, united by welded-on webbing plates, lightened yet made more rigid by swaged holes.

FRONT SUSPENSION

Porsche-type trailing arm front suspension – de Dion rear suspension used long multi-tube radius rod location fore-and-aft. Suspension medium and damping front and rear by Lockheed oleo-pneumatic struts, weighing a mere 4lbs each.

BRM P15 MARKS I & II: *Libre Life* 1952-55

	Events	Starts	Finishes	Wins	2nd	3rd	4th	5th	Drivers
1952	8	17	7	3	2	2	-	-	Parnell, Fangio, González, Wharton, Moss
1953	11	21	17	6	6	3	1	1	Fangio, González, Parnell, Wharton
1954	13	21	17	5	3	5	4	-	Wharton, Flockhart
1955	6	7	5	2	2	-	-	1	Flockhart, Collins
	38 events	66 starts	47 finishes	16 wins	13x2nds	10x3rds	5x4ths	2x5ths	Only 7 drivers



FUEL TANK

Tail fuel tank capacity varied during development – from 1948 launch-spec 48 gallons in scuttle plus 18-gallon tail tank ahead of smaller tail tank containing gearbox oil.

GEARBOX

Rear-mounted 4-speed transaxle gearbox unit based upon that of 1939 1.5-litre V8 Mercedes-Benz W165. Top speeds in gears on highest available ratios were 95mph in 1st, 115mph in 2nd, 130mph in 3rd and 165mph in 4th.

V16 ENGINE

Highly supercharged 135-degree V16-cylinder engine – upper crankcase half carrying four 4-cylinder blocks cast in RR50 aluminium alloy. Bore 49.53x48.26mm stroke, displacing 1487.76 cc. Ten main-bearing crankshaft, roller-bearing camshafts.

very hot footwell at the pedals – burning both drivers' feet, ankles and shins in 1951 British GP.

> was bundled onto the International Trophy grid at Silverstone, on August 26. French star Raymond Sommer drove, but the car managed only last-moment practice before shearing a transmission joint at flagfall.

> That September, Reg Parnell drove the BRM to win two Goodwood races. The press trumpeted 'the BRM's redemption'. On October 29 two V16s contested the non-Championship Peña Rhin GP, but both retired.

Through 1951 a catalogue of testing failures meant the BRMs appeared for only two races, the British and Italian GPs. Reg Parnell and Peter Walker gallantly finished fifth and seventh at Silverstone, shins burned by cockpit heat. But management created a terrible muddle at Monza. Both cars for Parnell and Hans Stuck non-started. Extensive Monza testing followed, most notably with young driver, Stirling Moss.

Cancellation of BRM entries in the Turin GP early in 1952 then killed Formula 1 as the FIA's favoured World Championship category since Ferrari was left unopposed. World Championship status devolved instead upon Formula 2. Mays' reasoning behind the Turin default centred upon his all-consuming admiration for new superstar, Fangio. Unsure of Alfa Romeo's plans for 1952 he was seeking another berth. He would be in England in April. The team rushed back for him to test the V16. This BRM move was suicidal. Suddenly the BRM V16 was an ex-Grand Prix car - eligible for residual F1 and Formule Libre racing.

The team's 1952 programme - using three P15 Mark I cars - comprised eight races, including the Albi GP in France, Ulster Trophy at Dundrod, a 35-lap *Libre* race supporting the now F2 British GP at Silverstone, and the 67-lap Boreham International.

On August 15, 1952, the Trust admitted defeat, offering the project for sale. Ironically, one week later at Turnberry, the BRM V16 notched its first win since Goodwood 1950.

Again the driver was Reg Parnell. Two further wins followed, at September Goodwood, 'Pampas Bull' González driving. But on October 14 the Trust accepted the only offer received for all BRM assets and liabilities. From November 1, 1952, BRM would be owned by Alfred Owen's family group - the price £23,500.

Through 1953-55 BRM entered its V16s in 48 more Formule Libre races. They began with the existing three long-chassis Mark I ex-F1 cars, once-beautiful body lines longsince lost with huge radiator and multiple panel louvring to cool all that clockwork. But chassis 3 was written-off at Albi '53, though driver Ken Wharton survived. So then there were two...

Wharton won four times for BRM late in 1953, then starred in New Zealand early in 1954. At Easter Goodwood '53, the Mark I V16s had been beaten by a little 2-litre Maserati. Alfred Owen asked Rudd how that could happen? Tony explained that the Maserati was shorter and lighter, and better suited to the wet. Owen responded by ordering two lighter and shorter Libre Project 30 BRM V16 Mark II cars, to use existing engines and transmissions.

The first Mark II 'Sprint Car' used an Accles & Pollock tube purchased by Rudd to build an Aston Martin special. The cars had Morris rack-and-pinion steering, a 92in wheelbase, 6in shorter than the F1 Mark I's, smaller wheels and tail fuel tank.

Ken Wharton gave the first of them a winning debut at Easter Goodwood '54. For the second race that day he swapped to V16 Mark I chassis 2, was rammed by Roy Salvadori's Maserati 250F yet limped to victory. His car was beyond economic repair - a write-off winning a race... a bizarre V16 achievement.

Of the three V16 MkI works GP cars built, only chassis 1 survived. The two MkIIs were driven in 1955 by Peter Collins and Ron Flockhart, the former scoring the last win for a factory V16 at Aintree. The V16 BMR's swansong came at Castle Combe, Flockhart second behind Harry Schell's Vanwall -Britain's contemporary Formula 1 future...

Many enthusiasts missed the sight and sound of these spectacular cars. Today, thanks to the Owen family's enthusiasm, three more long-chassis V16 Grand Prix cars are being built by Hall & Hall to give new generations of race-goers tinnitus. These were the cars that made Great Britain motor racing-minded. Others would bring the ambition over the line, but in 1962 BRM with Graham Hill finally succeeded. Now, in months to come we can celebrate the original project's great, mad, wonderful dream. Just don't forget your earplugs. •

"Wharton's car was beyond repair – a write-off winning a race"





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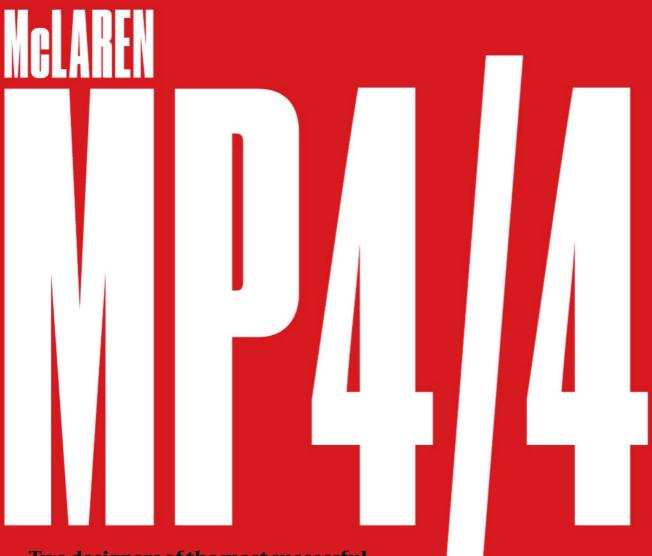




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Two designers of the most successful F1 car of all time, the McLaren MP4/4, explain how it was borne of brilliant creativity and practical thinking

WORDS JAMES ESLON
TAKEN FROM MOTOR SPORT ONLINE, DECEMBER 2022

THE ULTIMATE EXPRE



SSION OF TEAMWORK



or any Formula 1 designers looking back through history in an effort to find the best of the best, scouring chapter after chapter of successes, picking out just one creation can be tricky to say the least.

It's made particularly difficult when you had a hand in producing the ground-breaking McLaren MP4/1, the first grand prix car with a carbon monocoque. Or its eventual follow-up, which Niki Lauda took to a brilliant third title after his incredible comeback. Then again, you could be agonising to choose between the McLaren-Ford Ayrton Senna laid waste to the field with at Donington '93, or the MP4/13 with which Mika Häkkinen claimed his first crown in 2000.

But for former McLaren chief designer Steve Nichols and senior design engineer Matthew Jeffreys, there's little in doubt as to which model they plump for: the devastatingly successful MP4/4, driven by the iconic pairing of Ayrton Senna and Alain Prost in 1988.

Viewed by many F1 fans as the definitive competition car, Nichols calls the most successful grand prix machine of all time the "ultimate expression of teamwork", whilst Jeffreys says it was the "highlight" of a career packed with F1 titles.

Coming towards the end of the turbo era in 1988, the low-slung design stood out from

the rest of the field. Though comparisons have been drawn by Gordon Murray between it and his unsuccessful Brabham BT55, Jeffreys and Nichols explain how it was a pragmatic approach combined with imaginative design solutions which resulted in grand prix brilliance.

However, it was also not without creative flair - after previous technical director John Barnard switched to Ferrari for 1987, the 'kids' below him were suddenly allowed to play with first the evolution of the MP4/3, then the revolutionary MP4/4 - albeit in slightly stressful circumstances.

"We all used this as an opportunity to break out a little bit, do some of the things that we wanted to do," Nichols tells *Motor Sport*. "I wanted to do more, and I think other people in the team wanted to stretch their wings too. I wanted to use all the brainpower

"I wanted to use all the brainpower to take things to a different level" we had to take things to a different level. But it was difficult when John left [before 1987], because we knew following the Porschepowered MP4/3 in 1987, we were going to do a Honda turbo engine for one year and the year after that a naturally aspirated Honda car. Neil Oatley came on board to bolster the design team, with him taking the naturally aspirated '89 car and myself heading up the '88 MP4/4.

"Our total technical staff during that period was 17 people. We had to divide it up into a normally aspirated team and a turbo team, giving me even less people to work with... it was pretty stressful!"

Nichols, with his team of Jeffreys and others, had just eight months to come up with the MP4/4 concept, meaning a machine incorporating a Honda power unit which would soon be out of date. Nevertheless, it didn't stop them from trying out fresh ideas.

"We had stagnated, I thought, a little bit over the years from say, '83 to '86," says Nichols. "We'd maintained the skinny little V-shaped monocoque that was optimised for wider tunnels underneath with ground effect in the post-ground-effect era - I had the impression that John was involved with Ron [Dennis] more on corporate matters, and seemed to be concentrating more on that."

"Steve had always wanted to get rid of the V-shaped monocoque, and by the MP4/4 we had time to do it," explains Jeffreys. •







"It means you can effectively get the fuel lower in the car, because you can make the bottom of the car sort of square-sided, instead of V-shaped, so it drops the centre of gravity of the fuel.

"In that particular case we kind of lucked out a little bit because of the regulations. The reduced size of the engine [Honda being smaller than the TAG-Porsche], the reduced 150L size of the fuel tank that year, the rule which dictated we had to put the driver's feet behind the axle, it all dictated the layout - it just sort of happened."

"We had also been able to make some changes on the MP4/3 which also carried over," points out Nichols. "The MP4/2 had a top radiator outlet, which we changed to the side on the MP4/3 to make it lower and more compact. The rear of the car also maintained the Coke-bottle shape that you can see when looking down from above."

Meanwhile Jeffreys, at the suggestion of Dave North, implemented an ingenious idea to solve a front suspension conundrum - once again following the MP4/4's traits of pragmatism married with lateral thinking.

"I was the project leader composite/ monocoque designer at the time," he explains. "That was my sort of speciality in the late '80s and early '90s. I was also put in charge of the front suspension, which we decided would be pull-rod. After moving around various options, we came up with the idea of putting the spring dampers in vertically, behind the driver's feet.

"It made great packaging sense, kept it low, and there was space to do it - but the problem was this now meant there wasn't space for a conventional sort of rocker [connecting the strut, as with a standard pull-rod suspension].

"I had one of those of coffee discussions with Dave North, when he suggested using tracks instead of a rocker, similar to what was used when he was at Brabham. I thought, 'That's an interesting idea.' However, it was very much my responsibility to deliver the rising rates that Steve wanted, and design a completely new type of front anti-roll bar because the packaging meant it was [a] pretty weird [space] for a conventional one."

Jeffreys has now turned his creative nous to painting incredibly detailed profiles of iconic F1 cars in addition to his engineering work - with many prints signed by legends of F1 such as James Hunt's former team boss Lord Hesketh.

It's fitting that the first car he turned to paint was the MP4/4, a car he "knew a lot about dimensionally - so I was able to draw it pretty accurately!" •

Back in 1987, Jeffreys was tasked by Nichols to use his artistic eye in creating technical drawings to style the bodywork areas not affected by aerodynamic restraints.

Nichols told the *JayEmm on Cars* YouTube channel that he agonised over the diameter of the front nosecone so as to maintain a McLaren "family resemblance", but that the rest of the responsibility went to Jeffreys in making the car aesthetically pleasing.

"Obviously, the aerodynamics, the engineering and the science is the most important thing," Jeffreys says. "But there are some areas which the aerodynamicists say aren't sensitive - it doesn't make a difference. In which case, if you're going to come up with a shape, you might as well make it look nice! That was our philosophy.

"Steven and I think along similar lines - literally, in some respects - in terms of what looks good and what doesn't, the sense of proportion of things. The narrow nose came about because the drivers [in their seating position] went backwards in effect, relative to the front of the car.

"Steve was keen to have a sort of flowing shape, or two rather - the angle of the cam covers and the fuel tank, and the drivers' shoulders, which kind of follow through in the bodywork at a pleasing sort of angle.

"Once that was drawn up, Colin Smith, a design draughtsman, would then meticulously create the bodywork, first producing a wooden buck - essentially a full-scale model - section by section. With a full-size car appearing before your eyes, you can see if it looks a bit weird or whatever - this is how we adjusted the nose."

Completing the design was an old associate of Gordon Murray's to help with the car's unique packaging.

"Where Gordon did contribute was that he brought in Pete Weisman to work on the step gear that was required for the gearbox, because the crankshaft was low," says Jeffreys. "Having said that, it was mainly Dave North who did the detail and design of it."

Getting it all to work together though, and in such a short period of time, wasn't quite so simple.

"I'd be at the factory until 10:45pm every night - because that's just before McDonald's closed!" laughs Nichols.

"Everybody was so good on every level. The manufacturing guys, the laminating, the

"I'd be at the factory until just before McDonald's shut" race team, the huge amount of effort that went into the testing programme and the Japanese test team, they threw everything at it - it was phenomenal.

"It was such a blessing for all people to be donating their time, coming in on the weekend to get it done, doing it for free because they wanted to. The MP4/4 was, to me, the ultimate expression of teamwork."

It certainly could be argued to be just that. That 1988 season will live long in the record books - unless Red Bull has anything extra to say about it, see right - as being the most dominant grand prix season of all time. Allied to two of the best drivers ever in Senna and Prost, the MP4/4 won 15 wins out of 16 races, scored 15 pole positions and set 10 fastest laps. Senna would win eight times on his way to the title, with Prost topping the rostrum seven times, missing out to his rival by just three points. Of their closest challengers, only Ferrari got a look-in, winning (conveniently) on home soil at Monza with Gerhard Berger. The Austrian would finish third in the drivers' championship, but with less than half the points of second-placed Prost. Ferrari would be runner-up in the constructors' but with a paltry 65 points to McLaren's 199. The rest were nowhere. In total six MP4/4 chassis were created, and all but the test car were driven to grand prix wins. Design creativity that, in 1988, couldn't be beat. •



TOGRAPHY GETTY IMAGES



Why record-breaking Red Bull RB19 still doesn't top McLaren

The RB19 is one of the most dominant F1 cars ever. But as *Mark Hughes* points out, McLaren's scale of advantage in 1988 was on another level

ed Bull's 2023 season will take some beating. A total of 21 wins across 22 grands prix – 19 going to runaway champion Verstappen, against a feeble two for team-mate Sergio Pérez – putting the RB19 into the record books. Red Bull also racked up 14 straight grand prix wins, eclipsing McLaren's 11 with the MP4/4.

There are a lot of parallels between the two seasons. Utter dominance broken only by a single Ferrari win being a glaring one. But before we delve too much into historical stats, a bit of book-keeping: Ferrari actually took 14 consecutive world championship grand prix victories in 1952-53. It's been not classed as a record because the world championship at that time also included the Indianapolis 500, a totally different category contested by a different bunch of participants. So, Ferrari did not win 14 consecutive rounds of the world championship because of that anomaly. But the Indy 500 was not a grand prix so Ferrari does still equally hold the record for the longest run of consecutive championship-status grand prix wins.

So, can the MP4/4 still be classed as the sport's greatest-ever machine? Yes, as generally McLaren's scale of advantage over the 1988 competition was of an entirely different league to Red Bull's in '23.

Toto Wolff commented the 2023 Red Bull was like a car from a higher category and the rest are racing F2 cars. That's an exaggeration, of course, but applied to the 1988 McLaren it would not have been. Its qualifying advantage over the secondfastest car (Ferrari) was 1.47% (around 1.3sec), but its race advantage was way bigger as the Ferrari could not run the distance at full boost on its fuel allocation whereas the McLaren could. Red Bull's advantage in 2023 was nowhere close.

What was the source of the McLaren's staggering advantage? The biggest factor was Honda and how it reacted to the extreme rules for turbo engines in their final year. At the end of 1985 the FIA had announced a multi-year regulation glide path, with progressively greater restrictions applied to the 1.5-litre turbos year-on-year, the idea being that by the final year of '88, the naturally-aspirated 3.5-litre with far fewer restrictions would be the obvious choice. Honda thought otherwise and while it worked on its secret new V10 for 1989, it created a totally new V6 turbo specifically around the 1988 regulations, even though it knew it would be obsolete by season end.

Designated the RA168E, it was a masterpiece. The '88 regulations reduced the boost limit from 4-bar to 2.5, and restricted fuel to 150 litres, down from 195L. Non-turbo cars were allowed 215L. Further, the minimum weight for turbo cars was set 40kg higher than for the 'atmos'.

To achieve the required efficiency Honda reduced the size of the combustion chamber, increasing the compression ratio massively for more thorough burning. A special blend of fuel was developed. The detonation limit was raised by extremely effective cooling of the cylinder heads, with water galleries on the inner (cooler) side of the head. On the block they were located on the outside, so as to absorb less heat. This facilitated more uniform heat distribution around the cylinders and combustion chambers.

The end result was a beautifully compact engine which delivered around 100bhp more than the best naturally-aspirated motors. A 17% power advantage is something Red Bull today could only dream of. But it wasn't only power, it was efficient power. It could run with the full 2.5-bar boost throughout most races without needing more than 150L of fuel.

Look at Hungary 1988. Senna won ahead of Prost, around half-a-minute clear of Thierry Boutsen's third-place Benetton-Ford and 90sec clear of the fourth place Ferrari of Gerhard Berger. Verstappen's victory margin of 34s over Lando Norris' McLaren there last year was comparable, but that was Verstappen's biggest winning margin of the season. Hungary '88 was one of the smallest margins for the McLaren.

Red Bull head Christian Horner was 14 when McLaren set that 11 consecutive wins record (which could have been 16 but for Senna's collision when lapping Jean-Louis Schlesser at Monza). Amid congratulating his own team for its efforts, he was quick to acknowledge the common link of the two eras: "I think we have to congratulate Honda as well, because they've done it twice now," he said. "They were 35 years apart, but we have to take our hat off to Honda for that contribution."

PHOTOGRAPHY LYNDON MCNEIL / TAKEN FROM MOTOR SPORT, AUGUST 2019



To celebrate 100 years of one of Britain's greatest marques we gathered together three of its most famous racers from three very different racing eras. In a world exclusive, *Andrew Frankel* channelled his inner Bentley Boy for a track test like no other





his is quite something: the first time that cars from all three eras of Bentley's racing history have been driven together. Each has their claim to fame: the GT3 is Bentley's latest competition car, a state of the art racer in the most competitive category of sports car racing. The old Blower is not merely Sir Henry Birkin's own car, not only the one in which he led Le Mans in 1930, but the one that exists today as the most original of all racing

vintage Bentleys. And the one that sits in the middle chronologically? It's the 2003 Le Mans winner - not one of a type of car that won that race, but *the* actual winner.

They have come together at Silverstone to celebrate Bentley's centenary. It's not true that Bentley has always been a racing brand - for 71 of those 100 years Bentley did not race at all. But racing was there from the start - indeed Bentley raced long before it got around to delivering a car to a paying customer in September 1921. Over the

decade that followed, Bentley put Britain on the racing map. True, Bugatti and Alfa Romeo dominated grand prix racing, but Bentley's five wins at Le Mans between 1924-30 announced Britain's presence on the global racing stage, a position from where the country has rarely looked back.

It was Rolls-Royce which denied Bentley the opportunity to race after it hoovered up the bankrupt company in 1931. Had it been Napier as originally intended, Bentley might not have had to wait a lifetime before

Bentley through the ages





1919 Bentley Motors founded at Cricklewood, London, by brothers Walter Owen (left) and Horace M Bentley. New 3-litre Bentley runs for the first time in 1920, a robust 16-valve four that hints at WO's locomotive apprenticeship. First car delivered in 1921; gains reputation for performance and reliability.

1922 After racing at Brooklands, Bentley enters a 3-litre at the Indianapolis 500 and wins the team award in the Tourist Trophy. In 1923 Duff and Clement's private Bentley finishes fourth at the inaugural Le Mans 24 Hours. One year on a 3-litre wins Le Mans, and again in 1927 and '28 – but financial struggles begin.



returning to the track. But when it did under Volkswagen ownership in 2001, the results were swift, culminating in that 2003 Le Mans win, breaking the records for both the greatest distance covered in the 24 hours and the shortest time spent in the pits. Fast and reliable: WO would have been buzzing with pride.

Many still regard the decision not to defend the title in 2004 as a mistake, as the car would certainly have still been favourite to win. But by then VW had spent hundreds of millions designing a new Bentley road car, transforming the factory and putting Bentley back on the top step of Le Mans. It was time for the outbound flow of money to be reversed.

How then to regard the GT3? In some respects it's Bentley's most successful racer yet. It's the first to be sold as a racing car to private customers - although in the 1920s plenty raced theirs, including John Duff who took Bentley's first victory at Le Mans in his - and across five seasons the first-generation

GT3 car won 45 races and earned over 120 visits to the podium. And this all-new second-generation car is quicker still.

If there is one thing that links them it is Bentley's claim that as a factory team it never entered a race it did not have a chance of winning outright. So, glossing over Bentley's first international race - the 1922 Indy 500 in which it finished stone last - we'll move swiftly forward eight years to the other end of the original Bentley company's racing endeavours.

1926 Diamond millionaire Woolf Barnato (right) steps in as financier and chairman of the ailing firm, and works driver.

New 6½-litre announced.



1927 To replace the ageing
3-litre a 4½-litre car is
released, while the
180bhp Speed Six
6½-litre will go on to
be the firm's most
successful competition
car, winning Le Mans in
1929 and '30 with
Barnato.

1929 Supercharged 'Blower', developed by Sir Henry Birkin, released, but suffers from poor reliability. Only Birkin's single-seater has any track credit, although he takes a Blower to second in the 1930 GP de Pau. Nevertheless the model becomes a marque icon.

1930 Despite serious finance problems following the Wall Street Crash, WO develops 4-litre and 8-litre cars. Now seen as his masterpiece, the latter is a rival to Rolls-Royce's Phantom but cannot save the firm; in July 1931 WO and Barnato are forced to sell up, and Rolls secretly buys it.



tis Le Mans 1930 and you are Sir Henry 'Tim' Birkin. With the money of a wealthy lady called Dorothy Paget, you have taken the 4 1/2-litre Bentley and fitted an Amherst Villiers supercharger. WO Bentley is livid and can be heard muttering, 'to supercharge a Bentley is to pervert its design and corrupt its performance'. It doesn't matter - WO lost control of his company years ago and chairman Woolf Barnato is delighted.

So you are happy for your two-car private entry to unite with the three works Speed Six Bentleys against a common foe the like of which has never been seen at Le Mans. A Mercedes-Benz SSK whose 7-litre engine is not only larger than that in the 6 1/2-litre Speed Sixes, it's supercharged too. Worse, at its wheel is Rudi Caracciola, Germany's finest driver. Your job is to break it.

So you go haring after it. Unlike your supercharger, the Mercedes' is summoned by clutch according to need. Its engine is designed to tolerate the stress only briefly. So the game is make Caracciola use his blower all the time. Within three laps you've caught the huge Benz on the Mulsanne Straight. The road is narrow and the SSK is

"It starts instantly with what is know as 'that bloody thump'"

in the middle. But you're doing 125mph and gaining. But then a rear tyre throws its tread mangling your wing as it exits the scene. What should you do? Limp back to the pits, obviously. Obvious unless you're Birkin: what you actually do is sail past the Mercedes, half on the grass. You do not stop at the pits; instead you break the lap record.

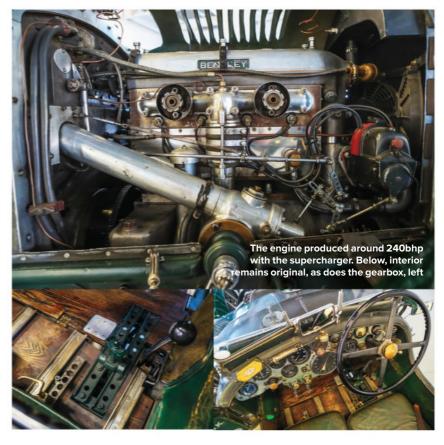
Birkin didn't win this or any other race in a Blower, nor did anyone else. But as a child, that story more than any other lit my imagination, and in some small but significant way started me on a path that led to Silverstone and that very car.

Unlike the car that did win that race, Old Number One, whose identity required a court case to settle so 'evolved' had it become, there's never been any doubt concerning the number two team Blower, UU5872. It's only had one significant accident, and that was before that fateful

Le Mans, for which it was rebuilt in the form seen here. For most of its life it belonged to the Sears family - Stanley, Jack and David whose credentials speak for themselves. It was bought back by Bentley with VW's money and has since been maintained, but not restored. In its imperfect and oily state, it is perfect. There are the pedals pressed by Birkin, and there is the splat of instruments that, knowing what I do of him, he would have in all probability ignored.

Magnetos on, ignition retarded, thumb the button and it starts instantly with the noise referred to in Bentley circles as 'that bloody thump'. Like most vintage Bentleys, its accelerator is the middle pedal. The gearbox contains massive cogs that require precision timing if they are to mesh without protest. You just have to learn the ratios - a big pause between first and second, as fast as your hands can move between second





and third and something between the two for selecting top, remembering to doubledeclutch always and apply the appropriate rev-match throttle blip on the way down.

You can see why it was quick at Le Mans: the Silverstone International Circuit has a good blend of fast and slow corners and the quicker you're going the happier it is. In the slowest turns it feels cumbersome, not just because of its age and tyres, but because that huge blower slung out ahead of the

front wheels adds considerable mass to an already extremely nose-heavy car. Relative to its performance the drum brakes aren't great either, and would need management if they were to last.

But get it percolating in third and top gear and the old Bentley is magnificent. It has around 240bhp, over double what a standard unsupercharged 4 1/2-litre generates, and it will get to around 90mph down the Hangar Straight, despite a slower entry and lengthy braking zone. What you want is a mile or three of Mulsanne so you can watch that gorgeous chronometric Jaeger speedometer flick into three figures and beyond, engine bellowing, steering shaking, hunched down below the aero screens, hoping that the tyres can take the punishment, reeling in that damn Mercedes ahead...

It's hard to drive this car and not get an attack of the Birkins. •

Bentley through the ages

1931-1939

1931 Rolls-Royce forms Bentley Motors Ltd, with production of a new 'Silent Sportscar' restarting at Derby in 1933. It is built alongside

Rolls-Royce products, sharing chassis and engine variants, all with coach-built bodies and a straight-six 3½-litre engine developed from Rolls-Royce 20/25, enlarged in 1936 to 4¼. No more works racing, though Eddie Hall races his car in three TTs; Bentley becomes the sporting RR alternative. In 1935 WO leaves for Lagonda.

1939 Capable of 120mph, a streamlined Portout-bodied 4¼ is built for amateur racer

Nicky Embiricos as a test-bed for a future Continental design (above). MkV model with independent front suspension introduced but almost immediately Bentley production ceases for war. Experimental one-off Corniche crashes in high-speed testing in France; waiting in Dieppe for shipment home it is destroyed by bombs. Only 17 MkVs built – the last Derby Bentleys.



ot so the GT3. If the Blower is a car you drive with your heart, the GT3 requires a diametrically opposed approach. If challenged to drive the old Blower as fast as I could, I reckon it would need three or four laps to do a time I could not significantly improve. I doubt I'd be able to say the same of the GT3 after an entire day.

It's not that the intervening 90 years have somehow made racing cars more difficult to drive, on the contrary: driving a modern GT3 car almost as fast as it can go is simplicity itself. And the only downside to that is that come race day you'll come nowhere.

This second generation of Bentley Continental was a far easier car to turn into a competitive GT3 machine than the first, because it's based on the same aluminium-intensive platform as the Porsche Panamera. It is a fundamentally lighter car whose primary components are more easily sited for racing. Most importantly, a greater rear weight bias has been achieved because the old car was significantly limited for traction. It's more efficient through the air too, and easier for gentlemen drivers to manage in

tough conditions. It's also so light it will carry ballast everywhere it races, a strange thing to say about a Bentley. But some nice touches from Crewe remain, such as leather door pulls and paddle shifters from the Mulsanne limousine.

The cockpit is sparse and less space-age in appearance than some rivals, but there's still a vast array of knobs and switches, few of which I will need today. The seating position is fixed both to aid ingress and exit and also to centralise one of the car's heavier components - the driver. Instead the wheel

and pedals now come to you. I'm told the engine has been made quieter, but when it starts the 4-litre twin-turbo V8 still sounds like the charges going off under a high-rise building rigged for demolition. But you can't just pull away. The clutch is on the steering wheel and is, in effect, a large switch.

There's no skill in what happens next: you engage launch mode with your hand gripping the clutch against the circumference of the wheel, put your foot hard on the accelerator and let go. But there is just a little courage needed because if you

Bentley through the ages

1946-1980

1946 Production resumes at Crewe with 4¼-litre MkVI, first Bentley to be sold with factory steel body. Improved 4½-litre R-type follows, then streamlined Continental of 1952 (below) – "the fastest saloon in the world". Soltan Hay enters the Embiricos car in the first postwar Le Mans race, finishing sixth, plus the next two events.







"It's on the brakes that this modern GT3 feels most alien"

lift for an instant, the car stalls. So you keep your foot down and slither up the pit lane with smoke pouring out of your wheel arches. There appears to be no other way.

It's strange, then, that it doesn't feel that quick in a straight line. A supercar like a McLaren 720S would stay with it once the wheels stopped spinning and come past as the drag of the Bentley's wings started to tell. You thunder down the straight, feeding it gear after gear, but there's nothing otherworldly here, not yet at least. That all comes in the braking where it doesn't matter how

hard you hit the pedal because you're not going to trigger the ABS at high speed. To anyone used to road cars, or even old racing cars, this is where a modern GT3 car feels most alien. For a corner like Stowe you brake barely before the turning point, staying on the pedal all the way to the apex, but bleeding off the pressure as the downforce washes away.

Then it's just a question of how hard do you dare get back on the throttle, and how soon? So long as you've not dialled up too much traction control (which cleverly lets

you control not only the level of intervention but the point of activation too), the car will slide amiably enough, but without time to talk to the engineers, study the data and learn how the tyre behaves over a stint, I don't have a feel for the best way to get the most from it.

Before I'd even think about racing it I'd want a stack of tuition, not in how to control it on the limit because it's an entirely forgiving car, but how to extract the best possible lap time from it. That's a subtly but significantly different thing. •

1955 S-series Bentley introduced, identical to Rolls-Royce Silver Cloud barring grille and trim, with 4.9-litre six, upgraded to 6.2-litre V8 in 1959 (S2); twin-headlamp S3 followed in 1962. Coach-built bodies still available.



1965 T-series introduced (above) – first unitary-bodied Bentley. Two-door saloon unique to Bentley but four-door almost identical to Rolls-Royce Shadow, beginning a slide in the marque's distinctive identity and prestige. In fact, 95 per cent of buyers opted for the RR badged version.

1980 Following collapse and nationalisation of Rolls-Royce parent group, Vickers acquires Rolls-Royce cars and Bentley; launches Mulsanne as Bentley version of Rolls-Royce Spirit; Turbo two years later begins moves to differentiate Bentley again, with performance variants up to 400bhp Turbo RT taking the marque into 1990s and arrival of Arnage with Cosworth-developed turbo BMW V8. Bentley/Rolls-Royce sales now equal.



nd then there is the Speed 8. I've loved the other two, but I know vintage Bentleys well and I must have driven a dozen GT3 cars over the years. But the actual Le Manswinning Speed 8, the car in whose pit I camped for the entire race, whose drivers I interviewed and whose mechanics I annoyed? This is something else.

The car was designed from scratch for the 2003 season, its rather more conservative EXP Speed 8 predecessor having been raced in 2001 and 2002. And yet there are still those who'll blithely tell you any Speed 8 is 'just an Audi R8 with the roof'. It's not and never was, not even in 2001.

"It's just sheer bloody ignorance," its designer Peter Elleray told me. He had designed the R8C that raced without success in 1999, and people made far too great a mental leap. So I got him to put it in words anyone can understand: "Yes, we had that knowledge [from the Audi project]. But engine aside, there was not a single thing on the Bentley that had anything to do with the R8C or any other Audi."

It's a ridiculously hard car to get into, and once in there's a whole new level of intimidation. I can remember in 2003

peering at its LCD screens and steering wheel buttons and thinking it looked spaceage, but compared to a modern LMP1 car it's seriously starting to show its age. But at least it has three pedals in its footwell.

A modern Le Mans prototype requires dozens of people to run it, but this one fires up angrily but easily at the push of the button. Its voice is metal-on-metal ugly, the harsh bark of its flat-plane crank sitting in stark contrast to the fabulous growl and howl of the cross-plane GT3 motor. The clutch strategy could barely be more different either: a tiny bit of throttle until

you feel it bite, then just roll gently off the pedal before touching the gas.

Guy Smith, the only man to have raced both a Speed 8 and a GT3 Bentley, has been full of reassurance: "It's a lovely car; the harder you go, the better it gets. You have nothing to worry about - just trust it and you'll be fine." But it's scary in here. It's incredibly claustrophobic, the extremities of the car are hard to judge and every time I touch the accelerator it goes nuts - 600bhp tends to do that to 900kg of car.

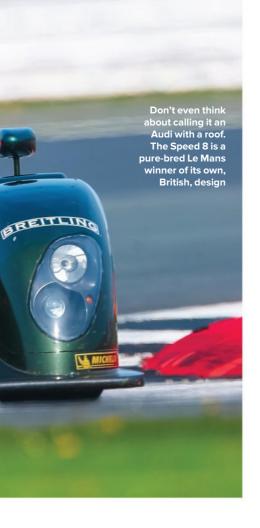
The steering feels kart-like in its directness. It's lighter to handle than I

Bentley through the ages

1998-2019

1998 Vickers sells its automotive arm; BMW buys Rolls-Royce while VW group buys Bentley, separating the marques for first time since 1931. VW reverts to Bentley Turbo R V8 in Arnage as a stopgap, with improvements up to final 500bhp model of 2009.

2001 There's a works Bentley at Le Mans for the first time since 1930 – the 4-litre twin-turbo V8 Speed 8 EXP. It finishes third overall, behind the winning Audis, winning the LMGTP class in the process.



With 600bhp on tap and weighing only 900kg, the Speed 8 is stunningly quick

expected and despite Guy's calming words I don't feel at home in here. But nor should it be reassuring for those who drive it slowly: a GT3 might tolerate being handled like it's a bomb waiting to explode, because ultimately it's based on a street car and comes with a street engine. The Speed 8 is not. If you're to find out anything other than how to scare yourself, you have to drive it.

So I do. I forget its value, its history and instead just go as hard and fast as I dare: in a car like this it is the only way. And here's the truth: this now quite old racing car is on another level to anything else I've driven,

including Group C cars. The straight-line speed normalises quite rapidly and I've driven plenty that accelerate more quickly, but the brakes and grip are barely believable.

I'm told it will corner faster on wets than the GT3 does on slicks, and I believe it. It's probably doing 170mph at the end of the Hangar Straight, yet even ignoring what seems to be a sensible braking point, counting a bit, counting a bit more and only then braking and turning in, it still hits its marks every time.

And I can start to see what Guy means: above all the car is surreally stable: while the GT3 likes a big, physical fight, the Speed 8 is best at doing what it's told. Because it's so fast and intimidating and develops such enormous downforce, you just presume it's going to be impossibly hard to drive. But it's not. Smith says that even when you're extracting a time from it, it's always on your side.

I'd love to have learned more, more about its quick corner apex speed, how best

to manage the brakes and how it behaves when it really starts to slide, but beyond a touch of understeer in the slowest corners, it just went where I pointed it.

Driving home, I wondered which of these Bentleys spanning 90 years of competition I'd drive again. Would it be the GT3, but in a real race? It's mighty tempting and with some tuition I know how much I'd enjoy the experience. Or the old Blower, just for the sense of occasion, knowing what it is, and who once sat in that seat?

But no, it's the Speed 8, and not just because it's the one about which I still have the most to learn. Racing cars that were never designed to be anything else are just different; wonderful though they are, the road-based origins of both the Blower and the GT3 are clear. The Speed 8 is a car of simply exquisite purity and focus. It's also a card-carrying Le Mans winner. To me that fact alone makes it one of the most special cars anyone could hope to drive. •



2003 The evolved Speed 8 takes a resounding overall victory at Le Mans, scoring a one-two finish in its third and final year of participation. New era two-door Continental GT coupé and convertible launched, with VW W12 motor and 4WD – first sports Bentley for years, revitalising Bentley's sporting image.

2010 New Continental adds turbo V8 to range, with super-high performance variants topping 200mph, while opulent four-door Mulsanne saloon, powered by a radically modernised descendant of the 6.75-litre turbo V8, forms Bentley's Rolls-Royce rival.



2013 Bentley enters GT racing with Continental GT3, beginning a long and successful programme that continues today, including team victories in Blancpain and British GT in 2017.

2019 Bentley celebrates 100 years since WO founded the company in North London, creating a legend that has carried through to the modern day.

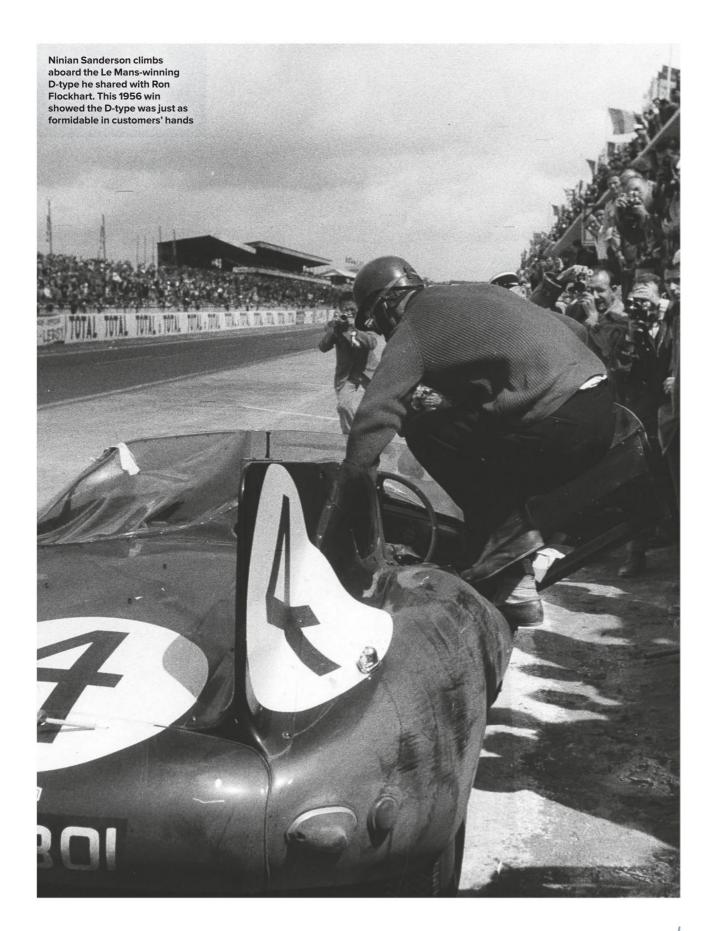
JAGUAR

It wasn't simply one of the greatest racing cars of the 1950s, it's in with a shout of being the greatest racing car of all-time. Fusing aerospace technology with track know-how, Jaguar created a legend that whitewashed its rivals at Le Mans and moved the sport forwards

WORDS KEITH HOWARD
TAKEN FROM MOTOR SPORT, JUNE 2004









own the decades numerous cars have claimed to draw inspiration from the aerospace industry, but few have done so with the conspicuous success of Jaguar's D-type. In the wider car industry of the 1950s, aeroplane influences would become associated with silly styling extravagances on American road cars whereas - for all its undeniable beauty - Jaguar's racing successor to the C-type was designed by Malcolm Sayer on strictly Bauhaus principles. Form followed function - but it so happened that the form determined by aerodynamic principles turned out to be ravishing to the eye.

The D-type had its origins in the one-off C/D prototype that Jaguar built in 1953 as a

first step towards creating a successor to its C-type. The latter had won Le Mans for a second time that year, not least because it pioneered the new technology of disc brakes. Jaguar understood that its replacement would have to continue the theme of technological advancement, but this time its most obvious manifestation would be in the way the car was constructed.

In the words of Norman Dewis, Jaguar's chief development driver: "When we moved away from the C-type – the D was different in its centre of gravity, its steering geometry and things like that, as well as its construction – we moved into a new era of sportscar design. The concept of the D entirely breaks away from the old tradition of a complete chassis frame: it had a shorter wheelbase,

"We moved into a new era of sportscar design with the Jaguar D-type"



was lower and, because of its structure, had much better handling than the C. You could feel it straight away."

Sayer's innovation was to use an elliptical-in-cross-section, stressed-skin cockpit tub built mostly in 16swg (1.6mm) aluminium alloy, the rear bulkhead of which carried the rear suspension pickup points. Running forward from this bulkhead was a substantial W-shaped triangulated frame. In the C/D interim this was made from magnesium alloy using argon arc welding, but this method was abandoned when the welds proved porous, casting doubts on the structure's longevity.

Ahead of and behind the cockpit tub, the sumptuously curved body panels were shaped purely for aerodynamic efficiency, the C-type edict that the car should resemble Jaguar's road-going models having by now been rejected. When a fin was added behind the headrest to improve directional stability in crosswinds, the car's image as an aircraft on wheels became obvious.

The D-type's record at Le Mans – three wins in the four years from 1954 to '57, albeit only one of those by a works car – is eloquent justification of Sayer's excellent chassis and aerodynamic design in particular, but also of Jaguar's racing programme in general.

Any successful racing team depends as much on the meticulousness of its preparation as the inspiration of its designers, and Jaguar was no different. The D-type won races not just because of its fine engine, slippery aerodynamics and advanced construction, but because Jaguar had also

made the car as bomb-proof as possible. As residents living near MIRAs test track south of Nuneaton could testify, the car ran there day and night, clocking up the development miles that would ensure it was as durable as it was fast. Had it not been for this, the D-type's history might have been very different. Instead of its forward thinking being a source of admiration, traditionalists would have shaken their heads knowingly and delivered aphorisms on the theme of sticking to the tried and tested.

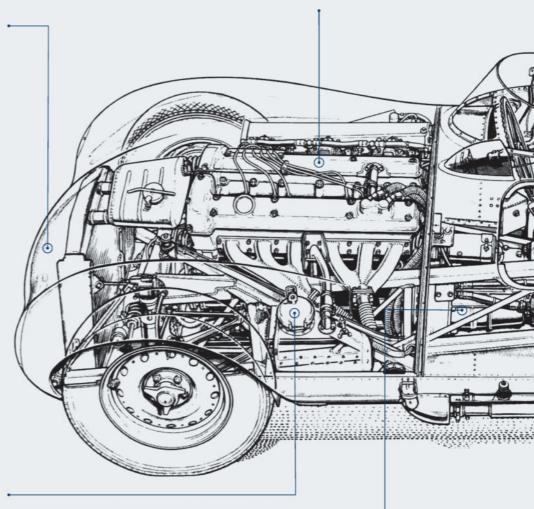
But Sayer and Dewis, under the patronage of Sir William Lyons, were proved right. In the 50 years since the D-type first graced Europe's race circuits, this extraordinary car has cemented its place in history as one of the finest ever.

BODYWORK

For 1955, the body gained a longer nose than shown here, in order to reduce the car's aerodynamic drag. The engine was also modified with new valve angles and a revised inlet manifold, changes which Dewis recalls, "gave us 26-28bhp more, which put us up to about 298bhp. In 1955, I pulled 192mph down the Mulsanne whereas the previous year we did something like 180mph. So there was a big difference." Although Norman can't recall the improvement in drag co-efficient, we can estimate it from those power and speed figures. To achieve 180mph with 270bhp the car's CdA must have been about 0.60m sq: to make 192mph with 298bhp it must have been reduced to about 0.54m sq, and that's roughly a nine per cent improvement.

ENGINEERING RELIABILITY

A major contributor to D-type reliability was Norman Dewis' memory:
"When we went over for the Le Mans test weekend I occasionally drove, and I was always a reserve for the race. Engine man Bob Knight said,
'Norman, give us the gear and revs you use for each corner' So after so many laps I'd come in and give him this info – I had to keep it in my head – then go out again, gather some more. So we built up a picture of what the car did for one lap. For the next year we set a target lap time, then built a histogram that told us we'd be running at, say, 2000rpm for so long at full throttle and so long at half-throttle, throughout the rev range. Then we simulated that on the dyno. If there was a failure they'd run the test again until the engine could run that histogram reliably. Other teams didn't know we were doing this and I don't think they did it themselves."



LUBRICATION

The D's straight-six XK was fitted with dry-sump lubrication. "That was a big change. With the wet sump [on the C-type] we had problems with oil surge exposing the oil pump's pick-up pipe so it sucked in air. A 1g stop would also throw all the oil to the front of the sump where the timing chains would pick it up and fling it into the head. We knew we had a problem there, but fortunately we just scraped through on it. Although we didn't have engine reliability problems, it could get worrying. We tried different baffle systems with flaps that would open and shut under differing conditions of cornering, braking and acceleration. It worked pretty well, but the dry sump system was much better'

TRANSMISSION

Although not strictly necessary, synchromesh was fitted to first gear.

"We didn't need it at Le Mans or Reims or Spa. But some of the drivers thought they might need bottom gear occasionally, so we made it all-synchro for that purpose. The ratio was so low you could almost start the car in second anyway." The 'box was criticised by some drivers, but Dewis defends it: "The engine and gearbox were two beautiful units that could stand hammering all day long. You could have gone 48 hours, never mind 24. In fact, I'd already done almost 48 hours to ensure we'd last 24!" But the transmission did have a habit of jumping out of second, eventually prevented by fitting a clutch interlock mechanism. "I never understood why Jock Thompson, who designed the gearbox, never got second gear right.

The locking device was an afterthought, but it worked."

Under the skin of the D-type

Jaguar mainstay *Norman Dewis* walks us round one of racing's greats



REAR FIN

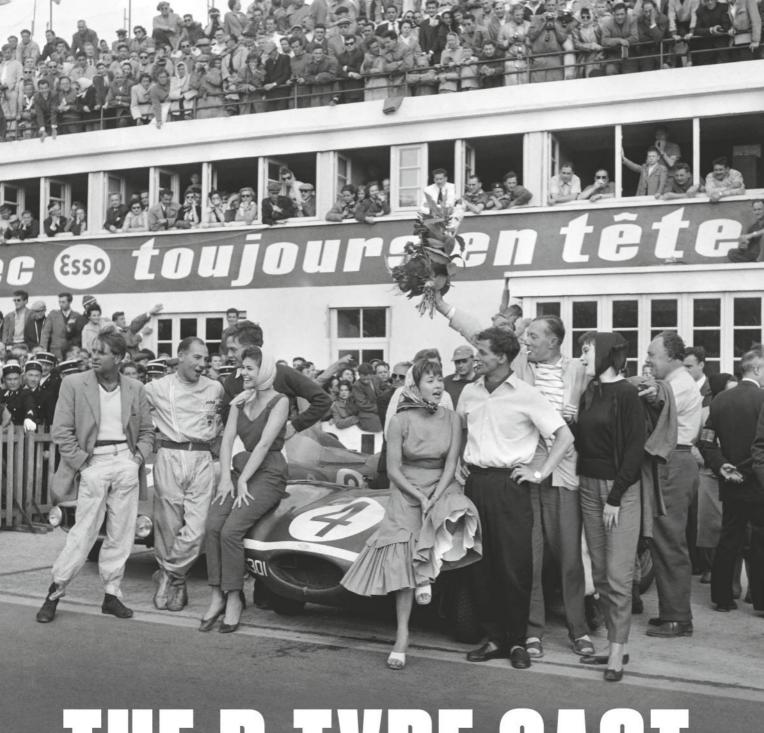
"The first D-type I had was fitted with the head fairing only, no fin. Towards the end of its development - we'd done all the wind tunnel and wool tuft tests — I was doing a six-hour endurance test at MIRA. As I was coming off the banking, doing about 165mph, suddenly the car twitched down the straight. I went to the control tower, looked at the wind direction, and noticed that on this straight we had a crosswind hitting me at about 45 degrees. When I got back I said to Malcolm Sayer, 'Are we sure about the car's stability in crosswinds?' We waited until conditions were more or less the same, took the car out again and found that it was the wind that was causing this effect. So Malcolm placed a fin behind the headrest. We tried various sizes: we started with a small one and increased it up to the size you see here."

REAR AXLE

The rear axle, carried over from the C-type, was criticised by those who thought the car deserved better. Certainly it had its limitations, although Norman Dewis recalls it was well enough suited to the D-type's main role: "We wanted to win endurance races at big circuits like Le Mans and Reims. That's where we scored. On the short circuits we didn't do too badly, but the D-type was not the right car for them. We had traction problems in tight corners or any corner with a bump. There were a lot of bumps at Silverstone in those days and the car would jump from one to the next. Also we'd get inside-wheel lift. Today the car is beautiful on short circuits like Silverstone and Goodwood because they have billiard-table surfaces. I warned Nigel Webb, who owns XKD 505, the car that won Le Mans in 1955, that the D-type wasn't ideal for this sort of track, but Win Percy drove it and said it was marvellous. He could get the back out and it was controllable because there were no bumps."

DISC WHEELS

A distinctive D-type feature was its Dunlop aluminium-alloy disc wheels. "They were lighter, yes, but the other big point was their stiffness. The wire wheels had always given us problems. In the early C-type days, all the spokes were loose after a race. We increased the number of spokes which was an improvement, but even then the odd one or two would come loose. That's all it takes for the rim to deflect and begin steering the car. Going to the disc wheel was a breakthrough – handling was much more consistent over a long race. But we had to be careful with brake cooling, one of the reasons we had stuck with the wires. The disc wheel had holes drilled near the rim to give us the same extraction. There's no pictures, but on the first set I tested those holes weren't there."



THE D-TYPE GAST

Jaguar's sportscar successes put Britain on the map. In the early 1950s the D-type scored a Le Mans hat trick before Vanwall ended Britain's championship F1 wait at Aintree in 1957. *Paul Parker* speaks to several key players in the D-type's incredible story



Sir Stirling Moss Works driver, 1954

Those who drove the D-type in period have mixed feelings about the car. And perhaps because he drove it during its development phase – and had met with such success in the C-type – Stirling Moss has the least flattering memories of it.

"The C-type was much nicer to drive than the D, which was a less accurate car. We had lots of problems with the D's disc brakes: flexing hubs caused pad knock-off, vaporisation and much more. We went up the escape road at Mulsanne as many times as we went round the corner during practice at Le Mans in 1954.

"I was first, second and third at different times early in that race, but after a couple of hours the car dropped to 4600rpm in top, so I had to come in. We refuelled but, after removing the fuel filter, the problem got worse: Peter Walker [his co-driver] was stuck at Hippodrome for 40min. But then it cleared [the problem was caused by contaminated fuel] and it went okay for a while – I pulled 174mph [on 17-inch wheels] at night. But at 11.56pm, I had total brake failure at Mulsanne and crept back to the pits. The

team had repaired it by 1.40am, but decided to withdraw the car from the race after that."

Stirling's second race with the D-type was the Reims 12 Hours on July 4-5.

"I had a fair start and gained 300 yards on the first lap. I eventually lapped everybody up to the Umberto Maglioli/Robert Manzon Ferrari. A plug electrode fell out at 1.50am and I stopped, refuelled and continued until 4am, by which time we had a two-lap lead. Peter [Walker] took over and had done only two laps when a driveshaft broke."

Stirling's final D-type outing was at Dundrod for the 1954 Tourist Trophy on September 12-13. On this occasion he used a 2.5-litre version designed to take advantage of the race's handicap regulations.

"I drove it to the circuit and it felt fine, albeit a bit undergeared. I managed a 5min 8sec [3sec faster than the 3.4], but I was having to use Dunlop Road Speed tyres and was very pissed off; there was a big row before this was resolved.

"I was up at 7am on race day to do a few laps to run the car in - the team had changed the pistons after

the motor began seizing during practice. But after three laps the engine began to seize again. I slowed for about a minute and it felt okay again. Later it jumped out of second gear and revved to 7300rpm. I got up to third on handicap with a fastest lap of 5min 1sec [2sec quicker than the quickest 3.4]. I handed over to Peter Walker, who had one stop for plugs, and I took over in fourth place, but 300rpm down. Eventually, the oil pump sheared off and I had to wait at the line to be classified a finisher.

"Jaguar were pretty upset about my going to Mercedes in 1955. I didn't have the most reliable time at Jags, but I liked the friendly team and felt very proud walking alongside the C and D-type at Le Mans."





Ian Scott Watson Confidante of Jim Clark

Until Jim Clark joined Lotus, Ian Scott Watson was his manager, as well as a close friend. "Jim and I met [Border Reivers team chief] Jock McBain at Charterhall in late 1957. Jock

wanted to race sportscars and had purchased the ex-Murkett Brothers' D-type for £1,600. Its driver was to be Jimmy Somervail, but when he was unable to leave his farm, Jimmy [Clark] got the ride. He did the first 100mph sportscar lap in Britain, at Full Sutton, and raced the car on 20 occasions, winning 12 of them. He liked it a lot and drove it on the road often.

"At Spa in 1958, I had to leave the night before the race because my father was dying, so Jimmy raced alone. He was not too fond of Spa and did not enjoy the experience, made worse by the fatal accident that befell Archie Scott-Brown in a Lister-Jaguar. When Reivers got its Lister, Jimmy treated it with a great deal of respect."



Paul Frère Works and Equipe Nationale Belge driver, 1956-57

This former Jaguar service manager for the Belgium Motor Company – and noted journalist, who now has a corner named after him at Spa – joined the 1956 works team after tests at Silverstone and Reims.

"I loved the car but it did not love me! I shared XKD 603 at the Nürburgring in 1956 with Duncan Hamilton, and it was more in the air than on the ground, bottoming out on the bumps. Our speed was limited by that solid rear axle. We broke one of the locating arms for the rear suspension on the first day, and on the next day, when it was pouring with rain, I managed to lose control between Hohe Acht and Wippermann, plunging backwards down a ravine, completely out of sight. The car did a somersault and

ended up 50 feet below the level of the road. I clambered out, thoroughly shaken, and left my helmet in the car as I climbed back up to the track. A marshal saw me without my helmet and said, 'Have you seen the driver?'

"At Reims, I co-drove with Mike Hawthorn and we lost the race to our team-mates when Duncan Hamilton used the superior acceleration of the fuel-injection car to catch me and win against team orders. Duncan was later sacked from the team as a result of his actions.

"Sadly, it was even worse at Le Mans: I crashed at the Esses on the second lap on a very slippery surface. Moments later Jack Fairman spun his D-type

> at the same place and was hit by Alfonso de Portago's spinning Ferrari. Both Jags were out. Lofty England was absolutely incredible about it – That's motor racing,' he said.

"I drove a D-type at Le Mans in 1957, sharing Pierre Stasse's Equipe Nationale Belge car with Freddy Rousselle. We should have finished second, but a points failure lost us 45min. We finished fourth. The D-type was great to drive. The engine was so flexible and the steering was wonderful. It was not so good on bumpy roads, but it was perfect for what it was designed to do: win Le Mans."





Jimmy Stewart Works and Ecurie Ecosse driver, 1955

Having lost Moss, Jaguar set about recruiting new faces for a team now led by Mike Hawthorn. Among those tried out was Ecurie Ecosse and Aston Martin works driver Jimmy Stewart, the elder brother of Jackie.

"I tested OKV 2 at Silverstone along with Don Beauman, Desmond Titterington, Ninian Sanderson, Ivor Bueb - and Hawthorn. I was still suffering the effects of a badly broken arm after crashing one of the Aston Martin DB3S coupés at Le Mans, and had to have another go in the car about three weeks later. This went much better - I had a great time flinging the car around in the rain - and [team manager] 'Lofty' England wrote to confirm that I had earned my place in the team for Le Mans that year.

"Before that, though, Ecurie Ecosse bought two D-types and entered them for the Eifelrennen in May. I had not quite reached Adenau Bridge on my first lap when the brakes failed and I went backwards — and upside down! — through a hedge. Desmond [Titterington, his team-mate] also crashed for the same reason [probably pad knock-off caused by hub flex]. I was very shaken and knocked about, and Stirling stopped in a Mercedes, helped me out and gave me a lift back to the pits.

"I immediately decided to retire from racing and phoned 'Lofty', who tried to persuade me otherwise. I do regret stopping now (I was only 23), but if I had carried on I might not be here today.

"I loved the D-type: it understeered a bit in the dry, but it was much easier to drive than the C-type and felt much quicker."



Drive Espana



Tour of Historic Northern Spain 1-13 October 2024

For years people have been talking about a tour which covers some of the most important locations in the history of Spain—hard to choose but we had a go in 2023—It was a great success, so we're doing an exclusive to Jaguar tour in 2024. We start on the ferry from Portsmouth with a Sunday evening departure and two nights at sea to make new friends and rekindle old acquaintanceships. We arrive early into Santander so there is time for sightseeing on the way to our first stop, Segovia. Here there are the remains of many ages in Spain, the Roman aqueduct, the Alcazar and the cathedral. There is a Royal City just a few miles away. After Segovia we're off toward the Portuguese border to Ciudad Rodrigo which was besieged during the Peninsula war. It's also close to Salamanca. Next we plunge south to Guadalupe, a major place of pilgrimage even today. The driving in this area is unparalleled in Spain in its quality—a drivers dream! After Guadalupe it's Toledo. Two nights here so you can visit this world heritage city—it's amazing! Next a castle with battlements and crenellations so Siguenza is our stop. It was central to the medieval civil wars and Pedro the Cruel (or Just) We finish inland at Argomaniz—a lovely ancient building in a town where virtually no-one lives. Napoleon slept here the night before the battle of Vitoria—which he lost The tour includes ferry crossings with outside cabins and no bunks, dinner bed and breakfast at all the hotels—all the brilliant Spanish Paradors. You also get a detailed road book and map and as well Jasper Gilder will accompany the tour

Sun 1 Oct	Evening departure from Portsmouth on Brittany Ferries Galicia with a day at sea to chill out and meet old and new friends
Tues 3 Oct	Arrive in Santander then drive to Segovia for two nights at the Parador (215 miles)
Thurs 5 Oct	Drive to Ciudad Rodrigo for two nights in this lovely medieval town, staying at the Parador (165 miles)
Sat 7 Oct	Drive to Guadalupe for a night in the peace and tranquilty of Extramadura. Lengthen the trip by dropping into Caceres, home of some of the conquistadors (150 miles without Caceres)
Sun 8 Oct	Drive to Toledo for two nights at the Parador. It's a great spot and the Cathedral, Santa Tome, the old town, the Alcazar, the El Grejo Museum, Zocodova Plaza etc will eat up your day (130 miles)
Tues 10 Oct	Drive to Siguenza for a night, travelling via Aranjuez (home of the Summer Palace) and skirting Madrid (167 miles)
Wed 11 Oct	Drive to Argomaniz for a night where Napoleon prepared for a battle in which he was beaten by the Duke of Wellington in a precursor to Waterloo (183 miles)
Thur 12 Oct	Drive 110 miles through the Basque Country to Santander ferry port for afternoon embarkation on Brittany Ferries Salamanca
Fri 13 Oct	Mid evening arrival at Portsmouth



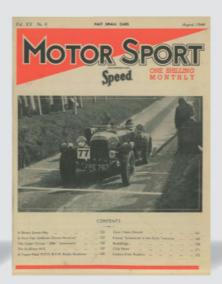
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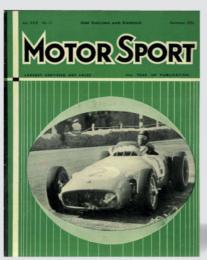




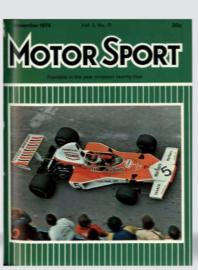


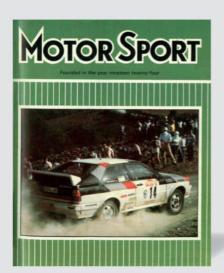


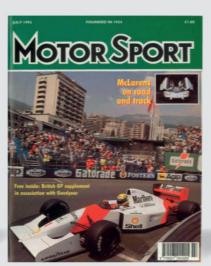
















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TASTE THE ACTION AT OCTANE TERRACE



Tommy Banks

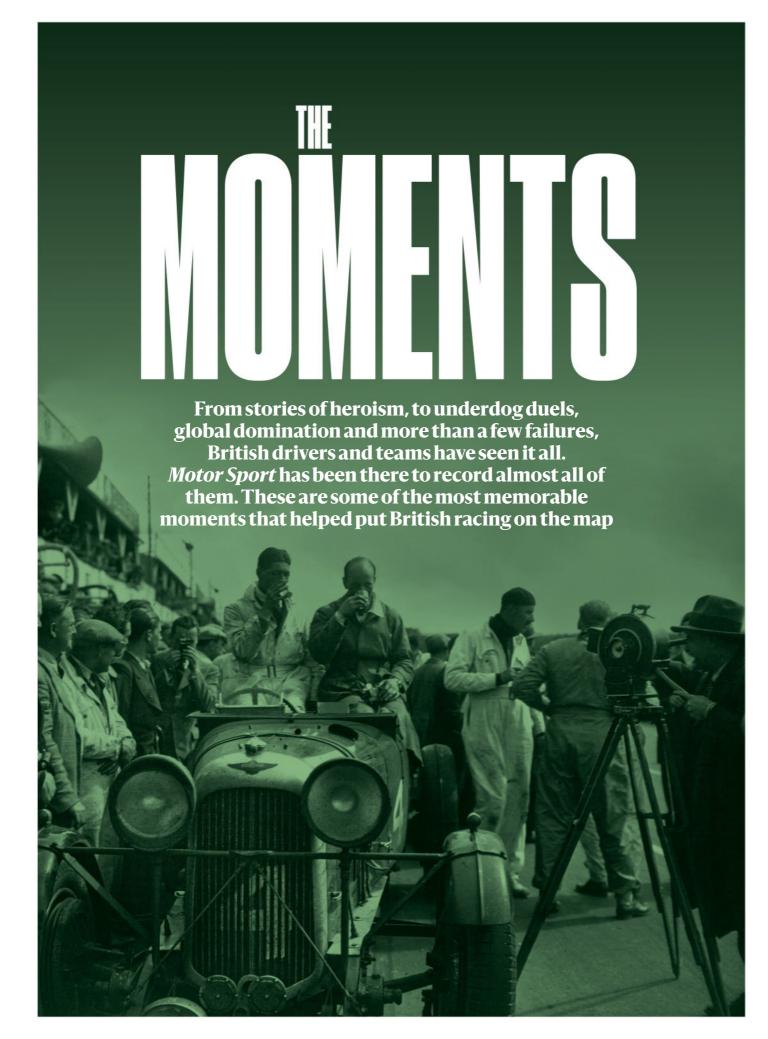
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18-21 JANUARY 1964

WHEN MINI MASTERED THE MONTE

In 1964, the Mini's victory on the Monte Carlo Rally laid the foundations of its iconic status and changed rallying forever. *John Davenport* relives an epic event with the team's key figures

TAKEN FROM MOTOR SPORT, FEBRUARY 2004



t was the last weekend of January, 1964. Bruce Forsyth and Tommy Cooper flanked Joan Regan on the revolving stage that marked the finale of Britain's most popular televised show, Sunday Night at the London Palladium. The glamorous Tiller Girls stood alongside them, but for once only two of the long-legged high kickers were on the stage's central podium. And they were sharing it with two nervous-looking gentlemen in dark suits and ties and a little red car with a white roof. The men were Paddy Hopkirk and Henry Liddon and the car was their 1071cc Mini Cooper S, which days earlier had won the Monte Carlo Rally... Just like that!

To us, now, a Mini winning the Monte doesn't seem such a strange idea. Back then, it was simply amazing. That such a small car—an innovative piece of engineering from a British company and driven by a British crew — could triumph on the world's most prestigious rally was something to marvel at. And to celebrate.

The victory was not just on the front page of every British newspaper, but was in the nation's living rooms at peak viewing time. The amazing Mini had already taken wins on the track, but it was this display of endurance that truly captured the imagination, in Britain and beyond, and propelled the car towards becoming an icon of the 'Swinging Sixties'. The car would, of course, be immortalised on celluloid in *The Italian Job* five years later, but Hopkirk's win was a major marker in helping to establish a legend.

The 1964 Monte was not the first competition appearance for the Mini Cooper registered 33 EJB. Built in the summer of '63, the car's maiden outing had been the Tour de France, crewed by Hopkirk and Liddon. It was one of four of the new 1071cc

"We probably looked like those Russian policemen... the ones that looked like tea cosies carrying guns"

Cooper S models entered by the factory, and Hopkirk came a creditable third overall in the Touring category, which he also won on handicap. Having developed a liking for French roads, it was decided to use the car as Paddy's mount for the Monte.

Cliff Humphries

BMC development engineer

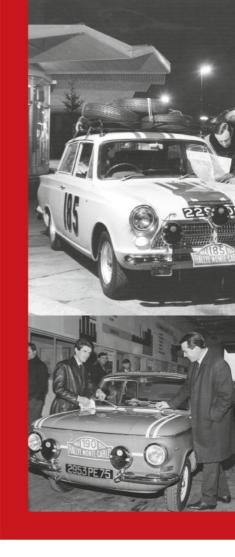
"In those days we would get one mechanic to build the whole car. That included the engine and gearbox. The cylinder heads were done by Weslake, but our guys would have to grind in the valves, fit the springs and camshaft and deck the cylinder block to get the right compression ratio. We never used an engine twice. When it came back from a rally it would be sold off to a private owner and we would build a new one for the next rally. The whole process could take nine weeks, or more if the mechanic was building a car from scratch."

The BMC entries were shipped from the Port of London to Gdańsk in Poland. On the boat were two more Mini Coopers, a works car for Raymond Baxter/Ernie McMillen and a private car for Dr Shelagh Aldersmith/Liz Jones. They were accompanied by mechanics from the Abingdon works, plus the redoubtable Dr Aldersmith. On arrival at Gdańsk they were faced with a 250-mile drive to Warsaw, where they met up with the crews who had flown in and were to drive the cars on to Minsk, a further 370 miles up the road.

Paddy Hopkirk Winning driver

"I flew out to Warsaw and a welcoming committee took me to be reunited with Henry and the rally car. They also tried to reunite me with a month's production of Polish vodka. The local police had dreamt up this reception for us, which was very nice, but we had to drive the Mini up to Minsk the following day. I guess they knew how cold it would be and were just making sure that we had adequate anti:freeze inside us.

"And boy, it was cold. Alec Issigonis deserves full marks for designing such a super little car, but he had not given much thought to the survival of the occupants in a Russian winter. A Mini heater is a contradiction in terms. We were soon equipped with fur hats and fur boots. In fact, we probably looked a lot like those Russian policemen that we all made fun of —they looked like tea cosies carrying guns."

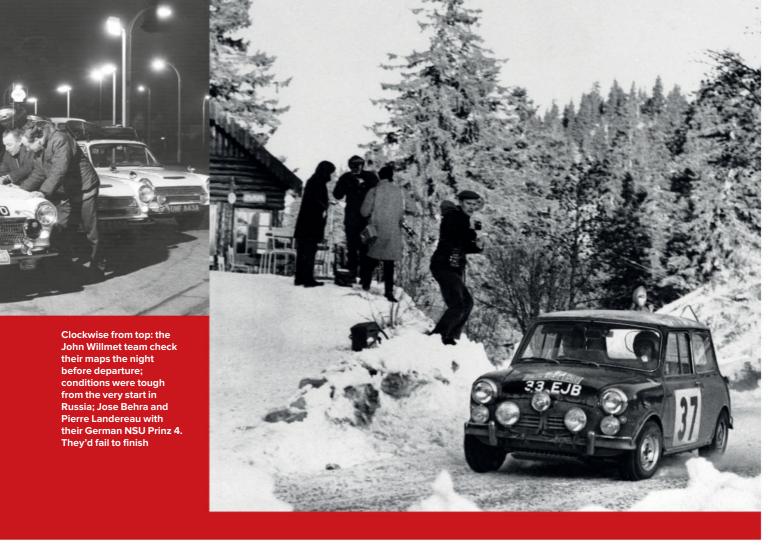


he night-time temperature dropped to below -40°C and the rally cars had to be tow-started in the morning. That came as a bit of a shock to the locals, who had imagined that the superior technology available in the West would have bypassed such primitive methods.

Stuart Turner BMC team manager

"Why Minsk? I tried not to choose starting points for the drivers but let them pick their own. I was keen for there to be a good spread so that if one starting point had bad weather, the others would be okay. But Minsk was an obvious choice because it was the first time in 52 years that there had been a starting point in Russia, and so there was bound to be a lot of press coverage."

For the Minsk starters, the flag dropped at 00:34am on Saturday, January 18. Facing them was a nine-hour run (back!) to Warsaw on roads that, while not free of ice, at least had no new snow. That was a big relief



because snowploughs in the area were few and far between. The biggest difficulties came at the borders, where even special arrangements for the little convoy could not avoid the inevitable bureaucratic delays. Hopkirk had a very worrying experience when he took a wrong turning and encountered a brace of 'tea cosies' waving their guns in his general direction.

By 10pm on Saturday evening they were in Prague – and Sunday breakfast was taken in downtown Frankfurt. The day was spent in a foggy tour of the Low Countries, returning in the early hours of Monday morning through the Ardennes and Luxembourg to arrive at Reims just after 8pm.

Bill Price

BMC Competition Dept co-ordinator

"I had a rather short involvement with the rally. My first task was to go with Den Green and Johnny Lay in a car to Frankfurt to service the cars as they came in from the East. It was about six o'clock in the morning and the chosen place was a frozen car park. The temperature was -10°C. There was no problem

with the Minis, but we diagnosed a leaking radiator on the Morley brothers' MGB and phoned home to get a replacement shipped out to meet them at the Oostende control.

"While the rally went off to the Nürburgring, we drove to our next service at Arnhem. We picked up the BBC on the radio and it was saying that two British girls in a a Mini Cooper had been taken to hospital in Maastricht after an accident. We guessed that it must be Pauline Mayman and Val Domleo. We headed towards Maastricht and, by the most amazing luck, a chap pulled up alongside us at a traffic light – he had seen the Monte service plates - and asked if wanted him to show us the hospital. We found the girls, left Pauline in bed and took Val back to the scene of the accident for her to retrieve their kit. We then pressed on to Arnhem, where we were happy that there were still no problems with the other Minis.

"The plan now was for us to drive to Paris, leave our car with the Austin dealer, catch a flight to Nice and integrate with the rally service. Sadly, the airport was completely fogged in and likely to stay that way for some time. I rang Stuart Turner, and he said that it was best for us to go home when it finally cleared – which is what we did."

Stuart Turner

"My role was largely completed & before the rally started it was my task to work out the service arrangements and make sure that all the kit and spares would be in the right place at the right time, and that the teams of mechanics would find their way to the right spot. I remember my wife Margaret insisting that I clear all the maps and paperwork away from the dining room table as we had guests coming for Boxing Day!

"To me, doing the service plan was the most challenging job in rallying – and I loved it. On the event, I would jump into a car with a driver and go round to see the rally at various points. There were no mobile phones or radio so there was no chance to exercise any tactical control. In any case, the rally went straight from Reims to Monte Carlo so we only saw it a few times. I didn't even make it to the finish ramp in time to see them arrive."



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eims was the central point where all the routes converged, at a large Elf garage on the outskirts of the city. Thirty or so French motorcycle cops were waiting to escort the tired crews to the service park and control in the town centre, in the shadow of the famous cathedral. Their method was to gather a group of three rally cars together, then switch on every available flashing light and siren and head for the centre oblivious of traffic lights, other mad users or the speed limit. For drivers who had already been on the road for 56 hours, this was definitely a wake-up call.

The first cars left Reims at just after 9am. These were the Warsaw starters; the Minsk cars followed them. (If you were an Athens starter, you were not on the road south until 2.30pm.) As Monday night approached, the roads became smaller and more mountainous, while the time controls got closer and closer together. Crews had been arriving with 20 min or more in hand; now they were scrabbling in with just the odd minute to spare.

The organisers had banked on using a special stage at Mont Revard, before Chambéry, followed by the classic stages of Chartreuse and Chamrousse. However, Revard was closed because of road works and the authorities of Isère wanted to charge too much for use of the latter two. Thus the rally shot past all this prime mileage, and it was not until sometime after midnight that it arrived at the first special stage, 14.3 miles of hoar frost over the Col du Festre. Slow up and very fast down is the best description, and here, as on all five stages, it was the Ford Falcon of Bo Ljungfeldt that set the fastest time.

Actually, that's possibly not true. The times of those who retired never arrived in Monte Carlo, much like their owners, and so were never published. And rumour has it that a Chrysler Valiant driven by Esko Keinänen set fastest time on the first three tests before a driveshaft broke...

"For drivers who had already been on the road for 56 hours, this was a wake-up call"



Erik Carlsson/Gunnar Palm's Saab was a constant threat, but they had to settle for third place

The next special stage, taking in three cols between La Madeleine and Pellautier, followed immediately. At 28.6 miles this was the rally's longest stage and featured a mix of fast and twisty sections, many with spectacular drops. (It was here that Sam Nordell, the Vauxhall driver, was killed during the recce.) Ljungfeldt again had the fastest recorded time. But Hopkirk was only 19sec slower on scratch – and led the rally by 30 points on handicap.

When Hopkirk equalled Ljungfeldt's time on the icy Chorges-to-Savines stage after Gap, he was 44 points clear. Not that he knew it; Ljungfeldt and Carlsson may have learned of Hopkirk's times, but Paddy could not have known theirs. He was ahead of them on the road, and since the stages were not started on whole minutes, no outside observer could be sure of any times. The drivers just had to get on with it and go as fast as they could.

As dawn broke, the Minsk runners were coming to the last two stages in the Alps overlooking Nice. The first of these was St-Martin-Vésubie, the infamous 'Ford Falcon Autobahn', so dubbed by Pat Moss and Liz Nystrom. But even here, with a 28sec second advantage over Hopkirk, Ljungfeldt could not stop the Mini gaining

more points on handicap, while the twistier Col du Turini provided another huge leap forward for the little car.

Erik Carlsson Saab works driver

"The weather was a bit too good for Saab: cold, but not much ice and snow. What there was came on the three stages around Gap, where we could keep up with the Minis. But the 'Ford Falcon Autobahn' was impossible for us. It was dry Tarmac most of the way. I lost 48sec to Paddy – even Pat [Moss, in another Saab] beat me. She went like hell in those conditions. It was much better on the Turini, where there was proper snow and I was second fastest behind Ljungfeldt.

"Part of the problem in such good conditions was that we did not use racing tyres like the Minis. We had a Dunlop contract, but to cover all the possibilities, from full snow to dry Tarmac, we also had to carry some studded BF Goodrich snow tyres and Pirelli wet road tyres. With two service cars and a supervision car to look after two rally cars, the tyre choice was never going to be optimised for every stage. The BMC boys did a fantastic job to look after all those cars they had and get the right tyres on them." •

hus, with the rallying over, Hopkirk led from Carlsson, Moss and Timo Mäkinen, with Ljungfeldt only fifth. But the crucial seconds on the four-lap circuit test were not subject to the coefficient, and counted as points. So Ljungfeldt could gain considerably – and the gap to Hopkirk was only 64 points.

The Falcons were the quickest on the circuit: Ljungfeldt did the fastest time ahead of Jo Schlesser, followed by Günther Klass (Porsche Carrera), the two Mercedes 300SEs of Eugen Böhringer and Dieter Glemser, and then Anne Hall in a third Falcon. But Hopkirk drove quickly and sensibly to drop just 34sec to Ljungfeldt. The Swede did manage to leap ahead of Mäkinen's Cooper S and the two Saabs –but Hopkirk remained just out of his reach.

Ljungfeldt's drive in the big 4.7-litre machine must be reckoned one of the best in modern rallying. And yet there was someone else able to go one better. Hopkirk and Liddon's tenacity and planning paid dividends; they had put in a lot of time practising the stages, helped by the fact that three of the stages were around Gap, the other two around La Bollène.

Paddy Hopkirk

"I don't remember much of the rally and the stages. You were so tired you only thought of driving as fast as you could. I do remember seeing Stuart Turner at the roadside coming away from the Turini. He stopped us and asked how it had gone. We could only say that it was okay because we didn't know how we compared with anyone else. He wanted to chat more, but we would have been late to the finish.

"Even then, after arriving in Monaco, we did not know how things were. It took a long time in those days to get all the printing clock records in from the controls and do the calculations. I went to bed on the Tuesday afternoon. At about four o'clock on Wednesday morning, the telephone woke me. It was Bernard Cahier, the French journalist. He wanted to know how it felt to be the winner. I thought he was kidding and told him it was a bad joke. But he finally convinced me."



eople often speculate as to how Hopkirk was able to so convincingly beat his Finnish team-mates Mäkinen and Rauno Aaltonen on an event and in conditions that should have suited them well. What one has to remember is that Hopkirk was, at that point, more experienced than they were, as well as being at the peak of his career. Sprinkle in a dose of hard work and you have the recipe for his success.

"He wanted to know how it felt to be a winner. I thought he was kidding"

Stuart Turner

"After the rally, Tony Dawson, BMC's PR dynamo, was simply fantastic. Before we knew where we were, there were telegrams from The Beatles (we had organised a lift for Ringo from Paris airport in a rally car before the start, when he had arrived after the rest of the group), a lunch with Juan Manuel Fangio, Graham Hill, Jo Bonnier and other luminaries, and then a celebration dinner, with Alec Issigonis as the star guest.

"Tony's final stroke of genius was to get the winning car, together with Paddy and Henry, flown back by the Channel air ferry so that it could appear live on 'Sunday Night at the London Palladium', which was at the time by far the most-watched programme on TV. To add to the joy of the success, Tommy Cooper was on the bill."





It's arguable that the Mini would never have gained its endearing reputation without the success of Paddy Hopkirk and Henry Liddon on the 1964 Monte

What happened next...

The Monte Carlo of 1964 seemed to open some kind of tap. The Mini's win captured the imagination – and not just in Britain. Even America heard about it, since (the losing) Ford America had brought a pack of journalists with it. And, throughout the boardrooms of the car world, it seemed to pluck nationalist heart strings and generally set them thinking on how to win rallies, the Monte Carlo in particular. This victory triggered 20 years of growth within the sport.

To start with, the others did not have it easy. Waiting in the wings was a 1275cc version of the Mini Cooper, which was racking up outright wins by mid-1964. It didn't matter that rallies were starting to ditch their capacity coefficients. With its bigger engine, the Cooper S had a sufficient

power-to-weight ratio to win without handicaps. Famously, it did just that three more times on the Monte. First Mäkinen defeated Böhringer in a works Porsche 904 in the snows of '65. He won again in '66, only to be thrown out with all the other British-entered cars for an alleged lighting infringement. And finally Aaltonen won in '67, finishing just 13sec ahead of Ove Andersson's Lancia Fulvia. By '67, Lancia, Alpine, Porsche, Ford, Sunbeam and Opel were snapping at the heels of the Mini and, sure enough, on their last appearance as a works team, on the Monte of '68, they were swept aside by Porsche.

But they had had their effect. Rallying was on the up, and would stay that way. Carlsson may have bought the firework, but Hopkirk had lit the blue touchpaper.

The scoring

This was the penultimate Monte to use the factor of comparison on stage times. This was a formula designed to reduce the benefits of tuning and engine capacity. The basic bit was the square root of a figure arrived at by dividing the cylinder capacity in litres by eight times the cylinder capacity plus one. A further fixed coefficient (zero for Group 1, 1.04 for Group 2 and 1.05 for Group 3) was added depending in which group your car was entered. This gave you your particular 'factor'.

The times over the five special stages were added together and multiplied by your 'factor'. Then, a day after the 'finish', there was a series of races on the Monaco GP circuit, each lasting four laps. The scratch time there was added to the adjusted stage times to give your final result. Simple...ish!





LAGONDA'S LAGONDA'S LE MANS UPSET

It's been almost 90 years since Lagonda defied the odds, beating Alfa Romeo to earn its first Le Mans victory: a worthy triumph often overlooked in the race's long history

WRITER PAUL FEARNLEY / TAKEN FROM MOTOR SPORT ONLINE, MAY 2023

rivateer Arthur Willard Fox was the prototype modern endurance racing and rallying team manager. A stickler for detail, his cars and drivers were well prepared, pampered even, and expected to perform well and to order as a result. His well-equipped and spickand-span Fox & Nicholl service station/showroom/workshop in Tolworth on the Kingston Bypass was a byword for efficient success: a British Scuderia Ferrari.

Le Mans was Fox's happy hunting ground, a class-winning campaign in 1930 being the first of three consecutive third places overall. These were achieved using Talbots designed by Georges Roeschand whose excellent performance belied their upright stance and muted delivery minus thrashing overhead cams and whining supercharger.

Forced by financially straitened Clement-Talbot's subsequent withdrawal to join Alfa Romeo's ranks for 1933 - well, if you can't beat them - Fox's tight-knit team scored yet another third place before switching to a Singer for the following year and finishing seventh.

Seeking an uptick in competitiveness, Fox renewed the relationship with Lagonda that had opened his Le Mans account: a retirement in 1929 due to head gasket failure.

The Staines-based company was on its uppers, too, but the enthusiastic Fox persuaded it to supply, via agents Warwick Wright, three 'lightweight' and uprated versions of its M45 Rapide for the 1934 RAC Tourist Trophy, a handicap race at Ards that eschewed supercharging.

They finished fourth, fifth and eighth - a solid result befitting the equipment. Powered by Meadows' 4.5-litre pushrod 'six' - good for 140bhp at 3600rpm in tweaked form - torque was the watchword for a car that weighed over 1500kg still. Two were entered for Le Mans in 1935 but few expected them to deny Alfa's lithe and lissome, supercharged 8C a fifth consecutive victory.

Fox's driver selection was intriguing. Hawker Siddeley test pilot Johnny Hindmarsh was a known quantity: an affable, capable and reliable team player who looked much older than his years and who had finished fourth for the team in 1930 and co-driven its Singer in 1934. Co-driver and fellow flier Luis Fontés could not have been more different. Gawky at 6ft 2in and sporting thick-rimmed spectacles, this illegitimate son of a Brazilian shipping tycoon and British mother looked every

inch the student that he had so recently been: an alumnus of Loughborough Engineering College not yet 23.

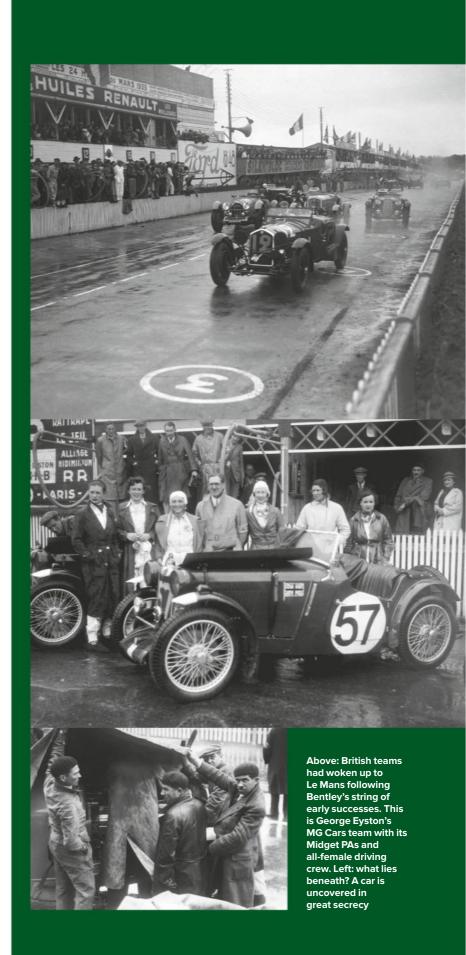
Suddenly flush with the family fortune, his apparently hot-headed, last-minute hiring of John Cobb's 8C 'Monza' for the 1935 JCC International Trophy at Brooklands in May caused a stir such was his inexperience: he had recorded RAC TT retirements in an MG and Invicta. His victory - the product of measured, sustained speed attained in shirt-and-tie and minus headgear - was a sensation. So, too, was his bacchanalian party in celebration. Those looks deceived in more than one way.

At the end of the same month and in the same car - now in his ownership - Fontés finished third behind a pair of faster, more modern Bugatti Type 59s in the Isle of Man's Mannin Moar: a gruelling 200-miler on a demanding road course. Fox, for whom money was secondary to talent in such matters - though oodles of cash never hurt - had seen enough to be convinced. Hindmarsh, however, would be trusted with the opening stint.

he race began under glowering skies and on a slick track that played to the hefty, sturdy, long-wheelbase, long-legged Lagonda's strengths and Hindmarsh was able to mix it with all of the Alfas bar that of Raymond Sommer. News that the latter's co-driver was too ill to compete caused the pack to ignore this runaway. Sure enough, the race's fastest man - twice a winner - called it quits, exhausted, after fuel-feed problems cost him his lead before halfway.

Fontés held his end up and the Lagonda was still in the mix when the race was blown wide open as dawn approached. In quick succession: Philippe Veyron's 5-litre supercharged Bugatti Type 50 lunched its back axle, as did twice winner Luigi Chinetti's Alfa; and then Earl Howe's leading Alfa holed a piston. Suddenly a Lagonda 1-2 - the second M45 was being shared by 1927 winner for Bentley (and the car's owner) Dr Dudley Benjafield and Sir Roland Gunter looked a distinct possibility. The fly in that ointment was the remaining Alfa being co-driven by Heldé - real name Pierre Louis-Dreyfus - and fellow Frenchman Henri Stoffel, a veteran who had finished second for Lorraine-Dietrich as long ago as 1924.

The weather closed in again and this match was even - to the extent that the Lagonda's advantage after 169 laps in 18 hours was just 87 seconds. A 7-minute stop for Stoffel to cure a misfire (new plugs) and



Clockwise from top left: the Le Mans pits looked a lot different in 1935; primitive light trails blaze: **Prince Nicholas of** Romania in his Duesenberg 7.0L, he'd fail to finish after just 38 laps; Hindmarsh (right) and Fontés toast a hardearned victory

"It's galling that so worthy a performance by Lagonda is often overlooked"

a water leak put the Lagondas back in the box seat - only for Benjafield to suffer gearbox problems that would cause it to have to rumble round in top and finish 13th. Its sister car was ailing, too, Fontés pitting at least twice to discuss zeroing oil pressure.

These unplanned stops, however, threw their rivals into confusion - though not so the fabulous Mr Fox - and Louis-Dreyfus thought he was overtaking for the lead in the closing stages when in fact he was merely regaining the lead lap. Said to be running on sump fumes, the Lagonda won by 5.26miles in 1868.42 having averaged 77.85mph. It's galling that so worthy a performance is so often overlooked - and chilling that it's a conundrum stained by tragedy.

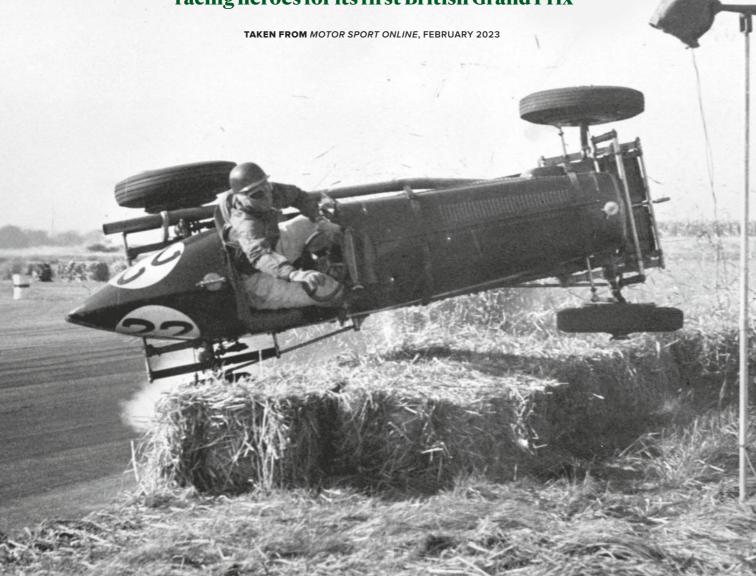
The unanticipated control and judgment Fontés had exhibited on the track - his breakthrough season also included finishing second at Phoenix Park and winning in Limerick aboard his Alfa - deserted him on the road when in October, driving drunk, he killed a motorcyclist in a head-on collision near Coleshill in Warwickshire. He was sentenced to three years and banned from driving for 10. Upon his early release in March 1938, he would race aeroplanes and hydroplanes rather than cars.

Though Hindmarsh would drive a Fox & Nicholl Lagonda LG45 at Le Mans in 1937 - retiring early because of engine trouble - the increasing threat of war kept him in the air more and more. He was killed in an unexplained accident while flying a Hawker Hurricane above Brooklands on 6 September 1938. He was not yet 31.

Fontés was 27 and a pilot for the Air Transport Auxiliary when he was killed while circling RAF Llandow in a Vickers Wellington on 12 October 1940. Some say an engine failed, others that he clipped a telegraph post. The 'luckless' Louis-Dreyfus on the other hand lived to be 102, having fought for the Résistance, escaped to England via Spain, Lisbon and Ireland, and flown over 80 missions as a gunner with the RAF's Free French bomber squadron. •

WHEN RAGING MET RAF SILVERSTONE

Silverstone celebrated its 75th anniversary as a grand prix circuit in 2023. *Andrew Frankel* looks at when a former RAF bomber base welcomed racing heroes for its first British Grand Prix





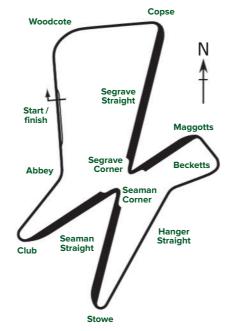
Opposite page: drama for Geoffrey Ansell, who flipped his ERA B-Type. That year's British Empire Trophy winner was thrown from the car but escaped unharmed

Clockwise from far left: a young Stirling Moss took part in the supporting 500cc race; Ascari turned out for Maserati. He would trail team-mate Villoresi home in second; Prince Bira aboard his Maserati on his way to fifth

t wasn't the first race held on British soil after the war, for that had taken place over a year earlier on Jersey. It wasn't the first to take place on what is today recognised as a proper motor racing circuit, for that had occurred just a fortnight earlier at RAF Westhampnett, soon to be more popularly known as Goodwood. It wasn't even the first race at Silverstone for that had happened just minutes earlier when a couple of dozen 500s had fizzed, buzzed and banged their way around the track led by a precious young lad called Stirling Moss, at least until the sprocket on his Cooper broke. Nor was it the first race to be officially known as the British Grand Prix because that happened either in 1949 at what was technically the RAC British Grand Prix, or 1950 in the inaugural round of the World Drivers' Championship.

But, while acknowledging the claim of Brooklands, I think it is fair to say that the 1948 Royal Automobile Club International Grand Prix is today considered to be the first British Grand Prix, and as its 75th anniversary falls this year it seems timely to recall it now.

It came about when a one-year licence to hold motor sport events was granted to RAF Silverstone, home to Number 17 Operational Training Unit which had spent its war years teaching young men how to operate the Vickers Wellington twin engine heavy bomber at night. So a track was laid using two of its three runways and certain sections of the perimeter track. It was used in this configuration just once, adopting in 1949 the wholly perimeter-based layout that would be retained in whole or substantial part for the next 60 years. At 3.67 miles, the 1948 layout remains Silverstone's longest circuit configuration to this day.



The layout was interesting to say the least, though the following description does assume an at-least working knowledge of the track in its more recent iterations.

The pits were on the old Abbey Straight as it ran down to Woodcote between 1949 and until it was seriously abbreviated by the creation of Bridge corner and a new infield section in 1991. It flung itself through the super-fast right at Woodcote and down what remains of the National pit straight. But Copse was a hairpin right as the track joined the airfield's longest runway. Cars hurtled along until they turned sharp left as the straight was bisected by the smaller, second runway, continuing to rejoin the perimeter road just short of the old Becketts. From there they'd head through Chapel down what remains the Hangar Straight to Stowe.

Here was another hairpin onto the other end of the same runway they'd joined at Copse, but now running in the opposite direction. Cars would hare along its length, drivers enjoying the presumably quite interesting experience of seeing competitors hurtling towards them on the same stretch of Tarmac (well, concrete), disaster being averted by a sharp left turn onto the hitherto unused half of the smaller runway before another hairpin brought them back onto the perimeter at what is today the exit of Club, back up the track towards Abbey and onto another lap.

The entry was a smorgasbord of old and new, not just the cars, but their drivers too.

No fewer than eight ERAs, almost half of all pre-war production, were entered dating from the very earliest A-types of 1934 to a brace of 1939 E-Types. More modern machines included a quartet of Talbot-Lago T26Cs and a pair of brand new Maserati 4CLTs to go with assorted pre-war 6CMs and 4CLs.

Disappointingly for the vast crowds, two cars fielded by the new company created by a former Alfa Romeo race team manager named Enzo Ferrari failed to turn up. But there was an actual Alfa in the race, and one of the strangest too, for Tony Rolt turned up in the fearsome twin-engined 'Bimotore' pre-war monster, but sans its rear engine, making it more of a 'Unicomotore'.

Pre-war hero Louis Chiron (Talbot) was there at the age of 49, as was Phi-Phi Etancelin (Talbot) aged 51. Raymond Mays was there for ERA to keep the English end up at 49. But the next generation were there too, though understandably old to be starting out in grand prix racing having been somewhat delayed by keeping the scourge of Nazism at bay. Rolt was there, of course, and recently recovered from Colditz Castle, as was his future team-mate Duncan Hamilton in a Maserati. Five years later they'd win Le Mans together for Jaguar. Other future Le Mans winners included Lord Selsdon (though the heavy lifting of his 1949 win in a Ferrari was done by team-mate Luigi Chinetti) in a Talbot, 1951 winner Peter Walker in an ERA and 1959 winner Roy Salvadori in a Maserati.

But all eyes were on those two modern Masers, crewed by Luigi 'Gigi' Villoresi and none other than Alberto Ascari, who within five years would become Formula 1's first double world champion. Helpfully, for those who wanted to see a motor race, their Scuderia Ambrosiana team was delayed en route to Silverstone, and was unable to take part in all practice sessions so had to start from the back of the grid.

It made very little difference. Chiron led away, but within two (of 65) laps Ascari and

Villoresi had scorched through the field and already lay fourth and fifth with only Etancelin's Talbot and Prince Bira's pre-war Maserati between them and the leader.

By lap three Villoresi was leading and that was pretty much that. Both he and Ascari had their share of adventures and mishaps over the next three hours, but nothing to interfere with their stranglehold on the race; indeed it has been suggested they were circulating somewhere below ultimate pace, both to preserve their machines and to put on a show.

Villoresi duly won, with Ascari 14sec behind, the stand out performance of the day belonging to neither of them, but Bob Gerard who brought his 13-year-old ERA home in third place, only two minutes off the lead and over two minutes ahead of Louis Rosier's works Talbot, the only other car to finish on the same lap as the leader. There followed a crowd invasion of the circuit, rendering prize giving impossible. The scene for the next 75 years had been set. •

"All eyes were on the modern Masers, crewed by Villoresi and Ascari, who were starting at the back"

Luigi Villoresi won
by 14sec ahead
of Ascari as the
Maserati team
dominated, even if
they started at the
back after arriving
late. But the laurels
for home hero
would go to Bob
Gerard, who was
third in his ageing
ERA B-Type



HOTOGRAPHY ALAMY, GETTY IMAGES

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PHOTO: SIMON WILLIES







t is 50 years since Donald Campbell broke the World Land Speed Record on Lake Eyre in South Australia with his gas-turbine car, Bluebird. On July 17 1964 he recorded the incredible speed of 403.100mph in a wheel-driven car, before the age of jet and rocket propulsion took over. But the bald facts do not do Campbell's achievement justice, as I found out when I went to visit Lake Eyre to discover what it would have been like all those years ago.

It seems strange that the LSR should be set on a lake, but this is one of the largest lakes in the world. The Lake Evre Basin covers 1.2 million square miles, one sixth of the total of the vast land of Australia. Yet because it is such a dry, arid country the lake is rarely full, and for much of the time it is dry. This enormous parched level area of salt was seen for the first time by a European, Edward John Eyre, in 1840. Here at the lowest point in Australia, 15m below sea level, water covers the lake only every seven or eight years, and it has only been at capacity three times since Eyre first stumbled upon it. Even today in a modern 4WD vehicle it's an adventure to access the very heart of Terra Australis, the great Southern Land.

Starting from Adelaide we headed north toward Muloorina, the homestead where Campbell and his entourage put up half a century ago. Turning off the single lane Sturt Highway and crossing the South Flinders Ranges, we emerged onto the flat plain below, where a few emu, sheep, cattle and wild horses are the only life among the abandoned houses. It had been raining since we left Adelaide and, as we reached the end of the sealed road, some 600km further north, it was still raining. The unsealed road, made up of the ochre desert earth, was wet and slippery as we slithered another 48 miles to Marree. Ahead, however, the 31-mile track to Muloorina was closed due to the rains. We turned back to stay at the Marree Hotel, built in 1883 when the narrowgauge railway reached the town. Here we learnt that the road behind us had also been closed. It was the 21st Century and we were stranded - no way in or out, no mobile phone connection, in a place where you can only drink bottled water. Luckily they also had some beer...

Next day it continued to rain and the 'roads' remained closed. This was what Campbell and his team experienced on their first visit - plans ruined by steady rain in one of the driest places on earth. The hotel was quite crowded with other travellers stuck in this 'town' at the crossroads of three desert tracks, once an important staging point for livestock transport but now sidelined. Just 60 people live here, one third Australian, one third Aboriginal and one third Afghan, descendants of the cameleers who provided transport in the early days.

The main street was a deluge of mud sucking at our boots as we explored the derelict trains, the derelict mosque (Australia's oldest) and the cemetery, the town's dead population split like the living into three groups. We discovered the Lake

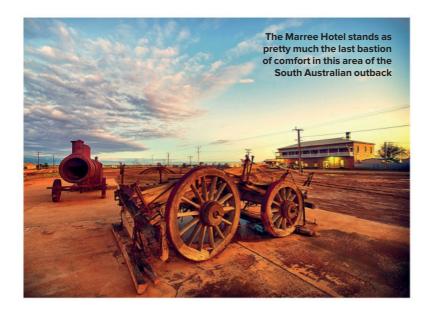
Eyre Yacht Club, one eccentric man's folly for sailing on the lake when it held some water. It had water now, no doubt - but no means of accessing it by land.

If not by land then we could charter a plane. But the nearest was at William Creek, 200km away, and we would have to wait until it had dropped supplies to those cut off by floods. In this dreary outback town, with a monotonous blanket of cloud overhead, it was an existence of frustration, boredom and flies. The flies were everywhere, though of Campbell and Bluebird there was little evidence, even though Marree was an important town for the project, where the men would drink or collect supplies and Campbell's wife - the singer Tonia Bern - even gave a charity concert. A small picture of the car in the very top corner of a mural at the hotel and a fly-blown copy of John Pearson's Bluebird and the Dead Lake (an account of the events of 1964, which I found at the general store) were the sum total.

And yet through my frustration of not being able to reach Muloorina, there came to me the realisation that I was experiencing exactly what Donald Campbell and the rest of the Bluebird team had endured. Campbell had first flown over the Lake in 1961, scouting for a new record venue after a disastrous 1960 attempt on the Bonneville Salt Flats in Utah which had nearly killed him. At Lake Eyre he had found mile upon mile of flat salt with no one else there to cross his course. But in 1961 there had been no rain. In fact there had been very little rain for seven years until Campbell arrived in April 1963 - but after two months of downpour the attempt was postponed until 1964. A huge amount of preparation work had been carried out to get Bluebird onto Lake Eyre. The Australian Army had built a causeway from the desert across the muddy ooze on the lake's edge to the salt, and this access point was another hour's drive from Muloorina. I was beginning to understand the challenge that Campbell and the 150-odd support crew must have had to overcome just to get Bluebird into position, let alone carry out two runs of over a mile in length at more than 400mph.

When Campbell returned in April 1964 it rained again, and it would be another agonising three months before the record was finally broken.

As he sat there waiting and counting the ever-increasing financial costs that the delays incurred, it must have been incredibly stressful - like watching a taxi meter click over when stuck in traffic and short of cash.





"Campbell had brought the fastest car ever built across the world to one of the most desolate, inaccessible and inhospitable places on earth"

ust as it had rained in April 1964 so it was in April 2014. The flat and uninspiring landscape was not the desert of heat and light Campbell or I was expecting, but a soggy morass of damp grey and flies. At last our plane arrived. We needed to see Muloorina and more importantly Lake Eyre, where Campbell had executed his heroic last-ditch run. In much the same way that Campbell must have switched from lassitude and torpor to steel himself for practice runs at speeds never before exceeded in Australia to test the surface of the much softer than anticipated salt, so too did we switch from our Marree languor to suddenly being at 500 feet at 150mph. After days of twiddling our thumbs, in just a few minutes we were above the homestead of Muloorina, where Campbell, his mechanic Leo Villa, who had served his father Sir Malcolm before him, and his lieutenant and designer Ken Norris, had patiently lived for so many weeks as they waited for the sun to bake the salt hard enough to take Bluebird's weight and traction through its four driven wheels. What a desolate place among the flat vista that spread and spread before us. We circled a few times, spotting the graders that had helped level the course on the Lake and the 'Old Blitz' truck, which had carried Bluebird from Muloorina to the Lake, now consigned to the metallic graveyards littering the homestead. But we were unable to land at Muloorina; the red mud strip then-owner Elliot Price originally marked out with desiccated camel bones was too wet.

We flew on above Lake Eyre and that is when the enormity of Campbell's undertaking really struck home. He had brought the fastest car ever built from the other side of the world to one of the most desolate, inaccessible, inhospitable and loneliest places on our planet. The logistics were incredible, the effort phenomenal, and yet on a surface that turned out to be quite unreliable he broke the World Land Speed Record. He alone stepped into the cockpit and shot off into the white void. How on earth had they managed it, here? How had he managed it, here? We turned and headed for Marree. The road to



Muloorina was still closed but the road heading south to civilisation was open once again. We packed up and headed south.

Back on the real road we stopped at the Prairie Hotel in Parachilna, another 19th-century pub on the old train line, where we were pointed towards John Teague at the service station at Hawker in the foothills of the Flinders. John turned out to be a mine of information; he even had a block of salt that Elliot Price, dubbed 'the King of Muloorina' by Campbell, had sold to his father after the record. Better still, he remembered many of the local men and women who worked on the project a lifetime ago, including Bill Mitchell, the manager at Muloorina, and 'Blue' Hughes. Unfortunately Bill was sick and not receiving visitors, but it was in meeting 'Blue', halfway home, that we came the closest to the spirit of Bluebird in 1964.

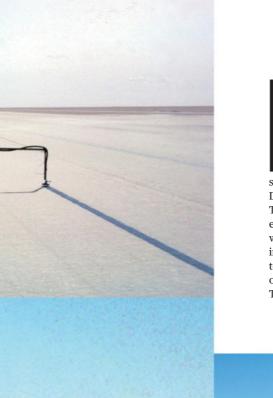
'Blue' (called thus because of his red hair, in true Aussie style) is now 84 and his wife Lorna 80. As they sat in their bungalow, they told me of the excitement of hosting the members of the Bluebird

project on the homestead where they lived and worked.

'Blue' drove the grader to level the salt, and the truck in which Bluebird was delivered to the Lake. Lorna cooked and washed for the men billeted in their home. It was a hard and in many ways monotonous way of life, they said, and the arrival of Bluebird was a welcome change from routine. They spoke of Donald and his wife Tonia as though it was yesterday: "Face to face they were just the same as you or me, and very friendly."

They talked of the other characters involved including Andrew Mustard, with whom Campbell did not see eye to eye, and Pat Crowe the photographer, both of whom had become life-long friends. What an incredible experience to talk with these two octogenarians who had both been on the salt for the record run, and to see Lorna's face light up as it must have done when she was just a young woman as she described Bluebird: "It was just so fast!" There was nothing else to be said. I had found Donald Campbell and Bluebird after all.

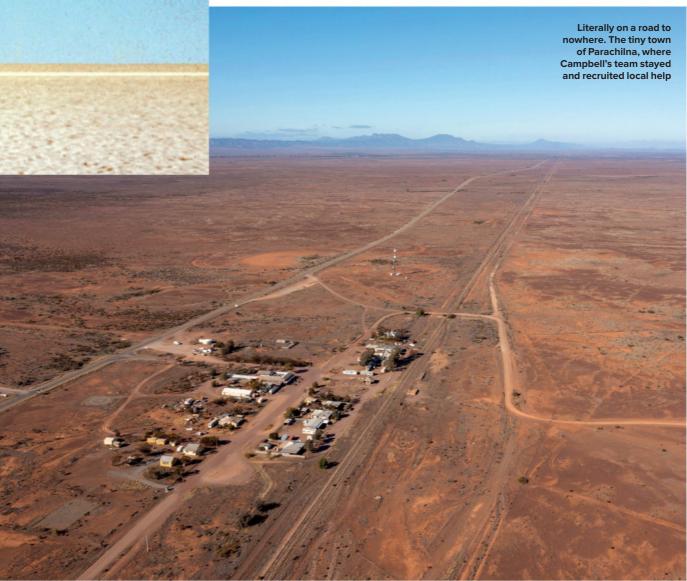
"By the time he broke the record, both Campbell and Bluebird were regarded as dinosaurs"



y the time Campbell broke the world LSR on Lake Eyre, he and his car were already regarded as dinosaurs. With its engine driving the wheels, Bluebird was old school and old technology. Even his unique feat of also breaking the water record that same year, reaching 276mph on Lake Dumbleyung, raised lukewarm applause. The 1960s were the jet age, a time of space exploration, and Donald's achievements, while acknowledged, were never regarded in the same light as those of his father, who took the LSR nine times and the WSR four, or of those inter-war heroes Segrave, Parry Thomas, Keech, Eyston and Cobb.

Within months Campbell's hard-won record was blown away by jet-propelled cars, new records being set five times by Americans Tom Green, Craig Breedlove and Art Arfons, working up to 536.710mph to put Campbell completely in the shade.

In 1965 Breedlove extended the speed record to 600.601mph, while Garry Gabelich in The Blue Flame hit 622.407mph five years later. That record stood for 13 years before Richard Noble and his team took Thrust 2 to 633.468mph - and another 14 years until Squadron Leader Andy Green went supersonic in Thrust SSC, touching an astonishing Mach 1.0175 (763mph) - a record that stands to this day.





HOW WE BROKE THE SOUND BARRIER

The battle for the Land Speed Record raged between Britain and America, until ThrustSSC layed down an as-yet unbeatable marker. This is the team's story

WRITER RICHARD NOBLE / TAKEN FROM MOTOR SPORT, DECEMBER 1997

here were never any problems ThrustSSC, just opportunities. The first came with the completion of the Thrust2 project, and the achievement of the first British World Land Speed Record since Donald Campbell's record in 1964. We were the best in the world again and there was every expectation the record would be retaken by well-funded Americans the following year. I talked to our sponsors about keeping the

team together for the Thrust3 supersonic car. The sponsors were a wise lot and made it clear there was to be a new opportunity elsewhere - so no funding for Thrust3.

But there was always the lingering doubt; with Thrust2 we were the best in the world and without doubt the programme had been the most exciting experience of my life. It seemed criminal to leave the speed at Mach 0.84. But faced with sponsor withdrawal, the way forward was not obvious.

In 1990 Art Arfons produced his 27th Green Monster - this was a small tricycle layout car with Art positioned ahead of the front wheels. In LSR history, large heavy cars have always won out over the lightweights. Art was going to change all that. Writing for *Autocar*, I went back to Bonneville. Art had enormous problems with the car and while I was kicking the salt, Craig Breedlove - the first man over 400,500 and 600mph - turned up.

"Say Richard, I've made the big decision, I've brought two J-79 series engines and I am making the big comeback." His resting time between LSR bouts would turn out to be 31 years.

With Breedlove committed to targeting Mach 1, this opened the doors for the greatest motor race of all time. This would lead to an unrivalled media spectacle and surely another car could be financed if we could find far-sighted sponsors. But how to get started? And where to start with a fresh team?

Thrust2 designer John Ackroyd, was committed to ballooning and reluctant to tread the poverty isolation of the LSR trail again. Thrust2 had been within an ace of flying, with inevitable appalling results, so a new team with aerodynamic experience was needed. It was a new dimension, the designs of the subsonic era were from the pre-computer age.

Progress was slow until 1992. In July, I had a meeting with Ken Norris, designer of Donald Campbell's Bluebird car and boat. By good fortune I was late and so was Ron Ayers, ex-Chief Aerodynamicist of Missiles at BAC and now studying the Vickers Wind Tunnel reports on pre-war LSR cars. Ron was wondering why all the cars appeared to under-perform. Within a month we were trying to work out what had happened to Thrust2 and with that knowledge gained the only sensible progression forward.

"You're designing a new LSR car I know it!" My long-suffering wife Sally could see only another nine years of uncertainty, poverty, extreme financial and personal risk with no obvious reward.

On October 4th, the Thrust2 team met to celebrate the eighth anniversary of the record. I cornered Glynne Bowsher, designer of Thrust's wheels and brakes. "You want 9-inch wide, 9000rpm wheels? Don't tell me any more I'll get started tomorrow!"

The ThrustSSC design started with two RB199 Tornado engines, a cockpit in the

"Nobody asked if we had any money. The honest answer was 'No!' We had no capital at all"

nose and butterfly tail. Another month's work and we almost had the ThrustSCC final design. Ron bought a desktop computer and spent 550 man hours in a month creating the shape mathematically with 5,000 sets of co-ordinates. TSSC was never drawn until much later.

There was another opportunity on the horizon. Word had got around of the secret McLaren Maverick project. Then they rang for the Thrust2 video. Sensing McLaren's explanation that it was to amuse sponsors was less than the whole truth, I agreed and did nothing. Three more frenzied McLaren calls, more promises but no action proved something serious was afoot in Woking.

The McLaren launch to journalists went ahead in December '93. One recorded the presentation and the tape was in my player days later. They were not particularly friendly to ThrustSSC and planned a £25m programme. It was clear that there was no

room for two LSR contenders. We'd have to beat them on design and technology - there was no way to challenge them on money or PR. So our organisation was incorporated as a company without the Thrust name and the team split into cells in London and the Midlands. There was no publicity at all during the research phase allowing McLaren the PR high ground without challenge. To all intents and purposes the ThrustSSC project had gone away.

Work funded by 40 companies - much of it by Castrol - pushed on at a tremendous rate. Ron was underway with his rocket programme at Pendine where a supersonic model burned 300 time-expired, 2-inch rockets. In parallel his Cray 92-based CFD programme carried out at Swansea University was evaluating the design's aerodynamic performance. By May 1994, Ron was on a huge high. Against all the odds, the results of the programmes broadly tallied and where there was divergence it was as small as four per cent. He concluded that the design was safe and viable.

Always the master of understatement Ron said simply: "We'd better build it."

I had an agonising decision to make. It was clear we were going to launch the programme without a major sponsor.

To stay with Breedlove, the funding was going to be a nightmare. Early potentials were not interested. The dream of a British supersonic success was of minimal interest among sponsors who preferred tennis and global yachts. I budgeted on 30,000 man hours for build in 12 months it took 100,000 hours and a two-year daily battle against insolvency with survival horizons of often only 24 hours. The decision not to drive was the right one, and a great relief for Sally, but it was seriously painful.

The June 3 press launch was a huge success, but no one asked if we had any money. The honest answer was 'No!'. The company had no capital. Work started at G-Force in Fontwell, an outstanding organisation that most generously flexed the workforce according to our inability to pay.

Somehow Ron met up with Jeremy Bliss, who changed the entire face of the project. Jeremy had worked with Lotus developing active ride for its F1 cars and then transferred to McLaren to be Ayrton Senna's personal engineer. Highly skilled and with a hugely impressive grasp of diverse technologies and planning, Jeremy took on the entire systems work, which involved the active ride, telemetry and recording 120 channels of data, myriad secondary systems and then the design change from torsion bar to





hydraulic passive suspension. The personal workload on Jeremy would have overwhelmed most engineers who would have insisted on an entire design department in support. Jeremy did it by himself and he saw it right through to Mach 1.02.

So, who would drive?

I approached the DERA Centre for Human Sciences and met Professor Roger Green. He specialised in providing human data for the military. Over 30 applicants were deterred by our PR team, which tested resolve by suggesting the competition was too tough. The six-month programme at Farmborough involved personality, medical and stress testing as well as driving.

Candidates, accompanied by Russell Brooks, drove a VW Golf rally car around a mud track at Saltburn. One entrant was a quiet Flight Lieutenant with 10 years as a fighter pilot. He'd been persuaded to enter by his girlfriend. Russell reported he started slower than everyone and just drove ever faster as he learned the track. He learned the brake points by looking at Russell's right foot stab involuntarily at an imaginary brake pedal. The teamwork tests confirmed it, Roger had found our driver. Andy Green threw himself into the project and was instrumental in getting permission for ThrustSCC to move from G-Force, which it had outgrown. At Farnborough the workforce gained local and highly skilled volunteers and progress accelerated. On September 23, ThrustSSC made its first run on the runway, bursting both front tyres when the Dunlop carbon brakes proved not to need a warm up.

A month later, Breedlove reached 675mph on a run, but a crosswind and transonic effects rolled the car, it describing a 2-mile diameter semi-circle as it slowed. Breedlove was lucky to escape alive. The message was clear... Mach 1 has to be taken seriously. The Spirit of America would take a year to rebuild.

nable to finance a trip to Black Rock, we took ThrustSSC to the Al Jafr desert in Jordan, which had been made available by His Majesty King Hussein. Although Al Jafr looked similar to Black Rock, it was harder, rougher and there were stones. It almost broke the team. In the six weeks spent preparing the desert, over 170 miles of track were cleared of stones, a backbreaking task in the hot sun. ThrustSSC took longer to prepare and there were just three runs before the desert flooded for the first time in five years.

The desert had showed problems with the rear-wheel steering and directional stability. The last run was made on November 21. We were in trouble. The British sponsors were unimpressed and there was no more money. A pragmatist would have quit, but now the project's Mach 1 Club came to our help. By making the project open to its members, we now had 3000 dedicated supporters. We never asked for donations, we simply charged for once only membership, ran open days and tried to provide an irresistible range of merchandise. It was our only source of finance until BTR joined as a main sponsor in Spring 1997.

With the race with Breedlove in September, ThrustSSC was in no condition to challenge, so it was back to Al Jafr, with Royal Jordanian again providing the fuel for the Heavy Lift Antonov. This time the machinery, under the management of

"Breedlove's car made a 2-mile diameter semicircle as it rolled. He was lucky to escape alive"

Martyn Davidson, ran like clockwork. The team was on-site for 13 days and made nine runs culminating in 540mph on June 4.

The desert was having a serious effect on the car and damaged the rear suspension brackets. The only decision to make was to return home and raise finance for the showdown: \$900,000 was needed. We had just 60 days to find it.

Thus began one of the most extraordinary periods of the project. With team and car together, sponsorship prospects seemed exceptional. But they stayed away and we needed a miracle to get the project to the US.

It came from the Internet. Under the management of Jeremy Davey, we had built an audience of 7 million and had made the very first electronic trades ever off the Net in the UK. So we appealed to them: help fuel the Antonov and we can continue. Soon fuel was being bought at 30,000 gallons a day

by users in 100 countries. Castrol gave and loaned more money while readers of *The Daily Telegraph* started bringing in funds at £15,000 a day. Daikin Chase and Sterling Software came in as sponsors. We loaded the Antonov at Stansted for the fifth time and landed at Reno, Nevada on September 3, relatively ready for action.

e couldn't afford hotels so the team were based in rented apartments. The local restaurant put up its prices, so we set up breakfast and sandwich production in the Gerlach Community Centre. Andrew Noble had set up the US support machinery the previous month and with the loss of our vehicle sponsor we were lucky that our old Thrust2 friend, Dink Cryer of Carson City Dodge, provided the support vehicles. From the car manufacturers there was silence.

Americans like Jack Frank and Dave Hackett joined the team and on arrival the course was set up. Enormous help was given by Tom Reviglio of Western Nevada who supported us in the way the UK sponsors had not. In just two days the Thrust desert site was ready.

At an early stage in the programme we'd agreed to share timekeepers with Breedlove but I found the Sports Car Club of America had little grasp of the situation, so brought in USAC's Dave Petrali, who had timed Thrust2. There were no more problems with time keeping.

Run 39 had us operational. Andy found the ride smooth but the car fishtailed more than in Jordan. On September 25 I lost my Land Speed Record as we reached 714.144mph. The 80mph jump from the Thrust2 record was the greatest in history.

By October 7 speeds had reached Mach 0.98. The Spirit team never really seemed to get going. They seemed to manage by whim rather than checklist and the key operational sequencing which we had learned the hard way was never in evidence.

Now Sky started transmitting live to over 100 million viewers. CNN followed Sky's lead and before long we had audiences approaching one billion. Almost everything we had promised those would-be project sponsors had eventually come to pass. But they still stayed away.

On the 13th we tried for the supersonic record. The FIA agreed to sanction a single or double supersonic pass as the first supersonic achievement or record. The runs were made at Mach 0.997 and 1.007 but not inside the requisite 60 minutes, due to

"The car was an awe-inspiring sight. Accelerating faster than you could believe, in total silence"

parachute damage from the 40ft afterburner flames. But there was no doubt: we had finally gone supersonic.

Now to Wednesday, October 15. Run 65 began at 09:09.21.698. By 550mph the car was 60ft out of line but Andy corrected it. As he accelerated he nearly had a bird strike. As the car entered the measured mile, it was an awe-inspiring sight, accelerating faster than you could believe in total silence.

At the press pen there were no supersonic bangs but on the hills sharp cracks were heard and in Gerlach, houses were rocked and the local post-mistress nearly had a heart attack. Mile Speed 759.33mph; Mach 1.015. Run 66 was away at 10:04.08.090. Andy reported ThrustSSC was much more stable up to 550mph, then anticipated the usual left yaw and Thrust went right! Again the heart-stopping moment as it raced across the mile in silence and disappeared. Mile 766.609mph; Mach 1.020. World Record: Mile 763.035mph; Kilo 760.343mph.

By the time I got back to base it was all over. Instinctively we decided not to run again. The Barrier was broken, the tension gone, and the project complete. The biggest compliment came from the team of USAC timekeepers: they returned their fees for October 15.

I was very glad, we had been running a huge risk. ThrustSSC would soon need a rebuild and the team was very tired. This was a prime time for accidents.

In summary, it was an astonishing achievement by a small and highly professional team. The key human factor, apart from Andy, was the Engineering Team which deliberately had no chief engineer and insisted on the highest standards of safety. Another crucial element was the operational organisation, developed by Martyn Davidson and completed by Adam Northcote-Wright. A huge part of the success was the work put in by the Mach 1 Club and merchandising teams and the unsung heroes who kept the team and the desert security operations running.

Like Thrust2 the project was thought impossible and not backed by big sponsors. But credit goes to Castrol, BTR and especially the Mach 1 Club and Internet, which together created 20% of the revenue.

And what about the driver? Andy's contract stated that he was free to leave at any time. ThrustSSC was experimental, complex, never easy to drive and often unstable. Yet he drove it 66 times, went officially supersonic four times, but we believe the true figure is actually six. He never flinched from the job nor burdened us with emotional concern.

The last words of his report from those final runs best sums it up: 'Subjective feeling that rear-wheel steering should be limited to forklift trucks in future!'

And what of the future? ThrustSSC has raised the World Land Speed Record by 129.56mph and is the first car officially to go supersonic. Future challengers have to reach 770mph and that means safe supersonic performance before considering an attempt on the LSR. It is important to remember that, past Mach 1, aerodynamics are more predictable. I hope challengers will come as they have in the past and we don't have to wait 14 years.

As for the ThrustSSC project, we now have to fight to clear substantial debts before it can be finally laid to rest. •



