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Issue 15 UK £6.99 USA $12.00

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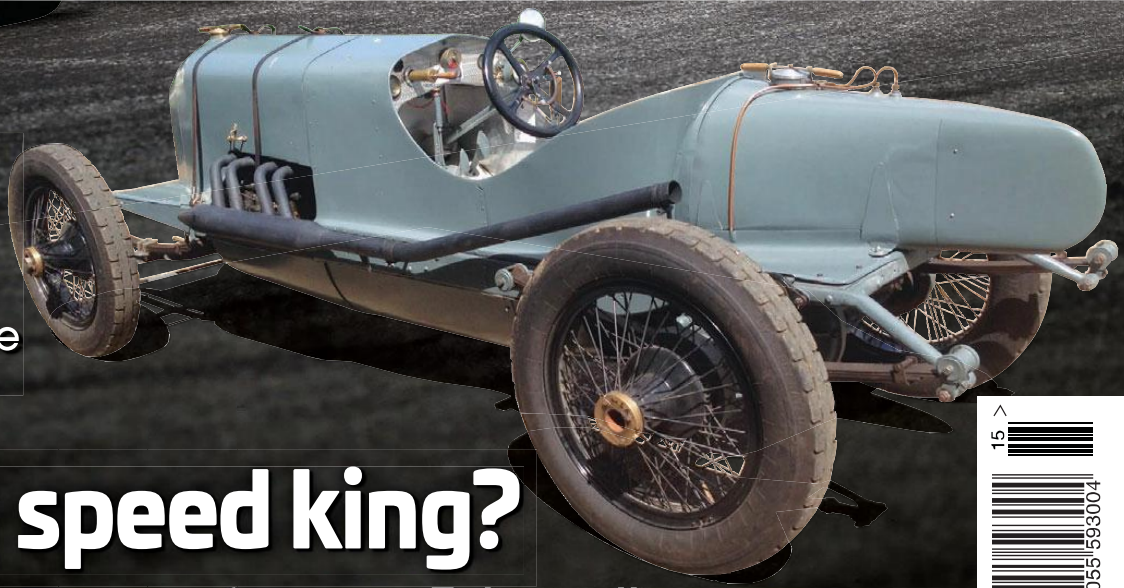
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The challenge of getting the active ride Williams FW14B back onto the racetrack



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Back on active duty

The challenge of getting the active ride Williams FW14B back onto the racetrack

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Issue 15
Volume 4 Issue 3
Published March 2018
The next issue will be published in May 2018
ISSN 2055-5938

SUBSCRIPTIONS
Subscriptions from:
Kimberley Media Group Ltd
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Fax +44 (0)20 8446 2191

Historic Racing Technology is published quarterly by Kimberley Media Group Ltd.

Cover images:
Williams F1/LAT
William Twelvetrees

Design & Production:
Maluma Design Associates

Printed by Warners Midlands plc
© Kimberley Media Group Ltd.

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Safety Fast

THE news that was breaking as we were going to press with this issue is that American Medical Response (AMR) has become the Official Medical Support Company of SVRA (Sportscar Vintage Racing Association) in what has been described as primarily a consulting role. It will evaluate all SVRA procedures for medical support to ensure the safety and health of competitors as well as event attendees. AMR is the leading medical transportation company in the US and is also the official Emergency Medical Services Partner for NASCAR working collaboratively with track physicians, infield care centre staff and regional health systems to enhance emergency response capability.

This seems to me to be an extraordinarily good idea, a tie-up between the medical services, particularly first responders, and an organisation that holds and promotes historic racing. According to the press release, Randy Strozyk, executive vice president of AMR Operations said that: "It is essential that motorsport events have a top medical response team in place which is available to drivers, crews, and anyone on the grounds. We are proud of the confidence SVRA is showing in AMR and our commitment to safety."

This reminds me of the time when Louis Stanley created the International Grand Prix Medical Service in 1967, funding the mobile medical unit which for the first time provided good standard medical facilities at circuits holding a Formula 1 race.

That was half a century ago, but so is historic racing in some matters. Regrettable though it is, we are still seeing the occasional death here and there in the sport. Only last December, in what was a low level event, Shawn Rayner and Steve Dear were killed when competing in their Ford Escort Mk2 at a local rally event over the Christmas holidays. On a more high profile note, Denis Welch was sadly killed in a race at Silverstone in 2014 and the year before Christian Devereux died when his 1965 Mini Cooper S spun off course and crashed into another vehicle at Donington. I'm sure there are others.

It's true, these deaths are few and far between and need to be put into proportion and the safety personnel and equipment at circuits like Donington and Silverstone are second to none while St John Ambulance is usually in attendance as well, but having a medical organisation involved as a sponsor along the lines adopted by the SVRA has to be a good thing. The surprising thing is that it has not been done before, at least as far as I am aware.

I am not sure whether there is an equivalent to the AMR in the UK, so this may be an academic question, but to affiliate with a high level medical service of some sort has to be a good thing for all concerned. HRT

William Kimberley
Editor



NEWS

Edited by Alan Stoddart

Historic F1 races to support the British Grand Prix

FANS at the British Grand Prix are set to be treated to a fantastic support act in the form of iconic Seventies and Eighties historic Formula 1 cars from the 3-litre era. The classic racers feature in two support races staged by Masters Historic Racing on the Silverstone Grand Prix circuit.

Entries in the historic races will come from both the FIA Masters Historic Formula One Championship in Europe and the Masters USA series, ensuring a packed grid of cars hailing from Formula 1's 3-litre era. The support races at Silverstone will be the only chance this year to see the historic racers attack a European Grand Prix circuit during a modern F1 race weekend.

"It's great to know that British F1 fans will now have three opportunities to see our cars compete on British soil in 2018 – at the Silverstone Classic, at our own Masters Historic Festival at Brands Hatch at the end of May, and now too at the British Grand Prix," said Masters Historic Racing founder Ron Maydon.

"The fact that we have been asked to organise a support race at the British Grand Prix certainly reflects the quality of the show we put on at Montreal, Austin and Mexico City last year. I'm sure that we will evoke many wonderful memories with the spectators that were also present at Silverstone and Brands in the Seventies and Eighties as well as fascinate the younger part of the crowd." HRT



BELOW To celebrate Silverstone's 70th anniversary, Masters Historic Racing will be organising two F1 support races at the British GP in July

Photo courtesy of Masters Historic Racing

Photo courtesy of Masters Historic Racing



ABOVE The new Masters Endurance Legends series will feature in two support races at the revived French Grand Prix

The Masters Endurance Legends series to support French GP

THE new Masters Endurance Legends series is set to feature in two support races at the revived French Grand Prix at the Paul Ricard circuit in June with famous Le Mans prototypes and GT cars.

Masters Endurance Legends is a new series catering for Le Mans prototype and GT cars from 1995 – 2012 and will add the Formula 1 Grand Prix de France support race to its already-announced six-race programme for 2018, that includes races at Imola, Brands Hatch, Silverstone, Nürburgring, Spa and Dijon. The race at the revived French Grand Prix will include cars that starred at Le Mans, Daytona, Sebring and other classic endurance tracks in the world.

Well-known historic organiser Masters Historic Racing, which initiated the Masters Endurance Legends series, will be responsible for staging the support races.

The Paul Ricard circuit, well known territory to many of the recent Le Mans prototypes and GTs, was previously part of the ELMS and ISRS calendars. Today, the 4 Hours of Le Castellet is a permanent fixture on the ELMS calendar.

"I'm proud that in its first year Masters Endurance Legends will be able to showcase its spectacular variety during the Formula 1 Grand Prix de France weekend", said Masters Historic Racing founder Ron Maydon. "The Paul Ricard circuit is perfect for these cars, as they will be able to really stretch their legs on the straight while the technical return section is a true challenge for any driver. Building on our experience in staging Historic Formula One support races at Grand Prix weekends, I'm sure we will put on a good show for the French crowd."

"The French Grand Prix along with the Paul Ricard Circuit has a strong heritage in motorsport. Welcoming a historic cars competition as a support race on the weekend Formula 1 returns on French soil after a 10 year absence is a great news", said Gilles Dufeigneux, general director of the 2018 F1 French Grand Prix.

"Having the opportunity to see, smell and hear some of the most iconic and successful racing cars suits our programme perfectly. Indeed, these cars will not only be seen on stage but driven flat out and race against each other. With F1, F2, GP3 and now Masters Historic Racing on board, all is set to offer the spectators from all over France, Europe and beyond a great and varied show. During three days, emotions around past, present and future will be on schedule. Everybody at the French Grand Prix is excited to welcome these great series."

The French Grand Prix will return to the Formula 1 calendar after an absence of 10 years. In the Seventies and Eighties, Paul Ricard used to co-host the race, alternating with Dijon-Prénois, before the event switched to Magny-Cours in 1991. The last French Grand Prix at Paul Ricard took place in 1990 and was won by Alain Prost's Ferrari 641/2. HRT



Pete Austin

ABOVE The Historic Sports Car Club has re-affirmed its commitment to the Classic Racing Car Series

Classic Racing Car Series gets strong 2018 calendar

THE Historic Sports Car Club has re-affirmed its commitment to the Classic Racing Car Series, with a re-work of car eligibility and an attractive calendar of races for the coming season.

For the this year the focus will return to the category's origins as a series for racing cars from the era before wings and slicks changed the look of single-seater racing. Cars from the 1960s right up to 1971 are eligible, while the series is also open to cars from Formula 1, Formula 2, Formula 3, Formula Atlantic, Formula Junior and Historic Formula Ford. In some cases, the CRC races offer drivers with Formula Juniors and Formula Fords a second chance to race over the weekend.

A well-supported drivers' meeting late in 2017 was the catalyst for a re-worked package for this season, with six events including the Oulton Park Gold Cup meeting. In addition, drivers with 1600cc Formula 2 or Formula Libre cars have a chance to race at Thruxton during the circuit's 50th anniversary race meeting on 2/3 June.

"Our Classic Racing Car series has been running for more than 20 years now and it is home to a wonderful array of period single-seaters," said HSCC CEO Grahame White. "We hope that the 2018 calendar will continue to attract good grids of these lovely cars." HRT

SVRA to host pre-1920 racing exhibition

THE Sportscar Vintage Racing Association has announced that it is collaborating with Hagerty and Blain Motorsports Foundation to produce a new exhibition series of races dedicated to cars up to and through World War 1. The events are set to be staged at SVRA weekends at the Indianapolis Motor Speedway, Sonoma Raceway and Watkins Glen International Raceway.

"These cars are important and deserve a showcase," commented, Tony Parella, SVRA president and CEO. "Not only will these historic cars be stretching their legs on the track, but with the work of Brian Blain and his foundation along with Hagerty there will also be educational and informative displays of tools, spares, period clothing that capture the feel of life in 1920 and before. This is rich content that adds to our automobile-themed festivals at SVRA events."

There will be 15-20 runners at the IMS Brickyard invitational, the US Vintage Grand Prix at The Glen and the Sonoma Historic Motorsports Festival. The whole event will take place in period, with the drivers and supporters dressed appropriately, while only tools and equipment of the times will be used.

"Our long term vision is to create a travelling road show that will extend beyond SVRA weekends and out to other automobile celebrations, such as concours events," said Brian Blain, president of the Blain Motorsports Foundation. "We believe that doing justice to these rare vehicles by giving them their own run group will attract spectator interest as well as sponsors. These cars and displays offer wonderful educational value to youngsters." HRT

Sonoma Historic Motorsports Festival



ABOVE The SVRA is staging a new exhibition of races at places like Sonoma Raceway for pre-1920 racecars



2018 EVENT CALENDAR

MARCH	22	Masters Test Day	Brands Hatch Indy, UK
APRIL	20/22	Motor Legend Festival	Imola, Italy
MAY	26/27	Masters Historic Festival	Brands Hatch GP, UK
JUNE	22/24	The Most Historic Grand Prix	Most, Czech Republic
JUNE	22/24	Formula 1 Grand Prix de France*	Le Castellet, France
JULY	6/8	Formula 1 Rolex British Grand Prix*	Silverstone GP Circuit, UK
JULY	20/22	Silverstone Classic	Silverstone GP Circuit, UK
★ 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

*Support race. Correct at time of going to press.
Dates and venues may be subject to change.

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NEWS

CAN-AM cars to join Pre '80 Endurance Series

THE HSCC has unveiled the 2018 Pre '80 Endurance series, which will for the first time feature an invitational class for Can-Am cars.

A schedule of races at three high-profile historic racing festivals as well as a visit to Spa-Francorchamps makes up the 2018 calendar for the series, which is entering its fourth season and attracts iconic racers from 1970's sports-racing, GT and Touring cars.

The series brings with it all the spectacle of the World Endurance Championship, the FIA GT Championship and the FIA 2-Litre Sports Car Championship thanks to the varied grids. The Can-Am racing cars, from the series' heyday in the 1970s, will further add to the mix thanks to the McLarens, Lolas, Marchs and BRMs which ran with engines of up to 8-litres. Additionally, the Pre '80 Endurance Series will visit Oulton Park for the first time to be one of the headline races at the Oulton Park Gold Cup. The series will also feature at the Silverstone GP circuit International Trophy and the Legends of Brands Hatch GP circuit meeting before concluding at the Circuit de Spa-Francorchamps in September.

The inclusion of the two races at Oulton Park will also add to the event's celebration of 50 years of the Chevron B8. While the B6s and B8s will have a dedicated race, other sports-racing cars from the Chevron range, such as the B16, the B19 and the B26 will be able to compete in the Pre '80 race.

"The Pre '80 Endurance Series delivers some excellent racing from very good looking grids and adding Can-Am cars to the mix is only going to enhance the spectacle," said Grahame White, CEO of the HSCC. "There are not too many places to race a period Can-Am car these days so we hope that some of them will join the Pre '80 grid." HRT



Pete Austin

BELOW The Historic Sports Car Club has unveiled the 2018 Pre '80 Endurance Series, which will feature an invitation class for mighty Can-Am cars for the first time

Spa Summer Classic adds two new events

TWO invitational events have been added to the schedule of the Spa Summer Classic (22-24 June) — the Spa Ardennes Challenge and the Spa One Hour, the latter a race usually held in September at the Belgian circuit.

The Spa Ardennes Challenge will be two 40-minute races for a wide variety of classic sportscars, GT's, Touring and saloon cars, built between the 1950s and the 1980s. Each race will feature a compulsory one-minute pitstop for fuelling and/or a driver change, with cars running on treaded tyres and complying to a 108 dB noise limit. Organisers are targeting cars from organisations such as the Crosslé Racing Drivers' Club, the AR Motorsport Morgan Challenge and the Classic Sports Car Club.

The One Hour race, meanwhile, is for Touring and GT cars of the '60s, '70s and '80s, though as is often the case, Caterhams are prohibited! The organisers hope to create a relaxed atmosphere in the style of meetings of yore for the races, with competitors entering the standalone race for the sheer pleasure of racing on a classic circuit. HRT


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NEWS

Touring cars set to feature in 2018 Castle Combe Classic

A grid full of period Touring Cars will be one of the crowd-pleasing highlights at the seventh Castle Combe Autumn Classic in October. The race for pre-1966 cars will be held in memory of Terry Sanger, a local hero through the 1960s as he raced more and more outrageous saloon and Touring cars.

After a break in 2017, the fabulous spectacle of pre '66 Touring cars will be back in 2018 and the event organisers are already working to attract a grid full of American V8s, Lotus Cortinas, Alfa Romeos, BMW 1800s and Mini Coopers. The sight of these cars sliding into the corners and racing door handle to door handle will be a real highlight of the race programme. It is a race that, for the older Castle Combe fans, will rekindle memories of drivers like Vince Woodman, Geoff Mabbs, Ron Fry, Steve Neal, Brian Cutting and Richard Longman.

The race will be open to cars complying with FIA Appendix K regulations, which ensures period authenticity. With more than 100 eligible cars now based in the UK, the team at Castle Combe is aiming to attract a 30-car grid for this special race.

The Terry Sanger Trophy, meanwhile, will celebrate the life of a true racing character who was inextricably linked with Castle Combe. Remarkably, his life story encompassed two of the key features of the 2018 Autumn Classic: as a youngster he was marshalling at Quarry when Stirling Moss crashed in 1953. Later, Sanger raced a Ford GT40 and contested the daunting Targa Florio road race in a factory car in 1969.

However, it is for his saloon car racing that the Bradford-on-Avon driver is best remembered. He raced cars extensively in the 1960s and was famous for racing an early special saloon, a Ford Cortina Mk1 with a Ford V8 engine installed. Later, having retired from racing, he regularly drove the fast intervention medical car at the circuit. HRT



Castle Combe Autumn Classic

ABOVE One of the features of the seventh Castle Combe Autumn Classic will be a race for pre-1966 Touring cars

Rosberg's Williams to star at Thruxton



Thruxton Circuit

ABOVE Williams Heritage is preparing Keke Rosberg's Williams FW08C F1 car for an outing at Thruxton for its 50th Anniversary Celebration on 2-3 June

THE car which was driven to Monaco Grand Prix glory by Keke Rosberg in the 1983 Formula 1 World Championship is set to return to the track as part of Thruxton Circuit's eagerly-anticipated 50th Anniversary Celebration.

The milestone celebration is set to take place on 2-3 June, marking 50 years since the first motorsport event was held at the venue on Easter Monday in 1968.

Helping make the weekend special for motorsport fans will be a host of single-seaters, sportscars and saloons from the last five decades of racing. Aside from the racing itself, there will also be a raft of demonstration runs and static displays as well as car club reunions a funfair, live music and overnight camping.

The FW08C weighs just 540 kg thanks to its aluminium honeycomb chassis, and its 3-litre Cosworth DFV V8 puts out 530 bhp through a 6-speed gearbox. It will mark the first time an F1 car has been driven at the circuit since 1993, when Damon Hill averaged 147.25 mph in the title-willing FW15C.

The car is now part of the Williams' Heritage portfolio, which is headed up by Jonathan Williams and run by Dickie Stanford, and looks after the F1 team's collection of historic Formula 1 racers.

"We are thrilled to be able to confirm the attendance of the Williams FW08C for a high-speed demo run at our 50th Anniversary Celebration," said Bill Coombs, Thruxton Group's managing director. "I have no doubt that the FW08C will make for a quite incredible spectacle in June. It is what I would call a 'proper' F1 car with its screeching V8 engine and wide rear tyres and it will surely bring back many evocative memories for those like me who were lucky enough to have witnessed it competing during its heyday." HRT

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The Mercedes-Benz C292 was a stillborn Group C prototype race car intended for the 1992 World Sportscar Championship season as an evolution of the Mercedes-Benz C291, but never raced due to Mercedes-Benz withdrawing from sportscar racing after the 1991 season. It retained the purpose built 3.5 litre naturally aspirated flat 12 engine coupled to a transverse 6 speed sequential gearbox.

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First continuation DB4 GT rolls off production line

ABOVE The DB4 GT Continuation will see production re-start for the first time in 10 years at Aston Martin's facilities in Newport Pagnell

IN December, Aston Martin announced that one of its most iconic models – the DB4 GT – was to be celebrated with a series of 25 track-only continuation cars. Now, the first of these special models are being completed at Aston's Newport Pagnell base.

The DB4 GT was launched in 1959 and was immediately celebrated as one of the marque's rarest and most revered creations. It was an evolution of the production DB4 and introduced the same year Aston Martin won the Le Mans 24 Hours. The car was created for performance, and was shorter and lighter than the production model, and featured a more highly tuned version of Aston's 3.7 litre straight-six engine. A total of just 75 DB4 GTs were made, with only eight of them being lightweight models.

The continuation models remain faithful to the design of those original lightweights, and are being built by Aston Martin with a mix of traditional craftsmanship and modern techniques. As such the cars benefit from improvements in engine performance, handling and braking, but, according to Aston, don't lose any of the DB4 GT's character.

The continuation models use VIN numbers which carry on from the last original DB4 GT ordered – chassis 0202R, and use the same Tadek Marek-designed straight six. However, modern manufacturing techniques mean that the new models will have 340 bhp, up from the 302 bhp of the original run. Power is driven to the rear wheels through a four-speed manual gearbox and a limited-slip differential, just as in the original DB4 GT.

Given the racing history of the originals, Aston is keen for the continuation models to be used and enjoyed on track. To this end, Aston Martin Works has created a two-year international track-driving programme held at a number of the world's finest race track, including instruction from Aston Martin's driver training team. HRT

Bentley wins gruelling rally in Far East

THE 1925 Bentley Super Sports of Graham and Marina Goodwin reigned supreme on the Endurance Rally Association's The Road to Saigon rally. They held the lead on the Vintageant category from the start line in Singapore right the way to the finish in Saigon or Ho Chi Minh City as it is now known.

Former Peking to Paris entrant Andrew Webster and his co-driver Ian Robertson took second place in their 1939 Chevrolet Master 85.

Rallying over 8,600 km in 27 days, around 35 crews took on a series of challenging regularity and speed trials as they journeyed through Thailand, Cambodia, and Vietnam.

The Classics division was won by Marco Halter and Claudia Engelhardt in a 1963 Ford Falcon, who had fought a close battle with runners up Gerry Crown and Matt Bryson, former Peking to Paris winners, in the 1974 Leyland P76. Third place was secured by David Gainer and Kerry Finn in the 1972 Datsun 240Z.

Collecting their trophy, Halter acknowledged the importance of this, his first win and declared that he has two heroes in classic rallying. Of runner up Gerry Crown, who is still competing at 88 years old, Marco said: "I wish I can drive as fast as you when I'm as old as you. You're a fast driver and a fast drinker." HRT



ABOVE Graham and Marina Goodwin win the Vintageant category of The Road to Saigon rally in their 1925 Super Sports Bentley

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ABOVE Dan Gurney's last Formula 1 car, the McLaren M14a, was on display at the Hall of Fame

SMILING ON THE BRAVE

William Kimberley and **Alan Stoddart** walk Race Retro to find out what's new

HAD it been a week later when the Beast from the East hit the UK with snow storms and freezing temperatures, it might have been a different matter, but fortune smiled on Clarion Events, the owner of Race Retro. The weather remained quite clement during the time the show was on so that Clarion could claim that there were 23,100 attendees over the three-days at the National Agricultural Centre in Stoneleigh in mid February, representing a 10 per cent increase.

As usual, there were plenty of activities to keep everyone interested. This included the two Silverstone Auctions sales over the weekend, tributes to 30 years of Jaguar's success at Le Mans with the winning XKR9 on display and the live action stage with Rallying with Group B delivering 'the best rally stage ever' at Race Retro, according to former rally champion Russell Brookes as around 80 cars, including over 20 from the Group B era, provided a thrilling spectacle on the bespoke stage.

Inside the halls at the business end of things were companies such as Anglo American Oil, Bailey Morris, BG Developments, Classic Fuel Solutions, Elite Racing Transmissions, Goodridge, HB Bearings, Raceparts, Reis Motorsport Insurance and Spax Performance among many others plying their trade.

Gathercole Race Engines was also present. This is a company that has made a name for itself in the historic racing car world, with its race-prepared engines. From a husband and wife business, it has now grown to six, including an apprentice, while it has also moved into a purpose-built unit that also houses its CNC machine.

"We've been building engines for a long time, concentrating on the FVC/FVA and the BDG Ford engines and the Lotus twin-cam. Traditionally we have sourced parts from other people, but

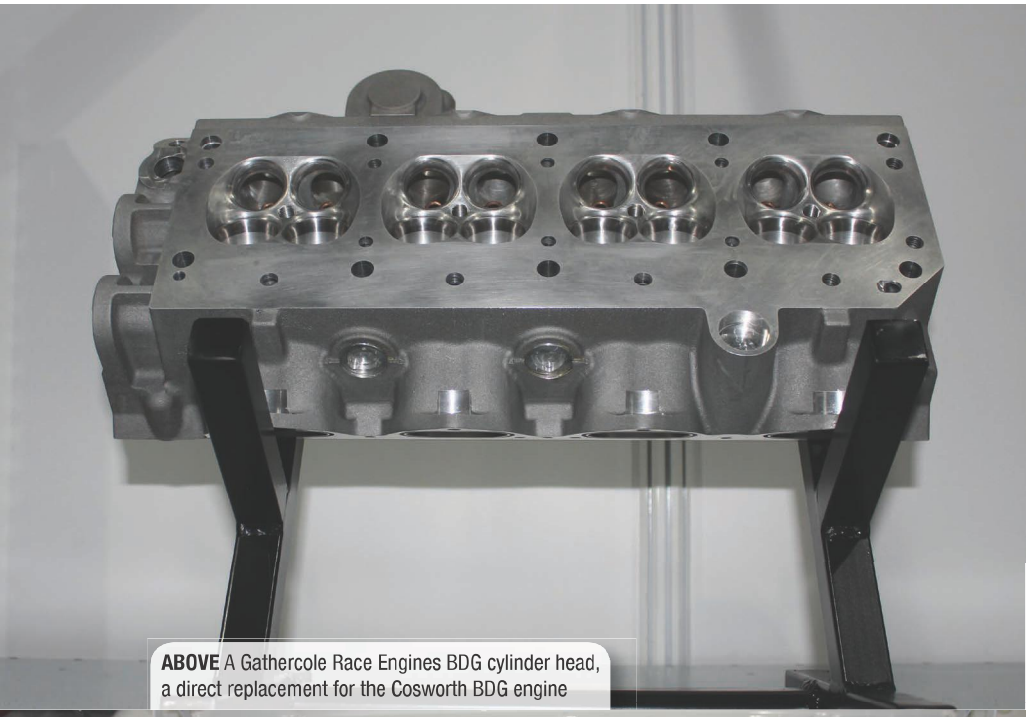
over the last five years we have gradually been building up our own portfolio of parts, blocks and heads," says Lorraine Gathercole, a director of the business and wife of David, the founder. "The only outside suppliers are Arrow Precision for rods and cranks and a US suppler which makes the pistons to our specification.

"We now have a complete inventory of all the parts so that we can now sell any individual component right through to an engine kit or complete engines and so can supply engine builders around the world. Recently we've been supplying to Germany, Italy, the US, Australia and New Zealand."

One of the things that the company is looking into is whether to put a full management system on the BDG to meet demands from the rally world. "If competitors are not running an FIA car, they don't need to have the more complicated old mechanical system and can run something a bit cleverer. If they're running a Mk1 Escort, they want a BDG, but they want it simplified, so we have developed a plug-in-and-play unit to make it much more user-friendly for the customer and to give people different options with different engines.

"We are also increasing the capacity of the engine so can get them up to 2.5 litres. We can increase the bore size because the pattern work we've had done is beefier so we can go out to a 93 mm bore from just under 90 mm, which is the norm for a 2-litre, with a 93 mm stroke, which gets it to two and a half litres, which is what seems to be something that people want."

The business is now turning its attention to the historic rally world, where it is less well known. "In the rally world they have a much wider power band they want to use whereas in the race world it's only between 6,500-9,000 rpm. It is things like this that excite David."



ABOVE A Gathercole Race Engines BDG cylinder head, a direct replacement for the Cosworth BDG engine



ABOVE A fuel Injected BDG engine developed by Gathercole Race Engines

A TOTALLY DIFFERENT BREED

"When I built my first rally engine we went into the forest with 280 bhp and a 2,000 rpm power band window which we very quickly found out wasn't the way to go," says David Gathercole. "I realised then that these guys were a totally different breed. It was thoroughly enjoyable but a great learning curve, so when we did a rally at the end of last year, we did a new gravel engine which met the requirements, so it was still very powerful but controllable.

Antigravity Batteries was also another exhibitor showing its recently launched Re-Start range of batteries. These are equipped with a system that prevents a battery running flat by isolating it when its charge level reaches a certain point. When this happens, a press of the power button reactivates the system, offering up enough power to start the car, enabling the battery then to charge normally from the engine.

"The battery simply turns itself off and when the button is pressed it will start up and away you go," explained Antigravity UK's Paul Bennett. "This feature is particularly crucial in lithium-ion batteries, which must not go flat. That has been one of the big problems stopping their adoption, but this Re-Start technology will overcome it. It's a great upgrade from all the previous batteries which have no monitoring in them – if they go flat then that's it, they are gone." HRT

All photos: Williams F1/LAT

RETURNING TO ACTIVE DUTY

Getting a technological milestone up and running again was never going to be easy, but, says **Alan Stoddart**, in the case of Williams and its FW14B, ingenuity prevailed



ABOVE The FW14B was one of the most dominant cars in F1 history, but just getting the engine to run again in the modern era required ingenuity from the team involved

HARD to believe it may be, but in 1992 the most closely guarded secret in F1 was hidden by nothing more than a square foot of Alcantara. Beneath this dull layer of fabric lay the heart of Williams' now perfected active suspension system, which so emphatically took both Williams-Renault and Nigel Mansell to the very top of the constructors' and drivers' championships.

The velcroed on Alcantara was used to keep out prying eyes both in the pitlane and, somewhat optimistically perhaps, in the event of the nose becoming detached in a collision. Now, 26 years later as Williams Heritage prepares FW14B Chassis Six for its new owner, the very same piece of fabric remains.

Amazingly, this low-tech solution worked. Although there were odd glimpses throughout the years, including an incident at Estoril when Mansell's team-mate Riccardo Patrese ran into the back of Gerhard Berger, no-one was able to get a clear photograph of the cutting-edge system. This wasn't however the first time that Williams had used an active suspension system on one of its Formula 1 cars. Initially the Active Ride idea came from AP Racing, which had been looking at the system for use in road cars, but after deciding not to pursue it commercially approached Williams in 1984 believing it may have merit in racing.

Williams immediately saw the system's potential, especially given the stiff springs that the cars were using to cope with the high aerodynamic loads now being generated. The F1 team believed that it would be able to use the system to maintain the ideal aerodynamic platform, without sacrificing a car's compliance which would be especially beneficial on bumpy tracks.

ACTIVE ANGUISH

Fine in principle, but actually mastering the Active Ride was a rather trickier proposition. "I started at Williams in 1985, and they were already messing with it in R&D then," explains Dickie Stanford, general manager of Williams Heritage. "We even ran a system on the '87 car, the FW11B, Nelson [Piquet] won Monza with it... then they went full active ride in '88, and, well, we didn't understand it.

"We thought we did, but we'd adjust the movements for the wrong things and stuff, so it was taken off at Silverstone and we went back to passive suspension."

Despite the extra five years of development, however, the mechanics working on the car still found the system a lot to get used to, with stories spreading about it pouring oil everywhere because it had sprung a leak, adds Stanford. Thanks, though, to the 15 months the underpinnings of the system were running on the FW13 and 14, it was properly sorted by the time the race team got it. "This meant that if you followed the procedures it was fine, but if you tried to cut corners you were normally in trouble."

The new system was arguably more worrying for drivers. It was controlled by Moog valves, which responded to changes in ride height as determined by increased pressure in the Shell hydraulic fluid, which opens and closes the valves. "So when you've got your pressure in the system, and the car's moving up and down, it's putting valve pressure on the block and on the Moog valves and they determine where the fluid's going to be pushed to keep the struts at the right height," explains Stanford.

> **"The old ECU couldn't keep the engine running, so we came up with the idea to reverse engineer it"**

The benefits of the system were obvious: in addition to maintaining the FW14B at the optimum angle for aerodynamic effectiveness, by providing a hydraulic link between different corners of the car, the Active Ride also effectively acted as an anti-roll system with fixed balance. Furthermore, the hydraulic system meant that warp stiffness was independent of roll stiffness, allowing impressive body control without compromising traction on rough or uneven surfaces.

There were some things though, that were only to be learnt on track. "Just ask Riccardo," Stanford grins. "Originally there was no failsafe in the system." As it happened, this turned out to be a problem when the system malfunctioned and, instead of maximising the tyre's contact patch as it should have, allowed all four wheels to come up off the ground, bottoming out the car. "I think he ▶



ABOVE Karun Chandhok drives the title-winning Williams FW14B Renault, raced in 1992 by Nigel Mansell. In-period, FW14B's active suspension, semi-auto gearbox and traction control swept rivals aside

did about six or seven revolutions down the straight without touching anything... It was a thing they [the Williams engineers] didn't know about, one of those things that you only find out about when it happens. I don't think Riccardo ever put his absolute faith in the Active Ride after that."

UNDER PRESSURE

Chassis number six was run on track for the first time since 1992 last summer, to celebrate Williams' 40th anniversary. Getting the car ready for the demonstration was no mean feat, especially given Renault's inability to help on the engine side of things. "The car ran a few years ago, and it'd be fine in the workshop and everything would work," Stanford says. "But the moment you took it out, once it got to second gear it would cut the engine." Adding to the drama was Williams' marketing department which suggested the 14B would be a good draw at the anniversary celebrations at the start of July, rather than sometime in August as was the original target. So who did Williams turn to? That other great British stalwart of motorsport engineering expertise: Cosworth.

The company's senior applications engineer, Milan Špičák, was drafted in to help. "It was mechanically ready to run," he says, "but the old ECU couldn't keep the engine running... Our solution was to use our modern electronics, that we currently use and offer to our customers, to get the engine running."

The conventional method to get a car up and running would be to have it on a dyno, which would enable an engineer to do the mapping that would properly run the engine. This, however, wasn't an option for the 14B, says Špičák, because it would have required too much time, both for the dyno testing itself and for the preparation of the engine for the dyno. It would also have likely required some parts, which weren't available given the engine needs to be run for a while throughout the rev range, and then finally it would have needed time for rebuild. "We had to come up with a solution that was quicker and safer for the engine," he ▶



ABOVE The team's impending 40th anniversary celebrations at Silverstone, seen here, provided a challenging timeframe in which the FW14B had to be readied for Karun Chandhok to drive

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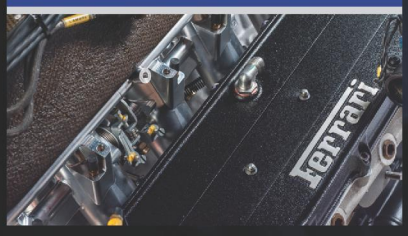
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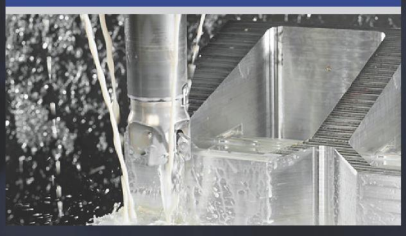
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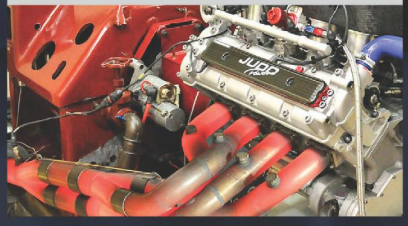
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notes. “So we came up with the idea of reverse engineering the old ECU.

“Williams had a couple of the old ECUs, but none of them were able to run the engine properly,” explains Špičák. “Instead, I simulated the engine with the simulators we use for engine development. I connected the old ECU to our simulator and I was pretending I was an engine. I was measuring the reactions from the ECU and using those values to populate a map that could be used to run the engine with our current, state-of-the-art ECUs.”

COSWORTH TO THE RESCUE

Although easier on the original engine, and less time intensive than running on a dyno to work out the mapping, this reverse engineering and simulation was not without its obstacles. Even ignoring practical things like simply being able to connect a 25-year-old ECU to

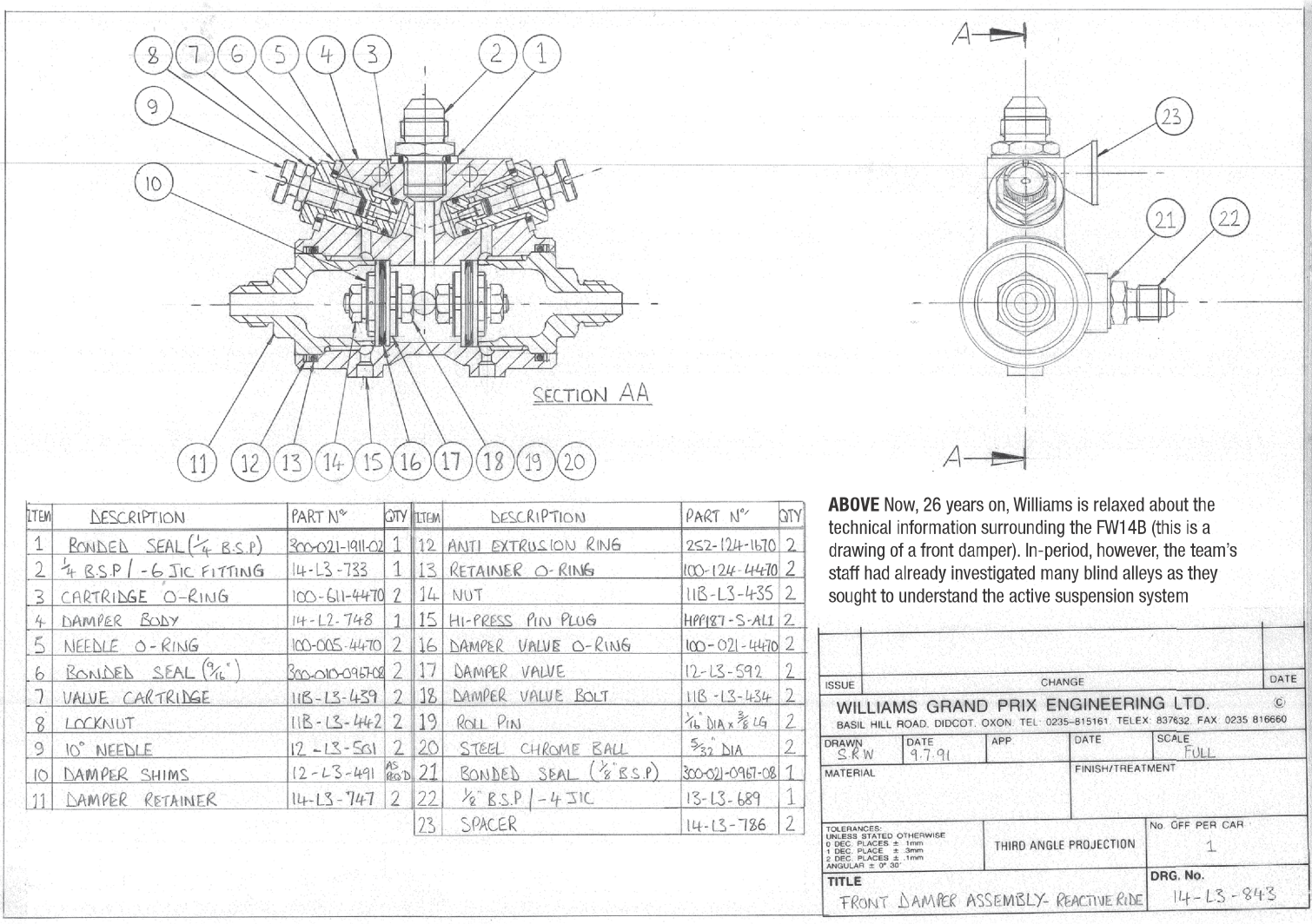
> **“The remarkable thing, especially given its dominance, was that the FW14B was never intended to race”**

Cosworth’s system, it was challenging to understand what exactly needed to be simulated to convince the ECU that the simulation was an engine it needed to run. On top of that, because none of the original ECUs worked, Špičák had to identify where there were faults in the map so as to avoid carrying them over to the new ECU.

This is where the human element was invaluable. The simulator set up wasn’t just the ECU, it was connected to a display enabling Špičák to see the RPM, the throttle position, some of the temperatures and pressures, while he was also measuring the values for ignition and injection. “Then I had to use my own judgement to identify whether these values were possible to run an engine or whether the ECU had a fault,” he explains. “It wasn’t just measuring out the values, we needed to match those maps and identify whether it was a plausible set up.”

Aiding in this regard were Williams’ engineers, some of which had run the car back in ‘92. They helped Cosworth use the old data analysis software, on the old PC running Windows 3.1, to look at the actual data from when the car was competing to see how the numbers coming from the simulation compared to the numbers the car ran at back in the day.

“We were looking at whether the data I was assimilating was of reasonable values compared to those they were getting in 1992 on the Williams Chassis



ITEM	DESCRIPTION	PART N°	QTY
1	BONDED SEAL (1/4 B.S.P)	300-021-1911-02	1
2	1/4 B.S.P / -6 JIC FITTING	14-L3-733	1
3	CARTRIDGE O-RING	100-611-4470	2
4	DAMPER BODY	14-L2-748	1
5	NEEDLE O-RING	100-005-4470	2
6	BONDED SEAL (9/16")	300-010-0967-08	2
7	VALVE CARTRIDGE	11B-L3-439	2
8	LOCKNUT	11B-L3-442	2
9	10° NEEDLE	12-L3-561	2
10	DAMPER SHIMS	12-L3-491	AS REQ'D
11	DAMPER RETAINER	14-L3-747	2

ITEM	DESCRIPTION	PART N°	QTY
12	ANTI EXTRUSION RING	252-124-1670	2
13	RETAINER O-RING	100-124-4470	2
14	NUT	11B-L3-435	2
15	HI-PRESS PIN PLUG	HPP187-S-AL1	2
16	DAMPER VALVE O-RING	100-021-4470	2
17	DAMPER VALVE	12-L3-592	2
18	DAMPER VALVE BOLT	11B-L3-434	2
19	ROLL PIN	1/16" DIA x 3/8 LG	2
20	STEEL CHROME BALL	5/32" DIA	2
21	BONDED SEAL (1/8" B.S.P)	300-021-0967-08	1
22	1/8" B.S.P / -4 JIC	13-L3-689	1
23	SPACER	14-L3-786	2

ABOVE Now, 26 years on, Williams is relaxed about the technical information surrounding the FW14B (this is a drawing of a front damper). In-period, however, the team’s staff had already investigated many blind alleys as they sought to understand the active suspension system

ISSUE	CHANGE	DATE

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S.R.W	9.7.91			FULL

MATERIAL | FINISH/TREATMENT

TOLERANCES: UNLESS STATED OTHERWISE 0 DEC. PLACES ± 1mm 1 DEC. PLACE ± .3mm 2 DEC. PLACES ± .1mm ANGULAR ± 0° 30'

THIRD ANGLE PROJECTION | No. OFF PER CAR: 1

TITLE: FRONT DAMPER ASSEMBLY- REACTIVE RIDE | DRG. No. 14-L3-843



ABOVE Reunited: Nigel Mansell and Dickie Stanford survey the FW14B during the team's anniversary celebrations



ABOVE Where team-mate Riccardo Patrese was spooked by the active suspension system, preferring the feel of the standard car, Nigel Mansell would live with the FW14B's floaty feel on corner entry, knowing that more grip lay beyond it

Controller," Špičák adds.

The work didn't just centre around getting the engine running – a tall enough task in itself – but, as importantly, getting the engine running in a way that was sympathetic to the engine's scarcity. After all, as Stanford points out, "It's a bit difficult to get these V10 engines". Even this, however, required some ingenuity given that the original knock sensors which the team were using to protect the engine from premature combustion needed to be calibrated on the dyno.

"We wanted to be on the safe side when running the engine and not destroy it with knock events, so we decided to run the four original knock sensors. Usually you would calibrate the knock sensors in a controlled environment on the dyno and, if needed, get the engine knocking to understand what a knock event looks like, but we didn't have that controlled environment," says Špičák.

"We found a simple solution. We bought an MP3 audio recorder and we used it to monitor the signal from the knock sensors. When the car returned from the on-track shakedown, we listened to the sound recorded on the MP3, so we could actually hear whether the engine was close to knock or not... based on that you could calibrate the knock control in the engine, and know where the ECU needs to look to identify knock."

All this help from Cosworth meant that instead of dyno time, all that was needed to entirely remap the engine on a new ECU was plenty of technical nous and a healthy amount of Elf fuel and Elf E50 oil. The latter was changed every time Cosworth came in to fire the engine up, a regular occurrence when they were trying to sort the interfaces between the engine and Williams' own systems for things like the gearbox.

"We'd be trying to do the chassis and then Cosworth would ring up and say, 'We have to start the engine,' so we'd have to put the engine back on and fire it up for, let's say an hour, while he'd do his thing then he'd go away," says Stanford. "Then he'd ring up the next day and say, 'I need to come back and start the engine'."

The frequency of the visits reflected the fact that the FW14's rebirth entailed the use of a plethora of Cosworth products: its MQ12 ECU, L2 Logger, CDU4.3 full colour TFT Display Dash, Toolset and Toolbox Cosworth Software. A new loom was also designed by Cosworth for the MQ12 ECU, plus a data loom for the L2 and CDU4.3.

"We wanted to keep 'in-period' as much as possible," stresses Špičák. "However, data logging and the ability to see accurate real-time values was paramount in such a project, and provided the ability to clearly display values and alarms to driver and engineers when preparing, warming up and running the car."

One of the benefits of the switch to a modern Cosworth ECU showed itself when it came time to do a shakedown of the car. There was no time to put it on a dyno, so Williams actually just took the car to an airfield, ran it in a safe mode and then each time the car stopped, Cosworth was able to simply connect a ▶



ABOVE Karun Chandhok stops in the pit lane aboard a Williams FW14B Renault during the team's anniversary event

laptop to the car, make an adjustment then incrementally climb to higher speeds and higher revs.

Things weren't so simple for Williams. "With our side, the chassis side, the suspension, the gearshifts and stuff like that, we use a card," says Stanford. "When the car stops we put a memory card into the slot. A light flashes, and then, when the light stops flashing we take the card out, and take it to the truck where the data can be read. Revolutionary data logging in 1992, perhaps, but a relative inconvenience today."

Aside from the ECU, most of the car's other components are original. Williams uses Judd to look after the Renault V10s. In the case of Chassis Six, all that was needed was an inspection, but in other engines Judd has been able to modify the cylinder head to take new valves and seals, which are the most common problems, according to Stanford. The gearbox is the original Williams unit which used Xtrac internals. As with the engine, it has not needed any new parts but Stanford is confident that anything that is needed in future can be made up from the original drawings, which the Heritage department still has.

Helpfully, other components are still available. The AP Racing brakes for example are still made, and can even be sourced directly from the same chap at AP (Brian) as in 1992. Although, mentions Stanford, "He's retiring soon so we need to get as much stuff off him as possible!" Otherwise the only equipment that has had to be changed has been for safety reasons: a new Lifeline fire extinguisher, new Willans harnesses and a new bespoke ATL fuel tank.

TEST PLATFORM

Another of the remarkable things about the FW14B, especially given its dominance, was that it was never intended to race. This Chassis Six, the first 14B, was only ever designed as a test car for Williams to develop technology that would later be used on the FW15, which was the car expected to run in the '92 season all along. However, according to head of Williams Heritage, Jonathan Williams, the 14B proved so good in testing, and so much better than the 14, it was used for the '92 season instead. Furthermore, it continued to be used even after the FW15 was available.

Aside from the big jump made by the active suspension, the move to the 'B' upgrade also solved reliability problems, which had hampered the team's season in 1991, and brought traction control. The semi-automatic gearbox had been the source of some of the problems in '91, so evolutionary improvements were made. The paddle-operated semi-auto 'box was hydraulically actuated.

"It's effectively a sequential gearbox," explains Heritage technician Steve Salmon. "Basically it's like a ratchet mechanism in there, it holds hydraulic pressure on both sides, and when you want to shift it dumps pressure one side so it fires across. It was quicker to dump pressure rather than trying to send pressure to it." The speed of the changes was also improved by the hydraulically operated clutch, which was made by AP Racing.

The traction control meanwhile was apparently one of the simplest things to introduce into the car, but also one that brought significant gains, especially in the wet. Stanford says that the system – which according to Paddy Lowe, who at the time was Williams' joint head of electronics, took just one line of code to program – initially was met with some resistance from Renault.

The system worked by using wheelspeed sensors in each of the four wheels. The speed indicated by the front wheels was used as the true speed, because they were unpowered.

The rear wheels meanwhile, which could be spinning under the power of the engine, could be indicating a higher speed than the front wheels, which would indicate wheelspin. If this occurred, the ECU would simply cut some of the engine's cylinders to reduce the power going into the rear wheels. It was this cutting of certain cylinders that gave Renault cause for concern. A concern that proved to be unfounded after a year of racing – Williams' nine retirements in the 1992 season was a handy advantage over the 13 recorded by second-placed McLaren, for example.

IMMACULATE CONDITION

The thorough preparation that is being conducted by Williams Heritage on the 14B means that it will be delivered to its buyer in immaculate condition.

This process has been made easier by the fact that most of the original parts on the car can be used. If this hadn't been the case, it would have made the job that much bigger, especially since the replacement of one component would have likely necessitated the replacement of other parts and other difficulties further down the line.

"Let's say the voltage regulator failed on the side," says Stanford. "We'd contact [Magneti] Marelli, which made the original, to see if they could help and if not we'd start searching for a specialist, try to get a replacement and then try to get it into a box that looks very similar to keep it all looking authentic. It means a lot more legwork trying to find someone that could do it; there isn't a lot in there, but what is there is a one-off.

"You'd also then be looking for a new voltage regulator and a new alternator to replace the original," he adds. "Normally it's not just the one thing, normally it's a few things, and then you have the wiring looms in between them. It would turn into quite a big job; it just breeds problems."

Still, on this car at least, this isn't something that Williams has had to deal with. This enabled the team to focus on the more mechanical tasks that need to be completed before it is delivered.

"Steve's stripped the car and given it another rebuild ready so when the customer takes delivery everything's 100 per cent. He's done the engine, checked through the gearbox and all the active and adjustable suspension is done. Steve's now waiting for the seals to come through for the active struts," says Stanford, detailing the current state of the iconic Formula 1 racer.

"And once they're done, the car should be finished" HRT



BELOW Problem solved – after a lot of hard work. Cosworth's MQ12 ECU was pivotal in the quest to get the engine running again

A new chapter

William Kimberley investigates a scheme helping to combine traditional skills with modern technology and methodologies

NINETY-nine years ago, work began on building a British icon, Bentley cars. The passion and craftsmanship of these early automotive entrepreneurs is rarely found these days in car manufacturing dominated by robotics and Artificial Intelligence. Yet within the UK there still exists a business which strives to sustain the knowledge of these early automotive engineers. William Medcalf Limited, based in Liss, West Sussex, is a highly regarded business within the vintage Bentley community.

William Medcalf, the owner, appreciates and cherishes these historical skills within his business. However, this has not deterred him from seeking to use modern methodologies to enhance the performance of the vehicles for his clients.

Supporting the business to move forward in terms of technology, professionalism, processes and systems Medcalf has been working with the University of Surrey. Through funding, gained from Innovate UK, the firm has formed a Knowledge Transfer Partnership (KTP) with the university.

MEETING A CORE STRATEGIC NEED

Innovate UK is the new name for the Technology Strategy Board – the UK's innovation agency. Taking a new idea to market is a challenge. Innovate UK funds, supports and connects innovative businesses through a unique mix of people and programmes to accelerate sustainable economic growth. The KTP is a UK-wide programme that has been helping businesses for the past 40 years to improve their competitiveness and productivity through the better use of knowledge, technology and skills that reside within the UK Knowledge Base. Its purpose is to meet a core strategic need and to identify innovative solutions to help that business grow.

Dongni Pan, a KTP Associate at the University of Surrey, is a graduate from China who began working with Medcalf in 2017 after graduating from Cranfield University with a Masters of Science (MSc) in automotive engineering technology. She is working to optimise the performance of vintage Bentleys through the application of leading edge technologies and research. Initially, the project will focus on engine optimisation through the use of Ricardo WAVE, a simulation software package for 1D



ABOVE Initially, the project will focus on engine optimisation through the use of Ricardo WAVE

engine and gas dynamics analysis.

The software enables performance and acoustic simulations to be carried out based on virtually any intake, combustion and exhaust system configuration, and includes a drivetrain model to allow complete vehicle simulation. The preliminary model is currently undergoing stringent engine dyno tests to support optimisation inside the simulation software, leading to performance improvements on the engine. After completing that work stream, Dongni will focus on engine component redesign, followed by the third stage on vehicle dynamics.

The technical aspects are an important element of the KTP, but it proffers and expects to deliver much more. The partnership has supported Medcalf in re-engineering its processes both internally and externally. Through analysing the production planning and control systems which manage the flow of orders and materials through the machine shop, several areas for improvement have been identified.

Professor James Aitken of the University of Surrey has worked with the business to untangle the complexity it was managing. "Through recognising the difference between the rally preparation and car preservation value streams, the firm has managed to tailor its operations to deliver maximum value to clients," he says. "This allows the business to gain the benefits of lean production for standardised operations while improving their agility to meet the significant customised and specialist needs of Bentley cars."

The progressive and sustainable ▶



ABOVE A Knowledge Transfer Partnership (KTP), formed with the University of Surrey, will help improve the performance of cars built in an iconic era

vision of William Medcalf to nurture a business which is not only profitable but also gives back to society, is clearly demonstrated in the development of talent at both a technical and managerial level. The business continues to recruit and train apprentices to capture and enhance the knowledge within the firm as well as providing skills and employment for young people interested in historical cars. The KTP also provides a platform for management development as the associate is expected to develop the knowledge and experience to become an industry leader.

Dongni is learning wider business management skills, including sales, marketing, operations management and purchasing. "She is developing knowledge and gaining experience across the entire enterprise," says Medcalf. "This provides the business with an individual that can understand the technical dimensions of our cars within the wider context of our commercial activities. Critical skills in a growing market place."

> **"Working to optimise the performance of vintage Bentleys through the application of leading edge technologies and research"**



BELOW The KTP is helping develop skills at both a technical and managerial level. Dongni Pan, a KTP Associate at the University of Surrey, is playing an important role in the company's new approach

Henry Platt, the engineering business manager at Liss, has also embarked on knowledge development and sharing through establishing a supplier association. The supplier network will provide a base for the sharing of best practice with and between organisations.

"The association will provide a platform for us to unlock the competitive advantage in our supply chain through continuously improving quality, delivery, cost and involving suppliers on our new product introductions as we progress with the engineering gains from the KTP," he says. "These improvements will support the synchronisation of our customer demand with flexible and reliable delivery times from our supply base."

MANAGING SUPPLIER SCHEDULES

The first step in the process of establishing the association was through the deployment of an innovative audit approach, based on operational and psychology metrics. The business has analysed its suppliers in terms of quality, delivery performance and time management. Research from the University of Surrey indicates that understanding the different time perspectives of suppliers and how they manage their schedules is key in transforming the delivery performance of the supply chain.

This new chapter in the business life of Medcalf is inspiring changes that will improve the performance of the cars designed and built in the iconic 1922 to 1932 era. Through blending traditional craftsmanship with world-class research, the firm plans to improve its competitive position while delivering greater value to clients. Values which reflect the heritage of these early beacons of British engineering. HRT



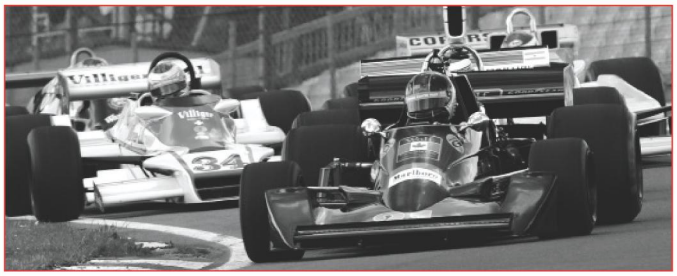



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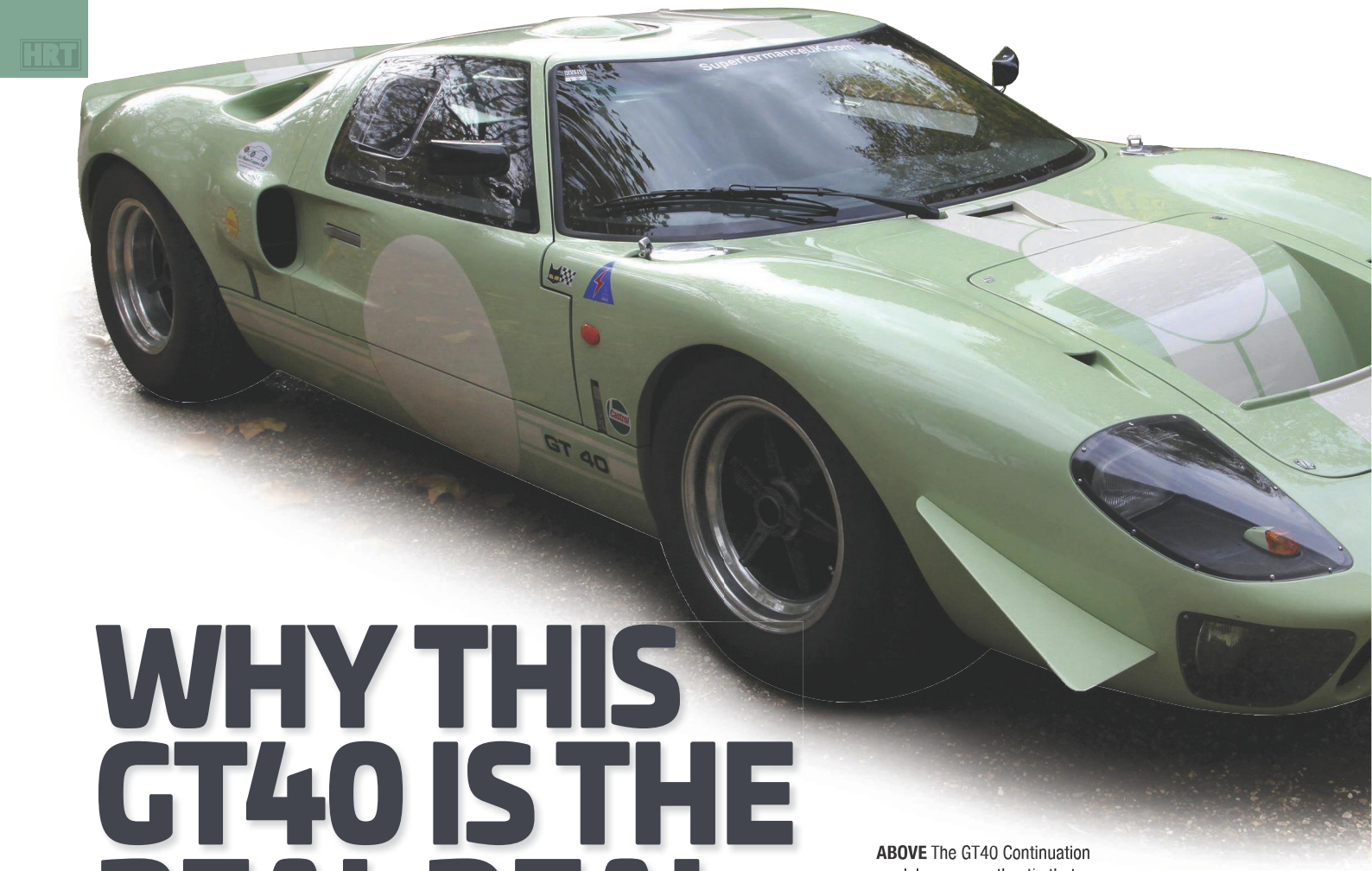
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WHY THIS GT40 IS THE REAL DEAL

ABOVE The GT40 Continuation models are so authentic that 85% of the component parts are interchangeable with the original cars

They may be manufactured in South Africa, but these GT40 Continuation models are legitimate heirs to what has gone on before, and not just kit car lookalikes. **William Kimberley** reports

FOR the manufacturers of "Continuation" models – Jaguar with the E-Type and other models come to mind, as does Lister and Aston Martin – it is relatively easy to prove the provenance. If nothing else, there is the all-important badge which shows that it's more than a replica and much more than a kit car masquerading as the real thing. A continuation model is just that, even though there may be a gap of 60+ years since the last one was produced.

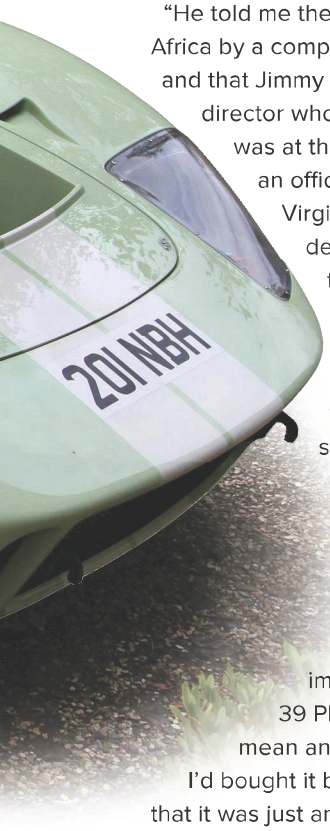
When it comes to the Cobra it is much more of a minefield. For a start, Carroll Shelby himself is no longer with us, although his name and licensing company live on to protect his legacy. However, that has not stopped kit car manufacturers producing cars that are a Cobra in all but name, at least as far as the looks are concerned. The engineering, though, is a different matter.

The same can be said for the Ford GT40. Again, there are plenty of GT40 lookalikes, but none can wear the Ford badge because they're not Fords.

It was into this arena that Nigel Hulme, retired property investor, wandered some years ago. When not involved in the commercial world, he was racing his beloved Cobra, 39 PH, that had finished seventh at Le Mans in 1963, the highest non-Ferrari finisher and winner of the 4-litre GT class. The car later went to John Willment Racing, where it was driven by Jack Sears and Bob Olthoff.

Hulme has been involved with Cobras all his life, owning them, racing them and making money out of them, as he succinctly puts it, but had never been to an American Shelby meeting until 1998 when he attended the Shelby World Convention in Charlotte in North Carolina. It was there that he met Olthoff, which set him on a course that changed his life.

"I was very thrilled to meet Bobby as I owned the car at the time and he had these rather nice shiny Cobras, not original ones, but I was impressed with the look of them," he recalls. "He told me that he was the East Coast dealer for Superformance that make these cars. I didn't know anything about them so he offered to let me drive one.



Having driven many originals, it was far nicer and I told him how fantastic I thought it was.

"He told me they were built in South Africa by a company called Hi-Tech and that Jimmy Price, the managing director whom I consequently met, was at the convention. He had an office in Newport News, Virginia and had around 15 dealers across the States that were bringing such cars into the country at that time. However, they weren't even the right sort of chassis: they were a box section chassis with crush zones. Jimmy told me all about it and we got on like a house on fire. He was really impressed that I owned 39 PH, which didn't really mean anything to me because I'd bought it back in '73 thinking that it was just another old Cobra.

"There was a sort of autojumble where there were Shelby Daytona Coupe models on sale that Carroll Shelby had signed and I bought one. Jimmy, who was also there, told me that it was the next model he was going to replicate, but that he was only going to do it if Peter Brock, the car's original designer, was involved as he didn't want it to be a kit car replica. I told Jimmy that it was my favourite car and that I was from this day on his UK agent, aren't I? We shook hands and that was it. There was nothing in writing."

At this time the car could not be called a Shelby or a Daytona for legal reasons, so Hulme was at a loss what to call it. "What did they do in Europe – they won their class at Le Mans in 1964, so I thought I'd call it a Le Mans Coupe," he explains. "I got permission from the Automobile Club de l'Ouest, which owns the Le Mans race and associated trademarks, to build a small batch of cars, paying the club a royalty on each one, and then set up my business Le Mans Coupes Limited."

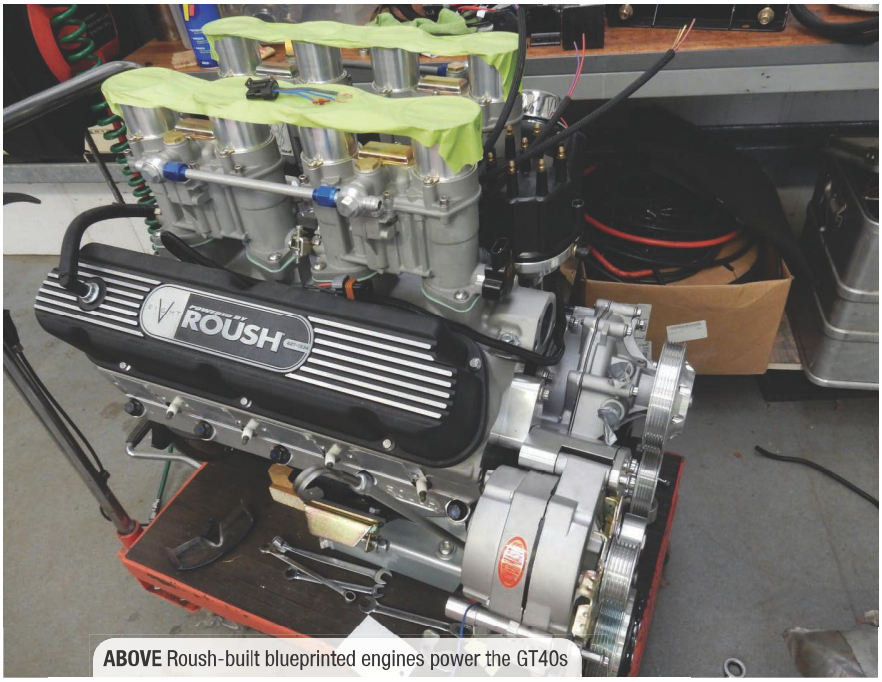
NOT JUST A REPLICA

The Shelby Daytona Cobra is not just a replica of the legendary championship-winning Daytona Coupe of 1965. It is the car that would have been built had the designers had the benefits of modern computer-aided design, and not been constrained by the short deadlines and tight budgets typical of racing in the 1960s.

Peter Brock, the car's original designer, was asked by Jim Price in 1996 to create the definitive Daytona Coupe, not by replication but by drawing on history to produce a new modern car, better than the original with spiritual ties to the past. Given the best resources, not just to recreate their original designs but to take them forward and evolve them, Brock, Bob Negstad and Price developed the Shelby Daytona Cobra, a modern-day supercar that transcends its heritage, equally at home on the road as it is on the track.

Originally called the Superformance Daytona Coupe, the newer model, the Shelby Daytona Coupe, carries a CSX9000 series chassis number complete with Shelby American issued MSO Certificate and chassis plate.

The change in the model's name occurred once particularly messy legal issues were sorted out in the US. Superformance International, Price's US procurement and distribution subsidiary, as distinct from Hi-Tech, the factory in South Africa, had been sued by Carroll Shelby for infringement of the trade dress, the Cobra mark, counterfeiting of the Cobra mark and so on. This happened just as Ronnie Kruger, a retired South African motor and allied industry executive who was recruited by Price to establish and develop the corporate headquarters for Superformance International, arrived with his wife in February 2001.



ABOVE Roush-built blueprinted engines power the GT40s

> **"While the modern-day customer wants the retro look that the GT40 offers, he doesn't want 1960s technology"**

Things became even more serious in July that year when Ford, which owned the Cobra name, entered the fray alongside Shelby. The outgoings to cover the cost of the law suit were around $3 million that Price had to cover as he owned both Superformance and Hi-Tech. Eventually an out of court settlement was reached with Ford that forbade the use of the Cobra name and ▶



ABOVE A retro look, but this GT40 has all the mod-cons

Race versions

WITH interest in a race version growing, largely due to the FIA allowing continuations of the Lola T70s to be raced, Olthoff Racing, in conjunction with Kim and Alan Petersen from Pathfinder Motorsport, decided to pursue a race version. Based on current Vintage rules, the GT40 R was developed. Basic roll bar design and street car deletions were sent to Superformance in South Africa. Olthoff Racing developed FIA-spec fuel cells and canisters with Fuel Safe.

To speed up research and development, Olthoff Racing upgraded #002 – the first production car – to 'R' specifications. First, a 6-point roll cage and fuel cells were fitted. The car was entered in the Virginia International Raceway Gold Cup – SVRA race in July 2009 with Dennis Olthoff driving. He finished fourth overall and second in class in Group 5 running on Avon street tyres. It won the SVRA Group 5 Championship in 2010 and finished second in HSR Group 5.

The first factory GT40 R was raced successfully at the Zippo Grand Prix, held at Watkins Glen, followed by races in Road Atlanta (SVRA) and Sebring (HSR) in 2009.

Olthoff Racing has completed six GT40 Rs for vintage competition, while Le Mans Coupes Limited has produced several FIA-accepted cars in the UK. HRT

marques by Superformance.

Kruger then approached Shelby personally and found him quite accommodating. "Kruger had read Shelby's autobiography and had a feeling he knew what made him tick," says Hulme. "He told Jimmy that at his expense he needed to get Shelby to South Africa, show him what he was doing and let him know its quality, and that is what happened. Jimmy showed him the Daytona Coupe and told Shelby that if he didn't like it, he would shelve the project because he was losing money anyway. However, the two men got on well, Shelby liked what he saw, licensed the car as a Shelby product, as he did the MkIII, and they also gave him a Daytona Coupe, which helped and finally all was well."

At long last the hurdles were therefore cleared. Then came the next step change in the company's life when Superformance entered the GT40 reproduction market, acquiring the original drawings and jigs that were used by KarKraft, one of the two original manufacturers during the mid-1960s. At this point, a licensing agreement with Safir GT-40 Spares, the holders of the GT40 trademark, was signed. This marriage allowed Superformance to produce exact continuation cars of the original GT40 with serial numbers to match. They were so authentic that more than 85% of all the component parts are interchangeable with the original cars, including the entire monocoque chassis itself. Additionally, the chassis numbering continues from those of the original 1960s production run (GT40P 2000 Series). As these cars were exact to the 1960 versions, they have also been included into the GT40 Register.

The first prototype was air freighted to the US in May 2005 where it appeared at various shows to wide acclaim. It was followed by Dennis Olthoff testing the first production car in South Africa in December. Various upgrades and changes followed before full production started in February 2006.

By this time, though, Kruger had ▶

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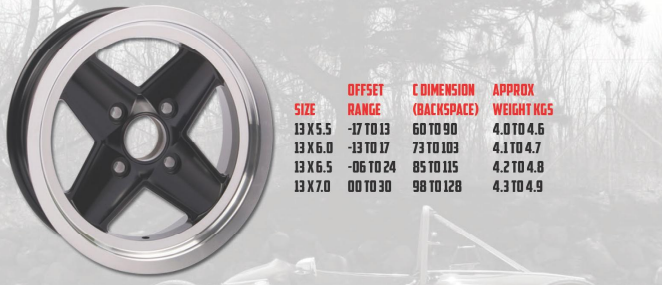
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Ford GT40 Continuation specifications

Chassis: Steel monocoque chassis to original specification including steel roof section.

Body: (MkI or MkII option) GRP composite front clip, rear clip and doors, incorporating roof top air vents on MkII version. Glass front windows, lexan side windows with vents and optional driver's side 'Gurney' bubble. Original 'Hartswell' door latches and catches. Original front and rear light clusters. Paint: base clear coat in a variety of colours.

Interior: Period-style instrument panel fitted with Smiths gauges. Right-hand-mounted gear lever for right-hand drive cars. Original style seats with silver rivets, interior carpeting. Cockpit ventilation via de-mister vents and air conditioning.

Engine: Roush-built blueprinted road race engines incorporating: forged crankshaft and forged H beam connecting rods. Aluminium Roush CNC ported cylinder heads. Sizes available: 343 cu. in./402 cu. in./427 cu. in.

Fuel system: Twin sill-mounted stainless steel baffled fuel tanks.

Exhaust system: Original 'bundle of snakes'-style exhaust system incorporating catalysts.

Transaxle: Original-style 5-speed RBT ZF or the new stronger RFQ.

Steering: Right or left-hand drive with 'as original' steering wheel.

Brakes: Wilwood super light brakes with adjustable pedal box.

Suspension: Fully independent and fully adjustable front and rear.
Front: Unequal wishbone design with coil-over shock absorbers.
Rear: Bottom wishbone top link twin trailing arm with coil-over shock absorbers.

Wheels: Halibrand-style for MkII or BRM type for Mk1.
Sizes: 8" x 15" front; 10" x 15" rear.

Tyres: Avon ZZR or Yokohama Avid.
Sizes: 225x60x15 front; 295x50x15 rear.

Warranty: 1 year full - car and gearbox; 2 years - engine.

Power
402 IR: 530 bhp & 500 ft/lb of torque @ 4900 rpm.
Options: From 430 bhp to 580+ bhp.

Performance
Acceleration: 0-60 mph: 3.7 secs*
0-100 mph: 8.4 secs*
Standing 1/4 mile: 11.2 secs*
Maximum speed: 205+ mph* (* Estimated figures)

become very unwell to the extent that by September 2004 he could not run the business any more so Price, who wanted to run the factory in South Africa, put the Superformance distribution rights up for sale. It eventually went to the Hillbank Automotive Group, which is privately owned by Lance Stander, a Superformance dealer in Irvine. In July 2005, the Newport News operation in Virginia was wound down with the headquarters being transferred to southern California.

THE ASSEMBLY PROCESS

While this operation was responsible for the sales of all the cars coming out of Hi-Tech in South Africa, Hulme and Le Mans Coupes still bought direct from the factory. "We order the car from the factory and it arrives here as a chassis, including four-wheel vented disc brakes with Wilwood four-piston callipers and basic wire harnessing, on a trolley as there aren't any wheels," says Hulme. "We do quite a lot of modifications to the bellhousing and the clutch mechanisms."

The GT40 Continuation models, as they are called, are powered by Roush-built blueprinted 343 cu in/402 cu in or 427 cu in road race engines that Hulme buys from Olthoff Racing in the US. The engines feature a forged crankshaft and forged H-beam connecting rods and aluminium Roush CNC ported cylinder heads.

"Even though the Roush engines come complete, we still modify how the belts are adjusted as the car has a bulkhead that makes parts of the engine inaccessible," says Hulme. "We also change items like the throttle springs and many other things we've learnt from building up to 40 cars to date."

At Hulme's insistence, they also come with Ford 303 truck cams rather then the normal Roush ones as it helps the engines meet the legal emissions requirements in the UK. "We also recently did a Cobra where we wanted to put a 303 cam in it rather than the normal Roush high lift one because of the emissions, but as we weren't ordering a separate intake system for it, they ran it on the brake," he reports. "If you look at the quoted figures for a Roush 331 SRX crate engine, it develops 350 bhp and around 350 lb/ft of torque. On my engine with the retro cam, it develops 386 bhp and 400 lb/ft of torque. By doing a low lift, no overlap cam, we've improved the horsepower and the torque. For a racing engine it wouldn't work but for a road engine, it's perfect. In the GT40, the car will potter along at 1,500 rpm in fifth."





ABOVE& BELOW The Shelby Daytona Coupe is not just a replica but the car that would have been built had CAD existed at the time



ABOVE The CSX9000 series chassis number adorns the Shelby Daytona Coupe

In place of carburettors, Le Mans Coupes installs a fuel injection system into its cars. "In the GT40, for example, Weber lookalike Borla eight-stack throttle body systems house a fuel injection system from FAST that maintains the appearance of the original without the hassle," he says.

"Using a sophisticated ECU and mapping we can achieve the optimum fuel and performance curves for improved fuel consumption and power ▶



ABOVE & BELOW The Superformance MkIII blends the coveted Cobra chassis with an engine made by the company with more Ford wins than any other

output. We buy the harnesses from FAST which Andrew, our resident wiring guru, then takes completely apart and cuts them to the right length. You get some cars where you get nine feet of wire tucked up in the corner, but we bespoke it so it fits the car and it looks professional."

The transmissions for the GT40 are bought from Quaife although a ZF box can be obtained from RBT Transmissions, which bought the manufacturing rights for the ZF 5 DS-25 Series transaxles. It has also since developed the proprietary RBT-6 six-speed transaxle.

If a customer wants brakes other than those the car comes with, Hulme recommends Wortech that makes bespoke brakes for his cars. Other GT40 features include Bilstein coil-over suspension with performance springs, air conditioning, adjustable pedal box, original style seats, fully independent front and rear suspension, and more technical features.

The MkIII is powered by the Ford 302, 342, 351, 402, 460 and 427/428 cubic inch engines fitted with a Tremec 5-speed gearbox. The Shelby Daytona Cobras are powered by GM's LS3, that can also be supercharged to produce more than 650 bhp.

Every car supplied by Le Mans Coupes complies with the Individual Vehicle Approval scheme which enables registration in the UK.

"There's no question that the quest for nostalgia has quickened over the years," says Hulme. "While I personally adore the Shelby Daytona Coupes, it is far less known than the GT40, beautiful though they are, and in Mk2 version quite suitable for everyday road use. Meanwhile the GT40 Continuation cars have proved to be extremely popular. While the modern-day customer wants the retro look that the GT40 offers, he doesn't want 1960s technology, so the cars we sell have all the mod cons of a current production car. However, we remain true to the spirit of the originals in every sense and believe we are maintaining the heritage." HRT



ABOVE The involvement of the car's original creator Peter Brock, seen here at the Hi-Tech factory, was a cornerstone of the project to develop the ultimate Daytona Coupe





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"CHICKEN-SHIT SPECIAL" IS FLYING AGAIN

William Kimberley finds out how one man's passion developed into a company that is now a key player in the classic car restoration world – and saved a very special TR3



HAD it not been for an early love affair, there is every chance that Racetorations would not exist, or if it did, would be specialising in other models that have a higher market value. If that was the case, though, then it would be a loss for the Triumph TR world.

When Darryl Uprichard went into business with his company just over 30 years ago, it was almost by accident. He had carved out a good career that included working for GKN, Smiths Industries, Chartered Consolidated and Inchcape, but it came to a shuddering halt in the mid 1980s due to global currency exchange rates. He had taken a job in the Far East where the company concerned was supplying the US with products that were being made more competitively in Japan until that country suddenly boosted the value of the yen. Exporting goods to the US suddenly made no sense.

Uprichard was already an avid TR3 racer, campaigning his car both in Europe, which he preferred, and the UK. The financial package he came away with helped him start a business revolving around the TR models he loved. The kick start for engine tuning came from John MacDonald of MacDonald Racing where he used to take his TR for servicing and dyno testing. It was the opportunity of driving MacDonald's TR-engined Morgan while he was waiting for his own car to be put on the dyno that opened his eyes to what was possible. He found the Morgan a revelation to drive: it had so much power!

From starting his own business in his garden shed, it was moving into a 1,000 square foot building in 1986 that really moved the operation up a gear. Now working with a partner, a friend from his GKN days, things began to roll. While there was no marketing to speak of, what really helped were his racing exploits. So competitive was his TR3 that it was catching the eye of others, particularly in Europe, who wanted to know what was under the bonnet and sent their engines to the UK to be rebuilt. By then, though, he was also expanding his knowledge to other parts of the car, particularly the suspension.

"When we started Racetorations, TRs weren't really worth a great deal and it was a big problem for us," he says. "We weren't spending large amounts ▶



"It was truly dreadful. It had come from a French barn with evidence of nesting chickens!"

LEFT One of the most successful ever non-works TRs (33DNK is technically a TR3 'A') has just been restored to its former glory

on big development projects, but simply modifying the cars according to customers' requirements. I didn't have any money behind me to race my TR, so most of the stuff was done on a budget. It was effective and I could prove it worked because I was racing and doing reasonably well. It was certainly faster than all the continental TRs of the time."

SOMETHING OF A MIRACLE

The fact that he has ended up running a business revolving around TRs is something of a miracle because his first experience with them actually wasn't that happy. As a youngster, he had a new Mini Cooper as a runabout, which he loved. He did buy a TR3 but simply because it was advertised as a 'competition' car and he wanted to go racing.

"It was actually a hillclimb car that cost me £100," he recounts, "which I thought was quite reasonable to get me into racing. I was told by the person who was selling it to me that it was very special and particularly good for hillclimbs because it was lightweight with tongue and grooved wooden flooring that could be completely removed when doing the hillclimb, which I thought was a great idea. My girlfriend at the time was not terribly impressed though, as I could never get the tongue and groove to fit together and every so often it would fall out and she'd be holding her feet in the air. It was a complete fallacy of a competition car. It never ran properly and I got fed up with it.

"I developed all the stuff for this TR3 by the seat of my pants because there were no TR tuning specialists back then," he says. "I used to buy my tuning products from Vic Derrington in Kingston who was alive then, restricted to aluminium rocker covers and less than serious tuning goodies! The only company building engines in those days was SAH, who produced a whole modified TR engine for £130! I just couldn't afford it so I had to do things myself on a suck it and see it basis."

From these acorns grew the business that is Racetorations today in far larger premises, looking after a worldwide customer base. Apart from buying in products like the hoses from Goodridge, Stack instrumentation, Newman Cams, engine bolts and rods from ARP and brakes from AP Racing, the company does as much of the work in-house as it can.

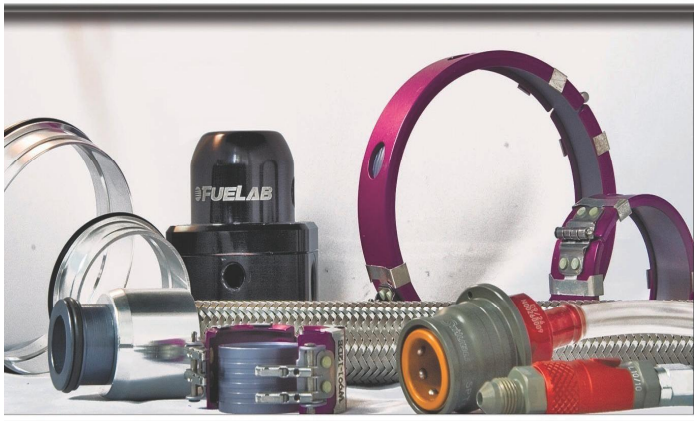
It has its own bodyshop, a spray ▶



ABOVE & BELOW The TR3's cheeky nickname was well deserved, for life in a French barn had left it in dreadful condition

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booth, does all the wiring looms and intriguingly does all the highly intricate interior trim and seat upholstery. However, most parts are cast and machined from local suppliers. Fortunately, the company is located in an area with good machining facilities.

WHY THREE'S A CROWD

Uprichard has been involved with the TR Register, being a founder member and president for two terms. In 1990 he ran the first TR local group that continues to this day and initiated the TR Register Race Championship as well as the Goodwood sprints. However, there were some fits and bumps along the way.

One particularly character-building episode involved the RAC. "I used to sprint with my TR at a meeting held by the Alfa Romeo Owners Club and thought it was a good thing for the TR Register to do and convinced the committee to authorise it," he recalls. "I realised that I had to include the RAC as the sanctioning body but when I told them that I wanted to start three cars at the same time, I was told that it was absolutely forbidden. The cars had to start one at a time at 10-second intervals, which I thought was really boring, so decided not to bother with the RAC and run the event without their intrusive involvement!



ABOVE The original chassis and inner tub was salvaged

"Unfortunately they sent an observer who saw a succession of three cars taking off from the start line and consequently wrote to the club to summon the club secretary and myself to a special meeting at Belgrave House in London. We were confronted by what looked like a courtroom on our arrival, with a handful of solemn people seated behind a long table. It was all very intimidating.

"At the start of the proceedings, we were told that it was usual for such events to be recorded and were asked whether we had any objections. I replied that I did and that I didn't give my permission. 'Overruled' was the immediate response, so I thought 'here we go'. We got admonished, fined and warned that if the TR Register ran another illegal event, it would be denied the authority to run any motorsport events. I duly learnt my lesson."



ABOVE The running gear, including the axle and suspension parts, was original

In the early years the Triumph TR did not have anything like the value of an Aston Martin, Bentley or Ferrari, which meant that if the customer was restoring a TR for investment purposes rather than having a love affair with the car, they would never see a return on investment. While that is still true to some extent today, such is the affection that the different Triumph TR models generate, there are enough customers who are prepared to pay the price required to own a Racetorations-built TR. The company has achieved a worldwide reputation for the building of its unique top of the range Triumph TR2-6s.

Through innovation, thorough and detailed workmanship, modern road and track performance and absolute attention to detail, Racetorations has created a niche product that, insists Uprichard, has no equal.

However, perhaps the most intriguing ▶

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ABOVE Research revealed the TR3 to have raced at different events, including Goodwood, back in the 1950s



ABOVE One of the project's biggest challenges involved its distinctive droopsnoot nosecone

car to have gone through Racetorations' hands recently is a TR3, one that ironically Uprichard once himself owned. "About 15 years ago Bill Piggott, the TR Register archivist, rang and told me that he had found a racing TR3 in France," he explains. "I was already racing my own TR3 successfully and really didn't want another one, but he persevered and before the days of the camera phone, even sent me handwritten line drawings of the car. I looked at it and thought it was truly awful with its droopsnoot nose.

"However, he didn't give up and it was one day, I guess I must have had some money in the account, that I found myself committing to buying it. When it turned up – and it was truly dreadful – I called it the 'Chicken-shit Special' as it had literally come from a French barn with evidence of nesting chickens.

"It then immediately disappeared under a blanket, where it remained for many years. I wasn't in a position to do anything about it and it was something I thought I might do in my retirement. I fended off Bill, who would occasionally phone me and ask if I'd started rebuilding it?

"Then Bill visited one day about 10 years ago, checking a TR5 we were doing for someone, and he asked to look at the TR3 again. After inspecting it, he came to me and told me he thought it was worth a bit of money. I told him that if I told my wife that I had a TR that was worth something, she would laugh in my face again!

GOODWOOD GLORY

"He was insistent that it could be a car that raced at Goodwood in the late 1950s. He subsequently researched it and almost a couple of years later a big brown envelope arrived through the post containing race reports and pictures from the late 1950s showing the car racing at different events, including Goodwood.

"Once I knew that, I realised the car was valuable, but I still had a wreck and neither I nor the business had the resources to bring it back to life. Thinking that it was such a shame that it should remain forlorn and unloved, I sold it to a customer who was in a position to invest in the car and bring it back to life. The condition being that Racetorations would rebuild it to the

specifications that raced at Goodwood in 1958/59."

It was a great project to work on, but it had its challenges. The biggest one was to make a new front nosecone, as it was unique. "There was a steel one and an aluminium one," Uprichard explains. "We kept the original chassis, tub and engine block but changed the gearbox casing to a later TR version. All the running gear, including the axle and suspension parts, were original, it even had a Watt's linkage!

ORIGINAL PARTS

"It needed re-upholstering, though this was minimal. We fitted new instruments. It didn't have the original Webers on it because they didn't come back from France, so we fitted replacement ones and modified the engine to FIA specification."

As far as possible, all the original parts were built back into this historically interesting TR3. The car has now been taken by its new owner to Scotland, where he intends to compete in it. Whether it will be seen again at Goodwood, time will tell, as with Racetorations' future. Asked where the business is going from here, Uprichard says that he already has a succession plan in place with the business gently being passed over to his key employees. They include Dan Heywood, whose first encounter with the company was on his year-long placement from university while studying motorsport engineering.

Sam Bishop, another heir to the business, joined from school and did a four-year apprenticeship. He then left Racetorations briefly, lured by the bright lights of joining JLR Classics in Browns Lane, Coventry. However he was asking for his job back a few months later, as things hadn't' quite lived up to expectations.

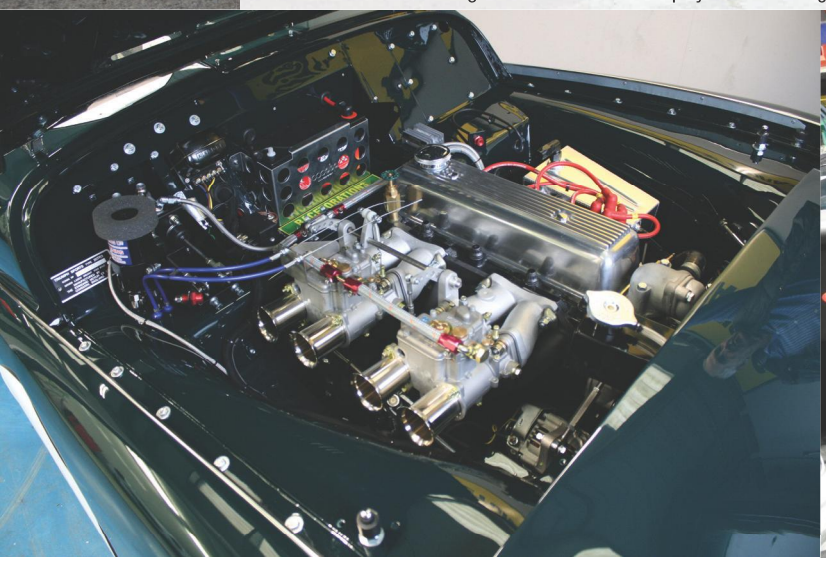
The workshop is run by five senior staff, some with over 30 years experience of the TR marque. All are extremely skilled in their profession as TR craftsmen. Apart from heavy machine tasks, all other work is carried out in-house. This has been key in controlling the quality of the company's products.

Racetorations is renowned for its quality TR rebuilding. That work employs the use of many special products – enhancing performance and/or presentation – that the company has developed and continually improved over the past 30 years.

As Uprichard says: "Triumph TRs are very special cars that attract owners who will do anything to keep their passion for them alive. We are very proud of our engineering expertise, one that I think favourably compares to restorers, no matter in which cars they specialise." HRT



ABOVE & BELOW Breathing new life into 33DNK displayed the full range of Racetorations' talents





HIDDEN TREASURE

Chris Pickering examines the painstaking recreation of a rare Edwardian racecar, found hidden beneath a sheet, that once spearheaded the Wolseley experimental department's chase for records



FEW people outside of the classic car world remember the Wolseley name these days. Subsumed into the corporate mass of BMC in the 1950s, and quietly ditched by the mid-seventies, it's now largely forgotten. But things were once very different. Prior to the First World War, Wolseley was the largest carmaker in Britain. Guided by a certain Herbert Austin (yes, that Austin) and with a list of drivers that included Charles Stewart Rolls,, (yes, that Rolls) it was one of the first British brands to make a genuine impact on international motor racing.

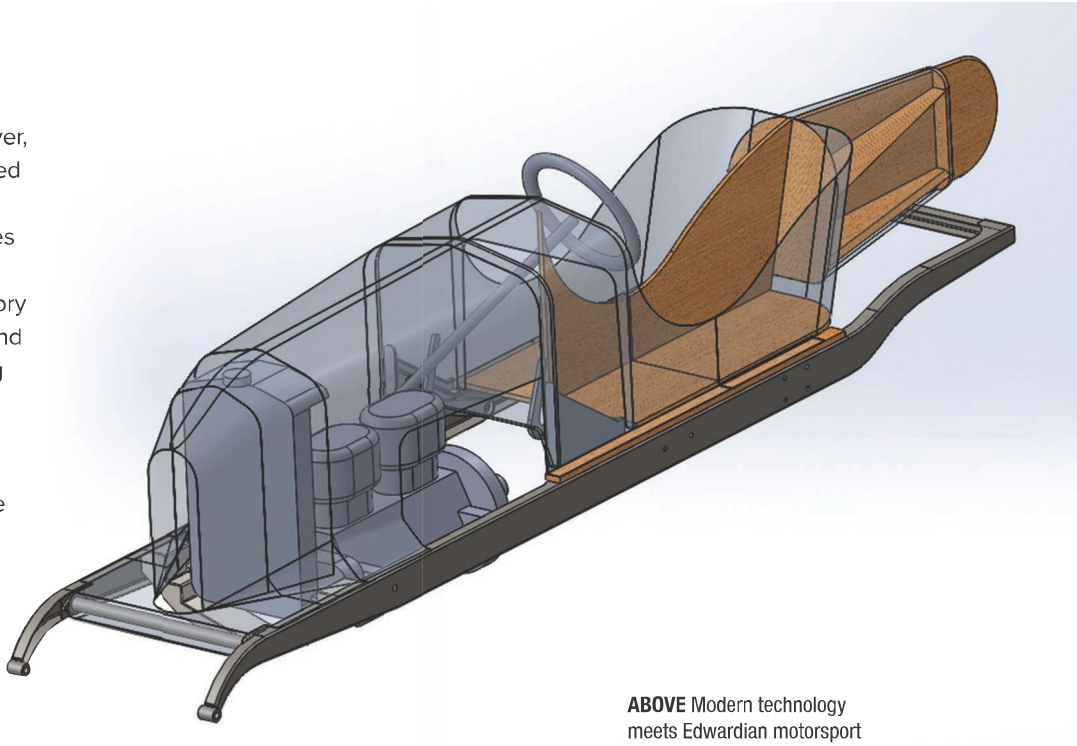
By the time the Edwardian era was drawing to a close, the company was predominantly focused on road car production. Behind the scenes, however, its experimental department was locked in a battle to take class speed records and become the first to cover 100 miles in one hour at the recently-opened Brooklands circuit. To do this, the factory built a single-seater racing car in around 1911 or 1912, based on its 16/20 touring model. Relatively little is known about the car, except for the fact that it was mothballed after Percy Lambert in a Talbot beat Wolseley and others to the 100 mph title in February 1913.

Soon after the First World War the Wolseley 16/20 racer was acquired by one of the experimental department's engineers and converted into a road car. What happened to it after that is a mystery, and it's safe to assume the original car is now long gone. But it's certainly not forgotten.

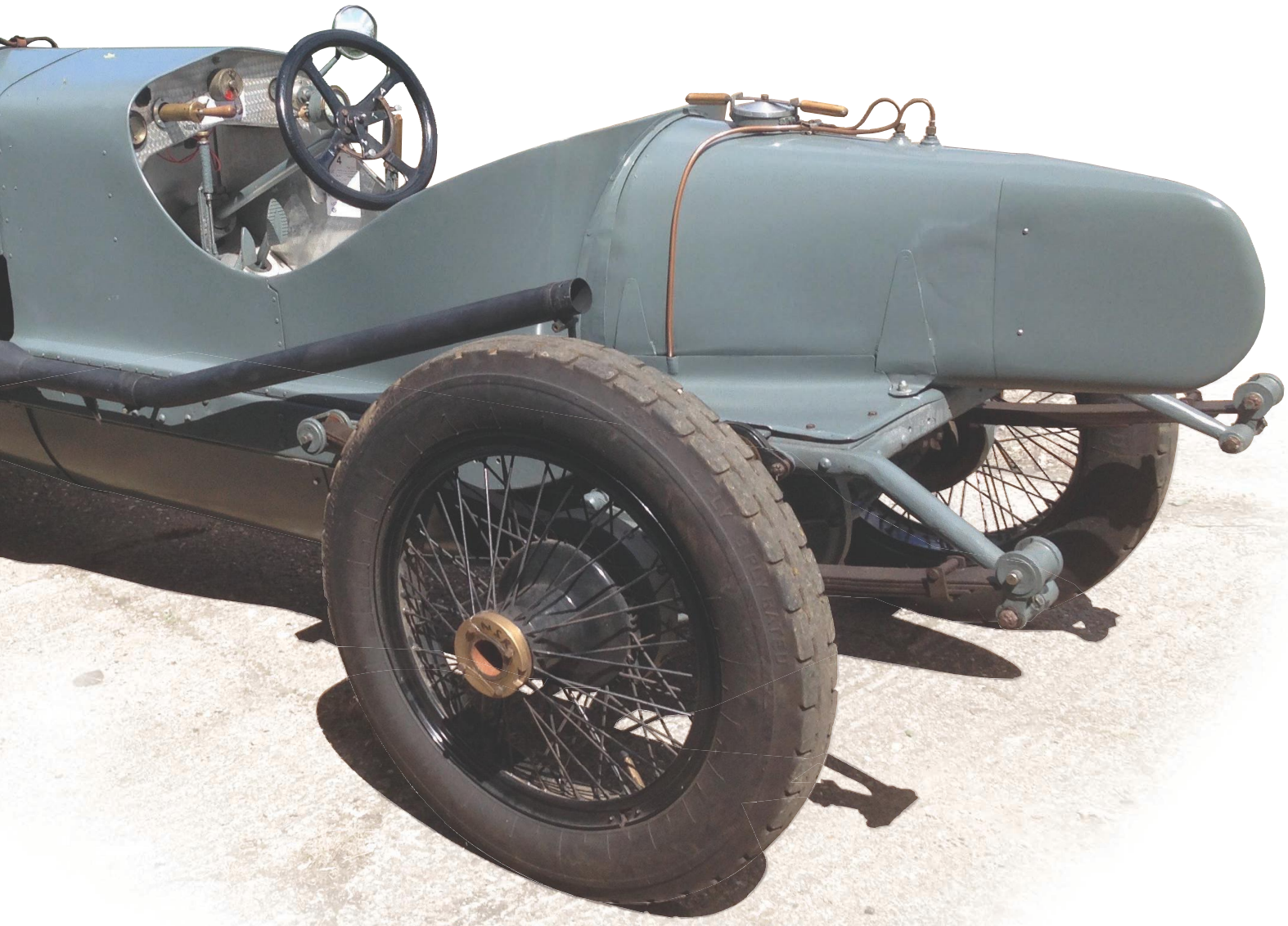
In 2008, father and son team Roger and William Twelvetrees were on the lookout for an Edwardian racer. The pair already owned a 1916 Buick, which had given them a taste for cars of that era, but they wanted something that would be more competitive in speed events.

The search led them to a field used by Edwardian car aficionado Hickey Hickling, William explains: "We'd arranged the visit to have a look at a 1915 Cadillac, but while we were there Hickey suggested we could also look at a collection of parts hidden under a sheet. They turned out to be the remains of a Wolseley 16/20 touring car – or, more specifically, various bits from several cars."

Somewhere back in the mists of time, the car's rolling chassis had been converted into a farm trailer, including a modified front axle that allowed it to be pulled by a horse. In other respects, though, the chassis had survived remarkably well. There was a spare engine and gearbox in easily salvageable condition, plus an assortment of miscellaneous Wolsesley parts.



ABOVE Modern technology meets Edwardian motorsport



Hickey mentioned that he'd acquired the bits with the intention of building a replica of the 16/20 works car himself, but with lots of other projects in progress he'd never got round to doing so. Before long, a deal was struck to acquire the remains, and the Twelvetrees set about building their own recreation with the help of pictures from Wolseley historian John End (who saved and recreated the Wolseley Moth) and hands-on assistance from Edwardian car expert Clive Press.

PHOTOGRAPHIC RECORDS

The plan was to resurrect the car in Roger's workshop, operating on a relatively modest budget and carrying out as much work in-house as possible. This was helped by the fact that Roger and William are both professional engineers, although neither are automotive specialists by trade.

As so little is known about the original car, the first step was to pore over a collection of period photos and try to deduce as much as possible about its construction. Although the competition car featured a number of significant modifications, its roots clearly lay in the production 16/20. This meant the features shared with the touring car chassis could be used to establish a scale for the other parts shown in photographs.

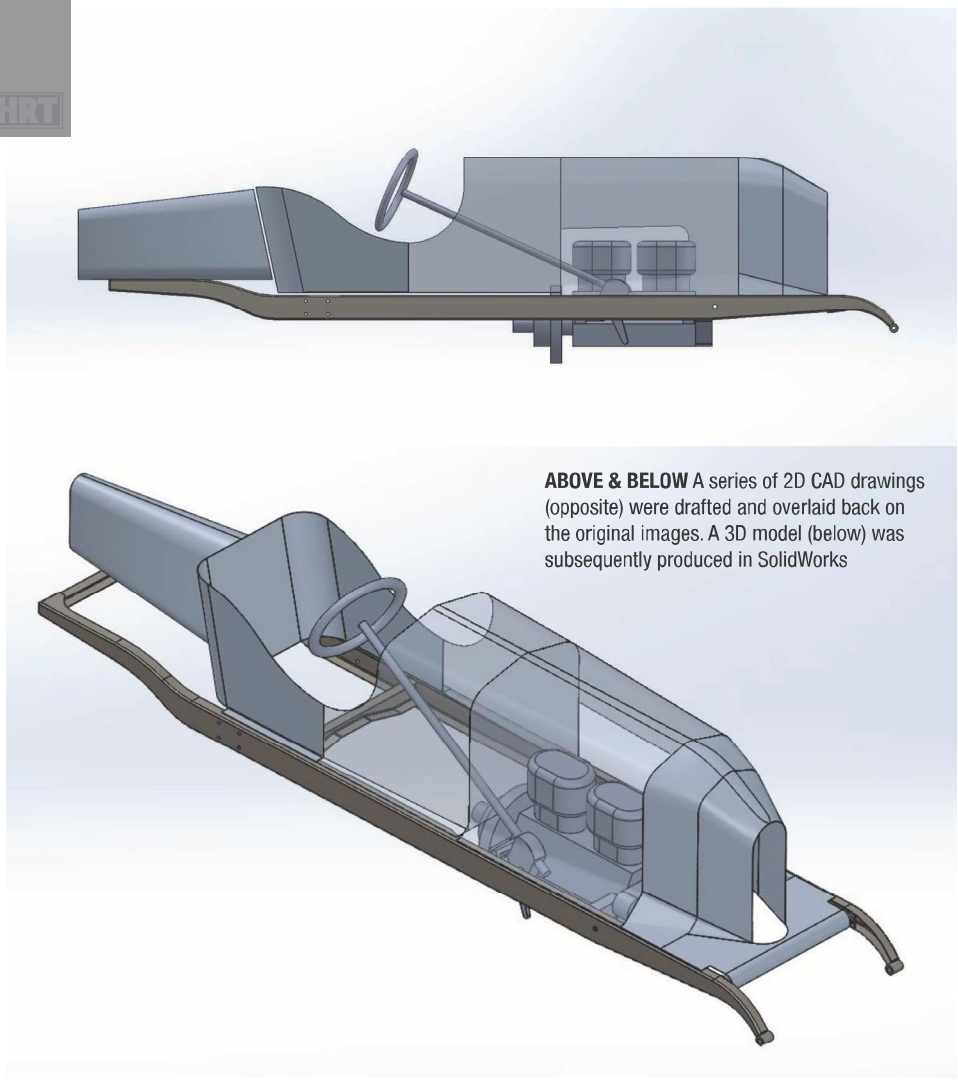


ABOVE The Wolseley as it was first found

William began by drafting out a series of 2D CAD drawings and then overlaying them back on the original images to check the correlation. Later on he produced a 3D model in SolidWorks.

"Had the opportunity been there I would have liked to have laser scanned various parts to generate a proper high-detail model of the key components," he recalls. "As it was, we had to measure the parts by hand and then reverse engineer them into the CAD model. We can't say it's an absolutely precise model, but I think it's as close as anyone would get working purely from the photographs and parts available."

One of the first things to be verified was that the spacing of the two chassis rails on the front of the racer was identical to the touring car. However, the rails of the racer remain straight, while the road car chassis swells out further back to accommodate the larger body. With the dimensions confirmed, the chassis was sent to Clive Press to be straightened out, using a hydraulic ▶



ABOVE & BELOW A series of 2D CAD drawings (opposite) were drafted and overlaid back on the original images. A 3D model (below) was subsequently produced in SolidWorks

“It was a bit of detective work to reverse engineer the parts we had in front of us into a complete assembly”

press to flatten the web and a cut-and-weld process to maintain its channel-section profile. The two bolt-on cross members were shortened with a similar process, using interlocking joints where the welding was carried out.

A little detective work helped to fill in some of the blanks where the parts themselves were obscured by the bodywork. For instance, it could be seen from the drillings on the chassis that the engine mounting points had been shifted some 15 inches back on the racer.

Elsewhere, a degree of engineering judgement needed to be applied. The external profile of the radiator could be inferred from the photos, for instance, but the internal details remain a mystery. It’s likely it was a wet shell type, but it was almost certainly a custom design. With no likelihood of being able to fabricate an exact replica, Roger and William took to a rather more prosaic approach. They found a 1930s radiator on eBay, believed to be from an Alvis 12/60, and adapted it to fit.

Similarly, it was known from the photos that the racer’s handbrake and the gear lever were mounted on opposing sides of the cockpit, but none of them showed the exact arrangement. The standard road cars had these levers positioned side-by-side outside the chassis to the driver’s right, but the mechanism appears to follow the same layout. Fortunately, the collection of parts that the Twelvetrees had acquired featured two different linkages. This meant they were able to combine the two to rig up a dual system that appears to be the same – or at least very similar – to that used on the original racer.

“It was a bit of detective work with the parts we had in front of us to reverse engineer them into a complete assembly,” William recalls.

CHASSIS

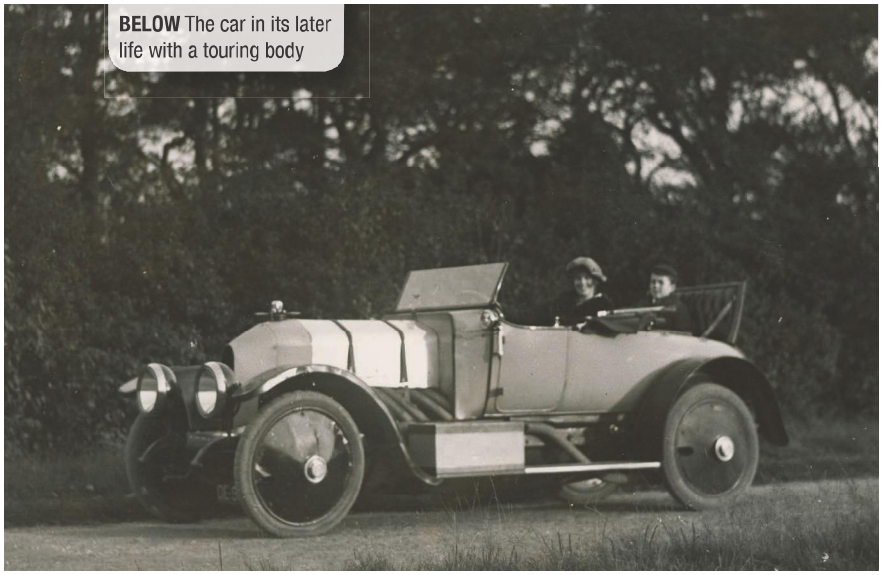
The chassis rails effectively stop at the rear springs, with a pair of cast aluminium-bronze outriggers reaching out to the spring hangers behind. With the springs measured off the photos there was then a degree of guesswork involved in the shape of the outriggers, which are obscured by the wheels. Having applied a degree of engineering judgement to the design, a physical model was created by Clive and taken to the foundry, Non Ferrous Founders in Leicester, to serve as a pattern.

The rear axle is an export-type Wolseley 16/20 design, which uses a bevel gear arrangement in place of the worm drive fitted to most of the UK cars. The bevel gear setup is said to be preferable for sporting applications as it has less frictional losses and it allows a degree of overrun, whereas the worm drive can lead to rather vicious engine braking.

In most respects, the axle is completely standard. The only exception is the gear ratio, which has been raised from 4:1 to the highest that would fit in the casing at around 3.2:1. Conveniently, a detachable pinion carrier assembly allows the final drive ratio to be altered without stripping the whole back axle.

“We were mindful of what the Wolseley engineers were trying to do with the original car, so we’ve geared this one for a theoretical maximum of 100 mph at 3,000 rpm,” says William. “We’ve had it up into the mid-eighties on the sprint course at Rockingham. If you were on a long banked circuit like Brooklands I think it would pull 100 mph, but for our purposes it could probably do with being geared a little shorter.”

With that in mind, a second pinion was fabricated at the same time as the original crown wheel and pinion set, allowing the ratio to be reduced by around 10 percent. This has yet to be fitted, but the thinking is that it could be a better compromise on sprints and hillclimbs where the average speeds are relatively low.



BELOW The car in its later life with a touring body

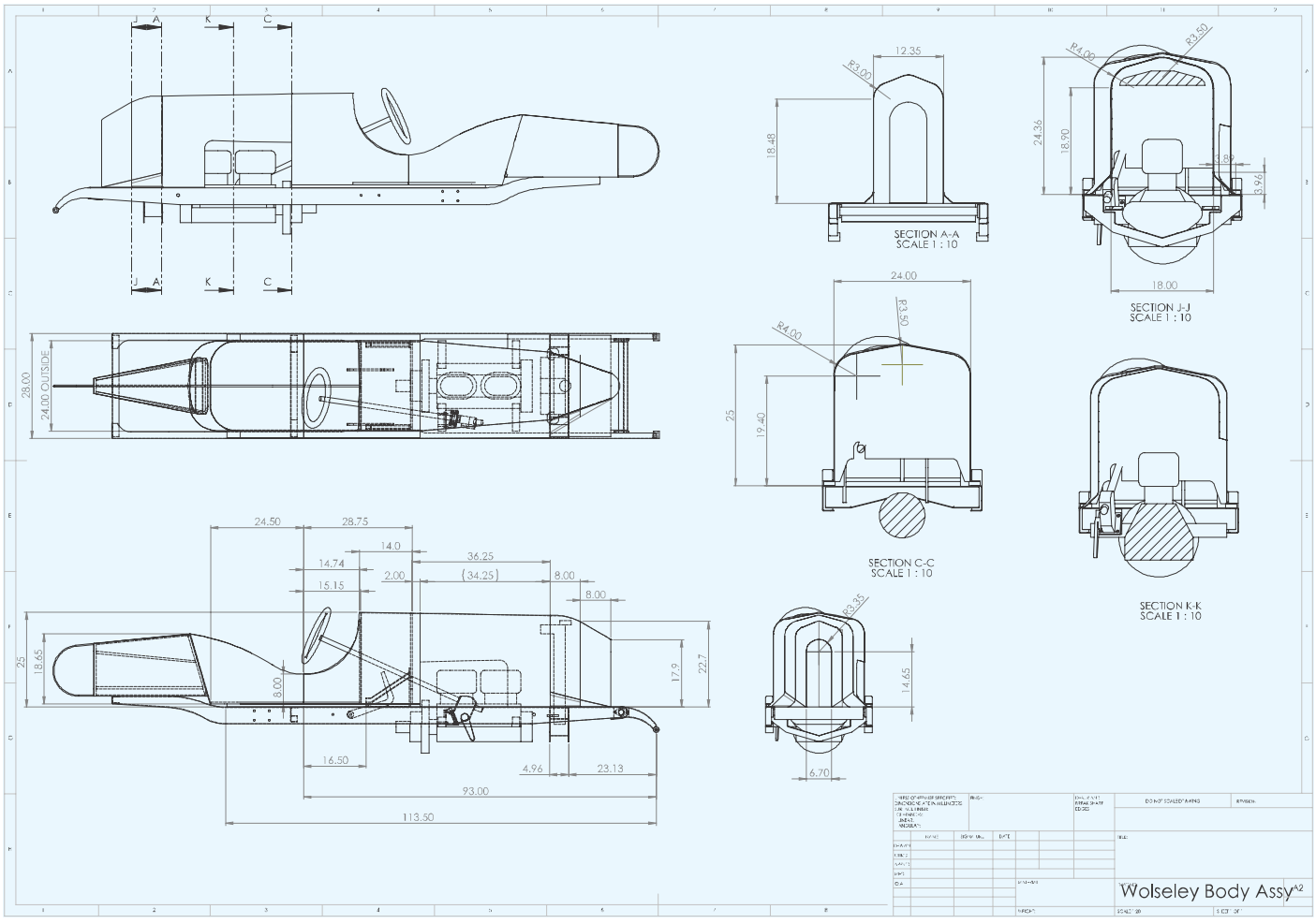
ENGINE AND GEARBOX

The 16/20 engine is quite conventional compared to some of the more extreme Edwardian racing cars; you won't find pistons the size of dinner plates or a 900 rpm red line. Instead, the four-cylinder sidevalve unit displaces a modest 3.1 litres and revs to a heady 3,000 rpm.

Despite these comparatively modern touches, Wolseley never set out to push the boundaries – at least not with its touring cars, William explains: "In the very early days Wolseley experimented with some quite exotic transverse horizontal engine layouts, but by this point had a reputation for quality more than innovation. Everything was beautifully made and the tolerances are very small. For instance, the original exhaust manifold was pegged and machined to match the ports on the cylinder blocks, which were cast in pairs and mounted separately on the aluminium crankcase. It still lines up perfectly even though you're joining four separate parts that were pulled out of a field."

A series of relatively mild modifications have raised the power from the road car's stated output of 20 bhp up to an estimated 75 bhp. The most significant of these is an increase in compression ratio, achieved by enlarging the inserts for the water manifold that mount inside the top of the cylinders and fitting a set of domed pistons. Roger and William haven't yet measured the volume to calculate the new compression ratio, but it's estimated at around 6.5:1 (up from somewhere in the region of 4.5:1 as standard).

"You can tell the engine is running a lot more compression now," says William. "There's quite a bark to it. There's no electric start or anything like that, so swinging the handle can be quite tiring if it fails to fire after the first couple of times. With it being more than three litres and only four cylinders the ▶





ABOVE Roger and William attempted to recreate the original exhaust arrangement, although little is known about the exact spec of the original engine – there's speculation it may even have been overhead cam

compression is pretty fierce and it can kick back quite violently if you get the ignition timing wrong."

The new pistons, produced in aluminium by Arias Pistons, also help to reduce the reciprocating mass. However, a rather more dramatic effect has been achieved by shedding some 25 kg from the original flywheel – this was more akin to a stationary engine design originally, weighing in at a hefty 44.5 kg. Elsewhere, the original crankshaft remains standard, as do the connecting rods, all having been crack tested by Insight Testing in Rotheram. A re-bore from CK Motor Engineers in High Wycombe was all that was required on the main castings, while the same company provided the white metalling services for the bearings.

The last of the major internal modifications is a new camshaft from Kent Cams, which runs a far more aggressive profile than the original, although that remains something of a relative term. In production trim, the Wolseley ran no valve overlap at all, with the inlet valve only opening two degrees after top dead centre and the exhaust valve closing even earlier. It's thought this was done to replicate the characteristics of an atmospheric inlet valve, as used on some early engines, which simply opens due to the downward motion of the piston creating a suction effect. The aim for a road car of the time was a flexible and lazy engine that could cruise at 35 mph in top gear at little more than a fast tick-over. In contrast, the new profile is designed to improve the scavenging, with timing modelled on later sidevalve units and a set of uprated valve springs from Entex.

No carburettors had been supplied with the original set of parts, so the decision was taken to fabricate a new inlet manifold and fit a pair of bronze Strombergs. These come from a fractionally later period than the car itself, but they are thought to be similar in size to the originals and they come with the added benefit of increased adjustability. Wolseley was one of the first companies to use the early leather bellows-type SU carburettors, introducing them to its 16/20 road cars in 1913, so it's thought they may have been used on the racer in-period.

"There's still some work to be done on the fuelling," comments William. "We've not done a full rebuild on the carburettors yet, so there's some wear in them that we still need to take out. We've also put a point in for a lambda meter in the exhaust. Our previous experience with the Buick suggests that's a worthwhile exercise and now we've succeeded in getting the Wolseley road registered we have a bit more opportunity to fine tune it."

In true Edwardian style, a hand pump on the dashboard is used to pressurise the fuel tank up to about 2 psi for starting. That pushes the fuel through to the carburettors, after which a cam driven air-pump pressurises the tank just enough to keep the fuel flowing. Meanwhile, ignition is provided by an original-style Bosch DR4 magneto.

Relatively little is known about the exact specification of the Wolseley experimental department's original engine. It must have produced at least the same sort of power as the Twelvetrees' car to give it a realistic shot at the record, although it's not known how exactly this was achieved. There is one intriguing theory, though.

"Our car is based on standard 16/20 parts, but I do wonder if the original car might have had an experimental engine," notes William. "When you look at the photos it has an interesting exhaust port layout, with two equally-spaced pairs. In contrast, the standard 16/20 engine has the two central ▶

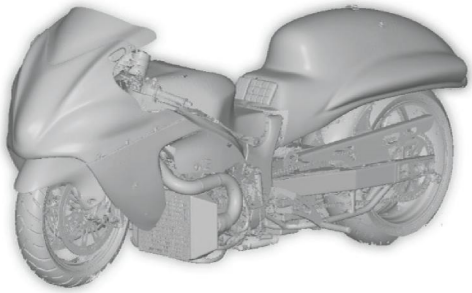


ABOVE The engine survived remarkably well

CENTRALSCANNING

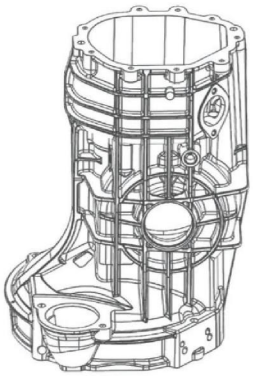
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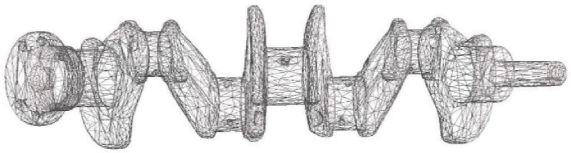
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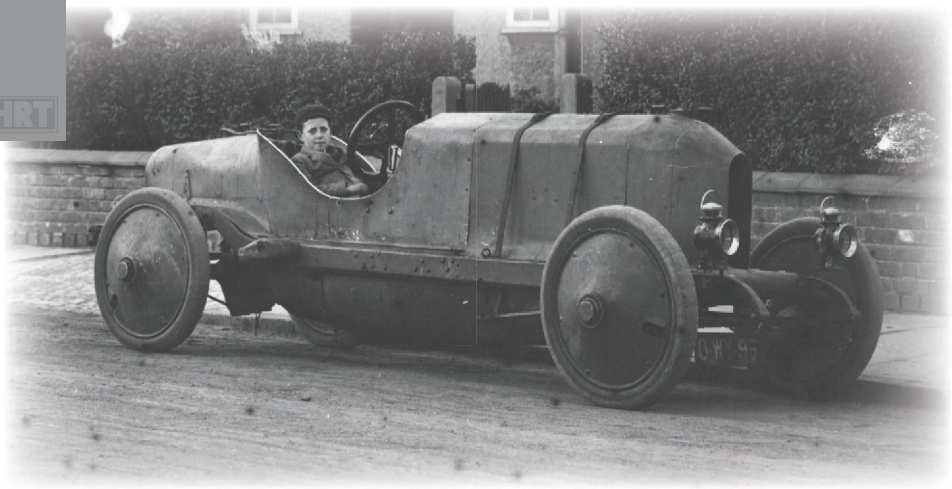
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ABOVE George Day – son of Harold Day who later converted the car to a tourer – at the wheel in 1919. The car's construction was initially deduced by the careful study of period photos

exhaust ports very close together and then the two outer ports further away, with the intake ports in between. We've tried to reflect that aesthetically in our car, but it may have had greater significance. When Wolseley resumed its racing activities after the First World War the company built an overhead cam engine of about 2.6 litres that had that same exhaust layout. It's possible that the engine in the 16/20 racer was a forerunner to that unit, based on a standard 16/20 bottom end. It may even have used an overhead cam layout."

There is some anecdotal evidence supporting the idea that its performance was an order of magnitude different to a normal 16/20. Period photos of the car show a small boy proudly sitting at the wheel. His name was George Day, and Wolseley historian John End had the opportunity to speak to him much later in life.

"The car was said to be extremely fast, even once it had been converted to a family car with a touring body," William explains. "George recollected that it was still capable of 100 mph in that form. Obviously, those are the memories of someone who was very young at the time, but it suggests it may have been something rather special. That said, we've not finished developing the car in its current form and we've had over 80 mph out of it already."

Of course, the challenge with a car of this era is often less about getting it going and more about getting it stopped. Like virtually all Edwardians, the Wolseley has no front brakes. Instead, the primary means of slowing the car down is a hand lever, mechanically linked to a set of internal drums on the rear wheels, with fresh linings from Bonding & Reline Services in Leicester. There is also a foot pedal, which applies contracting metal shoes to the outside of a single drum on the output shaft of the transmission, but this can be tricky to modulate, so it tends not to be used ("applying it too violently could cause havoc in the rear axle," notes William).

Instead, the established technique is to use the ratchetted handbrake to slow the car down, he explains: "Typically, you'd put the brakes on, then release them a little but leave them trailing on the ratchet as you change down. Obviously you need to double de-clutch, so you need two hands and two feet if you want to maintain a grip on the steering wheel. Just before turn-in you'd usually let the brakes off completely, turn in and then get on the power."

The gearbox is perhaps more conventional than you might expect ▶



ABOVE A mock up of the body starting to take shape

ABOVE Clive Press (left) and Roger Twelvetrees (right) – note the wooden formers for the body

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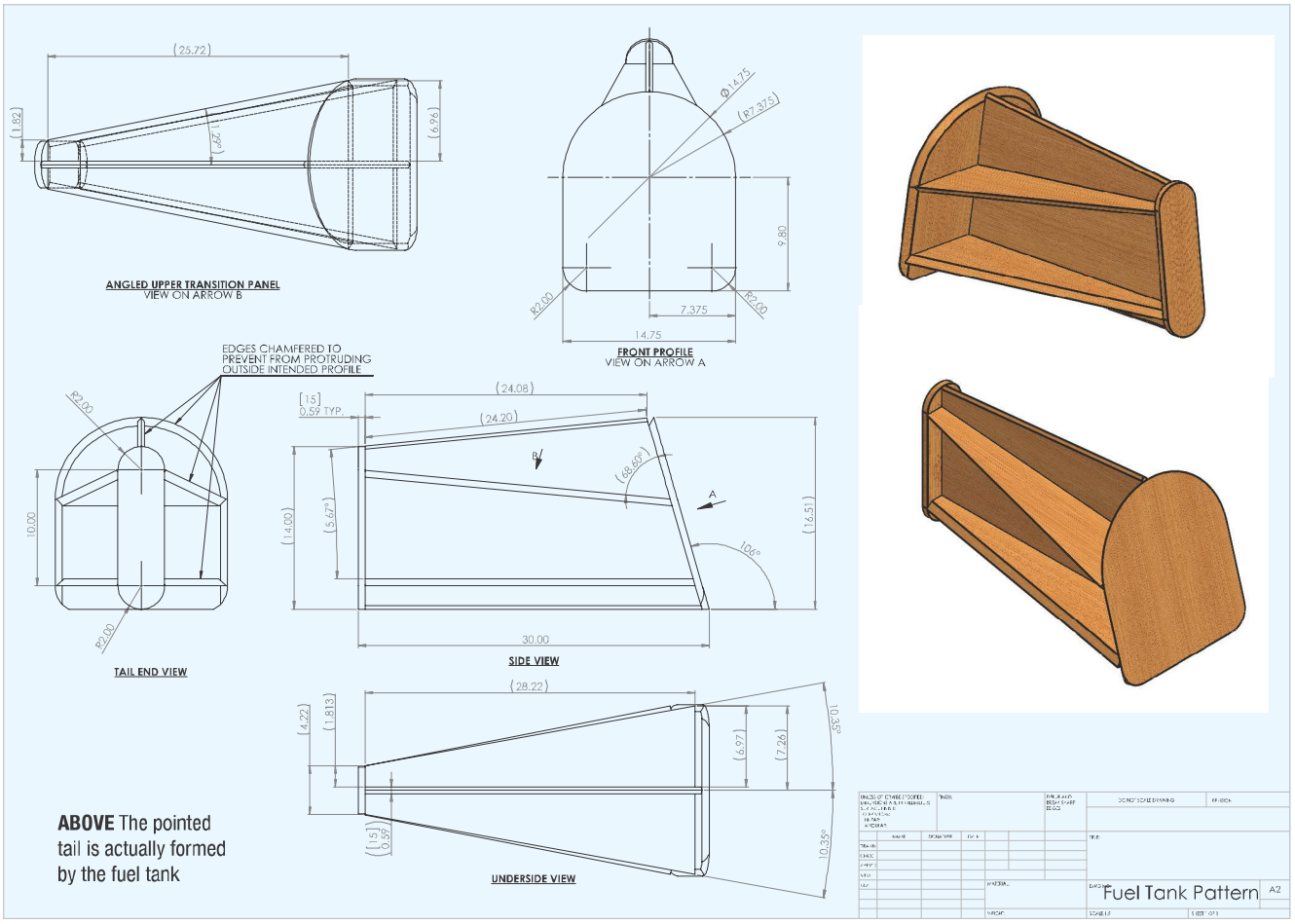
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ABOVE The pointed tail is actually formed by the fuel tank

from a car of this era. It's a straight cut design with four-forward speeds plus reverse, using a standard H-pattern shift. A short Cardan shaft separates the gearbox from the engine, but in other respects it looks much like a modern front-engined, rear-wheel drive layout, with a multi-plate wet clutch mounted to the flywheel and an open propshaft running back to the axle. A separate triangular-shaped tubular frame is ball jointed to the gearbox cross-member to support the torque reaction from the back axle.

Fortunately, the gearbox had been packed with grease before it was stored, so it required little more than basic reassembly. A small area of corrosion on the casing was corrected by Brooklands Exhausts in Nottingham, while new bearings from EB Bright were supplied as a precautionary measure. The gears and the shifter mechanism, however, are all original.

The end result is a gearbox that's remarkably user-friendly for its era, William explains: "It's proved to be really easy to drive compared to the Buick, which has a three-speed gearbox and a cone clutch with a leather lining. The clutch on that is practically digital – it's just in or out – which can make it quite unnerving to manoeuvre around in a crowded paddock at somewhere like Prescott. The multi-plate clutch in the Wolseley, on the other hand, is very light and progressive."

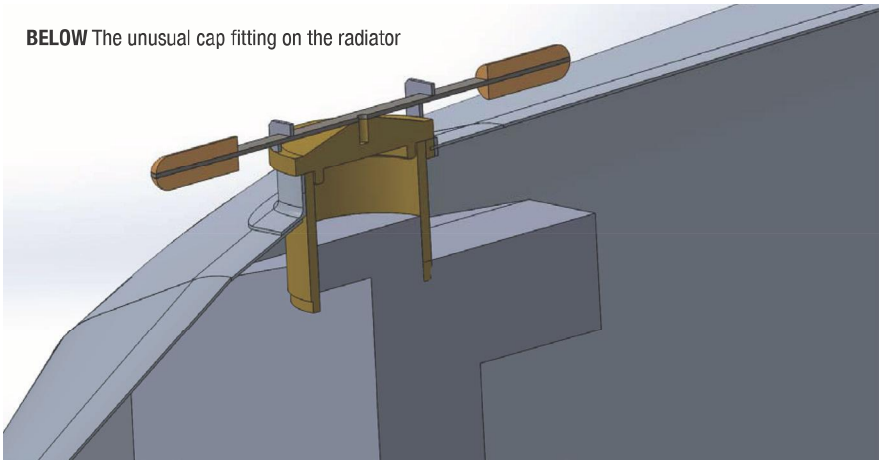
Concessions to modernity are few and far between. There is now a full-flow oil filter to protect the engine, plus the crude sliding couplings on the propshaft and the Cardan shaft have been replaced with modern Hardy Spicer universal joints. Aside from that, all the major mechanical items on the car come from within a few years of its 1911 inspiration.

Structurally, the only significant differences to a regular 16/20 chassis are the straightened rails and the presence of two additional cross members (one used to mount the radiator and a second tubular brace just behind the cowl). Both are believed to mirror modifications used on the original racer, William explains, with clues to their presence in the photographs. In short, this is very much the real deal.

BODY

The last major job was the body, which was created entirely by hand in the Twelvetrees' own workshop. It contains ▶

BELOW The unusual cap fitting on the radiator



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no complex curves, so the 18-gauge aluminium skin could be shaped without the use of specialist equipment. William began the process by taking slices through the cross section of the 3D CAD model and printing them out in full-scale to act as cutting patterns for a set of plywood formers. Roger and Clive then set about stringing these together as a basic buck for the body.

A wire frame is used around the cockpit section to provide a little shape to the edges, but the rest is largely freestanding. The front bulkhead is a wooden sheet sandwiched with aluminium on either side, which provides some stiffness to the scuttle, while the radiator cowl is attached directly to the chassis.

At the back, the pointed tail is actually formed by the fuel tank, which has a fabricated section to finish off its profile. Originally, the plan was to make this in aluminium as well, but welding the material proved to be tricky, so it was substituted for a steel part. This is attached to the chassis via flexible mountings to protect it from shock loads and give it a bit of vibration damping.

One interesting detail is the unusual sprung bayonet style of the cap fittings on the radiator and the fuel tank. These appear to be Wolseley's own design and unique to the car, so they were reverse engineered by William as closely as possible from the period photographs, while Roger manufactured the required parts in his workshop.

The finished article is stunning to behold. It has a delicate, streamlined shape that's redolent of those final years before World War One when car designers began to embrace the first principles of aerodynamics.

BACK ON TRACK

The reborn car had its first competitive outings in the autumn of 2016 at VSCC Loton Park. Right from the start it was clear that it had a responsive chassis and an impressive turn of speed due to its light weight (estimated at around 850 kg). However, there were a few handling foibles initially.

Having deduced the racer's original wheel and tyre sizes from the photographs, the Twelvetrees had set about finding the closest possible match from the parts available today. In the interests of safety, the decision was taken to go with straight-sided tyres instead of the original beaded edge design. This is common practice for Edwardian racers, as beaded edge tyres have an unnerving tendency to 'break the beads' and become

Pete Austin/VSCC



ABOVE The reborn car had an impressive turn of speed but also some initial handling foibles

dislodged under high loads.

In order to get the right overall circumference from the current tyre options they chose to use a slightly smaller 23-inch rim diameter. Based on experience with the Buick's 34 x 4-inch tyres the decision was taken to use a slightly wider 33 x 5-inch profile. As part of this exercise, the original touring car's Rudge-Whitworth wire wheels were rebuilt with straight-sided rims by Richards Brothers in Cardiff, with BF Goodrich Silvertown Cord tyres.

"We wanted something that would give us a little bit more rubber on the road while still being in-keeping with the era," says William. "In hindsight, it might have been better to use slightly narrower tyres, 32 x 4.5-inch on the front, and keep the slightly fatter ones on the back. The option for the slightly smaller tyre is still there and could give us about a six per cent reduction in gearing which might be useful.

"We had some funny steering effects initially. Ideally, you should run straight-sided tyres at around 60 psi, but because the front of the car was so light and the tyres were quite wide, we found we were having to run them at 50 psi to get a bit of compression on the contact patch. That's about the minimum pressure you can get away with and we found that it would shimmy on the steering, so there was a bit of work to find the right tyre pressures."

Generally speaking, the car is fairly well-balanced, he explains, but this lack of weight over the nose does give it a tendency to understeer in the wet. What's more, this understeer could lead to a resonance in the springs, which would cause the front axle to judder. A generous bootful of throttle would cure this and send the car into oversteer, William recalls, but it was still a rather alarming trait.

The solution was swiftly found in a set of Hartford-style friction dampers. Initially, the Twelvetrees' car was run with no shock absorbers at all (a somewhat alien concept to modern eras, but common for Edwardian designs, where the friction between the spring leaves provides its own damping effect). On examination of the photos, though, it was clear that the original car had been fitted with rear shock absorbers. What's more, a set of drop links hinted that they had been used on the front too.



BELOW Initially, the car was run with no shock absorbers at all. Friction dampers were fitted after further examination of photos revealed that they could well have been used at both the front and rear

Adding the dampers sounded like a simple operation, in theory. However, the pair soon realised that the only place to mount them on the front was inboard of the chassis rails, which explained the slightly convoluted drop link arrangement visible in the photos.

"We did this in a bit of a hurry in the run up to the event, with a pile of [1930s era] Riley shock absorbers we had lying around," William recalls. "It was a huge improvement in the handling, but it's something we will tweak with some more period-style shock absorbers when we get the chance."

Fitting the rear shock absorbers was another significant step, he says. So too was the addition of a set of wedges on the front axle, which tilted the steering axis back, taking the castor angle from zero to around 2.5 degrees.

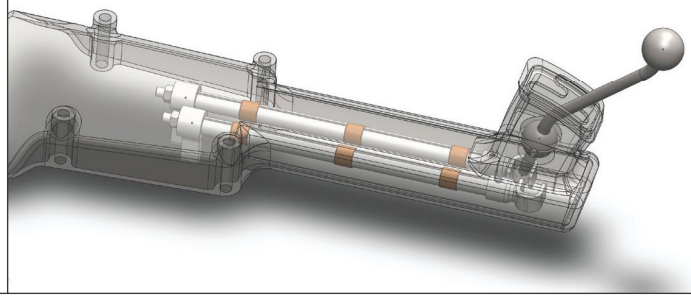
This fine-tuning is an on-going process, in between family life, work commitments and other motorsport activities, but the car is already acquitting itself well.

"It's a very responsive chassis and it's very evenly balanced," comments William. "We've not actually put it on a set of scales, but the engine and gearbox are so far back, and the rear axle is such a big lump, that it must be approaching a 50:50 weight distribution. In the dry you can really throw it into the corner and then tweak the power to get maybe a touch of oversteer. It actually feels more like driving an early vintage car than an Edwardian, in many respects. That's borne out by its characteristics on-track, which seem to be very similar to something like an early sporting Vauxhall."

No one knows just how close Wolseley came to breaking the 100-mile record with this car. It's believed that bad weather hampered one attempt, raising the intriguing possibility that this could have been the first car to sustain an average of 100 mph had things turned out differently.

Ultimately, though, it fulfilled another important role. When hostilities ceased after the First World War the factory resumed racing with cars such as the streamlined Wolseley 10 'Moths', the 15 hp racer, and the aero-engined Viper that went on to set their own records at Brooklands and beyond. You could say the original 16/20 racer served as an evolutionary link to these cars (potentially even paving the way for the Moth's overhead cam engine if William's theory is correct). Whatever the case, this faithful recreation is serving its purpose well, providing its owners with a competitive platform for Edwardian motorsport and a great deal of fun along the way. HRT





LEFT TO RIGHT The skills KWSP showcased on the Amilcar project, turning scan data into CAD data and using that to produce a 3D printed prototype and the final component, will prove valuable in the historic market

TAKING A MODERN APPROACH TO THE HISTORIC MARKET

William Kimberley reports on a new venture whose ambition is to play a role in the transformation of the historic vehicle market

ESTABLISHED in 2003 by former Reynard Head of Special Projects Kieron Salter and Chief Sports Car Designer Will Phillips, KW Special Projects (KWSP) operates within the high performance engineering sector, designing, manufacturing and supplying complete solutions to many industries. It has a wide range of technical design capabilities including Computer Aided Design, aerodynamics and CFD, Finite Element Analysis, software, automation and control systems and simulation.

The company is what Salter claims is a disrupter, especially with its extensive range of lightweighting, digital manufacturing and 3D printing capabilities. However, the company has now set its sights on a new sector – the historic vehicle market with the creation of KW Heritage Engineering.

While this is a fresh venture with a new person brought in to specifically head it up and develop new business, KWSP has already dipped its toe in this segment a couple times with the Amilcar and Alfa Romeo projects, as we have reported in previous issues.

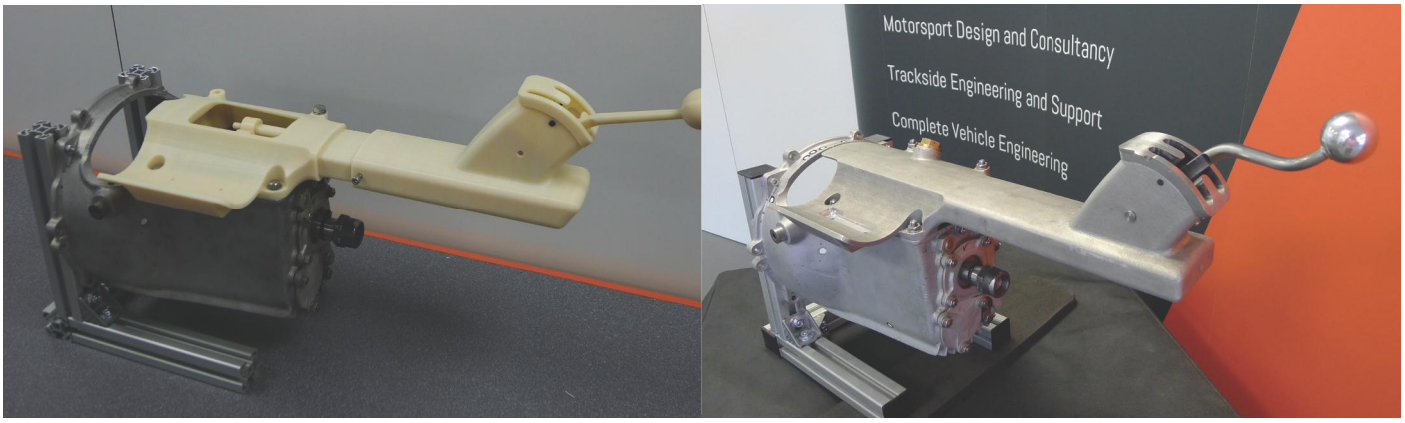
"When we did the Amilcar project around four years ago, it never occurred to us to target the historic car sector specifically," says Salter. "When it came along it was of interest because it was a challenging engineering problem and it was a stunning old car. We just delivered what we needed to do without thinking too much about it.

"However, it made us open our eyes to the fact that there's possibly an exciting market there for our expertise in reverse engineering and re-manufacturing. We consequently started to see what there was around and as an engineering solutions provider offering those types of services that we delivered on the Amilcar.

"We quickly got some good feedback, Martin Stretton telling us that he had a problem with the Alfa and wondered whether we could help. We delivered that but came to the conclusion that reaching out to prospective customers as KWSP had limited impact because not everyone gets it. Therefore about a year ago we made the strategic decision to create a side of the business that specifically focused on the historic marketplace. However, while it will be working out of a new Bicester Heritage site later this year, it's still within KWSP so that connection with all the other technologies is in place as it's all about bringing modern technology and melding it with the historic, the heritage, which is where Ed Smith comes in."

With more than 20 years' experience in motorsport engineering, Smith joined KWSP as head of KW Heritage Engineering at the start of January from Palmersport, where he had overseen a variety of racing car and performance vehicle projects. Notably, he had worked on the FIA Formula 2 car in partnership with Williams F1 and the more recent BRDC British F3 car in collaboration with Tatuus.

"This route we are following goes back to Reynard days in recognising the culture and nature of the business you are going to tackle," says Salter.



"When we went into IndyCar in the US, we realised that we had to have a presence in America. It's the same with other countries and other market sectors. You can't approach the whole of the heritage engineering sector in the same way we do performance sports, because it's a different message and a different style of communication. This is one of the main reasons we've brought Ed in as you've got to build networks and relationships with people. Many of our business activities are digital in every sense but in the heritage market it's much more about having individual conversations and understanding the customers' needs."

DIFFERENT APPROACH

"Part of that is understanding our own limitations," says Smith. "If I talk to someone who wants my opinion on a project, and I've done that a few times, I probably won't know all of the answers, but I'll have a broad idea of what the component is and a broad idea how it's made. We don't want to go in there with too many preconceived ideas. We want to understand how the customer typically or traditionally makes various components and try to learn from that and offer a slightly different approach."

"It's a complex market," says Salter. "You've got some customers who want pure authenticity and that kind of restoration but others who want minor improvements for reliability and yet other customers who want the original architecture but substantially modified underneath."

Scanning, which not that long ago was regarded as a bit of a black art, has become far more acceptable today, and the idea is not rejected out of hand. "The last thing we want to be is double glazing salesmen," says Smith, "and we want to take time to explain why the technologies we are offering can help them achieve their goals."

Asked what KW Heritage Engineering is specifically offering in these early days, he replies that he typically will pick up the phone and briefly describe what the company does. He will then ask what they need to do to restore a car with particular reference to the components they cannot get off the shelf or have a drawing of.

"Some of them say 'good question'. Others will say that they will reverse engineer it, completely stripping it as the current use and individual characteristics, and then scan it, taking into account the feedback gained. Alternatively, if the components are fairly small, then a customer might send them to us."

"Capturing this digital asset is one of the foundations of the services we want to build," says Salter. "In fact, there are two categories to the data being captured. One is data that's been captured where you want to keep the integrity of what's been captured, in other words you are scanning your car now because you'll have a digital record of it. Then there's the other type, as typified by Stretton's Alfa Romeo's front cover that arrived in several pieces. It's being scanned as a template to start with because you don't want to make what's been scanned as it's now broken and worn and not the right shape; instead, we are using that to create something new.

> **"The equivalent of a photo booth so that anyone can come along and have their car digitally archived"**

"So for a casting, for example, the piece that's been scanned has already been final machined and had bearings and the like fitted. When you want to make a new casting, you have got to add material in the right places for when it is going to be post machined for bearings, which means it needs an engineer and somebody who knows what they're doing. This is part of the engineering skills we have at KWSP.

"The question is how you capture it easily, quickly and cost-effectively. There are companies out there that charge means to getting that replacement part," says Smith. "Which is when I ask whether they have heard of 3D scanning and the ability to capture the form of a component and then to engineer it, and possibly improve it, using a CAD package so that a machine can then be used to manufacture it. This can sometimes lead to a picture being sent to me of the component in question so that I can go back to them with a ballpark price."

Sometimes KWSP will go offsite to scan a component or product rather than asking the customer to send or bring it to them, depending on the job. "Just recently we scanned a long nosed D-Type Jaguar on-site," says Smith. "We ask a little bit about the car so we get a feel for its history,



ABOVE & BELOW Projects like Martin Stretton's rare Alfa Romeo Tipo, where KWSP resurrected a corroded engine cover with modern technology, were among the company's early exposure to the historic market. Here a finished casting is scanned for inspection purposes

specifically to scan cars or components, but that's becoming a bit of a commodity now because the technology for scanning is now relatively easy to get access to and the prices are coming down. However, the bit that's valuable for us is what you do with the data once you've got it. We are looking at how we get that digital access even more quickly and are considering setting up the equivalent of a photo booth at an event like Silverstone Classic so that anyone can come along and have their car digitally archived.

"This is the equivalent of a black and white photograph in the old days that allows you in 20 years time to say what it looked like. The expensive bit and the bit that takes time is how to turn that scan data into CAD data and using that to make tooling or jigs or how to bring a body panel, like that used originally on the D-Type, back to its original shape. It still allows the handmade craftsman side of the business but using something that is absolutely accurate by using a template that's in the shape it originally was."

Salter says that the new business is focusing on a relatively low number of specialist projects as they are the ones that can require what he calls the clever stuff before it trickles down to the middle layers and then to the large volume market. "However, we need to develop the processes to get the cost down," he says.



While the cost of scanning is coming down, neither Salter nor Smith would readily use a third-party scanner. "It's a bit like being a photographer. Having a camera doesn't make you one, or at least a good one," says Salter. "By concentrating on the relatively low volume, specialist projects, it's in both our and our customers' interests that we personally do the scanning so that we are collecting the right data. There are genuine issues with obsolescence that make that engineering process worth pursuing, rather than buying an existing aftermarket component solution.

"When we've developed our process and got a closed loop process for scanned data to make parts cost-effectively, then we can offer the methods and the processes to those who can do their own scanning. To use the 3D printer analogy, where it was only accessible for the few who could afford it, now there are desktop versions that are less good but they've opened ▶

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ABOVE KWSP is leading a high profile project to streamline the production of foot orthotics, potentially resulting in a 'while you wait' service. The lessons could be applied to the historic racing sector

up the technology for everyone. We might reach the point where we have a web portal where people can send their scans with people in the background doing a little bit of CAD engineering to make the part makeable and a week later they get the part through the post. This is already very close to what we are doing with foot orthotics."

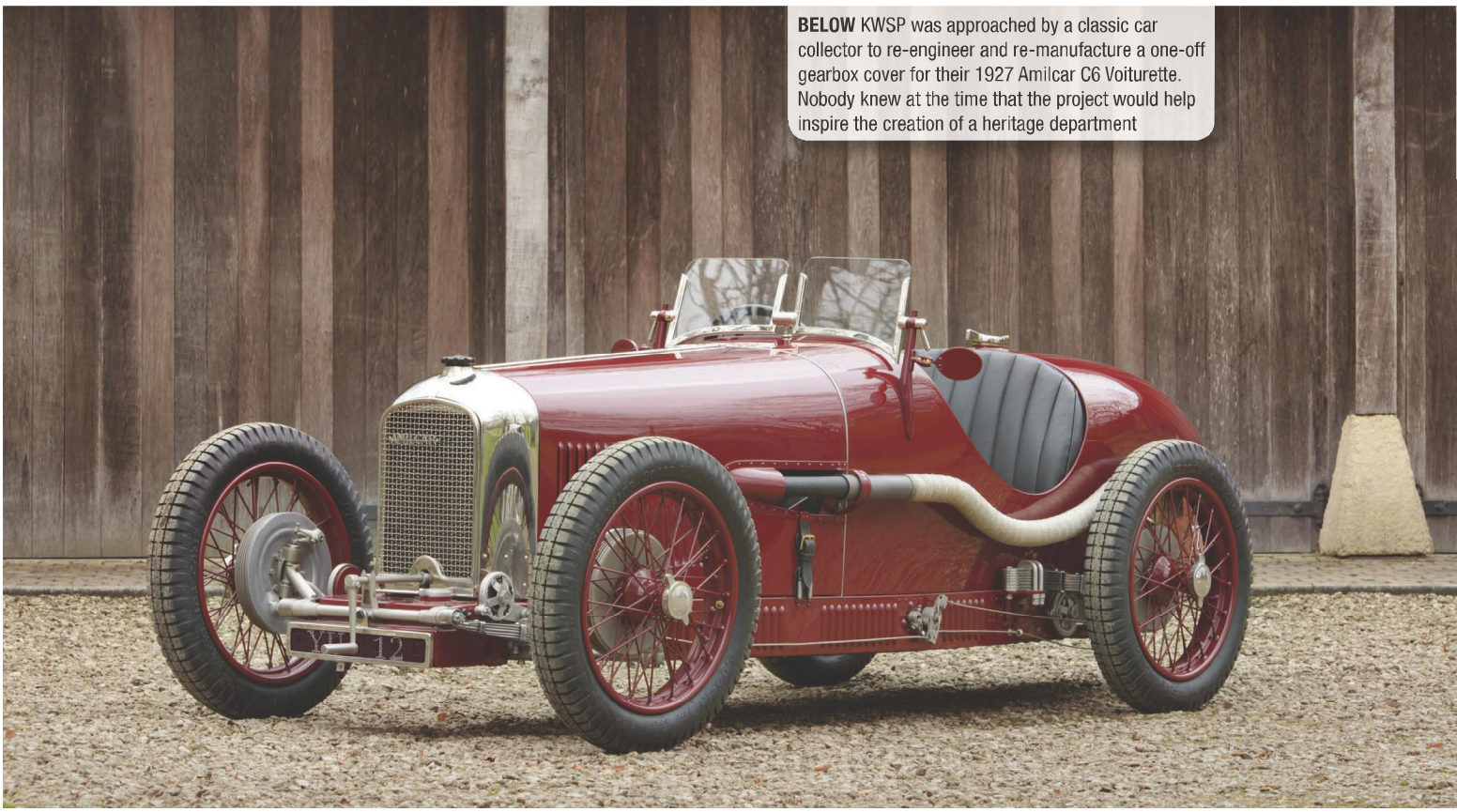
ORTHOTICS ADVANCES

The latter is a project which is partly funded by Innovate UK, where KWSP is joined by experts from Newcastle University and advanced foot orthotics manufacturer Podfo Ltd. The overall goal is the creation of a functioning printing process for insoles by early 2019. The idea is to develop a toolkit that allows clinicians to take a patient's prescribed design based on their individual sole and gait measurements, and 3D print a custom orthotic on-site, considerably shortening the current time taken to produce insoles.

"In effect, we have closed the loop between scanning at the prescription stage for foot orthotics to 3D printing it and making it on-site," says Salter. "At the moment, they do the prescription which is then sent to a CAD engineer; the CAD design is then sent to a manufacturer and three or four weeks later, the part arrives. It's very similar to what we think we can do for the heritage market, which I think makes us really unique."

Another thing that KWSP brings with it that it believes is not widely on offer in the historic market is a knowledge of composites. "Composites have been around now since the early 1980s," says Salter. "I just discovered this year that the Creation Autosportif I started to design in 2002 is now racing in the Masters series as an historic car. However, it's a full composite chassis and there are some Benetton Formula 1 cars that we've seen as well as road cars that are now coming into the marketplace. It requires quite a bit of knowledge to assess any damage and what it might be, and that's something we'll definitely be focusing on as a contemporary skill we can bring to that marketplace."

The move into the historic car market is a natural one for KW, as Salter puts it: "The obsolescence and personalisation market for vintage cars is enormous, one of the sectors we've identified with a lot of potential for mass customisation. Our in-house technology and expertise creating from scratch are just right for the demand as no designs exist for the parts." HRT



BELOW KWSP was approached by a classic car collector to re-engineer and re-manufacture a one-off gearbox cover for their 1927 Amilcar C6 Voiturette. Nobody knew at the time that the project would help inspire the creation of a heritage department



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VINTAGE, BUT NOT AS WE KNOW IT

Vintage Tyres' Ben Field addresses some of the talking points in the ever-evolving historic tyre market

Vintage Tyres started out as a supplier of tyres to the veteran and vintage car markets back in 1962, but as the appreciation of classic cars and bikes expanded from the '70s onwards, so did Vintage Tyres.

Today the company proudly bears the tagline 'Tyres for cars and bikes from the 1890s to the 1990s'. And it's true, as a quick glance round its Beaulieu, Hampshire warehouse will tell you. Here, a walk along the racks takes you from tall, narrow beaded edge tyres to wide radials via racing crossplies and neatly-wrapped whitewalls.

> **"The definition of 'classic' is moving all the time"**

"I know the term 'vintage' clearly defines an era in the historic vehicle market," says Ben Field, Vintage Tyres' Managing Director, "but our range is so much broader, and in a funny way pretty much defines the modern interpretation of 'vintage' which is anything older, interesting and worth cherishing."

COMMON MISCONCEPTION

A common misconception about companies like Vintage Tyres is that they sell 'new old stock'. Field is quick to quash that concept: "All our tyres are freshly made from moulds that we own, or from manufacturers including Michelin and Vredestein who still create new tyres in classic patterns."

Field points out that 'new old stock' tyres bought online and at autojumbles are actually a real danger. "Tyres get harder with age, and lose grip as a result. Just because a tyre looks OK



ABOVE Vintage Tyres worked with Avon to produce a 195/55VR13 for the Renault 5 GT Turbo

and has a good tread depth, don't assume it is safe to fit," he stresses. "Tyres have a date code on the sidewall. The 'tools' section of our website (vintagetyres.com) has an easy-to-follow decoder. We don't recommend fitting any tyre that's older than 10 years."

Vintage Tyres doesn't just supply tyres, it makes them, too. The company owns many moulds and works closely with a range of factories to create tyres under its own Ensign and Waymaster brands.

"Chris Marchant, the previous managing director, was the prime mover in making sure we had the moulds to create exclusive products, but it's been the company policy to bring long-extinct tyre patterns back into production for decades. These include the Dunlop Aquajet and Weathermaster, the Avon Traction Mileage and a range of Ensign Chevrons," says Field.

"We have, to date, brought more than 30 tyres back into production. It means ▶



ABOVE The company stocks a huge range of tyres to suit cars and bikes from the 1890s through to the 1990s, plus all the associated inner tubes and rimbands

that some cars can now run around when they couldn't before or were running around on the wrong tyres."

Just recently Vintage Tyres worked with Avon to produce a 195/55VR13 for the Renault 5 GT Turbo – a high-quality tyre had long been unavailable for this car. "The tyre's first major outing was at Retromobile in Paris and it attracted a great deal of interest," says Field.

Tread patterns are also vital, he says. Does the customer want to stick with the same one that came with the car, no matter the age of the vehicle, or is

> **"It's company policy to bring long-extinct tyre patterns back into production"**

a more modern pattern which is more efficient acceptable? It depends on the customer and on the car, he says.

For road cars, the key thing is the tread patterns. "That's the starting point," says Field. "What does it look like? Is it age appropriate? It is things like this that the typical owner takes into consideration.

MODERN STANDARDS

"If you've got a '80s hot hatch, you want the tyre pattern that goes with it. However, it's possible to have this but with a tyre that is made to modern standards and with a compound optimised for the vehicle. Avon's Turbospeed CR27 tread pattern which we used for the GT Turbo tyre was around in the period which is why we chose it, and it suits the car well."

While there is a growing demand for hot hatch tyres, the 'classic market' is still buoyant, but the definition of 'classic' is moving all the time, says Field. "The process of re-introduction, and in some cases, re-invention never stops. There's always something new, albeit veteran, vintage, classic or modern classic, at Vintage Tyres." HRT



ABOVE & BELOW Founded in 1962 to keep older cars and bikes on the road, the company's warehouse in Beaulieu is still, to this day, staffed by enthusiasts

Both sides of the fence

IF Ben Field's attention to detail resonates with his many customers, it's because the Vintage Tyres Managing Director's own passion is for historic vehicles.

He began restoring cars and motorcycles in the late Eighties. Projects ranged from building specialist vehicles for the AA and aluminium catamarans for the Far East, to replica Frogeye Sprites and even bits of the Millennium Dome in the Nineties. He then worked as a journalist on a range of classic car titles until 2015 when he took over as managing director at Vintage Tyres.

"I've never stopped fiddling with cars and bikes and I've owned dozens," Field admits. "The collection is now down to two, though: a hillclimb-spec supercharged MG Midget and a significantly slower (probably heavier) BMW R65 motorbike." HRT



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MORE THAN MEETS THE EYE

William Kimberley visits a company that specialises in a product that should be on the wane. But as he discovers, that's far from the case

VERY much a family business with the three sons of one of the founders now running the show, Burlen has carved out for itself a very unique slice of the market. It is the owner of SU, AMAL and Zenith, all renowned carburettor manufacturers with a considerable heritage, while also being an important Weber distributor.

None of the brothers was originally destined to join the business, although all had worked for their father during school holidays, but it just happened. Mark had a background in sales and marketing and is now the managing director while Andrew, his older brother, looks after the warehouse and logistics and Jamie, his younger brother, became reponsible for the production side of the business.

Burlen Services as it was known, was formed in 1971 by John Burnett and Mark Cullen as a garage in Salisbury city centre, but from servicing the everyday car it evolved into focusing on sports cars, becoming a Morgan dealer in 1973. From that it began to specialise in carburettors, spurred on by the fuel crisis in 1974 when people were really concerned about reducing fuel consumption and it became the official SU, Zenith and Solx agents and a Weber dealer. This in turn led to a close involvement with SU with Burlen undertaking the production of some threatened products such as the HS and HD carburettors.

The relationship just grew and grew to the point that in 2000 Burlen acquired the rights to buy SU from Dana so could manufacture all its carburettors and fuel pumps. Four years later it also bought AMAL from its owner. Meanwhile Burlen had moved to its present premises on the outskirts of Salisbury in 1984, renaming itself as Burlen Fuel Systems a year later.

Everyone knew that SU was a good brand to have but were taken slightly aback by AMAL's performance. "We own the Zenith brand for carburettors, which nowadays is more focused on the kits than it is making carburettors although we do occasionally make the CD carbs, but it's small fry," says Mark Burnett. "However, the AMAL business has thrived and is just about equal to the SU business. It's never where we thought it would be as we believed it would be no more than just a nice little bolt-on thing."

Originality is key to everything at Burlen, says Burnett, and it has become increasingly important. "For example, we put quite a lot of effort into surface finish. A new casting will come that's all shiny, but it's wrong and then there's another component that fits to it which may have a different shine as it's come from a different supplier. So we put a lot of effort into making things like that look right."

MODERN TECHNOLOGY

It is difficult to bring modern technology into the business, says Burnett, although products are still developed. "It's difficult to develop much of what we've got very far and we have to be really careful when it comes to anything that materially affects how something looks or even performs. We came up with some Viton rubber seals instead of

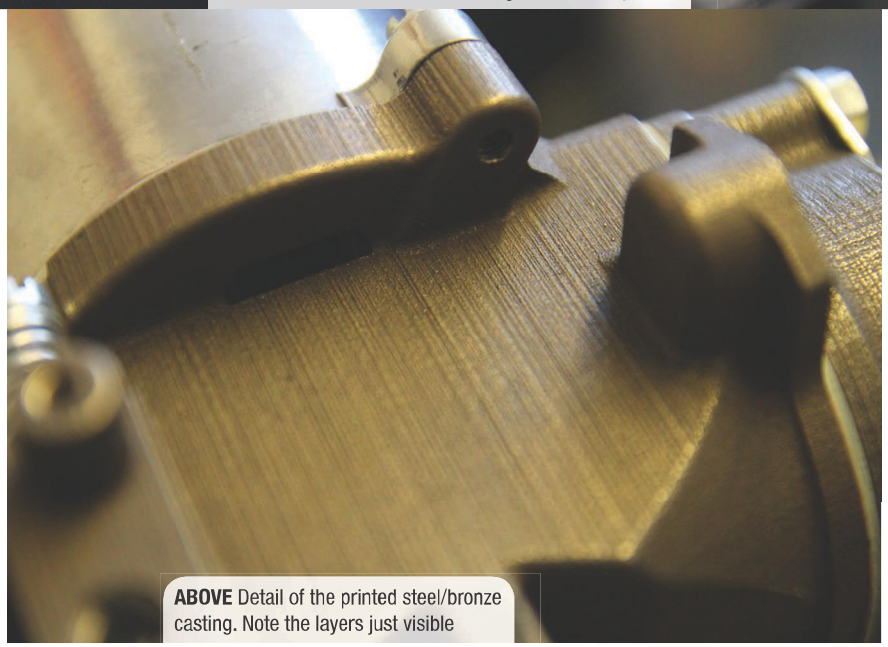
> **"It began to specialise in carburettors, spurred on by the fuel crisis"**



ABOVE Burlen Fuel Systems Managing Director Mark Burnett holding a printed steel/bronze SU DU6 carburettor prototype



ABOVE An HD8 SU carburettor being assembled by hand



ABOVE Detail of the printed steel/bronze casting. Note the layers just visible

the cork ones on the H-type carbs and there's a new bearing, but to look at it from the outside, you wouldn't know. However, sometimes opportunities do come up. A few years back one of our sales guys suggested it would be a good idea to put a removeable pilot jet into the Mk1 AMAL carb as there was a location hole in the casting already. It meant that we could then offer a slightly upgraded carburettor without ruining the aesthetics and it was an instant hit."

While Burlen is the name for carburettors, it has not stopped it from developing a fuel injection system, initially for HD8 SU carbs on the 4.2-litre E-Type Jaguar. "The idea is to develop something that we can fit inside an SU throttle body. It has been in development for four-and-a-half years and we have learnt more than we thought we ever would in the process. There are companies that offer a rudimentary version of this, so it's not a completely new thing, but we wanted to come up with something that was transferable, that we could move from carb to carb and which would be quite straightforward to develop. However, 'straightforward' went out of the window once we realised just how complicated it is in the world of injection fuelling."

HOME BUILDERS

Burnett says that while they are in talks with specialist companies that will be able to install the fuel injection system, it should be possible for the advanced home builder to be able to fit it as well. "However, it needs to be mapped and that isn't straightforward and so certain aspects of that will be locked," he explains. "The goal with all our products, though, is for someone to be able to fit it for themselves."

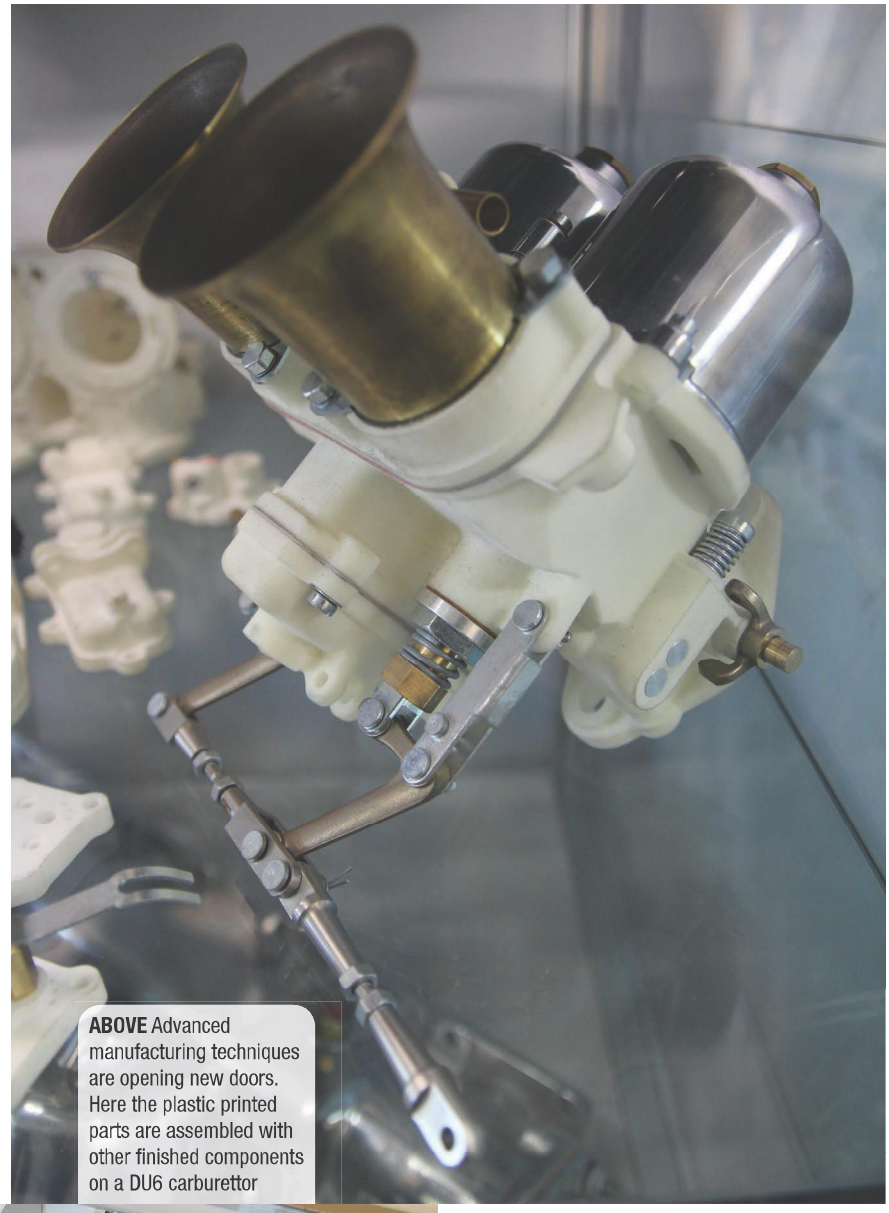
While this kit has been designed for the E-Type, Burnett says there are plans to introduce a range for other cars. "The injector unit, for example, will fit into carburettor sizes two smaller than the E-Type's and there are a lot less ▶

complicated vehicles than the Jaguar."

Another project that Burlen has been working on is re-manufacturing twin-choke SU carburettors from the 1950s that were made for the Coventry Climax FPF. "We think they made 200 pairs, and that was it," says Burnett. "However, a few years back we said that we'd really like to make them again for no other reason than that it would be really cool. It wouldn't make us millionaires, but it would be great to do it. There have been a few hiccups along the way and it has been something we've been doing behind the scenes.

ADVANCED MANUFACTURING

"We realised that there are now certain things that can be done using advanced manufacturing techniques such as making a proof of concept in printed stainless steel with bronze and a plastic printed throttle body. It can then be machined and put onto a car and tested without having gone to the expense of creating a tool. This is where we are with the Coventry Climax carbs. We are going to make a smaller bore and are currently working on the drawings for that. Once that's done, we'll go ahead with the tooling.



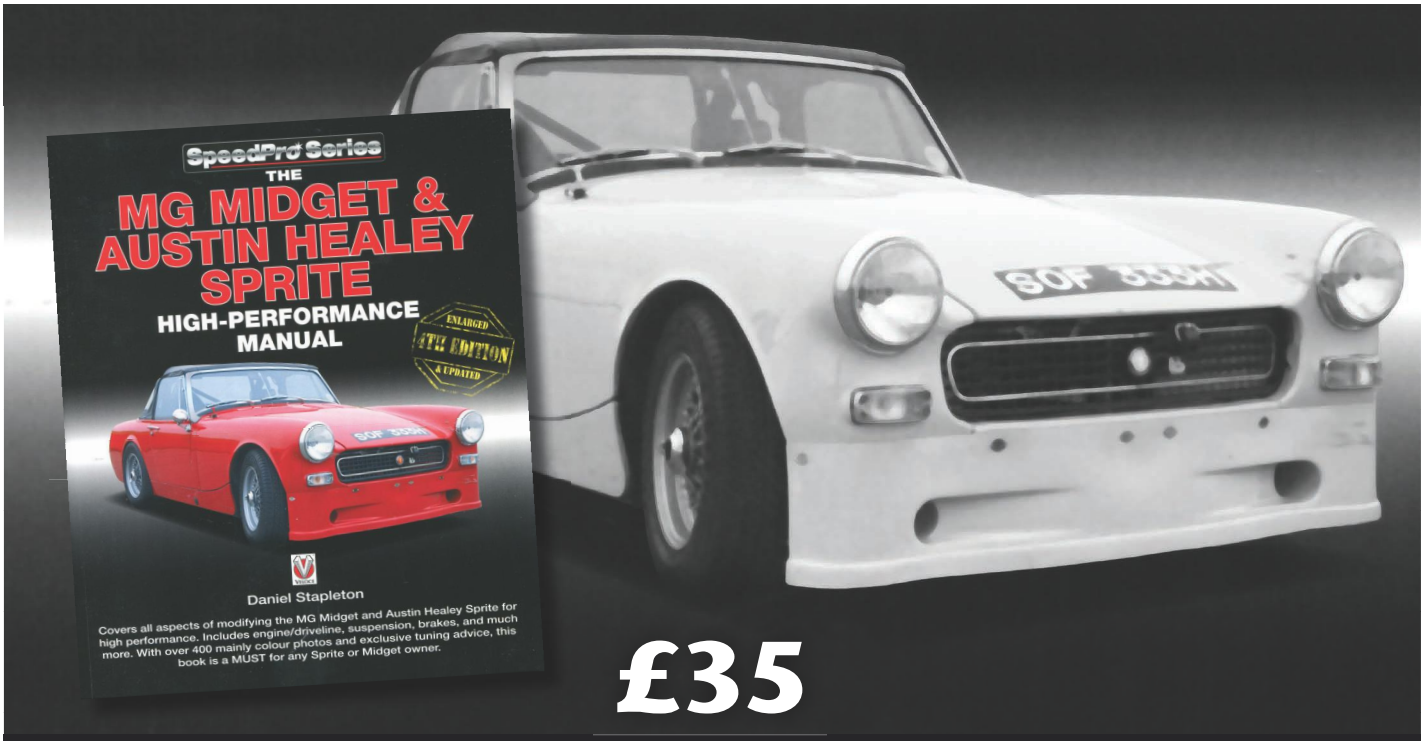
ABOVE Advanced manufacturing techniques are opening new doors. Here the plastic printed parts are assembled with other finished components on a DU6 carburettor



ABOVE The 4-axis CNC mill in action in Burlen's machine shop

"We did actually find some original drawings for the body casting and found a pair of original carbs, but the two didn't match in the slightest. That was typical of SU. Obviously the castings work, because it's a carburettor, but the question is what do we build? We wanted to make a couple of tweaks to it and so we ended up scanning it to make a 3D model, putting the two together on a screen and seeing where things didn't match and then creating something from that, that would then work on both sides, which wouldn't have been possible just a few years ago."

The carburettor is about as traditional as it gets and Burlen has made a name for itself in them, but it is not afraid to move with the times, whether it is developing a fuel injection system or embracing new technologies such as advanced manufacturing. The carburettors may be old technology, but there is still life in them yet. HRT

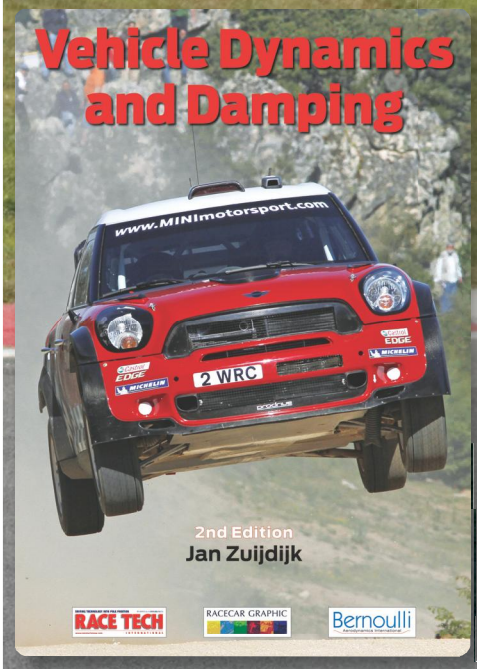


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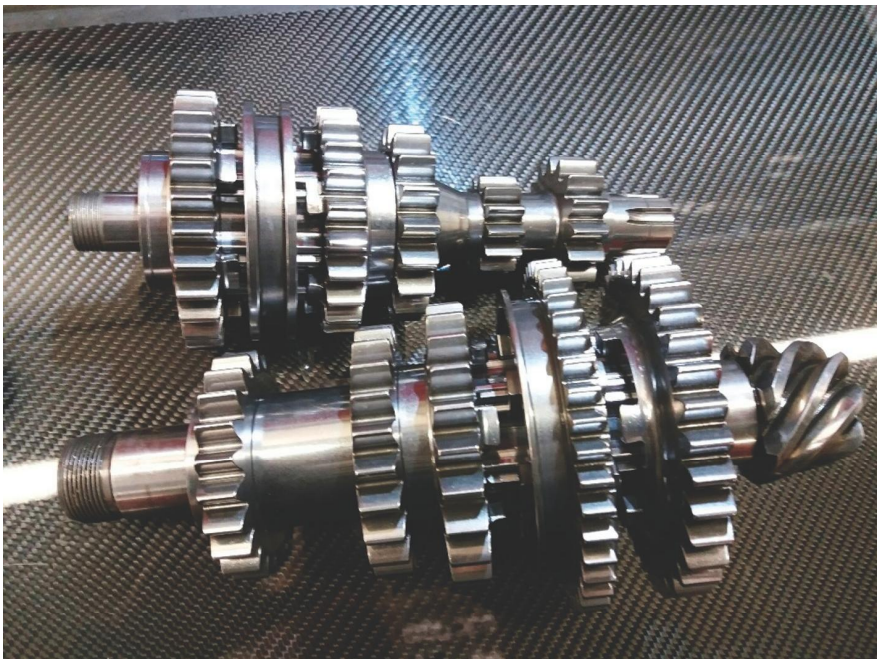
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EMBELLISHING THE PAST

From time consuming bespoke work, to simple ideas that make a lot of sense, there are some companies that are making owning a classic that much sweeter, says **Alan Stoddart**



THE golden age of Touring cars in the mid-to-late Nineties saw racers that were technically advanced and had many bespoke parts as a result of almost limitless budgets. This meant that every manufacturer's car was beautifully unique. The issue with this complexity now is that many of the original manufacturers have moved onto new projects or are no longer in existence, drawings are not available and replacement components need to be made in quantity on extremely long lead times. This is where companies like **SGS Racing Transmissions** step in.

One of the projects the company has recently been involved with, for example, involved a company with an outer CV joint that had expired, but a replacement was unavailable and drawings misplaced. Luckily for SGS, it found an OEM part which matched the driveshaft splines, but the outer showed no resemblance at all. The question then became how to interface that OEM part with the CV joint.

SGS found a solution in manufacturing a new outer profile. To achieve this, the company wire eroded and turned off some of the old features of the OEM part before spark eroding an interface which enabled the new profile to be integrated into the joint. Happily for the customer, all this work was also achieved for the deadline, enabling him to join the Super Tourer grid in time for the next race.

Another of SGS Racing Transmissions' strengths is producing straight cut gear kits for historic racers. Often helical type gear trains are not robust enough and have ratios that are more suitable for road use than track use. SGS produces straight cut gears with dog interfaces that are designed to fit the original casing, and using dog rings designed to function with the original selector forks and rods, creating a stronger and more durable transmission.

Moss Europe has announced new 5-speed gearbox conversion kits for the MGA and MGB. They are based on a brand new Mazda MX-5 gearbox and give the MGA and MGB the slick gear changes that have become synonymous with the MX-5, together with a fifth gear for relaxed cruising.

The kits are supplied with a fully assembled gearbox with a bespoke cast bell housing and casing designed to fit directly to the MG's engine back plate. The bell housing flange has been designed to resemble the standard gearbox thus preserving engine bay originality.

Each conversion kit uses the flywheel applicable to the engine, an appropriate clutch cover and a Mazda OE clutch plate. The installation on the MGA does require the removal of existing gearbox mounts and the enlarging of the gearbox tunnel aperture, but for the MGB there is neither cutting nor permanent modifications required. Full instructions are included.

BELOW Moss Europe 5-speed gearbox conversions for MGA & MGB





ABOVE A Panasport wheel as seen on a Triumph TR4

The kits include a brand new Mazda 5-speed gearbox assembled into custom casing and bell housing, a concentric clutch slave cylinder assembled with pipework, a Mazda OE clutch plate and gear knob, custom gearbox mountings, speedo drive and cable and a bespoke propshaft. The gearboxes are prefilled with SAE 75W-90 oil.

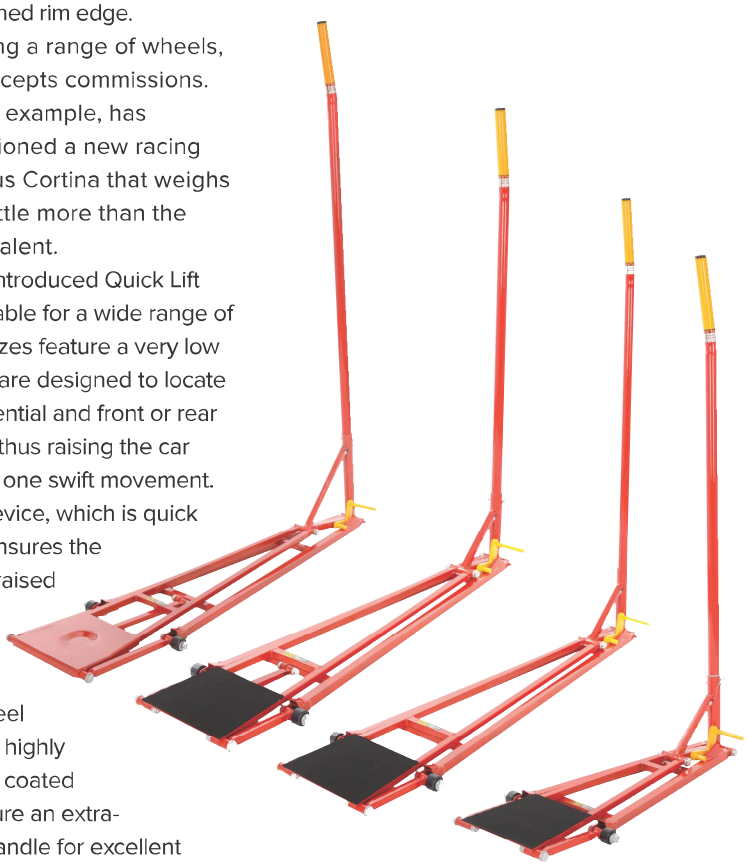
Kits are available for high and low starter MGAs, 3 bearing MGB 1962-65 and 5 bearing MGB 1965-68. All retail at £2,700.00. Kits are also available for cars with engine conversions

Panasport, likewise specialises in making brand new parts for historic racers, in its case wheels for both race and road cars, which have styling as the only nod to the originals. For more than 40 years the company has been developing motorsport wheels with the emphasis on lightness and quality, which helps improve a car's acceleration, braking and steering response. Each application is specifically machined to the optimum offset with close tolerance centre bore and bolt circle for a particular race car. Glossy clear coating then protects the metallic powder painted finish and the bright micro-machined rim edge.

As well as offering a range of wheels, Panasport also accepts commissions. Racetorations, for example, has recently commissioned a new racing wheel for the Lotus Cortina that weighs in at just 4.3 kg, little more than the magnesium equivalent.

B-G Racing has introduced Quick Lift Jacks that are suitable for a wide range of vehicles. All four sizes feature a very low closed height and are designed to locate beneath the differential and front or rear chassis members, thus raising the car to a fixed height in one swift movement. A safety locking device, which is quick and easy to use, ensures the handle cannot be raised unintentionally.

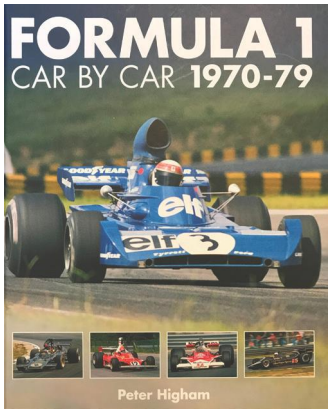
They are produced from high-grade mild steel with a durable and highly visible red powder coated finish. All four feature an extra-long, ergonomic handle for excellent leverage with a yellow tip to enhance visibility and nylon roller wheels to allow easy manoeuvrability. HRT



ABOVE BG's Quick Lift Jacks which are suitable for a wide range of vehicles

Formula 1

The Auto-Biography of a Rally Champion
Peter Higham
Published by EVRO Publishing
ISBN 978-1-910505-22-9
304 pages
£50.00/$79.95



WHILE this is a book that could be defined by the pictures within it, all 720 of them, it is the authoritative text by Peter Higham that really catches the attention.

He has been on the publishing side of the motor racing scene for decades, principally working for Autosport magazine and than running Haymarket Publishing's motor racing magazines and its photographic library. To say it has been well researched is an understatement.

While many readers will automatically defer to what he has written about Ferrari or maybe Lotus and McLaren, the bits that caught my eye were about the teams and cars that have long been forgotten. Remember Gene Mason Racing? This is the year-old March entered by Skip Barber in the 1972 Canadian and US Grands Prix. Heros Racing Engineering? A Tyrrell 007-Ford that Kazuyoshi Hoshino raced at Fuji in 1976, the only car on Bridgestone tyres. He was eventually forced to retire after 27 laps when he ran out of rubber.

I had to check out 1978 to see what was written about the Brabham BT46B-Alfa Romeo fan car that ran once in its life before being banned, winning the Swedish Grand Prix. It was also the year that Ronnie Peterson lost his life at the Italian Grand Prix, which is touched upon in the introduction to that particular year.

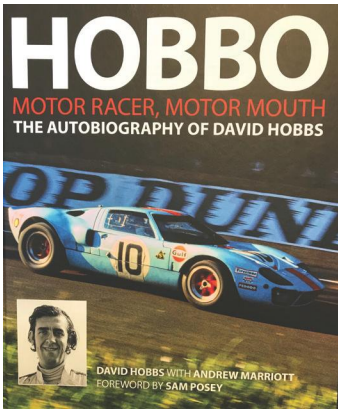
After the chapter on each year is a comprehensive list of results with the drivers in alphabetical order and the results per race as well as the cars they drove. There is a separate list of the winner of every Grand Prix that year plus the Drivers' and Manufacturers' championships.

What I love about the book is that you can just delve in on any page and you will find something of interest. It will also stir memories for many of us of a certain age.

The book is not cheap, but it is worth every penny such is the colossal amount of work that has gone into it between the covers. HRT

Hobbo

Motor Racer, Motor Mouth
The Autobiography of David Hobbs
David Hobbs with Andrew Marriott
Foreword by Sam Posey
Published by EVRO Publishing
ISBN 978-1-910505-31-1
304 pages
£50.00/$79.95



DAVID Hobbs typified the racing era of his time, one of the great all-rounders who could drive any car in any series and be competitive.

A collaboration between Hobbs and Andrew Marriott, the extremely well known broadcaster, this book sums up the driver's career, highlighted by some wonderful pictures. What helps here is that he drove some of the most evocative cars of all time, including the Ford GT40, the Lola T70, the Broadspeed Jaguar XJ-C coupe, a Trans-Am Chevrolet Camaro, a McLaren at the Indy 500, the Can-Am McLaren M8D and even NASCAR, leading the Daytona 500 in 1976.

As he says in the chapter dealing with his Formula 1 career, it is't really that impressive, seven Formula 1 World Championship races over a period of seven years, but the cars he drove are all really interesting. It includes the call from Honda who wanted to enter a second car in 1968. John Surtees was already installed as the main driver, Hobbs being brought in to drive its new air-cooled V8 RA302 which Surtees refused to drive. Hobbs recounts the test that both drivers had at Silverstone which showed the car still needed a huge amount of development.

The book is absolutely full of such well told anecdotes, showing an insight into how racing was from the mid 1960s to his final two races in 1990. There is then a chapter on his 40 years as a television commentator followed by a more personal chapter on his family and business.

As with Peter Higham's book, it isn't cheap, but it is a mighty good read illustrated with some wonderful pictures. HRT

Wow Gilles!

Villeneuve, The Undying Legend
Photographs by Ercole Colombo
Published by SKIRA
ISBN 9788-572-3605-6
206 pages
£40.00/$50.00



THERE is little to no text in this book that celebrates the racing legend that was Gilles Villeneue. For those who still idolise the Canadian driver, it will be one to add to the library. HRT



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