

HISTORIC RACING

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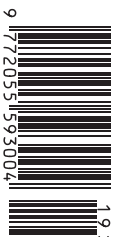
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THE 'MUNCHER' IS BACK!

Giant-killing Aston Martin's return to Le Mans
- 40 years after its heroic feats there



- F1 star reunited – with car he hated!
- Spirit of the 1920s-style Special lives on





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THE 'MUNCHER' IS BACK!

Giant-killing Aston Martin's return to Le Mans - 40 years after its heroic feats there

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Beware fakes

I have written about this before but unfortunately it is an ever-growing problem, and one that is becoming more evident in historic motorsport and that is the growing prevalence of counterfeits, of products that pretend to be something they are not.

Fake products are made on the cheap, using inferior materials, not tested and really not fit for purpose. You may think you have the deal of the century when buying something at a real knock-down price, but don't fool yourself, more than likely that product will fail.

It becomes vitally important not to be fooled when it comes to safety items. Counterfeit fire proof race suits, race seats, safety harnesses, head restraints and even fire-resistant underwear can be found on the market and are difficult to distinguish from the genuine article. The giveaway is that they are usually cheaper, much cheaper than the original, but do not be tempted into buying them as in extreme conditions you could be risking life and limb.

I was on a visit to Brembo recently to see its new products and the manufacturing processes, when the conversation came around to the question of fakes and forgeries and to my utter astonishment, I was told that nine in 10 Brembo products sold in the Far East are counterfeits. They mainly all come from China and use the Brembo name. Some try to follow the original design, but others just use the name. In all cases, I was told, they were totally inferior to the original Brembo product and are not up to the job which is to slow and stop cars. In a real emergency

they will fail. It was a real problem, and Brembo was trying to combat it, but no sooner does it manage to get a factory shut down, then another one pops up in a different part of the country.

As Alex Bone (Partner) and Stuart Greenwood (Associate), Patent Attorneys for intellectual property law firm AA Thornton have written for us in our sister publication Race Tech, a great deal of effort is being put into countering this problem by the manufacturers. The prestige of a brand takes years to build up and can be eroded instantly by a counterfeit product, something that Brembo also told me. For the customer with the dodgy product, all they know is that it is the Brembo name on the product they have bought.

However, stopping counterfeit products from making their way onto the market can be very difficult. You can try to stop the manufacture at source, or you can stop the manufactured products from making it to the market. Both approaches can be very successful at preventing unauthorised products from reaching the market, but they are not easy solutions, especially bearing in mind that the internet knows no borders.

The sensible approach for buyers is to purchase the products from a trustworthy supply chain using common sense and using the guidance from the manufacturer. As the lawyers write 'If a deal looks too good to be true, or the presentation is not as expected, then it should be a warning'. **HRT**



William Kimberley
Editor



RIGHT Bespoke colour and trim palette plus extensive detailing evokes legendary DBR1 racer

Special edition 'DBS 59' celebrates DBR1's 1959 24 Hours of Le Mans win

ONE of the greatest moments in Aston Martin Lagonda's (AML) illustrious motorsport history is the inspiration for the latest Q by Aston Martin: Commission; the 'DBS 59'.

Inspired by Aston Martin's historic 1-2 finish in the 1959 24 Hours of Le Mans with its iconic DBR1, Aston Martin Cambridge has commissioned a collection of 24 very special DBS Superleggeras— one for every hour of the legendary endurance race. Called the 'DBS 59', each is identified by bespoke design features, hand-crafted interiors and graphic elements drawing directly from the DBR1 and the race it so famously conquered.

A marque synonymous with success in the world's toughest endurance race – the most recent being a dramatic class win for the V8 Vantage GTE in 2017— Aston Martin's outright victory in the 1959 24 Hours of Le Mans is the stuff of motorsport legend. Facing stern opposition from works Ferrari and Porsche entries, plus a team of Ecurie Ecosse Jaguars, the David Brown Racing Aston Martin DBR1s fought valiantly to score a famous 1-2 finish in a masterful display of pace, reliability and teamwork.

Since described by Sir Stirling Moss, who helped Aston Martin win the 1959 World Sportscar Championship, as

'the most important Aston Martin ever produced', the DBR1 has deservedly attained iconic status. Just five were built between 1956 and 1959, making it one of the rarest Aston Martins ever, and when one last went to auction at Monterey in 2017, it set a new world record as the most valuable British-made car ever with a sale price of £17.5m (\$22.5m).

Immediately identifiable by its timelessly beautiful Aston Martin Racing Green paintwork, the DBS 59 features extensive use of gloss finish carbon fibre, most strikingly on the roof, roof strake and painted bonnet louvres. A classic combination of Obsidian Black and Chestnut Tan leather is used throughout the interior, together with fabric inspired by the DBR1 seat material used to trim the 'DBS 59's' seat backs and door inserts. Bronze detailing is strategically deployed around the exterior and interior, with the front grille surround, 'Superleggera' bonnet script, rear Aston Martin script and Q Fender Badge amongst the items painted.

Additional Q by Aston Martin detailing include bespoke saddle leather helmet pods in the rear compartment to hold special 'DBS 59' crash helmets, race suits and gloves, and a bespoke 'DBS 59' logo embroidered in the seat

headrests. Each of the 'DBS 59s' will be identifiable by a small painted white roundel adjacent to the side strakes, with each car numbered from 1-24.

Further accessories include period blue race overalls complete with Aston Martin and 'DBS 59' logos; replica string-backed racing gloves modelled on those worn by 1959 Le Mans-winning driver Carroll Shelby; replica 1959 race helmet; bespoke 2-piece luggage set to match interior trim; bespoke car cover in Aston Martin Racing Green and featuring white roundels with specific edition number.

The DBR1's proud genetic legacy is very much evident in the 2018 DBS Superleggera. The fastest and most powerful series production model in Aston Martin's multi-award winning range, this 211 mph, 715 bhp Super GT is an inspired combination of imperious performance and impeccable style.

Speaking of the 'DBS 59', Aston Martin vice president and chief marketing officer, Simon Sproule said: "When Aston Martin Cambridge expressed a desire to create a limited run of DBS Superleggeras inspired by the DBR1's famous Le Mans victory we knew it had to be something special. The soft metallic hue of the Aston Martin Racing Green paintwork is classy and timelessly beautiful; the level of thought and detailing is exceptional. My favourite element on the 'DBS 59' are the seat backs that feature fabric inspired by the DBR1 seat material, but there are countless touches that will intrigue and delight." **ART**



ABOVE One-off rally cars pay homage to the Jaguar XK 120, introduced in 1948

Jaguar creates two F-Type Convertible in 70 year celebration

JAGUAR has developed two F-Type Convertible rally cars, with design cues from the F-Type Chequered Flag Limited Edition, to continue its celebration of 70 years of sports car heritage since the XK 120 was revealed by Jaguar founder, Sir William Lyons, at the 1948 Earls Court Motor Show. It was the fastest production vehicle of its time and reaction to it was very positive, thanks to its striking design with swooping wings and long flowing lines.

The XK 120 was successful on both the road and the race track, completing the gruelling Alpine Rally unpenalised three years running from 1950 in the hands of Ian Appleyard and wife Pat – the daughter of Jaguar founder Sir William Lyons – for which they were awarded the coveted Coupé D'Or (Gold Cup). In 1951 the Appleyards and their XK 120 also won the 3,400 km-long, pan-European Tulip Rally and the 1953 RAC Rally of Great Britain – the first time outright winners were declared.

The one-off F-Type rally cars also pay homage to the legendary Jaguar XK 120 registered 'NUB 120' which, in the early 1950s in the hands of Ian Appleyard, completed three consecutive Alpine Rallies without incurring a single penalty point, and won the RAC and Tulip.

Both rally-specification F-Type Convertibles are powered by Jaguar's 300 ps 2.0-litre Ingenium 4-cylinder petrol engine. With modifications

overseen by Jaguar Design and Engineering, both cars were built to FIA specification, with comprehensively uprated brakes and suspension fitted alongside a protective rollcage, race-seats with six-point harness, bonnet-mounted light pod and fire extinguisher.

The rally F-Types feature upgrades to the brakes, suspension and drivetrain including the addition of grooved discs with four-piston callipers front and rear. Hand-built competition dampers and softer springs ensure the high-performance cars can be driven flat-out over rough rally stages. Three-way adjustable dampers allow the cars to be tuned for different surfaces and

feature spherical bearings for added precision. With motorsport-spec wheels and tyres specifically for use on gravel, a limited-slip differential improves power delivery on loose surfaces while a hydraulic handbrake helps drivers tackle hairpin bends.

The rally cars' livery takes design inspiration from the new F-Type Chequered Flag Limited Edition, which features a range of subtle exterior visual enhancements, including unique 20-inch Gloss Black wheels with a Diamond Turned finish and a Black Contrast roof on the Coupé. Inside, the luxurious Ebony Windsor Leather interior features Performance seats with embossed Chequered Flag headrests and a Dark Brushed Aluminium centre console trim finisher.

The celebratory models were put through their paces at Walters Arena rally stage, South Wales, to demonstrate their performance credentials and will now attend a series of Jaguar events over the next few months.

"The opportunity to design a rally car doesn't come along very often so I was fascinated to see how we could take our modern day sports car to a similar character," said Ian Callum, Jaguar director of design. "These models are a fitting tribute to the XK 120 and all the great Jaguar sports cars since its reveal 70 years ago, including the latest F-Type Chequered Flag Limited Edition." **HRT**



ABOVE With design cues from F-Type Chequered Flag Limited Edition, the 300 ps 2.0-litre rally cars feature bespoke FIA-spec modifications

SVRA breaks new ground with nationwide motorsport reunions

THE Sportscar Vintage Racing Association (SVRA) is to present motorsport reunions to celebrate iconic marques throughout the 2019 season. The idea was tested with a Corvair reunion at the Virginia International Raceway (VIR) weekend in September with outstanding results. The VIR event saw the largest number of racing Corvairs ever appearing at a single venue, and drew a record number of ticket-purchasing fans and automobile enthusiasts for its SVRA event. It also attracted new car owners to SVRA.

While motorsport reunions have traditionally been annual gatherings at single venues, SVRA is breaking new ground by showcasing such celebrations from coast-to-coast through the national platform of its 2019 schedule.

“Our vision since my first year with SVRA in 2012 was to move our sport from its dependency on entry fees as our primary revenue stream to focus on ticket sales and sponsorships,” said Tony Parella, SVRA president and CEO. “We have not raised the price of entry fees since 2012 while steadily growing our sponsors and the front gate. SVRA is moving into the realm of mainstream motorsports and this new programme is more evidence of that.”

Parella’s long-term vision is to reduce, and in some cases even eliminate, entry fees for car owners and teams. The reunion programme is expected to be particularly helpful to the “shade-tree” mechanics of vintage racing. These are people who prepare their own equipment with a passion for the celebration of revered marques and the camaraderie of vintage racers. The new programme will be an additional element to the established SVRA festival-style weekends fans have enjoyed over the last few years.

Every car owner entering the featured marques reunion will not only receive free entry, but also a reunion group

photo and Hero Cards to pass out to youngsters – or anyone desiring a photo and background on a car. The featured marques will be highlighted in the event posters and programmes. Free entry will entitle car owners to run their racers in two sessions with their normal SVRA run group on Friday and Saturday, as well as a 30-minute feature reunion race on Sunday. SVRA plans to expand the list of motorsports reunion marques in the future, including multiple marques in future race weekends.

The featured marques for the reunions are:

- Sebring – MG Reunion
- Road Atlanta – Early Porsche 356 / 911 Reunion
- Auto Club- Datsun Reunion
- Road America – Lola Reunion
- Laguna Seca – Historic Trans Am
- Lime Rock – 55 years of Mustang Reunion
- Mid-Ohio – Corvair Reunion
- Portland – BMW Reunion
- Brickyard – 50 years of American Formula Fords
- Watkins Glen – Triumph Reunion
- VIR – Alfa Romeo Reunion
- COTA – Ginetta Reunion

SVRA’s nationwide platform is at the heart of the organisation’s growth strategy. It is combined with the growing participation of legendary professional drivers and leveraging the high net worth demographic in the paddock for sponsorship attraction. This provides three pillars for business expansion. Top-brand companies that have joined the list of sponsors include Jaguar, Land Rover, Merrill Lynch, NetJets, Sunoco, and Mazda. Company officials report consistent annual triple-digit growth since 2012. **HRT**



ABOVE The SVRA meeting at VIR broke the record for the most Corvairs on track at the same time

Masters 2018 series winners announced



Pre-66 Gentlemen drivers
winner ~ Andy Wolfe



Pre-66 Touring car winners ~
Mike Gardiner / Andy Wolfe



Pre-66 FIA Historic
Sportscar winners ~ Keith
Ahlers / Billy Bellinger

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ABOVE Following FIVA's annual World Rally for cars in 2018, three further events in 2019 have been announced

FIVA to run three World Rallies in 2019

FOLLOWING the huge success of FIVA's annual World Rally for cars in 2018, held this year in the stunning rural scenery of Mid Wales, FIVA (the Fédération Internationale des Véhicules Anciens or international federation of historic vehicles) has announced there will be no fewer than three FIVA World Rallies in 2019 – two for cars and one for motorcycles.

All three of these events are open

to classic vehicle owners from around the world who enjoy driving their pride and joy, not just members of FIVA. The first event is the Austria Classic Rallye on 22-26 May, a 650 km regularity run that promises the spectacular scenery around Vienna, Burgenland, the Wachau and the Semmering region. It is open to all vehicles built up to 1980 with a valid FIVA ID Card.

The second event is the FIVA World Motorcycle Rally in Croatia on 27-30 June. This is a touring event for a huge range of historic motorcycles that will cover around 150 km per day, going through northwest Croatia, the coastal region of Slovenia, and Trieste in northeast Italy. The event is run by HROS – the Croatian Oldtimer Association.

The third event is the FIVA World Rally, Andorra on 1-7 July. This is a 500 km touring event visiting Andorra and Spain, and featuring a concours d'elegance and static show. The highlight will be the dynamic driving experience high in the Pyrenees mountains. Cars must be at least 30 years old to take part.

"While the three World Rallies that FIVA is holding in 2019 are enormously varied, one thing they all have in common is spectacular scenery," said FIVA president Patrick Rollet. "Austria, Croatia, Andorra... it's hard to think of three more enticing European destinations for a few days of classic motoring, companionship and shared fun." **HRT**

HSCC celebrates 50 years of F5000

THE Historic Sports Car Club will celebrate 50 years of Formula 5000 in a display at Autosport International at the National Exhibition Centre (NEC) Birmingham on 10-13 January. The Club will mark the 50th anniversary of the UK debut of the spectacular category with a showcase six-car display of the mighty 5-litre single-seaters. Cars from Lola, McLaren, Surtees, Gurney and McRae will be on show, as now raced in the Club's Derek Bell Trophy race series. A number of drivers from the period are expected to be at the show in January.

Based on the American Formula A category, Formula 5000 arrived in the UK for the 1969 season and in-period Formula 5000 rivalled Formula 1 cars for speed. The F5000 cars joined the grid for the traditional early season non-championship F1 races like the

Silverstone International Trophy and the Brands Hatch Race of Champions. Notable F5000 racers included Peter Gethin, Mike Hailwood, Mario Andretti, Rene Arnoux, Patrick Tambay, Alan Jones and Derek Bell.

Formula 5000 was introduced to the UK by John Webb from Brands Hatch and the inaugural race was at Oulton Park over the 1969 Easter weekend. At its peak in the early 1970s, Formula 5000 was active in the US, Canada, New Zealand, Australia and Europe.

The HSCC display at Autosport International will feature six cars owned and raced by Club members including the ex-Mike Hailwood 1971 Surtees TS8 of Chris Atkinson and the 1970 McLaren M10B raced by Peter Gethin for Sid Taylor's team. The 1969 ex-Horst Kroll Lola T142, now raced by Adam

Simmonds, will represent the early cars, while the 1975 Lola T400, now raced successfully by Michael Lyons in the HSCC's Derek Bell Trophy, is one of the ultimate F5000 designs.

Grahame White, CEO of the HSCC, said: "Formula 5000 played host to so many iconic names that we recognise to this day. It was a category which came to the UK in 1969 and thrilled fans with some extraordinary works of engineering and raw power. These cars now race in our Derek Bell Trophy series and continue to make a fabulous spectacle." **HRT**



ABOVE A selection of Formula 5000 cars will be on display at Autosport International on 10-13 January

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ABOVE Babs, the land speed record car that remained buried in the Pendine Sands for decades will be on show at the National Motor Museum, Beaulieu until Easter

Babs comes to Beaulieu to celebrate Chitty Chitty Bang Bang 50th anniversary

THE iconic Land Speed Record breaker Babs that inspired Chitty Chitty Bang Bang has joined the Chitty Chitty Bang Bang 50 years exhibition at the National Motor Museum, Beaulieu until Easter. It is usually on display at the Pendine Museum of Speed in South Wales.

Known as Chitty Bang Bang IV, it was the creation of racing driver Count Louis Zborowski and inspired Ian Fleming's Chitty Chitty Bang Bang story.

Babs joins an original screen Chitty Chitty Bang Bang, the Humber 8 hp driven by Truly Scrumptious, the original Child Catcher carriage, Coggins Garage recreated in the museum to house the inventive machines of Rowland Emmett, and a replica of Grandpa Potts' hut in Beaulieu's Chitty Chitty Bang Bang

50 years which celebrates the film's golden anniversary.

Babs started life in 1923 as the Higham Special and was even more extreme in its design than the Count's previous three Chittys. When he died a year later, it was bought for £125 by talented racing driver John Godfrey Parry-Thomas who re-christened it Babs. After boosting power to 500 bhp by adding new pistons to its American Liberty V12 aeroplane engine, Parry-Thomas beat the Land Speed Record by more than 20 mph by reaching 171 mph.

When Sir Malcolm Campbell raised the record again the following year, Parry-Thomas made an attempt to regain the title which ended in disaster and he was killed. The wrecked car was buried at Pendine Sands, where it remained for more than 40 years.

In 1969 Babs was excavated by university lecturer and car restorer Owen Wyn Owen, who discovered that the car was not as badly decayed as expected and embarked on bringing it back to its former glory. Today, the fully-restored Babs is a fitting tribute to the aeroplane-engined racing cars and their fearless drivers whose exploits inspired Ian Fleming.

Other Chitty memorabilia on show at Beaulieu includes the leather bonnet strap from the Count's original Mercedes Chitty, a solid silver Chitty model bought for producer Cubby Broccoli by his wife Dana and original film concept art by Sir Ken Adam, storyboard watercolour artwork by Robert Laing and technical drawings by Peter Lamont which have never been previously exhibited. **HRT**

Masters returns to Donington

THE Masters Historic Racing organisation will return to Donington Park on 8-9 June 2019, for its first event in three years at the East Midlands circuit. The event will feature a three-hour race for cars eligible for the Spa Classic Six Hours, meaning a cavalcade of Ford GT40s, Mustangs,

Jaguars E Types, and Aston Martins, Porsches and Lotuses are likely to be in attendance.

The FIA Masters Historic Sports Car series will also have a non-championship race, featuring a stunning grid of Le Mans-style sports cars and Group 4 period cars from 1962

to 1974, with further action to come from the Masters Pre-66 Touring Cars, which will feature anything from V8 monsters down to the humble Mini.

The festival will also feature the Dutch GT&TC series for cars from 1966-1981, as well as guest races from the Historic Sports Car Club. **HRT**



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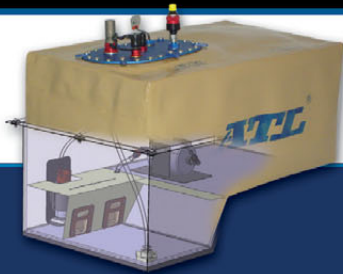
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ABOVE Pre-66 Minis will be competing for the Betty Richmond Trophy next April at Goodwood at the 77th Members' Meeting

Pre-66 Minis to race at Goodwood

THE Betty Richmond Trophy for pre-66 Mini saloons and variants has been added to the 77th Members' Meeting schedule at Goodwood on 6-7 April. Celebrating 60 years since the Mini began capturing the hearts of the nation, this one-make race is certain to showcase some flat-out racing and some of the closest battles of the weekend.

The race is named after the current Duke's grandmother, Elizabeth 'Betty'

Richmond. Her husband Frederick 'Freddie' Gordon-Lennox, the 9th Duke of Richmond, was passionate about cars and planes, and was himself a successful racing driver. After World War II, it was Freddie that turned the perimeter road around RAF Westhampnett into the Goodwood Motor Circuit, which officially opened in 1948.

Freddie was on good terms with Alec Issigonis, the designer of the

original Mini, and in 1959 managed to take delivery of one of the first Minis produced. The present Duke remembers the car well, stating: "It was a bright-red Austin Seven with a steering wheel as big as the car! My grandfather loved it, he was fascinated by clever, light, small-engined cars. It's where his love for Lancia came from. But Betty loved the Mini even more and used to go hurtling around the Estate in it, to the extent that my grandfather wouldn't let her venture outside the park.

"Thinking back, Betty was really the one responsible for my love of motorsport. She used to buy books on cars, which she then got my grandfather to give me. She also encouraged my grandfather to spend time with me at the circuit, taking me round to see the cars and meet the drivers. It was an eight-year old's dream.

"It is, therefore, entirely fitting to name this new race at the 77th Members' Meeting after my grandmother who is really the person, more than anyone, who got me hooked on cars, bikes and racing." **HRT**

Heritage Engineering apprenticeship scheme given a boost

CAMBRIDGE & Counties Bank, which offers finance for classic car purchases, has announced it is to become official 'Finance Partner' to the Federation of Historic Vehicle Clubs (FBHVC). The partnership will see the bank, which launched its specialist classic car division in the spring, support the FBHVC's Heritage Engineering apprenticeship scheme, held at the Heritage Skills Academy at Bicester Heritage. It will provide a £10,000 bursary which will be made available via an application process to help with travel and accommodation.

However, the support is not just financial as Cambridge & Counties Bank will also be designing and delivering the business modules within the curriculum as well. Managers and key subject experts from within the bank will be passing on training to ensure the

apprentices are fully equipped with the skills and knowledge they need to run a business and manage finances.

The Heritage Skills Academy brings together experts from across the restoration industry who are committed to teaching the skills required to preserve and restore pre and post-war engineering heritage. The course is the only one of its kind accredited by the Office of Qualifications and Examinations (OFQUAL). Students that complete the full term will leave with a nationally recognised Advanced Diploma in Heritage Engineering with an option to specialise for a further year. The course covers a range of sectors, including classic motor vehicles, aviation, marine and steam. The main focus is on students aged between 16 and 18 years of age and the Academy is supported by the

Government Trailblazer scheme.

"It is vitally important that we nurture and support skills for the future," said Mike Kirsopp, CEO of Cambridge & Counties Bank. "Apprentices entering the world of heritage engineering will likely be working within small businesses or a business of their own and so equipping them with the understanding of finance, cash flow, accounting and asset management will be critical to their future success. We have the expertise and passion here at Cambridge & Counties Bank to support these students and play our part in preserving the future for historic vehicles."

"Having Cambridge & Counties Bank as our finance partner will help the federation in its work to champion the cause of transport heritage in the UK," said David Whale, FBHVC chairman. "The bank's approach to supporting our students through a balance of commercial assistance and the offer of training and apprenticeships reflects their obvious commitment to supporting the classic car sector and the thousands of skilled jobs it creates." **HRT**



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THE CAR THAT GAVE RED BULL WINGS

Hal Ridge reports on the restoration of the Sauber C14 that marked the start of Red Bull's remarkable F1 adventure

ENERGY drink giant Red Bull rocked onto the Formula 1 grid for the first time as a team in its own right in March 2005, at the Australian Grand Prix. But a decade earlier the Austrian firm's colours had adorned a grand prix racer in its first title-sponsorship livery on the Sauber C14, in 1995.

Designed by technical director Andre de Cortanze and design chief Leo Ress, the C14 was the car with which the Swiss team achieved its first podium in Formula 1. That reward came in its third top-flight campaign, when German Heinz-Harald Frentzen finished third at Monza.

Frentzen was partnered by two drivers across the season, with fellow Mercedes Junior Karl Wendlinger being replaced

the last two races, in the hope that he would rediscover confidence and form, but to little avail.

If the drivers were struggling to come to terms with the horrors of the previous season, the cars were also very different too as the FIA sought to reduce escalating speeds. The 1995 regulations had dictated a drop in engine capacity to three litres (down from 3.5). Having used an Ilmor Mercedes 217B 3.5 V10 engine in the previous campaign, Sauber's tie up with Red Bull was combined with being the only team to have official works support from Ford, and as such ran an ECA Zetec-R 3.0 V8.

In an era where CAD (computer-aided design) was still a pipe dream and cars were sketched by hand, with

“A lot of good, old-school characters wanted to help revive such a car. Many components arrived without any charge”

by Jean-Christophe Boullion from the fifth round. The Frenchman was blessed with raw pace but the team's ties with Wendlinger ran deep following the Monaco accident that had left him in a coma, fighting for his life, the previous season. The Austrian was reinstated for

communication between racetrack and factory made via handwritten telefax, the use of paddle shift on the C14 was state-of-the-art. But, replicating the game-changing gearshift system was just one of the myriad challenges faced by Reinhard Koppe's Automotive



Composite Koppe firm when it took on the restoration of an ex-Wendlinger C14 in 2016.

Having been used for displays and exhibitions, including being driven by Wendlinger in the re-opening of the Red Bull Ring in 2014, the C14 in question, chassis 95.C14.04, was bought by its owner with significant work to do, with the intention of bringing it back to life. It had been entrusted to a firm in Essex, England to have work undertaken. Two years later, with the engine vaguely positioned and an exhaust fitted but little else, the car was subsequently transported to Koppe's base in Schwanberg, Austria.



ABOVE Karl Wendlinger at Goodwood, reunited with the car in which he ended his F1 career more than 20 years ago

Jeff Bloxham



ABOVE The C14 is dismantled at Koppe's base in Austria, after two years of unsuccessful effort to have the car restored in the UK

BAD SHAPE

“The whole car was in bad shape when it arrived, nothing was finished and it was held together with cable-ties and tape,” explains Koppe. “There was melted wiring and missing bolts all over the chassis and there were no new parts anywhere. The ECU (Pectel MQ12) used firmware from 2007, so it would not have been possible to even select a gear, and anyway the gears and dogs were worn out.

“Parts had been used that were not to F1 standard with regards to safety, the main sensors were missing or did not work, the engine was leaking oil and ▶

was out of line with the gearbox. The biggest challenge was maybe that there was no literature at all, no documents, no spares or manuals.”

It's commonly known that in a niche sport like motor racing, it's often who you know as much as what you know that counts. Knowing the head of production at the Sauber F1 team, Ernst Keller, having worked together in the World Sportscar Championship in the '80s, gave Koppe a significant leg-up in the C14's restoration. "Ernst worked as the chief mechanic on this car when it raced. He's a very good man and it didn't take us long to persuade him to join us in my workshop – that was a big help," he says.

BLANK SHEET

By their very nature, Formula 1 cars are not designed to be operated by private outfits. Nevertheless, with a relatively blank sheet, Koppe's brief was to make the car as easy to service as possible.



ABOVE The engine was leaking oil and was out of line with the gearbox

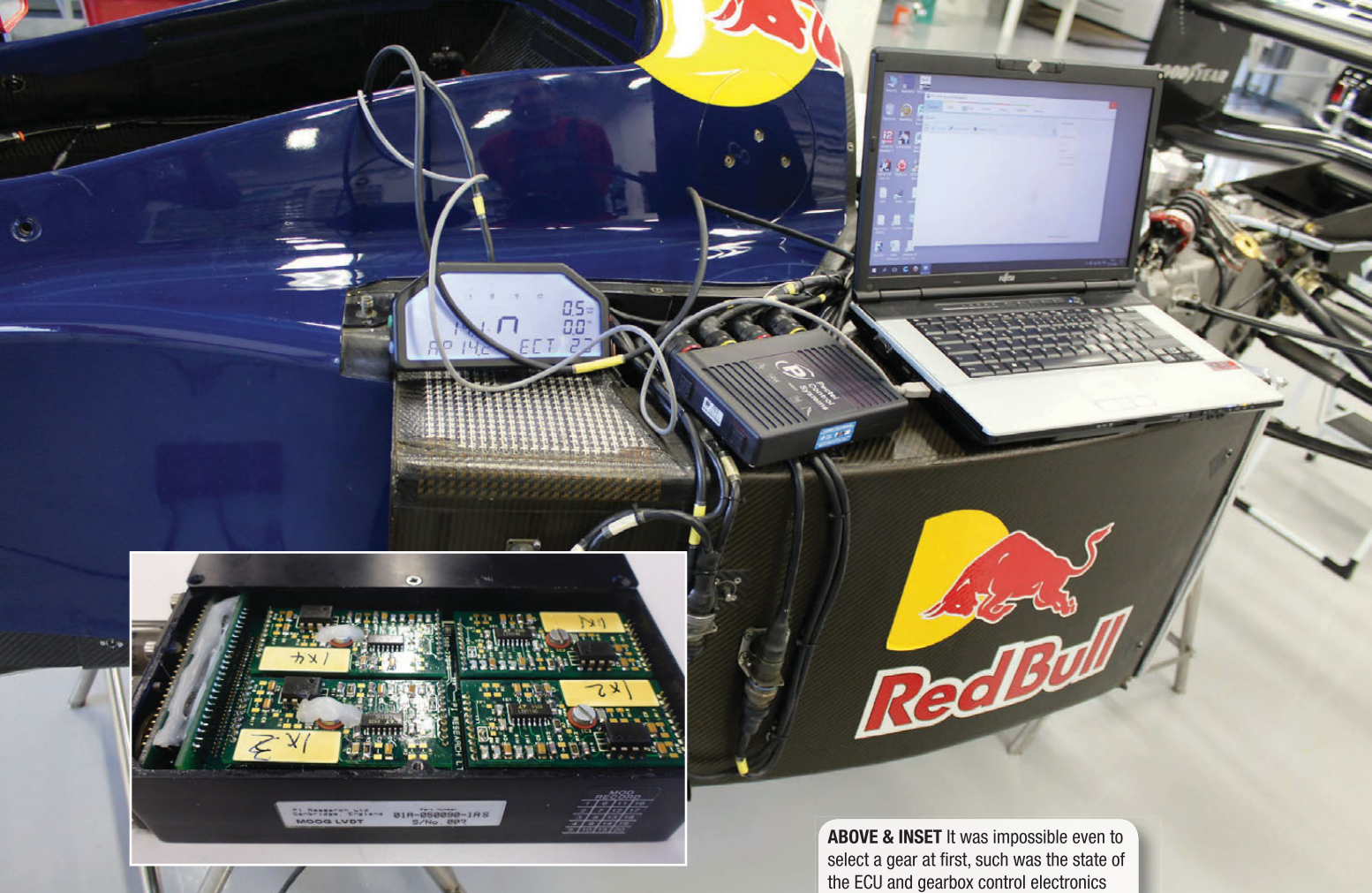
In period, the C14's state-of-the-art gearshift strategy for its six-speed Xtrac transmission used a MOOG hydraulic servo valve, exclusively fabricated for Sauber to control each shift in conjunction with an LVDT (linear variable differential transformer). Fundamentally, two low-amp wires were responsible for each gearchange and for holding each gear in position.

"The big challenge was to have a proper gear shift, using an available GCU (gearbox control unit) and MOOG controller, to have a simple dash with a simple logging system and to have a nice hydraulic system too so it was easier to operate," says Koppe.

The car's carbon monocoque and bodywork (with the nosecone that had been used from the San Marino Grand



ABOVE The car was in poor condition when it arrived. As work progressed, the pile of discarded components grew larger



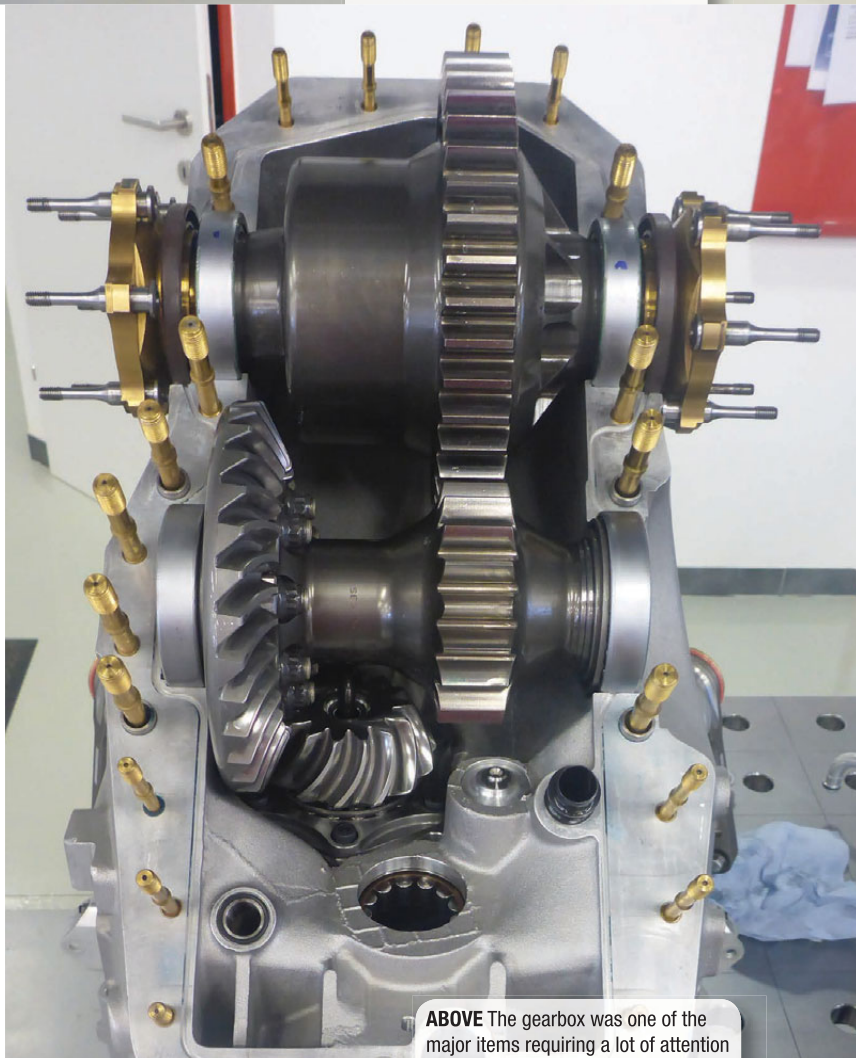
ABOVE & INSET It was impossible even to select a gear at first, such was the state of the ECU and gearbox control electronics

Prix, raised up with two supports from the front wing, having replaced the low, droop nose with which the car had been launched) required little work other than to repair some of the interior carbon panels. Elsewhere, a comprehensive nut and bolt update was undertaken, with rod-end joints and bearings replaced, and titanium bolts made to replace all of the old steel ones. Otherwise, the double-wishbone pushrod suspension, with Sachs dampers, four-pot Brembo brake callipers and carbon discs, was unchanged.

WORKS ENGINE

Where most work was required though was in the rebuild and operation of the engine, air system for the valvetrain, electronics, gearbox and hydraulics.

In 1995, Sauber had exclusive use of V8 ECA Zetec-R engines, while other teams (such as Minardi and Simtek) ran a different variant of the motor, with various versions of the ED name. Those customers had around 30 horsepower less than the works version. With a 90-degree V configuration, the longitudinally-mounted works ECA has a bore of 94 mm and stroke of 53.9 mm. It initially produced in the region of 600 horsepower, before being developed in stages and eventually ▶



ABOVE The gearbox was one of the major items requiring a lot of attention

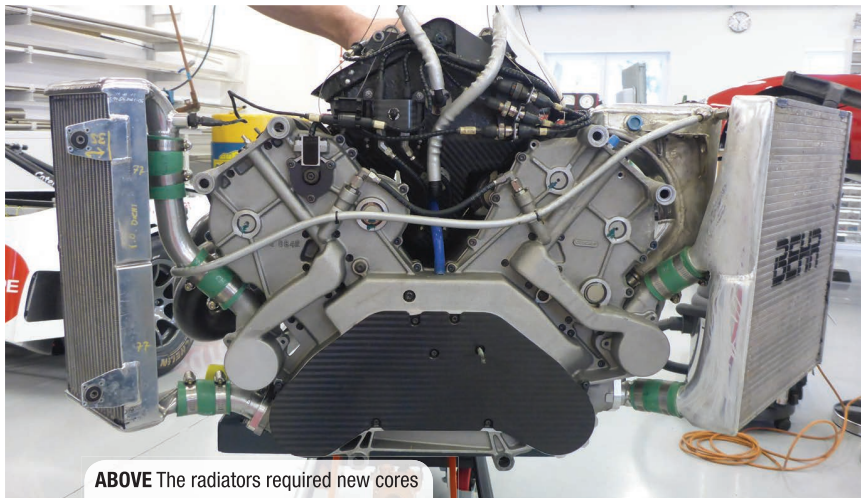


had 630 horsepower at 14,000 RPM.

Although already assembled when it arrived at Koppe's base, the engine did need an overhaul. "We had to take it out, and fit new O-rings and seals everywhere," says Koppe. "We had to sort the air pressure for the valvetrain, get new cores for the water radiator and make new fuel lines and some brackets. But, modifying the loom to accept the sensors and connectors was one of the big jobs. When we got the car the only cockpit function was ignition on and the start button. No CAN (controlled area network) communication and no logging function. When we looked at the software data we found the mapping was very poor."

ALARMS INSTALLED

In a bid to make the reconfigured C14 as user-friendly as possible, additional sensors were built into the new loom by Koppe employee Mario Penner to incorporate a safety net and to enable variable alarms. "We had to make sure



ABOVE The radiators required new cores

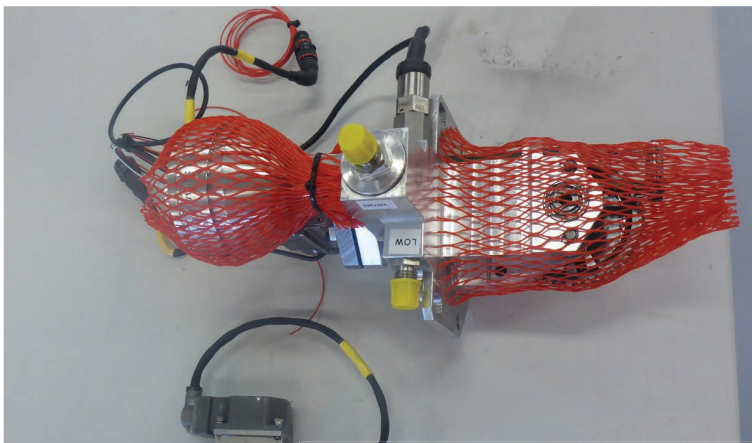
the car is as easy to use as possible in the future for the customer. That meant things like a map switch for the cold start and adjustable traction control using a 4G 3-axis sensor," says Koppe.

In total, seven different software tools were used on the C14 in its reconstruction. Work on the gearshift system started with fitting more commonly-used and available paddles to the back of the Momo steering wheel than the items used in period. "The big challenge was to make the gear change work with the low current MOOG valve and to find a good result

for communication between all the functions required in the processors," says Koppe.

Data engineer Karim Antaki was brought onboard to work with the Pectel MQ12 ECU, which has a full closed-loop gearshift strategy inbuilt. Antaki made several visits to both Cosworth and Shiftec in England during the six-month restoration of the car, while Marc Amblard from Shiftec, renowned in the industry for his knowledge of such systems, was instrumental in the process.

A decision was taken to reduce the maximum RPM to 12,600 RPM for ▶



CLOCKWISE FROM ABOVE A new gearshift mechanism, paddles, gear ratios and seat were all on the wish-list as the work came together





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reliability, and as such gear ratios were designed and custom-made by a firm in Italy, before the 'box was rebuilt. "It was a big job and wouldn't have been possible without many people," admits Koppe. "Even for such a strange project, I was very impressed that there have been many suppliers around the world that were really proud of being able to help us – a lot of good characters from the old school that wanted to help revive such a race car. I was surprised too that many components arrived without any charge."

With the C14 in one piece and running, and after days of systems checks had taken place, with Keller's assistance the

“ The ECU used firmware from 2007; it would not have been possible to even select a gear”

car was set up for corner weights and ride height as per its original base setup data sheet before its first test in April 2017 at Spielberg's Red Bull Ring.

Early laps were used to make corrections to the mapping, before the last 10 of the 22 tours completed were undertaken by Wendlinger – returning to the seat he frequented over 20 years earlier – under full load. "The engine didn't have the right performance that day but there was big satisfaction to see

that everything worked," says Koppe.

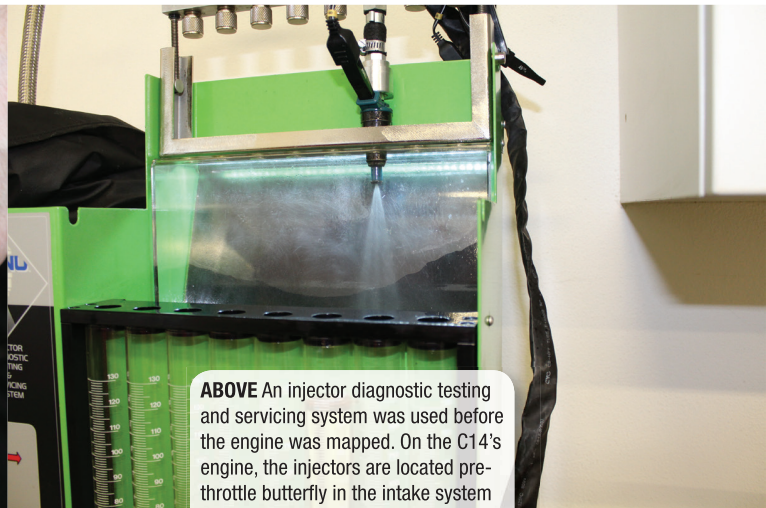
"Except for one interrupted CAN on the last lap, nothing at all gave troubles."

Following more fine-tuning, the car was run again in Hungary and Austria, before Wendlinger drove it at the Goodwood Festival of Speed in 2017.

"I drove the car the first time they tried to fix it, at the first Red Bull Ring Grand Prix in 2014. It did not really work because there was some problem with the fuel pump. I think I also drove it once



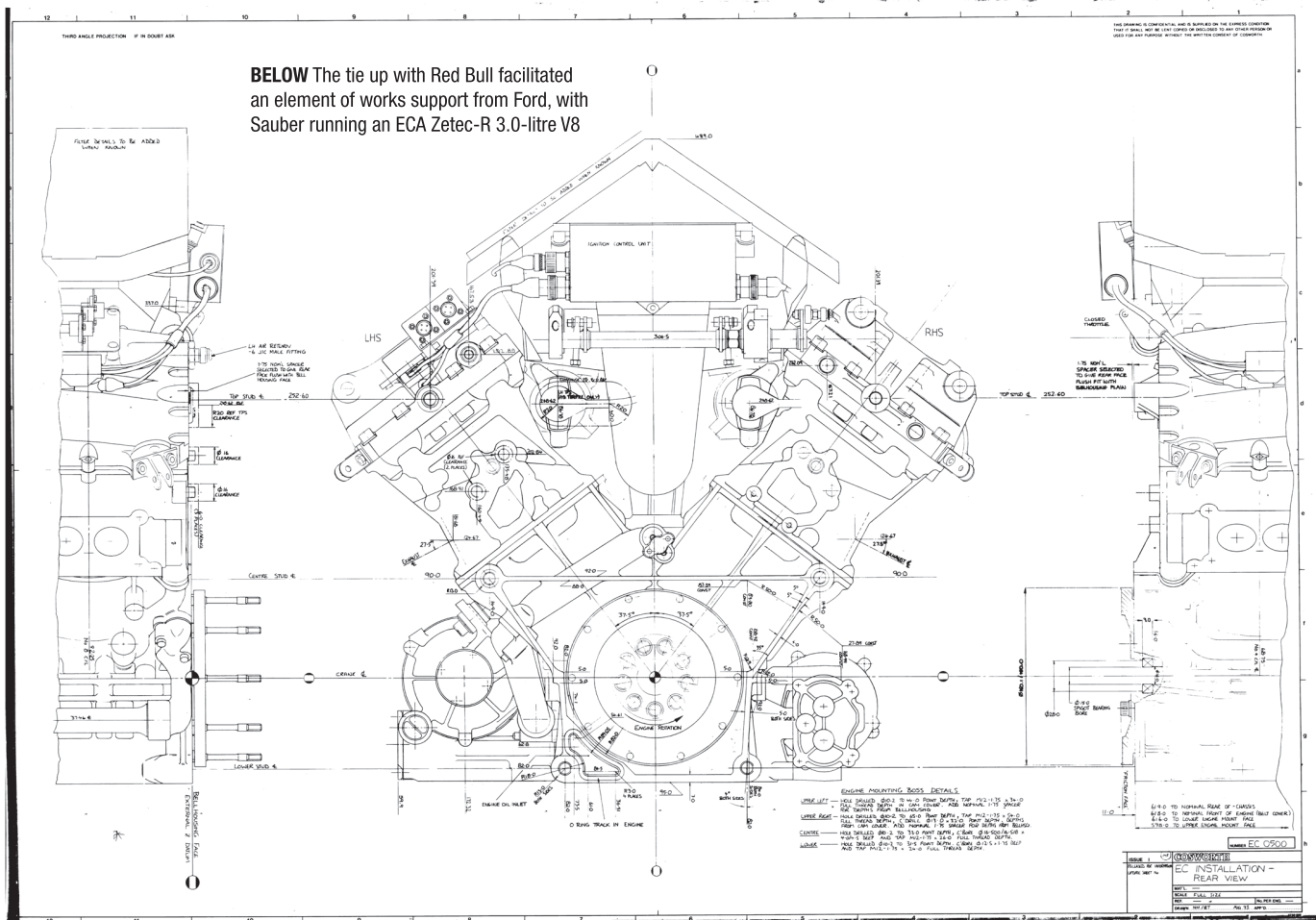
ABOVE Tackling the entire rewiring of a historic F1 car is no mean feat



ABOVE An injector diagnostic testing and servicing system was used before the engine was mapped. On the C14's engine, the injectors are located pre-throttle butterfly in the intake system



ABOVE The C14 at Goodwood. Today, we think of Red Bull for its string of four double world titles, but when the C14 was conceived just staying in business for the full season was regarded as a major success for the team



BELOW The tie up with Red Bull facilitated an element of works support from Ford, with Sauber running an ECA Zetec-R 3.0-litre V8

more before Reinhard fixed it,” explains Wendlinger. “It was a nice experience to get back into it [post Koppe’s restoration], but it’s always a question of how fast you go. The speed I could reach even at the Red Bull Ring with slick tyres was by far not what we did in 1995, but still it was a nice comeback in the car and nice to refresh the memories again.”

REUNITED – WITH CAR HE HATED!

The Austrian, who today still competes in GT racing, says the experience of driving the C14 took him back to a time of more “natural” driving: “Already at that time there was good engine power compared with the weight of the car. It was good, it had good speed and good acceleration, but compared to the modern Formula 1 cars, there was no adjustment for differentials, everything was fixed and we could not change these on the steering wheel at all, [our job] was just to drive. Everything is so much further developed now – the 1995 F1 car is really an old-timer but for me it was nice to sit in and drive it even if it was just promotional events. But of course, you’re not really driving on the limit.”

Wendlinger admits to having mixed emotions about his last term at motor racing’s peak, not least because of his physical condition following his 1994 Monaco shunt, but also due to the C14’s specific handling characteristics. “After the crash I had in 1994 I didn’t feel comfortable in this car,” he reveals. “There was the rule change back to a 3.0-litre engine and also the aerodynamics were cut down. This car was very loose turning in, and in the personal condition I was in, I did not feel very well with this car. I didn’t like to

drive it: there was understeer mid-corner and exiting, and I was not competitive.

“I felt the 1994 car [the C13] was a nice handling car, but this was quite difficult to drive in the first four races I did that year, at least with how I was feeling. Then they developed it and changed it a little bit during the season, but for me then it was over more or less.”

Today, the car, which is believed to be the only C14 sold by Sauber and in working condition, is housed in the welcome centre at the Red Bull Ring, poised for action. **HRT**



ABOVE Exhaustive systems checks were conducted before the car was finally ready for action

THE SPIRIT OF THE SPECIAL LIVES ON

Chris Pickering examines an extraordinary 1920s-style car that suggests the glorious tradition of special builders is alive and well

MOTOR racing has always attracted a particularly ingenious breed of home inventors. In America it was known as hot rodding. In Britain – particularly in the twenties and thirties – it was referred to as special building. And nowhere were these specials more prevalent or more successful than the hugely popular hillclimb events that took place at venues like Prescott and Shelsley Walsh.

A small army of homebuilt machines competed at these events, regularly upstaging the well-known brands. Specials became part and parcel of British motorsport, establishing a tradition that survives to this day in the vintage racing scene.

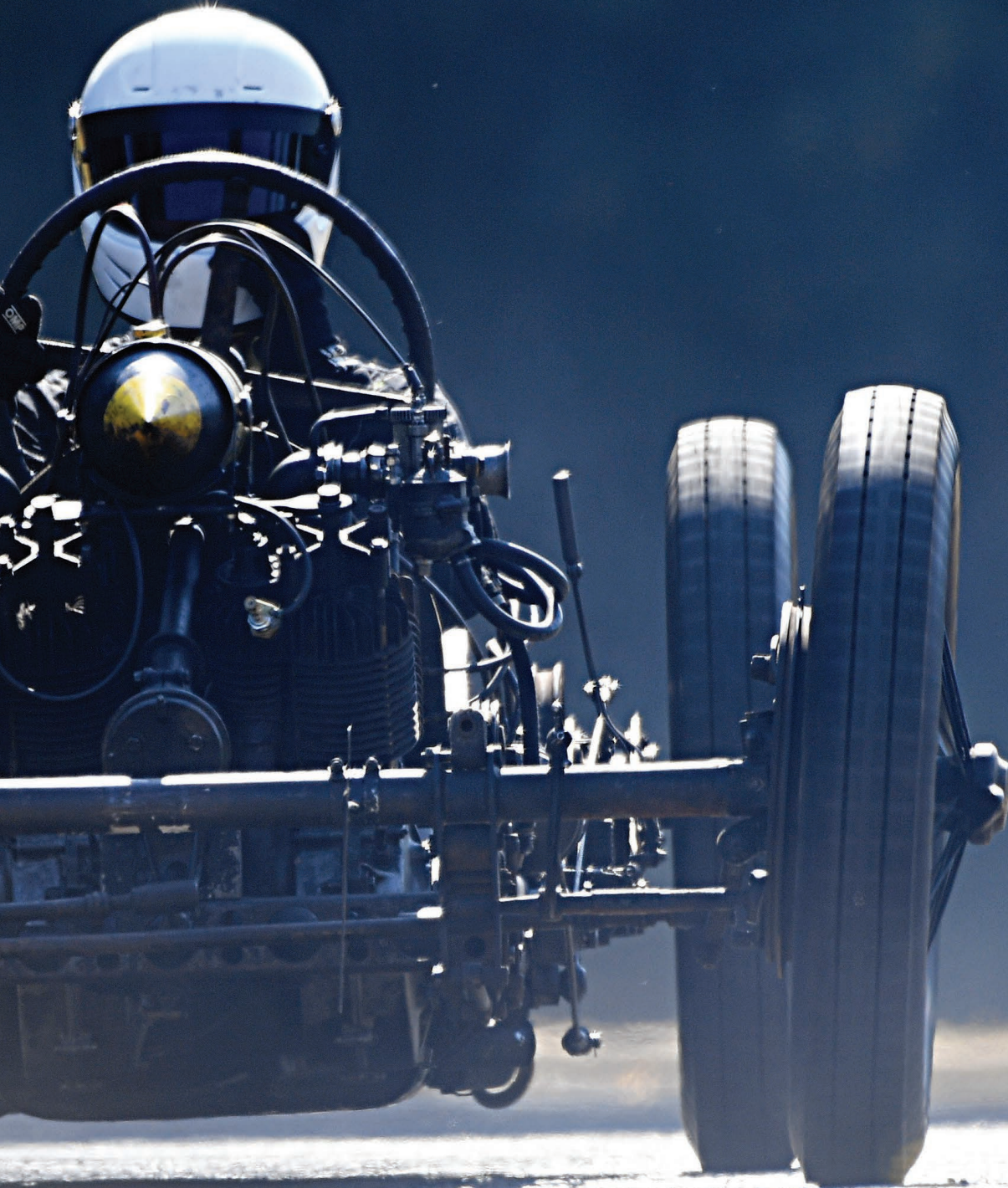
Duncan Pittaway's gloriously mad twin-engined hillclimb special, known as the Hornet, is a continuation of this grand tradition. It draws on cars like the Bloody Mary Special, built in 1929 by John Bolster, the founding technical editor of *Autosport* and namesake for the Bolster Cup at Goodwood that now celebrates these weird and wonderful machines.

These days, the Hornet is looked after by vintage racer Tim Harrison. He developed a fascination with this mythical machine at an early age and eventually, egged on by friends at a race meeting, plucked up the courage to approach Pittaway and ask if he could borrow it.

"I thought the worst thing he could say was no," recalls Harrison. "Duncan was very keen to see the car competing again and the following weekend my friend [and fellow racer] Eddie Williams and I found ourselves driving over with a trailer to pick it up."

Since then he's become the car's unofficial custodian, slowly getting to grips with its quirks and delivering some memorable performances along the way. ►





ABOVE The Hornet, a gloriously mad twin-engined creation for hillclimbs, continues the special builder tradition

CHAINS AND DOGS

The Hornet began to take shape in the late eighties, put together in a small terraced house that Pittaway was renovating at the time. True to the spirit of the original Shelsley specials, it was to be something of a bitsa, based loosely around a set of GN running gear. The chassis is an early twenties Citroën item that was discovered in a hedge in France. This was promptly shortened, narrowed and inverted to allow the GN-based rear axle to sit above the line of the chassis tubes.

The JAP vee twin was the default engine choice for cars like the Bloody Mary Special, which used the same twin-engined configuration as the Hornet. However, with these becoming an increasingly rare commodity the decision was taken to use a pair of Harley Davidson units instead. These sit on a detachable frame, which slides into the chassis along the main rails. Each has a one-to-one ratio chain drive onto a shared cross shaft. From there, another chain transfers the drive back to a second cross shaft, via a clutch mounted on the sprocket.

“ A continual thirst for development – with a generous dose of creativity and perhaps just a dash of madness ”

“It’s a period Harley Davidson clutch, although it’s now running carbon graphite friction plates,” explains Harrison. “You expect it to be quite brutal, but it’s actually relatively user-friendly. You slowly let the clutch out and there’s this odd sensation of the car gliding away smoothly, yet suddenly going very quickly.”

The rear half of the transmission is similar in concept to a GN or Frazer Nash, except here it’s been split into two stages: the first two ratios are provided by a pair of chains running back to yet another cross shaft, with dog clutches used to control their engagement. Slide the dogs left and the first chain engages, giving you one ratio; slide them to the right and the second chain takes over. From there,

the process is effectively repeated with two more chains running either side of the driver’s seat to the (solid) back axle. “The location of the chains is somewhat disconcerting the first time you drive it, but I’m reliably informed they do just drop to the ground if one does break,” Harrison notes.

Switching between the various chains and sprockets provides a total of four different gearbox ratios, with an ingenious linkage used to provide a conventional H-gate shift pattern. This mechanism comes from the fertile mind of Mark Walker (a revered special builder himself and owner of the 200HP Darracq that has previously graced these pages). It uses a series of bell cranks to translate the lateral movement to one set of dogs, while the longitudinal movement controls the other. It’s delightfully simple, with a well-oiled clack as the mechanism shifts from one ratio to the next.

“One of the advantages of this configuration is that you can change gear without going through neutral,” notes Harrison. “For instance, when you’re coming into the roundabout at Chateau Impney it’s possible to go

straight from third to first, providing you match the revs correctly. The only downside [of the two-stage layout] is that it doubles the risk of going dog-to-dog if you’re changing both shafts at once.”

The original Citroën chassis would have used a conventional shaft-driven gearbox and back axle, so all the cross shafts sit in bespoke aluminium bearing carriers, which are bolted into the chassis. Each mounting hole is slotted to allow the chain tension to be adjusted, as are the engine mounts.

A TALE OF TWO TWINS

While the Hornet’s intriguing transmission setup is largely hidden from view, you can’t fail to spot the two

Harley Davidson vee twins sitting on the front of the chassis. These are JD-Series engines from the mid-1920s, over-bored to around 1,275 cc each, giving the car a total capacity of 2,550 cc.

The ancestry of these engines goes right back to an atmospheric inlet design produced in the early 1900s and they still feature an inlet-over-exhaust valve arrangement as a relic of that period. The advantages of this approach are that it allows the intake valve to occupy a huge area, plus it places the spark plug in an ideal position to ignite



the mixture. (Modern NGK iridium spark plugs are used, making the engine more responsive and easier to start, with a homemade adaptor that allows them to fit into the vast holes drilled for the 1920s originals.)

By the time the JD-Series came along, Harley Davidson had switched to mechanical valve actuation on both sides. This uses a relatively conventional cam-in-block configuration, albeit with the exhaust valves driven direct from the cam – their stems poking out of the crankcase – while a pair of

exposed pushrods reaches up to the intake rockers. There's a slightly steam punk feel to the whole design with its workings laid bare.

"It's a really cool engine," comments Harrison. "If you take the timing cover off there's a lovely series of gears going from the cam up to the magneto at the back. They had things like drilled connecting rods from the factory and they're even relatively oil-tight."

The JD-Series engines use a monobloc design (with the cylinder heads and barrels integrated into one

casting) and inside each combustion chamber lies what's known as a Ricardo chip. These removable inserts were an early attempt to promote a swirl motion inside the combustion chamber, originally conceived by Harry Ricardo, whose future work would include everything from the Alfa Romeo Tipo 163 V16 to the De Havilland Mosquito. Their presence in the top of the cylinder also helps to increase the compression ratio, although this is a relative term, bearing in mind that it started off at something like 4.5:1. ▶

BELOW With holes everywhere, it's as if an army of giant, ravenous mice have attacked





ABOVE The basis of the Hornet's chassis is an early twenties Citroën item, discovered in a hedge in France

Originally, the motorcycle engines would have run on American-made Linkert carburetors, but the car now uses Amal GP items. Following common practice, these have been fitted with SU float chambers, which allow the mixture to be adjusted relatively easily; the higher the level in the float chamber, the more the main jet will be submerged and the richer the mixture.

The Hornet had started off running on petrol using a set of SU carburetors. More recently it has switched to methanol, but things haven't always gone quite to plan. Initially, the rough running was attributed to timing (methanol engines typically run around 10 degrees extra advance relative to their petrol counterparts). Eventually, however, the problem was traced to jets and needles set up for running on petrol.

"We were warming up at Prescott one day and someone came over and commented that the engines sounded like they were running lean," recalls Harrison. "We didn't have any other jets, so he promptly came back with a pistol drill and bored them out to 3.5 mm. Ever since then it's run sweetly."

The fuel system is pressurised by the torpedo-shaped air tank mounted above the engines. This is rumoured to



ABOVE A 48 mm socket is used as a starter drive

have started life as a fire extinguisher and now gets replenished using a hand pump modified from a garden sprayer. The same arrangement provides pressurised engine lubrication in place of the gravity-fed system found on the original motorcycles. Typically, this is pumped once before the start on a hillclimb, Harrison explains, or whenever a decent-length straight presents itself in a circuit race.

A BIG BANG

Vee twin-engined cars are not an uncommon sight in vintage racing circles. Most, however, use the ubiquitous JAP engines. These were championship-winning grass track motorcycle engines well into the

1970s and continue to be developed for vintage racing today, putting the Hornet's Harley Davidson engines at something of a disadvantage.

"The main thing the Harley engines lack in comparison to the JAPs is development," notes Harrison. "The JAP engine has been continually raced on two, three and four wheels since the twenties and they're making huge power now. In the States, the JD-Series Harley engines are still raced in motorcycles, where they make a lot of power, but they've never had quite the same amount of development. I think they're probably slightly more reliable, though, because they're not quite so highly strung."

Of course, like most classic motorcycle engines, the Harleys are air-cooled. ►

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In general, this simple, lightweight approach works very well, but it's not without its challenges, particularly when you have two of them running flat out beside each other.

"They do get hot," comments Harrison. "There's an inlet leak on there currently that's causing a huge disparity between the cylinders. We used a laser thermometer to measure the temperatures at a recent event and the back cylinder on the left hand side was 200 deg C hotter than the other three. It was around 420 deg C and I'm told aluminium alloys can start to melt at about 450 deg C!"

The engines are run in a 'big bang' configuration, with each of the number-one cylinders firing at the same time. This reduces the load on the chains, compared to having one engine firing while the other is still on its compression stroke.

"They essentially work as one big vee twin, but getting them to fire at the same time can be quite difficult," notes Harrison. "There's a cable-operated



ABOVE Everything on the car is drilled. Even the brake shoes have holes in them

timing adjustment for each engine with a turnbuckle on it. We literally just watch the points while turning the engines over by hand to see when they're opening."

Harrison has since developed a novel technique to check that the engines are indeed firing at the same time. He removes one spark plug from each engine and films them using the slow

motion setting on his mobile phone while the whole assembly is turned over using a starter motor. It's an ingeniously simple 21st century approach to this rather unusual problem.

CHASSIS

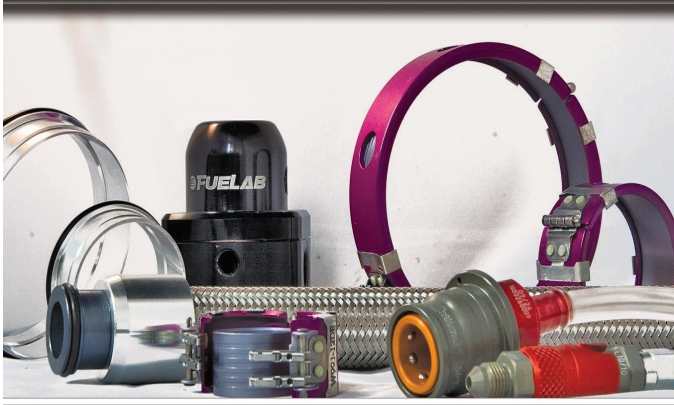
Engine and drivetrain aside, the Hornet's design is about as minimalist ▶



ABOVE The front suspension is effectively a Frazer Nash layout turned upside down with the springs above the dampers, plus an extra pair of radius rods



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SIZE	OFFSET RANGE	C DIMENSION (BACKSPACE)	APPROX WEIGHT KGS
13 X 10.0	-38 TO -08	97 TO 127	5.3 TO 5.9



SIZE	OFFSET RANGE	C DIMENSION (BACKSPACE)	APPROX WEIGHT KGS
13 X 5.5	-17 TO 13	60 TO 90	4.0 TO 4.6
13 X 6.0	-13 TO 17	73 TO 103	4.1 TO 4.7
13 X 6.5	-06 TO 24	85 TO 115	4.2 TO 4.8
13 X 7.0	00 TO 30	98 TO 128	4.3 TO 4.9

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ABOVE The location of the chains is initially disconcerting for the driver. The two rearmost chains can be seen here (one either side of the seat), plus the solid axle and single rear brake

Andy Swift



ABOVE Each Harley engine has a one-to-one ratio chain drive to the first cross shaft



ABOVE The air tank was reputedly made from an old fire extinguisher

as it's possible to get. The chassis is a traditional ladder frame design, with solid tubular axles at both ends. On the front, the GN-style suspension layout has effectively been flipped upside down, so the axle sits above the leaf springs and below the dampers. For the Hornet, a pair of radius rods has been added to provide additional location. These operate in the same axis as the springs and dampers, but all three links pivot on slightly different arcs, which means the front suspension has relatively little travel before it binds solid. This, we're told, is intentional, resulting in similar

behaviour to a go-kart chassis.

The pared-back theme continues elsewhere. What little extraneous material did exist on the chassis appears to have been attacked by an army of giant, ravenous mice, with holes everywhere to 'add lightness'. Even the brake shoes – exposed to the elements without any backplates – have holes in them.

The brakes are cable-operated, with a traditional setup at the front and a single drum used on the back axle (drilled, of course). Most of this hardware comes from a Morris Cowley, as does the steering linkage and the stub axles.

The brake pedal runs on a shaft with a pair of arms, which pull the cables in opposing directions when they rotate (also allowing the brake bias to be adjusted by altering their length). Similarly, the clutch is cable-operated, with the pedal hinged on the same shaft.

As on the front, the rear axle sits above the level of the chassis, helping to reduce the centre of gravity height. It's another relatively straightforward GN-type setup, with a pair of trailing arms that hold the solid axle between two bearings. Leaf springs, running longitudinally from the back of the chassis rails, provide the compliance, ►



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Photo by Mr Derek Hibbert

Mr David Jones racing in his Talbot 4CT at the VSCC Wiscombe event, 13th May 2018.



Photo by Mr Roy Cousins

Mr Ian Balmforth in his 1917 Hudson Super Six Racer, at the VSCC Loton Park event on Sunday 9th September 2018.

The Vintage Sports-car club 2018 Speed Championship season has now ended with a fantastic result in the Edwardian class. Our congratulations go to the winner of this class, and fourth in the championship overall, Mr Ian Balmforth with the 1917 Hudson Super Six racer. I S Polson built this replica car in our workshop for its previous owner. In second place was Mr David Jones in his Talbot 4CT, which we completed 5 years ago and prepared for subsequent racing seasons.

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as well as giving a certain amount of additional location. Finally, a pair of drop links, hanging down from the radius arms, pick up on the Hartford-style dampers, which are mounted transversely just behind the axle.

“There is a useful amount of suspension travel at the back,” comments Harrison. “I’ve got the dampers set quite soft at the moment, which just keeps things a bit more controllable over the bumps. It can be quite an exciting ride if not.”

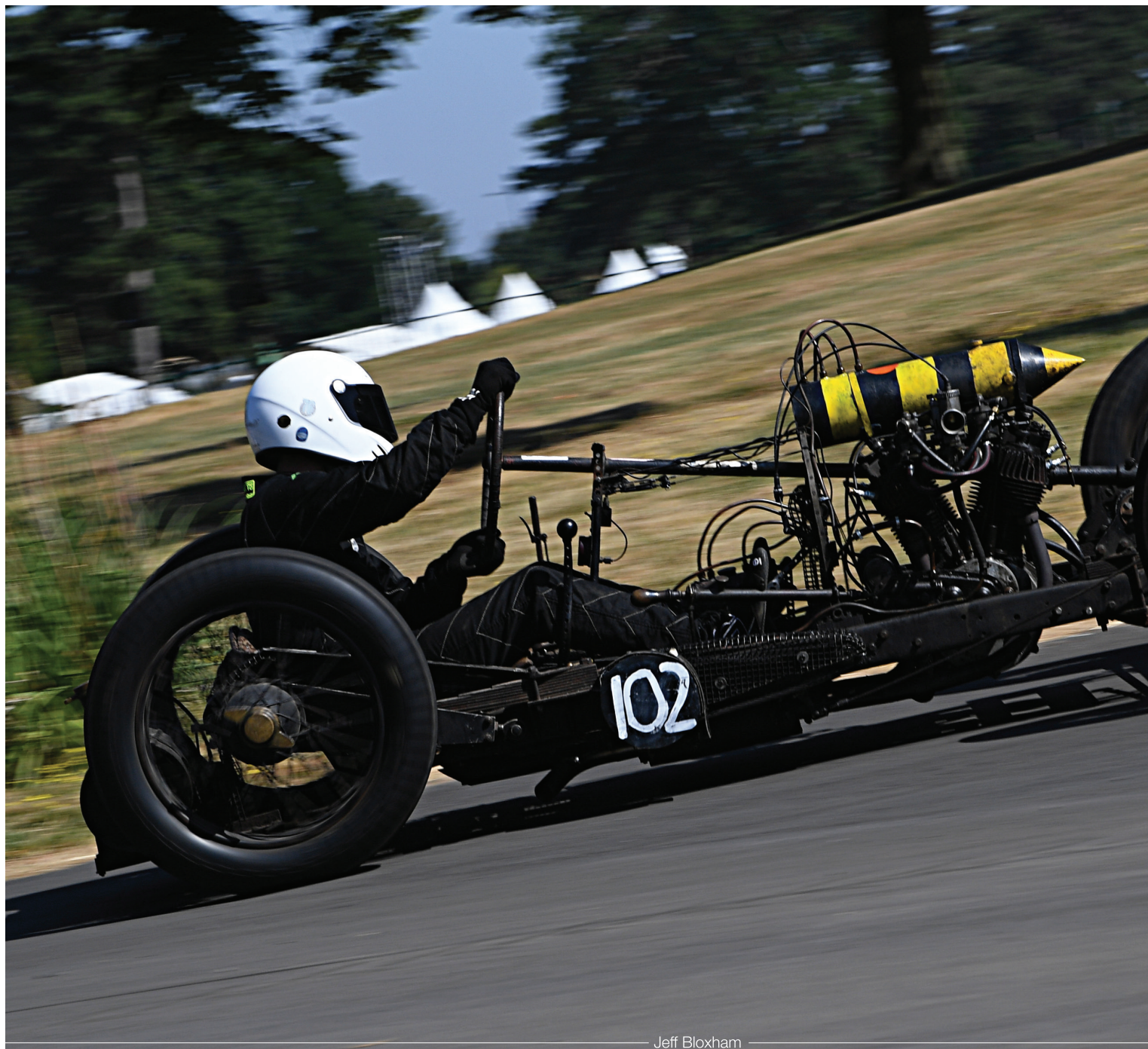
SHOCK AND AWE

Even starting the Hornet is something of an event. Originally, it was push-started but after a certain number of sprained ankles and pulled muscles the team started to look for an alternative solution, Harrison recalls. (“We quickly ran out of friends in the paddock – people see you getting ready and then they run away,” he jokes.)

The solution to this problem was originally devised by Robin Harcourt-

Smith, who looked after the car in the early 2000s and carried out a lot of the initial development. He fitted a dog for an external starter motor, but Harrison has since found a beefier solution in the form of a 48 mm socket welded onto the end of the first cross shaft. Motive power is provided by a truck starter motor with a three-quarter inch drive on the end of its spindle and a pair of torque reaction bars to prevent it wrenching your arms out of their sockets.

Once it starts there’s a cacophony



— Jeff Bloxham —

of noise, even on the larger, quieter exhaust system used for speed events. There's also a lightweight system, with two side-exit manifolds, which saves 9 kg but ultimately adds too many decibels for most circuit racing venues. "It's a real shame," notes Harrison. "It sounds awesome on the other exhaust."

The seat is low – so much so that the driver gazes out between the spokes of the steering wheel, with the rest of the view dominated by those coughing, chattering engines. According to

BELOW & RIGHT The Hornet completed several seasons of VSCC hillclimbs and sprints (right) but, given the inspiration for the project, always seemed destined to race in the Bolster Cup at Goodwood



“ We used a laser thermometer to measure the temperatures and the back cylinder on the left hand side was 200 deg C hotter than the other three ”

Harrison, driving the Hornet is every bit as intense as you might imagine: "It's quite overwhelming. There's a lot of vibration, so your vision starts to blur a little at idle on the start line. You're bombarded by the noises and you're conscious of chains whizzing around all over the place."

The handling is equally exciting, he explains: "The steering is very direct and you do get quite a lot of feedback. It tends to understeer on the way into a corner and then it can suddenly flick into oversteer if you're not careful. Overall, it's not dissimilar to a go-kart, because you're so low down and you've got bags of feel. With such skinny tyres and enormous brakes it is quite easy to lock up too. Not surprisingly, there's a lot of engine braking, though, so you don't tend to use them that much."

Between them, Harrison and Pittaway have slowly gone about developing the Hornet, refining various features here and there to improve its performance and reliability. The original recipe has remained very much the same throughout this time, but that's not to say it will stay that way.

"Duncan keeps talking about the possibility of putting another pair of engines on," admits Harrison. "I think

there's a danger that it wouldn't go a great deal faster but it would end up half as reliable. It would look brilliant, though."

The idea is to create an extension for the chassis, shifting the front axle a couple of feet further forwards and slotting in a larger engine frame. Harrison confesses the idea of supercharging has also crossed his mind ("primarily because it would allow us to put another pair of chains on to drive the blowers," he jokes).

If all this sounds a little far-fetched, it's worth bearing in mind that two engines ultimately weren't enough for John Bolster, either. After the original Bloody Mary was mothballed in 1937, he began work on a four-engined special (somewhat confusingly given the same name). This hair-raising device was reputedly capable of accelerating from 0 to 100 mph in under 10 seconds (in an era when the average family saloon would have taken four times as long to reach a top speed of around 50 mph). It was this continual thirst for development – with a generous dose of creativity and perhaps just a dash of madness – that characterised the original Shelsley special builders. And it's a trait that's still very much alive and well today. **HRT**



THIS TIME THE 'MUNCHER' IS EATING UP THE MILES - NOT THE BRAKES



Forty years after the car's heroic feat at Le Mans, **Alan Stoddart** reports on the remarkable mission to recreate 'Muncher' and take it back to the Circuit de la Sarthe for the Le Mans Classic

MOTORSPORT is full of great stories. One such tale was written in 1977 when Robin Hamilton, an official Aston Martin dealer and enthusiastic racer, decided that he was going to take on Le Mans. He did so with little more than words of encouragement and a session in MIRA's

wind tunnel from the then Newport-Pagnell-based carmaker, which was enduring one of its cyclical downturns.

Hamilton had David Jack (who now runs Aston Engineering) as one of the team of four that built the car for Le Mans. They started with a DBS V8 that they had already been using at

club level, where it proved to be a decent competitor thanks to constant development work, but for Le Mans Hamilton planned something special. The car, decked out in a brutish body kit and making a ferocious noise, was given the chassis number RHAM1. It was the first entrant to appear in the Le Mans paddock that year, an early start being necessary because Hamilton's team needed time to finish building the car.

Qualifying proved to be a fairly hectic affair, and after much ado the team scraped through in last place, which didn't do anything to help shake the



ABOVE & BELOW The brutal-looking 'Muncher' has been painstakingly recreated to faithfully mirror the '77 car



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perception in some of the paddock that the whole entry was a bit of a joke. Far from it, Hamilton had scrambled every resource he could to get the car to Le Mans and into the race, evidenced by the considerable list of contributors' names on the bodywork.

PERSISTENCE PAYS OFF

In the 24 Hours itself Hamilton showed the determination that had got them into the race. Apart from eating through the first set of front brake discs and driving 17 hours on the cracked second set,

which earned the car its nickname 'The Muncher', it all went astonishingly well. The big Aston, the heaviest car in the race by 275 kilos, placed third in the GTP class and 17th overall.

A week after proving the doubters wrong, The Muncher was back at Hamilton's workshops, and was already being stripped down so the team could reuse its parts and modify and upgrade it with an eye on future attempts at the legendary French endurance test. Budget problems meant that the car wasn't ready for the '78 running, but the Aston made it back to the iconic race in

1979, this time with a twin-turbocharged iteration of the V8 blasting out more than 800 hp, and a heavily revised body kit. This monster was driven by Hamilton's desire to beat Porsche 935s, but the lack of a proper intercooling system meant that its challenge was shortlived, bowing out of the 24 Hours early on thanks to a melted piston.

It was this '79 car that was acquired by Paul Chase-Gardener in 2014, but it was the story of the '77 car which inspired him. "It just captured my imagination," he recalls. "The whole thing about it being a dealer effort and the factory not being ►



involved in racing because it couldn't afford to at that particular time, it's an inspiring tale."

So when he took possession of the car, instead of working on restoring what was essentially a rolling museum piece, he was more enthusiastic about utilising the crates full of original components – including the engine from Le Mans in 1977, which came with the car – in a process that mirrors that of Hamilton 40 years earlier. His mission was to recreate the original and take it back to the Circuit de la Sarthe for the Le Mans Classic.

The first job was to get a donor car. Chase-Gardener managed to find a V8 club racer that had been recently racing in the Aston Martin Owners Club series. It had initially been built by Rex

Woodgate, a former Aston Martin chief mechanic who then went to set up the eponymous Aston race and restoration business. This car had originally been given to Woodgate by Aston Martin as a development car for the Vantage, but it had since been heavily modified so was no longer in a form that preserved any historical significance. This made it perfect for the project.

FROM CLAY IT WAS CREATED

The donor car was then taken to Jaguar Specialist Leaping Cats because of great work they had done on one of Chase-Gardener's other cars. The final body extensions were made in fibreglass, the mould for which in period would be taken

from bodywork shaped in aluminium. However, Leaping Cats recommended that a better way was to shape the bodywork in clay, a process that allowed the team to see the shape of The Muncher appear before their eyes.

"Leaping Cats do fantastic work, really, really first class, and their body maker essentially built the car out of clay. John Brown, the owner of Leaping Cats, was very enthusiastic and encouraging about the project from the start," says Chase-Gardener.

The bodymaker, Nick Shakespeare from Bespoke Design, was constantly comparing the body he was recreating to pictures of the original as it raced at Le Mans, most of which were not in the public domain and were kindly supplied



by Hamilton. Shakespeare was able to extrapolate from known dimensions in the pictures, and using precise laser measurements was able to build up a very accurate model of the car.

“He made it, and carefully shaped it, but then you could say, ‘I think that’s a little bit too wide’ and he’d just squash it and say, ‘Well how about that?’ It was a live moving thing. I’ve never seen anything like it.”

An aerodynamicist was also brought in to ensure that even documented aero work carried out in period was recreated. This also helped give Chase-Gardener confidence in the car, for he was understandably “very keen that the car should not take off at 160 mph on the Mulsanne.”

Rounding out the authentic look of the



ABOVE RIGHT & BELOW Four decades on, the car runs again – trouble-free – at Le Mans



recreation was the interior, which saw the original Muncher’s steering wheel mounted in front of a dashboard that had again been specially made with the help of photographs from the 1977 car to recreate the one that enclosed Hamilton for that endurance test. The level of detail is remarkable, to the point that as far as Hamilton can remember, the same roll of Dymo labelling tape was used to label the new dashboard as the one he originally used all those years ago.

With the body perfected, it was then time to start fitting out the car. One of the areas that required urgent attention was the wheels, hubs and tyres. In period it ran Dunlop crossplies, but they

aren’t available now. Nor are modern tyres in the size required by the original wheels, so Paul and Alec Cooper of Coopersport, who was working on the car, set about finding a solution.

“We had to look at what was available to give us the sort of rolling diameter and width that we needed,” Cooper explains. “It turned out that some tyres that Avon were making were pretty much the right rolling diameter and pretty much the right width, but the profile of the tyre meant that they would sit on a different diameter rim.

“So then we had to make hubs and wheels to match the kind of tyre we could get. In the end it worked out well ▶



ABOVE Where aluminium was used as a template for the fibreglass first time around, on this occasion polystyrene and clay acted as a mould for the bodywork extensions



because the tyres we could get are used in the Porsche Supercup apparently, and Avon said that if you can use these then you can also have different compounds, wets, intermediates and different dry compounds, so it was a smart choice for racing.”

The brakes were another area that needed major attention. When Chase-Gardener first campaigned it at Le Mans in 2016, because of the short amount of time that had been available to get the car ready it had to remain on the “modern” club racing set up using open back six-piston callipers and large diameter discs. The rear brakes were still in standard road car form.

In period Hamilton enlisted the help of AP Racing to come up with a suitable system to stop the car. At the time it was developing a system for the Broadspeed Jaguars, whose twin fist-type system could be adapted to the Aston with a few modifications.

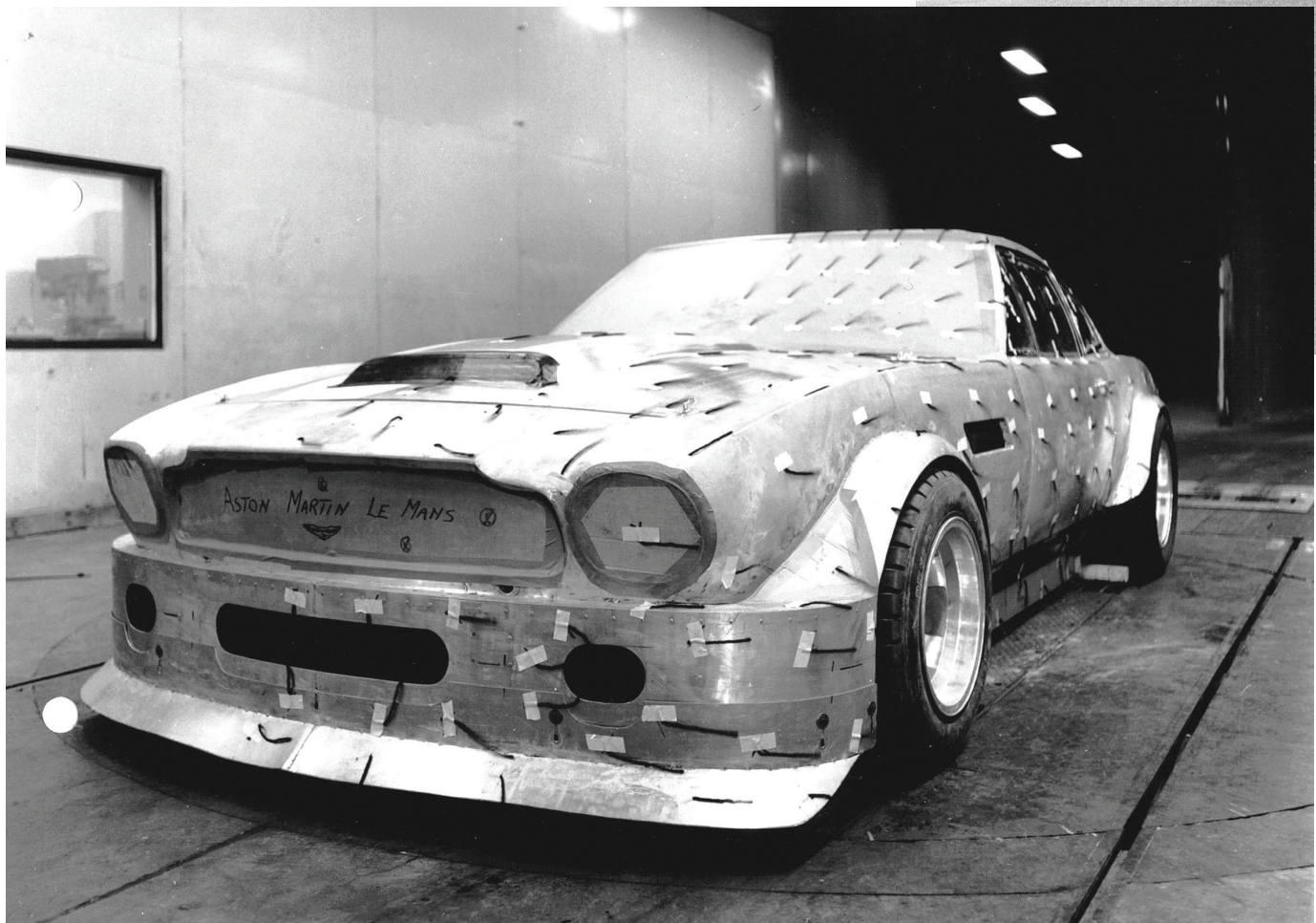
As David Jack was involved with the original brakes, it was just a matter of

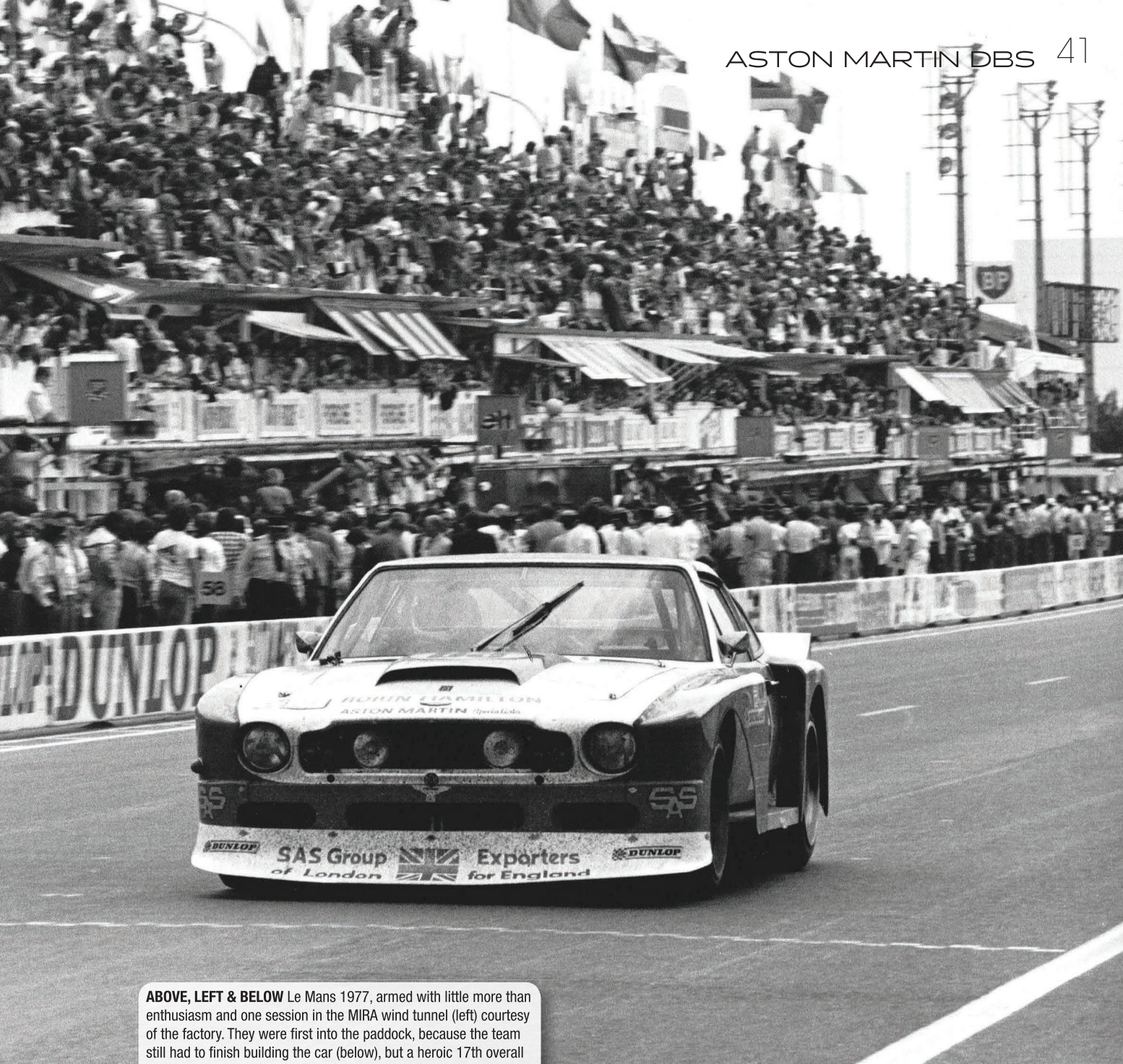
approaching AP again to obtain the original fist-type callipers, which, due to the demands of historic racing, have been remanufactured. A suitable size with matching discs was identified along with a slightly smaller version for the rear inboard brakes. It was then a matter of Aston Engineering designing and manufacturing suitable disc bells and calliper mounting brackets. It also added better brake cooling ducts than in period.

ORIGINAL SOLUTION STILL WORKS

The rear brakes also needed careful consideration as they are inboard, mounted directly to the differential assembly, which not only has to cope with the heat from the transmission but also the heat from the brakes. Again, suitable disc bells and brackets for the single fist-type calliper had to be designed and manufactured. It also meant that the differential needed an effective cooling system.

The solution Hamilton came up with was





ABOVE, LEFT & BELOW Le Mans 1977, armed with little more than enthusiasm and one session in the MIRA wind tunnel (left) courtesy of the factory. They were first into the paddock, because the team still had to finish building the car (below), but a heroic 17th overall

using a power steering pump that was belt driven off the propshaft, running the loop and ensuring that everything stayed cool. This solution has proved effective once again and could well be one of the things that have helped satisfy the new car's appetite for brakes, along with the addition of better air cooling ducts.

Chase-Gardener was fortunate in that he was in regular contact with Hamilton, so he was able to discuss design decisions made on the original car in the '70s. Robin also put him in touch with David Jack, who had built the car in period.

This connection proved particularly handy when it came to the engine, which Jack was enlisted to help restore to life. "I remember this," he exclaimed when he ►





first saw the original engine emerge from the crate where it has stood in storage for many years recalls Chase-Gardener. "We gave him this engine and he remembered it from last time he'd seen it, so he gets the top off and everything, and then I get a call saying, 'I'm thinking of this and this and this, and I reckon we can probably get about 500 hp out of it and quite a bit of torque'.

"When the rebuild was done he set it up on the dyno and I go to see it, and there is this screaming noise coming out of this thing. He's revving it and it's a wonderful, wonderful noise, but he's saying, 'Well we can't quite get the carbs to pull all the way up at the moment and we are having a bit of trouble here, and we have these problems and these problems...' but I was amazed that this engine that ran Le Mans in 1977 was running that well: it seemed alright to me!"

Sure enough though, Jack's expertise was spot on, and at the first test it wasn't actually pulling as well as hoped, with the graph seen on the dyno, making the car



ABOVE The engine had spent the best part of three decades sweating in a wooden crate



ABOVE A small aesthetic change to the shape of the bonnet, to closer resemble the shape of the '77 car, had big ramifications: the engine had to be lowered, triggering all sorts of packaging difficulties

"relatively undrivable" low down. With this mission in mind, Jack took the car and put it on the rolling road for two days, running it up and running it down and trying to perfect every possible detail.

"In the end it was unbelievable," enthuses Chase-Gardener. "He got the powerband down by about 1,500 revs and it pulled brilliantly well low down. It was so much more drivable. The man's a magician! Although he wasn't too keen when I said, 'Well you should do another two days and you can get me a bit more!'"

Getting the engine to this condition was no easy task however, as standing and sweating in a wooden crate for some 30 years had caused a few problems, with it being in a completely seized state and suffering from rust in the bores when Jack first stripped it. This meant a complete rebuild was necessary, with new cams

being made up, to help with an increase in torque as well as new Omega pistons to replace the forged Cosworth versions that were used in 1977. This proved to be a smart choice, explains Jack, as Omega actually makes a bespoke piston for Aston Engineering with its own forging.

In rebuilding the engine the company also took advantage of the 1 mm overbore allowed, made use of an improved crown and increased the compression ratio. The original valve seats were removed and replaced with lead-free items, which also allowed an improvement in valve seat angles, as dictated by Aston Engineering's work with the engine on the flow bench.

PISTON IMPROVEMENT

Aston Engineering also replaced the standard Aston Martin connecting rods with its own strengthened versions, produced by Arrow.

"So we have improved pistons because we can, and we've put in a stronger rod, which is not a performance-based issue, it's more to do with safety," he adds. "We've put in a rod that's bulletproof for the RPM and the loads... otherwise everything else is the same."

The proof of the engine's rebuild was how it performed on track, not the figures achieved on the dyno, however. This came to light at one of the tests the team conducted before the 2018 Le Mans Classic, where the engine felt as though it lacked the flexibility that the dyno numbers suggested it should have. This was initially a bit of a mystery ▶



ABOVE The final engine with amended intake trumpets and a redesigned tray

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ABOVE & BELOW The original car earned its nickname for munching through the brakes, but careful attention to the cooling ducts has conquered the problem. The final twin fist-type calliper brakes are seen above, the diff with rear inboard brakes below



it sit lower. This was a delicate job as taking the trumpets down too far could have made the problem worse. Finally, the carburettors themselves had to be modified, with the auxiliary venturis requiring a trim to help shave precious millimetres off the height. These changes meant that the car had to go back on the rolling road, which revealed that work on the carburettor jets was also necessary and the emulsion tubes had to be changed.

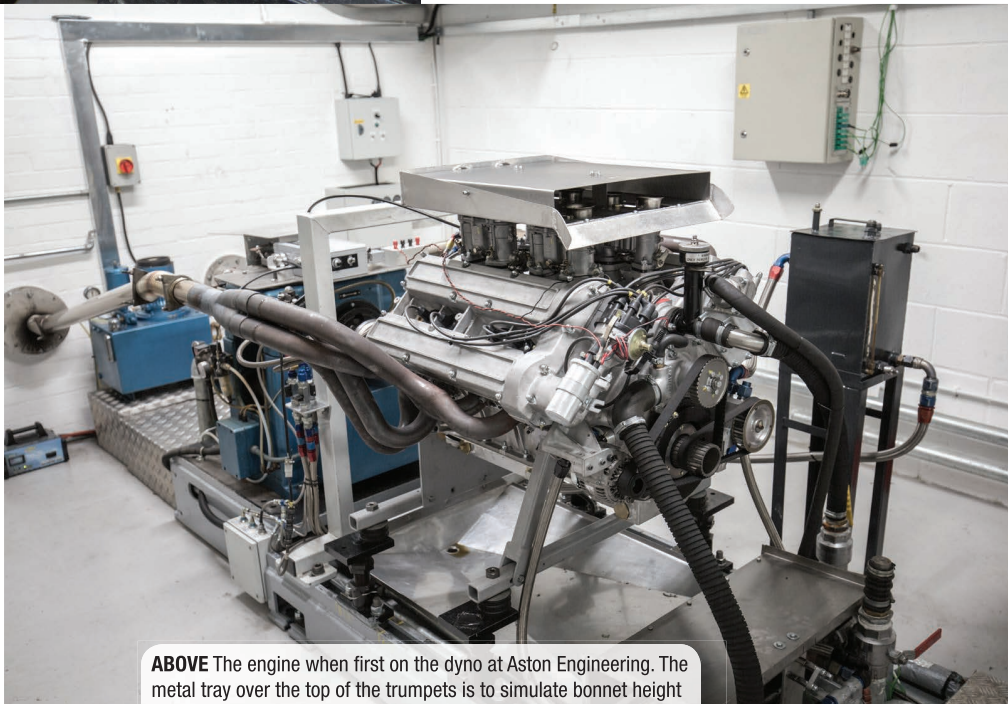
PACKAGING ISSUES

This problem hints at the difficulties with packaging that were faced in the recreation of the original Le Mans Aston, especially given that changes to one part often necessitates revisions elsewhere. The exhaust proved to be problematic and required some changes to be made to the primary pipes so that it would clear the steering column and the suspension mounting. It didn't clear the suspension mounting because that had needed to be moved after the exhaust had been designed and manufactured. Furthermore, when the suspension was actually installed, with the roll centres and the camber accurately adjusted, the top wishbone was then fouling the exhaust.

These packaging problems were exacerbated by the lowering of the ▶

because usually when the dyno work is completed it translates very well into the engine's performance in the car. However, when Aston Engineering first dynoed the engine, the car was using a different airbox to the one it would later run because of a change made to the shape of the bonnet to perfectly resemble the original '77 car. This small aesthetic change meant that the intake trumpets for the front two or three cylinders were closer to the bonnet than anticipated, which was enough to affect the engine's breathing and produce a power loss of about 60 hp, as well as affecting the engine's power delivery across the rev range.

The bonnet couldn't be raised again, so the trumpets on the carburettors had to be remade to be flatter, and the base plate had to be changed to make



ABOVE The engine when first on the dyno at Aston Engineering. The metal tray over the top of the trumpets is to simulate bonnet height

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engine. It wasn't just carburetors that had to be altered to accurately recreate the '77 Muncher, with the entire engine having to be dropped down on repositioned mounts. This of course meant that the gearbox also had to be moved so the entire drivetrain correctly lined up.

"It's all very well trying to work it all out, but it doesn't even need to be half an inch off before you have got a very serious problem," explains Cooper.

Dropping the engine also meant lots of work had to be done to fit the sump in. "If you look at how involved the sump is, you can see how it had been modified to fit," Cooper adds. "So once we decided to drop the engine, that all had to be reworked as well. We realised we couldn't get it into the car so we had to cut part of the sump away, redesigning it slightly."

Packaging the radiators and the cooling system was also a challenge, particularly given Chase-Gardener's insistence on exactly replicating the plumbing as it

“ Robin Hamilton drove the car for a few laps, his first time in a racing car for 37 years. It was a great moment”

was in period so that the car also looked perfect under the bonnet as well as from the stands at racetracks. This meant Jack and Aston Engineering had to work out where the coolers went on at the front and then, because they weren't there on the donor car, re-engineer and replumb the car as it was in period. This level of detail even went down to the arrangement of the pipes from front to rear.

KEEPING IT IN PERIOD

"We had copper pipes running down the sills," recalls Jack. "We ran the hot water down one side and the cold water down the other. But this rear-mounted radiator system did not work during testing in 1977, so for Le Mans Robin had to revert back to a more conventional solution with

a front-mounted radiator. The vertical rear louvered panel is a remnant of the original cooling system that never got changed back. All the things we had to sort out for Paul were very much the way we did it in period really."

There was also some luck involved in recreating Hamilton's original Aston. One such example came in the form of the gearbox. The donor car had arrived with an American four-speed 'box in it rather than the original ZF five-speed that was used in '77. Not only was it the wrong gearbox to have, because of the high speed nature of the Circuit de la Sarthe its lack of a longer fifth ratio would have made Le Mans an incredibly difficult proposition.

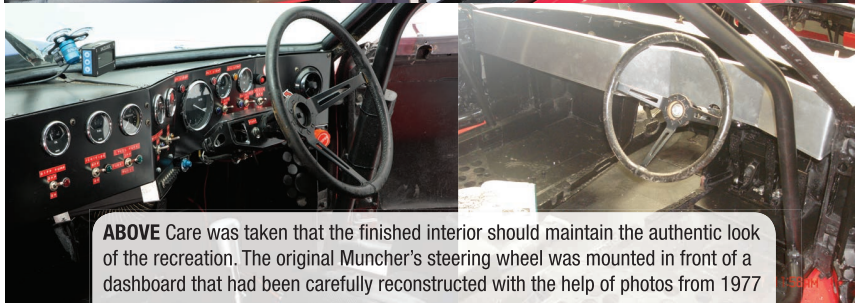
Chase-Gardener says that the outlook wasn't too good either, with even Jack

BELOW The donor car's American four-speed gearbox didn't bode well for the long straights of Le Mans. A lucky break enabled the acquisition of a ZF five-speed similar to that used in the original '77 car





ABOVE & BELOW Robin Hamilton was reunited with the car at a Donington test, earning a guard of honour from the other cars as he completed his first laps for 37 years



ABOVE Care was taken that the finished interior should maintain the authentic look of the recreation. The original Muncher's steering wheel was mounted in front of a dashboard that had been carefully reconstructed with the help of photos from 1977

doubtful that the right gearbox would ever be found. What's more, he didn't even have enough parts to have the option of rebuilding one. Fate seemed to smile on the project though. "Funnily enough I got a call about two weeks after David said that he hadn't seen one in 10 years, from a friend of mine who was working at Chatham's Austin Healey place in Bristol. He said, 'I've got a ZF gearbox from 1969. I think it's got Maserati mountings on it, but it's never been out of the box. Are you interested?' "Obviously, I bought it then and there

over the phone. He sent it to me and now it's in the car. Unbelievable!"

All the work that went into recreating the Muncher came together a couple of weeks before 2018's Le Mans Classic, at the car's third and final test at Silverstone. Much had been learnt at the previous tests at Mallory and Donington, but solutions and tweaks had been devised. Additionally, running at Donington had given the team a chance to do some setup work, ensuring that the brake balance was right and that the geometry was all as it should be for Chase-Gardener's assault on the French

event. The Donington test proved to be vital, as it revealed that the car was found to be loosening the bolts on the driveshaft when it got hot.

"Imagine if we had not found that before we went to Le Mans! David Jack changed all the fixings to be sure they would stay put. The other thing about that day was that Robin Hamilton came to see it testing and then drove the car for a few laps, his first time in a racing car for 37 years. A number of the other guys on the track day made a bit of a procession behind him in his honour. It was a great moment," Chase-Gardener reminisces.

THE FAIRYTALE STORY CONTINUES

When Silverstone came around though, it proved to be a problem-free day. Everything went well and confidence was building about the real test just around the corner. All the work paid off and this good form continued through the Le Mans weekend itself, with David Jack in the pits just like 1977 and the team enjoying a totally trouble-free weekend. What's more, like Robin Hamilton's effort back in '77 which created the legend, Chase-Gardener's trip to Le Mans also resulted in a 17th place finish.

The car is now tucked away for winter, with a tilt at Spa set to be its next outing. The rebirth of a character as colourful as 'The Muncher', and the on-track battles in which it will no doubt go on to fight, are surely set to add ever more intriguing chapters in the car's story. **HRT**

TITLE-WINNING HEAVYWEIGHT BACK FOR MORE

Now owned by United Autosports co-founder Zak Brown, the 1990 BTCC title-winning RS500 has been restored to its former glory. **Chris Pickering** reports



Silverstone Auctions

ABOVE A lot of detective work has been involved in getting the car back as close as possible to its original specification

Is it possible to define a golden age of touring car racing?

Such has been the variety of machinery in the British Touring Car Championship (BTCC) alone – from three-wheeling Minis and caddish Jaguar Mk2s through to flame-spitting Chevrolet Camaros and space age Super Tourers – that it's surely impossible to pick a definitive period. But there's no doubt that the FIA Group A regulations, which were run across much of the world during the 1980s, would be a strong contender.

From Brands Hatch to Bathurst, these

rules produced some of the most memorable moments in touring car racing, not to mention some of the most celebrated machines. And none were more dramatic than the Ford Sierra RS500 Cosworths, which dominated the closing years of the format.

With upwards of 550 bhp from a heavily turbocharged 2-litre engine, basic chassis technology and a total absence of driver aids, these were the last of the hairy-chested old school touring car designs (in the BTCC, at least). The Trakstar-liveried car you see here is arguably one of the ultimate

examples, having won the British championship in the hands of Robb Gravett in the final year of the Group A regulations, 1990. Now owned by motorsport mogul and co-founder of United Autosports, Zak Brown, it has been restored to its former glory as part of the team's historic collection.

The Trakstar cars actually began life with the Dick Johnson Racing team in the Australian Touring Car Championship. TV presenter and DJ Mike Smith acquired two cars and shipped them back to the UK to compete in the BTCC under the banner

of his Trakstar team, co-founded with Gravett. The cars were re-shelled by Dave Cook of Yortech Fabrications and treated to a full mechanical refresh ahead of the 1989 season. The favoured Eggenberger suspension was retained from the Dick Johnson days, while Mountune was brought in to develop the engines.

The principal opposition at the time was Andy Rouse, who narrowly beat Gravett to the win the Group A class in the team's first year. However, the situation was reversed in 1990, with Rouse finishing second in class, while Gravett took both the Group A title and the outright championship victory, winning nine out of the 13 races.

Not everything went to plan, though. The team ran out of money towards the end of the 1990 season. Seeing that the championship was within reach, Mountune agreed to continue supporting the team on the agreement that the car would be taken in lieu of payment at the end of that year.

With the Group A regulations abandoned, the car was largely obsolete in the UK. Incredible as it seems these days, with the RS500 reaching near-mythical status, there was actually some degree of relief when an Italian buyer eventually came forward and arranged to have the car converted to left-hand drive. It then spent the next two decades in Italy before it was returned to the UK, converted back to right-hand drive and sold to Brown at the Silverstone Auctions Race Retro Competition Car Sale earlier this year.

BACK TO BASICS

“The shell was in really good condition when we got it. We just checked that it was square – which it was – and set about stripping everything out,” recalls United Autosports technical director Paul Haigh.

The engine – one of the original Trakstar units – went back to the Mountune workshop where it had started life 29 years earlier. On the chassis side, meanwhile, the first priority was to replace the complete fuel system, including new lines, pump

and connectors, plus a new tank from Advanced Fuel Systems. The gearbox and differential were then sent off for a rebuild at Bara Motorsport.

“Originally it would have had a solid spool in place of the differential, but by the time we got the car it was running on a Ricardo viscous diff,” says Haigh. “We thought it would probably be a bit of a handful with the spool, so we stuck with the differential.”

The suspension follows the same

for circuit racing). As supplied, these were so short that the United Autosports mechanics discovered they couldn't actually take the wheels off without removing the suspension.

United Autosports has strived to keep the car as original as possible, although this has required considerable research in some cases. No underbonnet photographs existed from the car's original BTCC campaign, so Haigh contacted BTCC stalwart Malcolm



basic layout as the Sierra road cars. At the front, it uses a MacPherson strut layout, with cast alloy hubs and spherical bearings for the top mounts. The rear suspension retains the period Eggenberger trailing arms, with built-in hubs, while the dampers are now fixed-rate Bilsteins all-round. Braking duties, meanwhile, are taken care of by period-spec AP Racing ventilated discs and four-pot callipers, supplied by Questmead.

At some point during its time in Italy the car had been fitted with tarmac rally-spec dampers (despite being used

Swetnam, who had been Trakstar's team manager at the time (now back in the BTCC with Motorbase). Sierra RS500 guru Paul Linfoot was also called in to assist with parts procurement.

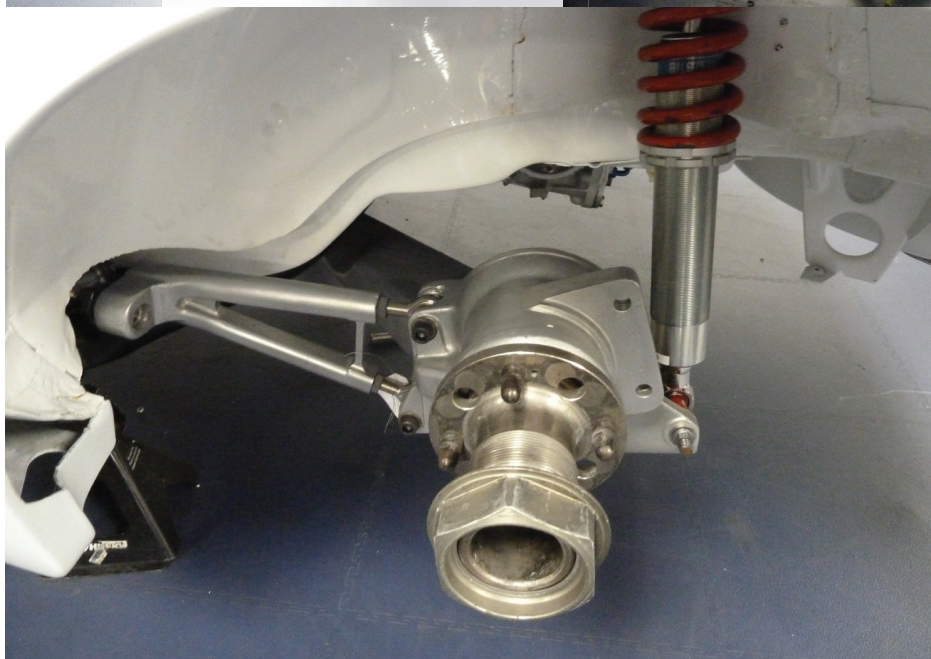
“All the Sierra Cosworths were slightly different back then,” comments Haigh. “There wasn't a standard spec as such, but we think we've got it as close as we possibly can to its championship-winning state. With a little help we were able to piece together where everything went.”

There were the usual parts that had to be replaced due to their expiry date, ▶

HRT



ABOVE & BELOW The rear suspension retains the period Eggenberger trailing arms, with built-in hubs. Dampers are now fixed-rate Bilsteins



ABOVE The team remains on the hunt for a non-power-assisted steering rack

such as the seat, harness and fire extinguisher. In general, though, the Group A regulations mean that the car can run today exactly as it did in-period. One exception on this particular car is the use of power-assisted steering. Although power steering was permitted at the time, the car originally ran without it; the team has been on the lookout for a non-assisted rack to return it to original specification, but so far these have proved elusive, we're told.

In general, however, Haigh says that things have gone quite smoothly: "Rebuilding a saloon car is typically an easier task than a single-seater. The shell provides most of the structure and the suspension layout is reasonably straightforward, so you can

Silverstone Auctions



ABOVE The Gravett RS500 leads the way back in the BTCC's Group A era

Newspress

more or less bolt it back together and drop the engine in. The fuel system was quite a painstaking process, but there was nothing especially difficult on the RS500. Compared to the Lancia LC2 [Group C car] that we'd done immediately beforehand it was a walk in the park."

Of course, this being a fearsome flame-spitting RS500, much of the work took place on the engine. And that's where we pick up the next chapter of the story.

ENGINE REBUILD

The Cosworth YB engine in the RS500 was descended from the Ford Pinto, but there was precious little of the original design remaining. More or less the only

recognisable resemblance comes with the block, which had received detail changes, but appears outwardly very similar. It was the breathing that made the biggest difference, with the 16-valve Cosworth head and the addition of a large turbocharger.

When the road-going Sierra Cosworth came out in 1986 it was one of the most potent sports saloons on the market with 204 bhp, care of a Garrett T3 turbo and a Magneti Marelli management system and four injectors. The production RS500 was essentially a homologation special built to support the race programme. It was equipped with a larger T4 turbo and homologated to run eight injectors (even though the road cars only actually used four).

A host of other changes including a substantially larger intercooler helped raise the power to 224 bhp.

Cosworth was tasked with the job of creating a competition kit for the engine, which was dubbed the YBF. This included standard connecting rods that had been shot-peened and balanced, a production crankshaft that had been lightened somewhat and a set of bespoke forged pistons. There was also a pair of competition camshafts, dubbed BD16, designed to work with the standard hydraulic lifters and a ported cylinder head. Other details included a 'Maram' 248 turbocharger shaft, with a left-handed thread for the turbine nut, which prevented it coming loose at high speeds (as the standard ▶



items had a habit of doing).

This kit acted as the starting point for pretty much all of the engine builders who set about developing the YB, explains David Mountain, founder and technical director of Mountune: “The ‘kit’ spec was around 1.8 bar boost and it gave you about 460 bhp straight out of the box. By the end of the eighties, we were running upwards of 2.1 bar and 550 bhp. At that point we were running solid tappets with much more radical cams; we’d changed the pistons, upped the compression ... they evolved quite dramatically, but the starting point for all of that was the YBF.”

In period, the base engines were generally either part of a donor road car (also used for the chassis) or supplied as a complete YBF kit. Subtle changes to both the chassis and the engine meant it wasn’t feasible to start off with a regular ‘base spec’ Sierra Cosworth for either. The RS500 cylinder block,

for instance, was significantly stronger, care of improved material quality as well as changes to the structural design. Likewise, there were detail changes to the head casting, which meant that it was essentially impossible to start off without a complete YBF engine or the Cosworth conversion kit.

The idea was that the Cosworth YBF engines should be more or less bulletproof at the standard boost pressure, and generally they were. But, of course, it wasn’t long before people started pushing things further. The first issue the teams encountered was blown head gaskets. Cosworth supplied an uprated item as part of the conversion kit, which was fine at the original boost pressure, but it rapidly ran into issues once teams started turning the wick up.

“Our solution was to run Cooper o-rings in the top of the bore,” comments Mountain. “We counter-bored the top of the block and put

a Cooper o-ring into the bore with a sealing gasket around the outside. Similarly, we machined through the top of the block to drop extra-long head studs down into the lower section of the casting where we could generate a much larger clamping force.” These days the somewhat problematic Cooper O-rings have been replaced by a Klinger five-layer steel headgasket, following modern touring car practice.

According to Mountain, the engine’s best attribute was its strength. The production-based crankshaft and connecting rods were found to be almost unbreakable, as were the heads, which used the Coscast process (developed by Cosworth and now owned by Grainger & Worrall). If anything, the weak link was the cylinder block, he explains: “Even with the changes to the RS500 block it was limited by its Pinto roots. In the end, when we were running 550 bhp, we had ▶



CLOCKWISE FROM ABOVE The lack of underbonnet photographs from the car’s original BTCC campaign was just one of the obstacles faced in returning the car to its original spec



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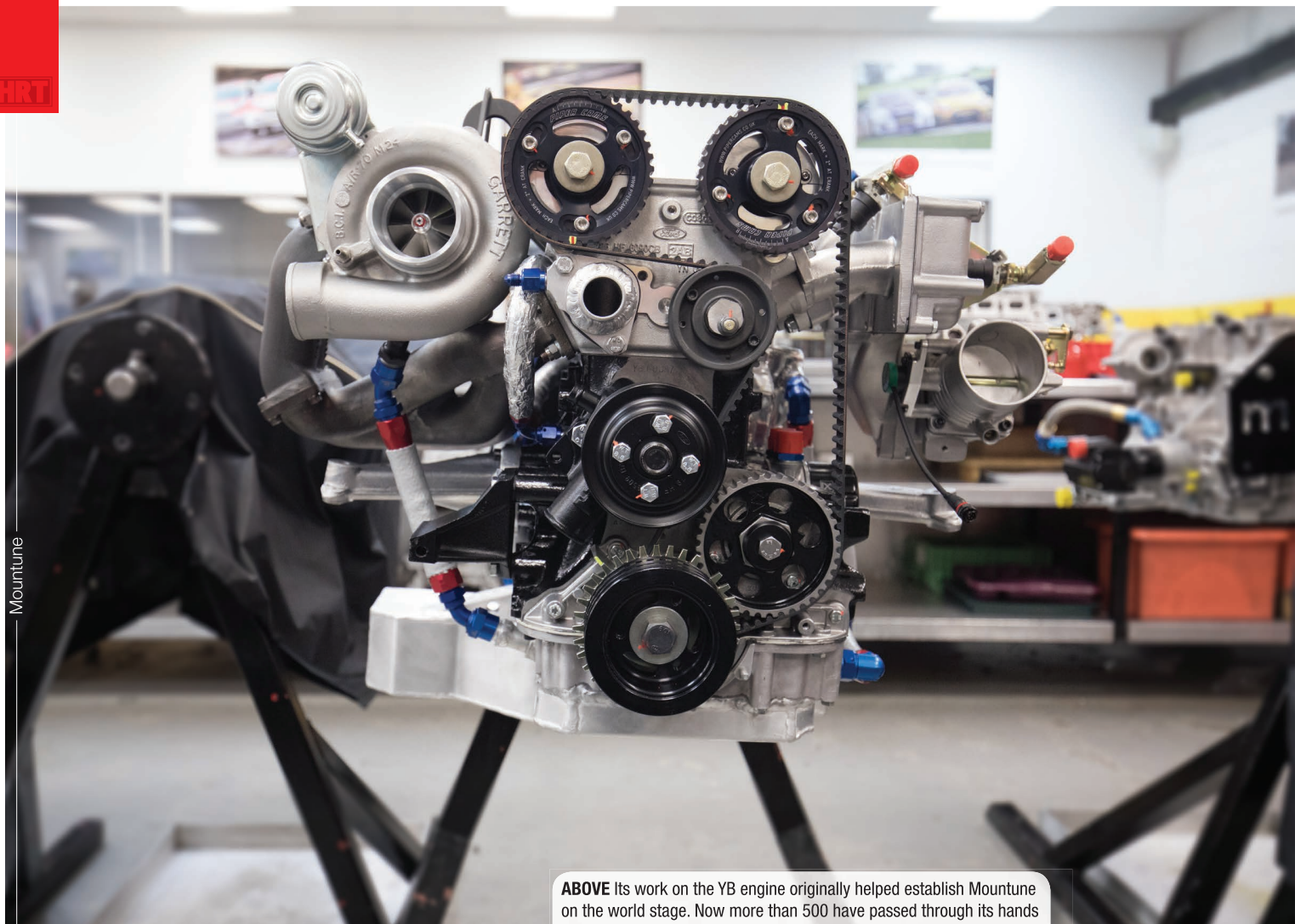
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ABOVE Its work on the YB engine originally helped establish Moutune on the world stage. Now more than 500 have passed through its hands

to rebuild the engines every three hours and change the blocks every six. If you had a misfire due to something like a failed spark plug or a plug lead that had broken down it would crack the block from top to bottom almost instantly.”

Back in the early nineties this wasn't too much of a problem as the blocks were freely available via Ford or Cosworth. These days, the supply of original castings has dried up, but a solution has been found in the form of Nikasil-coated steel liners.

“The supply of blocks is something we're hoping to fix, but right now you have to try and find an original RS500 block if you need a replacement,” he suggests. “Pretty much any old block is likely to be cracked, particularly if it's had some serious power put through it. But that doesn't matter so much anymore, because we can machine out the whole of the inside of the casting and effectively turn it into a wet-liner engine. That means we can reclaim blocks that were previously

unsalvageable, due to cracks or corrosion, and make them a lot stronger in the process.”

In theory, he says, the wall thickness of the steel liners is such that the current engines should be able to run 650 bhp reliably. The reality is that they are pegged back to around 550 bhp to maintain parity with the other Group A cars.

MAJOR BOOST

Back in-period the rival engine builders were split by their choice of management system. Moutune ran Bosch 1.2 Motronic, while Andy Rouse ran a Zytek system. These were the latest and greatest ECUs on the market at the time, but things have changed since then.

“At the time we were always having detonation problems,” comments Mountain. “We ran as much power as we could get away with, but the prospect of detonation was never far

away. At the time the cutting-edge systems only offered two or four timing pulses per cycle off the flywheel, but now we run 36 minus one with much more processing power. That gives us far more accurate timing and a system that can keep up with the engine.”

Boost control was similarly crude, he explains. The adjustable boost control that Moutune ran in period was essentially just an air-bleed on a T-piece to balance the wastegate tension. Electronic valves were in their infancy, and while Rouse had some success with them, Moutune reverted to a mechanical system after brief experimentation.

“I remember, before the British Grand Prix meeting in 1990, we were driving up and down the bypass with trade plates on the car so we could get the boost setup right. We went out and won the race, but it was very different to the level of technology you'd find in a touring car today,” recalls Mountain.

The biggest revision to the engine in

its current spec has been the engine management, he says: “Naturally, everybody wants to keep these cars as original as possible. The problem is that you reach a point where there is absolutely no support for the old systems, whatsoever. We had a discussion with the scrutineers and agreed we needed something we could support and update.”

The end result was that the original Bosch system has been replaced

has crept up. When the competition RS500 first appeared it ran 6.2:1. By 1990 it was running 7:1 and now it is up to around 9:1. That’s a not-inconsiderable figure, when you bear in mind this is a highly-boosted road-based engine, running on what is essentially pump fuel. “The main thing that’s allowed us to operate reliably at this compression ratio is the management system,” notes Mountain.

Conversely, the boost pressures have

higher compression ratios, modern management and shorter-duration-but-higher-lift cams, the engines start perfectly, idle happily and are much more drivable.”

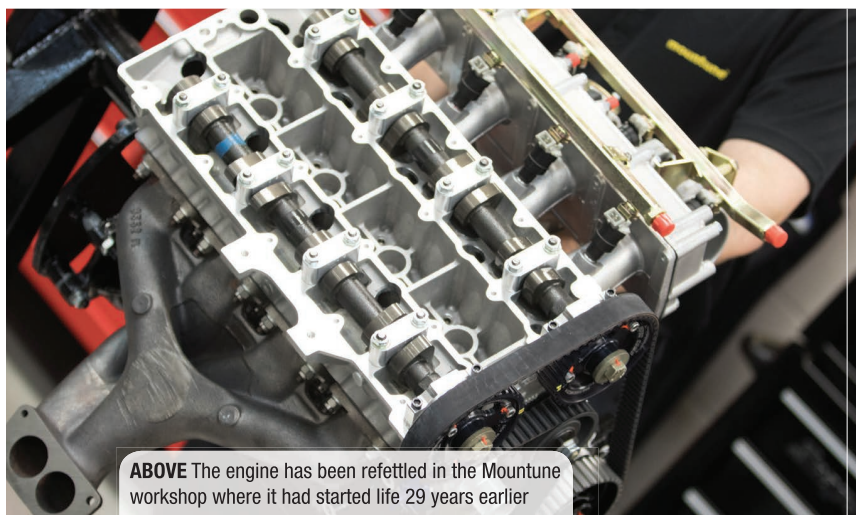
In terms of outright performance, however, they remain much the same as they were at the end of the 1990 season. Before an engine is raced it has to be examined by an MSA scrutineer, who checks things like bore and stroke, valve sizes and turbo specification conform to the period homologation. Once it has been declared legal the engine is sealed – including the all-important turbocharger.

“Ultimately, if you’ve got a legal turbocharger on the engine there’s not a great deal else you can do in terms of pure performance,” comments Mountain. “Beyond that basic scrutineering process it’s basically a gentleman’s agreement that everyone will abide with the spirit of the competition. The idea is to maintain the same sort of relative performance as we would have seen between, say, the RS500s and the E30 M3s in-period.”

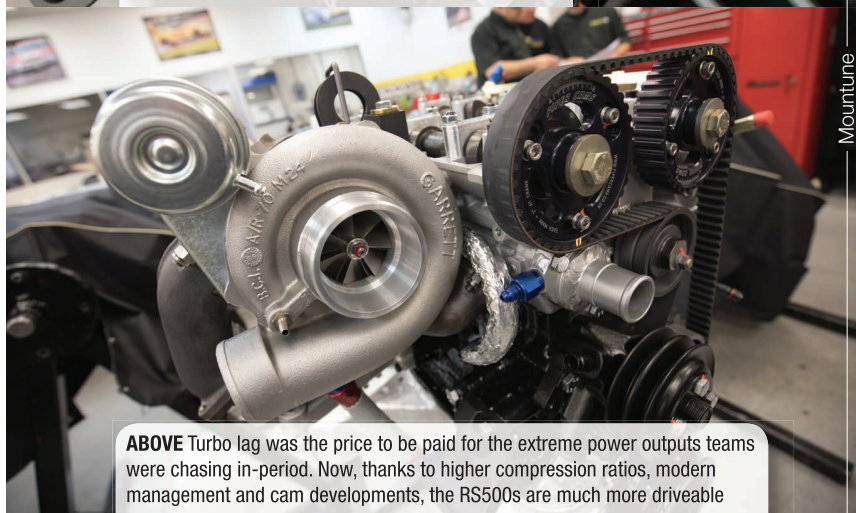
Not all the parts are readily available and there’s an acceptance that some items can be re-manufactured, providing they are produced to period-spec. “Luckily, both the engines we’ve done recently had good OE crankshafts and connecting rods. But if we needed to replace a crankshaft today it would have to be a steel billet part, and providing the dimensions are correct we would be allowed to do so,” notes Mountain.

There’s even talk of commissioning a run of period-correct cylinder blocks and heads, although this would be a big investment once all the tooling had been produced. Nonetheless, with the rising value of RS500s and an increasing number returning to the track it’s thought the sums could be made to balance fairly soon.

As for the United Autosports car, its restoration was close to finished when we spoke to the team. The likelihood is that the car will appear at selected events next year, adding to the growing grids of Group A machinery that celebrate one of the greatest eras of touring car racing. **HRT**



ABOVE The engine has been refitted in the Mountune workshop where it had started life 29 years earlier



ABOVE Turbo lag was the price to be paid for the extreme power outputs teams were chasing in-period. Now, thanks to higher compression ratios, modern management and cam developments, the RS500s are much more drivable

by a modern Cosworth SQ6 ECU. This brings a host of new engine protection measures, such as automatic oil pressure and water temperature cut-outs, plus a far greater data logging capability to spot and investigate potential issues. It also means it’s now far simpler to run electronic wastegate control, so the potentially-fiddly mechanical system has been abandoned.

Over the years, the compression ratio

come down. It’s now possible to get 550 bhp at the somewhat reduced level of 1.9 bar (with an even lower boost setting for wet conditions). This results in less stress on the mechanical components, lower compressor outlet temperatures and reduced cooling loads. It also makes the engine nicer to drive.

“The original RS500 had masses of turbo lag, but that was the price you paid for those power outputs at the time,” comments Mountain. “Now, with

Mountune

Peugeot has an illustrious history of spectacular vehicles that have conquered the World Rally Championship. This isn't one of them! But, as **Hal Ridge** finds out, it is a remarkable machine nevertheless

PEUGEOT'S recent shock withdrawal from the World Rallycross Championship has seemingly brought an end to a legendary era in motorsport for the brand's sporting arm, Peugeot Sport.

Reading between the lines, the competition department of the French marque will continue to work on both research and development of technologies and customer motorsport programmes in rally and circuit racing. But, for now at least, the days of the iconic Peugeot Sport logo being emblazoned on a top-level works motorsport programme have been shelved.

The manufacturer's story is one steeped in history, boasting success and incredible

A GROUP B PICKUP? YES, REALLY!

competition machines. Look no further than the Group B 205 T16, the 905 Le Mans, the 306 Maxi, the 206 WRC, 207 Super2000, the record-smashing 208 Pikes Peak and its predecessor the 405, the Dakar 3008, to name just a few.

But, while Peugeot's lion emblem has lived upon some of the sport's greatest machines, it's been attached to some oddball creations too.

Arguably none more so than the Group B Peugeot 504 Pickup. Yes, that's Group B, the same revered category for which spaceframe chassis, four-wheel drive, composite-bodied, fire-breathing monsters such as the 205 T16 were created in the 1980s, with which drivers like rally legend Ari Vatanen wowed crowds on the world's



rally stages, before the cars were banned for being too fast and dangerous.

The coupe version of Peugeot's 504, a V6, was homologated in the mid-1970s as a Group 3 car and was a familiar sight in African off-road endurance events. Group B rules were introduced in 1982, and when it was decided to homologate the 504 pickup for rallying in December that year, due to cabin size restrictions (having only two seats) it wasn't eligible for Group A. It did, however, fit within Group B rules and as such is one of many unexpected machines on the list of cars homologated under the Group B umbrella.

Using a four-cylinder petrol engine, the pickup remained rear-wheel drive. With a view to

ABOVE The 504 pickup is one of the oddball machines created during the iconic Group B period



Syd Wall

competing on some of the globe's roughest rallies, many standard components were retained. After all, the pickup was renowned for its durability while being used in the harsh African terrain by farmers.

SAFARI DEBUT

On its World Rally Championship debut, on the 1983 Kenyan Safari Rally, a 504 pickup finished eighth overall driven by Johnny Hellier and John Hope. The next season, the pair finished 15th in the same event, while the best WRC

“A lot of people mocked us when we told them what we were doing”

result for the car was achieved on the Ivory Coast Rally in 1984, piloted by David Horsey and David Williamson to fifth overall. That pair also scooped the African Rally Championship title in the same year with the unusual machine.

The vehicle in question here is not an original rally car from the 1980s, nor does it pretend to be. It's a variant of the Group B pickup, freshly converted by a pair of Yorkshiremen.

Adam Keeler and Allan Weston created this 504 in just four months, in time for an inaugural appearance at the Goodwood Festival of Speed in July 2018. Keeler is no stranger to period machines and knows all about Group B, including owning an MG Metro 6R4, but says the rarity and quirks of this machine had appeal.

“We knew the pickup had been a Group B car and you never see them, so ▶



it was exciting to build a car with Group B history that starts conversation. A lot of people mocked us when we told them what we were doing, especially one good friend of ours. He just thought it was a crazy idea. But then when we were pushed for time to get it finished for Goodwood, even he came to help and said it's awesome," explains Keeler.

The project started with the acquisition of a pickup, but finding the right car wasn't easy. "They are hard to find now, because all of a sudden they've become classics, I guess because they were throwaway things," says Keeler. "A lot of them recently have actually gone out to Africa – they love them out there. This one wasn't advertised particularly well on eBay: it looked worse than it was. The main thing was that the bodywork was solid, tatty yes, but solid. The hardest part of the project really was finding a decent vehicle to start with, because they're usually all knackered. This one was used in an auction yard for towing vehicles."

POOR SHAPE

On returning to Weston's workshop, the first job was to strip the chassis, but upon removal of the rear bed liner, it was soon apparent that the floor was in poor shape. It was cut out to enable new chassis rails to be fitted, along with a fresh floor, fabricated to house spare wheels and mount tool boxes and fuel tanks etc. At the same time, the roll cage was fitted to the cabin and through the bulkhead into the rear area usually used for storage in a standard vehicle.

"We haven't based this on a specific vehicle," says Keeler. "We've copied everything as close as we can but with some small changes. We had some pretty good photographs of one in period, so we knew it had a big tool box there, we knew it had fuel tanks, we knew it has recessed wheels and how the cage was. The important thing is we had got the FIA homologation papers so we were able to pick through those. We've done the cage much stronger than it would have been. We've done it to full WRC thickness tube, added a diagonal in which it didn't have, and the



ABOVE A fresh floor had to be fabricated to house spare wheels, tool boxes and fuel tanks



ABOVE The roll cage is much stronger than would have been the case in period, with WRC thickness tube and a diagonal bar added



ABOVE Details like the large Safari-spec spotlights on the front wings always capture the attention

seatbelt bars. They would have gone to the chassis but it's stronger for the belts to be on the cage."

Although not a regular feature from its heyday, a pair of water carriers have been fitted to this version of the 504, above the rear axle. Keeler is adamant that water would have been carried when required, and with the machine being rear-wheel drive but with no real mass at the rear, weight is a welcome assistance for finding traction.

"They didn't run a tailgate either," he notes. "It ran with one of those bars. Although it doesn't do much, we copied that directly: it's nice to focus on those details, like adding the [jacking] points on the sills."

Other exterior details of interest include the large Safari-spec spot lights on the front wings, and the 205 T16-esque flaps on the front bumper. "All

“ A lad came into the workshop and said, ‘Why don’t you turn the radiator upside down?’ I said, ‘Don’t be stupid’. Actually, it wasn’t stupid at all!”

504 saloons, pickups and coupes had the flaps on the front," adds Keeler. "We had a right job trying to find the right plastic to make them because most of it just flops down."

Inside, this pickup replicates the period Group B car by being right-hand drive, an OMP steering wheel located in front of the Corbeau driver's seat.

The hydraulic handbrake sits between the driver and navigator seats in the utilitarian interior, with additional gauges courtesy of TIM and RaceTech and a tripmeter from Microstrip. The SPA fire extinguisher sits in front of the

co-driver's seat. "Inside the gauges are exactly as they would have had them in period and we've made the sliding windows instead of the windup ones – we've copied everything we can," says Keeler.

170 HORSEPOWER

Unlike its predecessor, the V6 coupe, the 504 pickup utilised a 1971 cc four-cylinder, eight-valve, pushrod engine, mounted longitudinally in the front of the car, inclined to 45 degrees. With a compression ratio of 9.5:1, the motor ▶



ABOVE The 504 may have an 'Out of Africa' feel, but its roots are firmly in Yorkshire



ABOVE The utilitarian interior replicates that of the original Group B car, accurate down to the gauges used in period

produces 170 horsepower at 6,500 rpm and 200 lb-ft torque at 4,500 rpm.

The engine isn't a standard Peugeot unit from a road machine, though, but is instead a hybrid using an aluminium cylinder head and cast steel block. Thanks to studying the homologation papers, and the help of a Peugeot

specialist, Weston and Keeler were able to recreate the period engine.

"The saving grace with the engine for us was a guy from a company in South Yorkshire called Peugeot Specialist Parts. We went to him and asked what he thought the head was off, based on photos in the homologation papers.

He said he thought it was a 505 GLX Ti, and sure enough he was right," says Keeler. "We would never have found that out in a million years, but he knew. He could tell by the ports and he had one."

EVOLUTION VERSION

The duo then had an engine builder put their competition engine together, using new componentry such as pistons and liners, while they did the installation with the rest of the build. "The block is out of a Talbot Express and we've used an inlet manifold off a Volvo 240 with an adapter plate, to get the rake to angle the carbs over," says Weston. By using a pair of twin Weber 40 DCOE carburetors [attached to K&N filters] instead of a single unit, this version of the 504 is based on the evolution version of the ▶



BELOW Unsurprisingly for a workhorse vehicle over African terrain, the suspension is primitive

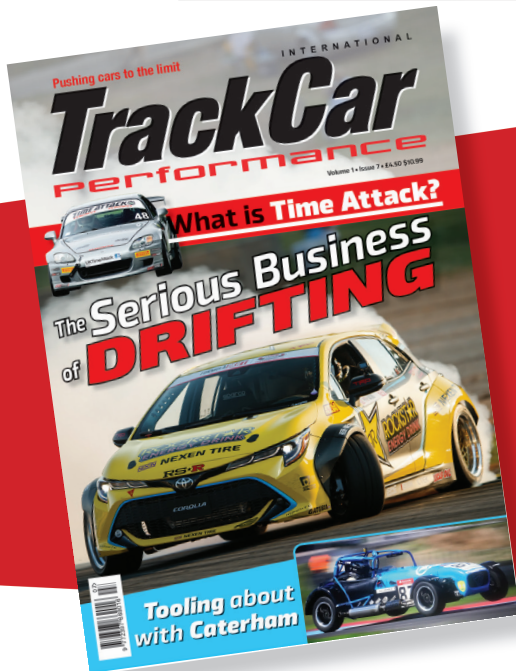
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ABOVE Emulating the front flaps found throughout the entire 504 range was no mean feat



ABOVE The ultimate ambition is for the pickup to actually compete

car introduced in April 1984.

“The carbs are off a 16-valve Vauxhall engine and the only real modern twist is that it’s got electric ignition rather than points and condenser. That makes it a bit easier to look after. For the radiator, we used the diesel one that was in the car when we got it, turned upside down,” says Weston. “It’s quite tight there and I couldn’t get it in and out. A lad we know came into the workshop and said, ‘Why don’t you turn it upside down?’ I said, ‘Don’t be stupid’, but because the outlets are almost the same, it actually wasn’t stupid at all.” To save them from getting damaged elsewhere, the Facet

“The bodywork was solid. Tatty, yes, but solid”

fuel pumps and filter are mounted behind the bulkhead in the rear of the pickup, as period.

The gearbox attached to the engine, via a single-plate hydraulically-operated clutch, is a five-speed standard Peugeot unit, with standard ratios. The robust nature of the standard ‘box was the reason for it being used in period too. It’s the same with the rear axle, that’s fitted with a 4.8 limited slip differential. “In the

later pickups that [differential] came as standard. We didn’t realise until we got it that it had an LSD, so that was a bonus,” says Keeler.

Brakes here are also standard. The fronts are two-pot callipers with 273 mm discs, while attached to the rear axle are 255 mm drums. While the period machines had a cable-operated handbrake, this version has a hydraulic unit, coupled with a brake bias valve. At the front, Weston and Keeler have used 505 GTi hubs, again sourced by Peugeot Specialist Parts. “He worked out what the (15” x 7”) wheels were that Peugeot used. He traced and found a lot of parts for us,” admits



ABOVE The engine is based on an evolution version introduced back in 1984, employing twin Weber 40 DCOEs rather than a single carb

have moved on somewhat between the mid-'80s and the present day. Like rally legend Sebastien Loeb wants to improve the suspension on his 306 Maxi, featured in HRT18, Weston wants to upgrade the dampers on the pickup. "We'll take an insert out and measure it," he says. "There was something similar available from [motor factors] Euro Car Parts for many cars for years. As long as we can find the right stroke, I can make an adapter to make it work."

COMPETITION DREAM

The dream of owning a Group B rally machine is not unique, but the product of their hard labour certainly is. By creating their 504 pickup, Keeler and Weston have achieved their ambition in an interesting and left-field way. But, while acknowledging it's been enjoyable to run the car at Goodwood and Chris Evans' Carfest, what they

would really like would be to compete in the pickup, to complete the story.

"We can get a log book from the MSA for demonstrations, but to be honest, the most disappointing thing that we've come across with this project is that we can't get it log booked for rallying, because it's based on a commercial vehicle," says Keeler. "We just wanted to do a single venue rally like the Christmas Stages at Croft or something in it for a laugh, and we're talking to some people in France to see if we can resolve that. We'd be last, we know that, but we don't care."

This '80s rally machine was clearly a head-turner in period and still is today at events like Goodwood. But that buzz would be amplified many times over if this was the next car to come around the corner on a UK rally, after modern machinery and a plethora of Ford Fiestas and MkII Escorts. Hopefully this pair will get dispensation to do just that. **HRT**

Keeler. Those wheels are now fitted with Pirelli gravel tyres.

The suspension is relatively primitive, unsurprisingly so given that this is based on a workhorse rather than a thoroughbred racing machine.

MacPherson strut dampers with coil springs are used at the front, while the live rear axle is attached to leaf spring rear suspension with single shock absorbers, a pair of which are also bolted into the rear of the pickup as spares that could be changed on the go.

This machine's suspension is largely standard but, just as with specialist top level competition suspension, things

CORROSIVE CONTENT

There are lots of problems that can be traced back to a car's fluids. **Alan Stoddart** takes a look at how Millers Oils is dealing with some of the most serious



ABOVE Originally designed for NATO's vehicles, Tank Safe protects a car's internals during storage

WITH the prevalence of information, and often misinformation contained in newspaper articles with headlines like 'MPs call for ban on petrol and diesel car sales' and 'Petrol and diesel cars banned in the UK from 2040', it might seem churlish to worry about the inclusion of a small amount of renewable material in petrol, however for those with even relatively recent historic racers, this small amount of ethanol can play havoc with a car's internals.

Not only does the ethanol in petrol help reduce the amount of fossil fuels being used, it also offers some practical benefits such as boosting a fuel's octane rating, giving petrol higher resistance to knock and enabling higher engine compression. This comes at a price though. Older engines, which were designed before adding ethanol to fuel was ever thought a likelihood, were subsequently not prepared for the inclusion of what is effectively a weak acid in their petrol. Adding to its corrosiveness is ethanol's ability to support moisture. A typical E5 fuel, made up of 95 per cent petrol and five per cent ethanol, can support around 750 parts per million of water. This means that in a 60-70 litre fuel tank there might be 100 ml of water suspended in it.

"All this causes issues with zinc, lead, brass and aluminium, which are all affected if regularly used with a fuel containing ethanol," explains Martyn Mann, Millers Oils technical director. "The first thing you'll notice is bright brass components start to look dull, like they've been etched, and aluminium will corrode, forming a white sludge in the

engine and leaving white deposits in things like carburettor float bowls.

"There are other things too, with lead solder often being affected in things like the float sender in the petrol tank or even within the carburettor."

It isn't just metals that are affected either, as anyone who has seen what ethanol can do to fuel bladders will attest. Ethanol is a solvent so it can effectively eat away at many parts of a fuel system, as well as bladders and fuel lines, things common on older cars like cork gaskets are also at risk. This is a problem for people with all kinds of historic vehicles, with Mann noting that he's even had reports of problems from the owners of old lawnmowers.

BORN FROM A PLANE CRASH

Fortunately there are solutions for people with historic racers, one of which had its origins in a plane crash.

Millers have made fuel additives for the classic market for a long time, with one of the main ones being VSP, which addresses older problems. It adds two octane to the rating of a fuel, which brings the aforementioned benefits to knock resistance; it protects the valve ▶



ABOVE VSPe protects and cleans inside an engine, while also staving off the harmful effects of the ethanol in fuel

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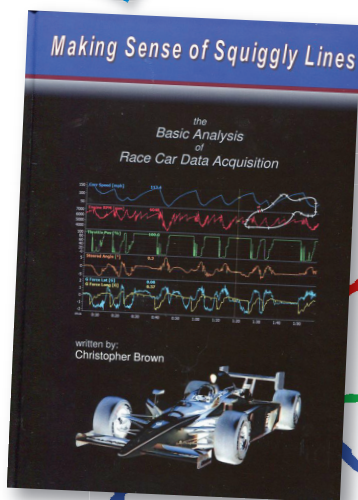
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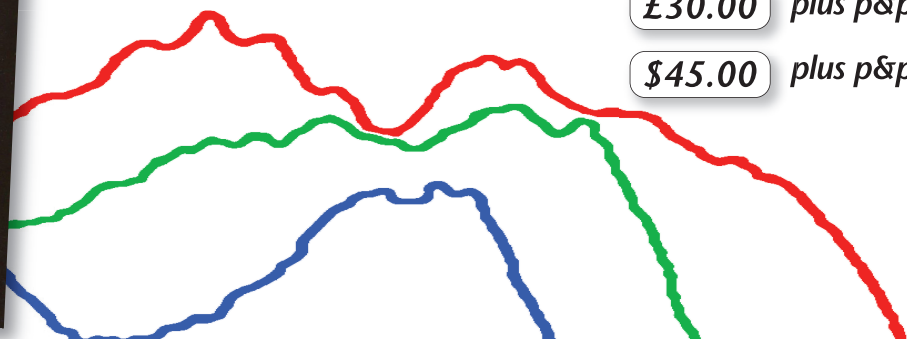


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seats, which could suffer from wear since the removal of protective lead from fuel; and it also acts as a detergent.

A few years ago though, one of Mann's colleagues was actually involved in a plane crash as a result of an engine problem. After this incident, when it was revealed what caused the crash, Mann started to think of ways to prevent similar problems in future.

"And so, to cut a long story short, we found that the technology which was developed as a result of that plane crash actually helped neutralise the corrosive effect of ethanol," he explains, "and that's what we put in the additives now."

This inclusion of ethanol protection is what has added the 'e' to additive which is now known as 'VSPe'.

Mann adds that this isn't the only instance of Millers seeing the usefulness of a technology designed for a completely different application. One such offering is the company's Tank Safe, which is ideal for this time of year when cars are going away for winter after an exciting season's racing.

TALE OF TWO TANKS

This treatment can be poured directly into the fuel tank regardless of how full or empty it is, and it offers protection in both its liquid and vapour phases, which means that it protects from corrosion both the part of the fuel system that is touched by petrol as well as the parts that aren't. So you can pour it in the car and then run the engine, getting it throughout the fuel system and into the carburettors, and the car can still be used with the Tank Safe in the system, useful if a bit of a burn in a classic on the one bright day in January proves irresistible, but it also offers a corrosion barrier whilst ever it is inside.

Mann admits however that members of the historic racing community weren't the technology's first customers.

"We call it Tank Safe because it goes in fuel tanks, but ironically it's actually NATO technology which was developed for mothballing military vehicles between usage. It used to really be going in tanks!"

The other part of the preservation package is Millers Classic Preservation Oil, a 20w50 engine oil.

It works well as oil, and it contains the full amount of detergents and dispersants that you'd expect but it also has the liquid and vapour phase corrosion resistance in there.

"So to get the car ready for winter you change the oil at the end of the season and put some fresh oil in, drain away all the acids that have built up during the year while you've been burning fuel, and then put in some of the liquid

and vapour phase corrosion package so that when the oil drains down and the top end of the engine gets a bit dry, the package is there as a vapour and protects the engine as well," says Mann.

Whether it's a tank, a lawnmower or even an exciting old XK120 for example, it's going to need looking after, and although all will need rather different maintenance routines, Millers at least offers something to help with each. **HRT**



ABOVE Vast amounts of research go into ensuring Millers additives and oils do exactly what they should

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THE FORCES WITHIN

The forces created in an engine running at more than 8,000 rpm are frankly astounding, which, as **Alan Stoddart** finds out, is why when it comes to historic motorsport, there are no such things as good vibrations

It is often easy to forget exactly how incredibly strong some of the forces in an engine are. Between modern cars that propel four people and a weekend's luggage along the motorway noiselessly for hours on end and classic racers that have been minutely honed and refined by countless engineers, over spans of many years until they seamlessly run with

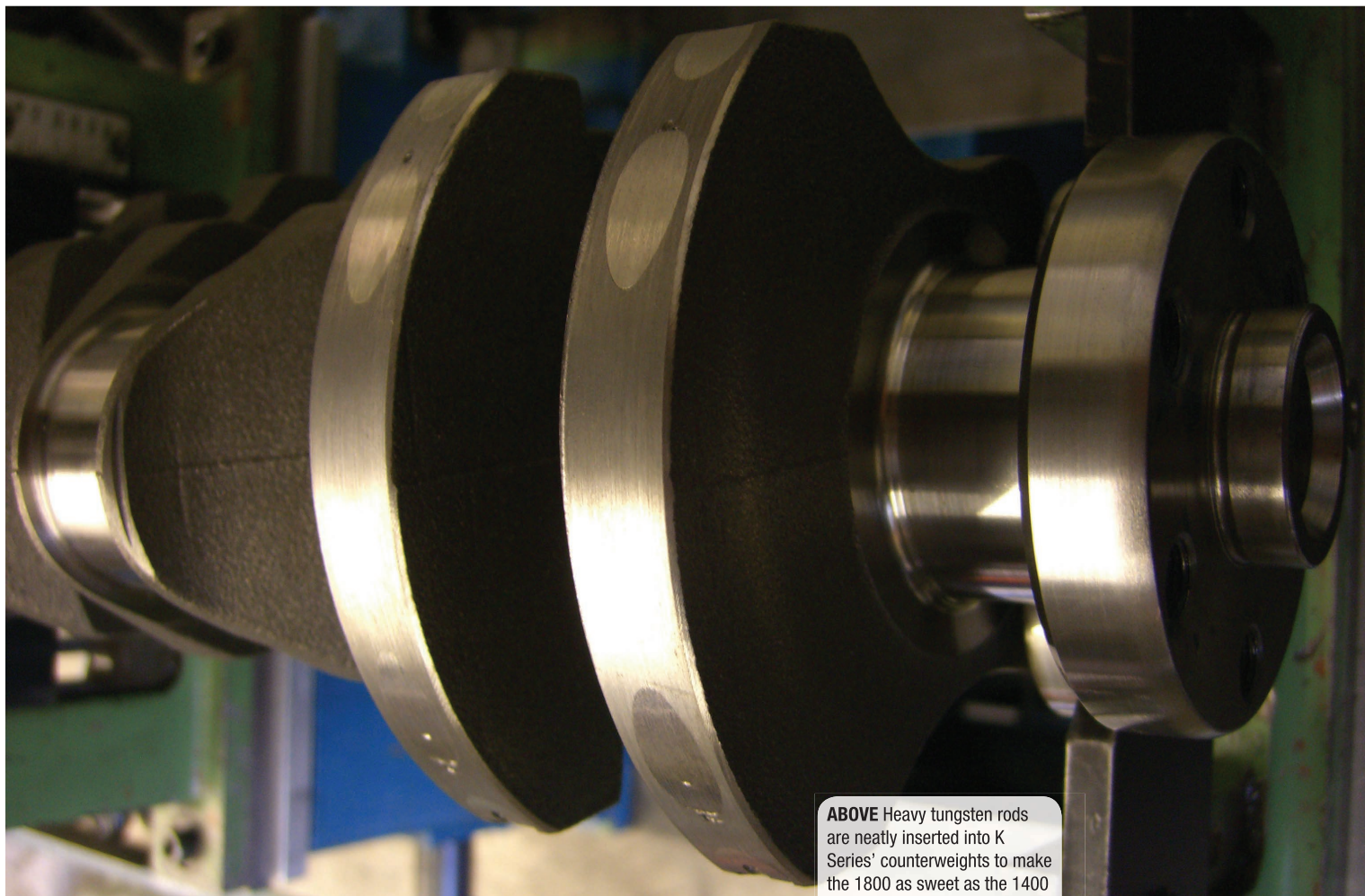
metronomic efficiency, we are removed from what those forces really look like. Most of us at least.

Vibration Free's founder Steve Smith, knows all too well what actually goes on inside an engine, as his company's specialism is identifying those forces caused by complex imbalances and correcting them. Work he has done on

the Rover K series engine, found in lots of cars including many Caterhams and Elises, is a great example of the kind of fine tuning that he can do, and the kind of forces he has to contend with.

The K Series engine started out as a 1,400 cc, before being upgraded to 1,600 and then up to 1,800 cc. Because the crankcase was only ever designed to be a 1,400, there wasn't room to increase the counterweights on the crankshaft, which is apparent when driven. While the 1,400s are a smooth and freely revving engine, and the 1,600 is quite good, the 1,800 is actually a little rough and rather hesitant. Much of this, explains Smith, is because of the crankshafts.

"We think of them as being stiff enough to be rigid throughout their rev range and they pretty much are, but it's all about degrees of flexure. Cranks do flex with the revs that engines are pulling now, combined with the aluminium blocks that many engines use, which causes problems when the



ABOVE Heavy tungsten rods are neatly inserted into K Series' counterweights to make the 1800 as sweet as the 1400



ABOVE Vibration Free welcomes all comers, but perfect balance is important to more than just race cars

counterweights are mismatched and there is a huge bending force...

“On the 1,800 the counterweights were short by over 200 grams each, which is fine for lower rev engines, but when supplied to Caterham for higher duties, they suffered a lot of spurious big end failures, broken cranks and other related failures.

METAL BENDING PRESSURE

“Well, we calculated that at 8,200 revs, there is 968 kgs of force coming off each pin, so in the centre of the crank you have basically got two tons pushing it one way and you have a ton at either end helping the bend by pushing in the opposite direction. That’s what you have to picture”.

“If instead of an engine it was stuck between V blocks, and you put two tonnes on it in the middle with a press, is it going to bend? Of course it is.”

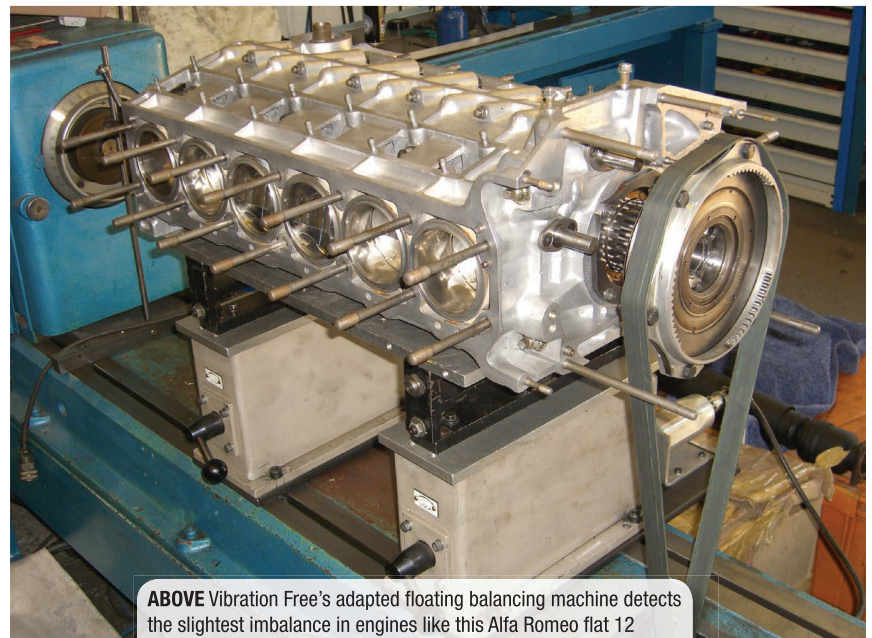
Vibration Free’s expertise then is being able to counter these metal-bending imbalances. In an 1,800 K series this means drilling out the counterweights and adding weight by inserting tungsten rods into the holes. It makes the crank 2.5 kg heavier overall, but the engine will run smoothly at 9,000 rpm all day long with no issues.

It’s doesn’t have to just be about reliability and smoothness however. One of Vibration Free’s projects involved properly balancing the counterweighing

along the length of Chevrolet’s V8 NASCAR engine. After analysing the imbalances and inserting heavy metal into the counterweights to properly balance the crankshaft, load on the main bearings was reduced by an enormous 23 per cent at 10,000 rpm. What the team does with this saving is up to them however, it could benefit longevity, but the team could instead decide to up power even more, already safe in the knowledge that the bearings can take an increase in load or revs.

Chasing the actual mechanics of balancing a crankshaft involves spinning it to release the imbalance conditions

seen as vibration but also to ensure it is, and will stay straight whilst being spun for balancing. Sometimes in order to keep the crank straight, it is necessary to fix it in its crankcase, as some engines require the crankshaft to see the weight transfer from the rods and pistons also; these can be spun up as a “short block assembly”. In either case, the arrangement is set up on an adapted floating balancing machine platform, which is free to move under the slightest force. The assembly is then spun up externally at speeds around 300 rpm, with vibrations in the engine translating into movement of the floating platform, which can be measured ▶



ABOVE Vibration Free’s adapted floating balancing machine detects the slightest imbalance in engines like this Alfa Romeo flat 12

and quantified at all engine speeds to give Vibration Free a very accurate understanding of what is actually happening. With this information, Smith and his team are able to add and remove accurate amounts of weight in very precise locations to nullify the vibration.

“ You have basically got two tons pushing it one way and you have a ton at either end helping the bend by pushing in the opposite direction”

So, dynamic balancing is about getting the centre of mass of a rotor of any shape or size to rotate on its central axis. Radial vibration forces result if tolerances slip and it is quite apparent to the end user that something needs attention. Something more subtle is “torsional vibration”, which sees the crank physically twisting along its length.

“And of course,” explains Smith, “whatever the crankshaft is driving is then upset.”

Some indicators of torsional vibration in cars would be; the rear view mirror shuddering at around 2600 rpm, flywheel bolts coming loose, alternator brackets failing, carburettors giving “stand-off” at mid-range, accessory belts coming off, distributor rotor arms working loose and many other things, before ultimately, the crankshaft breaks!

TORSIONAL VIBRATION DAMPERS

“Whenever a gear train is involved, like on an AC engine that has a crankshaft gear that drives a cross shaft, on one end of which is a magneto while a water pump is on the other, the gears are going to chatter so whatever it is driving gets out of phase.”

“So, if you are driving the distributor, which is creating the spark, then the timing goes out. It’s the same with the magneto. Or if you are driving the valve train then the valve train goes out.”

To deal with these problems, Vibration Free has been designing and manufacturing “torsional vibration dampers” for the last 10 years with over 265 designs under its belt. As a mechanical device called “Sterling Rattler”

they are either fitted to the front of the crankshaft, often with pulleys attached, or as a flywheel version and have given a power boost to many an engine.

An early lesson was learnt by Smith, when he was involved with Jaguar production cars. Road test analysis

showed that after crankshaft balance, camshaft imbalance was the second biggest source of vibration in the engines. This was in mind when he was assisting TWR with balancing the Le Mans V12 Jaguar engines which had a tendency to throw their cam belts at the end of the Mulsanne straight. From his work on the roadgoing V12s he knew camshaft unbalance was at fault.

To understand why this is, Smith explains that you have to consider vibration pulses as either erratic or cyclic. The random vibration pulses are

a lot less harmful than repetitive cyclic ones. Imagine a child on a swing; if you gave a small repetitive push at the right time, a large swing action will result. If you gave a random push, it would most likely ruin the exaggerated swing action. So, on a camshaft which by its nature has an out of balance lobe at each end produces a very repetitive cyclic pulse into the cambelt or cam chain. If the revs reach the right speed at which the belt or chain is aggravated by the imbalance pulse, disturbance ensues.

To cite two examples says Smith, “Renault were the first production engine manufacturer to balance camshafts as standard practice with their Clio engine and a NASCAR engine builder could only control valve train on his two 10,000rpm pushrod V8 engines after he balanced the camshafts.”

The runners of historic racing cars can take heart however, because Vibration Free commonly sees customers getting caught out by vibrations; whether it is in crankshafts, cam shafts, wheels, propshafts, or other parts like turbos and air conditioning compressors. Finding the ▶



ABOVE As with this Sunbeam Tiger, the engine doesn't always have to be removed from the car for balancing

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HRT



ABOVE & BELOW The same principles that are used to balance a GT40 can be applied to anything that needs to balance

problem on vehicles through vibration analysis is relatively straightforward and cost-effective. Often the correction is carried out the same day with engines, propshafts and wheels all being balanced in-situ on the car.

Seemingly worlds away from the crank in an old Bugatti or Maserati are research satellites, receiving and beaming back data to a control centre somewhere, but actually, says Smith, the principles are surprisingly similar. The satellites in action spin at 5 rpm, with a square base that acts as the receiver and the transmitter. This base is pointing back to a very specific location on earth, so when the satellite spins there can't be any wobble whatsoever. Like a high performance crankshaft, it must be impeccably balanced.

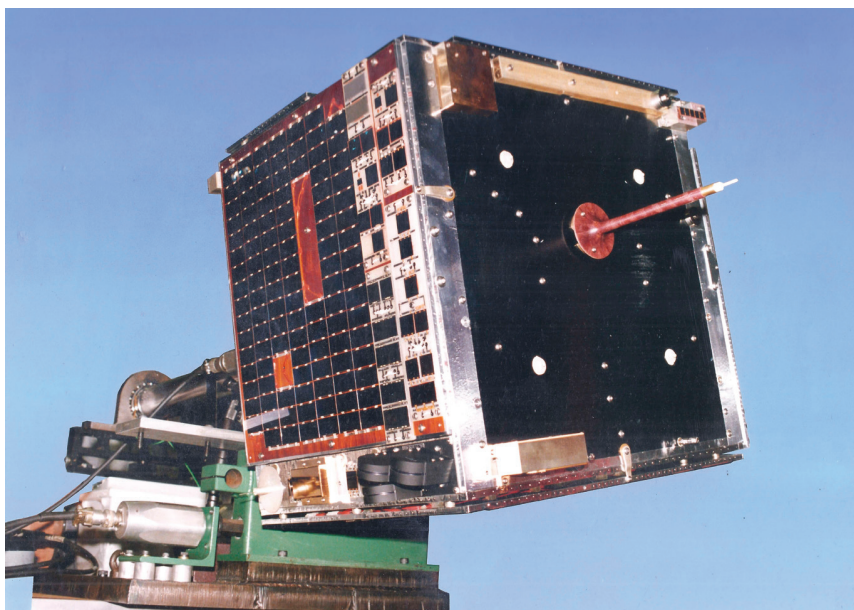
"The way we were going to balance them was to add some stainless plugs around some fixings on the top and bottom faces of the satellites, they had made all these Lego brick type fastenings for us to use," Smith recalls.

"Well, when I went to balance them in the Farnborough Space centre and they let go of it in the balancing cradle, it just fell heavily to one side. We had

to put a kilo and a half of brass bar on it to get rid of the static imbalance. This was crucial weight as well, so they also had to pay a hefty Euro fine for being overweight on fuel."

Smith eventually got to the bottom of this enormous imbalance. It turns out that when the satellite was modelled by its manufacturer, it neglected to model the wiring loom because of its complexity. Quite a costly omission, that.

It stands as testament, however, to the capabilities of Vibration Free that its abilities are such that they are recruited by the manufacturers of such satellites. Furthermore, aside from the improved reliability, and smoothness and eagerness to rev and all the other perks an engine balanced by Vibration Free offers, it must be quite satisfying to know that your '50s F1 car makes use of a bit of space age technology. **HRT**



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ABOVE The fruits of modern research and technology can't be uninvented. But that's enough about camel racing – what about historic motorsport?



Newspress

GOT THE HUMPH WITH MODERN TECHNOLOGY?

Whether it's a camel or a Cortina, the temptation is to race it. Which, as **Alan Stoddart** reflects, raises all sorts of issues

LIKE a top-flight rally car or a highly-strung drag racer, camels are pretty impressive and highly specialised bits of kit. Traction is handled by big flat footpads that spread out as weight is put on them, stopping the camel from bogging down in the desert, while bushy eyebrows, two rows of long eyelashes and nostrils that can be closed keep sand from being a problem.

And of course, there is the hump. A dromedary can store 80 lbs of fat in its single hump, which it breaks down when needed, giving it the ability to traverse more than 100 miles of desert without water. Camels also have the ability to make the most of it when they do find a water source, and can drink 30 gallons in less than 15 minutes.

Humans have long used camels as

working animals, roping them in to carry heavy loads across deserts. But, as is their way, people have also pitted camels against one another in races, and despite all their specialisms, people have found ways to improve their performance.

Lots of these developments have been spurred by the increases of wealth in the Gulf states in the latter part of the 20th century, which meant there was vastly more money at stake in the traditional racing, and, as with historic motorsport, increased budgets have meant that camels keep getting faster. New training regimes taking place in bespoke centres on treadmills and in swimming pools, and research-perfected diets mean that records have tumbled.

Some of the more extreme trappings of modernity however are raising very

similar issues to those in historic racing. In the same way that people attending the Goodwood Revival might well ask whether a 1960s racer that has had many of its 1960s limitations ironed out by the same technology perfecting today's F1 cars is really historic, someone at the Al-Marmoom Festival in Dubai may wonder, when watching a camel with a physiology perfected using advanced breeding techniques like embryo transfers and cloning, whether it is really the same sport as his father watched 50 years ago.

Of course, some technology is unquestionably beneficial. It's as hard to argue with new fire extinguisher systems, fireproof overalls and dependable safety harnesses as it is with camel-riding robotic jockeys that have replaced children over the last 10 years, but for both sports there must be a limit somewhere. This is especially true given that aversity to any technology is both unrealistic and naïve.

Just as race car builders in period would have done, many of the outfits readying classic Maseratis and Austins for competition are bound to push the rules to the limits (and sometimes beyond), and utilise every technological advantage they can to be at the front of historic races and snatch the prestige they offer. What's more there are also other pragmatic factors at play. Should a non-period component really be outlawed if its only function is improving a historic racer's reliability and enabling a driver, as well as the fans, to be able to enjoy a car on track rather than hidden away in pieces in a garage somewhere?

It is not obvious where the line, which inevitably must be drawn, should be drawn, but the historic racing community should take heart from other sports like camel racing, which despite an influx of wealth over the last few years, and some controversial decisions which have upset certain elements, is, like historic racing, enjoying an unprecedented increase in participation, spectator numbers and reach. It seems that regardless of the myriad factors being weighed behind the scenes, whether camels or Cortinas, people just like to watch things race. **HRT**

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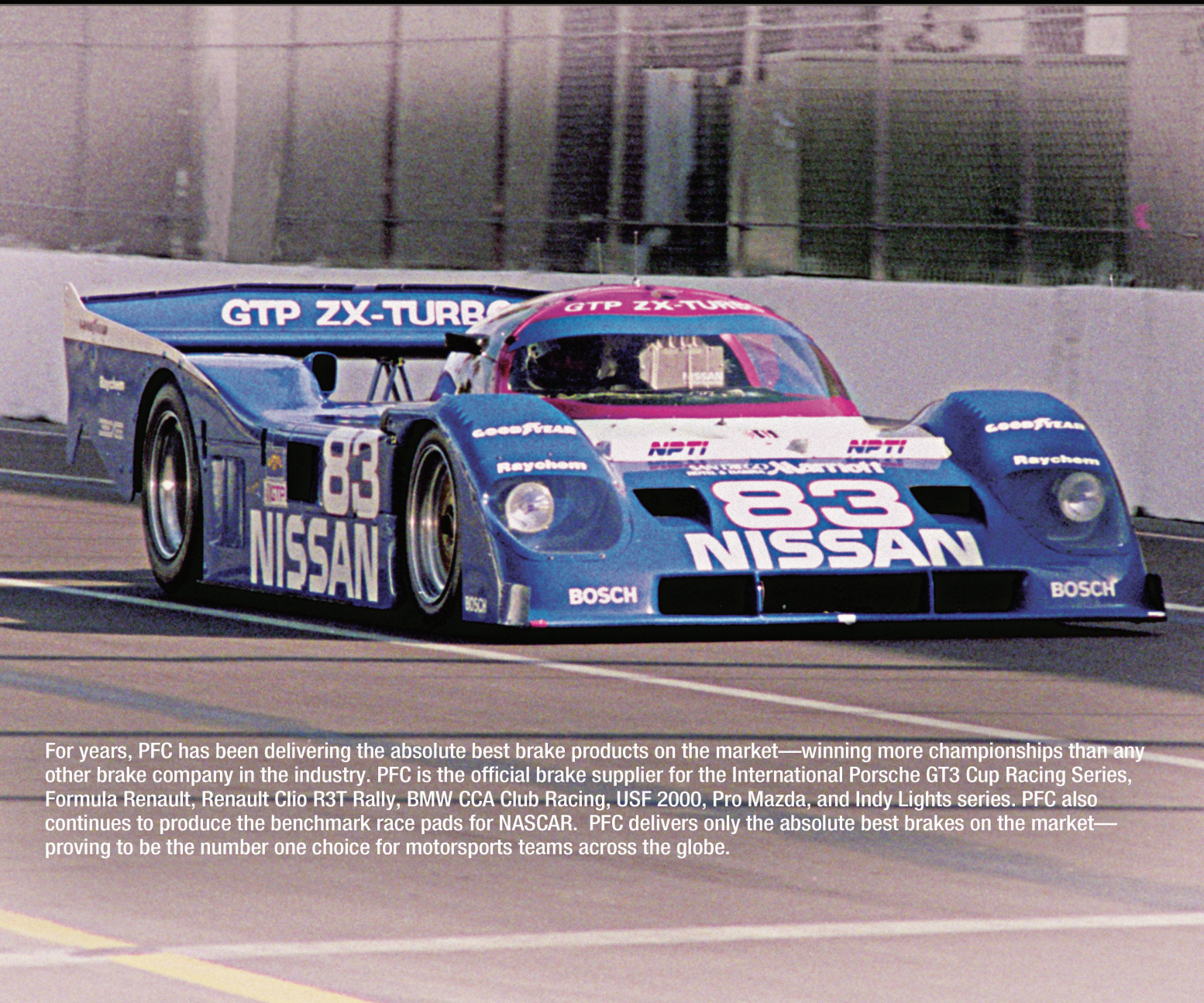
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