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The amazing story of 'RED RACER'

From the Iron Curtain, to dancing yetis and Goodwood: Škoda's remarkable 1100 OHC Spider

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EDITOR
William Kimberley

ASSISTANT EDITOR
Alan Stoddart

CONTRIBUTORS
Chris Pickering
Hal Ridge

CONSULTANT EDITOR
Mark Skewis

HEAD OF DIGITAL CONTENT
Sara Kimberley

ART EDITOR
Paul Bullock

ADVERTISING MANAGER
Mike Norman

COMMERCIAL DIRECTOR
Maryam Lamond

MANAGING DIRECTOR
Adrian Goodsell

PUBLISHING DIRECTOR
Soheila Kimberley



@historicrace

facebook.com/
HistoricRaceTechnology

HISTORIC RACING
Technology

841 High Road, Finchley
London N12 8PT
Tel: +44 (0) 208 446 2100
Fax: +44 (0) 208 446 2191

www.kimberleymediagroup.com

A vanishing commodity?

JUST recently I visited the Low Carbon Vehicle event at Millbrook in the UK which is about as far removed as you can get from historic racing. It was all about the coming electrification of the car whether we like it or not. It followed straight after the UK Government's new Electric Vehicle Energy Taskforce was announced as part of the 'Road to Zero' strategy in July.

So what? you might well ask. That has nothing to do with historic motoring and certainly not with historic racing. The trouble is that it might have an almighty impact unless we are careful.

I appreciate this was an exhibition for those companies that were wanting to exploit any new opportunities in the automotive area and therefore there were many there who were committed advocates of this brave new world, but listening to a good many of them, some of whom I have known and respected for years, it did give me pause for thought.

Over 60 percent of the UK's independent forecourts, more than 4,000, have closed in the last 15 years according to the Petrol Retailers Association. If this trend continues, by 2030, there will practically be none left. So the argument put forward by the new technologists is that perforce, the average new car buyer will therefore almost automatically select a fully electric car as by then their average range will be around 350-400 miles. As more electric vehicles come to market, so even more petrol stations will disappear, and along with them the ability for any existing internal combustion engined cars to travel.

This is certainly one scenario, but in my heart of hearts I don't buy into it. For a start, the independent petrol stations are closing not due to lack of demand but because the big four supermarkets Tesco, Sainsbury's, Asda and Morrisons are killing them off. They might only have a 17 percent share of forecourts but they account for 43 percent of fuel volume and these giants can afford to make a near loss on fuel, because the meaty profit is coming from groceries. We need to understand the background when such 'facts' about closing petrol stations are made.

However, there's no doubt that the tide is turning at governmental level against all forms of vehicle powered by the internal combustion engine and it can only be a matter of time before a totally unsympathetic government comes to power and regards historic motorsport as a playground for the rich from which they can impose taxes. After all, if the government is going to cut off its nose by reducing the huge income it gets from the tax on diesel and petrol, then it will have to make it up in other ways.

As we know, governments get these things wrong. It was all very well incentivising new car buyers a few years ago to buy diesel for the sake of the health of the nation, carefully ignoring the fact that while they were addressing CO2 concerns, they were overlooking NOx, but now the owners of diesels are regarded as the drivers from hell and inappropriately taxed accordingly. My son-in-law has recently bought a brand new diesel-powered Range Rover but to pay for parking outside his house, which is in a controlled parking zone, he has to pay an extra £400 because it's a diesel, which is simply outrageous.

By the time the current 'Road to Zero' strategy unravels, which is almost certainly will before 2040, those politicians that implemented it will be long gone from the scene, just like the mob that made us buy diesels, but they won't care as they would already have made their mark, rightly or wrongly.

So back to historic racing. It does have a future, and I believe that petrol will remain freely available. The only worry is that it's not taxed to high heaven by mean spirited governments. HRT

William Kimberley
Editor



NEWS



ABOVE '25R' is the first McLaren F1 Certified car

New service aims to safeguard originality of iconic car for future generations

William Kimberley

McLAREN Automotive has introduced a new service to authenticate the heritage of iconic McLaren F1 supercars. The launch of the new programme is coincident with the unveiling of the first F1 to be approved for certification, the renowned '25R' 1997 F1 GTR Longtail.

"Even among F1 GTRs, this car, designated '25R', is unique – and now it is as near to being new as we can make it," commented Ansar Ali, managing director, McLaren Special Operations (MSO). "The car is the exemplar of everything that the new certification programme stands for and we are proud to have '25R' as the very first McLaren F1 Certified car."

The F1 Certified programme has been developed to guarantee the authenticity of both road and track versions of the Le Mans-winning supercar, offering ultimate peace of mind for current and future owners. A unique Certificate of Authenticity – which McLaren Automotive is the only body in the world able to issue – authenticates a car's provenance, originality, service life, road/race history and condition. Conformity with the original specification and to any McLaren-sanctioned upgrades is confirmed by reference to the factory archives.

Along with the certificate, owners receive a bespoke illustrated book documenting the history of their car. In total 106 McLaren F1s were built between 1993-98, among them 64 road cars and 28 GTR race cars, and all are eligible for the scheme.

A veteran of many endurance events in period including the Le Mans 24 Hours, over the past 18 months '25R' has been restored to 'as new' condition by McLaren Special Operations. Using original F1 GTR



parts held by the factory, the restoration has returned the car to the same specification and livery it had when it ran at Le Mans in the first year it raced.

The top-level circuit career of F1 GTR '25R' spanned eight years and several continents. It was built as one of three Longtail cars for the Gulf-Davidoff team to compete in GT racing in 1997 and driven at Le Mans that year by Ray Bellm, Andrew Gilbert-Scott and Masanori Sekiya. It was forced out two hours from the end of the race when an oil line fractured, causing a fire. Repaired by the factory, '25R' was subsequently sold to a team in Japan where it continued racing until 2005. At the Fuji Speedway that year it became the last F1 GTR ever to compete in a contemporary race series.

After being on static display in a Japanese collection, it was sold to the current owner and brought back to the UK in 2016. The owner's collection is curated by classic car consultancy Kidston SA, founded by McLaren owner Simon Kidston, also a leading international broker of McLaren F1 cars.

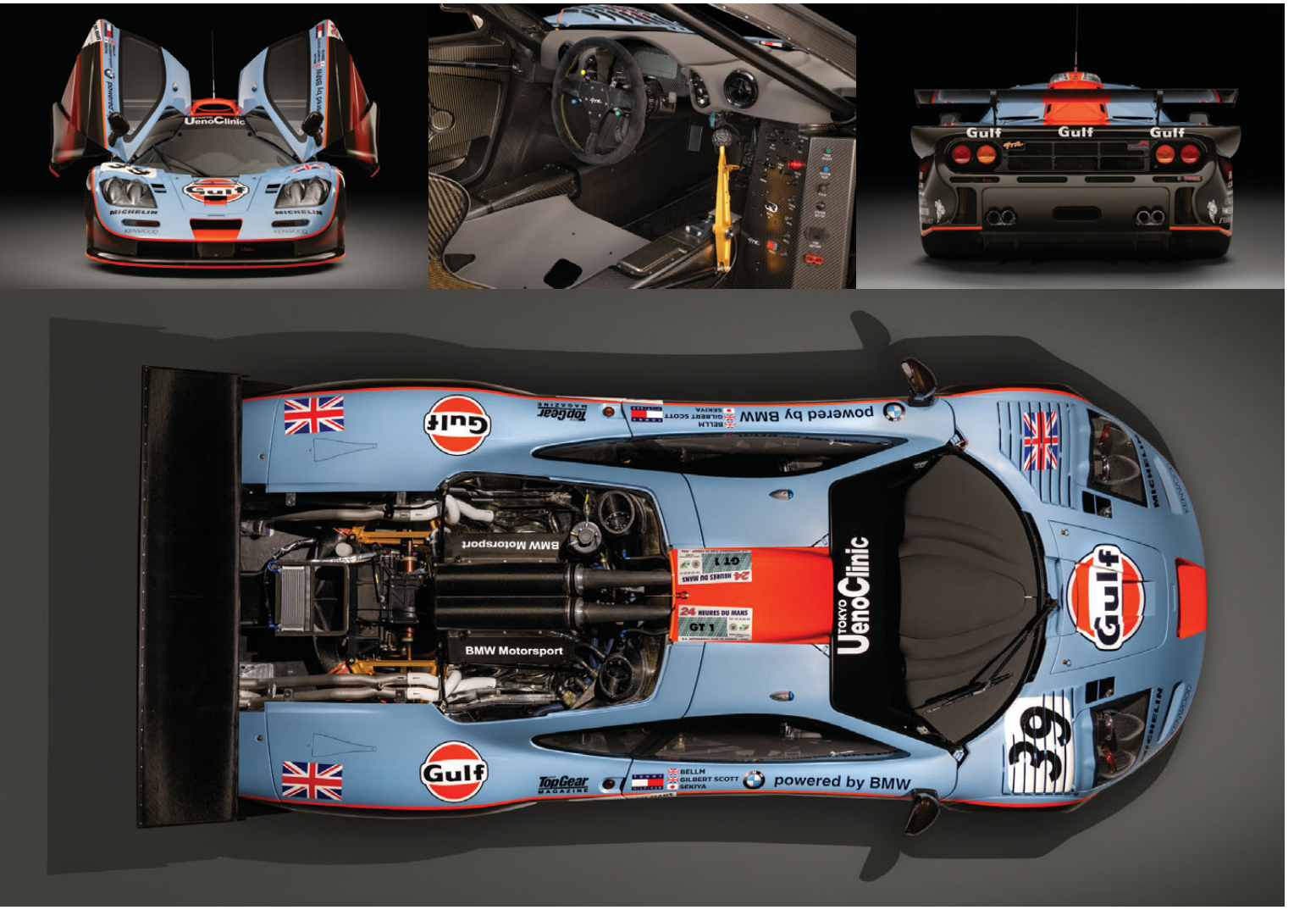
Kidston SA entrusted the car to McLaren Special Operations in Woking as, battle-scarred from years of racing, '25R' needed extensive remedial work. Refurbishment became a ground-up restoration to 'as new' condition using new, old-stock GTR parts stored at the factory in containers last opened 20 years ago.

DOWN TO THE LAST DETAIL

The new parts used in '25R' go further than being specific to the 1997 GTR; they are all pre-June 1997 parts, ensuring the car is exactly as it would have been in the run-up to Le Mans that year. This includes the 'tall' Le Mans gearing and the blue roof identification lights – taken from an aircraft's wing, and the only non-McLaren part in the entire car – with which the car was fitted for Le Mans.

With the new body panels displaying the exact Gulf-Davidoff team livery and bearing the car's 1997 Le Mans number 39, '25R' is a true 21-years-old time-warp machine, as witnessed by visitors to the Hampton Court Palace Concours of Elegance.

"McLaren cherishes its rich heritage of iconic and world-beating cars such as the F1," said McLaren Automotive chief executive officer Mike Flewitt. "'25R' presented us with a unique opportunity to demonstrate this by restoring it to precisely how it was when it raced at Le Mans in 1997, thus ensuring its future. Maintaining the integrity of these historically significant cars is paramount and F1 Certified will play a big role in allowing us to do that for the peace of mind of owners today as well as preserving a wonderful heritage for future generations of car lovers." HRT





LEFT Construction of this unique car took approximately one and a half years

Porsche Classic builds a classic 911 using genuine parts

PORSCHE Classic has built a highly desirable collector's item: the last 911 Turbo with an air-cooled engine - 20 years after the end of series production. The design of the 993-generation 911 Turbo is based on an original bodyshell, and the vehicle's appearance is just as unique as its history: Painted in Golden Yellow Metallic, it references the 2018 911 Turbo S Exclusive Series. The black wheels are highlighted by Golden Yellow design accents, while the seats and interior trim are finished in black with Golden Yellow details. The bodyshell features the characteristic side air intakes of the 993 Turbo S that were also available as an option for the regular 911 Turbo in 1998.

"Project Gold" showcases the comprehensive skill of Porsche Classic in fascinating fashion", says Detlev von Platen, member of the executive board responsible for sales and marketing at Porsche. "This project clearly demonstrates our strategic approach. Although we are starting a new chapter in our sports car history with the Porsche Taycan, the story of how the company evolved is no less significant. On the contrary, this Golden Yellow 993 demonstrates how incredibly passionate we are about the tradition of our brand."

"Project Gold" represents Porsche Classic's spectacular contribution to the "70 years of Porsche sports cars" celebrations: With this anniversary in mind as well as the forthcoming market launch of the Taycan as the first purely electric Porsche sports car, the experts at Porsche Classic came up with the idea of constructing a completely new vehicle based on an existing genuine type 993 bodyshell, showcasing both tradition and innovation. The experts were able to rely on a selection of over 6,500 genuine parts that Porsche Classic offers exclusively for 993 generation models. Overall, the Classic division currently stocks some 52,000 parts, which can be sourced via Porsche Classic Partners and Porsche Centres around the globe to repair and restore classic Porsche cars.

Construction of the unique vehicle took approximately one and a half years. The bodyshell was first put through the corrosion protection and painting process applied to today's series-production vehicles. The collector's item was then assembled and tuned by Porsche Classic specialists at the Porsche restoration workshop in Stuttgart. A brand new 3.6-litre twin-turbo flat-6 engine developing 450 hp was installed, delivering the performance the vehicle originally had when it was in production. The manual transmission and all-wheel drive were also sourced from the Porsche Classic range of genuine parts. The hand-stamped chassis number follows the last series-production model of the 993 Turbo which rolled off the production line in 1998.



LEFT Undergoing cathodic dip coating

The exterior and interior elements were coordinated with the workshop's dedicated Porsche Exclusive Manufaktur experts who were responsible for creating the 2018 911 Turbo S Exclusive series, which was limited to 500 units worldwide. To complement these elements, the designers at Style Porsche worked on the colour gradients and positioning of badges as well as other interior details.

The 993 remains a sought-after collector's item to this day, and is considered a particularly sophisticated and reliable vehicle. It was the first 911 to feature a redesigned aluminium chassis, giving it exceptional agility at the time. The 911 Turbo version of the 993 was also the first to have a twin-turbo engine, making it the lowest-emission standard automotive powertrain in the world in 1995. The front section is lower-slung than on the earlier 911 models, thanks to a switch from round to poly ellipsoidal headlights. Hollow-spoke aluminium wheels, a first for any car with aluminium wheels, were another innovation of the all-wheel drive 911 Turbo version. Only 345 units of the 911 Turbo S with its 450-hp performance-enhanced engine were built. HRT

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Michael L. Levitt LAT Images

ABOVE Don Panoz helped revive sportscar racing in the US not only by creating the American Le Mans Series and owning a number of circuits but also funding the development of race cars and race engines in his name. He is seen here in one of his cars at Road Atlanta in October 2017

Racing pioneer Don Panoz dies at age 83

DON PANOZ, one of the most important figures in the history of sportscar racing, has died at the age of 83. He was best known to race fans as the founder of the American Le Mans Series (ALMS) and creator of the famously loud and uniquely styled front-engined Panoz LMP1 race cars.

He fell in love with the unique atmosphere of the 24 Hours of Le Mans after experiencing it himself for the first time and aimed to replicate the spirit of Le Mans, its unique rules and regulations while adding his own fan-friendly atmosphere, first through the creation of a "one-off" event at Road Atlanta, the 10-hour or 1,000-mile Petit Le Mans, which debuted on 11 October, 1998.

Buoyed by the success of Petit Le Mans, he founded the American Le Mans Series (ALMS), a series of races throughout North America on world-class race tracks, including three that he owned: Sebring International Raceway, Road Atlanta, and Mosport — what today is known as Canadian Tire Motorsport Park. He became a driving force for sports car racing in North America at a time when the sport was badly in need of direction, vision and leadership.

His involvement in motorsport extended well beyond the ALMS and his race tracks, which all were part of his Panoz Motor Sports Group. His Panoz Esperante GTR-1, was the first successful front-engined prototype race car in more than 30 years. Following that, Panoz was a pioneer in the introduction of hybrid technology in sports car racing, bringing the car known as "sparky" into competition at the 1998 Petit Le Mans.

Another highlight was the Panoz Esperante GT LM, which won both the 24 Hours of Le Mans and Twelve Hours of Sebring in 2006, which also earned Panoz the coveted "Spirit of Le Mans" award from the Automobile Club de l'Ouest.

In the early 2010s, he was instrumental in the development of the revolutionary Ben Bowlby-designed DeltaWing race car, which was half the weight and horsepower, but all the performance of other prototype race cars. The DeltaWing raced in the 24 Hours of Le Mans, the ALMS and the WeatherTech Championship until the end of the 2016 season.

Beyond sports cars, the Panoz Motor Sports Group also included Van Diemen, which built successful chassis used in open-wheel and prototype development series; Élan Technologies, which built engines and chassis for a variety of race cars; and G-Force, which built IndyCar chassis that would win the Indianapolis 500 in 1997, 1998, 2003 and 2004. The organisation also built the well-respected DP01 chassis used in the final season of the Champ Car World Series before its merger with IndyCar in 2008. Most recently, the Panoz Avezzano race car won the 2018 Pirelli World Challenge GTS class Sprint/Sprint-X Manufacturers' Championship.

It was in 2012 that ALMS merged with the NASCAR owned Grand-Am Road Racing Association. With Jim France as chairman, Panoz became vice chairman of the new organisation, which took on the International Motor Sports Association (IMSA) moniker. He had acquired the rights to use the IMSA name years earlier for his own sanctioning body, extending the lineage of the highly respected organisation founded in 1969 by Bill France Sr and John and Peggy Bishop.

"It is difficult to find the right words to express my sadness with the news of Don's passing," said Scott Atherton, who ran ALMS before the merger and who then became IMSA president. "He was a very special guy — the most visionary and creative person I have ever worked with. He was a serial entrepreneur of the highest order. Don was the consummate 'idea guy' — not all of them good mind you — but he came up with several that were truly brilliant that transformed entire industries.

"Many of us who make our living in motorsport owe him a debt of gratitude. He deserves full credit for putting professional sports car racing back on the map when it was at its lowest point. His acquisition of IMSA, Sebring International Raceway, Road Atlanta, Mosport and the creation of the American Le Mans Series are enduring monuments of his legacy." HRT

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ABOVE The MSA has relaxed roll cage rules for stage rallying in cars built before 2005

MSA relaxes impending roll cage regs for older cars

THE Motor Sports Association (MSA) has relaxed impending changes to roll cage rules in stage rallying to address concerns regarding their compatibility with older cars and difficulties in retrofitting the additional parts. Regulations due for implementation next year would have required all vehicles first issued with a Vehicle Passport after 1 January 2019 to comply with new roof and windscreen pillar reinforcement measures. However, those requirements have now been restricted to models first conceived after 31 December 2005 on the basis that older cars have less raked A pillars that negate the need for reinforcement bars. Additionally, any vehicle issued with a Vehicle Passport or Competition Car Logbook prior to 1 January 2019 will be exempt from the new requirements.

The regulation changes recommended by Motor Sports Council and ratified by the MSA Board are as follows:

48.10.1. Have, as a minimum, safety roll-over bars a ROPS complying with K.1, Section K Appendix 2 Drawing number 5 or 6, and longitudinal door bars complying with K.1.3.5(b) (side sections K Appendix 2 Drawing number 9).

For vehicles first not issued with a Vehicle Passport or Competition Car Log Book prior to from 1 January 2019 – and of a make and model with a conception date post 31.12.2005 – the following additional members are mandatory:

- Roof reinforcement complying with K.1.3.5(c) and Section K Appendix 2 drawing number 10(a), (b), (c) or (d).

- Windscreen pillar reinforcement complying with K.1.3.5(e) on each side if Section K Appendix 2 drawing number 63 dimension “A” is greater than 200mm.

The reason for this is to address concerns raised, for example, on older cars where the addition of windscreen pillar reinforcement may cause issues with vehicle egress, and where typically less raked windscreen and A pillars permit a similarly less raked front hoop negating the necessity and purpose of the reinforcement bars themselves.

The FIA regulations apply roof bars to cars homologated from 2005 onward, and windscreen reinforcement pillars to cars homologated from 2006 onward. MSA regulations do not specify homologated cars, however the model conception date in the proposal is deemed suitable to cover both members as it reflects the latter of these FIA dates.

On a separate topic, the MSA has committed to an in-depth review of competitor safety equipment over the next two years. This will explore a raft of initiatives, including strategies to reduce the burden on competitors of the unnecessary replacement of seats and harnesses, while ensuring suitably high standards of safety are maintained in the sport.

A cornerstone of this new initiative will be to provide greater education for competitors in respect of their own safety and to place more responsibility on the competitor to maintain a level of safety equipment, above a defined MSA minimum standard.

As a first step, the MSA will recognise an extended life for certain FIA-homologated seats and harnesses in the UK. The MSA Board has approved the following Motor Sports Council recommendations with immediate effect:

In stage rallying, seats homologated to the FIA 8855-1999 standard are granted a two-year extension at the end of their initial five-year life.

Across disciplines requiring a homologated harness, the MSA will recognise a 10-year life for harnesses homologated to the latest FIA 8853-2016 standard. This homologation is for six-point harnesses as a minimum, and is tested with higher loadings than the previous standard.

The MSA will be publishing new guidance on installing seats and harnesses, while giving scrutineers further training in this area. The governing body will also be reiterating scrutineers’ powers to retain or invalidate homologated equipment if they have serious concerns regarding its condition or know it has been involved in a major accident.

Looking ahead, the MSA is investigating new ways of tracking homologated components as well as evaluating more cost-effective accident data recorders (ADRs) for wider use.

“As the governing body, one of our principal roles is to grow motorsport at grassroots level while promoting safety within the sport at a realistic cost for competitors,” said MSA chairman David Richards. “I firmly believe the time has come for a wholesale review of our approach to safety across the entire motorsport landscape and this review will be delivered by 2020. It’s therefore appropriate to allow our competitors to continue using their recently purchased seats at least until then, when the outcome of this review will be published.” HRT

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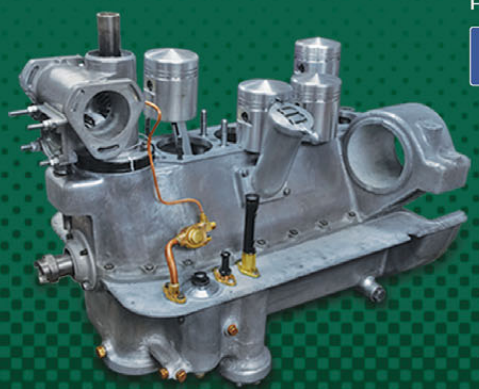
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ABOVE Former Group Lotus CEO Jean-Marc Gales has been tasked with driving the revived and renamed business to new heights

JD Classics acquired by Woodham Mortimer

William Kimberley

JD Classics, one of the UK's leading restoration, racing and trading companies has been acquired by Woodham Mortimer Limited, a newly established company wholly owned by HPS Investment Partners of New York. The acquisition follows a calamitous few months which saw JD Classics go into Administration.

The sale safeguards the jobs of approximately 60 employees at the company's headquarters in Maldon, Essex, and includes the company's world-renowned workshop and restoration business, as well as its successful racing team.

Now renamed Woodham Mortimer with immediate effect,the new business has already begun trading and will benefit from a solid financial foundation that will deliver a sustainable yet ambitious development plan.

Founded in 1987 and trading from a network of showrooms in Essex and London's Mayfair in the UK and Newport Beach, California, it was sold two years ago to a consortium led by Charme Capital Partners, a private equity firm based in London, Milan and Madrid. Co-investors in that deal included deCAR Partners, which invests in vintage luxury and fine art-related companies, and FiveW Capital, another financial investor.

Projecting a very favourable image, JD Classics ran into serious trouble earlier this year following a highly damaging court case. Mike Tuke, a businessman who sold his business Finsbury Orthopaedics for a total pre-tax consideration of over £60m approached JD Classics' managing director Derek Hood in December 2009 for advice as to investing the proceeds of the sale into classic cars. Hood offered to advise him on both the buying and selling of such cars and commented that he could "double" Tuke's money.

Tuke immediately purchased four cars for a total price of £5.4m, including a Bugatti Veyron that had previously been owned by Jenson Button. Through 2010, Hood persuaded Tuke to purchase a further 17 cars for a total of over £14.5m. From 2011 onwards, Tuke entered into 15 sales transactions, many involving part exchanges for other cars. The total value of the cars involved in these sales and purchases was estimated to be about £40m. However, Tuke sustained very substantial losses on those cars

As a result, he instructed Michael Grenfell of Wilmot & Co solicitors to institute multiple proceedings against JD Classics and/or Hood in four separate actions involving a number of allegations of misrepresentation and fraud. In one example given in the court case that was held in April this year, it was claimed Tuke paid £254,000 for what he was told was a "very rare" AC Aceca Bristol competition car in the belief that he was dealing with a third-party seller through JD Classics, but the court heard JD Classics in fact "owned the car itself", having paid just £84,000 for it only three weeks earlier.

The dispute was over whether Hood and JD Classics had ever agreed to act as Tuke's "agent", the response being that JD Classics was always dealing "on its own account".

After lengthy court proceedings, the judgement was made in Tuke's favour, concluding that Hood had engaged in "deliberate and dishonest conduct" concerning representations made as to the ownership of a Jaguar Lister Knobbly in respect of which Hood had "painted a false picture" by claiming that it was owned by the potential buyer of a Jaguar XKSS when it was in fact owned by JD Classics. Hood declined to give evidence at trial but the judge considered that the reason for his dishonesty was "clear", namely a desire to sell the Jaguar Lister Knobbly at what Tuke said was a gross overvalue by "pretending that it was being offered in part exchange".

In an effort to salvage JD Classics' now seriously tarnished image in the industry, Hood was replaced in June by a new management team involving Jean-Marc Gales, former Lotus Group chief executive who remains with the new company as its chairman and CEO.

"It is fantastic news that we can today announce a future with financial security and a solid plan for growth, through the acquisition by Woodham Mortimer Ltd," said Gales. "Despite the difficulties of the recent past, the company remains a world-class organisation with a workforce of dedicated and highly talented individuals. We will continue to grow and develop a business that builds upon the excellence that JD Classics established. We look forward to a future at the absolute pinnacle of classic car restoration, historic competition and sales." HRT



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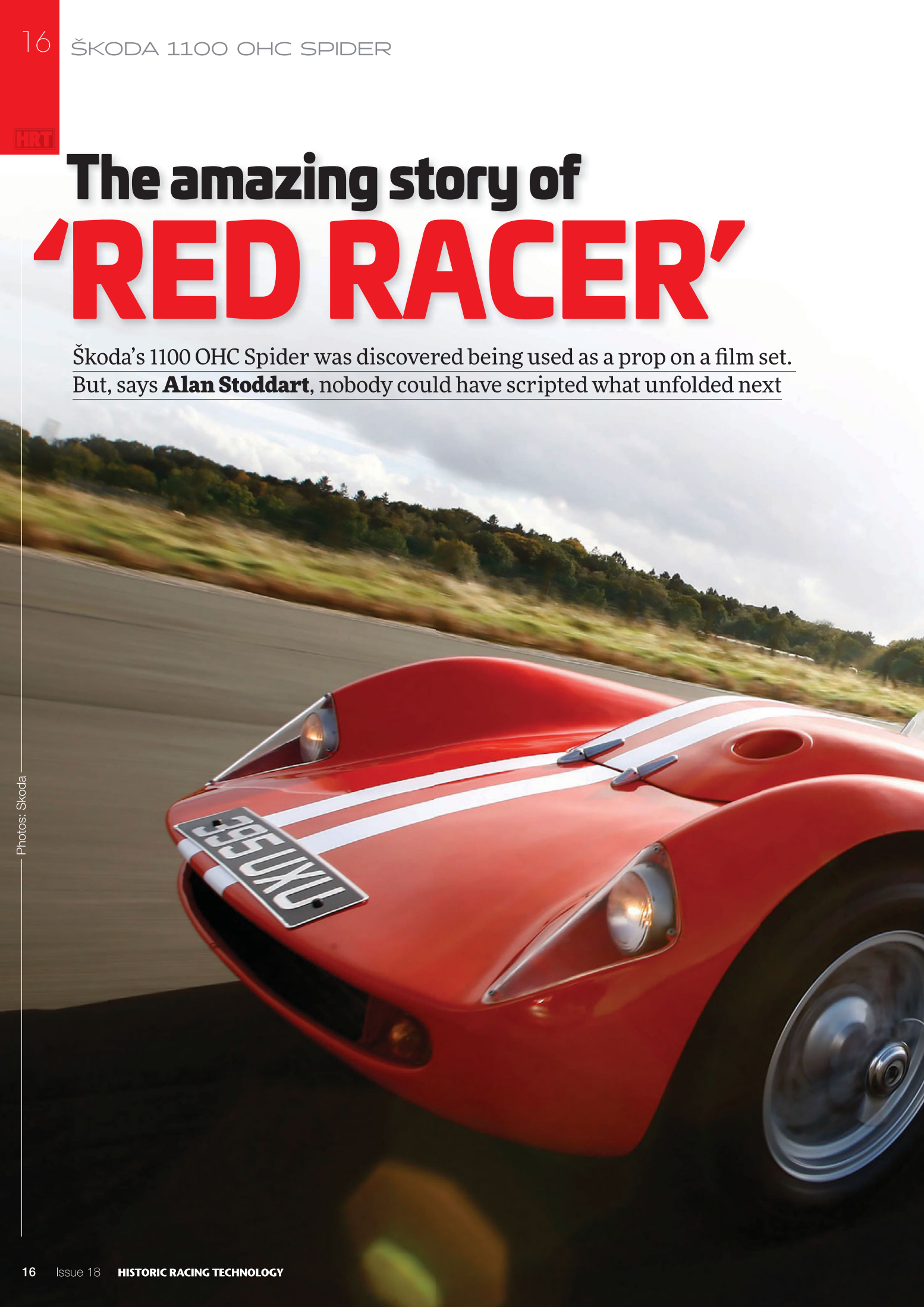
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The amazing story of 'RED RACER'

Škoda's 1100 OHC Spider was discovered being used as a prop on a film set. But, says **Alan Stoddart**, nobody could have scripted what unfolded next



Photos: Skoda

IF someone was to ask you to imagine a very rare, beautifully engineered and heart-stoppingly pretty racecar from the 1950s, what springs to mind? Well there are plenty to choose from, what about the Aston Martin DBR1 with its thrumming straight six, or the innovative Jaguar D-Type with its Le Mans pedigree? Speaking of Le Mans, there is the Mercedes-Benz 300 SLR, a beautiful car best known for its tragic accident, or the sonorous Maserati 450s, and of course, let's not forget the litany of fiery prancing horses stampeding out of Maranello.

It's unlikely however, that your very first thought would be a car that was pieced together in the corner of a factory in Mladá Boleslav by a team of engineers that were working out of hours, simply for the love of racing. A car of which only two were made, with just 90 bhp and only a smattering of race wins including a victory in Leningrad at the hands of Miroslav Fousek. It is very unlikely that your first thought would be Škoda's 1100 OHC Spider, the Czech firm's enigmatic 'Red Racer'.

Despite being made in the corner of Škoda's factory however, the car was a true racing prototype in that it bore little resemblance to any of the firm's road-going offerings. Even the engine was surprisingly bespoke. It was based on the 440 saloon engine, but the racer's motor had only the bore and stroke dimensions, of 68 mm and 75 mm respectively, and aluminium crankcase and block in common with the version you could have driven off the forecourt of a dealership in Hradec Kralove, for example.

> **"It is a phenomenal bit of kit. If only we'd been able to see it somewhere like Le Mans"**

Added to this base engine was an aluminium cylinder head that utilised twin overhead camshafts, operating two valves per cylinder through interposed levers, which were driven by an intricate train of gears from the front of the crankshaft. Another difference to the road engine was at the crankshaft, which was fully machined all over and adapted to use three thin wall bearings rather than the older Babbit-type bearings that were still in use on the production engine.

Inside the engine, the connecting rods and pistons were bespoke and engineered with very high quality steel and techniques picked up from aircraft engineering. This led to, among other things, the very distinctive shape of the piston's crown.

"It's pent roof," explains Steve Gault who works maintaining Škoda's heritage fleet. "It's more towards the American hemi-type head, which incidentally is more than likely why they used aviation-type fuel. When we had new pistons made we added a packer plate just to lower the compression so we can run it on regular pump gas, otherwise it's just a nightmare."

The same is also true of the connecting rods, adds Gault. "They were clever guys back then, and that shows in the engineering that has gone into these rods. If you buy a rod these days, it's all just shot peened, it's not smooth ▶



LEFT Yes, it really is a Škoda: the enigmatic 1100 OHC Spider in action

or polished or anything like that, but the Škoda uses old aircraft engineering. They are pretty, pretty things."

This bespoke nature of the car has made it harder for the team looking after it, which is trying to keep everything as original as possible. They have however been helped by the specialist engineers who still have the skills to build pieces in the traditional manner using period technologies. For some things though, unusual solutions have been required.

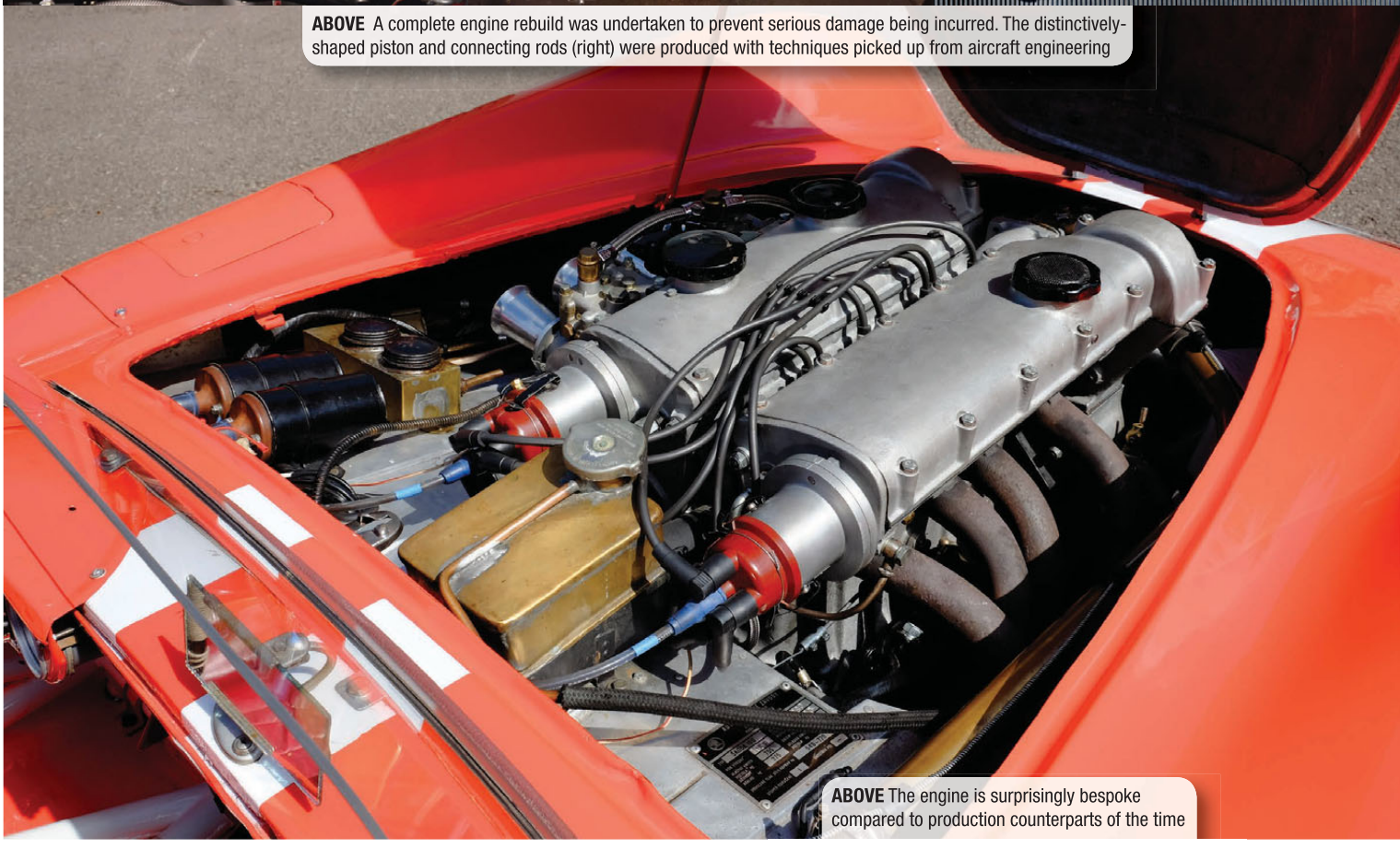
This was the case when the 1100 OHC needed replacement lenses being made for the rear lights. The usual companies Škoda may have gone to just didn't appreciate how specialised the work was. "We'd speak to people who would ask, 'Do you want to do a run of 20?' and we'd reply and say, 'Well... no, we only want one for our one car,'" recalls Gault. "So things like injection moulding were too expensive, and 3D printing wasn't as good as it is now, but we did work quite closely with a company that made models. We used them when we were doing an advert for a new car that featured a dancing Yeti, so we got them to make all the plastics for the lights and pullouts and headlight covers.

"Those guys were brilliant."

Other things like the cams and the brakes had to be completely remanufactured because they just wore away. The brakes were particularly interesting, because although they were based on production drum brakes, they were heavily modified with numerous air vents and fins which behaved as a heat exchanger to improve the brake cooling and reduce fade as much as possible. They were also mounted inboard, either side of the differential to keep the unsprung weight down and maintain better balance, which was crucial on a 550 kg car without independent suspension. In fact, balance was so important on the lightweight racer, which utilised a torsion beam arrangement, that the gearbox is actually slightly off-centre to laterally offset the weight of a driver. ▶



ABOVE A complete engine rebuild was undertaken to prevent serious damage being incurred. The distinctively-shaped piston and connecting rods (right) were produced with techniques picked up from aircraft engineering



ABOVE The engine is surprisingly bespoke compared to production counterparts of the time

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ABOVE The philosophy of preserving originality has prevailed in the car's restoration

Getting specialists is all part of the usual course of looking after the 1100 OHC, though, whether it is the F1 bodyshop that was used to rebuild the fibreglass body, or the traditional panel beater that was more used to working on DB5s who was used to restore the original aluminium bonnet. It's all unique, so subsequently needs carefully chosen companies to maintain the car's impressive presence.

UNLOVED AND FORGOTTEN

It is an effort that is all worth going to though, says Gault, especially when the car's incredible story is kept in mind. After being manufactured in 1958, the car was raced a handful of times, mainly within Czechoslovakia, but also at the odd international race such as the aforementioned Leningrad GP. It wasn't long, however, before the two open top cars were left unloved in the factory.

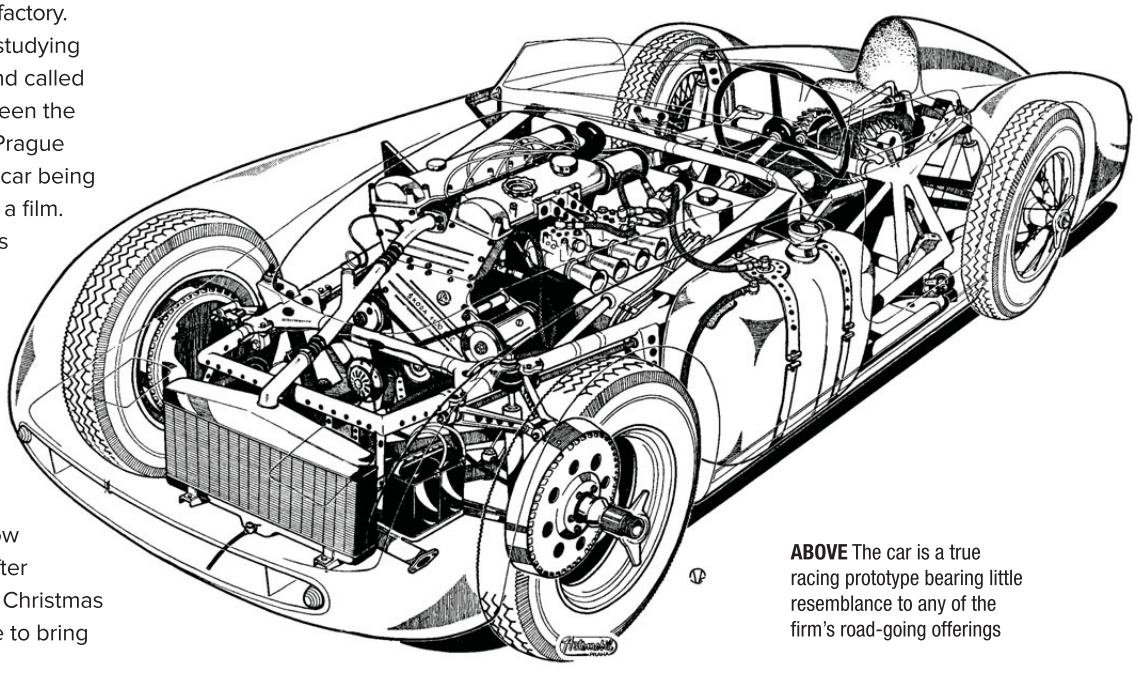
A few years later, a Czech studying at Imperial College in England called Martin Svetnicka, who had seen the car racing on the streets of Prague some years before, saw the car being used as a prop on the set of a film. Later, after many approaches to Škoda management and the help of a few contacts, he was eventually able to purchase one of the two 1100 OHC spiders. Working in the garages of his former university in Prague over the winter, and sneaking in through a window to continue working there after the institution closed for the Christmas holidays, Svetnicka was able to bring the engine into a state where it could be road registered on 13th January 1969, a day before his visa expired and he was forced to leave Czechoslovakia.

The plan was to drive back to London through the snow, but, amid the political tensions of the time, he was stopped and the car was briefly impounded at the crossing into Germany by the highly suspicious border guards. After talking himself out of this particular predicament, Svetnicka made it as far as Wiesbaden before the engine once again seized completely and the car had to be left for a period at a local garage. It wasn't what he had hoped for, but at least the Red Racer had made a rare escape from behind the Iron Curtain.

The second half of the journey back to London was equally gruelling, with Svetnicka, travelling with a friend who was president of Imperial College's Motor Club, battling to tow the 1100 OHC back to London from Wiesbaden in the snow with a hired Renault 8. There was much drama in this eventful journey: multiple spins on the motorway; hanging off the Renault's rear bumper in the hope of weighing down its driven rear wheels enough to give traction for climbing any hills that needed to be passed on route; and trying to keep the Škoda, which at its tallest is less that 38 inches, under control on the eight inches of snow the pair were facing.

Eventually, the Red Racer made it to England, where it has stayed. It was used by Svetnicka and then changed hands a couple of times, undergoing bits of work here and there before being bought by Škoda to be fully restored and lovingly cared for by its heritage department, which it has done admirably.

The work carried out by Škoda UK's heritage department has largely been ▶



ABOVE The car is a true racing prototype bearing little resemblance to any of the firm's road-going offerings

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focused on preserving originality. However, this is not to the point that some slight concessions cannot be made to ensure the car can still be driven and enjoyed, while using subtle changes which can stop more serious problems developing.

One of the bits of preventative maintenance that is currently being carried out is to the car's propshaft.

"Basically, on a modern car the propshaft has multi-splines on them, but the Red Racer is just a five-spline connection so it is very noisy and there is a lot of movement in it," explains Gault. "Because we do a lot of the short, sprint-type venues, it is putting quite a lot of wear on the propshaft. So, we are modifying the engine end of it to make it multi-splined and to make it more reliable before it does break. It also means we can keep it original at the back where it meets the gearbox.



ABOVE An advert for a dancing yeti was the unlikely inspiration for the recreation of the lenses in the rear lights



ABOVE Much effort was made to improve the cooling



ABOVE It's hardly the name you would expect to adorn such a spectacular racing car

"So before it breaks and causes some major damage to the gearbox or the engine or whatever else, we are putting a stop to that, while also making the car quieter and more fun. By doing this work now it also means we can keep the original propshaft – we are just modifying one end."

As a result of taking a preventative approach with the Red Racer there haven't been any major issues with the car, with only "silly little things" like distributor caps coming off due to vibration from rough roads and the like. This didn't stop a complete engine rebuild four years ago however, when the team decided it was better to put some investment into the engine up front rather than waiting for something to go wrong.

KEEPING TRUE TO THE ORIGINAL

As well as having the new engine internals manufactured to original specifications, even parts that would have been easy and almost undetectable to change for more modern, more reliable parts, weren't. Things like the head gaskets. "We just made them exactly the same," Gault recalls. "We didn't go to cork or anything, they are still just sandwich steel parts, which is fine but it is the sort of thing that if you were going to modernise it to make it more reliable, those are the sorts of things you'd do.

"Even the bits that you can't recreate, like the fuel pumps and such, we try to hide."

This philosophy of preserving originality even extends to manufacturing techniques employed in the maintenance of the car. This meant that when ▶

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the time came to remanufacture parts to the original specification there was no 3D printing or laser scanning; instead it was more along the lines of Vernier callipers and "proper old boys in sheds". These engineers were approached because they understand the period methods, materials and techniques, which enabled them to accurately reverse engineer components.

There are some parts that would be virtually indistinguishable if they were crafted using modern techniques but which have still been remanufactured using original methods regardless. The door hinges, for example, needed to be replaced after one of them broke off. One of heritage department's contacts at a top F1 team even offered to make one, saying it would be no problem to quickly 3D print a new one for the car, which was exactly the same shape and size as the original. However, Škoda instead chose to go to an independent manufacturer who with his bricks and sand was able to cast one in the same manner as the original.

A similar story is told of the customised drum brakes. After so long the linings had become hard and brittle and were not performing as they should, so Škoda had them re-lined by hand. Rather than using modern high-performance materials, though, they were simply re-shod with cork and leather.

This determination to maintain originality has proved problematic at times. Dirty fuel meant there were problems with the carburettors, for instance. Solving this involved installing another swirl pot to remove any particulates or anything from the fuel before it reached the engine, which is particularly important given the sensitivity of the carburettors. It also meant that new jets needed manufacturing.

"We had to make new jets for them because nothing was available off the shelf," says Gault. "The dyno guy said, 'Oh don't worry, I can get you some Webers', but we had to insist that we were sticking to the originals.

"It's a process of trying to get the balance right with any sort of twin carb. The experience of using Webers is easy, but you're a bit blind getting these old Jikov carburettors right, so you really





ABOVE A notable feature is the use of inboard brakes, mounted either side of the differential, to keep unsprung weight down



ABOVE The car's preservation draws on both past and present: a traditional panel beater restored the original aluminium bonnet, while an F1 bodyshop rebuilt the fibreglass body



ABOVE From the Iron Curtain to Goodwood: Red Racer has had a remarkable journey

need an old boy who knows how to work them. It's a real dark art.

"When we first rebuilt the engine, the carburettors were very rich, and of course you can't buy a jet to fit in the thread that's in the carburettors so we soldered them up and drilled them to make the holes in them to properly weaken the mixture. Before we did that, it was just washing the bores."

This effort to keep everything authentic is paying off though. Both of the intriguing little roadsters are still in existence, with the other being looked after by the Czech firm's own museum in Czechia. That car isn't as original as the car being tended in the UK, something Gault is very proud of. "When we bought the car we obviously started reaching out to the factory for a bit of assistance and help, but it became quite obvious that the guys who used to know about it aren't there anymore, so now it's going the other way, they are reaching out to us asking for advice," he says.

"But obviously, it's important that we try and keep them both running."

It's important because they are such interesting and unusual cars, which represent a sincere and capable motorsport effort from a marque that is unfortunately more frequently associated with some of its less proud moments. Gault thinks this is rather a shame, when they actually built such a cleverly-designed racer.

"They built it from scratch as a race car, so it is spaceframe technology, and obviously the body's all aerodynamic, as are the floor pieces," he says. "They have just put a lot of thought into building it as a race car; it was never meant to be built as anything else."

"At the time they were obviously looking for mass production cars, which this wasn't, but it is a phenomenal bit of kit. If only we'd been able to see it somewhere like Le Mans," he speculates. "It probably would have done very well." HRT

THE CAT THAT BARED ITS CLAWS

Few people have ever seen a Cheetah in the flesh, let alone raced one, but it was love at first sight for Ian Burford when he stumbled across this dramatic V8-powered missile. **Chris Pickering** reports



OF all the cars built to topple Carroll Shelby's mighty Cobras, the Bill Thomas Cheetah was perhaps the most gloriously unhinged.

It's effectively a set of C2 Corvette mechanicals bolted to a lightweight spaceframe chassis, with the 327 cubic inch (5.4-litre) V8 pushed so far back that the heavy duty Muncie transmission connects directly to the differential without the need for a propshaft. Brutally short overhangs and a cockpit that sits virtually over the back axle give it an almost-cartoonishly menacing appearance.

national competitions and an updated Super Cheetah prototype was taking shape at the factory. But then a series of unfortunate events began to unfold. First, the SCCA changed the homologation requirements for its sports car events from 100 cars to 1,000 cars, making it a far greater undertaking for a small independent company. Next, Chevrolet pulled the plug on its support – spooked, some say, by the prospect of 1,000+ Cheetahs poaching Corvette sales. Finally, a devastating fire swept through the factory in September 1965, putting an end to Thomas's dream.

> **"Like a 2,000-piece jigsaw with no box to guide you and half the pieces missing"**

In many ways, the story behind the Cheetah is a tale of what might have been. Its creator, Bill Thomas, was a tuning specialist who had a longstanding relationship with Chevrolet. In 1963, having cut his teeth converting production models for stock car competitions and drag racing, Thomas set his sights on building his own car. General Motors secretly agreed to support the project, giving Thomas free rein to pick from the automotive giant's vast parts bin.

Things seemed to be going well. By 1964, the first Cheetahs were picking up encouraging results in

The exact number of original Cheetah chassis that survive is somewhat contested. Based on the number of fibreglass bodies ordered from the supplier it is estimated that no more than 23 were built, with perhaps as few as six original cars having continuous traceability since that time.

Until recently, only one Cheetah was known to have FIA papers and that car was based in the United States. But that would all change when British racer Ian Burford stumbled across one by accident.

"A friend of mine was looking to sell some of his collection in order to raise some money for a new project," explains Burford. "We were flicking through some images of various different things on his phone and he said 'and then there's this, which is the remains of a Cheetah'. That was the first time I'd seen one and I just thought it looked fantastic. It was like something from the future."

A deal was struck and Burford took possession of various parts, including a bare chassis, an assortment of steering and suspension components and some



Jeff Bloxham

ABOVE The Cheetah's futuristic looks make it a fan favourite

bodywork. It's believed that the chassis was a spare item built in-period, which was then put into storage, although there are signs that it had been assembled to some degree in the past.

The parts were still in the US at this stage, but Burford arranged to have them shipped to the UK, where they were met at the docks by Shaun Rainford and his team from CCK Historic. The Sussex-based firm then set about building the car you see here.

JIGSAW PUZZLE

The first job was to assemble the existing parts and begin a dry build of the chassis. CCK general manager Daniel Lackey likened it to setting out on a 2,000-piece jigsaw with no box to guide you and half the pieces missing.

"We started collecting the driveline components that we knew we would need, such as a Corvette differential and driveshafts, the rear hub assemblies and a donor gearbox. On the front end, we sourced period Chevrolet drum brakes, wheel bearings and hubs," he recalls. "In the end it proved to be relatively straightforward. Everything that was Cheetah-specific was there and everything that was Corvette dropped right in. A few brackets and other bits needed fabricating, but it was self-explanatory by that point."

The Corvette parentage is evident throughout the car, but there are ▶



ABOVE The car has a very short wheelbase and most of the weight around the centre, but is surprisingly driveable – if treated with respect

some fundamental differences to the Cheetah's design. For a start, the big V8 is placed much further back in the chassis, taking the 'front-mid' engine layout to real extremes. In some respects, it's a much more sophisticated chassis design too, with a true spaceframe construction that looks intricate in comparison to the Corvette's 1930s-style ladder frame.

Unfortunately, however, it's also rather dainty. Even by the standards of the era the Cheetah's chassis was considered prone to flex. This was borne out when CCK put the car on its chassis dyno and found its torsional rigidity to be around half that of a Cobra – hardly a paragon of structural engineering itself.

"A well-known Formula 1 chassis designer had a look while his own car was in the workshop recently and he thought the idea of putting a 5.4-litre V8 in it was hilarious," notes Lackey. "There is actually a reasonable amount of longitudinal support, but there's not a great deal to stop it twisting. We've now got a welded-in roll cage. For safety it has rear stays to the back of the chassis with a diagonal – which is an FIA requirement – so that helps significantly, but it's still not the most rigid structure."

Like the Corvette, the Cheetah uses independent suspension front and rear, with a number of parts shared between the two designs. The details, however, are quite different. At the back, for instance, Thomas used conventional coil-over damper units in place of the Corvette's characteristic transverse leaf spring, which also forms part of the suspension linkage on the C2. To accommodate this change, the Cheetah uses bespoke rear uprights, with a set of hairpin-shaped radius arms running forwards to the chassis, while the driveshafts continue to act as top links. The tubular steel lower links are basically the same design as those found on the Corvette, but they have spherical bearings at the ends to allow for the curved motion imposed by the radius rods.

At the front there's a classic unequal length double wishbone setup, fabricated from tubular steel, with



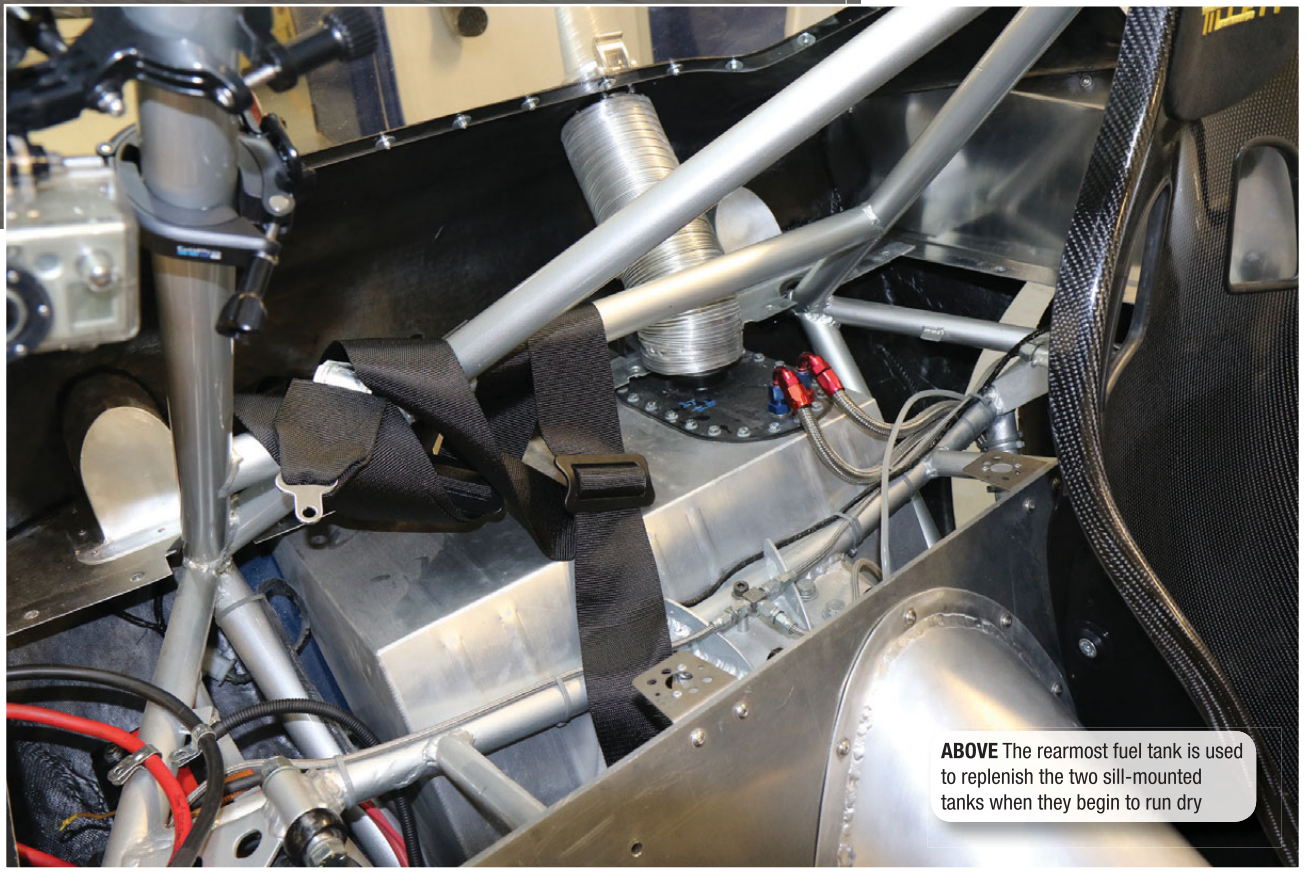
Jeff Bloxham

> **“A well-known F1 chassis designer had a look. He thought the idea of putting a 5.4-litre V8 in it was hilarious”**

Chevrolet spindles and uprights. Again, coil-overs are used, with Alpha springs and AVO dampers found on both ends. A lot of attention has been paid to the setup, with an unspecified chassis consultant brought in to advise on suspension settings and geometry before the initial shakedown.

“The suspension was quite cleverly designed,” notes Lackey. “There’s plenty of inbuilt adjustability including castor, camber, toe (on both ends) and the front top wishbone mounting points.”

As with the Corvettes of this period, the Cheetah uses drum brakes all round. This was already quite an old fashioned setup by the time that work ▶



ABOVE The rearmost fuel tank is used to replenish the two sill-mounted tanks when they begin to run dry

began on the project in 1963, but the car's light weight, aided by modern linings supplied by Questmead, mean it's not the disadvantage that you might expect.

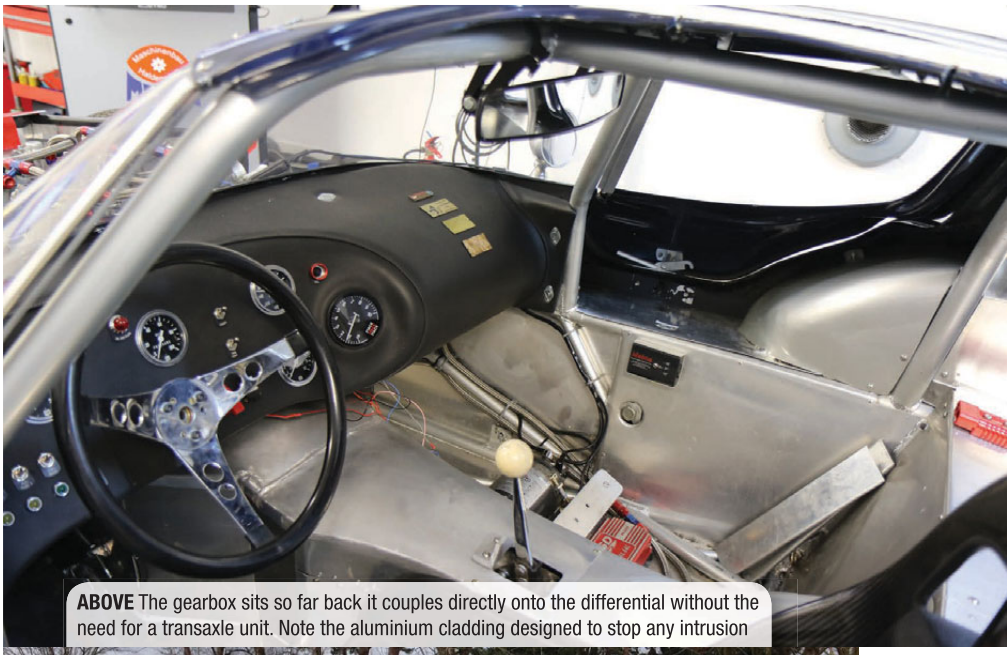
BEATING HEART

The Chevy Small Block V8 sits – quite literally – at the heart of the Cheetah. This engine went through a number of different iterations during nearly half a century of production, so great care was taken to source a period-correct Corvette unit with the right casting numbers.

Inside, it uses the original crank and connecting rods with a modern set of forged pistons from JE. The camshaft comes from Crower Cams, along with custom pushrods, while the fixings and fasteners come from ARP, with most of the parts supplied via UK-based V8 specialist Real Steel.

Some gas-flowing has been carried out on the heads, but the scope of the modifications is limited by both practicality and authenticity. The standard C2 Corvette valves, for instance, already occupy most of the combustion chamber with no real scope to expand.

"The car was built to be strong and ▶



ABOVE The gearbox sits so far back it couples directly onto the differential without the need for a transaxle unit. Note the aluminium cladding designed to stop any intrusion



ABOVE Shaun Rainford (left), owner of CCK, with Cheetah owner Ian Burford (right)



ABOVE The Cheetah employs drum brakes front and rear

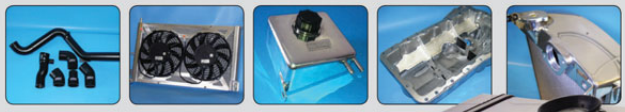
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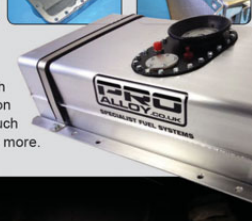


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ABOVE On the rolling road. If you look carefully you can see the different holes that betray the adjustable front wishbone mounts

driveable, so it has a relatively soft power curve," comments Lackey. "Also, it's still running a period crank; modern internals would inevitably have better balance and greater stiffness, which would allow it to rev higher where the regulations allow."

The C2 Corvettes ran mechanical fuel injection, as did a number of Cheetahs, but at least one car is known to have used a quad carburettor setup in-period. It's this layout that CCK has elected to follow, with four twin-barrel Weber DCOSP carburettors fed by a cast aluminium intake manifold from US hot rodding firm Mooneyes. The ignition system, meanwhile, uses points and a condenser, with an MSD electronic rev limiter set at 7,000 rpm.

No less than three separate fuel tanks are used to sate the big V8's thirst, with two in the sills and one behind the cockpit, each fabricated by Pro Alloy Motorsport.

"It took us a while to figure out how to feed one engine from three fuel tanks," admits Lackey. "It's easy to see why they did it – for quite a big car there's very little space inside, so they just had to be crammed into any available room. Due to the eligibility requirements we had to get the system as close as possible to the original layout, which meant reverse engineering much of it from period photographs. Sorting out the plumbing was a real headache at times – we went through numerous theories for weeks until we worked everything out."

> **"It took us a while to figure out how to feed one engine from three fuel tanks"**

The system uses three pumps to feed the carburettors from the two tanks in the sills. When these run low, the driver has to manually activate a fourth pump, which replenishes them from the reserve tank in the back. There are additional complexities, however. For instance, there was a concern that one of the individual fuel pumps could run dry and burn its motor out if the tank was allowed to empty. To prevent this, the side tanks are always filled to the same level and a pressure switch in the swirl pot is used to detect when the driver needs to activate the additional pump.

Due to the proximity of the engine, the gearbox and the rear differential, the decision was taken to clad the cockpit in aerospace grade aluminium. This is designed to protect the driver – who sits cocooned between all three – in the event of any rotating parts making a bid for freedom. Other safety gear includes a Tillet race seat with TRS harnesses and a Lifeline Zero 360 fire suppression system.

Aside from a heavy duty, close ratio gear set the gearbox now also features competition selector hubs and synchro mechanisms. The differential is a Positrack limited slip unit taken from the Corvette, but CCK has fitted carbon plates and uprated springs – around twice the standard rate – to give it much more aggressive locking characteristics. ▶

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Technical Analysis
Giorgio Piola

Size: 24,3x27 - Pages: 128 - Photos: over 400 technical drawings in colour - Softbound with jacket - Text: English
ISBN: 978-88-7911-656-5 - Price: £32.00 + plus post and packaging

As with previous years, 2015 was one in which Mercedes-Benz dominated both the drivers' and constructors' championships. The German manufacturer confirmed the technical advantage it had derived from the introduction of the revolutionary power unit, which first appeared in 2014. In place of Red Bull, which fell into disgrace after a media conflict with engine supplier Renault, it was Ferrari that attempted to stand up to the Silver Arrows. Side issues were the stories of a Williams wanting to come back and battle for the title; McLaren with a new but not very effective Honda engine, which touched the lowest point in the Japanese manufacturer's long history in F1; and the other leading teams of a season that ended with the official announcement of Renault's return, having acquired Lotus.

Offering a precise analysis of this latest F1 championship, especially from the technical point of view, there is once again Giorgio Piola. A hundred or so all-colour illustrations document the development of the various cars throughout the Formula 1 World Championship, and offer - as always - a wealth of information anticipating the 2016 season.

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BACK ON TRACK

There have been a few hiccups since the car had its first shakedown runs last year. During testing one of the cylinder heads was found to be porous, with white smoke coming from one bank. Initially, the engineers hoped to repair the item with cast iron welding, but it soon became apparent that a new set of heads would be required.

Beyond that, the most significant teething troubles have come back to the fuel system, Lackey explains: "Quad Webers is a difficult setup to get right on the Small Block Chevy. You get a reverse pulse that comes back out of the intake, resulting in standoff. And it's not hard to see why: if you look down the barrel of the carburettor you can see the inlet valve – it's just a straight shot. If you've got a plenum setup with something like a four barrel Holley carburettor it will absorb any reverse pulses. But with the Webers it just shoots back out."

Various tuning tweaks were employed to try and tame the issue, but in the end CCK went back to the drawing board.

"The reverse pulse is caused by the event timing of the valves," says Lackey. "Typically on a race engine, the inlet valve will close fairly late in the stroke, by which point the cylinder pressure is already rising. What we've done is to change the camshaft so it closes the



Jeff Bloxham

ABOVE The welded-in roll cage, rear stays and diagonal are an attempt to improve the car's structural rigidity



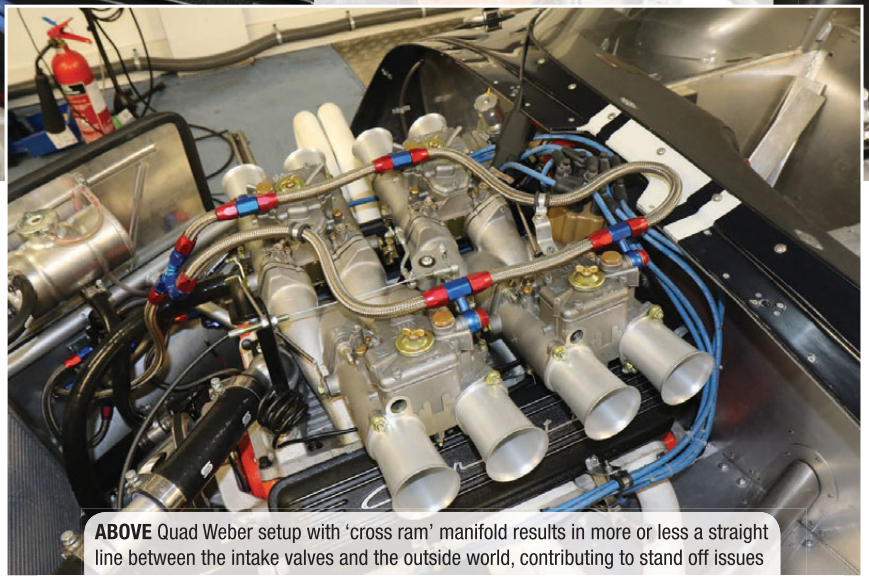
ABOVE The project stemmed from a friend swiping through pictures like this one on his phone



ABOVE The chassis is believed to have been a spare item built in-period but then put into storage



ABOVE Carb tuning is critical on the quad Weber set up



ABOVE Quad Weber setup with 'cross ram' manifold results in more or less a straight line between the intake valves and the outside world, contributing to stand off issues

inlet valve more than 20 degrees earlier. We put the engine back in the car and immediately saw a huge improvement. Unsilenced, it was putting out over 400 bhp – up from around 330 bhp – with no real changes apart from the event timing of the camshaft."

HALF A CENTURY BEHIND

In total, the restoration has taken just over three years and the Cheetah is now ready to race with a fresh set of FIA papers. Optimising the package will be an ongoing project, however, Burford points out: "The Cheetah had a lot of potential, but it didn't get very far after Chevrolet pulled the plug on the project. If you look at the Cobras and 250-series Ferraris we're up against they were developed a lot further in-period and they've been racing continuously ever since, so they've had half a century of extra development. We're basically doing work that Chevrolet should have done in 1964."

It's only now the car has started to rack up testing miles that some of its idiosyncrasies have come to light. For instance, the engine is so far back that the exhaust headers exit over the top of the footwells, with the main pipes run back along the outside of the sills, generating a huge amount of heat soak into the cabin. With limited scope to improve ventilation, Burford says he plans to invest in a cool suit instead.

The fundamentals, however, seem to be working well. "From what you hear about Cheetahs you'd think it was going to try and kill you the moment you get in it, but it doesn't," he says. "It has got a very short wheelbase and most of the weight clustered around the centre, so it will swap ends quite quickly if you're not careful, but if you treat it with respect it's actually pretty driveable."

There's certainly no shortage of shock and awe when the car is on track. At this year's Goodwood Spring Sprint it swept the board in a fan poll to determine the most popular car with over 63 per cent of the votes (the next closest cars were tied on a mere 11 per cent each). The Cheetah's rarity value and its otherworldly comic book appeal are sure to generate plenty of event invites too. Burford says that the focus was firmly on creating a working racing car rather than a museum piece, so you can expect to see a lot more of this car in the future. After all, it still has a score to settle with a certain Mr Shelby. HRT



DREAM MACHINE

Even nine-time world champions have pin-up cars. **Hal Ridge** reports on Sébastien Loeb's restoration of the rally screamer he dreamed of

EVERY reader of this magazine will have a dream car. But it's easy to forget that some of the sport's most decorated drivers can have similar feelings about a particular vehicle, even if they have had the pleasure of being paid to race some of the world's best machines.

Even legends of the sport have dream cars. In this instance, 20 years after first falling in love with the Peugeot 306 Maxi, rallying's most successful ever driver got his hands on his own version of the Group A machine.

"When I started rallying in 1997 I was driving a Peugeot 106 Group N with 100 horsepower. In the same rally we had (Gilles) Panizzi and (Francois) Delecour driving with the 306. The noise of this car was just amazing, so I have some very good memories of that time," says nine-time world rally champion Sébastien Loeb, who spent his entire top-flight WRC career driving for Citroën. "I had the opportunity to drive the Xsara kit car, then I went to the WRC [cars] where the engine is different: turbo and not revving so much. I have very good memories of the time of the kit cars when I was running the Saxo or the Xsara, but the 306 was the one that I was dreaming of the most. I always wanted to do a rally with this car and finally I had the opportunity to buy this one."

DRAMATIC DIET

Loeb's 306 was acquired in 2017, in time for the French ace to drive on the Rally de Provence, run by his own Sébastien Loeb Racing (SLR) outfit. Accustomed



ABOVE Twenty years after falling in love with the car, Loeb finally got to handle it

to running World Touring Cars and a number of machines in the various 'R' rally categories, the Alsace-based squad immediately saw room for improvement with the Maxi.

"It's really complicated to have a Peugeot 306 with good Peugeot Sport parts and not copy parts. We bought this car, but it was not 100% perfect. When it came for the first time and we loaded it onto the scales, we saw it was 100 kg more than what we normally expected. At this point, we decided to completely rebuild the car, to reach the normal weight of a true, proper, Peugeot 306," says Jean-Philippe Nicolao, SLR's technical director, who notes that Loeb's performance on the car's maiden outing gave the squad motivation to improve the '90s icon. "During the first rally, Seb was fighting with WRC cars. It was really close, so for sure without this 100 kg we knew it would be easier."

Once stripped, SLR realised that the ▶



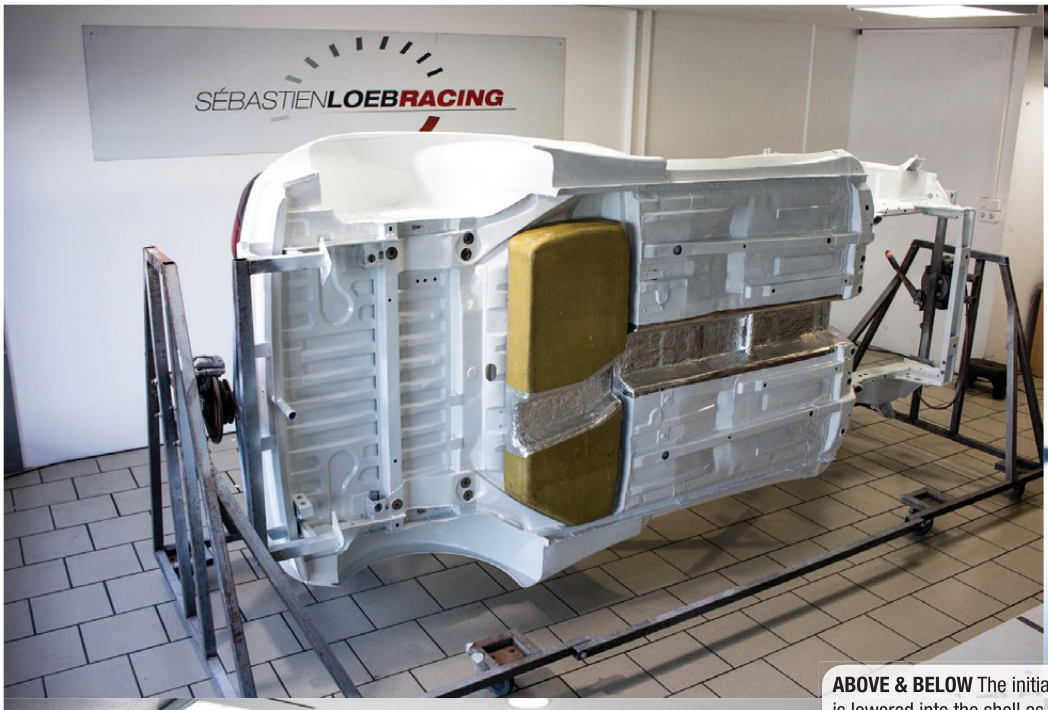
ABOVE The project was pulled together in a frighteningly short timescale

three-door shell needed substantial work to remove the required weight and return it to its former glory, but being an original period shell meant finding a buyer wouldn't be difficult either. The bodyshell was sold, and a road car shell was sourced to begin a ground-up rebuild.

"We started by aqua blasting the bodyshell, then took it to Matter in France," says Nicolao. "They fitted the roll cage and we obtained the homologation papers. To get the correct homologation papers, there's only two companies that can provide this. After that we removed a lot, for example the fixing points of the road car safety belts and every little thing like this to gain in weight, 100 grams by 100 grams."

With weight saving being the driving force behind the restoration, extreme care was taken not only with the bodyshell preparation, but with every detail, from the Sparco seats to the battery and 60-litre Merin fuel tank.

"The old fuel tank had had a lot of repair and the fixing points for the fuel pump were not so good," says Nicolao. "By repairing the mounts and changing the tank we saved five kilos. The battery was a normal one, but we gained four kilos of saving by putting in a lithium one." The squad also ditched the windscreen heater system for the same Siroco-made unit found on its 208 R5 customer rally cars and mounted it at the lowest point of the front of the car. That was another six kilograms saved. "These were good and not so expensive









ABOVE & BELOW The initial Evo 9 Pipo-built engine is lowered into the shell as the 306 Maxi takes shape

ways to lose weight," Nicolao notes.

However, buying off-the-shelf components that have a listed weight is one thing, going to a breaker's yard armed with a set of scales is rather more extreme, verging on the obsessive. But, that's what the SLR team did, and were pleased with the results.

"We went to a salvage yard with the scales and we compared the weight of all the front bonnets, doors, windscreens and windows, because the road car windows were different







ABOVE Period discs have been sourced to replace the 206 WRC versions originally scavenged for the car

> **"I was afraid that with my experience of the WRC cars, the 306 would feel old, but it's fun: the balance, the reactivity, is really good"**

thicknesses," explains Nicolao.

While the bodyshell was effectively all-new once Loeb's team had finished its painstaking work, the running gear initially remained as it had when it arrived in its workshop. The transversally-mounted, naturally aspirated 1998 cc 16-valve DOHC engine produces 305 horsepower and 265 Nm torque. The fantastic sound of the motor, renowned for revving to 11,000 rpm as it sings its way through the rally stages, is etched on the mind of any lucky enough to see one in action (or if not head to YouTube to watch Loeb in this version!). In period, the unit had a bore and stroke of 86.0, with a compression ratio of 12.5:1, using a cast steel block and aluminium cylinder head.

The Evo 9 Pipo-built unit in Loeb's machine didn't last long, however. In the 306's first appearance following completion, Loeb, navigated by long-time co-driver Daniel Elena, set fastest stage times and battled for the lead of the French national championship Rallye du Var event against more modern WRC and R5 competition, before the engine cried enough.

"It was completely brand new when we bought the car. We did 700 kilometres before it broke," says Nicolao. "Normally they do 1000 km, but for sure the use of Sébastien is not the same as the use of normal drivers. I think Pipo didn't take into account the driver," he almost laughs. For the following event, Rally du Chablais, an Evo 10 version of the two-litre screamer, which uses a dry-sump system to avoid surging and to enable the unit to be mounted lower in the engine bay, was produced.

MAGIC BOX

The engine is controlled by the "true blue" period Magneti Marelli AP10 multi-point ECU. This is the last version of the control unit used in the latest Maxi, SLR using the best of what was available in period in "respect of the factory Peugeot". "It's [this] one electronic box [ECU] that makes it," says Loeb. "You can ▶









ABOVE & BELOW Not even the windscreen was immune to the quest for weight saving

have anti-wheelspin and traction control."

The entire loom is also as period, but as it has started to give the outfit some reliability concerns, it is likely to be swapped for an identical but new version. What is not likely to be replaced however is the Xtrac seven-speed sequential gearbox, mounted transversally onto the engine. The gear ratios are identical to those used by the works squad for the San Remo rally in 1998.

SUSPENSION DEVELOPMENTS

The Maxi's suspension, of MacPherson design at the front and trailing arm with torsion bar rear axle, is also in period specification, made especially by Peugeot. The rear even has passive rear wheel steering characteristics under load. While the two-litre engine and transmission are now old hat, they are still largely competitive, but technology in suspension over the last two decades has come on in leaps and bounds.

With his vast experience of driving rally cars down narrow French lanes, owner and driver Loeb knows that there is plentiful time to be found in developing the suspension. "I was really surprised how well the car is going because I was a bit afraid that with my experience of the WRC cars, the 306 will feel like an old car, but it's really a good car to drive. It's fun, efficient and it's really enjoyable," says Loeb. "The suspension is not as good as today, but the rest, the balance, the reactivity of the car, is really good.

"I didn't know what the real level of the car would be compared to actual WRCs, but finally with a good feeling with the car it was possible to fight with them, so that was great. I just tried to do some set up to get a good feeling; the setup is very close from what Panizzi and Delecour were driving, so no big changes. On Rally du Var I was fighting with the WRCs. One stage was really bumpy and I lost a lot [of time] because I lost a lot of contact with the road and the travel of the suspension and the damping is not the same as today, so that's for sure something we can work on."

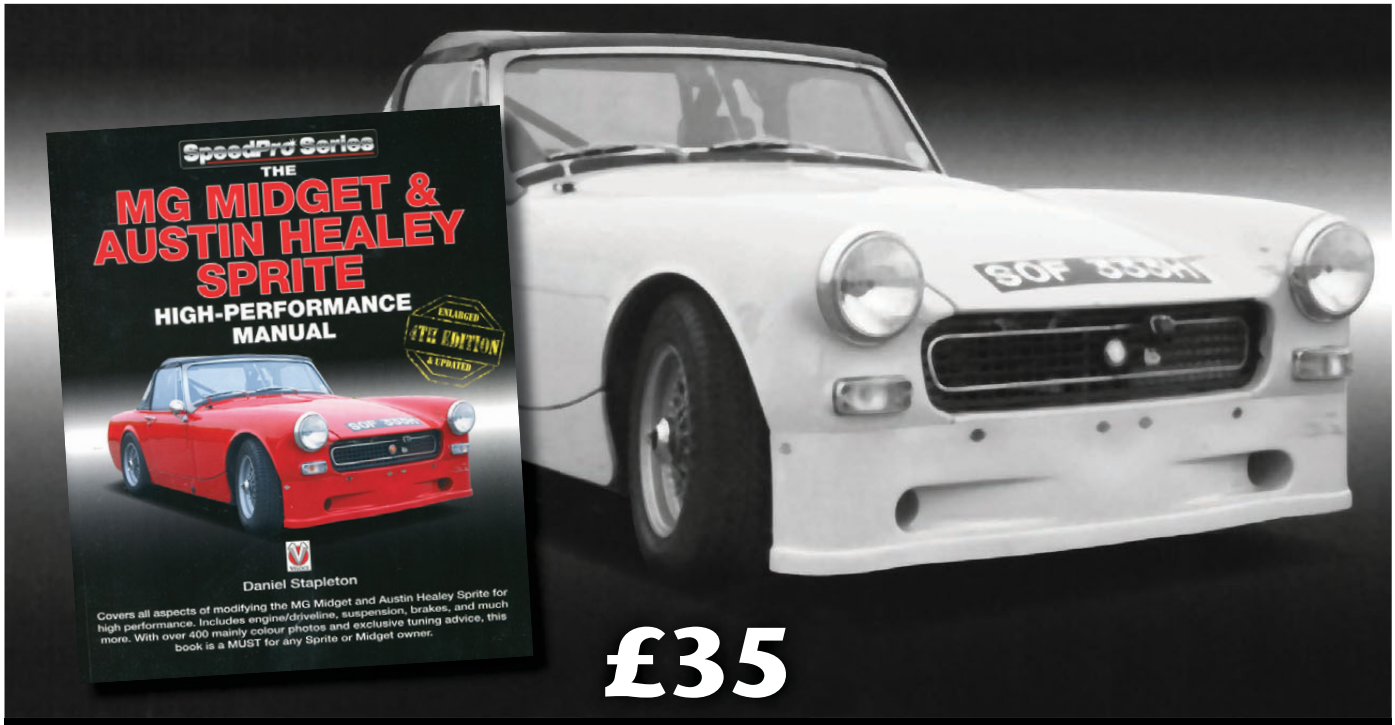
> "The rear even has passive rear wheel steering characteristics under load"

Although the team is keen to keep the essence of the car as original as possible, with Loeb not competing in any tightly controlled championships where the period specification of the car would have to be adhered to, SLR is open to making performance related upgrades.

The brakes though, are an area both engineer and driver are content with, especially since period discs have now been sourced to replace the 206 WRC versions they had been running. The front discs are vented, 370 mm in diameter and 32 mm wide, joined by eight-pot, four-pad Brembo callipers. The 280 mm solid rear discs are accompanied by two-pot, two-pad AP Racing callipers.

"At the beginning we had discs from ▶





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ABOVE The cockpit might betray the car's age but the machine can still fly

a Peugeot 206 WRC, but now we have found one pair of discs of true and proper 306 factory [heritage], so we are really happy on this side," smiles Nicolao. To achieve a stiffer middle pedal on the as-period Peugeot Sport pedal box, rigid steel brake lines have been used, rather than braided versions.

BIGGEST CHALLENGES

As shown with the front discs, one of the biggest challenges with the project was sourcing period components, despite having the French rally legend's name as a calling card. "When we started work on this project, a lot of people contacted us and said, 'Yeah we have parts or if you want I can manufacture, I have the plan, I have the CAD file.' But at the end, when we decided to change something or modify something, nobody has the parts, or if they do they don't want to sell them," remarks Nicolao.

"Our plan is to use scanning technology and to manufacture proper parts. We are convinced there is a market for this kind of car, but one of the biggest challenges is to manufacture or copy the original factory parts. When you start to do that, it can be really expensive."

The other big obstacle encountered ▶

Peugeot 306 Maxi suppliers

ECU	Magneti Marelli
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Chassis work	Matter
Heater	Siroco
Brakes	Brembo & AP Racing
Brake pads	Winmax
Gearbox	Xtrac
Engine	Pipo
Steering wheel	Sparco
Seats	Sparco
Harnesses	Sparco
Wheels	Braid
Tyres	Michelin
Oil filter	Mahle



ABOVE The development of modern suspension technology is highlighted by the 306's loss of time over bumpy stages

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ABOVE & BELOW Loeb climbs behind the wheel of his old favourite, above. Below, 'selfies' weren't invented when co-driver Daniel Elena first joined Loeb in the cockpit

> **"I have very good memories, but the 306 was the one that I was dreaming of"**

was that SLR received the fabricated bodyshell to its workshop just weeks before its maiden post-restoration start on Rally Du Var. "There were a lot of delays when we sent the bodyshell away. One thing I remember well is that when the car came back, we had only one month to completely rebuild it," reports Nicolao. "Compared to the cars we run normally, like the Peugeot 208 R5 or the 208 R2, it's not easy to find a place for everything: you have to adapt, you have to do modifications and you cannot find all the parts easily so it was difficult on this side, but we did it."

Loeb's dream machine is effectively new. As a newly registered bodyshell it has no previous history, which means the French star doesn't feel bad about adapting a piece of history. And when SLR says it's new, it really is. As Nicolao explains, 306 Maxi chassis number 94 never left the Peugeot Sport factory, attached to a car at least.

THE CAR THAT NEVER WAS

"When we decided to rebuild the new car, I contacted Peugeot," he recalls. "I didn't want to use a chassis number of another car. I wanted to have a brand-new car. In the past they kept five spare chassis numbers, so we asked them if we could have a new chassis number for this car. It was never run before."

At the same time, a second chassis plate was also acquired, along with a bare bodyshell that had been removed from the production line, painted in only primer. In time, Loeb's baby could have a sibling. "The target is to build a new one, like the current one, but we have a lot of work to do with the other programmes," muses Nicolao, referencing SLR's touring car, rally and World Rallycross commitments. "Maybe we will begin this winter." HRT







ABOVE It might be two decades old, but in Loeb's capable hands the car was quick enough to equal the pace of the French championship's new-generation WRC and R5 cars





ABOVE & BELOW Chassis number 94 never left the Peugeot Sport factory. Here, it is almost ready to depart the SLR workshop, 20 years on





THE QUEST FOR PERFECTION

Written by Nick Skeens, The Perfect Car is the biography of John Barnard, the brilliant racing car designer who has been described by many as revolutionising Formula 1. **William Kimberley** reports from the book's launch

IF there was such a thing as the perfect car for John Barnard, it was the Ferrari 412T, or Type 645, the 1994 Formula 1 challenger. When the car was first unveiled to the media, it was rapturously received, the 10 February 1994 issue of *Autosport* referring to it as 'One from the Heart'. As reported in the book, the article called the car stunning and a machine that would restore "the tattered pride of Italian motor racing and bring the *Tifosi* flooding back to Monza and Imola".

By this time, Barnard was 24 years into a career that had started at Lola, then led to McLaren, a spell in the US with Vel's Parnelli Jones and Chaparral, then back to England with Project 4 – that was then in the process of getting involved with McLaren – Ferrari, Benetton and then Ferrari again. There is no question that at every one of them he left his mark, one that was to change the shape of motor racing in different ways.

Apart from its clean lines and good looks, the Type 645 also featured a number of clever innovations. One was to replace all the ball joints in the suspension with what became known as suspension flexure. It wasn't as simple as it sounds and in fact was incredibly complex, but such were its advantages, Barnard was unfazed when hitting problems when developing and testing the idea.

As reported in the book, it came about in part in one of Barnard's 'What If' days, according to Mike Coughlan, who had rejoined Barnard at Ferrari after a spell as Tyrrell's chief designer. "Every Saturday morning John would come in and devote his time to way-out stuff," Coughlan explained. "We wouldn't concentrate on specific problems with a car; instead it was a time for fundamentals, for vision, for considering the next step rather than the detailed grind of getting work out. Flexures came out of discussion with clever people whom he had



ABOVE The Ferrari 412T of 1994, one of the most beautiful F1 designs, drew inspiration from the Spitfire fighter plane's cooling package. But heads rolled when Ferrari's engine department messed up



ABOVE The Chaparral 2K, the first full-blooded ground-effect IndyCar, set basic design parameters that are still followed today

employed. He generated the mindset that produced the ideas. And John was always more relaxed on Saturday mornings."

The idea had its roots in a wind tunnel model for the 645, specifically the need to reduce friction between the wheels, supported from the outside on stalks, and the chassis. "We ended up grinding rod ends to reduce the friction, and one day they broke, so John said, 'This is ridiculous – what do we want here?' So we drew something with tiny little blades. That transformed the wind tunnel model," recalled Coughlan

According to the author, Barnard was delighted with the clean simplicity of the new suspension connection to the chassis. "So now my chassis is dead clean underneath," he reflected. "I've got no ball joints, no bits and pieces. I've got no play here at all, none. Can't have any play. It's dead simple. It hadn't been done on any other vehicle to my knowledge."

> **"I wasn't the first to run titanium suspension, but I was the first to run it successfully"**

Flexures soon became a common solution in Formula 1.

Another hallmark of Barnard's genius, according to the author, were the beautifully crafted titanium uprights on the Ferrari with a suspension system also largely made of titanium. "I wasn't the first to run titanium suspension, but I was the first to run it successfully," he is quoted as saying.

Another innovation was the car's transverse gearbox that was similar to the one he had developed at Parnelli but which included his paddle-shift semi-automatic technology. Initially the casing was made out of cannily milled steel casing, then titanium and then carbon fibre/reinforced polymer (CFRP).

He was also a year ahead of the regulations by creating a CFRP rear impact crash structure. "The same basic arrangement has been in use at Ferrari ever since 1998 – CFRP bellhousing, titanium fabricated gearbox case, CFRP ▶



ABOVE McLaren's M23, his first taste of F1, offered a significant step forward in the evolution of race car aerodynamics

rear case and impact structure – but in a longitudinal layout," suggested Barnard.

However, it was inspiration from the iconic Spitfire, which every schoolboy reveres as the Battle of Britain World War II plane, that was the biggest innovative factor on the car. Barnard was reading an old book on aerodynamics that described the work done by Supermarine on the development on the fighter plane's trademark cooler. As described in the book, cool air was directed into the relatively small 'letterbox' opening on the plane's radiator pod, but on entry it would be immediately energised by radiator heat and expand rapidly as the duct widened and reduce in density as it went through the radiator core. Ever more energised, it would stream out of the back of the pod pretty much at the same speed as it had entered the front.

"The principle behind the design was that we were trying to create zero drag although there was a small penalty to pay due to the slightly larger radiators that were needed to get more air through reasonably quickly, and that meant larger sidepods," said Barnard. As he explained, though, calculations told him that the increase in drag around the outside of the pod created by bigger radiators would be compensated by internal drag of almost zero.

Aerodynamicist Dominic Smith, a new recruit to the team, was tasked with working with the concept using test rigs at MIRA. "By cycling hot water through the radiator system and blowing air through a representative sidepod, we could measure the effectiveness of the radiator and the effective drag of the system," Barnard recalled. "Once the car went on track it appeared to have good top speed. Of course, all the engine people said this was because the engine had more power than others, but I knew it was also due to the fact that it was a very slippery car."

For all this, though, the car's sheer elegance and beauty that featured so many innovative and groundbreaking innovations, it underperformed, Barnard saying that it was ultimately a big regret for him: "We had started racing when the engine people informed me that they had cooling problems. The radiators were quite big but they were asymmetric, so on one side we had small water and oil ones and a large water one on the other side."

Unfortunately the car didn't live up to its promise, major cooling problems causing all sorts of headaches. "To cut a long story short, we couldn't get it to cool properly," said Barnard, "the engine guys blaming the radical inlet design on the sidepods, believing that what might work for a Spitfire in a dogfight doesn't necessarily work for Formula 1 cars on a race track."

Senior management at Ferrari began to panic and the full force of Maranello blame culture came into play. A fall guy was required, Smith taking the brunt of the blame, Barnard assuming that Smith's meticulous calculations were at fault. The decision to fire him still haunts Barnard to this day.

In calling for major changes to the car, Ferrari top bosses Luca di Montezemolo and Jean Todt turned to F1 engineer and designer Gustav Brunner to take over. It was a major blow for Barnard but he found himself having to support the changes although he believed they were fundamentally flawed.

As reported in the book: "When they started modifying the sidepods to run the turning vanes, they had to revise the radiator setup. In doing this, the engine people took the trouble to put it on the engine dyno and measure the water flows. It turned out that they had never originally balanced the flow of the hot water going from the engine to the radiators. The car had been overheating because two thirds of the water was going through the small radiator with the oil cooler next to it and just one third through the big radiator. We had been trying to cool it with one third of the required radiator area."

In Barnard's opinion, all the pain could have been avoided had the Ferrari engine department done their job and checked the flows in the first place.

THE WHIZZ KID ARRIVES

Barnard's first taste of Formula 1 was with McLaren, drafted in to help Gordon Coppuck develop the M23, its brilliant F1 career beginning in South Africa in 1973 and ending in Italy in 1977. During those five seasons it won 16 grands prix, two drivers' world championships and one constructors' world championship.

Working under Coppuck's direction, Barnard came up with his first significant innovation. The rear wing of the M19, the predecessor to the M23, was mounted on a frame that featured a central post with tubular rods supporting the centre and either end of the wing. However, Barnard suspected that the rods created interference in the airflow, reducing the wing's efficiency. He was tasked by Coppuck to come up with a more elegant solution.

The result was to mount the wing on a single, central aluminium post which itself was faired into a streamlined, teardrop profile to create an aerofoil post free from any extra supporting struts. As Barnard stated at the launch, he was immensely proud of what he had achieved in creating what was to be a significant step forward in the evolution of race car aerodynamics.

"We started doing some aero testing in the British Hovercraft Corporation wind tunnel on the Isle of Wight, that had also been used for testing Concorde," he noted. "Because it was basically an aircraft tunnel where the occupants much prefer to be lifted up into the air than forced down onto the ground, the car, minus wheels and suspension, had to be mounted upside down to the tunnel's roof, connecting the rear wing post to the tunnel's measuring balance. When the airflow was turned on, we watched the balance register the downforce, or rather upforce, acting on the car by recording the movement up towards the roof as the wind speed climbed.

"We soon discovered a problem as the centre post was causing a big disturbance across the underside of the wing, fluctuating stall. It would attach and then suddenly break away and we would lose about a third of the back of the wing, which was obviously not a good idea with the downforce suddenly coming and going. That's what the tunnel showed. I don't know if it was doing that on the actual car on the track but it was back to the drawing board."

The answer came a couple of days later when Barnard returned to the wind tunnel. At a loss on how to design out a fluctuating stall, it was a conversation with one of the tunnel operators that provided the Eureka moment. On seeing the post, it was pointed out to Barnard that the design was similar to the rear fin of the VC10 airliner that had a wing sitting on top of the tail fin, similar to the way the car's wing was sitting on its post, that also had fluctuating stall.

As the author points out, the penny dropped and Barnard realised that all he needed to do was to reduce the depth ▶



ABOVE Barnard with Teddy Mayer and Ron Dennis at the start of a golden era at McLaren



ABOVE Barnard changed F1 forever when he conceived of designing the entire tub from carbon fibre

of the post – its length from front to rear – so that it fitted well inside the wing's boundaries. He subsequently rebuilt the model with a narrower post, put it back in the wind tunnel, and the fluctuating stall had disappeared. There was further refinement, the post and wing being designed as a non-movable part, the wing's angle of attack being defined by a range of bolts and holes.

As Barnard is quoted as saying in the book, "At the time the single-pot adjustable mounting was new. No-one had done it. When you've done it, it's bloody obvious. But until you try it, I can assure you it's not."

Such was the satisfaction with the results derived from the less than ideal wind tunnel, it led Barnard and Coppuck to look further afield, finally doing some full-size model M23 tests at MIRA to study airflow through the airbox and sidepods, testing different shapes and sizes of airboxes for the ducting. It was the dawn of the race car aerodynamics revolution we see in full swing today.

A further innovation on the M23 was the sidepod. Coppuck's design saw the monocoque extend the entire width of the car, forming the sidepod areas as well. By making them part of the chassis itself, torsional stiffness was improved, but as pointed out in the book, Barnard was sceptical about the design, especially as they would be difficult to repair if damaged. However, that was what it was and Barnard had to go with it as a junior designer.

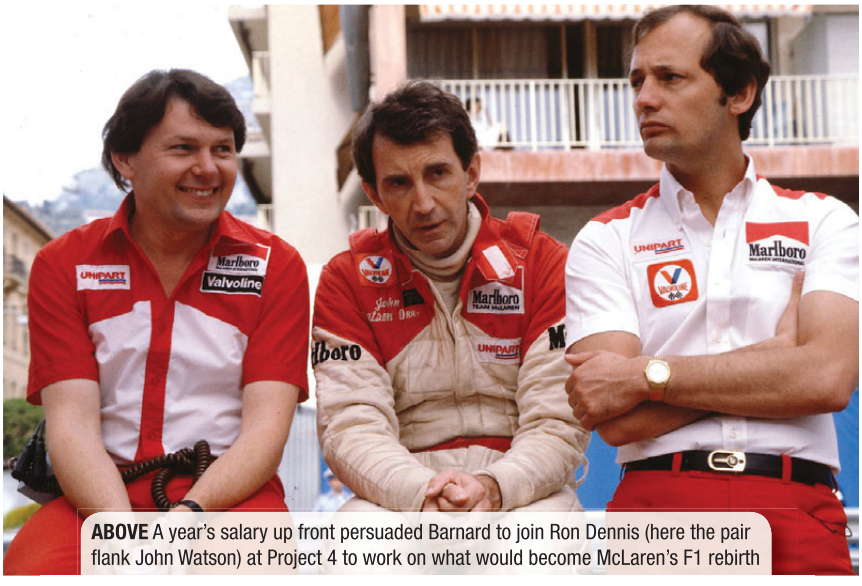
He did, though, set about toughening up the sidepod sections, also further increasing torsional stiffness. The secret was to do so without adding weight or interrupting the airflow into the radiators. His answer was to create glass fibre inner sleeves for both sidepods, the next step being to fill the gap between the glass fibre and the surrounding aluminium with a hard setting foam, adding stiffness and strength. A two-part foam-injection system was used, the tricky bit being to get the spray just right so that it did not distort the sidepods. The design turned out to be a complete success.

AMERICAN "SUPER TEAM"

After this spell at McLaren, Barnard was enticed to the US in 1975 where he joined Vel's Parnelli Racing or VPJ. The team had been founded in 1969 and was dubbed the 'Super Team' by the US press. However, when it came to its Formula 1 campaigns, it was facing a tough time, the Maurice Philippe-designed cars just not working well.

On arrival into the Californian team, just a few days after his marriage to Rosie, Barnard was thrust in at the deep end, needing to implement emergency suspension and brake changes on the VPJ-4. The result was instant. Mario Andretti drove the revised car to fifth place in the French Grand Prix just 15 days after Barnard's wedding.

Three years with the team led Barnard to join another legendary outfit – Chaparral Cars. "By the middle of 1978 Vel's had pretty much stopped racing. AJ Foyt had bought a couple of the cars and offered me a job, but I didn't take up the offer," Barnard said. "A little bit later I received a call from Hughie Absalom, who was then at Chaparral, telling me that team owner Jim Hall was looking for ▶



ABOVE A year's salary up front persuaded Barnard to join Ron Dennis (here the pair flank John Watson) at Project 4 to work on what would become McLaren's F1 rebirth

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ABOVE Ferrari's Barnard-inspired 641, which raced in 1989, introduced the semi-automatic gearbox to F1

someone who could design him a car, so why don't I go along and talk to him, which is what I did.

"I told him of the ground effect cars idea I had and that was pretty much it and it was done on a handshake. When I told him that I would be doing this in the UK, he queried it, but I told him I could get all the car built there, that British motorsport technology is the best in the world and had all the specialist skills I was going to need and that I knew all the people and places."

THE PERFECT CAR

An overriding demand by Barnard was that he had to take full credit for being the designer. Hall was taken aback, but agreed.

"So I went back to the UK and set up Chaparral Cars UK Ltd in my father's front room at home where I set up my drawing board," recalled Barnard. "I was soon joined by Rosie after she had settled our affairs in the US and who was then pregnant with our first child. The car was made in Luton by Sparshott Fabrications and that for me was the nearest I got to the perfect car, the Chaparral 2K, the first full-blooded ground-effect IndyCar."

There were teething problems, but it was immediately quick out of the box in 1979 although it didn't score its first win until the last race of the season. Al Unser was on his way to a memorable Indy 500 win but was robbed when his gearbox overheated. However, the following year it was the car to beat, Johnny Rutherford in the so-called Yellow Submarine 2K proving to be the class of the field, winning five races, including the Indy 500, and three second places to beat Bobby Unser to the championship. The car actually set the basic design parameters that are still followed today.

> **"He was game-changing. He introduced things that changed Formula 1 forever"**
> Ross Brawn

The relationship between Barnard and Hall was souring by the minute, though, while the 2K's potential in 1979 had been noticed by one Ron Dennis of Project 4. "I was talking to Patrick Head of Williams at the time as I wasn't working for anyone after leaving Chaparral for various reasons and I was looking to get into Formula 1 again in the UK," Barnard recounted. "He told me that there was this guy called Ron Dennis who was looking for someone to design a Formula 2 car for him, but that didn't really appeal to me.

"The next thing I know, though, is that Ron's on the phone to me telling me that it wasn't Formula 2 but Formula 1 that was of interest to him and why didn't I go and meet him to talk about things. We had a meeting and Ron being Ron made all sorts of commitments to me and while I was sceptical about his ambitions, he reassured me by offering me a year's salary up front with a firm commitment to a second year's salary as well. So I started work at Project 4."

At the time, the McLaren team was co-owned by Teddy Mayer, who Barnard found rather irritating. "He had this habit of coming into the drawing office, looking over your shoulder and asking questions. He was a sort of frustrated designer and wanted to be involved, but there wasn't much he could offer," was his blunt assessment of Mayer.

The real story, though, was not so much the re-emergence of the McLaren team but its revolutionary use of carbon fibre. The relatively new material had already found its way into Formula 1 in 1974 when under the radar Gordon Murray started to develop carbon brakes with the help of Dunlop. However, it is Barnard who can claim the revolutionary title as it was he who conceived of doing

the entire car in the material.

As the author writes in the book, quoting Barnard: "When I told Ron that we could make the entire chassis out of carbon fibre, he was quick to see the possibilities having already experienced carbon fibre in use on the BMW Procar rear wings. His response was, 'You do what you want technically and I'll find a way of funding it. That's my deal with you.'"

Although he would later fall out with him, Barnard admired this side of Dennis' character: "He would take momentous decisions, such as this one, completely on the fly."

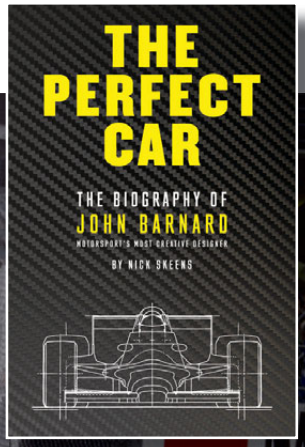
A crucial element in Barnard's understanding of carbon fibre was Arthur Webb, a carbon fibre expert who worked in one of the two teams on carbon projects at BAe Weybridge. "It was Arthur's fundamental knowledge of carbon and how to use it," he acknowledged. "We had no computers and things then, everything being hand drawn, and the whole process of designing with carbon as opposed to metal was so different. It wasn't just about designing the car but how to design it in carbon fibre.

"The reason for turning to carbon fibre for the monocoque was due to packaging because at that time we had ground effect underbodies. Greater downforce meant wider underbodies, but to have a wider underbody you need a narrower monocoque but then you lose stiffness and torsional stiffness. The question was how to get that back, which meant looking at other materials which is where carbon fibre came in. It all happened because I was looking to produce a better car."

A troublesome spell at Benetton, which was marked by ugly internal feuds, then two stints at Ferrari and some consultancy work for different teams through his B3 consultancy, marked a career that is probably unparalleled in motorsport. Not surprisingly, the book is full of superb anecdotes.

There are a good many tributes to Barnard in the book, but it's the one from Ross Brawn that stands out. "He was game-changing in terms of influence and involvement in Formula 1," suggested Brawn. "His period at McLaren was incredibly impressive and his periods at Ferrari too. It was the innovation – he definitely introduced some things that changed Formula 1 forever... He raised the standard of engineering in Formula 1... He was a deeply influential character on my career and Formula 1 generally." HRT

- **The Perfect Car**
  The Biography of John Barnard
  Motorsport's most creative designer
  By Nick Skeens
  Published by EVRO Publishing
  ISBN 978-1-910505-27-4
  £40.00/$60.00



ABOVE Lured back to England by Benetton, escaping the Italian media scrutiny that dogged Ferrari, Barnard helped design the Benetton B191 for the 1991 season

THE HEART OF THE MATTER

William Kimberley discovers how a very special car is being brought back to life with the help of a specialist engineering company

ORIGINALLY formed in 1864 in Luneville, France as the manufacturer of locomotives, the Société Lorraine des Anciens Etablissments de Dietrich and Cie branched out into making cars known more simply as de Dietrichs after the founder in 1896. The first three-wheeler was designed by Amedee Bollee, the older brother of Leon Bollee while the young Ettore Bugatti was commissioned to design a few models for the new make. In 1905 the car's name was changed to Lorraine Dietrich, the cars then wearing the cross of Lotharingen mounted on the massive radiator.

From the beginning the company had used motorsport to promote its cars with varying success, but it hit a bit of a slump in 1908 following the unsuccessful 13-litre OHV GP cars, although Arthur Duray did keep the marque's name alive by competing in the Grand Prix de France in 1911, albeit in a 1906 car.

The three years, though, were spent developing a new chain-driven car for 1912 that was powered by a 15,095 cc ohv 4-cylinder engine that redlined at 1,400 rpm. However, in that year's 478-mile Grand Prix at Dieppe, they didn't do that well, handicapped by engine troubles. It wasn't the end of the story, though, for one of them found its way to England where as 'Vieux Charles III' in the hands of Belgian driver Victor Hemery, it set three Brooklands British class "A" speed records that still stand today. It achieved 500 miles at an average speed of 86.05 mph, three hours at an average speed of 94.82 mph, and five hours at an average speed of 86.36 mph.

It then went back to France, where it remained during the Great War but was 'liberated' by Malcom Campbell, so the story goes, who brought the car back to England, coming through customs as an



ABOVE The complete rods

ex-war staff car. As one of Campbell's famous Blue Bird racing cars, it won the first race at Brooklands when the track re-opened in 1920.

After Campbell sold it on, it eventually became part of RGJ Nash's International Horseless Carriage Corporation collection of early mechanical transport based at Brooklands. However, it wasn't a museum piece as it was still campaigned in various events during the 1930s, its final competitive outing being at Silverstone in July 1966.

It then lay dormant until a long overdue restoration got under way at Weybridge in 1980, but big end bearing failures curtailed its outings so that in 1988 it was again retired. It was relocated to Brooklands Museum in 1993, where it has since remained.



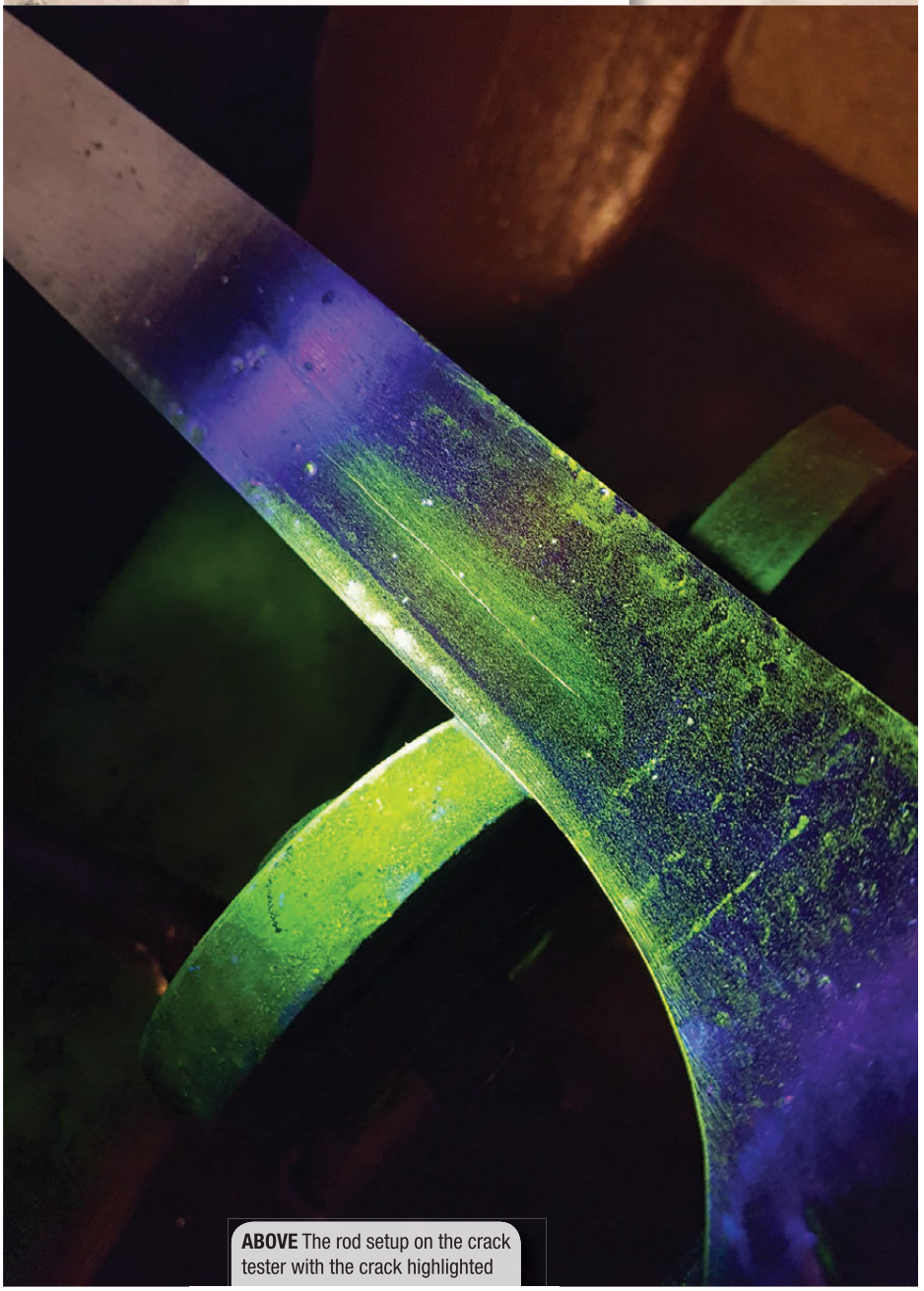
ABOVE Alfred Ellison acquired the car in the Twenties and won the BARC_100 miles long handicap at Brooklands in 1923 (Brooklands Museum)

PRESERVING THE CAR'S FUTURE

Believed by now to be the sole survivor of the four cars built for the 1912 Dieppe Grand Prix, it underwent a large mechanical restoration in the autumn of 2006. It was dismantled down to its chassis and gearbox in order to have its main and big end bearings inspected and renewed. After successfully being reassembled, it was started up again in 2010 at the museum with the prospect of restoring it back to its original glory.

Brooklands Museum contacted Formhalls earlier this year to inspect the rods for re-metalling to help preserve the future use of the car. After arriving at Brooklands and doing some investigation, it was clear the white metal on one of the big ends was failing with the obvious signs of the metal spreading across the surface. The advice was to replace all four of the big ends to provide the security of the lifetime guarantee provided when Formhalls re-metal and machine bearings.

When the crank and rods arrived at Formhalls in Downton, the crank was inspected, crack tested and polished. When considering the rods, it was determined that the most effective oil grooving design would be to introduce a single groove in the centre of the bearing with the mudgully. The single groove design ▶



ABOVE The rod setup on the crack tester with the crack highlighted



ABOVE Different stages of the weld repair process, including the end result on the far right

ensures the most effective spread of oil across the bearing surface during running and requires less machining. Minimising the amount of machining required on the white metal surface subsequently increases the structural longevity of the bearing.

During the crack testing of the rods a hairline crack was found down the neck of rod 3 towards the big end. To ensure the restoration of these bearings was as sympathetic as possible, it was decided to weld repair the rod and not replace it. It was gas welded to ensure the application of temperature was as controlled as possible thereby minimising any distortion that could occur from the welding process.

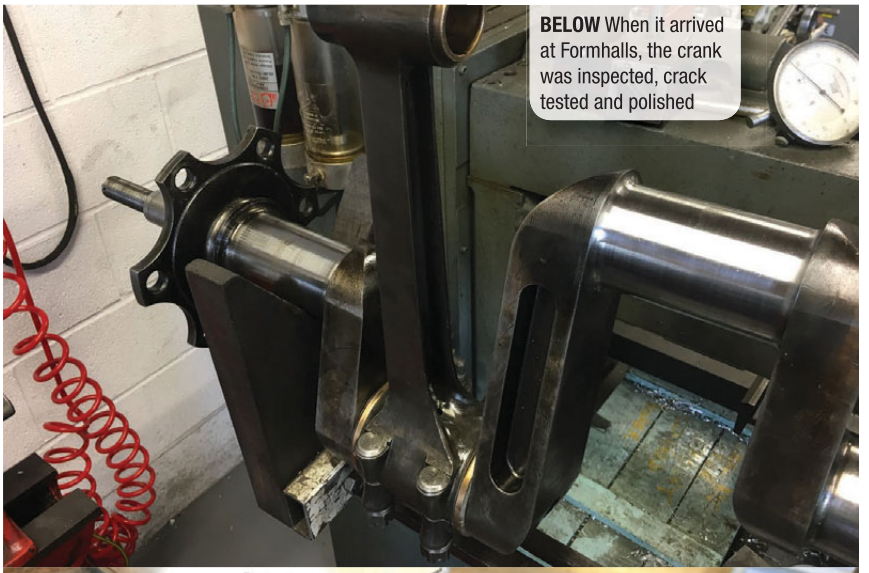
The oil feed pick-up pipe for rod 1 was also re-soldered to eliminate the movement it had begun to show. This could easily have led to a future bearing failure if the movement had become magnified.

Once all rods passed straightness and crack testing, they were cast using Formhall's lifetime guarantee triple tinning technique. After casting, rods are first rough and then precision machined. Due to the size and nature of these rods, a number of modifications were needed to be made to Formhall's rod borers, the small end clamp for the rod borer had to be milled out to cater for the unusually large size of the small ends and a new longer dummy gudgeon pin had to be made. The dummy pin is required to hold the small end square in place whilst the big end is being machined.

The theme of modifying tools and components did not stop there, as Formhall's also needed to make a unique radius tool to get the large radius required on the rod, the finishing radius being 17/64.

When all four rods were finished they were put through the final fitting stage which ensured all rods turned freely on the crank and that each rod met Formhall's lifetime guarantee quality standard.

With the 100th anniversary of the car competing at Brooklands with Campbell behind the wheel coming up over the horizon, nothing would be more appropriate than to see the car fire up and run on this very special occasion. HRT



BELOW When it arrived at Formhalls, the crank was inspected, crack tested and polished



ABOVE Copper feed repair



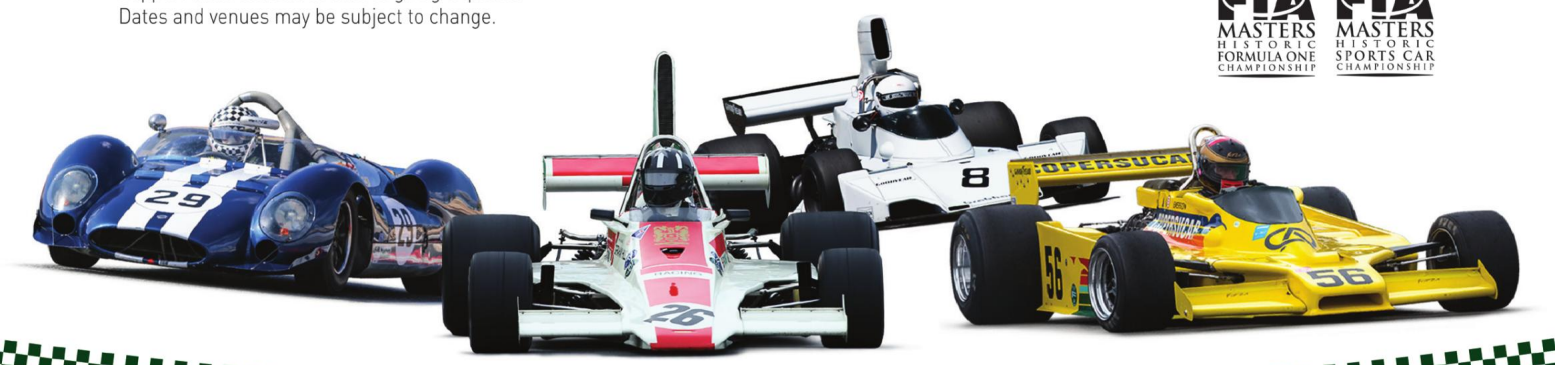
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★ JULY	26/29	Portland Vintage Racing Festival	Portland International Raceway, USA
AUGUST	10/12	Oldtimer Grand Prix	Nürburgring, Germany
★ AUGUST	18/19	Monterey Pre-Reunion	Mazda Raceway Laguna Seca, USA
★ AUGUST	23/26	Rolex Monterey Motorsports Reunion	Mazda Raceway Laguna Seca, USA
AUG/SEPT	31/02	Historic Grand Prix	Zandvoort, Holland
SEPTEMBER	14/16	Spa Six Hours	Spa, Belgium
★ OCTOBER	5/7	CSRG Charity Challenge	Sonoma Raceway, USA
OCTOBER	12/14	Dijon Motors Cup	Dijon, France
NOVEMBER	16/18	Sound of Engine	Suzuka, Japan

*Support race. Correct at time of going to press.
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MY OTHER CAR'S A PORSCHE!

Alan Stoddart investigates Sam Tordoff's transition from a Ford Focus in the British Touring Car Championship to the wheel of a 1954 Porsche 356

LOTS of the evocative names that you'll see on track at historic racing events are sadly no longer with us. Triumph, Cooper, Lola, AC and Chevron are all gone, while many others exist in name alone, without any real ties to their racing past such as MG, TVR and Lancia.

Of the few names that remain, only a few live up to their classic ethos. Ford and Chevrolet both stick to their muscle car heritage, while others like Jaguar and Aston Martin continue with long bonneted streamlined coupes, but there is arguably one manufacturer that, more than any other, has refused to budge from its tried and true formula: Porsche.

A modern 911 is the result of 70 years of refining, tweaking, honing, perfecting and revising a basic design that has its roots as far back as the Type 64 of 1938. There have obviously been a huge amount of changes, between these early Porsches and those of today, with even the most basic of today's 911s having 12 times the power of the old Type 64. They also boast technologies Dr Ferdinand Porsche could scarcely have imagined, like the Porsche Stability Management system which continuously monitors the direction, speed, yaw velocity and lateral acceleration of the car, and electric seats which can be manoeuvred in 18 (18!) different directions.

Despite all the paraphernalia that comes with decades of tireless refinement to a flagship product, Sam Tordoff reckons there is still an underlying familiarity between then and now.

And he should know! The BTCC driver, who has previously raced in Carrera Cup 911s, recently took ownership of a 1954 'pre A' 356 which he is duly hustling around circuits in historic race meets, and despite the sixty-odd years separating his rides he remarks how unsurprising the mannerisms of the old car are.

"The handling is effectively a Porsche," he says. "I have raced in the Carrera Cup for two years, so I'm very familiar with how unique the Porsche is in terms of the rear–engined balance, loads of weight in the boot, nothing in the front end. It's just got all the inherent characteristics of a Porsche.

"That does make it very different to drive, especially with its short wheelbase making it quite nimble, quite twitchy even, and you certainly can't drift



Jeff Bloxham

this car the way you can a Healey, for example, but it is still very exciting."

As with a new Porsche though, Tordoff explains that it's all a matter of being measured in your inputs. "If you come off the brakes too early, the nose comes up and you've just got masses of understeer, and if you try to get greedy on the throttle, the rear will bite.

"It's just a case of balancing that!"

Getting to this level of understanding has not all been plain sailing, however. Since picking up the car at the back end of last year, there have been a few teething problems, starting with a differential issue at the Goodwood Members Meeting back in March. The differential is very closely integrated ▶



ABOVE & LEFT More than six decades separate the 356 from his experience of the Carrera Cup, but Tordoff insists the inherent characteristics of the two Porsches are the same



Jeff Bloxham

ABOVE In the thick of the action: the mission has been to improve the car's reliability without detracting too much from its performance

into the gearbox, so not only did this put Tordoff out of the race, it meant Woolmer Classic Engineering (WCE), which looks after the car, had to completely overhaul the transmission. At the next race at the Donington Historic Festival in May, one of the rocker arms in the engine fractured. Once again this put the 356 out of the race, but it also provided WCE with the ideal opportunity to thoroughly go over the engine, completely taking it apart to give it a proper seeing to, since when it has been "working seamlessly".

LEARNING CURVE

This achievement is all the more impressive given that WCE is better known for running Austin-Healeys, so the switch to a Porsche has been quite an adjustment. "Andrew [Betteridge] and the other technicians have stepped up. Andrew has become quite the Porsche expert, and now what he doesn't know about a 356 isn't worth knowing," says Tordoff.

> **"You have to do a lot of preliminary groundwork, because if you just say, 'That'll do', you can be sure it won't"**

"So we are learning on the job, but I have raced for a lot of years, driving Paul Woolmer's customers' cars for the last five years, so I trusted these guys. I knew they weren't Porsche specialists, but I think in motorsport, who you trust, and finding genuine, trustworthy people, counts for a lot. It's something I've learnt over my 20 years of experience, so I was more than happy to give them the car and I knew that they'd get to the end of it.

"And they have produced a fantastic car! The niggles that keep happening are not foreseeable, so we just keep working through them – it's all part of the learning process when you acquire any classic."

Part of this process is understanding the engine you already have. As it came, the engine in Tordoff's 356 was very highly strung with incredibly tight tolerances. Things like the valves and pistons had overly small clearances, for maximum performance, which could dramatically reduce the life of the engine between rebuilds. This was a prospect that didn't hugely appeal to Tordoff or WCE, so one of the necessary things to do was to reduce the stress on the engine. With only 1,500 cc of displacement, racing the small, air-cooled four-cylinder boxer engine was always going to be demanding, so WCE turned to a skilful Porsche engine expert, Richard Chamberlain of CTR Developments, who offered some wise words.

"He told us that unlike many other engines, a lot of water-cooled engines, these Porsche engines require a

long, long time to measure, measure, measure every little component," recalls Betteridge. "But, when you have built them, that's it, they go, they work and they don't break. They go 'forever'.

"But, you have to do a lot of preliminary groundwork first and you have got to get that engine absolutely spot on, because if you just say, 'That'll do', you can be sure it won't."

With the help of Richard Chamberlain, the engine had a complete rebuild, getting new pistons, new valves, new conrods and bearings, but now with a slightly toned-down attitude to improve its longevity. It is still a race engine but it is now a race engine that can manage a season between rebuilds, rather than requiring one every race or two as was the case before the team started working on it. "We have gained a considerable amount of torque, with only a small loss of power," says Betteridge.

Within the original casing, just about every component is new. This at least was made easier by being air-cooled, which meant that barrels and pistons just "pop out". However, some pieces weren't just replaced, some components, where allowed by the FIA's appendix K regulations which ensure that cars racing in historic series are only using technology that was used in period, were in fact upgraded.

In the case of the 356, this meant things like aluminium pedestals could be used in the engine to reduce weight, but sourcing such parts has proved incredibly difficult. Parts for any 356 are very rare, but this is amplified for the pre A of which only around 7,600 were made during its production cycle between 1948 and 1955; moreover, ▶



Jeff Bloxham



Jeff Bloxham

ABOVE & BELOW The short wheelbase makes the car nimble, verging on twitchy to drive



ABOVE Tordoff's Ford Focus RS featured a special livery to commemorate the BTCC's 60th anniversary. It wasn't lost on him that his other regular mount, the 356, actually pre-dates the formation of the British Saloon Car Championship in 1958



Jakob Ebrey/BTCC

being an expensive car when new meant that there weren't even many parts being produced at the time. Fortunately however, for some of the components, the originals can be switched out for newer versions.

"Like everybody else we have modern technology in terms of piston manufacture because we have got much better processes now than they had in the 1950s for making these sorts of components," explains Betteridge. "That's perfectly allowed. It's like the lightened rods. They would have done that in the Fifties as well of course, when they took them out on the track they would have lightened the rods and lightened the pistons."

The next big project was the gearbox. Originally the car had a very standard 'box, but like the engine, to meet its new challenge of offering great performance for more than just a couple of races, the entire assembly was rebuilt, with new synchros on all the gears which makes it far more user-friendly than before.

CHANGING GEAR

This could well prove to be a particularly important decision when Tordoff starts to take on road rallies like the Mille Miglia, as he plans to do in the coming years.

The rebuilding of the gearbox was not done in-house due to requirements for very specialised tooling, as well as very

Jeff Bloxham

> **"If you try to get greedy on the throttle, the rear will bite"**

specialised knowledge, to be able to make a good job of the classic Porsche gearboxes. As such, rebuilding was handled by a chap called Andy Prill of Prill Porsche Classics, who has both the tooling and more importantly the know-how to complete the work to the high standard Tordoff and WCE were after. Since the rebuild though, Tordoff has relished changing gear. "It has been working beautifully," he says.

For Betteridge and the WCE team, getting under the skin of a 1954 Porsche has been rewarding and has also emphasised what a great engineer Ferdinand 'Ferry' Porsche, the 356's designer and son of Ferdinand Porsche, was. In a 1972 interview with *Panorama*, the magazine of the Porsche Club of America, Ferry explained the thinking behind the 356: "I had always driven very speedy cars. I had an Alfa Romeo, also a BMW and others. By the end of the war I had a Volkswagen Cabriolet with a supercharged engine and that was the basic idea. ▶

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"I saw that if you had enough power in a small car it is nicer to drive than if you have a big car which is also overpowered. And it is more fun."

This philosophy is plain to see in the stylish 750 kg racer, reckons Betteridge, who also identifies the company Porsche has gone on to be tied up in the pert racer from the Fifties. "It is a fascinating car," he says.

PORSCHE DNA

"It's a lovely car that shows the history of the manufacturer, even the roadcars. It's a lovely bit of kit and you can see where Porsche was coming from and why it did so well in the future.

"Of course, it has some anomalies. It is different, access is tight, there is not a lot of room to work in there, but then a lot of cars, particularly a lot of short run cars, are like that. You can certainly see the technology behind it. You get a real chance to appreciate the engineering. It's impressive.

"He certainly knew what he was doing."

With the drivetrain sorted, the next task facing the team is tweaking the drum brakes, which proved to be quite a surprise for Tordoff when he first raced the 356. "The braking is very weird," he laughs. "If you have never driven drum brakes before, they never stop! They just sort of pull in different directions all the time, but that is what drum brakes are, so you have to get used to it."

Despite this acceptance on the driver's part, Betteridge has taken a more analytical approach. "We've had a play with them already," he says. This has involved optimising the existing set up, whilst WCE looks at options to improve the overall braking stability, particularly at the front. As ever with historic racing, however, the challenge is to achieve this whilst remaining within the FIA HTP specification.

The next outing for the 356 is the Goodwood Revival, the car's first, where it is set to race in the Fordwater Trophy for production-based sports and GT cars made between 1948 and 1955. It is an exciting prospect for Tordoff and the event will mark the end of this year's racing programme, giving the team time to think about what the goals for next year are.

Overall, however, despite the work necessitated by the problems the car has faced over this year, Tordoff is buoyed by his experiences. "It's been a testing, trying year at times but we have certainly become more fond of it," he says. "It's a great car, it attracts so much attention because it's super rare and there aren't many others like it, and, being a pre A, it's one of the first ones, which means it is super light, has drum brakes and just a 1,500 engine, so people are attracted to it.

"It just puts a smile on people's faces." HRT



Jeff Bloxham

ABOVE The rare pre-A attracts a lot of attention

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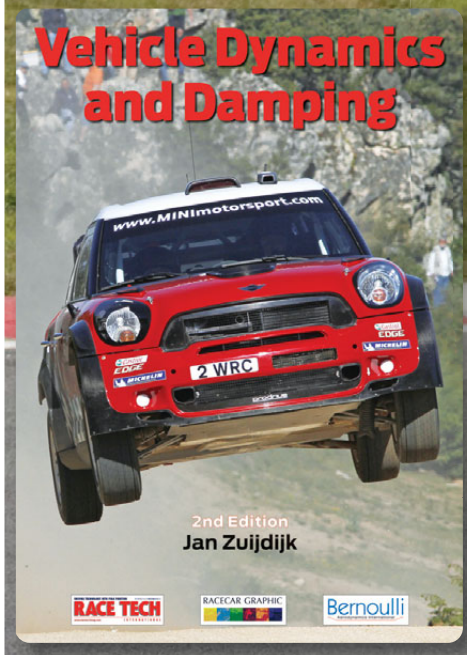
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AN HISTORIC ADDITION

For teams running historic racers, sourcing parts is always an issue, but as **Alan Stoddart** finds out, F1 technology may provide an answer

MODERN Formula 1 teams have truly staggering budgets. In November last year *The Independent* worked out that Ferrari, for an example, spent an eye watering £473m, of which about £338m is R&D – and that's just for the F1 team, not for Ferrari as a whole. This amount of money buys a pretty incredible amount of very advanced stuff, including specialist materials and production methods which companies have excruciatingly developed to shave off a few seconds a lap.

In recent years, one of the key areas of development has been in additive manufacturing and rapid prototyping. Seeing the potential in these technologies, Kevin Lambourne left his role at Red Bull Racing to set up Graphite AM with the goal of meeting the needs of Formula 1 teams. As it happens, though, the technology the company uses, the hard-earned fruits of its R&D programme, are also proving to be immensely valuable to a growing number of historic race teams, builders, owners and preparers.

Much of this value comes from Graphite AM's proprietary materials. The standard materials that are used for additive manufacturing are typically nylons with a PA11 and PA12 base. Particles of these materials are spread across the additive manufacturing machine's work bed in very fine layers, where they are then precisely fused together by a powerful laser according to the design, which creates one fine horizontal slice of the final printed part. The work bed then drops down the height of a single layer and more nylon is spread across the top, which itself is then accurately laser sintered, forming another layer on top of the previous one, and also sintering it to the previous level. This is repeated many times, with each horizontal layer of nylon that is sintered adding to the vertical height of the component.

Other materials can also be added to this nylon in very specific ratios in order to give the finished component different properties depending on its final application, in much the same way as different grades of steel with different qualities can be produced by using different amounts of carbon, manganese, chromium and other elements. An early example of this kind of mixture was nylon that had been 'filled' with glass fibres, but what Graphite AM did, which was what was being developed in Formula 1, was mixing carbon fibre into the nylon, which massively improved the stiffness to weight ratio and offered much better strength and stiffness than standard nylons or the glass filled nylons widely available.

> **"They still want a like for like replica of what was produced in the '70s, but we are now able to print it in an ultra-lightweight material that's going to last"**

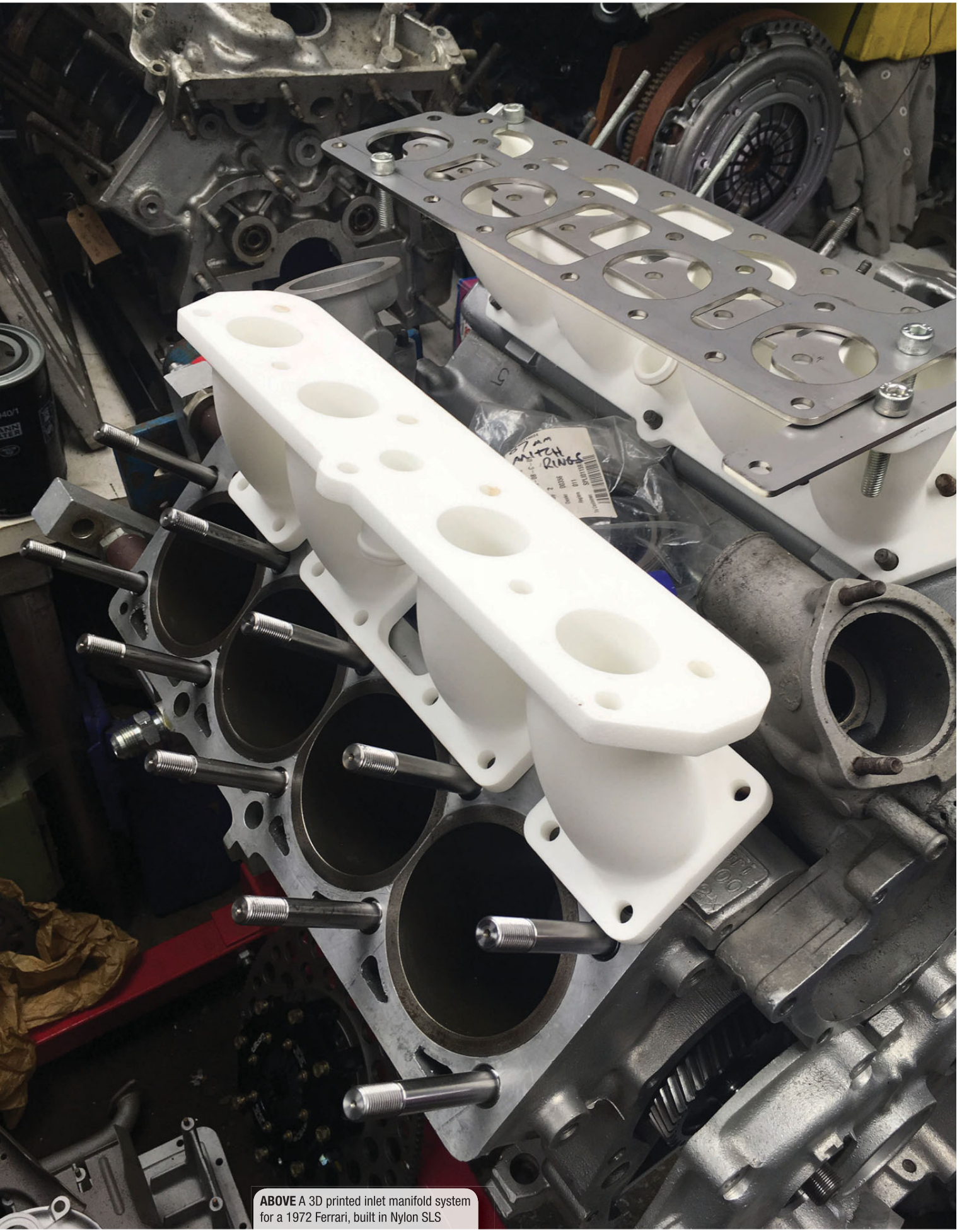
However, as a lot of the customers said that although they loved the Carbon SLS, they couldn't quite justify the cost as they didn't need the extreme levels of strength and stiffness, it led to the development of its Graphite SLS material, which, thanks to its unique qualities, is the material used for a lot of Graphite AM's historic projects.

One of the current projects is with a company called DTM Power, a Ferrari engine specialist that Graphite has worked with on multiple occasions.

"They really understand 3D printing, and really want to gain a competitive advantage for their clients by using the best materials," says Jonathan Warbrick, Graphite AM's marketing manager. "So ▶



ABOVE Graphite Additive Manufacturing is a 3D printing consultancy for companies that want to make more of the potential of additive manufacturing



ABOVE A 3D printed inlet manifold system for a 1972 Ferrari, built in Nylon SLS

we've done all sorts of things for them, things like impellors, brackets, intake systems and throttle bodies.

"The one we are doing at the moment is for a 1972 Ferrari. It's a lovely looking engine, but the intake system is an absolute pain to source and an absolute mission to machine, so we've 3D printed it."

To do this Graphite visited DTM to see the original part that its 3D printed version would replace. The company then scanned and accurately measured the piece, allowing it to build up a 3D model in CAD. This model was then pored over, mainly to make sure it was suitable for the additive manufacturing process. This entailed manually checking that things like the wall thickness was suitable for both the manufacturing process and the Graphite SLS into which it was to be printed, as well as running the design through special software which analysed the CAD layer by layer to ensure it would print well without any weak points or problem areas. At this design stage Graphite AM also subtly amended the CAD to make some slight improvements to the intake system.

Getting to this point leant on Graphite AM's expertise, a necessity given the range of materials and technologies available, with Warbrick highlighting that there are lots of different considerations that must be taken into account before the part can be made. Will the part be somewhere that gets very hot, is it something that could be exposed to oil or coolant, and whether the component will be raced on track all have a bearing on what technology and material Graphite AM will recommend to clients.

SPEEDING UP THE PROCESS

Ultimately though, all the care and preparation is worth it.

"Like lots of engine builders, DTM's got a lead time now, for a new engine, of something like four years. In the workshop they've got something like 20 engines in various states of repair, all needing time, energy and money to bring them back to life, but I think, from what we were told, that 3D printing was really helping to speed up the whole manufacturing process and allowing DTM Power the freedom of design to alter things as it goes.

"They still want a like for like replica of what was produced in the '70s, but we are now able to print it in an ultra-lightweight material that's going to last."

Classic Porsche specialist BS Motorsport is another company which Graphite has been involved with on many projects. BS has utilised Graphite's ability to minutely reproduce original components for a vast selection of parts that range from intake trumpets right the way down to things as everyday as dust caps. The company even commissioned Graphite to make some fuel jet nozzles out of a clear SLA material, which would enable mechanics to see the fuel coming through the nozzle. For some of these parts, Graphite was also able to use one of its other main capabilities: coating.

Although 3D printing in Graphite SLS leaves a very functional, almost black matt finish there are still ways that Graphite ▶



ABOVE A 3D printed water pipe built in Graphite filled SLS

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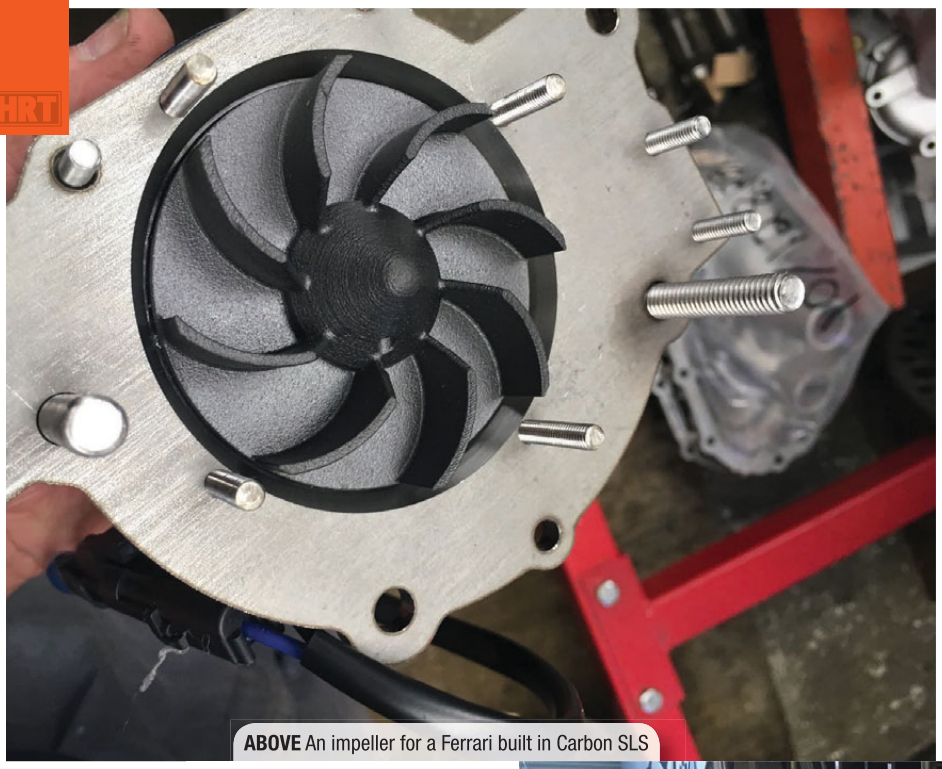
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ABOVE An impeller for a Ferrari built in Carbon SLS

can improve it depending on its ultimate application. One of the most frequently utilised is a vacuum impregnation process which is applied to the final piece, as although the printed pieces themselves are non-porous, if anything is going to be exposed to high temperatures, high pressures or a particularly aggressive fluid, Graphite recommends it as part of a "belt and braces approach".

Warbrick says the other coating that is also particularly popular with historic preparers is the chrome and nickel plating, which means that pieces of external trim and the like can all be made out of the Graphite SLS material to the exact size of the bodywork – not always easy thanks to classic cars' hand-beaten panels – and then plated so as to look like the originals. This, he suggests, is a particularly attractive option for owners who race their cars and would rather avoid damaging the originals in an on-track 'kiss'.

"We have one client, a gentleman that races his 1928 Lancia, and that started off with just a rear light surround," Warbrick recalls. "He came to us and said 'I can't get this anymore'. It was a metal surround for a back light, but in that instance there was also an opportunity to improve the design.

"The light surround was quite an aesthetic shape, and we were producing the back plate out of our graphite material, so we 3D scanned it, reverse engineered it and then changed the CAD ever so slightly. We then sent him a mock up for approval and he said it fitted like a glove. So we were able to print the finished piece for him."

"He was like many of our clients. Most of the time they can't get a part, either they can't source it anymore or the manufacturer is quoting a really long lead time. So we take their physical, original part and replicate it and reproduce it."

It may be more in terms of adding years rather than saving fractions of a second, but it seems the benefits of Formula 1's gargantuan budgets, and the materials expertise of its engineers turns out to be as useful to Lewis Hamilton's W09 EQ Power+ as it could be to Juan Manuel Fangio's W196. HRT



ABOVE One of the Porsches under the stewardship of Neil Bainbridge at BS Motorsport



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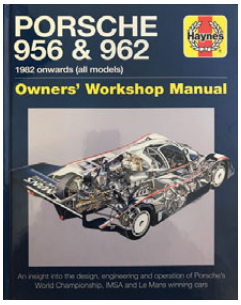
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Porsche 956 & 962

1982 onwards (all models)
Owners' Workshop Manual
Nick Garton
Published by Haynes Publishing
ISBN 978-0-85733-796-2
172 pages
£25.00



FOLLOWING Derek Bell's book on his career with Porsche (see HRT17) comes this book from Haynes Publishing in its Owners' Workshop Manual series. Of course, it's not just aimed at 956 and 962 owners as otherwise the sales would be pretty small, but for everyone who is fascinated by these two models that upheld Porsche's honour in endurance racing for so many years.

The first chapter is a scene setter with an account of how Porsche was going through what the author describes as an identity crisis following the Porsche directors' decision to phase out the 911 to concentrate on the front-engined 924 and 928. At the same time it also committed to race in the 1980 Indianapolis 500. The whole thing was a mess, but fortunately it led to the instalment of Peter Schutz, a German who had been brought up in the US and who knew the value of Porsche's racing success, as chairman. The 911 programme was resurrected but as importantly it led to the development of the 956....and the rest is history.

Chapter two focuses on the racing story and chapter three on the drivers, with Derek Bell naturally featuring large in the pages. For readers of this magazine, though, it is probably chapter four that will be the most engaging as it looks at the engineering that went into the car. Populated with fine pictures, this is the heart of the book.

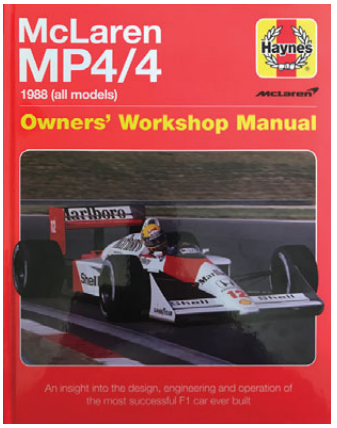
The engines are laid bare with some superb detail shots and a comprehensive two-page spread on their various specifications over the years.

For those who are really serious about owning a 956 or 962, there is a chapter on buying, restoring and owning one followed by nine appendices that list the championships won by the 956 and 962, their respective wins and their most successful chassis and drivers in both cars.

A lot of hard work has gone into this book and will be a welcome addition to the 956/962 enthusiast's library at a price that doesn't break the bank. HRT

McLaren MP4/4

1988 (all models)
Owners' Workshop Manuals
Steve Rendle
Published by Haynes Publishing
ISBN 978-1-78521-137-9
172 pages
£25.00



THIS is a book on the iconic Honda turbo-powered MP4/4 that took drivers Alain Prost and Ayrton Senna to victory in all but one race in 1988. It was an astonishing feat. It also brought the Brazilian driver his first World Championship. It can rightly be regarded as the jewel in McLaren's crown.

Steve Rendle has produced a truly interesting book as he has had access to previously unpublished archive material, including original technical drawings and other internal documentation.

Compared to today's Formula 1 teams that employ upwards of 600 people, including massive design teams, 30 years ago the teams were far more compact. As the author points out, the late Andy Willard was the one-man CAD department at McLaren in 1988. However, so new was the technology that he was the only one who knew how to use CAD for things like surface angles so a great deal of design was still done on the drawing board.

Where nowadays preliminary work starts on next year's Formula 1 cars almost a full year in advance, the MP4/4 was designed, developed and built in just six months. What made it even more complicated was that it was McLaren's first car being powered by a Honda engine.

The book is full of interesting handwritten notes made at the time. For example, there is an annotated design drawing of the gear-lever slider assembly to show the location of the problem with the gear linkage on Senna's car at the start of the Brazilian Grand Prix. Written in capitals, it says THIS DIMENSION WAS DRILLED TOO DEEP AND BROKE ON THE WARM UP LAP. Pity the person who was responsible for that.

As with the Porsche 956/962 book, the heart of this book is the anatomy of the MP4/4 which as the author states is a perfect example of engineering excellence. As he writes, there was nothing revolutionary about the car, its success was due to compact packaging and the holistic approach to its design.

For budding engineers as well as enthusiasts, this is a great book. HRT

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BELOW The record-breaking Ferrari 250 GTO recently sold for $48.4m – powered by a 2,953 cc Tipo 168 Comp/62 60° V12

THE NUMBERS GAME

A racing car's headline specs alone are often enough to get a petrolhead excited, but as **Alan Stoddart** suggests they may give more away than you might think

Most car people love to talk about numbers. Many of the more dedicated have a whole magazine of numbers they are ready to fire off at a moment's notice. There is a good reason for this: often a few numbers can tell you an awful lot more about a racing car than a mere empirical description of one of its properties.

Take for example the featherweight Lotus 25, which tips the scales at just 451 kg. That number, right on the limit of what was allowed by the regulations at the time is not only impressive in its own right, it also speaks volumes about Colin Chapman's obsessive, or as Jochen Rindt would later suggest, dangerous, focus on lightweighting. This number succinctly expresses the design priority of the car. The same is true for the fantastic Benetton B186, which was powered by BMW's astonishing 1.5 litre M12/13 turbocharged inline-four. The remarkable number associated with this car is of course the 'around 1400' bhp figure that the B186 served up in qualifying trim. That particular number is quite a statement in itself, but it also hints at the monstrous turbo lag, endless gearbox changes and its drivers' inability to practice for qualifying given that the engine was only good for about three laps in this extreme setup.

Another impressive number came up recently. One of the releases put out by Goodwood ahead of the Revival boasted that the historic festival was set to feature the 'most valuable motor race in the world'. This race, the Kinrara Trophy, is made up of a grid of thirty pre-1963 GT cars worth a staggering £200m combined. What do these numbers regarding the value of historic cars tell us?

The price of an historic racer isn't an intrinsic property, so it's hard to discern anything of a car's character or of an engineer's aspirations, instead, it reveals the level of esteem that any particular racer is held in. By this measure the 1962 Ferrari 250 GTO that in August sold at the Sotheby's auction at Monterey Car Week for $48.4m, is quite rightly held in very high esteem indeed.

There are downsides to these stratospheric amounts of money however. As the value of a car increases, the feasibility of it trading paint at an event like the Revival surely decreases until, on what would be a dark day for motorsport fans, the owner decides that he simply can't stomach the risk of a $25m investment diving for apexes at 120 mph. Other risks are less tangible though, with possibly the saddest being that the currency number supplants all others as a car's defining feature. Instead of thinking about output per cylinder, or ride height or redline rpm, or boost pressure or kerb weight or any other numbers that tell the story of a racing car and offer a glimpse into the minds of the engineers behind it, cars just become known as 'the most expensive car to ever sell at auction' or 'the most expensive British car' or the 'world's most valuable pre-war racer'.

Auction numbers are often astonishing, and big auction numbers are arguably good for the industry, with that money working its way to suppliers, restorers, modifiers and fixers, but it's worth bearing in mind what engineering and competitive feats propel all those lots to their lofty values. It's worth remembering the numbers behind the numbers. HRT



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